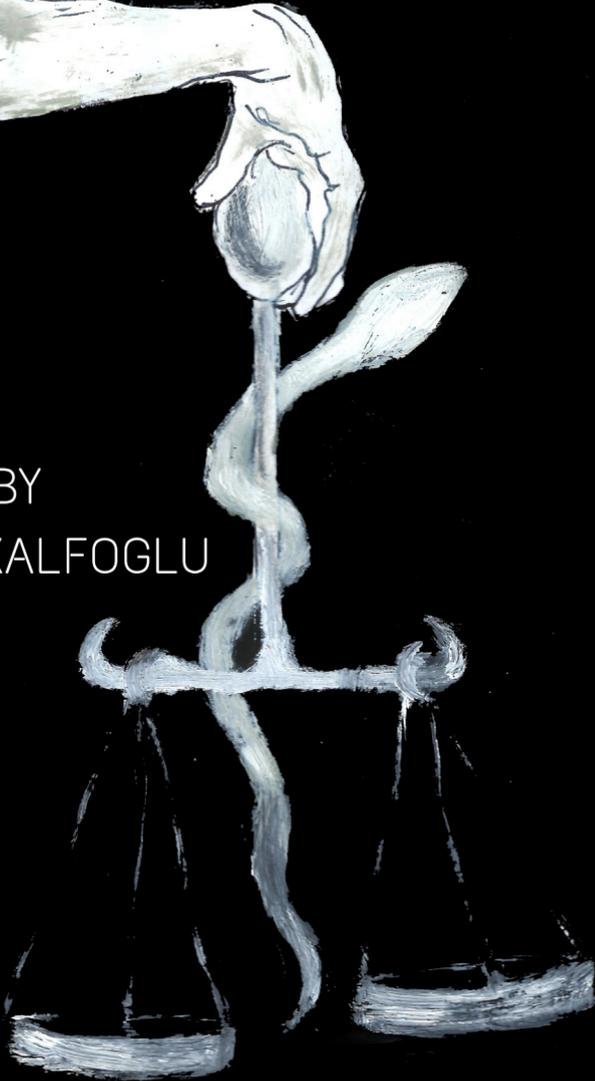


THE IMPORTANCE OF EXPERT WITNESSING

THE BALKAN EXPERIENCE

EDITED BY
SOTIRI KALFOGLU



FORENSICS

THE IMPORTANCE OF EXPERT WITNESSING: THE BALKAN EXPERIENCE



İstanbul Yeni Yüzyıl University, Turkey

2020

**The Importance of Expert Witnessing:
The Balkan Experience**

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THE IMPORTANCE OF EXPERT WITNESSING: THE BALKAN EXPERIENCE

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İstanbul Yeni Yüzyıl University, Turkey

2020

To the precious memory of Panayot Abacı...

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Notes About the Contributors

Ali HASPOLAT

Anesthesia and Intensive Care Clinics Program, Istanbul Şişli Vocational School,
Istanbul, Turkey

Ali Şefik KÖPRÜLÜ

Department of Anesthesiology and Intensive Care, Faculty of Medicine, Istanbul Yeni
Yüzyıl University, Istanbul, Turkey

Constantinos TROMPOUKIS

Department of History of Medicine, Faculty of Medicine, University of Crete, Heraklion,
Crete, Greece

Dilek SALKIM ISLEK

Department of Forensic Genetics, Institute of Legal Medicine and Forensic Sciences,
Istanbul University-Cerrahpasa, Istanbul, Turkey

Elif ŞAHİN

Faculty of Pharmacy, Istanbul Yeni Yüzyıl University, Istanbul, Turkey

Emel Hulya YÜKSELOGLU

Department of Forensic Genetics, Institute of Legal Medicine and Forensic Sciences,
Istanbul University-Cerrahpasa, Istanbul, Turkey

Fatma CAVUS YONAR

Department of Forensic Genetics, Institute of Legal Medicine and Forensic Sciences,
Istanbul University-Cerrahpasa, Istanbul, Turkey

İtır ERKAN

Department of Healthcare Management, Faculty of Health Sciences, Istanbul Yeni Yuzyil University, Istanbul, Turkey

Mariya GROZEVA

President of the Association of the Bulgarian Expert Witnesses, Forensic Medicine Department, National University Hospital, Lozenetz, Sofia, Bulgaria

Mehmet Akif İNANICI

Department of Forensic Medicine, School of Medicine, Marmara University, Istanbul, Turkey

Mete Korkut GULMEN

Department of Forensic Medicine, School of Medicine, Cukurova University, Adana, Turkey

Naim UKA

Head of Division for Identification, Coordination and Support. Institute of Forensic Medicine Justice Ministry, Prishtinë, Kosovo

Nermin SARAJLIC

Department of Forensic Medicine, Medical School, University of Sarajevo, Bosnia and Herzegovina

Nurcan HAMZAOĞLU

First and Emergency Aid Program, Vocational School of Healthcare Services, Istanbul Yeni Yuzyil University, Istanbul, Turkey

The Importance of Expert Witnessing: The Balkan Experience

Omer KARATAS

Department of Forensic Genetics, Institute of Legal Medicine and Forensic Sciences,
Istanbul University-Cerrahpasa, Istanbul, Turkey

Sila ASLAN

Department of Forensic Medicine, School of Medicine, Cukurova University, Adana,
Turkey

Sinem YILDIZ İNANICI

Department of Basic Sciences, School of Medicine, Marmara University, Istanbul, Turkey

Ş. Şebnem ÖZCAN

Department of Legal Medicine, Faculty of Medicine, Istanbul Yeni Yüzyıl University,
Istanbul, Turkey

Taner GÜVEN

Department of Legal Medicine, Medical Faculty, Demirođlu Bilim University, Istanbul,
Turkey

Preface

Expert witness activity, supports the legal system significantly. The court cases today are complex in nature and they require the resolution of scientific or technical questions. Expert opinions can be invaluable tools for clarifying issues of fact and building a case. They help jurors understand complex and nuanced information, they provide a sense of objectivity and credibility, and they integrate with the legal team to enhance the strength of the entire case. The experts reflect their own knowledge and qualification which is formed based on their education or special training on a particular subject that may be beyond the understanding of the average person.

This book has been organized two parts with the basic aim being to share experiences in expert witnessing and to establish an inter-Balkan academic cooperation in forensic sciences. Scientific techniques and the adaptation of the best practices in the discipline in crime combating are being discussed.

Within that scope, scientists from different expertise areas of forensic sciences have been contributed to the topic which we entitled “Best Practices in Expert Witnessing: Balkan Countries Experience”. The participants consist of very well-known scientists from Balkans mainly Bosnia-Herzegovina, Bulgaria, Greece, Kosovo, and Turkey which basically practice expert witnessing in their own fields.

Forensic Scientists or Legal Medicine experts form the natural “expert witnessing” team for case identifications. Therefore, the first part of this book entitled “Expert Witnessing as a Profession (medico-legal approach)” covers cases and/opinions or Legal Medicine specialists. To understand the extremely wide

variety of the subjects that this topic is related to, you can just take a look at the contents where you can see chapters related to practicing expert witnessing in various countries (Bosnia-Herzegovina, Kosovo, and Turkey) as well as specific approaches to expert witnessing like ethics and standardization issues.

Although expert witnesses are viewed as positive contributors there are numerous cases where they can be incapable or in certain cases liars or “hired guns”. A Bulgarian approach to this issue can be seen by the “malpractice” touch.

Finally, as expert witnessing is a widely inter and multi-disciplinary field, we included anesthesiology and radiology together with genetics in the second part of the book entitled “Expert Witnessing Within a Specialty (multidisciplinary-forensic approach)”

We all hope that this book will open a debate on expert witnessing for future practice and policy and will be a step forward to establish an inter-Balkan academic cooperation in forensic sciences for scientific techniques in crime combating.

Sotiri Kalfoglou

Medical Faculty

Department of Legal Medicine

Istanbul Yeni Yüzyıl University

Part One

Expert Witnessing as a Profession
(medicolegal approach)

Expert Witness From a Bosnian Perspective

Nermin SARAJLIC

Bosnia and Herzegovina have several levels of political structuring. The two main entities are the Federation of Bosnia and Herzegovina; and the Republic of Srpska.

In 2003 the Parliament of Bosnia and Herzegovina adopted the Law on the Prosecutor's Office whereas the duties were undertaken by courts/judges during Former Yugoslavia. Prosecutors conduct whole investigation process. Court proceedings were also changed in a way that it is no longer enough just a written expert opinion but the same must be defended in court during the hearing (1). The expert witnessing process works based on the "law of expert witness" that was established on 2005. This Law regulates the conditions and procedure of selecting and appointing expert witnesses in the judicial, administrative and misdemeanor proceedings to perform the tasks of expertise, rights and duties of expert witnesses, supervision of the work of expert witnesses, supervision of expert work by legal persons, keeping the directory of experts, as well as other questions of importance for expert work.

Within the Criminal Code, expertise is determined when it is necessary to obtain the finding and opinion of persons with the necessary expert knowledge to determine or evaluate an im-

portant fact. Experts may be hired by parties, defense lawyers and courts. “Parties” are the prosecutor and the suspect, respectively or the accused. An expert may also be invited at the crime scene investigation or reconstruction if his presence would be useful for opinions and findings.

Sometimes it is very useful that forensic pathologist as expert is present at the crime scene, as it is presented in the next case.

An elderly female person was found in the basement of the building in which she lived, at the bottom of the stairs.



Passive bloodstains were present (no traces of blood splashing on the walls or on the floor – no projected or impact stains). The bloodstain was without signs of dispersion and was not smeared, what means there was no movement of the body after the bleeding or after death. Non-physiological position of the left arm (humerus fracture and radius and ulna fracture in the ankle) were noticed at the spot.



Autopsy showed an impressive fracture of the left temporal bone, at ear level.



Deceased's glasses remained on her head, which means that the part of the glasses that comes behind the ear made pressure during the fall and led to an impressive fracture, as that part of the temporal bone is very thin. If the expert had not been on the spot, he would not have been able to know that, and would probably have told the police that it was more likely that a blow by another person inflicted the injury.

Presence of forensic pathologist at the crime scene, together with autopsy, helped to establish an accidental death, caused by fall.

Examination, Autopsy and Exhumation of The Body

An examination and autopsy of the body will be taken whenever there is a suspicion that the death was caused by a criminal offense or in connection with the commission of a criminal offense. This is a significant regression compared to the pre-2003 Criminal Procedure Code, which stated for autopsies: whenever a death case is suspected of being a natural death. This enabled autopsies to be performed in a significantly larger number of cases than it is today.

If the body is already buried, exhumation will be determined for the purpose of his examination and autopsy.

The examination of the subject of expertise is as follows: The expert examines the objects of expertise at the place where they are located, unless expert investigations require lengthy tests or if investigations are conducted in an institution or body or if the reasons for morality so require. The expertise of injuries is performed under the Article 122 of the Criminal code. According to this, the examination of injuries is carried out, as a rule, by examination of the injured person, and if this is not possible or not necessary - based on medical documentation or other data in the files. In practice, in most cases, expertise is done on the basis of medical documentation

CRIMINAL CODE – ARTICLE 285. EXAMINATION OF EXPERT WITNESSES

The examination of expert witness is explained in the Article 285 of the Criminal Code. According to this the expert shall

take an oath, or make a statement before the testimony. The text of the oath reads: “I swear by the honor-that I shall speak the truth and that I will fully and accurately present my findings and opinion”. An expert shall make his findings and opinions oral at the main hearing. In that case, the expert witness will be directly, cross-examined, or further examined by both parties and the defense attorney, or the court. The written finding and opinion of the expert witness shall be accepted as evidence only if that expert witness testified at the hearing.

War Crimes Expert Witnesses Testimony

In this type of expert witness testimony, it is important to state whether we are talking about antemortem versus postmortem injuries, the manner of injuries and finally the cause of death. The post mortem injuries may be formed because of animal activities, the action of natural forces or human activities. In some cases, it is possible to determine that some injury is postmortem, due to the different discoloration of the broken surface of the bone.



Photo x1. Clear signs of postmortem injury

The cause of death injuries to internal organs, and we may not be able to see damage to the bones themselves that lead to the death. Therefore, the cause of death **MUST NOT** always be stated. It is highly important to properly perform the exhumation as even small bones can give a lot of information, like injuries on the third cervical vertebra, which indicate cutting the throat as cause of death Photo x2.



Photo x2. Cut marks on the third cervical vertebra

Injuries sustained during physical abuse of victims are important part of expertise, as they represent signs of torture. In the case below (Photo x3), if it would be only fracture line in scapula, it would be never possible to say for sure is it antemortem or post-mortem injury. However, in this case, with the signs of the beginning of healing, it is possible to say that this person was blown with some heavy object in the shoulder and survived this injury for several weeks.



Photo x3. Beginning of the healing around fracture line

Proper examination of the skeletal remains is not possible before washing, drying and gluing broken fragments. In the next case, (Photo x4.) without those procedures it would not be possible to determine three gunshot injuries.



Photo x4. Three entrance gunshot injuries to the back of the head

Identification

Identification process of skeletal remains is based on DNA reports, however any additional evidence is important, either some surgical procedures (Photo x4A, Photo x4B, Photo x5), old healed fractures, diseases visible on the bones, or some dental data. This is especially important for mass graves, where it is necessary to prove that all bones exhumed in one case, belong to the same person.



Photo x4A. Surgical procedure - trepanation opening



Photo x4B. Entry gunshot wound in the same person with trepanation openings



Photo x5. Fibula fracture - surgically treated

Presented case, with surgically treated fibula fracture, where we obtained medical documentation was one of the rare cases where we got positive DNA match on mother and negative on father. Comparing postmortem data about fracture with ante-mortem medical documentation, helped to make final identification.

The Tomašica Mass Grave

The Tomašica grave-site near Prijedor in the north of Bosnia is reported to be the largest primary mass grave discovered thus far relating to the 1992–95 war. Most of the victims were men (and three women) from villages to the west of Prijedor, killed in July 1992 and their bodies buried within a few days at Tomašica, which was part of an iron ore mine (3). A total of 275 complete bodies and 125 body parts were exhumed from it by the Bosnian Institute of Missing Persons assisted by the Inter-

national Commission on Missing Persons (ICMP) in 2013. The subsequent autopsies (post-mortem examinations) were performed at the Šejkovača Center for Identification of Post Mortem Remains in Sanski Most. Post mortem examinations of the victims showed that nearly all had died from gunshot injuries but an additional striking feature was the degree of preservation of many of the bodies, even 21 years on, with skin, soft tissues and internal organs still present in abundance and gross structures clearly identifiable (4)



EXPERT WITNESS REPORT

The Paklenik Cave



The Paklenik Cave also known as the “Hell Cave” was discovered in during the summer of 2000 in Eastern Bosnia. The majority of the 75 remains that were discovered were well preserved. It is stated that the victims have been executed in the summer of 1992 and their bodies have been had been thrown into the cave. A deep layer of stones, rocks and tones of animal bones had covered the bodies and that retarded the process of decomposition (2) . The expert witness reports that were prepared fort< he remains included: the numbering system for the bodies and the autopsy process, the state of the bodies, clothing and personal effects, the, age, sex and identity of the victims, the ligatures, the injuries, the cause of death and the processes of identification.

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Problems of Forensic Medical Malpractice

Mariya GROZEVA

Introduction

The role of the expert witness is to provide a thorough and objective opinion on a case. In some circumstances the same expert witness examines whether or not a medical malpractice occurs (1). The following article is based on three examples of medical malpractice in forensic sciences that occurred in Bulgaria but they may be encountered all over the world.

Case One:

This case is about an arbitration expertise prepared by two surgeons about a patient (77 years old) who died in a hospital in a country town on 23.05.2013. Following the patient's death, the autopsy was performed on the third day (26.05.2013) by a pathologist from the same hospital. The temperature at this time span was recorded to be 24-25⁰C and it is not clear whether the corpse was stored in a dead body refrigerator.

The clinical diagnoses were reported are as follows:

Ileus due to adhesions, epigastric incarcerated hernia, rupture of the abdominal aorta, pulmonary thromboembolism, chronic ischemic heart disease, generalized atherosclerosis

The pathoanatomical diagnosis was as follows:

- Septic spleen, large skin surface with bullous epidermolysis, acute purulent infiltrate in the surgical wound, status post-surgical treatment of incarcerated epigastric hernia
 - Shock lung, focal micronecroses of epithelial cells of the convoluted tubule of the nephron, hyaline microthrombi in the blood vessels of the small intestine
 - Marked focal fatty degeneration of the liver
 - Hypertrophy of the left ventricular wall
 - Perivascular and pericellular brain edema
 - Arteriolar nephrosclerosis
 - Hydrops of the gallbladder
 - Degenerative changes of the epithelium of the renal convoluted tubules
 - Acute blood stasis in the internal organs

The pathologist accepts the developed sepsis for gas gangrene without microbiological examination. He describes macroscopic corpse decomposition with markedly enlarged scrotum and penis and he defines fetid smell from the dead body. Three different expert committees from surgeons, forensic medical specialists and pathologists concluded that: The immediate cause of the death of the patient was fulminantly developed gas gangrene after the operation for hernia of linea alba. These experts described in details in the court that the infection could have entered during the operation or later through the bandages of the surgical wound.

A revision of the histological specimens was done only by one of the expert committees, and the following findings were described:

BRAIN	<i>perivascular and pericellular edema;</i>
MYOCARDIUM	<i>assessment impossible - transverse sections;</i>
LUNG	<i>severe autolytic changes, acute on chronic bronchitis, emphysema, alveolar hemorrhages, regions suspicious of hemorrhagic infarction;</i>
LIVER	<i>marked focal fatty degeneration, cyanosis to nutmeg liver;</i>
KIDNEY	<i>myo-elastofibrosis of the arteries, a small region suspicious of anemic infarct;</i>
SMALL INTESTINE	<i>autolytic changes of the mucosa, hyaline thrombi in small vessels of the submucosa;</i>
SPECIMEN FROM THE SURGICAL WOUND	<i>fatty tissue with superficial fibrinous-purulent exudate.</i>

In the microscopic examination of the pathologist, who performed the autopsy, “presence of bacterial colonies in the lung” was described. The case was reexamined by our team and at the examination of the histological specimens during the preparation of our arbitration expertise, we established that MYCOTIC DRUZY were found in the lung which is typical for corpse decomposition.

The following were found in the other organs:

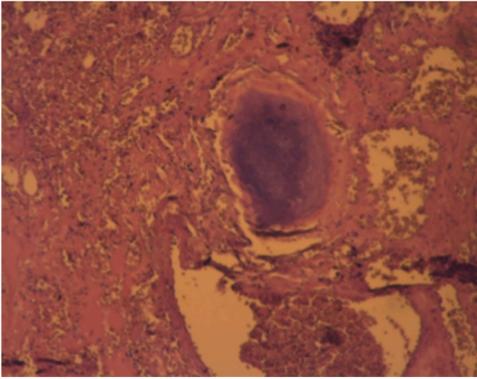


Figure 1: Decomposition of the Lung. Bacterial colonies.

BRAIN	<i>pericellular and perivascular edema and advanced corpse decomposition, corpse emphysema;</i>
MYOCARDIUM	<i>advanced corpse decomposition with corpse emphysema. Evidence of acute myocardial infarction;</i>
LUNG	<i>atelectatic field, blood vessel with a thrombus, intra-alveolar edema and markedly advanced autolytic changes;</i>
LIVER	<i>region with marked focal fatty degeneration and initial corpse decomposition, corpse emphysema;</i>
KIDNEY	<i>field with hyalinized glomerulus, inflammatory infiltrate around it with hyalinized vessels, corpse decomposition;</i>
SPECIMEN FROM THE SURGICAL WOUND	<i>fatty tissue with superficial fibrinous-purulent exudate.</i>
HOLLOW ORGAN (small intestine)	<i>decomposition.</i>

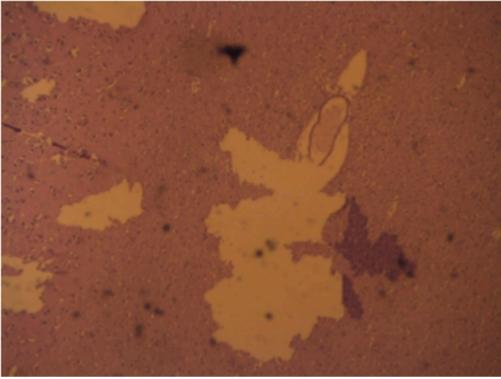


Figure 2: Decomposition of the Brain. Cadaveric emphysema.

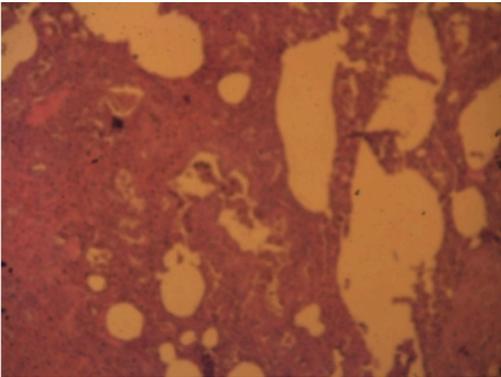


Figure 3: Decomposition of the Lung. Cadaveric emphysema.

In one of the specimens from the myocardium we found definite evidence of **acute myocardial infarction**. Based on this finding we concluded that the leading cause of death is **ACUTE MYOCARDIAL INFARCTION** from a period of 6-12 hours which we mentioned In our arbitration expertise. This corresponded to the described clinical picture which was defined as collapse of the patient in the toilet few hours before his death.

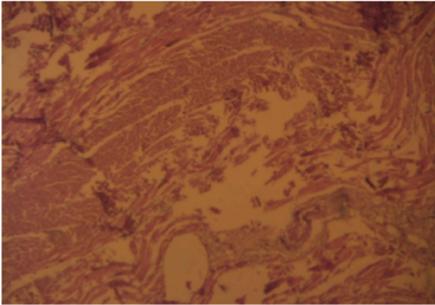


Figure 4: Acute myocardial infarction.

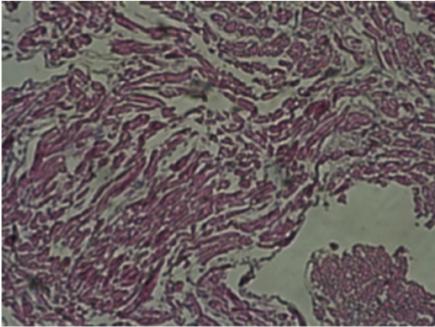


Figure 5: Acute myocardial infarction.

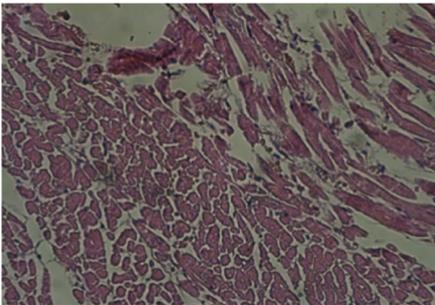


Figure 6: Acute myocardial infarction.

This morphological finding corresponded to the laboratory data for high levels of C-reactive protein - 119/260 mg/l and troponin – 4,6 ng/ml, blood pressure 85/68; 90/65 mmHg, heart rate 130 beats/minute, the patient was perspiring.

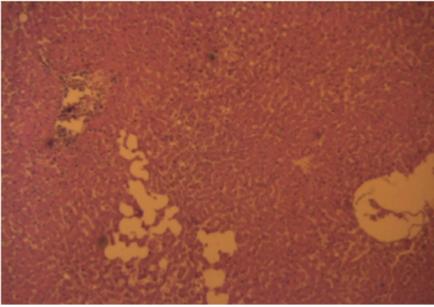


Figure 7: Decomposition of the Liver. Cadaveric emphysema.

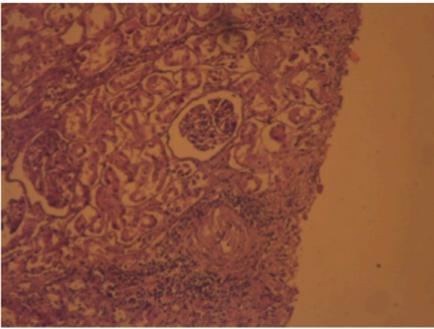


Figure 8: Decomposition of the Kidney.

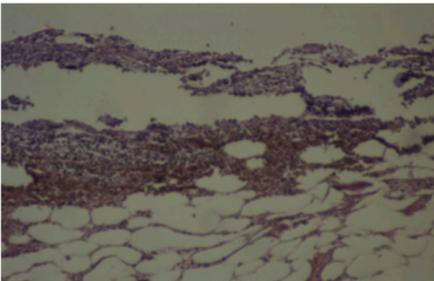


Figure 9: Mild inflammatory reaction of the peritoneum.

Cadaveric emphysema.

The prior reports prepared by the pathologists accepted without microbiological analysis, only on the base of the macroscopic description of the corpse, without considering the meteorological conditions and, performing an autopsy on the third

day after the death, that the cause of death was hospital-acquired infection, whereas the reality was the person died because of myocardial infarction (2). Another fact is that in the operating rooms and hospitals in Bulgaria during the last 50 years of the 20th and in the beginning of the 21th century there is no proved hospital-acquired infection (3,4).

Case Two:

The second case is about a 27-year-old woman who died on 07.06.2014 and underwent an autopsy. On the expertise report it is noted that the autopsy was carried out on the same day (07.06.2014) at 09:00 and finished at 09:45. The information before the autopsy revealed that the patient died after a procedure in a Medical Center for In-vitro Fertilization. In the court the forensic medical specialists explained that there was a technical mistake and the autopsy was performed one day later (08.06.2014) and not the same day.

From the Emergency Medical Service Report given on 07.06.2014, it is clear that the ambulance was called for the patient with anamnesis for “puncture for in-vitro fertilization”. An additional clinical examination report states that the patient was clinically dead because of anesthesia-fentanyl and propofol. The ambulance departed on 07.06.2014 at 09:03. arrived at the place in mention at 09:13. and departed at 09:56.

Significant technical flaws during the autopsy are:

- The day of the autopsy is not accurate, and it must have been performed the next day
- A test for pneumothorax was not performed
- A test for air embolism was not performed

- A test for thromboembolism was not performed
 - A specimen for excluding fat embolism was not taken
 - During the external and internal examination of the corpse the vagina was not examined. It should have been, because the procedure was transvaginal
 - The parauterine veins were not studied for thrombi
 - The blood vessels of the lower limbs were not examined
- Blood for chemical analysis was taken and propofol traces were detected.

In the histological examination, performed by the autopsying physicians, the following were described:

LUNG	<i>interstitial and intraalveolar hemorrhages, interstitial and intraalveolar oedema, zones of atelectasis, lymph follicles with hyperplastic changes- peribronchiolar; focal lymphocyte infiltrates; blood vessels congestion and lymphocyte infiltrates – peribronchial. The picture corresponds to interstitial pneumonia with developed respiratory distress syndrome.</i>
MYOCARDIUM	<i>verrucous mass on the endocardium with marked subendocardial fibrosis; interstitial edema, perivascular fibrosis and lipomatosis. Evidence of endocarditis and myocarditis in the past.</i>
LIVER	<i>acute congestion (cyanosis); scarce inflammatory infiltrates with the participation and of eosinophil leucocytes -periportal;</i>
KIDNEY	<i>interstitial edema, blood congestion;</i>
PANCREAS	<i>relatively mild fibrosis, lipomatosis; autolytic changes.</i>
UTERUS	<i>cystic follicles with manifestations of hyperplasia of granulosa cells elements; corpi</i>

	<i>lutei; pronounced manifestations of acute blood congestion</i>
	<i>For the purpose of the assigned forensic medical expertise we did revision of the histological specimens and established:</i>
BRAIN	<i>severe oedema around the cells and the vessels.</i>
MYOCARDIUM	<i>severe interstitial oedema, myocardiofibrosis acute on chronic myocarditis.</i>
LUNG	<i>intraalveolar oedema, scarce brown induration, massive thrombembolism, hemorrhagic infarction of the lung.</i>
LIVER	<i>severe interstitial oedema, discrete steatosis.</i>
PANCREAS	<i>fibrosis and lipomatosis, initial autolysis.</i>
KIDNEY	<i>thromboemboli, ischemic infarction.</i>
OVARY	<i>hemorrhage in the ovary.</i>
UTERUS	<i>oedema and hyperplasia of the endometrium.</i>

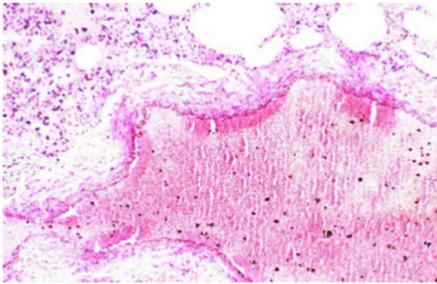


Figure 10: LUNG – red thromboembolism.

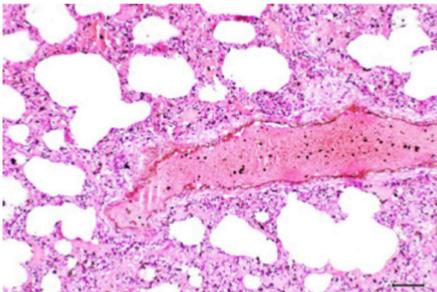


Figure 11: LUNG – red thromboembolism.

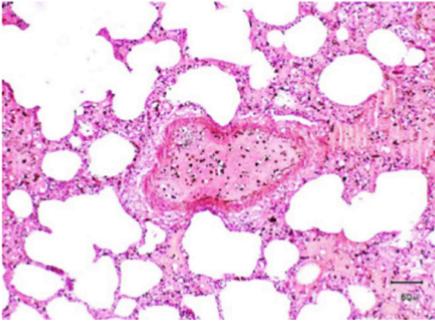


Figure 12: LUNG – red thromboembolism.

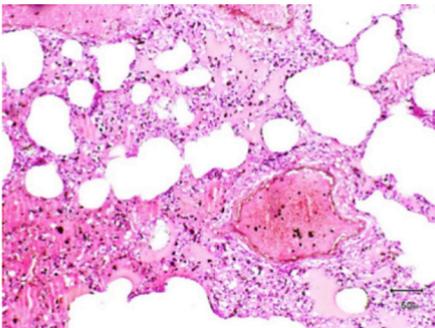


Figure 13: LUNG – red thromboembolism.

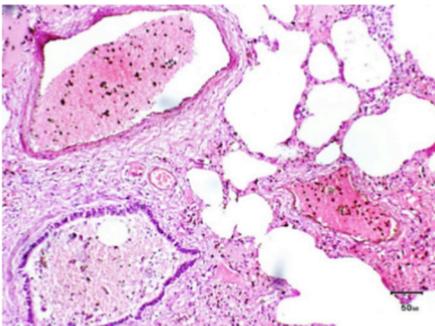


Figure 14: LUNG – red thromboembolism.

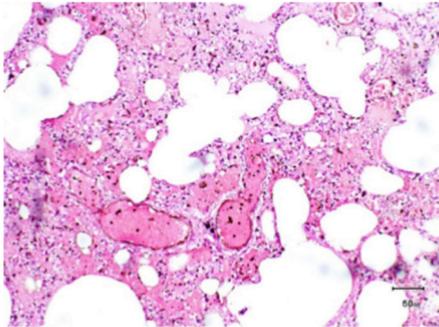


Figure 15: LUNG – red thromboembolism.

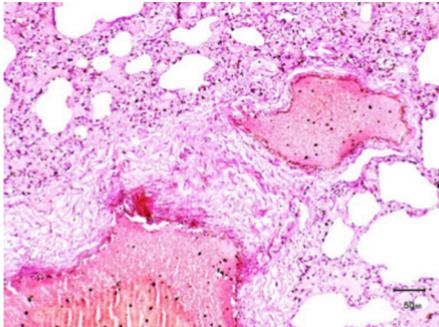


Figure 16: LUNG – red thromboembolism.

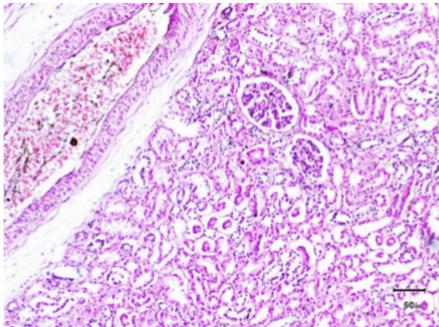


Figure 17: KIDNEY – red thromboembolism.

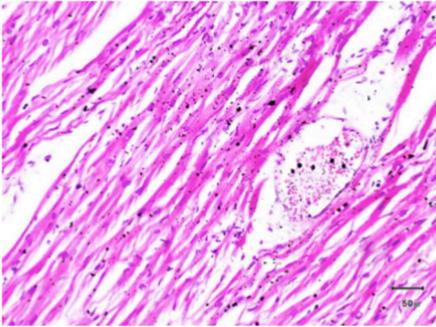


Figure 18: MYOCARDIUM – red thromboembolism.

The medical file of the patient included a document with the preprocedural anesthetic consultation attached, in which the patient declared that is allergic to Paracetamol. In the last echo graphic examination of the ovaries before the puncture, it is described that: “a few small follicles and only one dominant follicle” was present. The estradiol level was above 3700 pg/ml and the prolactin level were above 1000 with dominant follicle over 18mm with trilinear good endometrium type M – 9mm. It is written that ovulation was induced on the same day at 20:15, and an ampoule Ovitrelle 250 mcg/6500 E was applied subcutaneously. Follicle aspiration was performed 36 hours later. The data shows hyperstimulation of the patient and the puncture should have been postponed because of high risk of thromboembolism and other complications. However, on 07.06.2014 with the signature of the obstetric gynecologist specialist is stated by handwriting that “The patient is admitted to the clinic at 07:45 and refuses venous anesthesia”. The anesthetist. left the medical center without the permission of the obstetric gynecologist. At 08.10 after premedication prepared by the anesthetist an injection with Dormicum and Fentanyl was given to the patient and in mild sedation a follicle aspiration was performed

with a needle 17 g as all follicles above 18 mm are punctured and aspirated” (the exact number is not described).

The intervention went smoothly and without complications, with minimal bleeding through the vagina. Until 08:30 the patient was left alone and without observation by a medical specialist. When the obstetric gynecologist returned, he found very weak pulse and very low blood pressure. At 08:40 an emergency medical service was called. Resuscitation was carried out: cardiac massage, mask ventilation with oxygen, 1 amp. adrenalin was given intravenously; intravenous infusion of sodium chloride 0,9% 1 container was administered. At 08:40 emergency medical staff arrived. ECG- showed regular heart activity, the resuscitation continued with intravenous adrenalin, ventilation with Ambu with oxygen + cardiac massage was carried out. At 09:40 due to the lack of signs of improvement 1 ampoule intracardiac Adrenalin was made and all resuscitation efforts continued. At 10:00 ECG-rhythm showed no cardiac activity. When dilated pupils and clinical evidence of brain death were established, the resuscitation efforts were terminated.

In the expertise from the autopsy three forensic medical specialists accepted that the cause of death was propofol poisoning. This does not correspond to the detected traces of propofol, but confirms that the patient was under general venous sedation. In the court the autopsying doctors changed their standpoint and claimed that the death occurred as a result of acute inflammatory process in the lungs.

The reexamining of the case by our team concluded that the cause of death was definitely pulmonary thromboembolism. It is the result of injured blood vessels during the procedure of follicle aspiration. The procedure and the induction of anesthesia were done in absence of anesthetist/ intensive care specialist.

This case is an example of serious professional breaking of the law by criminal self-confidence of the obstetric gynecologist. Presently the case is still in legal proceedings and one of the reasons for that are the significant flaws in the forensic medical expertise of the corpse.

Case Three:

In this case it is the forensic medicine specialist who ends up with an incorrect conclusion in the court. A motor vehicle accident of a bicyclist that was hit by a car was stated as a murder case.

Obvious from the applied and accepted complex medical auto- technical expertise, prepared by experts, a doctor and an engineer, in which the following answers to the set tasks are given: “The motor vehicle accident of procedure occurred on 08.04.2016 around 2:00 between the cyclist and an unknown vehicle. The cyclist immediately before the accident was moving around the dividing line of the roadway in direction village Malo Konare to Pazardzhik town where an unknown vehicle reached the cyclist, and the overtaking happened from his left side. A hit occurred from the right side of the unknown vehicle on the left side of the body of the victim. From a medical point of view excludes a hit from behind...” It is accepted in this expertise that “the cyclist was pushing his bicycle, as the bicycle was 5-6 meters behind the body of the victim (behind the blood stains).

A copy of medical history of the hospital in Pazardzhik on the name of the patient from village MK. applied, admitted in critical general condition (GCS=4-5 points) on 08.04.2016 at 4:15 and died on 08.04.2016 at 18:05 with the following diagnoses:

Multitrauma, traumatic shock, head contusion, brain con-

tusion, subarachnoid hemorrhage, brain edema, lung contusion, left sided hemopneumothorax, fracture of the left 6,7 and 8 ribs, open fracture of the left antebrachium and open fracture of the left tibia.

The autopsy described the following:

Hight 172 cm; pale purple post-mortem staining; brownish suffusion 1x1,5 cm; on the front-upper surface of the left shoulder there is a massive abrasion of the skin and a bluish suffusion in the same region; on the left lateral region of the chest in the 5 intercostal space in the medial axillary line there is a surgical cut with a rubber drain; on deep cuts on the back a small vertical hemorrhage is established laterally in the left half of the back; in the left suprainguinal region there is an abrasion with grey-brownish color with the size of 5x4 cm, above the level of the surrounding area.

Plaster immobilization of the left brachium – plaster splint and gauze bandage; above it on the front surface of the same brachium in the upper third there is an abrasion of the skin with sizes 4x3,5 cm; below it and inwards there is a contused lacerated wound, in a slight oblique direction, surgically treated with a length about 5 cm and with 4 surgical sutures; under the plaster splint in the region of the left brachium there is a fracture of the left humerus, almost oblique, at the level 127 cm from the heel; on the internal surface of the left radiocarpal joint there is an abrasion with sizes 5/5 cm;

On the external side of the left elbow- abrasion with sizes 1,5/1,5 cm; the left ulna is broken in its middle third; on the posterior surface of the right elbow there is an abrasion - 2/2,5 cm; the anterior external surface of the right antebrachium in its middle and lower third is with a bruise with bluish color 10/5 cm, vertically situated; linear fracture of the skull bones from



Figure 20: The road that the accident occurred



Figure 21: The bicycle



Figure 22: The scene of the accident with a fallen sneaker of the cyclist

As fragments at the scene of the accident only two pieces from the headlights of the bicycle were found, which cannot be theoretically ruled out as impossible. Turning of the seat of the bicycle to the right occurs by a hit on the cyclist on the left side and by blows rotating the cyclist clockwise, as viewed from above.

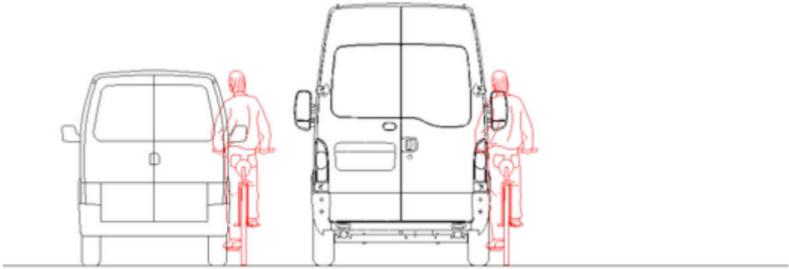


Figure 23: Scheme of the assumed vehicle that left the scene of the accident

The hit on the cyclist is direct, from the back, leftwards, as the left leg was low down and more probably the cyclist has stepped on the roadway. This is obvious from the fallen sneaker on the roadway, as from the left sided deep and massive traumatic injuries. The traumatic injuries at the right side are a type of field injuries. The main reason for the occurring of the motor vehicle accident is the act of the cyclist, who for unexplained reasons was moving in the middle of the roadway. The second reason for the occurring of the accident is in the act of the driver of the unknown car, who has not secured enough lateral safe distance towards the cyclist. The accident would have not happened if the cyclist had been moving on the right side of the roadway.

In order to move in the left lane, the unknown vehicle should have a reason, usually overtaking another motor vehicle.

It is possible that it has been overtaking the bicycle. It is obvious from the photos that the bicycle had a rear headlight, which did not work, because the dynamo was not turned on. This headlight had a reflector type “cat’s eyes”, which and in short range lights of the car should be seen from a distance of more than 100 meters and the car driver had the opportunity to take steps in order to provide safe overtaking of the bicycle.

The cause of the death is the open, severe head trauma: Massive bruising with dark red color in the left occipito-parieto-temporal region, linear fracture of the skull bones from the middle part of the occipital bone, going downwards and leftwards till the posterior cranial fossa, reaching the left pyramidal eminence to its posterior rim, massive hemorrhage under pia mater mainly on the convex part of the two brain hemispheres; contusion foci in the occipital part of the two brain hemispheres and the following severe brain edema with cerebellar herniation. These traumatic injuries are from a direct blow with a dull blunt, flat object like the side-view mirror of the car.

Conclusion

To conclude, the medical doctors have to be aware of which medical procedure may be legitimately performed under international and national law and have to consider the possible civil and criminal liability claims and disciplinary sanctions that may arise if he/she fails in the application (5). Subsequently, it applies this analysis to investigate whether body transplants would currently be legally allowed. The physicians are likely to be found liable for medical malpractice and they would run a considerable risk of being held criminally liable for negligent homicide (6). The participating physicians also risk severe disciplinary sanctions for professional misconduct, with a real pos-

sibility that they will be suspended or even banned from medical practice for life (7).

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“Kosovo’s Experience in Expert Witnessing”

Lack and Advantages of Expert Witnessing in Report with Court and Persecutor Office

Naim UKA

Introduction

In general, the term of forensic expert witness is a type of expert witness who would provide expert forensic testimony within a trial. A commonly known form of forensic expert witness is a scientist who performs an examination of a human skeleton so as to provide important evidence for a criminal trial. Forensic Expertise is not limited only in human skeleton. The Criminal Procedure Code of Republic of Kosovo explains in Article 133 the idea of expert analysis, whereas there are other related articles that are explained below.

1. For expert analysis to be used by the state prosecutor:

1.1. There must be a question material to either the guilt or innocence of the defendant or the extent of harm caused by the criminal offense

1.2. The expert must have specialized training or experience that is relevant and current. (Licensed)

1.3. The expert must have analyzed lawfully obtained evidence

1.4. The expert’s analysis must have used practices general-

ly accepted within his or her field or has a scientific or technical basis

1.5. The expert must write a report that summarizes his or her method of analysis and conclusions

An expert may not express an opinion on the guilt or innocence of a defendant.

3. The defendant or defense counsel may request the state prosecutor to take expert testimony.

4. The injured party or victim, victim advocate or victim's representative may request the state prosecutor to take expert testimony.

Article 134 – Decision to engage expert

Article 135 – Obligations of expert witness

Article 136 – Report of expert

Article 137 – Orders necessary for evidence to be examined by expert

Article 137 – Orders necessary for evidence to be examined by expert

If a defendant is unwilling to consent in writing to give a sample of blood, body tissue, DNA or other similar material or is unwilling to consent in writing to undergo a physical examination of injuries as required by an investigation, the state prosecutor shall request an order from the pretrial judge requiring the necessary sample or examination in accordance with Article 142 of this code.

The Forensic institutions in Kosovo are three in number and their names and functions are stated below:

- Institute of Forensic Psychiatry – Ministry of Health
- Forensic Agency of Kosovo – Ministry of Interior
- Institute of Forensic Medicine – Ministry of Justice

Institute of Forensic Psychiatry – Ministry of Health

The Institute of Forensic Psychiatry is obliged to offer expertise for judiciary institutions on level of psychiatry health.

Psychiatry Expertise should determine availability of accused person to justify for judiciary institutions. Other cases that the same institution is involved are the following:

- If an accused person was in good mental health (aware) during causing the penal case;
- If an accused person is mentally available to follow the judiciary process or he needs medical treatment etc.

The Institute of Forensic Psychiatry of Kosovo is divided into three Departments: “A”, ”B” and “C” where Department “A” is the Reception department. In this department are services like ambulatory expertise; Client admission; Psychiatric expertise for courts; and Laboratory analysis; The Department “B” includes the compulsory treatments including: patient admission transferring from department “C”, laboratory analysis for clients; consultation into IFPK; and consultation outside of IFPK; Finally the Department “C” performs psychiatric expertise, laboratory analysis, specialist consultation outside IFPK; and specialist consultation into IFPK;

Kosovo Forensic Agency - Ministry of Interior

Kosovo Forensic Agency is obliged to offer expertise for judiciary institutions on level of ballistics, fingerprints. It includes the Department of Forensic Traceology; the Department of Forensic Chemistry and Biology; the Department of Forensic Information Technology; the Division for Quality; and the Division of Finance and General Services

The Department of Forensic Traceology includes the Ad-

ministration of the Evidences Division; the Traceology and Fingerprint Division; the Ballistics Division; and the Questioned Documents and Handwriting Division.

a. Administration of the Evidences Division;

This division is established for receiving cases for examination, case registration in Laboratory Information Management System (LIMS) system, systematization of cases in evidence room, delivery of cases for examination, receiving of cases after examination, delivery of cases to the requesting parties, systematization of case files, and archiving of case files, etc.

b. Traceology and Fingerprint Division;

This division is established for the examination and visualization of fingerprints with Physical/Chemical and instrumental methods, processing, data entry of fingerprints into Fingerprints database (ordering of papillary marks of fingers and palms, also of unidentified marks), and digitalization of papillary marks (CAPFIS), identification of persons based on papillary by using papillary marks fixed in the crime scene, person's identity control and determination based on papillary marks received from the Directory for International Cooperation in the Field of Law Enforcement (ILECU), identification of corps based on papillary marks, and identification of tool, shoe and tire print marks.

c. Ballistic Division;

Within the Ballistics Division various ballistics examination from the field of Firearms are conducted. The examinations conducted within the Ballistics Division are: examination of firearms, examination of cartridge cases and ammunition, examination of bullets and/or projectiles, examination of the vehicle chassis numbers, determination of the shooting trajectories, test firing of registered firearms, etc.

d. Questioned Documents and Handwriting Division;

In the Questioned Documents and Handwriting Division are conducted various forensic examinations from the field of documents and handwriting/signatures. The examinations conducted, are: examination of questioned Banknotes and Coins, examination of Documents, examination of Banderoles, examination of handwriting/signatures, etc.

e. Department for Forensic Chemistry and Biology;

The duties and responsibilities for the Department for Forensic Chemistry and Biology are as follows:

DNA/Serology analysis, chemical analysis of narcotics, chemical analysis of explosives, arson and gunpowder particles, entering and comparison of DNA profiles into DNA database CODIS, composition and recommendations of standard operating procedures (scientific methods); and departments of administrative services;

According to court and prosecution orders, experts from the department testify their expertise in the court.

Institute of Forensic Medicine - Ministry of Justice

The Assembly of the Republic of Kosovo, Based on Article 65 (1) of the Constitution of the Republic of Kosovo, Approves LAW ON FORENSIC MEDICINE (Law No. 05/L-060) on April 2016; The description of the law is as follows:

CHAPTER II -FORENSIC EXAMINATIONS

Article 3; - Performing Medico-Legal Examinations

1. Medico-legal examinations such as: medico-legal autopsy, clinical medico legal examination, biological sample examinations and other forensic examinations, foreseen by law are carried out by the medico-legal experts of the Institute.

2. Medico-legal experts shall perform their duties in an objective, independent, impartial manner and they must adhere to

the principles of professional confidentiality concerning the collected information, analysis and other findings which they learn while performing their duties and non-discriminating practices, pursuant to the law and respective sub-legal acts.

3. The medico legal expert carries out the expertise pursuant to the law, with an order issued by Court or State Prosecutor.

The Institute of Forensic Medicine in Kosovo is obliged to offer expertise for judiciary system in scope of human skeletons and bodily damage; expertise of human skeletons related to the autopsy report and sexual rape reports which field is covered by medico-legal expert; expertise of bodily damage related to physical damages which field is covered by multidisciplinary medical experts (emergency specialist, orthopedic specialist, chirurgic specialist, medico-legal specialist etc.);



Figure 1



Figure 2



Figure 3



Figure 4

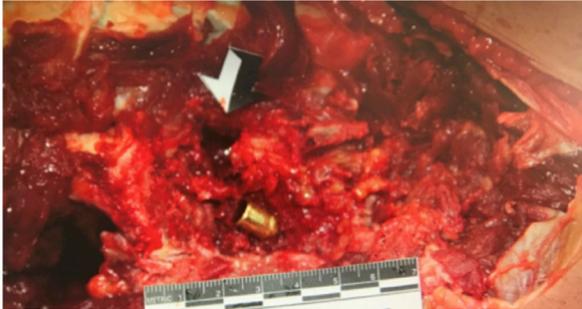


Figure 5

Testimony procedures

Medico-legal testimony in court following medico legal report's where need for medico-legal clarification is: Judge ordering medico-legal expert to testimony in court by proposal of persecutor, lawyers or by judge members in council; Misunderstandings, contradictions or disagreements between parts in court related to the medico legal reports can be subject of medico legal testimony in court by medico legal expert.

Figure 6: Judicial order for expert witnesses

a. Procedures of witnessing

All medico-legal reports (crime scene examination report, autopsy report, sexual rape case reports, qualification of injuries reports, reconstruction of crime scene reports etc.) may be subject of medico-legal expert testimony.

b. Lack and advantages of expert witnessing in report with court and persecutor office

State persecutors orders for medico-legal procedures (examination of crime scene, autopsy procedures, examination of sexual rape cases, examination of physical injuries, examination of medical documents, classification of injuries etc.) lacking the required medico-legal knowledge

Examples:

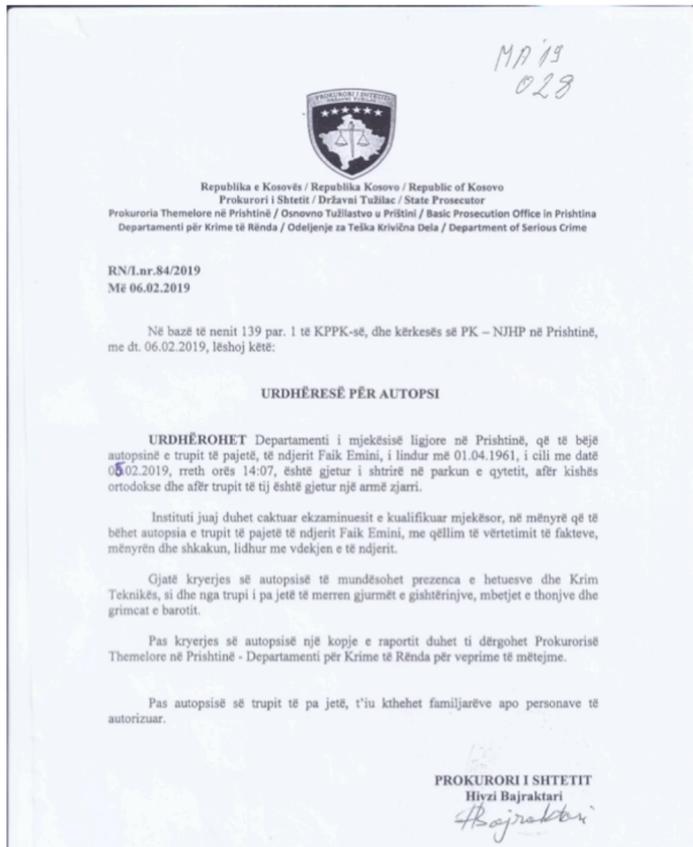


Figure 7: Persecutor order for autopsy

MAIN QUESTIONS:

- Nature of Death;
- Manner of Death
- Cause of Death

Except main questions in this order police investigator, ballistics police officers;

is requested to be present - because the death is caused by injuries with gunshot wounds

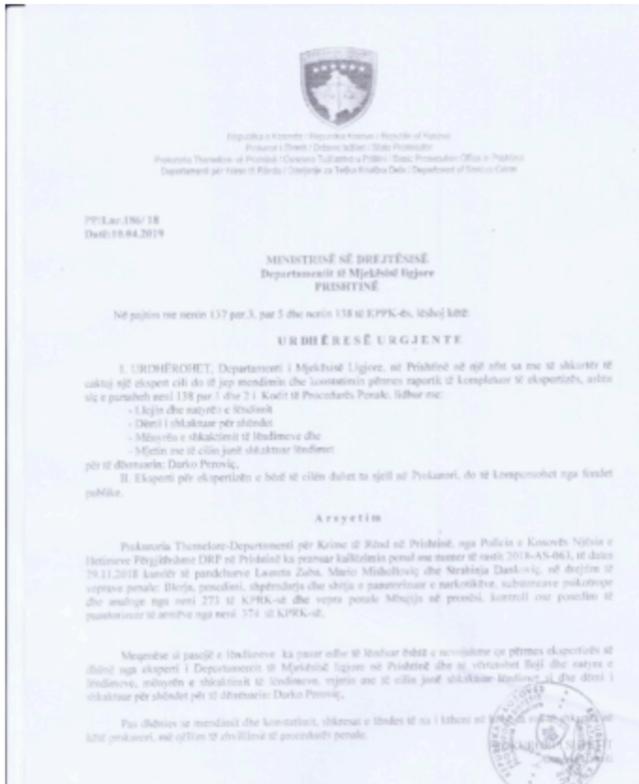


Figure 8: Persecutor order for qualification of injuries based on medical reports or physical examination

- c. Persecutor main questions:
- Type and nature of injuries (heavy/light injury) ;
 - Damage caused to health (temporary/permanent);
 - mechanism of causing injury (Sharp/blunt);
 - The tools with which the injuries were caused (not necessary to rename except is written in medical reports or police reports followed by pictures of the tools found in crime scene;



Figure 9

Public Communication

The Persecutor office is obliged through spokesman of Persecutor state office to declare some of the circumstances of the case; Medico-legal officials (doctor, technician, assistants etc.) are not allowed to contact public media (examples); Police officers are not allowed to contact with public media; therefore there is a lack of communication and cooperation.

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Medical Malpractice and Liability in Turkey

Mehmet Akif İNANICI

Introduction

Medical malpractice is defined by the WHO, as a failure of the physician to perform standard of care for treatment, a lack of skill, or negligence in providing care to the patient, which is the direct cause of an injury or death of the patient (1).

The first thing that comes to mind when we say the legal responsibility of the physician is his/her responsibility due to medical errors.

This responsibility has three dimensions:

- a) Criminal Responsibility
- b) Liability for Compensation
- c) Disciplinary Responsibility

In all three conditions the physician will face one or more than one sanctions. However, these sanctions are very different from each other. In other words, in the event that the physician causes a patient's death or injury as a result of a medical error, there will be three separate responsibilities.

Criminal Responsibility: The physician will be tried in a criminal court for carelessly causing the death or injury of his/her patient. At the end of the trial, a prison sentence or a judicial fine shall be imposed on the physician.

Liability for Compensation: The physician should pay the pecuniary and non-pecuniary damage caused by the error.

However, in this case, unlike the judicial fine, the amount of compensation is not predetermined and will be determined for the pecuniary and non-pecuniary damage to be determined by the court. It will be paid by the physician to the patient or their relatives.

Disciplinary Responsibility: It is a disciplinary sanction which will be applied as a result of a disciplinary investigation by the local medical chamber about the physician and/or by the hospital administration about the public official ones (2).

In terms of the responsibility of the physician, it constitutes the subject of the cases in the presence of the following two conditions.

1. Unlawful action [(a) If medical practices are not performed by authorized persons. (b) Medical interventions without consent of the patient or guardian are against the law.]

2. (a) Medical error, (b) Damage (Harmful result), (c) Appropriate causality link between the error and damage.

What are the medical implementations?

All kinds of procedures for the application of medicine and biology on the human body are considered medical implementations. Medical applications can be discussed under nine headings as the follows (3,4);

	Medical implementations	Examples
1	Disease prevention [(a)Vaccination of sensitive persons, (b) Ensure proper nutrition of persons, (c) Periodic inspection of healthy persons for early diagnosis]	(a) Vaccination of infants (b) Obesity surgery (c) Endometrial cancer screening
2	Diagnosis process of the disease	History Physical examination Laboratory tests (Medical Biochemistry, Microbiology, Pathology, Hematology) Invasive / non-invasive methods Consultation
3	Treatment process of the disease	Medicine, Anesthesia, Surgical, Radiotherapy, Physiotherapy Shock therapy, Psychotherapy
4	Follow-up care of the patient	Postoperative care
5	Collecting evidence of crime	Physical examination in child sexual abuse etc.
6	Conduct of scientific research	Cancer research
7	Pure beauty process	Laser hair removal, Aesthetic nose surgery
8	Reproductive process	Intrauterine devices – Birth control
9	Medical methods for fulfilling traditions and beliefs	Circumcision

Medical applications sometimes can result in unwanted medical status.

What is the unwanted medical status?

	Medical implementations	Unwanted medical status
1	Disease prevention [(a)Vaccination of sensitive persons, (b) Ensure proper nutrition of persons, (c) Periodic inspection of healthy persons for early diagnosis]	Incorrect application of the method / Application-related complications
2	Diagnosis process of the disease	Failure of diagnosis or Misdiagnosis Disregarding or not taking appropriate patient history Failure to recognize symptoms Failure to order proper testing Misreading or ignoring laboratory results
3	Treatment process of the disease	Improper medication or dosage Unnecessary surgery Method of treatment is incorrect. / The occurrence of complications
4	Follow-up of the patient	Poor follow-up or aftercare / The occurrence of complications
5	Collecting evidence of crime	Incorrect application of the method / Misjustice
6	Conduct scientific research	The occurrence of complications
7	Pure beauty process	The occurrence of complications
8	Reproductive process	The occurrence of complications
9	Medical methods for fulfilling traditions and beliefs (Circumcision)	Incorrect application of the method / Application-related complications

What is the distinction between medical error and complication (5)?

	Examples	Complication	Medical error
Unpredicted situation	20 years old, male - no smoking, no known disease, inguinal hernia operation, - previous investigations normal, no problem in surgery, sudden respiratory and circulatory failure arises while standing up the next morning, - Autopsy: Advanced pulmonary embolism as a result of deep vein thrombosis	+	
Predicted situation / no precaution	62 years old, male - gunshot wound, open tibia fractures, proper treatment, - sudden respiratory and circulatory arrest after 8 hours - Autopsy: Fat embolism	+	
Predicted situation / enough measures	52 years old, male - Rectal cancer - Sexual dysfunction as a result of tumor removal	+	
Predicted situation / taking a precaution	43 years old, female - peptic ulcer perforation, delay in admission to hospital, - proper treatment, - Autopsy: Peritonitis / Sepsis	+	
Predicted situation / not enough measures	35 years old, female - peptic ulcer perforation, no delay in admission to hospital, - discharged from hospital after proper treatment, - three times hospital application at different times (redness and discharge at the surgical incision and fever) - Autopsy: Peritonitis, Sepsis		+

Are there any other medical errors?

1. Wrong site surgery
2. Foreign object left in the body
3. Damages outside the work area (dropped patient during transfer)
4. A lack of skill (occurring of aortic rupture in the initial stage of laparoscopic abdominal surgery)

Who can give an expert opinion about the medical error?

There are several institutions that can report expert opinions about medical errors in Turkey. The Council of Forensic Medicine is the main organization of the Ministry of Justice which has the expert reports as its main obligation. The second type of institution that is responsible for expert witness reports are the University Hospitals. Finally, the Training and Research Hospitals of the Ministry of Health can issue expert witness reports for the defendant (medical doctors) or the complainant (patient).

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Ethical and Medico-Legal Evaluation of Expertise System

Mete Korkut GÜLMEN, Sila ASLAN

*“Ubi homo, ibi societas, ubi societas, ibi ius”
Where a (civil) society is present, there is the law.*

In particular, each individual, from childhood until full age, not only is influenced by the environment in which she/he grows in, but at the same time undergoes a process of “socialization” through which tends to share with others values and beliefs to be able to act within the new organization (1).

*“Ex facto oritur ius”
The law arises from the fact.*

This means that each fact, event or experience that we live and face each day can be traced back to an abstract case contained in a rule of law. In this context, the practice of forensic sciences and its expertise plays enormously important role in improving the law, ethics and the society values (2).

*“Justitia fiat, ruat coelum”
let justice be done though the heavens fall*

Introduction

The scientific knowledge and technology enormously rolls down and it is so hard to follow all of these improvements without the academies. Now; it is important for the forensic centers

to be appropriately accredited and use the highest technology and scientific knowledge for their clients (3). Evidence based investigations (evidences as much as science lets us to have) forms the basis of forensic medicine (2,3).

We came to a new stage of technology. Forensic daily practice needs to be more specific and clearer in demonstrating the objective criteria especially considering the human rights violations as well as the part of the human rights. In today's high technology and scientific world, justice needs much more to be supported by the qualified, standardized expertise. The most debatable and problematic ethical issue is the independency and reliability of these expertise (4).

The world is much smaller than ever. Networks give us the opportunity to consult with each other. We can use tele-consultation and report a difficult case with serious consultations of our colleagues even with a developed mobile or installed device technology. The scientific knowledge and technology enormously rolls down and it is so hard to follow all of these improvements without the academies. Now; it is important for the forensic centers to be appropriately accredited and use the highest technology and scientific knowledge for their clients.

The main problem seems to be the sufficiency of the forensic sciences expertise and laboratory systems such as drug testing laboratories in the system. Therefore, the question raises who should be the authorized in those laboratories as well as the standardizations, quality assurance and acquainted scientists (4).

It is well known in the international scientific society that a forensic case should be handled by authorized, acquainted forensic scientists. This should be applied to all forensic cases from engineering to pathology, or from to chemistry to docu-

ment analyses with all aspects of the scientific spectrum. It is of course obvious that a forensic case or an analysis cannot be delivered by anyone else but a forensic expert scientist. Of course, the interpretations of the reports and final evaluations should be performed and shared with several different sections of the forensic sciences (2, 5).

Autopsies are the most well-known or prior term of public perception for forensic medicine generally. We know that an autopsy can only be performed by a forensic pathologist but sometimes the evaluation by a team of scientists may be needed (6). It is known by experience that most of the clinical cases are serious forensic issues that a large team of forensic scientists should undertake (7). The judicial systems in many parts of the world, are interested with the crimes and criminals. Usually all of the criminal and civil code laws ask for forensic multidisciplinary scientific approaches. Any case which will lead us to a legal problem should be handled and evaluated carefully by the forensic scientist who is an expert on a certain field, e.g.; forensic toxicology, forensic genetics, forensic pathology, forensic odontology, etc. (8).

None of the countries can be exempt from this since almost all of them have signed supranational / international agreements especially the United Nations' and other similar articles (9). Double negative Therefore a non-forensic center or a laboratory cannot be accepted as a forensic expert center or laboratory if they are not designed as so with experienced forensic scientists, who are either a master of science in the field with an experience of minimum five years in the field, preferably by a forensic expert with a PhD (10).

As a concerned scientist and a person who cares about the justice system, to organize the system over a standard clinical

hospital and its laboratories will yield to serious and terrible results in any country. The forensic laboratory systems will corrupt as well as the true evidences. A forensic analysis either it is a forensic toxicology, genetics, pathology, odontology or else should be performed by a forensic expert and at a forensic center or a laboratory but else nowhere (2, 7). The justice can only be served by a true scientific expert.

The world needs justice in order to survive. Today's scientific knowledge and high technology lacks the philosophy where science is applied to law. Justice needs more ethical and philosophical values than ever and it should be applied in equality with freedom (11). Ethical values and universal scientific ethical perspectives should be the main stream in all countries no matter what the conditions are and should be coded as unclassified if not so.

We are improving in science and technology yet our legal and ethical values are still so poor and so we cannot develop a better judicial system to lead us to a better justice globally.

«The lawyers are seeking for a proper description of law to construct the justice» says, Immanuel Kant. Jean Jacques Rousseau and Jacques Bénigne Bossuet and many others are describing us what and how the law and justice should be. Throughout history many men of religion and philosophers voiced the concept “middle way”. Although “middle way” was voiced as a philosophy of life at the beginning, it gradually gained a moral connotation. Philosophers started to address the way it affected people's life and behavior. “Middle way/golden mean” concept in Aristotle's (384-322 BCE) theory of ethics (12).

Personal rights are the rights that a person has over their own body. Among personal rights are associated rights to protect and safeguard the body, most obviously protected by tor-

ture, assault and battery. Furthermore, aspects of personality are protected, such as a person's reputation, by the tort of defamation and legislation protecting the privacy of individuals, and freedom of movement. Freedom is a personal right. All people should be free. A person cannot waive a personal right. It is a part of the human dignity. We cannot limit neither suspend any of those freedom (13). As an expert we should respect to the confidentiality. Right to live is the first personal right and we cannot regret nor neglect it. Death penalty cannot be accepted. A person's name is also his/her personal right. All of the national and international declarations and/or conventions are concordant to all and many others. The people have and keep the right to resist against the authority in cases when the state rules out the personal rights. And this is the security system of all of the legal and judicial administrations. These are all a part of the law of nature.

Justice leads us to unwritten legal rules. So that as scientists, we are look for justice beyond the written ones but search for an unwritten one for to achieve justice. Justice is a must on behalf of the law of nature and the purpose of the law. Jurgen Baumann says that; the absolute value of justice or without thinking of that value, law is a clown show or just being a chatterbox. We all have to act in accordance with the human rights declaration as well as the world medical association declarations. Supremacy of law can only and best of all be protected by the independency of the judgement and expertise. All of the countries should be in justice. The main rule is to have an independent, competent, adequate, controllable, internationally standardized and accredited experts and expertise institutions. That means we have to develop a system with the triangle of the justice as, judgement, prosecution, defense. All of the sides should and might have

their own experts or expertise institutions. This is a must for a true justice and law.

We very well know that when we take out the justice and law from the states, the state will fall apart, on the other hand if we can protect our society with the justice, we can talk about; freedom, equality and peace for the people. To protect the law and justice, we need to know that we have to work within science, scientific knowledge and ask justice for all parties even for the persons that we do not approve their attitudes. The higher consciousness will especially be built over the shoulders of the forensic scientists and legal medicine practitioners. We do need more freedom, more of law and justice.

Ioanna Kuçuradi; asks for a state with a constitution that completely relies on the international and universal declaration of the human rights, and this should be a must for all states. Our universal scientific knowledge and ethics leads us to a more humanistic, more secular and more prosperous state. We will only live and survive unless within the scientific enlightenment, science, law and justice under the universal ethical values.

Duties of the College of Forensic Sciences are;

- To educate graduate students, professionals who are contemporary in science, expert in their subjects, constructive, creative, professional ethics and universal values.

- To keep the interactive information constantly updated by providing national and international academic cooperation.

- Intensive use of teaching and learning methods that direct students to research.

- To be an institution which educates scientists and experts who have international professional and academic standards based on a contemporary, active and participatory education.

Forensic experts; should be independent and should only

use the scientific knowledge but nothing else, work in accordance with standardization/accreditation and quality assurance, belongs to universal ethical values; humanism, secular mind, equality in the light of freedom and many many others (3, 8).

“Forensic scientist is to justice for justice”

In order to ensure independency;

- Collaboration with universities
- International collaborations
- National & international networks
- Non-governmental independent accredited standardized & quality assured institutionalization are recommended.

The experts are asked to contribute their objective and scientific attitudes by the judgment office for situations requiring special and technical knowledge in order to perform an accurate and a complete justice. The physicians, especially forensic medicine specialists are also requested as an expert for their suggestions on many cases on human and human sources. According to the legislation laws in our country, the medical expert charge has been given to all physicians that are authorized in their proficiency. In this extension, Forensic Medicine Institution, Superior Health Council, Departments of Forensic Medicine in universities, Forensic Medicine Institutes, hospitals, village clinics and physicians working in private are in service for the Forensic Expertise system. The forensic medicine specialist is essential in this process.

In Turkey the Forensic Expertise system should be reevaluated and reorganized as it is well documented and reported in the means of needs and all term solutions during the State Inspectors studies and report in December 2009. It is essential for

our country to redesign its' system as soon as possible because of the Progressing Reports of the European Council and also the State Inspectors reports.

The Forensic Medicine and Sciences can only be best in practice and serve to justice in fair equality for the best benefits of the human rights as it is actually can be named as “Humanitarian Forensics”.

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Expertise Practices in Turkey

Nurcan HAMZAOĞLU

Introduction

The expertise practices are within the most important evidence assessment tools of the judicial process within the framework of the rules of law in Turkey, once they rely on available evidences (1). Today, in line with the rapid improvements in the scientific and technological fields, the complexity of the structure of legal disputes and the increase of need for special and technical knowledge in the resolution of the relevant disputes also raise the role and importance of expertise practices in judicial activities (2).

The Concept of Expertise and the Legal Framework in Turkey

Experts are the specialists who are the consulting individuals during the judicial process on the matters that require special or technical knowledge (3). As stated in this definition, it is an important factor that an expert has special and technical knowledge regarding the subject that causes of the dispute.

The increase in the need for expertise as a result of the need for special and technical information has brought along the need for professionalization in expertise practices, which is an important parameter in the judicial system. Professional exper-

tise practices are also important in terms of fast and smooth operation of the judicial system.

Expert witness services in Turkey are not only given by real persons but also by legal persons. The qualifications required for the relevant real and legal persons and the conditions required for the provision of expert services are determined by the regulations in the Law on Experts No. 6754 dated 24.11.2016 and the Expert Regulations dated 03.08.2017. (2, 4).

Along with these legal arrangements that enable the expertise to be carried towards a professional ground; some other regulations such as the training of real and legal experts, the procedures and principles regarding the qualifications and the control they should have, and apart from the determination of the basic principles and obligations related to the expertise, the application and selection of the expertise, and the registration to the registry list; some other institutional arrangements such as formation of Expertise Advisory Board, establishment of Expertise Department, establishment of Regional Boards of Expertise and determination of their duties have been made in the places where the Regional Courts of Justice are located (5).

In the Law on Experts dated 2016, a 24 hours of Basic Expert Training course has been determined as one of the admission requirements for expertise. Basic Expert Training is an education for professionals and a training that is taken by people who have five year of professional work experience including basic information that will be needed to perform expert witnessing. This compulsory basic training is an important practice in terms of raising qualified experts and creating an efficient institutional structure (2, 4).

In order to provide expertise service, after receiving this basic training, individuals must first apply to the "Regional Boards

of Expertise” or to the “judicial or administrative justice commissions” of the Court. During the applications, the applicants should indicate their areas of core expertise and sub-specialties. In addition, the applicants must add to the application petition the documents that indicate their minimum of five years’ experience. The documents consist of diplomas related to expertise, documentation for working in the field of expertise for at least five years, and a document proving their proficiency or mastery in their professional area. For the legal person applications, it is obligatory to add the list showing the expert witnesses and their expertise fields together with the document showing that their activities in the legal person aforementioned. Besides the Turkish citizens, foreign citizens can apply as experts, as well.

After the evaluation of the applications by the Regional Boards of Expertise, the accepted ones are given an expert authorization certificate which is valid for three years.

Appointment of an Expert

In accordance with the relevant legal regulation, for the resolution of cases where a special or technical knowledge is required, it may be decided by the Court to appoint an expert. The parties involved also can request an expert review from the Judge or the Court, or from the Public Prosecutor during the investigation stage (Article 63/1 of the Criminal Procedure Code Article 266 of the Civil Procedure Code (10-12)).

The experts are assigned from the lists prepared by the “Regional Boards of Expertise”. If appointed, the expert has an obligation to accept the task. It is stated in the relevant legal regulation that in case an expert who has been summoned in accordance with the rules does not appear to the court without any valid justification, or if after appearing refuses to take an oath or

to deliver his vote and opinion shall be penalized (Article 70 of the Criminal Procedure Code).

The subject, duration, scope and the limits of the examination shall be notified to the appointed expert in written form. The documents required for examination shall be delivered by signature. And It is also stated that the examination duration shall not exceed three months. Upon request of the expert, the relevant duration can be prolonged for not longer than three months. The expert is obliged to fulfill the assigned task personally. The expert cannot transfer this task to another person, and is obliged to protect the confidentiality of the information and the documents given to him. Even if the relevant expertise task is over, he/she is obliged to keep the confidentiality. (Article 12 of the Law on Experts; Articles 51-52 of the Expert Regulations; Article 66 of the Criminal Procedure Code Articles 273-276 of the Civil Procedure Code (4, 9, 13, 14).

Another point to be emphasized is the status of the experts. The experts have a special status in accordance with the legal regulations in Turkey. The experts who have been appointed by a Judge or Public Prosecutor shall be considered as Public Officials during their duties (Article 58 of the Experts Regulation). Therefore, they are obliged to comply with the “Regulation on the Principles of Ethical Behavior of the Public and Application Procedures and Essentials”. Moreover, it is stated in the Expert Regulation that they must comply with the ethical behaviors such as competence, fairness, honesty, professional care, impartiality, prohibition of obtaining benefits, advertising ban, obligation of notification (4, 9).

Expert Report and Expert Opinion

An expert is obliged to make written and oral notice re-

garding his actions and opinion at the end of the investigation. The expert's obligation to report and the issues to be specified in the report are stated in the relevant legislation. Accordingly, the expert shall transmit the examinations made and the conclusion at the end of the investigation by delivering the requested examinations to the relevant authorities by signing. In accordance with the relevant legislation; the expert shall be able to give explanation upon the issues requiring expertise and technical knowledge in his report. Apart from that, he cannot make any explanation, legal adverb of matter and evaluation; if there are differences of opinion in the cases at which more than one expert is appointed, the relevant reasons shall be reflected on the report. Besides this information, it is stated that the assignment unit, file number, the parties, the assignment date of the expert, the subject of task, the method used in examination, scientific and technical bases, the date of report, the real expert's title, name and surname, registration number and signature shall be included (Article 55 of the Expert Regulation Article 279 of the Civil Procedure Code). (9, 14).

It is stated in the relevant legal regulation that the expert reports shall be presented orally or in written form which is preferred. The report presented shall be evaluated by the assigning authority. The relevant report must be complete, comprehensible and persuasive in order to be taken into account. At this point, the key element is the content of the report, however, in order to be evaluated properly and show the quality of the work, its conformity to the rules of form should be taken into account. Regarding the report, all questions should be answered, unnecessary explanations should be avoided, the language used should be clear and understandable so that anyone can understand the content of the report without any hesitant statement. For the

comprehensibility and persuasiveness of the report, the expert must give justification and indicate the references and opinions in his report (8, 15).

Besides, it also stated that, after the delivery of the report, a specified time limit shall be given to the parties in order to ask for any new expert opinion or to make objection against the relevant expert report, however, an additional report shall be requested by means of addressing new questions for disambiguation (Article 67 of the Criminal Procedure Code, Article 3 of the Law on Experts, Article 56 of the Expert Regulations).

Although the issues to be stated in the report have been specified in detail in the expert legislation, the legal character of the report is not clear enough. It is controversial whether the expert opinion shall be used as evidence or as evidence assessment tool (6). Even though, there are different opinions in the doctrine, it is stated in the decree dated 1991 of the Penal Department No. 1 of the Supreme Court that the expert opinion is not an evidence, it is just a statement regarding the evidence, the Judge is not hinge upon expertise inspection, and the mission of the expert is to enlighten the Judge on scientific and technical matters. In accordance with the decision numbered 2015/12-276 dated 24/05/2016 of the Supreme Court Assembly of Criminal Chambers regarding the experts reports and whether these reports are juristically binding in terms of judicial authorities, it is stated that the expert reports are not an evidence, but they are an evidence assessment tool and they are not restrictive in terms of the Court.

Within the scope of the relevant legislation, if the expert feels the necessity, he can ask questions through the Presiding Judge, Judge or Public Prosecutor, or if given the permission, the expert can ask direct questions to the suspect or accused

(Article 66 of the Criminal Procedure Code, Article 56 of the Expert Regulations).

Besides the expert report, it is stated that the public prosecutor, the intervening party, his representative, the suspect or the accused, his defense counsel or the legal representative may ask an expert of that field to give a scientific opinion which they shall use to evaluate the subject matter of the trial or to use it while preparing a written expert opinion or to evaluate the written opinion of the experts (Article 293 of the Civil Procedure Code Article 67/7 of the Criminal Procedure Code). Unlike the expert report, the expert opinion shall not be directly presented to the Court. The expert opinion requesting party shall present the expert opinion to the court with a written petition, and/or shall submit the examination and comments stated in the expert opinion as a petition for declaration and present it to the court. The expert of whom the opinion received directly or upon request, shall be invited by the Judge and give an oral explanation on his/her expert opinion. If the expert does not come to the hearing without any valid reason, the issued report shall not be evaluated by the Court (Article 50 of the Expert Regulations Article 67 of the Criminal Procedure Code Article 293 of the Civil Procedure Code). It is stated in the relevant regulation that an additional time shall not be requested for the expert opinion. However, in case that either party has been applied for an expert opinion, the lack of time for the opposite party to make counter statement shall be accepted as the reason for the reversal by the Supreme Court. In conjunction with these regulations, the Criminal Procedure Code and the Civil Procedure Code entitle both parties to get opinion from an expert. The specialists who submit their thoughts and comments in this way shall be essentially “experts” and therefore powers and duties are not different

from those of experts (4, 9, 13, 14, 17-19).

The expert's attitudes and behaviors regarding their duties or the compliance of their reports with the relevant legislation are controlled by the Regional Boards of Expertise. At this point, if the assigned authority considers that the expert's attitude, behavior or the report prepared by the expert is not compliant with the relevant legislation, this situation shall be reported to the regional boards. However, it is stated in the relevant regulation that it shall not be possible to apply to the Regional Boards of Expertise regarding the content of the expertise report in terms of its special or technical information (Articles 559-560 of the Expert Regulations).

The compensation regarding inspection, transportation, accommodation and other expenses received by the expert for his efforts and labor spent during the review, evaluation and reporting processes shall be made according to the tariff determined by the Ministry of Justice (Article 57 of the Expert Regulations, Article 72 of the Criminal Procedure Code, Article 283 of the Civil Procedure Code). In case the assigned expert does not fulfill his obligation within a specified time, a new expert shall be appointed instead. It may be decided not to pay fees and expenses to the expert who does not fulfill his obligation. Besides, the application of the necessary sanctions with the justification shall be requested from the Regional Boards of Expertise. The expert must submit a report regarding the processes done so far and return the relevant documents and items.

Official Expertise Institutions

Expertise service in our country is conducted by real persons and legal entities persons who are on the expert list formed by the Regional Boards of Expertise or through the institutions

specified in the Law that are able to give expertise services. These institutions will be mentioned in this part of the essay. In the resolution of disputes that require special and technical knowledge in the judicial process, it is stated that the court can apply to the individuals and organizations that their job is specifically expert witnessing. More clearly, if there is an official expert that is employed in an institution that is mentioned below, then he/she can be appointed by the Court without applying to the judicial commission expert list. The official expertise institutions established by legal regulations in Turkey are as the follows:

Supreme Council of Health: The Supreme Council of Health has authorization for official expertise in accordance with the Public Health Law in Turkey dated 24.04.1930 and numbered 1593, and Decree Law on the Organization and Duties of the Ministry of Health dated 1983 and numbered 181. This Council was established within the Ministry of Health and provides official expertise just in order for forensic medicine issues arising from medical interventions. The Undersecretary or the Deputy Secretary assigned by the Undersecretary, and Chief General Counsel or the assigned Legal Counsel are the natural members of the relevant Council. 13 members of the Council, which has 15 members in total, are elected by Minister of Health. They gather 4 times a year with the participation of at least eight members under the Presidency of Undersecretary or under the assigned Deputy Secretary. If it is necessary, the President shall call the Council to a meeting (20, 21).

Council of Forensic Medicine: This Council belongs to the Ministry of Justice and it has been established by a specific legislation as the primary expert witness institution of the country. It functions according to a Law called “Forensic Medicine Institution Law” (No. 2659). In accordance with this Law and

the Presidential Decree No. 4 regarding the Relevant and Affiliated Ministerial Institutions and Organizations and Other Institutions and Organizations, this Council has been established in order to express scientific and technical opinions on forensic medicine issues sent by Courts, Judges and Public Prosecutors. Besides the expertise activities, the Council aims to conduct forensic medicine expertise training, organize seminars, symposiums, conferences and similar events in the fields of forensic medicine and forensic sciences, conducts training programs and lend assistance for performing and conducting training programs with regard to forensic medicine for other relevant institutions, organizations and authorities (22, 23).

Police Criminal Departments: The establishment, duties and powers and as well as working principles and procedures of Police Criminal Laboratory Departments in İstanbul, İzmir, Adana, Samsun, Diyarbakır, Erzurum, Bursa, Antalya, Kayseri and Ankara allied to Police Criminal Department have been established and issued with the Establishment, Duties and Powers Regulation of Directorate General of Security Criminal Department and Department of Criminal Police Laboratory. There are different areas of expertise that serve in the fields of biology, anthropology, ballistics, chemistry, documents, trace, sound, image and data analysis (24, 25).

Gendarmerie Regional Criminal Laboratories: The establishment, duties and powers and as well as working principles and procedures of Gendarmerie Criminal Department and Gendarmerie Regional Criminal Laboratory organizations are issued with the Establishment, Duties and Powers Regulation dated 1 August 2006 and numbered 26246 of the Gendarmerie Criminal Department and Gendarmerie Regional Criminal Laboratory Organizations. In accordance with the relevant reg-

ulation, Gendarmerie Criminal Department is responsible for compiling an expert report in administrative or judicial investigations and prosecutions regarding their areas of expertise. Van, Aydın and İstanbul Gendarmerie Criminal Offices have been established within the body of Ankara Gendarmerie Criminal Department in terms of regional needs. Moreover, Crime Science Investigation Teams and Explosive Ordnance Disposal Teams where explosive incidents intensified have been established within the District Gendarmerie Commands and General Command of Gendarmerie in 81 provinces of Turkey (26, 27).

Universities: In accordance with the Article 37 of the Higher Education Law No. 2547, institutions and individuals may request scientific opinions, research, projects or similar services from the universities and affiliated units of them in accordance with the Article 38 of the relevant Law. This article states that upon request of the judicial authorities concerned and within the framework of the legislations regarding forensic medicine, the academic staff of higher educational institutions shall be required to act as expert witnesses in forensic medicine cases as well as in other legal matters.

Also, in accordance with the Article 31 of the Law on Forensic Medicine, it is stated that Higher Education Institutions or their attached units are considered experts according to the Criminal Procedure within the scope of Forensic Medicine Regulation regarding forensic medicine issues. Furthermore, there is an expertise service in addition to the education, training and academic activities within the job descriptions of İstanbul University Cerrahpaşa Forensic Medicine and Institute of Forensic Sciences, Ankara University Institute of Forensic Sciences, Karadeniz Technical University Institute of Forensic Sciences, Çukurova University Addiction and the Institute of Forensic

Sciences (12, 28, 29).

Conclusion

Expertise practices, which is one of the key elements of practice of law, plays an important role in the realization of justice. The key feature of this role proceeds from the objective and scientific nature of the expertise reports. These accountable, justified and detailed expertise reports prepared with objective and scientific criteria shall meet the qualitative expectations of the Court for the evaluation of a legal problem. And therefore, scientific and technical cooperation between the Forensic Medicine Institute, Police and Gendarmerie Criminal Laboratories and universities and international expertise institutions such as ENFSI (European Network of Forensic Science Institutes) will also carry expertise practices to a more effective spot.

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Part Two

Expert Witnessing Within a Specialty
(multidisciplinary-forensic approach)

Malpractice in Modern Anesthesiology

Ali HASPOLAT and Ali Şefik KÖPRÜLÜ

Introduction

It is a known fact that modern surgery works miracles and these miracles are only possible through the developments in anesthesiology. Anesthesiology serves both in surgical and non-surgical areas (many different fields of diagnosis and treatment such as CT, MRI, endoscopy, bronchoscopy, artificial insemination processes, labor, interventional radiology practices, lithotripsy operations, angiographies, electroconvulsive therapy and radiotherapy) as a result of approximately 100 years of knowledge. Concepts of “perioperative medicine”, which deal with any non-surgical problem in the process starting before an operation and continuing in intensive care, and thereby, “perioperative physician” have become a current issue with the impact of technological and pharmacological developments.(1,2) Therefore, anesthesiology and reanimation are the fields which enable invasive and non-invasive medical interventions to be performed without pain and stress and where pain, intensive care, emergency medicine, as well as basic and advanced life support are also practiced. Despite the developments in the field, undesired consequences are encountered more frequently due to the broad range of practice. This situation is reflected in daily life as malpractice lawsuits.

Clinical error is a major global problem. The media and the public are unforgiving against the perception that patients are hurt, and see every negative consequence as medical negligence. More than half of the population in the United States of America (USA) believe that the doctors who have committed a clinical error should be suspended. (3)

The number of medical negligence/malpractice lawsuits is increasing throughout the world. One-sided and manipulative news occasionally takes place in the media. These lawsuits, which may have severe consequences, disturb the physicians whose job is to intervene with the human body. Concepts such as “complication”, “medical/clinical error” and “medical negligence/malpractice” may be perceived differently by physicians and legal experts. While physicians are more inclined to consider all kind of adverse consequences caused by medical intervention as a complication, legal experts only consider adversities that cannot be attributed to a physician as complications.

According to a survey conducted by Australian and New Zealand College of Anesthetists, 23.6% of the anesthesiologists stated that they were accused of “negligence” in the past, and 73.6% of them expect to face such accusation in the future. Even though they invest 8.3% of their income to liability insurance, 47.2% of the physicians are concerned whether their insurance would be sufficient in the future. In the same study, obstetric anesthesiology was considered a sub-specialty where the most of medico-legal problems are encountered. A total of 20.2% of the anesthesiologists who work in this field plan to quit their jobs within the next 2 years. 12.8% of the anesthesiologists state that they plan to retire within the next 2 years. (4) In general, anesthesiologist complain about the medico-legal climate and either plan to retire early or withdraw from high-risk sub-specialties.

Malpractice vs Complication

Any kind of undesirable events may be called with different words such as accident, error, misfortune, and disaster by taking the factors which affect formation into consideration. An accident literally means an unforeseen and unplanned unfortunate event that occurs as a result of carelessness or negligence, thereby causing loss of life or property.⁽⁵⁾ An error is defined as unintentionally deviating from a certain behavior path or application process and violating accepted/known execution. (5) While luck, unpredictability and/or unavailability become prominent in the definition of an accident, an error is considered a process, which can be identified step by step and entirely controlled, is interrupted by the person/s responsible for implementing the process. A similar distinction is valid for the concepts of malpractice and complication. It would be correct to starting a discussion by explaining the concepts of “complication”, “permissible risk”, “medical/clinical error”, and “medical negligence/malpractice” first.

Malpractice is defined as a medical error occurred as a result of negligence, imprudence, carelessness or lack of knowledge/skills. Complications are damage whose occurrence is acknowledged by medical science and which inevitably occurs during an intervention implemented according to medical standards, although all necessary precautions are taken. There is unpredictability and/or unavailability in the concept of complication, defined by words such as “permissible risk” and “adverse effect”. In Turkey, “complication” was described by a Supreme Court ruling as “A complication, defined in the Turkish Dictionary of Science and Art Terms of the Turkish Language Association as “Another pathological event or disease which occurs concomitantly with a disease, a subsequent problem, complexity” refers

to harmful situations unpredictably occurring during an intervention and cannot be prevented and do not arise from the poor practice of a physician although the physician diagnose his/her correctly and perform standard practice and treatment with care without lack of knowledge, skills or experience. A complication is considered when unpredicted and unpreventable damage occurs without the control of a physician or patient even though standard rules and necessities are correctly applied".(6) Arterial puncture, pneumothorax development during the placement of central venous catheter, and hoarseness development in 2% of patients after a thyroid surgery despite all scientific measurements taken are examples of a complication. Based on the thyroid example, medical science predicts that hoarseness will develop in out of every 100 patients following a thyroid surgery; however, the surgeon cannot prevent it despite all improved precautions, and consider hoarseness as a risk naturally found in the intervention itself. Therefore, the discipline prefers to continue with the intervention. This is the exact point which distinguishes malpractice from complication. Malpractice which is defined by the World Medical Association as "damages resulting from a physician's failure to implement standard practice, lacking of skill or not treating patient during a treatment", is an error committed independently from the risks which are inherent in the nature of the discipline.(7) While carrying out a practice in a predefined way is called "standard", medical malpractice means deviation from the standard. All the situations, which a physician fail to predict them and/or take precautions against them although it can be foreseen and its formation can be prevented by taking necessary precautions, fall within this scope.

The distinction between malpractice and complication is one of the main subjects of medical law. Healthcare workers are

held liable for malpractice, but not for complications. A physician cannot be held liable due to complications; however, the physician and his/her institution must take precautions for predictable complications. If a complication is not managed well, the responsibility is brought to the agenda. If these precautions are taken and the physician cannot be held liable, it shows that complications are well-managed. If the precautions are not taken or there is a delay to take the precautions, complication management is not handled well; therefore, it is concluded that complication turns into malpractice and the physician and/or his/her institution is held liable.

If a complication is not noticed early enough and necessary precautions aren't taken even though the complication has been taken notice, and if the taken precautions are not considered an established standard medical intervention despite realizing and taking precautions, it is also considered malpractice. (8)

Malpractice is actually a sub-branch of the concept of error. An error is defined in dictionaries as an action that cannot be performed as intended. There is no universally accepted classification of human error. Although many people studying in this field have developed their own classifications, the classification by James Reason has been accepted the most. (9) Reason evaluates errors in three subgroups as 1- slip, 2- lapse, and 3- mistake.

1- Slips are subcortical errors. It is a situation in which you are not doing what you're meant to do. For instance, misdating the current year shortly after the start of a new year is a slip.

2- Lapses are absently/forgetfully committed errors. Forgetting to apply antibiotic prophylaxis before tourniquet inflation is a lapse. A lapse is caused by an error in the memory and can only be recognized by the person experiencing.

3- Mistakes are decision-making failures. Slips and lapses

occur when the actions are not implemented as planned. Mistakes occur when there is a lack of rules and/or knowledge. An example of a rule-based mistake is the unpleasant situation in which an anesthesiologist intubates a child with an inappropriate tube without realizing the tube is kinked, thereby causing the death of the child due to hypoxia. An example of a knowledge-based mistake is the situation when an anesthesiologist is accused of causing the death of a patient by not realizing that the tracheal tube is disconnected from the breathing circuit until the patient has a cardiac arrest and passes away.

Mistakes mostly occur in these situations:

- Doing too many things at the same time.
- Doing too many complex tasks at once.
- Time pressures.

Violation is another kind of an error. It means deliberately disregarding the correct behavioral rules and its punishment is more severe in law. The equivalents of “medical error” and “medical malpractice” in law are “negligence” and “malpractice”. All of these concepts are used interchangeably.

Malpractice includes:

- 1- Clarification error
- 2- Application error
- 3- Organization error

Research on Clinical Error

Early research on medical error were performed in the 1970s and 1980s. Few of them were found to be related to anesthesiology and intensive care in that period. In the USA, a significant increase occurred in the number of claims for malpractice due to medical negligence in the 70s. Medical Insurance Feasibility Study conducted by the California Medical Association

was the first attempt to calculate the incidence of medical errors. Retrospective investigation of 20,000 medical records showed that 4.6% of the cases had possible incidents that might lead to successful lawsuits. (10)

Harvard Medical Practice Study (HMPS) developed a more accurate retrospective case investigation method. (11) 30,000 medical records which were randomly selected from a pool of 2.7 million patients were investigated. It was identified that 3.7% of the patients encountered an adverse event, and these events were attributed to the various specialties. However, anesthesiology was not included in those specialties. Nearly half of the (48%) adverse events were associated with a surgery, and it was shown that more than half of these events caused damage healing within a month, 13% of them led to a disability healing within six months, 2.6% caused permanent disability, and 13.6% of them resulted in the death of the patients. It was stated in the study that more than one-fourth of the mistakes may be considered malpractice. (11,12) Studies of the California Medical Association (CMA) and HMPS has drawn attention to the extent of the problem and helped create awareness about it. In a report estimating the number of fatal medical errors in the USA to be annually between 44,000 and 98,000, which was published by the American Medical Institute in 1999, the costs due to malpractice were also considered surprising: 17-29 billion dollars in the USA, 6 billion pounds in the UK and 5 billion dollars in Australia annually.(13) All of these studies found that the incidence rate of annual surgical adverse events was 3% ; however, damage associated with anesthesiology accounted for a very small ratio (6/10,000) of this rate.(14)

Although it may seem that comprehensive epidemiological studies disregarded the field of anesthesiology, anesthesiologists

have studied “errors” from the very beginning. After the first death associated with anesthesia (15), there have been many studies regarding anesthetic risk which focusing on the contribution of the methods of anesthesia to mortality. Cooper was the first to apply “critical event report” concept, used by military aviation to the field by adapting it for “anesthesia safety”.(16) This study and other studies predating the HMPS by at least 13

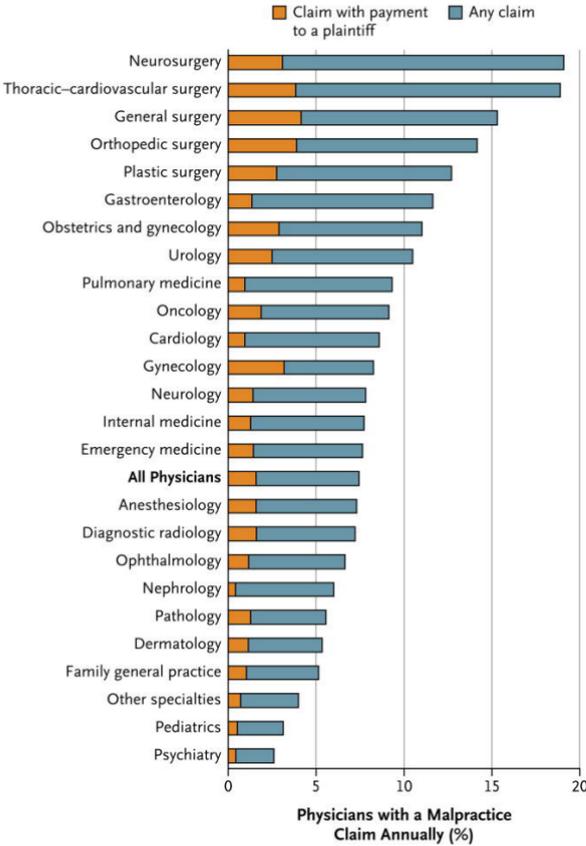


Figure 1

years have shown that medication errors are among the most commonly encountered anesthetic setbacks.(16,17) A possible critical event reporting system laid the basis for the Australian Incident Monitoring System (AIMS), which involved the anesthesiologists of more than 90 hospitals.(18) Analysis of 2.000 incidences provided detailed data on all of the aspects of the anesthetic errors.

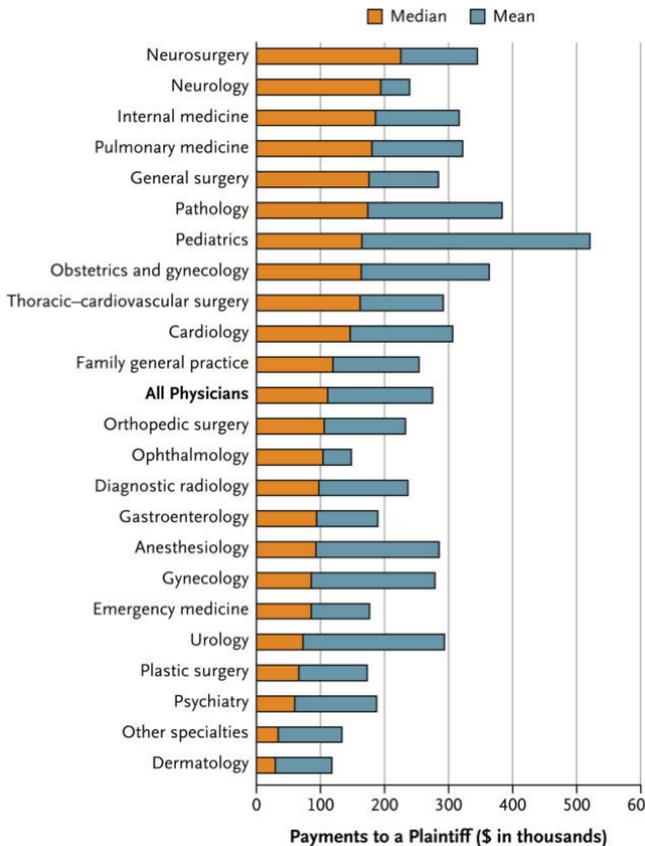


Figure 2

Distribution of Medical Malpractice Based on Specialties and the Role of Anesthesiology

There has been a significant increase in the number of medical negligence/malpractice lawsuits in the past 20 years globally. Law offices pursuing malpractice lawsuits reshaped the style of many physicians and caused them to prefer “defensive medicine”. Newly graduated physicians have started not to choose the specialties in which these claims are common while deciding on their area of specialization. Medical negligence claims have adversely affected smooth patient-doctor relationships. Jena et al. conducted a study evaluating 40,916 physicians by analyzing the data of an insurance company which covered professional liability insurance between 1991 and 2005. The rate of the physicians facing malpractice claims and that of the physicians which were charged to pay damages and the amount of the disbursement were reviewed in 25 specialties, and the related-data seen in figure 1 and figure 2 were sorted.(20) As seen in the figure, in the study, it was identified that annually 7.4% of the insured physicians faced malpractice accusations; however, only 1.6% of them paid damages. The study showed that anesthesiology ranked 17th among 26 specialties.(20) 315 complaints filed in Turkey in 2019 were analyzed in a study and it was suggested that 8 of them were on intensive care and one of them was on anesthesiology.(21) A study reviewing physician error claims and rulings of the Istanbul Medical Chamber showed that 78 out of 344 complaints (23%) were ruled in favor of the claim and the physicians were charged.(22) Similarly, the rate is approximately 20% in the international literature.(23) Another study in Turkey, which reviewed 733 physicians who were under investigation according to their specialties suggested that the field of Anesthesiology and Reanimation ranked

5th out of 27 specialties.(24) A striking finding of the study was that Anesthesiology and Reanimation was the 3rd specialty after General Surgery and Obstetrics & Gynecology which had the greatest number of the verdicts of dismissing from profession.

Principles of Medical Lawsuits

To win a medical lawsuit, the plaintiff (patient / patient's relative) should prove four elements:

- 1- Duty: There is the duty of a physician and/or an institution owed to a patient
- 2- Breach of duty
- 3- Damage: What a physician or an institution did/didn't do caused injury/disability/death
- 4- Cause and Effect: The damage in question occurred due to negligence

If one of these elements fails to be proven, the ruling will be in favor of the physician. However, it should not be forgotten that the anesthesiologist must also prove that there has been no case of negligence on his/her side. The importance of physicians and institution knowing, implementing and documenting their duties, authorities and responsibilities emerges yet again at this point. In that sense, it is necessary to underline these three elements in particular:

- 1- Healthcare providers (physician, nurse, healthcare workers and institution) are responsible for what they don't do as much as what they do
 - 2- Correct and complete documentation is a must
 - 3- Being unaware of the law is not accepted as an excuse
- As soon as a doctor-patient relationship begins, so does the

duty. The duty owed to the patient begins for an anesthesiologist when he/she examines the patient before a surgery and accepts to provide the service for the patient. The physician is liable for following care/service standard from that moment on. Similarly, the duty begins for an intensive care physician when the patient is in the intensive care unit, and the physician is liable for following universal care standards.

Currently, the implementation of a medical intervention by authorized staff, informed consent of a patient, and performing necessary and suitable intervention (treatment) generally accepted by medical science are necessary for the medical intervention to be lawful. If the physician fails to perform a medically necessary procedure or performs a medically unnecessary procedure, it is considered a “treatment error”. Furthermore, a false decision made by the physician during or after the medical intervention is accepted as a “treatment error”. A treatment error is used for every medical intervention that is against the standards of a specialty, in other words, a medical intervention of any nature which lacks necessary care. Examples of main treatment errors are as follows; leaving a foreign object in patient’s body during a surgery, choosing an incorrect treatment method, not running necessary tests, administering wrong drugs to patients, surgery on the wrong side, excessive medical intervention, failing to realize a complication, improper operation method, mistakes made while using technical devices, failing to refer a patient to another hospital in time due to medical inadequacy, consulting a related specialist too late, not following sterilization and aseptic – antiseptic rules, not warning the 3rd parties, medically intervening without reviewing records/tests and not doing a consultation when necessary.

Duties and Responsibilities of an Anesthesiologist

In Turkey, the duties and the responsibilities of anesthesiologists and anesthesia technicians are stated in the relevant articles of “Inpatient Facility Regulations” of the Ministry of Health. (25)

Article 116 – Maintains daily operation room worklist according to the operation list handed to them a day before the operation by taking characteristics of patients and operation duration into consideration. Performs required reviews and consultations of the patients who will be operated for the operation preparation, and provides premedication of these patients.

The anesthesiologist:

a) Is the chief of the personnel working in the fields of anesthesiology and post-operative care, and ensures that they work regularly and efficiently. Provides access to their in-service training. Is accountable to his/her chief physician for his/her department.

b) Decides upon whether an operation is going to take place under anesthesia based on the health condition of the patient.

c) Places the patient to the most suitable position on the operation table in coordination with the operator by bearing the characteristics of the operation and general state of health of the patient in mind. Determines the anesthesia method and administers the required anesthetic to the patient or have the technicians administer it under his/her supervision

d) Performs or have the technicians under his/her supervision perform all controls (respiratory, urinary and cerebral systems, blood pressure and electrolytes, patient’s body temperature, sweating, etc.) to maintain the operation and the general state of health of the patient during the operation under anesthesia in normal conditions. Records the method and the

course of anesthesia to an observation chart.

e) Takes all the precautions and implements treatment methods which he/she deems to be necessary until the patient regains his/her normal life functions following the operation. Consults the surgeon and other specialists he/she considers necessary. Helps the operation room supervisor with operation room processes and sterilization.

f) Is responsible for the supply, maintenance, preservation and consumption of all kinds of devices, equipment, drugs and medical devices in anesthesiology and post-operative care departments.

Duties and Responsibilities of an Anesthesia Technician

Article 137 – The anesthesia technician provides necessities for operation and narcosis to be safely and comfortably concluded under the supervision of an anesthesiologist or, in the absence of an anesthesiologist, an operation room supervisor.

The anesthesia technician:

a) Is responsible for the maintenance, cleaning and sterilization of anesthetic machine and keeps it ready to use at all times. Controls the anesthetic machine and operation table before every operation and prepares them for the surgery. Controls the oxygen and nitrous oxide tubes to ensure that they are full. Informs the anesthesiologist on time about the malfunctions in the anesthetic machine, required anesthetics and other supplies.

b) Anesthesia technician visits patients to be operated at least a day before the operation in the facilities where an anesthesiologist is not available. Reviews their files and ensures that missing tests required for anesthesia and operation are run. If he/she has difficulties, he/she informs the surgeon about the

situation.

As can be seen, the responsibility of treatments administered to patients in the anesthesia process is attributed to anesthesiologists. An anesthesia technician is the healthcare professional obliged to help anesthesiologists during the process.

Professional Responsibilities of an Anesthesiologist

It is necessary to address 5 important principles binding every physician before specifying the responsibilities of an anesthesiologist. Every physician:

1. Has the liability to diagnose. Anamnesis and medical history of the patient is significant at this step

2. Is liable for choosing an appropriate treatment method and treat the patient accordingly. The physician is responsible for carrying out all of the medical interventions in their specialty and any interventions which are not performed despite being indicated

3. Is liable for informing the patient and getting the consent of the patient

4. Is obliged to preserve the confidentiality of the patient. Otherwise, the patient is going to be eligible for receiving compensation from the physician

5. Is obliged to record files. Otherwise, it is going to be the physician's liability to prove their impeccability in case of damage, which is impossible in such a situation

In the light of the information, an anesthesiologist:

- Is responsible for informing the patient and/or his/her legal representative and getting informed consent

- Is responsible for all of the medical procedures, care and follow-up of the patient. This responsibility includes preoperative, perioperative and postoperative processes. As in a frequently mistaken instance, the responsibility of administering

regional anesthesia does not end with the end of an operation

- Is responsible for regularly managing the medical records of the patient and documenting all procedures, treatments and interventions in the patient's file

An anesthesiologist is also responsible for:

- The position of the patient in perioperative period
- Monitoring the patient's vital signs such as respiratory, hemodynamic, metabolic and liquid electrolyte balance
- Sterilization and disinfection of the used devices
- Complication precautions and management
- Confidentiality of the patient's personal life. In regard to this, whether a video call of the patient with his/her relative in the intensive care unit is a violation of confidentiality is a popular topic of discussion. A physician should at least be attentive to this subject

The primary reason for the lawsuits against anesthesiologists is patient injury/disability(26) Usually, an anesthesiologist is primarily held liable for the deaths during an operation. Anesthesiologists should make thorough preparations before administering anesthesia, review all the patient data, request a consultation if necessary, clearly determine the indication, method and risks of anesthesia according to the ASA classification, complete the anesthesia process with all the necessary skills and care by using the conventional knowledge, which has been adopted for implementation in their expertise, by making all the necessary preparations for emergencies, pay attention to positions and manipulations, make all the arrangements required for waking up the patient safely, postoperative care and follow-up of the patient, inform the patient about the method of anesthesia that is going to be administered and obtain their written informed consent, provide technical equipment and materi-

als, document complete, proper and detailed anesthesia records of the patient during the preoperative, perioperative and post-operative period to defend himself/herself in case of a criminal/legal liability. The anesthesiologist should also have sufficient, up-to-date information on the laws and regulations about the subject to defend himself/herself in case of an adverse event.

Lawsuits against physicians are usually filed following an event. The investigator, expert or judge investigates the event by examining the patient's files and documents. Documenting these completely and properly is considered evidence in favor of the physician. In this case, the plaintiff patient/patient's relative should prove the physician's error. If the physician notifies the missing material, device and understaffing to the administration in written form before any adverse event, it is easier to defend himself/herself against a charge attributed to him/her due to adverse events arising from lack of fulfillment.

Importance of Efficient Communication and the Role of Informed Consent

Even though the legal regulations of every country differ significantly, malpractice lawsuits essentially revolve around "the right to live", the basic human right accepted by the majority of the world. Rights which are among the personal values such as the right to life, the right to health, physical integrity and the right to self-determination, have further importance in terms of medical intervention and treatment. Medical interventions are direct disposition of these rights, and may lead to restriction of one's freedom, permanent damage on physical integrity and even death, even when they are implemented following the medical rules. Therefore, medical interventions are generally considered physical harm in the context of criminal

law, and a tort in the context of private law in principle. However, medical interventions are accepted as legal by following certain rules to prevent physicians from practicing their job under the threat of criminal and civil liability. The basic condition ensuring the compliance of medical interventions with laws is “patient consent” due to the right to self-determination, and the prerequisite for patient consent is “information”. The most important element providing compliance with laws for an invasive intervention is informed consent. Otherwise, when a patient files a complaint, a great legal issue arises even when no adverse event occurs. An informed consent only legalizes a medical intervention, it does not eliminate the legal liability of a physician arising from his/her own error.

Excessive increase in the number of lawsuits filed with the claim of medical malpractice combined with the anticipation that the increase may last underlines the necessity to pay great attention to the certain points during medical procedures. Physicians should be well informed about their profession’s legal basis, pay attention to these subjects, and quit their “old habits” in some of the most common erroneous procedures. Being sued does not only pose a financial risk. It is known that in approximately 80% of the lawsuits, the physicians were not found guilty. (22) However, the greatest punishment for physicians is the duration of cases which last approximately 5-7 years. Unemployment, family problems such as divorce, and even real medical errors may occur in this period.

As the duty of informing a patient is not fulfilled, consent forms including general expressions such as “I consent to be operated” or “I consent to leave the hospital taking on full responsibility”, which are taken based on old habits, will not be accepted as ethically and legally valid documents. There is no

established printed template of an “Informed Consent Form” fulfilling all of the conditions both in Turkey and in the world. Not only is it going to be futile using these comprehensive printed documents for the patients with different cultural levels, but also it will cause a series of unfavorable situations as it becomes a routine during a procedure and cannot reflect on possible differences.

While an informed consent does not always need to be in written form in every situation, it is suggested to obtain a written consent in invasive interventions as not obtaining written consent poses important problem in terms of the burden of proving otherwise. The prepared document should include information about the general state of health of the patient and diagnosis, type, chances of success, and duration of the suggested treatment method, risks of the treatment method posed to the patient’s health, use of prescribed medicines and their potential side effects, consequences of the disease in case the patient does not consent to the treatment, other treatment options and their risks in order not to create legal liability.(27) No such consent is required in emergencies. Liability about informed consent reduces accordingly with the level of emergency. The consent form should be filled by a legal representative or patient’s relatives for the individuals who are not able to consent such as those in the intensive care units with the temporary or permanent loss of consciousness or young children. If the legal representative is unknown, the consent form can be obtained from the spouse, children, parents, or siblings, respectively. (22,28) Informed consent should also be considered a chance to reinforce patient-doctor relationship. One of the leading causes of complaints against physicians is communication problems. It was suggested that female physicians, who have much stronger

communication skills, received fewer complaints. (27)

In the meantime, the right to reject treatment and self-termination are other important subjects. Treatment rejection forms clearly stating that the individual is informed should be obtained in written form in accordance with the general principles mentioned above.

While the problem about the compliance of medical interventions in the intensive care unit with laws can be resolved with informed consent, some interventions, which go beyond the consent of the patient and are even implemented without a consent due to the characteristics of the intensive care units and the patients, are also performed. One of these interventions which are much-debated is the withdrawal of life support. The decision to withdraw life support is important in terms of the right to reject treatment and passive euthanasia. The decision to withdraw life support, which is the withdrawal of the consent to the continuation of intensive care treatment, reflects the right to reject treatment and is passive euthanasia in its essence. This is a controversial subject in both medical and law fields, and it should be kept in mind that every physician must have general information about the laws of the country where they live.

The Importance of Liability in Medical Record Keeping

One of the subjects which will hold physicians liable is breaching “the duty of recording”. These documents are of significant importance as the resolution of the problem depends on them when facing an accusation. Thus, detailed records should regularly be kept on time and attempts to make additions, deletions, or changes on the document that will be considered forgery and will bear more severe legal consequences should

be avoided. Two different files or documents in a hearing will reveal negative prejudices about the lawsuit from the very beginning. When the file of a patient is requested, many healthcare facilities respond to the court with an official letter stating that “documents are not kept due to the nonexistence of archives”, even in forensic cases. This is highly erroneous as it means the confession of the crime. The rule “If you’ve recorded it, then you’ve done it; if you haven’t recorded it, then you haven’t done it”, even though it is partially incorrect, is practically valid for the courtroom and even for the experts.

Errors in Anesthesiology Practice

Studies investigating anesthesia errors show that the primary reason for errors is inadequate preoperative preparation. A study investigating perioperative deaths in Australia suggested that the most common error was inadequate preparation for the surgery or anesthesia.(29-31) The second most common error was selecting inaccurate agent or anesthesia method, and the third most common error was inadequate intervention during an emergency.(31) Gannon listed the causes of anesthesia-related deaths as follows: inadequate preoperative evaluation, lack of communication between team members, inaccurate intubation, drug side effects, and problems with the equipment.(32) It was identified in the study by Cooper et al. that a great majority of anesthesia accidents (82%) stemmed from human errors. (16) The rates of errors stemming from ventilatory-respiratory system (19.5%), anesthetic machine (19%) and drugs (19%) were similar, and these were followed by errors regarding airway providing method (12%), intravenous vascular access (7%), monitoring (% 4.5) and regulation of fluid balance (4%). It was also detected in the study that anesthesia equipment malfunc-

tioned in 14% of the preventable anesthesia accidents. These were listed as monitor (24%), ventilatory system (20%), airway components (18%), laryngoscope (18%), and anesthetic machine (12%) according to the frequency of malfunction.

In a study conducted by Beverley et al. it was identified that a vast majority of the anesthesiologists had at least one committed error while preparing an anesthetic mixture, and 98% of these incidents resulted in minor consequences.(33) Errors related to anesthesiologist were listed as follows: using wrong injector (60%), not reading the label (53%), choosing wrong ampoule (39%), stocking drugs incorrectly (18%), incorrect dosing (10%), and it was stated that the drugs which were confused most were non-depolarizing muscle relaxants.(33)

In the studies investigating physician errors in anesthesiology in Turkey, it can be seen that the studies have been generally conducted based on the data of the Council of Forensic Medicine. The Council of Forensic Medicine has a large database that can reflect the overall profile of medical malpractice in Turkey. There are two studies by Eke and Ertan thoroughly evaluating anesthesia malpractices in Turkey, and both analyzed the data of the Council of Forensic Medicine. The study by Ertan et al. reviewed 123 forensic reports related to the errors in anesthesiology.(31) The relation between the period when adverse events occur and medical error is shown in Figure 3.(31) Lacking or inadequacy of preoperative preparation stood out as the most common cause of errors, followed by errors about airway safety (20%). The third most common cause of an error was administering anesthesia outside of the operation room without providing required conditions (15%). It was observed that procedures were erroneous due to the absence of ventilators and monitors produced specially for magnetic resonance imaging in radiology

	Yes	No	Total	%
The period when the anesthesia is administered	6	3	9	(7.89%)
The period when the operation/intervention starts	8	3	11	(9.64%)
During the surgery	12	34	46	(40.35%)
End of the operation and waking up period	6	3	9	(7.89%)
Recovery period	2	6	8	(7.01%)
Postoperative 24-hour period	5	18	23	(20.17%)
Postoperative period after 24 hours	1	7	8	(7.01%)
Total	40	74	114	

Figure 3 The Relation between the period when adverse events occur and medical malpractice

units, improper room for imaging, and negligent follow-up of the patient. The rate of medication error was determined 7.5% in the study. In one case, instead of an analgesic, neuromuscular blocker (atracurium) was mistakenly administered by the nurse in the service. In another case, a gynecologist requested the administration of anesthesia induction agent (thiopental) for a curettage procedure without the presence of an anesthesiologist; however, a neuromuscular blocker (vecuronium) was mistakenly injected and the patient developed hypoxic encephalopathy due to lacking proper intervention in time. The cause of the error in another case was that although isolyte solution was requested from an anesthesia technician, 50% dextrose, which was mistakenly brought by the technician, was administered by the anesthesiologist without checking the drug. The rate of anesthetic machine and connection errors was determined 7.5%. The most common error in this field is connecting a carbon di

Error causes	Number of cases	Percentage (%)
1. Lacking or inadequacy of the preoperative preparation:		
Lack of any preparation, incomplete preparation and/or administering anesthesia before stabilizing existing pathology of the patient	17	42.5
2. Errors of airway safety: Skipping the forced intubation preoperatively, esophagus intubation, not being prepared for the forced intubation process, not making an incision for tracheostomy on time, administering anesthesia via a mask when intubation is necessary, slipping of the intubation tube while positioning the patient and not realizing it	8	20
3. Administering anesthesia outside of the operation room without providing the required conditions	6	15
4. Anesthetic machine and connection errors: Connecting a CO2 tube instead of an O2 tube, connecting an N2O tube instead of an O2 tube, failure to ventilate the patient by not controlling the device beforehand	3	7.5
5. Errors administering the medications and IV drip: Administering tracrimum instead of an analgesic, norcuron instead of pentothal and 50% dextrose instead of isolyte S	3	7.5
6. Lack of equipment in patient monitoring:		
Absence of ECG monitorization	2	5
7. Errors regarding the functioning of the system:		
Not dismissing an anesthesiologist with epilepsy who has moderate attention deficiency	1	2.5
Total	40	100

Figure 4 Distribution of the groups according to the causes of errors

oxide or nitrous oxide tube instead of an oxygen tube and starting the operation without controlling the device. A total of 5% of the errors stemmed from the absence of ECG monitorization and the inability to realize developing arrhythmia on time (Figure 4). Thanks to rapid advancements in technology, inadequate monitor-

ing gradually becomes a minor problem among the causes of death.

The study by Eke et al. also pointed to the importance of pre-operative preparation. (34) It was identified that 42% of the cases were not visited by an anesthesiologist and laboratory tests were run inadequately for the patients put under general anesthesia. In the study conducted by Ertan et al., it was concluded that one third of the procedures under the supervision of an anesthesiologist, more than half of the procedures performed by an anesthesia technician under a surgeon's supervision without an anesthesiologist, and nearly all of the procedures performed by other physicians of different specialties were erroneous.(31) All these studies show that the major cause of adverse events is preventable human errors.

In Turkey, there is no clear written information about how many operating rooms an anesthesiologist is responsible for, as in several countries. Anesthesiologists are responsible for more than one or even numerous operating rooms. This results in significant disruptions in implementations. Moreover, anesthesia technicians having to work alone in facilities where no anesthesiologist is available increase the medical and legal liabilities of the physicians performing the surgery. Holding a surgeon, who already has a risky profession, liable for both operation and anesthesia increases the risk further. In a case presentation showing anesthesia errors in Turkey, it was concluded that device control which should be routinely performed was not maintained by a newly appointed anesthesia technician, the circuit was not turned off as the device was fully recognized during the incident, and as a result, the anesthetic machine was considered malfunctioning.(35) The inability to provide patient ventilation and delay in oxygenation also led to a chain of errors. The cause of error observed in this case was human-based and preventable. Misuse of anesthetic machine is reported to be among the first three reasons leading to adverse events. (36) Misuse of

gas distribution equipment is encountered three times more than equipment malfunction. (37) Another situation important for anesthesiology is the follow-up of fluid and electrolyte balance in the perioperative period. In long-lasting operations, patients should be followed up for metabolic balance and blood gas especially in terms of hypoglycemia. Moreover, especially in child patients and in long-lasting operations, it is important to protect patients from hypothermia. Anesthesiologists should closely monitor especially children for hypoglycemia, hypothermia, metabolic acidosis and hyponatremia in the perioperative period. In a case presentation, an excessive amount of hypotonic solution was used and acute hyponatremia developed postoperatively. (38) Although anesthesia, by itself, rarely results in the death of a patient, anesthesiologists are also questioned along with surgical procedures in death cases in dispute, as anesthesiology is among the dynamics of the perioperative period. While the outcomes of the lawsuits are unknown in the studies conducted in Turkey, it can be said based on the acquired data that roughly 2/3 of the accusations attributed to the physicians lack a medical basis. (31) Lynch et al. stated that the rate was 46%. (39) Although the dismissal of the cases falsely charging physicians results in the acquittal of the physicians, factors such as statements taken during an investigation and/or a prosecution, being stressed during the judicial process (i.e. attending the hearings), worrying about making mistakes, inability to take initiative negatively affects the practice.

Classification of Adverse Events in the Perioperative Period

As the dynamics of the perioperative period consist of surgery, anesthesia and patient factors, adverse events can be classified diversely based on the surgical, patient, anesthetic factors,

time of occurrence, whether the result is preventable or not, human error or malfunction of devices. Procedures causing adverse events can be divided into three groups according to their periods:

1. Procedures leading to adverse events in the preoperative period (the period until the induction of anesthesia):

- Inadequate preoperative anesthesia examination
- Not obtaining an informed consent or obtaining an inadequate/erroneous consent
- Obtaining the anamnesis and doing preoperative anesthesia examination for the moderate-high risk patients (ASA-III and higher), who are planned to daily receive anesthesia, on the day of operation
- Inappropriate premedication
- Withdrawing the oxygen supply
- Empty oxygen cylinders and failure to notice them in time
- Filling gases incorrectly (such as carbon dioxide instead of oxygen) and failure to notice it in time
- Using incorrect color codes at the outlet of the gas distribution systems in the operation room, improper connections
- Incorrectly connecting the gas-carrying hoses coming out of the gas pipe systems in the operating room to the anesthetic machine
- The absence of an oxygen source that should be present in the case of an emergency in the operating rooms, the oxygen source being empty or containing a gas other than oxygen
- Malfunction of the laryngoscope, the absence of age-appropriate blade
- Lack of equipment required for emergency airway safety or the malfunction of the such equipment

- Errors related to central system alarm
- Not confirming that the machine is working properly by not performing pre-anesthesia routine control
- Too hot or too cold operation room
- Lacking preliminary preparation for position and manipulations (a messy bed, absence of required pads and equipment)
- Not preparing a “Check List”
- Not informing the hospital administration about the detected technical issues / not reporting to the hospital administration

2. Procedures leading to adverse events in the perioperative period

a) Anesthetic factors:

- Not carrying out the “Time out” procedure
- Not taking the patient’s medical history and current condition into consideration
- Failing to realize incorrect intubation
- Not applying antibiotic prophylaxis in the cases who require it
- Position and manipulation errors related to the patient (nerve compression, loss/subluxion of tooth, or a broken tooth, damaging the teeth, teeth prosthetics or implants, overextension/over flexion of the head/neck, an upper extremity abduction exceeding 90 degrees, not closely monitoring rapid hemodynamic changes which may develop while changing the position or the V/P imbalance, not taking necessary precautions against the risk of venous congestion and DVT development, not checking the risk of tube placed into a single lung in Trendelenburg position, smash-

ing the fingers in the lithotomy position at the end of the surgery, overextension/rotation of the legs, not protecting the ears, the lips, the nose and the eyes during prone and lateral decubitus position, development of visual impairment, not checking the endotracheal tube regularly, failure to realize respiratory and circulatory problems which may occur in Trendelenburg, reverse Trendelenburg, lateral decubitus and lithotomy positions, not paying attention to air embolism and hypotensive attack risks while in seated position, causing the patient to fall from the table)

- A foreign body inside the endotracheal tube, failing to realize that the tube is kinked, slipping or incorrectly fastening of the intubation tube
- Not controlling the cautery plate
- Incorrect artery access while trying to establish venous access
- Administering wrong medicine, blood product and/or anesthetic agent
- Failing to provide the required fluid and blood
- Not controlling the metabolic condition and body temperature in long-lasting operations and in children, not warming the patient up, development of hypoglycemia and/or hypothermia
- Errors in the monitorization system
- Decomposed circuitry or gas leaks due to improper connection
- Malfunctioning device alarms, turning the alarms off by mistake
- Blockage in breathing circuit due to a foreign body, kinking or pressure on the circuit
- Lack of suction power in the aspirator or malfunctioning

aspirator

- Dislocation of vascular access and failure to realize it
- Circulatory impairment after artery cannulation
- Not being in coordination with the surgeon and the procedure

b) Surgical factors:

- Bleeding
- Incorrect surgery
- Leaving a foreign object in the body
- Failure to inform the anesthesiologist or misinforming them
- Cautery burn
- Use of materials causing systemic problems such as contrast agent and bone cement
- Air embolism
- Exceeding the tourniquet duration (ischemia)

c) Patient-related factors:

- Malign hyperthermia
- Bronchospasm
- Anaphylactic reaction
- Persistent arrhythmia, vagotonia
- An unknown anatomical variation

d) Common effect of anesthesia, surgery and patient-related factors

3. Procedures leading to adverse events in the postoperative period and after waking up a patient:

- Carelessly repositioning the patient to the normal position at the end of an operation

- Prematurely transferring the patient from the operation room to PACU and from PACU to ICU without fulfilling the criteria
- Lack of monitorization during the recovery period
- Failure to postoperatively realize bleeding and hypovolemic shock in time
- Trachea and esophagus injuries related to the intubation and complications
- Incorrect fluid or drug use
- Not taking precautions to prevent misadministration of a medicine (i.e. not preventing PCA which would be administered through epidural catheter from being administered through central catheter)

Medication Errors

Studies (HMPS and CMA studies) have shown that clinical errors lead to serious damages/injuries and medication errors, not being specific to anesthesiology, are the primarily committed errors. Medication errors are an important global public health problem. It results in the injury of patients and increases the cost of healthcare services. It is often difficult to compare the results of studies on medication error research when so many different primary outcome measures are used. Forming a reliable, repeatable and accurate method to detect medication errors is an ongoing problem.

A medication error is “an error resulting in that a patient does not receive the correct medication or correct determined dose of the medication during the prescription, distribution or administration of the medication”. (40) It does not necessarily result in injury to be considered medication error. We see that various comprehensive terms step in such as “prescription

error”, “medication error”, “dosing error”, “adverse drug event (ADE)”, “potential ADE” and “preventable ADE”. ADE, one of the important terms, is an injury related to the use of a drug and includes adverse drug reactions such as anaphylactic shock and other allergic reactions.

There have been many studies conducted to determine the incidence of medication error. The study identified the incidence of basic medication administration errors mainly on adult inpatients by using “direct monitoring” and reported a 19% incidence of medication administration error in total, while %17 of these were dosing errors.(41) However, these are irrelevant for the anesthesiology in which the medications are mostly intravenously administered. The study was mostly conducted in clinics; it was suggested that a substantial amount of “incorrect application timing” was observed, and only 2% of the results included the wrong dose.(42) Therefore, the incidence of medication errors particularly in anesthesiology and intensive care, the cost of medication errors, comorbidities and mortality are still uncertain and based on the data, it is unknown whether the problem has improved or not.(43)

In a study conducted in New Zealand, Webster et al. determined medicine implementation error rate as 0.75% and stated that the most common mistakes were dose errors (20%) and drug substitutions (20%). 63% of the errors occurred during intravenous bolus, 20% occurred during IV infusion, and 15% occurred during the administration of an inhalation treatment. (44) The highest estimation of medication error in anesthesiology was detected in this study as 0.75%. There was no direct comparison of medication errors in operation rooms and intensive care units. Webster et al. also listed the results of the detected medication errors. None of the reported errors result-

ed in death or permanent disability. Several involved muscle relaxants, with one of awareness and two of unplanned periods of postoperative ventilation and prolonged time in theatre. In addition, 47 transient physiological effects were reported, five of which required intervention.

Epidural administration is a significant factor leading to errors. The most common errors are accidentally administering medications, most of which are anesthetics, through an epidural catheter or intravenously administering a medication to be used via epidural space. (45) Similarly, infusion therapy is a significant factor leading to errors in intensive care units. Errors in the preparation of infusions, not diluting the medication in exact proportions, timing errors and administering incompatible medications through the same intravenous cannula are the most frequently encountered errors. (46,47)

Taking the stressful, intense environment, and the number and complexity of the prescriptions into consideration, it seems to be reasonable to expect a high level of medication error in the ICU. Early studies in intensive care based on incident reporting and two small observational studies confirmed the idea. (43) In an observational study conducted in a pediatric intensive care unit in Canada, 147 errors were identified in an 18-hour shift. The vast majority (84.4%) involved drugs with a high potential for serious consequences. The total error rate was 17.4% in the high dependency unit and 38.0% in the ICU, falling to 7.1% and 11.7%, respectively, when timing errors were excluded.(48) A similar observational study on a pediatric ICU in Switzerland found an error frequency of 26.9%; the most frequent were errors of timing (32.4%), administration technique (32.4%) and preparation (23.0%) (49)

The observational technique for detecting medication error

was primarily applied to orally administered medications. In a study conducted by Tissot et al., 31% of the medication errors in adult ICU were dose errors, 22% were infusion rate errors, 18% were preparation errors, 14% physicochemical incompatibility, 8% were administration technique errors, and 7% were timing errors.(50) Critically ill patients with low physiological reserves are at particular risk of injury from medications administered in the intensive care unit; therefore, the rate of medication errors leading to ADE is expected to be higher than other patient groups.(51) ADE incidence rate was 6.1% and potential ADE incidence was 4.8% in a 6-month study conducted in two different centers. The highest ADE rates were identified in General ICU. Another study conducted in Pediatric ICU and Adult Surgical ICU using similar data acquisition methods suggested similar results.(52) ADE frequency was found to be 6%, potential ADE rate was 8% and multiple medication administration was identified yet again as the biggest risk factor even when a broader definition of ADE including negligence errors was used. Although only a few of ADEs cause any disability, nearly one-fourth of them are considered dangerous.

Prescription errors are one of the other common causes of medication errors.(53) A total of 1-2% of the inpatient orders are erroneous.(43) Prescription errors are the most encountered type of preventable medication errors and are quite likely to cause ADE.(43) Intensive care units are among the most possible places for the errors to occur. In a study based on the graphical review of over 21,000 orders in 24 intensive care units in the UK for a 4-week period, the prescription/order error rate was 15%. (54)

The only observational study of prescription errors in an adult intensive care unit pointed to an error rate of 4%, of which

one third was serious.(55) Computerized notetaking and medication ordering systems may reduce this rate.(43) The analysis of the reported medication error database in the USA showed that heparin, epinephrine, potassium chloride and lidocaine were the medications mostly involved in the errors.(56) A prospective study of prescription errors in a British training hospital indicated potentially serious errors and it was identified that more than half (57%) of the errors were skill-based slips or lapses, 39% were rule-based and 4% were violations.(57) Medication errors mostly encountered in the intensive care unit stem from lack of information and communication, inadequate/ illegible orders, errors in medication preparation and problems with infusion pumps. Work overload and lack of an efficient incident reporting system are the most significant causes. (50)

Transfer of patients is also related to morbidity and mortality.(58) In the study of AIMS-ICU, 40% of the identified errors related to transfers within the hospital were caused by equipment problems, inadequate documentation of the patient data and the rest were reported as administration problems and especially lack of communication between teams. Medication error was identified in 11% of the cases during the transfers and problems with the infusion pumps were reported in 4% of the cases. This study shows that medication errors are a significant cause of patient injury during a transfer process.

Errors in Patient Follow-Up

Not closely monitoring physiological parameters, inadequate monitoring, inattention to patient positioning, delayed or inadequate resuscitation may lead to serious injury in patients. In a study in 2006, 121 (6%) of 1952 lawsuits were reported to be associated with Monitored Anesthesia Care (MAC) 59) Despite low rates,

they have serious consequences such as hypoxic brain injury and death. It was reported that patient follow-up errors were the most common in eye surgeries (20%) and plastic/reconstructive surgery in head-neck cases (20%), and most of these errors were reported to occur in relatively healthy patients (ASA I and II) during small or superficial operations. This reveals how important are monitoring the position of patients at regular intervals, a basic ECG monitoring, or simple monitoring devices such as a pulse oximeter and capnography.(60) In the 1970s, 56% of cases were related to death and brain damage due to the complications of anesthesia mostly caused by respiratory issues, whereas with the increased use of pulse oximeters and capnography, it decreased to 31% in the 1990s and below 10% in the next 20 years.(61) Anesthesia-related death rates have significantly decreased to less than 1 in 10,000 throughout the world.(60)

Another important topic is prolonged side effects of medications even in day-long patients. A considerable number of respiratory depression cases are encountered in the postoperative service and may lead to complaints or lawsuits. The most common injuries leading to anesthesia malpractice claims are probably the injuries of the teeth and dental prosthetics. They do not usually end up in court and are resolved by the risk management departments of hospital administrations. (26) The most common claim (16% of all claims) ending up in court is nerve damage related to anesthesia. The most common injury sites are ulnar nerve (28%), brachial plexus (20%), lumbosacral nerve root (16%), and spinal cord (13%).(60) While ulnar nerve injuries are more likely to be associated with general anesthesia, the probability of other injuries to be encountered in local/regional methods is higher. The frequency of nerve damage claims has remained relatively stable throughout the years.

Another complaint related to anesthesia is reported as being awake and recalling the events (0.1-0.5%). While anesthesia-related death rate was 1/900 at the beginning of the 20th century, it was reported as 3.1-6.4/10000 in 1950 and 0.04-7/10000 after 1980. (62) The anesthesia-related mortality rate has reduced 10-fold since 1980.

The Role of Autopsy in Anesthesiology and Intensive Care

An autopsy was considered the definitive method to determine the cause of a death many years ago and autopsy rates for in-hospital deaths increased up to 50% in the 1950s. Being able to diagnose many fatal diseases before death with the improvements in imaging technologies, clinical laboratory and immunohistochemistry tests, flow cytometry, molecular and cytogenetic diagnosis methods, and the significantly higher cost of an autopsy have diverted the interest in autopsy throughout the world.(63) Currently, autopsy rates for in-hospital deaths in the USA have decreased to 2.4% (63) While a routine autopsy is not performed in-hospital deaths in Turkey, the rate has also decreased in the countries where autopsies have been intensively performed around the world.

In a study conducted by Lee et al. to determine the cause of death, to present new information, to determine whether a non-anesthetic contribution to the death was present and to investigate whether an autopsy was beneficial or damaging for the defense of the anesthesiologist in 2011, researchers detected that the autopsy positively affected the anesthesiologist's defense, whereas it damaged the defense in 27% of the cases.(63) It was argued in a similar study in France that the autopsy was in favor of the anesthesiologist.(64)

Inadequacy of the records in cases related to medical malpractice, and therefore, their unreliability, are an important argument for plaintiffs. A detailed autopsy may become a piece of evidence which has no alternative and may change the setbacks in favor of physicians. Law on Criminal Procedure states that all physicians may perform an autopsy, especially in obligatory situations. However, in serious cases with a malpractice claim, an autopsy performed by an experienced forensic expert, who will get a consultation when necessary, will please all of the well-intentioned parties of the case. (27)

Thorough Analysis of the Causes of an Error: Personal and Systematic Approaches

The easiest way is to accuse a person of being careless, indifferent, reckless or lacking of training for an error. Reason describes it as the “person approach”. (65) Cognitive psychologists believe that slips, lapses and mistakes are the price we have to pay in exchange of a high cerebral function. Doctors and nurses at the end of the chain are only a part of a systemic failure. Reason describes it as “system approach”. By taking the medication error into the account, the “system” of the error is ordering, stocking and presentation of the medications, maintaining the medication charts, prescribing/ordering, administrative/bureaucratic issues, equipment used and authorized personnel. The system fails when an error occurs in several of these factors. In the person approach, only a person is held responsible for this error and that person (usually a physician) is charged. This approach does not prevent the repetition of similar problems, but may bring the problems to a deadlock.

Declaration of Patient Safety published by the World Medical Association states that physicians cannot be solely held li-

able for failing to provide the safety of patients. (66) The declaration suggests adopting an approach that evaluates the system as a whole and recording all setbacks, instead of addressing physicians or other factors one by one. The declaration advises national medical associations pointing out that reporting all of the problems and setbacks instead of a punishment-based system enables providing solutions for the recorded problems, and therefore, prevents repetition of the setbacks, and that constant training events significantly contribute.(66) It has been reported that the malpractice system used especially in the USA damages patients' safety, and physicians' worries about lawsuits prevent them from reporting setbacks or intervening patients, and therefore, required precautions cannot be taken.(67,68) According to McIntyre and Popper information is obtained by recognizing high-level errors. Therefore, medical records should be documented well, and problematic patients should be closely monitored. It is impossible to determine the degree of an error in original diagnoses without an orderly medical record. (68) The expression "Errors are our treasure" is a result of this approach.

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The Radiologist as an Expert Witness

Constantinos TROMPOUKIS and Ş. Şebnem ÖZCAN

Introduction

Medical professionals may be asked to testify in either a civil or criminal case and they are expected to provide an unbiased expert witness opinion. This is a medical as well as an ethical responsibility within the judicial processes. The involvement in legal cases has to be evidence-based and experience-based. A radiologist may be involved in legal issues by various ways. Firstly, he may analyse bone samples based on his experience and knowledge to extract data and provide evidence from skeletal remains of dead. He or she may be involved in the estimation of several variables in living people. Lastly, he/she may be involved in cases of medical malpractice where expert witness opinion upon a case is required.

The skeletal remains form a unique source of information in forensic case work. Unidentified bodies found in open land or exhumed, as well as partially or completely skeletonized corpses can be identified, kinship ties can be determined and missing persons can recognized by the use of radiology. This is an extremely valuable outcome in terms of criminal or civil law, as well as for humanitarian, ethical and religious reasons (1).

Skeletal materials that are important for the forensic medicine are remnants of individuals who have died in the past 50

years. For this reason, they are called contemporary and can be examined as evidence in judicial processes. Skeletal materials older than 50 years are expressed as outdated or archaeological remains and generally have no medico-legal significance (2). These materials, which have been preserved for years help to obtain information via anthropological approaches in archaeological studies. Information about the history of human development in the evolutionary process can be obtained by their examination. Archaeological excavations related to prehistoric societies may reveal skeletal remains which can elicit paleodemographic, paleopathological characteristics and livelihood activities as well as the history and life of the ancient societies (3).

The basis of the forensic approach to the skeleton, which is on the surface or buried in open ground, is primarily a crime scene investigation procedure. It is ideal to work with a forensic archaeologist or forensic anthropologist in these type of incidents (4). The excavation methods used by archaeologists in prehistoric areas are also applied to samples of forensic importance. The material is removed from the area where it is buried by paying attention to environmental characteristics like impaired vegetation, signs of soil compaction, deterioration in soil order, etc. (5).

If the body of the individual is buried without a burial license, following an inappropriate/inadequate autopsy, in cases of suspicious death, in the possibility of medical malpractice, in poisoning, and murder, the individual is removed from the grave for examination or autopsy. In such cases, a team is established under the chairmanship of the prosecutor or judge, and there must be at least one forensic expert in the team. According to the nature of the event, a forensic anthropologist, a forensic odontologist and a forensic entomologist should also be on the team (6).

The remains found in the open field or removed from the grave can widely vary. Depending on the time after death and the effects of external factors, skeletonization may be partly or completely realized. Positive identification is achieved by the examination of a team of scientists where radiologist is generally involved (7).

The Identification of Skeletal Remains

The discipline that deals with the study of human skeletons is physical (biological) anthropology. Forensic anthropology is the most important subfield of physical anthropology. Cattaneo (2007) mentions that forensic anthropology has two areas of investigation: the study of human remains and the identification of living people (8). Within the scope of the first, forensic anthropology is concerned with determining the forensic importance of skeletal material by examining the human remains that have died in the last 50 years. The aim is to provide sufficient information that can lead law enforcement officers to positive identification by using human remains, trying to estimate the biological identity as close to reality (9). The second field of study is the identification of the living. In this context, physical examination, oral examination and radiological examinations, bone and teeth are evaluated and age determination is carried out. The determination of the real age of the perpetrator who is alive is important in terms of criminal law (6).

The information that can be obtained from skeletal remains through anthropological examinations is gender, age, height and ancestral origin as well as, cause of death and time of death. These examinations are based on morphological and metric differences in bones and teeth due to the characteristic features and anatomical points present in skeletal remains. Based on these differences, vari-

ous formulas, charts, macro and micromorphological methods and radiological criteria have been developed (5).

Using radiological methods in skeletal remains is also beneficial for identification. For example, antemortem and postmortem radiographs can be compared by identifying pathological changes in bones, old traumas, prostheses or other orthopedic operations. Radiological examinations can also be used for documentation of the dental condition (10). However, it has been reported that imaging techniques such as computed tomography and X-rays can reduce the amount of measurable DNA in bone which is a very valuable identification tool (11, 12). For this reason, radiological examinations should be preferred considering possible genetic analysis.

Information about the estimation of the age, the type of death and the time of death that can be obtained by radiological examinations will be mentioned below.

Age estimation

Although the age can be classified as chronological, biological, social, and developmental, the chronological age is the issue that will respond to the questions related to legal cases. The goal of age estimation for both dead and living individuals, is to approach to the chronological age of that individual as much as possible. For the living individuals, the age estimation is generally performed in order to determine if a person is under the age of 18 years. This determination is extremely important for the court decisions for cases of child abuse. For the dead, the age estimation is basic because it contributes in the identification process by narrowing the search of compatible reported missing persons and in some cases (13).

The age estimation from skeletal remains is based on the skeleton and tooth characteristics that change with the growth

of the individual. Knowing the formation and development processes of bones and teeth makes it possible to determine the age using them in fetuses, infants, children and young adults. In adults, the development of the teeth is completed and growth has stopped; for this reason, the age determination is done by the use of the pubic symphysis and auricular surface of the pelvis, cranial sutures and sternal ends of the ribs (2).

The decision on the methodology in estimating the age of death depends not only on the accuracy of the methods, but also on the experience of the scientist, the availability of appropriate tools and equipment, and the preservation of the remains. Although some techniques may seem more precise than others, it is recommended to try a variety them, especially when the question is to determine the age of death in adults (7). A combination of techniques is also suggested by some scholars (14).

Age estimation in living

Forensic age assessments are requested by authorities and courts. The expert report must include clear statements on the age assessment reliability in order to allow the court to decide without any doubt. Generally proof of being under or over a legally defined age limit is required for legal decisions. Examples of this type of legal decisions may be all sorts of sexual assaults to minors. Increasing cross-border migration has resulted in more people who can not prove their chronological age with valid identification documents. The right to shelter and services of the child care facilities by youth welfare offices after taking in unaccompanied refugee minors depends on the age estimation by the expert witnesses. Radiologists are generally involved in cases where doubts about the given age of an individual cannot be otherwise eliminated. In this case a radiologist who has

the necessary expertise can be called as a medical expert. The utilization of X-beams is a general practice in these cases. This utilization on people requires either clinical sign or a legitimate reason for approval. Generally in almost all legislations in various countries an X-ray examination due to legal requirements also requires a justifying indication. This does not necessarily require a benefit for the health of the individual, yet can likewise be considered as the normal advantage of the pertinent laws to the general population (15).

Criticisms of the legal requirements are certainly present. The reality is though that the X-ray examinations for age estimation in criminal proceedings should not have negative health effects for the person examined. In this case the principle of proportionality has to be taken into account. Mainly, irradiation is a health hazard within the normal range, and not a health disadvantage in the meaning of the provision, for the person examined. Generally the X-ray exposure for age assessment is not outside the range of normal health hazards (16).

Methodology

The logical premise of scientific age evaluation in youths and youthful grown-ups is the progression of different attributes that are indistinguishable for all individuals, for example, physico-skeletal development, and dental maturation. For age estimation, reference standards which define developmental stages correlated with both the sex and the known age of the examined persons. The evaluations are done taking into consideration of a specific reference population.

In the event that there is a lawful prerequisite for X-beam assessments without clinical sign, consolidating physical assessment, an X-beam of the hand, and dental assessment with a pan-

oramic radiograph of the jaw region is recommended (17). In case that hand skeletal advancement is finished, an extra X-beam or computer tomography (CT) of the clavicles ought to be taken (18, 19, 20).

Medical history and physical examination

The examination begins by taking the medical history. Illnesses and medications that could have influenced growth are being paid special attention. A physical examination where anthropometric data, such as height, weight, and body type, as well as externally visible sexual maturity characteristics follows. This stage is important because any developmental disorders can be revealed in this examination. If there are any disorders of this kind, chronological age and the biological age will differ and thus suspicious estimations can be done. Developmental delay and thus an underestimation of age may be decided, and have negative consequences for the legal system. Overestimating age due to disorders that accelerate development is also possible. In 1% of the cases it is not possible to estimate the age because of such abnormalities (Schmeling 2016). Following the medical history radiography of the hand, dental examination and examination of the clavicles have to be performed for the final assessment report.

The second step of forensic age estimation is the radiography of the hand. The size and the form of the individual bone elements and the ossification status of the epiphyseal plates have to be evaluated. The radiograph is then either compared with standard radiographs of the relevant age and sex or the bone maturity is determined for selected bones. The ossification rate in the relevant age groups depends primarily on a person's socio-economic status (21). Therefore, when choosing reference values for the comparison attention should be paid to use the

relevant ones (22). X-ray of the hand additionally serves as an indicator for CT scan of the clavicles, which is associated with a significantly higher radiation exposure.

The age estimation via dental examination is based on the developmental characteristics of eruption and mineralization of the third molars. Orthopantomogram can be used to determine the mineralization of third molars. To evaluate tooth mineralization, attention should be paid to changes in shape, independent of speculative estimates of length. The timing of the eruption and mineralization of third molars is dependent on the young person's ethnicity. Therefore, it is recommended to use population-specific reference studies when available (22).

Clavicles are the last bones to ossify in the entire skeleton. Therefore, the ossification stage of the medial clavicular epiphysis is an important assessment tool. Thin-slice CT can be used as an imaging technique to determine this stage (20).

Final age assessment and reporting

Physical examination, X-ray of the hand, dental examination, and, radiological evaluation of the clavicles is required to finalize an age estimation report. There are age-relevant differences due to ethnicity, socio-economic status, and due to accelerated development or developmental disorders. All the possible effects of the above-mentioned parameters have to be included in the report written. Differences in age estimations by the different diagnostic tools are also possible. In this case further diagnostic clarification will be required. If several characteristics were examined, the highest established minimum age shall prevail. The application of the minimum-age concept ensures that the forensic age of the assessed person is never overestimated but instead is almost always less than the actual age.

Cause of Death, Manner of Death and time of Death

Traumas are the main source of data in estimation of the cause of death and the manner of death in forensic anthropology. Examination of trauma in the bone reveals the cause of death, the manner of death, the strength that causes trauma, the duration relationship between death and bone damage (the time of bone damage). Forensic anthropologists may be able to deal with a trauma that occurred at or near the time of death (perimortem) and caused death, or may also experience a pre-mortem (antemortem or postmortem) manifestation of trauma (2). Cracks, especially in burnt bones, should not be mixed up with antemortem or perimortem traumas and anthropologists have to be knowledgeable enough to distinguish between antemortem, perimortem and postmortem traumas in the skeleton. Many causes of death other than trauma do not cause bone damage, while deaths caused by slow poisoning leave a scar/sign in the bone. While the person continues to live after taking the toxic substance, the substance accumulates in tissues such as, hair, nails, often bone. Those poisons can be detected by chemical analysis from skeletal remains post-mortem.

For the determination of the time after death using skeletal remains, it is necessary to know the taphonomy to estimate postmortem changes (7). Many factors that occur during the time between the death and the discovery of the remains cause significant changes in the remains. Taphonomic damage shows some features of perimortem trauma, so it can be misdiagnosed (2). Scars or fractures, especially due to animal chewing activities, can often be mistakenly interpreted as a result of human activities in forensic anthropology studies. At this point, taphonomic evaluation is important in revealing the moment of death and post-mortem processes and in separating human-induced

effects from natural ones (9). Normal variations observed because of burial conditions or post-mortem damage during excavation can be perceived as traumatic lesions. Size and shape differences between age, gender, ancestral origin are also variations that may not indicate a disease.

Diseases

In many forensic anthropology studies, the information available from human skeletal remains about diseases is limited, as many diseases affect soft tissues or cause individuals to die very quickly and leave bone tissue intact. However, bones are successfully used in identification because they give clues about bone and / or dental diseases or diseases reflected in bones and / or teeth. Forensic anthropologists can derive information about nutritional status, traumas, ancestral origin, social status, lifestyle, and sometimes even gender. Specific or rare diseases and disorders such as congenital anomalies are also beneficial in positive identification (23, 24).

Activities

The person's daily activities and profession leave a great deal of traces (scars) on his/her body. These scars may be pathological, or they may be the result of permanent effects that cannot negatively affect human life in the short term. Traces formed within the framework of occupational traumas or occupational accidents can provide information in terms of identification (9).

The medical malpractice

The medical malpractice concept was established over a hundred years ago and it states that during the course of a treatment, the lack of reasonable and ordinary care has to lead

to a bad result. It is the physician's duty to use reasonable care and diligence in his treatment of the patient (25). It is formulated as liabilities like negligence, insufficiently informed consent, intentional misconduct, breach of a contract, defamation, divulgence of confidential information, or failure to prevent foreseeable injuries to third parties that arise from the delivery of medical care. In medical malpractice, medical negligence is the most common situation where the defendant's behavior is compared to the standard of care for that specific situation. The standard of care is defined as, "that reasonable and ordinary care, skill, and diligence as physicians and surgeons in good standing in the same neighborhood, the same general line of practice, ordinarily have been exercising in like cases" (26). The expert witness has to answer the question regarding whether there was a deviation from the standard of care. Then the expert witness provides an opinion regarding whether the deviation of the standard of care could have been the cause of the patient's alleged injury. A deterioration in the patient's condition does not necessarily indicate medical negligence. Frequently radiologists are subject to medical malpractice claims. Malpractice claims may be observer errors, interpretation errors, failures to recommend appropriate follow-up testing, and failures to properly communicate clinically relevant results. "Missed findings" constitute the majority of claims. The expert witness has to determine whether a particular "undetected finding" was in fact negligent (27). Nevertheless the radiologist should have recent and substantive experience in the area and should limit testimony to his/her sphere or medical expertise. Medical witnesses should be adequately prepared and should testify honestly and truthfully to the best of his/her medical knowledge (28).

Expert witness testimony

Radiologists as expert witnesses must ensure that their testimony conforms to the legal parameters of their own legislation system. This factor is particularly relevant for testimony that involves “specialized knowledge,” such as medical expert testimony. Courts should admit into evidence only expert medical testimony that is shown through a proper legal foundation to be based on widely accepted theories of medical science or theories that are supported by a respectable minority of experts in the field at issue. Therefore, scientific validity is the main objective. However, the provision of expert testimony is a fundamentally subjective process that is vulnerable to personal biases. Most of the times medical issues become the reason for a “battle of the experts,” that have been involved from the two parties. This is not what the court needs. The court needs to have reliable medical expert testimony on which judges can depend. The medical experts should also have in mind that a defendant physician is not expected to possess the advanced knowledge or skills of a medical expert. Instead, the expert must determine whether the defendant exhibited the behavior of the “average” physician under the circumstances at issue. This principle is important because it forces the medical expert as well as the judge to acknowledge the potential fallibility of the defendant physician. The question is not whether a physician has made a mistake; rather, the question is whether he was negligent. Unless the untoward result was caused by a failure to conform to the accepted standard of care, he is not liable for negligence. Thus, a radiologist expert is enlisted as a spokesperson for the ordinary and average radiologist.

The radiologists as a medical expert

Although providing expert testimony has become a regular aspect of many radiologists’ practices, medical expert witness

testimony has evolved from a professional obligation to a veritable industry. This fact indicates that the potential for professional and financial profit is eroding physicians' traditional reluctance to participate voluntarily in legal proceedings involving their peers.

A radiologist should accept the duty of expert witness for radiologists and not other specialties. Although he is not expected to have extensive legal knowledge, he should be cognizant of the expert witness testimony process. He should not permit either party's attorney to influence his or her medical judgment or opinion. Finally, the expert must understand that he or she is not an advocate and he or she must be held to the relevant legal, professional, and ethical standards that shape his or her own role (29).

Conclusion

Bones and / or teeth constitute sometimes the only evidence suitable in forensic case identification. These skeletal remains are evaluated both by anthropological/radiographic or radiological examinations, so that the missing persons can be identified. Another significant part of witnessing for radiologist is the age estimation of the victims and/or the accused. Estimating the age may change the course of the whole case if a child is involved. On the other hand, radiologists often hesitate to help the court for cases of medical malpractice. Given the complex legal, professional, and ethical issues that are involved in the provision of medical expert witness testimony, it is important to be mindful of several basic principles that encapsulate the regulations discussed above. Although not exhaustive, these general principles reinforce the need for radiologist expert witnesses to balance the professional and financial advantages of providing

expert witness testimony with the disadvantages that may inure to the parties to a medical malpractice action and to the professional stature of the experts.

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The Role of Pharmacists in Expert Witnessing

Elif ŞAHİN

The Changing Role of Pharmacy

Both medicine and pharmacy are directly related to human health and therefore their history begins with humanity. The modern period of health as science has been started since Hippocrates. The cause of diseases has been tried to be understood and human health has been considered as the focus of research. Until the 13th century, physicians and pharmacists were equivalent. However, the medical professionals and pharmacy professionals were separated by the German Emperor Friedrich II.

The first pharmacy in the Ottoman Empire started functioning in the 19th century. All of the substances used for the drug had been prepared in pharmacies and were made specially for each patient according to the physician's prescription at that time. Therefore, the role of pharmacists was to identify the herbs and bring them into the formulation that the patient could use with various methods. Because of the developments in chemistry, active substances in plants had been started to be produced by synthesis from beginning of the 20th century. As a result, the pharmaceutical industry has started to develop (1,2).

Following the industrialization, the definition of pharmacy and expectations from the pharmacists have been started to change and role of pharmacists has shifted from "making the

drug” to “selling the drug”. With the understanding of the unpredictable adverse effects in the drugs synthesized in the mid-1900s, protection from these side effects gained great importance. This situation has necessitated the professional responsibilities of pharmacists to focus on the patient. Depending on the developing and changing conditions, the pharmaceutical profession is also divided into sub-specialties. With the concepts of clinical pharmacy and pharmaceutical care, the profession has gained a new format (1-3).

Clinical pharmacy is the scientific discipline that involves scientific principles of sciences such as pharmacokinetics, therapeutics, pharmacology and toxicology and all these are used for the benefit of the patient. By summary, pharmaceutical care is the discipline that the pharmacist uses all their knowledge to improve and maintain the quality of life of the patient. Both disciplines is to be “patient oriented”. The concepts of clinical pharmacy and pharmaceutical care, which have become a necessity of pharmacy, have led the pharmacist to be defined as a “health care professional” (2,3).

Because of their high count, being in touch with the society and being easily accessible, pharmacies are in a very important position for health today. Pharmacies are a kind of first stop in the health system for people in terms of directing towards the doctor and treatment. They are also the last stop in the health system in terms of ensuring drug compliance, transferring all kinds of information about medicine and treatment, and making healthy life recommendations (2,3).

Nowadays the main expectation in modern pharmacy is not only the preparation and delivery of the drug. The pharmacist has been described as a “drug and health advisor” (4). This advisory role and the counseling brought about the concepts of

pharmaceutical care, clinical pharmacy and rational drug use. In 1992 the International Pharmaceutical Federation (FIP) has developed standards for pharmacy services under the heading “Good pharmacy practice in community and hospital pharmacy settings” in order to carry out drug and health counseling. The common document on Good Pharmacy Practices (GPP) was adopted by the World Health Organization (WHO) and FIP in 1999, and FIP / WHO guidelines for Good Pharmacy Practices were used as a framework in subsequent years (5). In addition, standard practices have been determined for the pharmaceutical profession. These standards are very important for self-employed pharmacists and hospital pharmacists, and were firstly identified by the WHO as “seven-star pharmacists” in 2014. According to the “seven-star pharmacist” concept, pharmacists must be caregiver, decision-maker, communicator, manager, life-long learner, teacher and leader (6,7). However, two new criteria were added in the seven-star pharmacist concept today. In addition to the seven roles, it was decided that pharmacists should be researchers and entrepreneurs and thus the concept of “nine-star pharmacist” emerged (7). These standards for pharmacy professionals describe how safe and effective care is provided (6).

In our country, “Regulation on Pharmacists and Pharmacies” was published in the Official Gazette on 12 April 2014 in order to define the new identities and responsibilities of pharmacists in this development process. The mission, authorities and responsibilities of the pharmacist are described in detail with this regulation. According to the 50th Article of this regulation published in 2014, “Good Pharmacy Practices Guidelines” was prepared by the Ministry of Health and published on 27.10.2015 (1,8). The basic philosophy of Good Pharmacy

Practices is to improve the quality of life of the patient, to maintain and to apply pharmaceutical care based on the factors that are effective in the treatment process. The pharmacist provides drug and health counseling by observing the patient's health with rational use of drugs thanks to Good Pharmacy Practices (8). Hence which is expected from pharmacists today is not only to give the prescribed medicines to the patient but also to provide drug and health counseling. Good Pharmacy Practices expected from pharmacists are as follows:

- To evaluate prescription drugs in terms of dose, dose range, interactions
- To explain to the patient in detail how to use the prescribed drugs
- Controlling drug interactions in terms of medications used by the patient regularly
- Consulting drugs on over-the-counter medicines
- To direct to the doctor if necessary
- Counseling about lifestyle changes and disease, especially in patients with chronic disease
- Consulting on over-the-counter medicines, non-pharmaceutical products such as nutritional supplements (8)

In addition, pharmacists are obliged to notify the conditions about observed by them or communicated to them by patients or other health professionals directly or through provincial health directorates. Examples of these situations are given below.

- Use or abuse of drugs other than the doctor's recommended indications and posology
- Adverse drug effects developing due to drug use including pregnancy and lactation period
- Overdose
- Errors of drug usage

- Adverse drug effects occurring in relation to product quality problems
- Drug inefficiencies
- Conditions falling within the scope of pharmacovigilance
- Suspicions about fake product

As a result of the above an information cycle is created in which the pharmacist is actively involved.

As can be understood from all this, pharmacists have an important health counseling role in terms of individual and community health. For the adoption of this counseling role, updates have been made in pharmacy education as in all developing disciplines. Patient-oriented care practices have been added to the curriculum. Clinical pharmacy trainings, which were first begun in the US in the mid-1960s, started to take part the curriculum as a master's program in our country in 1991. Since 1995, it has been included to undergraduate education, and today it is given to all pharmacist candidates under the name of clinical pharmacy / pharmaceutical care in almost all pharmacy faculties. Clinical pharmacy is also a field where a post-graduate degree is studied. According to the Law No. 6566 published in the Official Gazette in 2014 (Law on Pharmacists and Pharmacies and the Amendment of Certain Decree Laws), two areas of expertise were determined, namely "Clinical Pharmacy" and "Phytopharmacy". So the way for graduated pharmacists to obtain specialist titles has been provided. Also it is possible for pharmacists to follow innovations and developments through in-service training (2, 8-10).

Forensic Pharmacy

Forensic pharmacy is an area of expertise gained with post-graduate education in various countries of the world. It is a forensic science related to the forensic problems encountered in the pharmacy profession and drug treatment. It has a multidis-

ciplinary relationship with other disciplines. Depending on the countries' legislations, people with a forensic pharmacy degree or certificate can provide consultancy and expert opinions to physicians and lawyers and courts in legal problems about drug and pharmacy (11).

Today, studies that are included in forensic pharmacy / forensic toxicology and carried out by pharmacists entered the records in the Ottoman State in the 1800s. Some of the examples in the archives are interesting. One of them is an analysis by a pharmacist that shows misrepresentations in the prescription, incomprehensible points and their harm to the patient. In the other example, the pharmacist had determined that Kermés Vétérinaire was given from a warehouse in Istanbul instead of Kermés Minéral and emphasized that the drugs taken from the pharmaceutical warehouses should be checked by the pharmacist (4).

Today, forensic pharmacists can provide consulting in many topics such as suspicious deaths and poisonings, drug addiction, problems caused by undesirable effects and interactions during drug therapy, in cases of malpractice occurring during drug and health counseling, fake drug production, drug abuse. They can make chemical /biological and toxicological analysis from biological materials and can interpret their results. In our country, the Forensic Pharmacy Commission was established as a sub-commission under the Forensic Scientists Association in 2008. This commission, through the Turkish Pharmacists Association, the Academy of Pharmacy (TEB), has been providing training to pharmacists through In-Service Training Programs and introduce forensic pharmacy since 2009. In addition, 60-hour certified trainings have also started to be provided at the Continuing Education Centers of various universities (11,12)

In addition to these, the following subjects are among the

areas of interest of forensic pharmacy in the World (4,13).

- Forged prescription
- Pharmacological euthanasia
- Drug-induced violence (whether the accused or the victim is affected by a drug at the time of the incident)
- Driving while under the influence of medication
- Effects of psychoactive therapy on balance
- Evaluation of individual pain threshold
- In compensation cases related to pharmacotherapy
- To provide pharmaceutical service in prisons
- To ensure the safety of the storage and transportation of medicines
- Drug analysis at the Olympic Games

As can be seen, forensic pharmacy, which has a wide area of expertise, is also very important for providing correct pharmaceutical care. For this reason, the steps taken in order for forensic pharmacy to be an expertise area that can be empowered in our country are pleasing.

Pharmacists as an Expert Witness

Today, pharmacists as an expert witness in various countries; assists lawyers, judges and jurors in understanding the complex scientific and technical aspects of drug-related problems in accordance with each country's own justice system. The pharmacy practice and professional background of the pharmacist who will be an expert witness is important. From the pharmacists who will be expert witness; lawyers may ask for expert opinion in the preliminary examination of the case, may receive written and oral evaluation during the discovery process, or may be request to attend the hearings and give their opinion during the trial process.

Most self-employed pharmacists can define standard pharmacy practices. In addition to standard pharmacy practices; depending on their education and specialization, they can also be expert witness in sub-specialties such as clinical pharmacology, clinical pharmacokinetics and toxicology (14).

The hospital pharmacist is a natural and correct choice as an expert witness in negligence cases in the hospital pharmacy (15).

Before accepting expertise, a pharmacist should determine whether the problem is within the scope of his/her expertise, whether there are any conflicts of interest, and whether there are other issues that could jeopardize professional relationships and the future (14).

There are 13 sub-specialties in the basic field of "Medicine and Pharmacy" under the Department of Expertise of the General Directorate of Legal Affairs of the Ministry of Justice in Turkey. These subspecialties are Pharmacognosy / Pharmaceutical Botany, Pharmacology, Pharmaceutical Chemistry, Pharmaceutical Technology, Pharmaceutical Microbiology, Pharmaceutical Toxicology, Pharmaceutical Biotechnology, Radiopharmacy, Drug Reimbursement, Pharmaceutical Inspection, Cosmetics, Counterfeit / Illegal Drugs, and Pharmaceutical Trade. The qualifications sought for people who will become expert witness in these fields are to meet the basic admission requirements for expertise and to be a graduate of the faculty of pharmacy. However, it is necessary to have a master's / doctorate degree in the sub-specialty area and to provide professional experience requirements. In addition, it is necessary to have the certificate of completion of the expert training given by the Ministry of Justice (16).

Examples of Pharmacist Practices as an Expert Witness; Malpractice in Pharmacy

Malpractice means worse practice and is actually a term that can be used for all professions. Malpractice in health is defined as the failure of physicians and other healthcare professionals to perform the standard treatment of the patient with bad practice, harm the patient due to lack of skill or negligence. Malpractice can be caused by negligence, carelessness, inattention, inexperience in the profession, and lack of attention (17).

Firstly from the legal point of view, it is necessary to talk about the concept of “Tort liability”. Tort liability is to be liable for damage caused by a non-contractual, illegal act. The pharmacist’s tort liability may come up with different events. These events can be in the form of doing or not doing the action. Examples of such events are the sale of drugs that are discontinued for sale, the absence of drugs that should be kept in the pharmacy, and the administration of the drugs in the prescriptions suspected of being inaccurate to the patient without contacting the physician. It must be proven that the conditions of tort are fulfilled in this situation (18).

It would be appropriate to evaluate malpractice in pharmacy in terms of self-employed pharmacy, clinical pharmacy and hospital pharmacy.

Self-employed pharmacy

The responsibility for the inaccuracy in the prescriptions during the treatments with drugs are up to the physician. However, because the prescription is generally prescribed by the pharmacist, pharmacists are also considered responsible in terms of supervisory and control functions (19).

When various case examples in the world are examined, it is

seen that pharmacists are assigned as expert witness in cases related to pharmacy standards. Specially in the case examples in the US, pharmacist opinions were taken as an expert witness in the cases against the pharmacists and which are within the scope of adverse drug effects and consultancy service. Examples of these lawsuits filed for reasons such as pharmacists' giving drugs other than prescribed drugs, not being able to detect interactions, and not warning patients about side effects. The court has ruled to support that pharmacists and pharmacies are considered to be service providers, not sellers in these case examples. So it has been actually decided that pharmacy standards were violated in such cases. However, pharmacists can only perform a limited expertise in cases involving causality or issues related to the practices of physicians. It should not be forgotten that pharmacists' responsibilities in terms of pharmacist malpractice are also based on pharmacist professional standards, not those applicable to physicians or other healthcare professionals (11, 20-24)

According to the pharmacy-related laws, regulations and pharmacists rules in Turkey, pharmacist's responsibilities are not yet clear, however, the prohibitions are clearly stated. At this juncture pharmacists are given responsibility for using their professional knowledge in the best way. For this reason, although the concept of malpractice is evaluated for only medical practices today, indeed malpractice is also possible if pharmacists do not use their professional skills (19-25).

The issues that may be encountered by a self-employed pharmacy pharmacist while performing their profession in Turkey and that may be subject to malpractice are listed below (26).

- Malpractice related to drugs that must be found in the pharmacy
- Malpractice related to storage of products in the pharmacy

- Malpractice related to OTC and BTC group drugs available in the pharmacy
- Malpractice associated with the delivery of parapharmaceutical products in the pharmacy to the patient
- Malpractice for the pharmacist's obligation to be in the pharmacy
- Malpractice associated with the pharmacist's responsibility in terms of informed intermediary doctrine

Clinical Pharmacy

The concept of Clinical Pharmacy, which first emerged in the US, has been defined as a discipline where pharmacists “play a more active role in patient treatment”. Although it may be mixed up with hospital pharmacy, it actually means “patient oriented” pharmacy both in hospitals and pharmacies. In our country, at the end of the 2000s, Clinical Pharmacist staffs (with Master’s and Doctorate degrees) started to be announced by the Ministry of Health (27). In addition, two specialities were defined for graduates of the Faculty of Pharmacy with the “Regulation on Specialty Education in Pharmacy” published on October 21, 2016. One of these speciality is Clinical Pharmacy. Training period for clinical pharmacy is 3 years (28).

With the Law No. 6566 published in 2014, it was decided to employ one specialist clinical pharmacist for each 100 to 300 beds in hospitals and in hospitals with more than 300 beds, one specialist clinical pharmacist for every 200 additional beds (29).

The services and responsibilities of clinical pharmacists are as follows:

- Creating a patient profile
- To be a patient educator with drug consultancy

- To follow all the effects of the drug on the patient
- To determine the patients who need dose and dose change in the hospital and save them in their files
- Identifying interactions between drugs used by the patient and preventing these interactions
- Preparing intravenous solutions and delivering them to the patient
- To control drug delivery systems in hospitals

Based on these responsibilities, clinical pharmacists may be responsible for incorrect monitoring of drug therapy. In such cases, another pharmacist's statement is usually required as an expert witness and the opinion of another pharmacist who expressed his opinion of negligence may be taken. This area will be important in terms of expertise in Turkey, after clinical pharmacists have completed their specialty training and start to be employed.

Hospital Pharmacy

Malpractice is an ever present possibility for the practical hospital pharmacist. Cases involving hospital pharmacists have increased in the world in recent years (15).

Conclusion

Nowadays, the mandate and responsibilities of the pharmacy profession have also increased in Turkey as in the world. These responsibilities are especially important from the standpoint of malpractice. Malpractice in pharmacy can occur not only in self-employed pharmacy but also in areas such as hospital and clinical pharmacy. First of all, it is aimed that pharmacists should be aware of and fulfill their mission and responsibilities in order to avoid malpractice cases. However, in many cases

where the drug is directly or indirectly related, especially in cases involving malpractice, pharmacists who are experts drugs can provide opinions and be as an expert witness.

Apart from malpractice, pharmacists can be expert witness in various areas within the scope of their expertise. However, it is an obligation to provide the conditions for being a legal expert witness.

Both pharmacists and lawyers should be informed about pharmacist's responsibilities and which areas pharmacists are qualified as expert witness. These informations should start from undergraduate education in both professions.

In addition, forensic pharmacy is an area that need to be developed and promoted for our country. In this way, pharmacists will develop themselves and find employment opportunities in much more different fields.

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Awareness of Standardization in Expertise Services Provided at Forensic Science Laboratories in Turkey

**Emel Hulya YÜKSELOGLU, Fatma CAVUS YONAR, Omer KARATAS,
Dilek SALKIM ISLEK, İtir ERKAN**

Introduction

One of the most important stages of the working mechanism of judgement is the institution of expertise. Experts can play key roles in the resolution of lawsuits by informing views to the system of justice on topics requesting technical knowledge and skill. Forensic sciences have a wide spectrum because it is a field in which many professional groups work together. DNA analyses, forensic genetics, forensic toxicology, pathology, forensic digital examination, medical practice errors, and incidents of violence are the primary areas. The specialists who provide expertise in the field of forensic sciences respond to questions of justice. based on the education they have received.

If we are to look to the past, the evaluation of competent people, ideas, identifications, and findings go back to antiquity. Upon the murder of Julius Caesar in Roman times with several bladed, sharp objects, a physician was made to examine his corpse, and he reported that one of the 23 wounds were fatal, piercing his chest cavity. This report is considered to be the first expert witness report in history (1). The legal use of data acquired as a result of research on the genetically molecular level is not very old. But rapidly developing technology contributes at

a very important point to the legal system. The inclusion of molecular genetic research in the legal and judicial system started with an incident that occurred in the United Kingdom in 1985. The British police force worked with Alec Jeffreys to find the perpetrators of two girls after they were raped and murdered. Sperm samples taken from the murdered youths were compared with the DNA profiles of about 5,000 males who lived near the crime scene, the real criminal was found, and it was understood that the other arrested individual was innocent. Help received from outside over time found its place in the legal system under the title of expertise. The contributions of expertise in forensic incidents that occur in all countries all over the globalized world is incontrovertibly important.

The evidence that comes from the justice system in accordance with the evidence chain of deliver is examined and analyzed in the forensic genetic and toxicology laboratories, and the acquired data are evaluated. Evidence can be examined at one or more different laboratories at different times. For this reason, there must be a shared language in the reports that emerge from these laboratories. In order to provide for this shared language, and for the process in laboratories to be auditable, for methods used to be correct and repeatable, and for services to be customer-oriented, compliance with international standards is necessary. The standard that experiment laboratories must follow is TS EN ISO/IEC 17025 (2). The compliance of laboratories that provide expertise services is conditional for the correct processing and reporting of the evidence (3).

At the focal point of the debates are questions like how and by whom will these services be provided and how will impartiality be guaranteed. The search for a new model for the structure of this topic and forensic sciences is on the agenda not just

in Turkey but all over the world. In addition to this, forensic medicine and forensic sciences are a topic of discussion whose terminological confusion continues. The deficiencies and problems in the system of expertise and the lack of a certain standardization leads to the prolongation of lawsuit processes. The point we wish to note in this section is to create awareness on the topic of standardization, which will ensure the primary resolution of problems in the system of expertise, which forensic laboratories serve and will contribute to the development and configuration of the system.

The Definition of Expertise and the Reasons Expertise is Necessary

Ensuring the accuracy and reliability of judicial processes and protecting all principles of trial proceedings is the duty of the judge. The judge must determine the incident or phenomenon that is the subject of the trial while fulfilling this duty and must manage the rule of law in accordance with the incident. Sometimes life experience and the general knowledge the judge possesses are inadequate to determine the subject of the lawsuit. In this situation, the judge receives help from experts who have the necessary technical knowledge.

According to the definition specified in Turkish Expertise Law number 6754, “expert” expresses “A real person or legal entity who are referred to provide their verbal or written votes or opinions in situations whose resolution or expertise requires special or technical knowledge” (4). An expert must be humble and open to criticism, even if it doesn’t appear that way in the law. They must be aware of their own talents, learning, and accumulation of knowledge and must be able to vocalize this in a suitable language in situations where the subject has exceeded

their limitations. Having a command of the topic, being able to vocalize this at points where they do not, and not seeing themselves as more superior than others in the court will help act in the framework of logic and not overlook the truth. Most importantly, someone in this position, which can affect the decision of the court and change the lives of people, must absolutely be impartial and independent. The expert must not forget that they have been tasked to assist the court and that the knowledge, education, and experience of the judge may be different, and they must convey their views scientifically in a manner that can assist. It is unavoidable that the field of expertise benefits from the views of different people in terms of reaching a judgement for the court or judge assigned in legal disputes. The judge contributes to the resolution of the lawsuit by taking the views of financial consultants, architects, engineers, industrial designers, computer software developers, chemists, biologists, toxicologists, specialists, and expert individuals from many different groups, beyond his or her legal knowledge, for the healthy resolution of the lawsuit throughout the trial. Situations that require the reference to experts was included in article 266 of the Turkish Expert Law: “The court shall decide to receive the opinion and view of experts, upon the request of one of the parties or of its own accord, in situations that require special or technical knowledge, apart from resolution law. An expert cannot be referred to on subjects for which resolution is possible with the general and legal knowledge that the profession of judicature requires.”

For reasons like an intense work load and the presence of numerous case numbers being tried in judicial proceedings with the multifaceted nature and diversity of disputes, the views of expert individuals is necessary in legal disputes. Today, as

knowledge and technology change and develop each day, it has become imperative, beyond the need to refer to specialized people in order for judicial authorities with legal equipment to reach a conclusion in legal disputes and for a judicial trial to be held.

The parties in legal disputes offer the court evidence that proves their claims for the judge to be able to reach a ruling. Other than being able to perform examinations over the evidence presented to the court, experts can request the necessary probative knowledge and documentation from the parties to reach a view and belief in the framework of the court's area of assignment. Experts evaluate evidence, claims, and defenses in light of the technical information and present to the court a report that informs their views and beliefs. An expert assumes the duty of assistant to the judge in legal disputes with this work they perform. This system ensures the healthy proceeding of trials and the swift resolution of disputes. The institution of expertise can be imperative in some lawsuits while being necessary in legal disputes.

Forensic Science Laboratories

Forensic science is defined as the science of revealing the relationships between objects, places, and people that become involved in crimes. Thus, it assists in the research and determination of scientific public and civil lawsuits. The fields of forensic science are defined as criminalistics, forensic biology, forensic genetics, forensic pathology, forensic anthropology, forensic odontology, forensic engineering, toxicology, behavioral sciences, document examination, and more (5).

The purpose in studies of forensic sciences is to minimize the influence of humans by not including giving rise to coinci-

dence and to maximize the validity and reliability in laboratory activities. In this context, there must not be any hesitation regarding the officials who gather evidence at the scene of the crime, the experts who provide a connection with potential suspects by analyzing this evidence or who exclude their interest in this incident, or the reports that these experts prepare.

Forensic science laboratories present expertise services and serve justice (6). Each citizen wants to be sure that the justice system works correctly. Therefore, the right results must be able to be produced from examinations and analyses made in forensic science laboratories and the accuracy of these results must be proven and presented objectively.

Forensic science laboratories are the places where the acquired are converted into a judicial report by examining the evidence collected from the scene of the crime. Courts expect quick feedback from forensic science laboratories. Every stage from the acceptance to the reporting of the evidence brought to the laboratories must be processed and evaluated in writing. These procedures allow for the accurate examination of the right evidence. The auditability of each stage at the laboratory is important for objectivity. The most important evidence for the objectivity of a laboratory is an accreditation document that shows that it works according to the TS EN ISO/IEC 17025 standard (7). It is mandated in the United States of America (USA) that all hospitals and clinics be accredited by an official institution. But in most countries and in our country, there are no mandates regarding the accreditation of laboratories, especially for forensic sciences. However, they must be mandatory when considering the effect of these laboratories over trials.

There are some conditions for a scientific method used in the name of expertise at a court in USA to be valid. This sub-

ject first came to the fore in 1923 with the use and presentation to the court of a polygraph as evidence in the *Frye v. United States* lawsuit (8). The court decided that the arguments used for expertise needed to rely on scientific methods that are adequately specified and accepted, upon the inability of this machine, which works based on changes in systolic blood pressure, to ensure the desired confidence in the lawsuit. The court noted that it was difficult to define a scientific principle or discovery when it exceeded the line between experimental and provable stages. As a result of the lawsuit, it was decided that the scientific method must have been accepted in its own field and that the polygraph working based on systolic blood pressure was not accepted since it was not a method that had yet been accepted by the authoritative people in its field. This situation has been named the Frye standard. According to this standard, it is not enough for a technique to be considered valid for work to be done by experts, and the requirement emerges for the method used to be an accepted method in that field. Another turning point with which the acceptance in court of evidence obtained scientifically is discussed was the Daubert standards that formed with the ruling issued from the United States Supreme Court in the lawsuit of *Daubert-Merrel Dow Pharmaceuticals Inc.* in 1993. According to these standards, if people considered experts have validity in scientific fields as of the involved topic checked and published by an academic arbitrator, which has been tested and obtained accurate results, and for which general errors are known, and if this person can explain in adequate clarity the application techniques and results, they may be considered valid before the court. After this explanation, many experts performed work to show whether they complied with the criteria with which Daubert defined their methods.

This situation is actually proof of the extent to which expertise is important in court. Certain standards of the people who will provide expertise and of laboratories for the provision of justice is essential. Methods used not only for a polygraph but also in alcohol and drug tests, threshold values and methods implemented in genetic tests, and frequencies specified compared to the studied population will significantly affect the results. It must be a shared language for this reason in scientific study. It is both scientifically and legally important to obtain the same results by performing the same study in laboratories all around the world that are accredited and work according to certain standards.

The ability to produce general conditions for the adequacy of experiment laboratories and technically correct and reliable results was defined in the TS EN ISO/IEC 17025 standard. The indicator of the adequacy of the laboratory is at an international level with the initiation of the use of this standard (9). In addition to this, laboratories competing at the same level with one another ensures the formation of a shared language in reports. At the same time, the reports that laboratories with these standards provide have international validity. In terms of this judicial system, especially in international lawsuits, the amount of evidence gathered at the scene of the crime is important in situations where it is not enough to allow for secondary review.

Evidence is directed to one or more judicial units after reaching the laboratories. Available at these laboratories generally are the biology (DNA), firearms, tool traces analysis, document examination, body and fingerprint, chemistry (narcotic analysis), and toxicology subunits (10). There is a need for efficient laboratory conditions, calibrated devices, validated methods, and competent personnel to implement these methods in

order for accurate and reliable results to be produced. The provision and auditing of these conditions could only take place with a quality assurance system. Quality assurance is the provision of reliable, impartial, and definitive results that are produced by a laboratory. Quality management must keep all institutions, their resources, materials, and procedures under control within an intelligently documented system. This system must show that customer requirements are met, should it be necessary, and that they will continue to be met in the future. The quality of the final products and services will be at the level of the weakest link in the production chain.

Accreditation / Standardization

The existence of accreditation studies in forensic science laboratories means the commitment that no matter in conducted studies is left to coincidence, that everything is put in writing, that everything up to the finest details are included, that all job descriptions regarding personnel are done, that training for expert personnel is provided fully and accurately, that maintenance and repair as well as calibration measurements for devices are done on time, that there is a flexible and permanent structure that allows for any and all corrective and preventive action and process, that laboratories are open to supervision to be conducted to determine whether the conducted activities comply with designated regulations and/or standards regarding the working system and personnel, and that they will be able to exhibit the courage to face all negative outcomes that may emerge (11).

In order for there to be confidence in the tests and experiments a forensic laboratory that offers expert services conducts, in the reports they arrange, and all other services they offer, these tests and the prepared documents comply with the deter-

mined national and international standards and be reliable and impartial (12). Accreditation/standardization is for this reason incredibly important that the service presented in a laboratory in terms of determining the quality of output or personnel and doing this according to the specified standards.

Accreditation/standardization must be viewed as a tool for laboratories that offer expert services and must be evaluated in this manner (13). What is essential for these laboratories is the prioritization of concepts like the adoption of standardization, constant improvement, development, self-evaluation, comparison, strategic plan, improvements, supervision, sharing, investigation, auditing, and personnel and customer satisfaction in all services presented and outputs produced at the laboratory.

Standardization within a process that has internal and external mechanisms of control presents very significant contributions to the improvement of the quality of a laboratory's services by offering an environment in which reliability, impartiality, transparency, and the effectiveness of these are guaranteed with procedures.

It is an irreplaceable need for the tests and analyses laboratories do to be reliable and to be in a quality that suits the specified objective (14). Technological and scientific developments in the field of forensic sciences are met with amazement but also harbor a slew of suspicions. The most important way to remove these suspicions is to perform accreditations based on the TS EN ISO/IEC 17025 standard, which specifies competency in the tests and analyses that laboratories perform.

The accreditation of forensic laboratories today has become the most important and most powerful element in terms of the effectiveness of services presented in the field of forensic sciences. Convincing the people and all institutions and organizations

to whom services are presented for scientific laboratories, gaining their trust, and ensuring the continuity of gained trust require significant efforts and endeavors (15). The shortest and most accurate way to provide all these is to be accredited by resorting to standardization from services provided by giving weight to the work related to quality management systems. Accredited laboratories must always work in compliance with the terms of accreditation in the expert services they provide, must declare that they are accredited for only the working subjects specified in the accreditation document, and must create and implement procedures that will help customers comfortably differentiate between the accredited scope and the scope that remains beyond the accreditation for the supplied services of compliance evaluation.

However, it must be remembered that accreditation in forensic science laboratories do not guarantee that no error will be made in examinations and analysis performed in the laboratories. Accreditation means a program that expresses a laboratory's possession of written policies and procedures to ensure and monitor quality.

Conclusion and Recommendations

Experts present services to the relevant parties in the analysis of incidents that have or have not lapsed into the trial stage for forensic genetics and forensic toxicology, by using techniques of scientific research and examining the incidents up to the finest details. The parties could be lawyers, people or institutions who are parties to a dispute, or judicial authorities.

The presence of material criminal evidence is the biggest helper and guide for law-enforcement units and is an important element in the determination of the relationship between

the style of the commitment of the crime and the victim or deceased and the perpetrator, and it is critically important in terms of emphasizing the importance of the processes of review and research to be conducted at the investigation stage. Forensic science laboratories must adopt as a principle performing all requested analyses in accordance with validated methods and by using the right equipment and materials. They must determine as a goal the independent and impartial declaration and reporting of the results, conveying them to the relevant parties, and storing the emerging results in the safest manner by accurately, securely, and quickly meeting the requests for analysis.

Forensic science laboratories and the forensic science community must strive for the presented services to be better and excellent and to increase the board for current standards. Forensic science experts must never forget that an expert report prepared with regard to an incident that occurred affects not just the accused, victim, or the relatives of both but also indirectly affects the entire community to which they are related.

Without including the procedures followed regarding the results that don't include detailed information and from which investigations are produced of the types of "the necessary examinations and evaluations were performed," "the results were produced with the help of current software and hardware," and "the work was completed in line with the request", which are included in the expert reports that forensic science experts prepare, without explaining whether experiment instructions were complied with, without providing the necessary information about maintenance and calibration for the software and hardware used, and without presenting any document that reveals how the results were reached like a decision benchmark instruction regarding the produced result, the believability and relia-

bility of the prepared expert reports will be opened for serious discussion, and hesitation will be experienced in considering it from a legal perspective (16).

Accreditation for experiment laboratories according to standard TS EN ISO/IEC 17025 in forensic sciences is the assurance that the expert services for courts can be obtained anywhere in the world. Compliance with standard TS EN ISO/IEC 17025 ensures that the each detail of the process in the laboratory is according to an unchanging and understandable procedure, that the work-flow processes are always the same and potential errors are thus minimized, and that efficiency is maximized in the processing of laboratory services.

Standardization among the most important criteria of reliability in laboratory studies increases the quality of service, environmental safety, and confidence in the institution with regard to the working area of the laboratory while being evaluated as an effective means of quality development and management that reduces the risks that service-presenting units and employees face (17). In this regard, forensic science laboratories must set goals for themselves with regard to the standardization of testing methods that are used and accreditation and must exist within constant efforts on behalf of individual and institutional development by creating policies in accordance with this.

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The Importance of Trace Evidence in Case Identification

Medical vs Forensic Genetics

Taner GÜVEN

Introduction

Forensic science covers all areas of life enough to be extended by putting the word “forensic” in front of almost all branches of science. Forensic medicine, on the other hand, includes forensic science that only concerns the human body. The human body is a complex structure that has not been fully resolved even today with all the development that has been achieved in medicine. Medical practice, requires mastering in the branches of Physiology, Neurology, Anatomy, Biochemistry, Pathology, Histology, Medical Biology, Medical genetics, Molecular Biology and Forensic Genetics. In practice, this situation exceeds human capacity and that is why “clinical specializations” have been evolved. Cardiology, Psychiatry, Obstetrics, Pediatrics, Thoracic Surgery, Geriatrics, etc. are known examples of specialization. Unfortunately, there is no specialization foreseen in the area of legal medicine or forensic sciences per se. It is called “judicial medicine” and it is expected that a forensic expert knows all the basic and clinical disciplines, can make all diagnoses that may cause harm or death without distinguishing children, gender, elderly, body region, mental, traumatological, pathological, and determine the degree of damage to the body or causes of

death. It is clear that efficiency which is mandatory cannot be reached. When issues such as forensic document examinations, lineage examinations, DNA evidence analysis are added to all of the above, we clearly understand why sub-specialty branches are required for an appropriate forensic medicine discipline (1).

In order to comprehend why sub-specialty branches training are required; we want to discuss the importance of collecting and analyzing trace amount of biological evidence.

Collecting and analyzing trace amounts, that is, almost no evidence; in the absence of all other evidence, it becomes the only means of reaching the truth that can provide the manifestation of justice (2). What we mean by trace amounts of evidence is not only evidence that can be examined under a microscope or histopathological examinations such as diatoms, but very small amounts of biological evidence that can only be collected from the scene with experienced imagination, deep forensic science and advanced technical knowledge (3-4). Such a small amount of biological material is only meaningful if it contains DNA.

The goal of this article is to attract attention to the importance of the biological evidence obtained in very small amounts and that its examination requires advanced expertise which we do not have. The establishment of a department to provide education for this specialty is essential for Turkey.

All homicide investigations begin by collecting evidence from the crime scene by the police in the supervision of medical examiner for the corps specifically. The scene of the incident is considered to be the coordinate where the murder took place or where the corpse was left later. The point that should not be overlooked is that the body itself is a crime scene, and perhaps the most important evidence is on the body and / or clothing and accessories. Evidence establishes the link between the sus-

pect and the crime and is the only means of enlightening the incident when there is no witness or video footage. Deciding “which evidence” is the hardest part of investigating the crime scene. Being free of prejudices requires a serious imagination and scientific perspective.

In a study that was performed for comparison purposes, crime scene investigation images of a previously resolved murder were shown to two groups. The first group was a professional crime scene investigation team and the second was a group of students trained in this regard. They were asked to distinguish evidence related to crime. The evidence chosen by students was significantly more successful. The probable explanation for this may not be that the crime scene investigation team failed, but that they developed prejudices and biases thus they could not use their imagination efficiently due to the hundreds of crime scenes they have examined before (5). Knowing the current capabilities of forensic science in evidence collection, the level of success that can be reached is beyond imagination. A murder committed in a hotel room was resolved by the DNA sample obtained from the mosquitoes collected from the room matching the suspect (6).

Naturally, laboratory examinations of the evidence obtained from the scene should also be examined unbiased and objectively. Thus case-specific solutions can be produced. The scientific creativity of the crime scene investigation team will be of no use if the laboratory refuses any non-routine operations requested from it, saying that it cannot be operated under the pretext of the workload. For example, since phenotyping studies (determination of visual characteristics by DNA) can determine the phenotype features with low probabilities, they are not useful in the field of forensic genetics and do not generate strong

evidence (7). On the other hand, if the phenotyping study is performed by using the methods used exclusively and out of the routine, they may help the police to narrow down the number of suspects in the absence of eyewitnesses (8-9).

Since the development of PCR technology, it has been possible to examine trace amounts of DNA as evidence (10). Trace amounts of DNA evidence, such as human blood from the mosquito, hair dandruff, or the nail material of a highly decayed corpse, can be decisive in reaching the culprit. Despite their critical importance in genealogy, immigration problems, sexual assaults, theft, and even fraud investigations, DNA evidence can sometimes be the only determinant in unidentified murders because, in severe criminal proceedings, second-degree evidence is often overlooked by the courts due to the principle of “suspect takes advantage of suspicion” (11). Except from eyewitnesses, camera footage, fingerprint at the crime scene or murder tool being caught on the perpetrator, the only way to convince the court that a particular person committed a murder is DNA evidence detected on the victim or perpetrator.

In this case, “What is DNA evidence?” The answer to the question should be known by a legal expert as well as a forensic geneticist. When lawyers in court do not know the answer to this question; both the prosecutor, the lawyer and the judge become the experts who perform the DNA analysis. The first thing that a court committee should know is that “forensic genetic examination” and “medical genetic examination” are totally two different disciplines of science and that a medical geneticist can cause grave mistakes that mislead the court if he/she lacks the notion of forensic science (12).

A person working solely in the field of medical genetics searches for the gene that synthesizes a particular protein, or ex-

amines the anomalies of chromosomes, which we can call gene packets. He/she uses a vast amount of DNA material from controlled subjects or subjects under controlled conditions. However, a forensic geneticist evaluates the sequential repetitive (STR) sections of DNA material, which can be obtained in very low amounts or even trace amounts, in the uncertain conditions of the crime scene, and replicates to the amount that can be examined by PCR technology and calculates whether it belongs to the suspect according to the probability theory. Considering that our DNA consists of 32 billion base pairs and 98% of them are common to all people, it can be understood how effective the personal comment of the forensic geneticist will be as a result of the expert report (13).

We think it is necessary to give a concrete case example in order to explain how misinterpretations made in the examination of traces of evidence can mislead justice.

Case: Two girls aged 8 and 9 live in a village. Since their houses are located side by side, they go to their schools on foot together every day. Their school is approximately 2 km away. The road passes through village houses and residential areas. When they do not return from school one day, their teachers informed that they never went to school that day. A search operation was initiated by the villagers and the law enforcement, but no result could be obtained. 44 days following their disappearance their bodies were found compressed in an empty pipe, in a non-residential area approximately 11 km away from where they disappeared. The corpses of the two little girls have been severely rotten and have been severely damaged by wild animals.

It was not possible to determine the causes of death and whether they have been sexually assaulted at autopsy because of the severe decomposition. There was no sign that could consti-

tute evidence at the scene. Y-STR is a genetic material belonging to men only that is why it is very useful in identification of male in a sexual assault. Y-STR isolation is the most effective method in parsing the DNA of the attacker in traces of DNA samples and in cases where the victim is a woman (14). Y-STR belonging to two men was isolated from the under-nail swab taken at autopsy of one of the girls. This was the only evidence that could have been obtained. DNA samples are taken from all men of the appropriate age in the village, but none match the Y-STR of the attackers. As a routine forensic practice, a DNA sample is taken from all persons who have been convicted in the prison for sexual assault but are known to be free at the time of the incident. The Y-STR of a person who is in prison in the province where the murders occur had a complete match. However, the autosomal STRs did not show inclusion. It is concluded that this person is not the perpetrator of the incident, but a person of this person's male descendant should have done the crime (15).

Based on this conclusion, DNA samples for Y-STR typing were taken from all the relatives of the person in mention who was the main suspect. After all, none of them showed a match. A total of 113 people was analyzed for DNA, and only the suspected person showed an STR match. Therefore, the case remained inconclusive.

The case remains unsolved for 11 years. It becomes an exemplary case in terms of the sociological consequences of an unsolved murder. Everyone in the village blames each other. Enemy families have been formed. The name of the village where the incident took place is also known as "village of perverts" in the surrounding villages. Even teachers who worked in the village primary school at that time were charged and even statements were taken by the judicial authorities at certain intervals.

After 11 years, the relevant prosecutor's office is asked to re-examine genetic analysis to a forensic medicine department of a university. In the second examination, it is stated that it is clearly seen that the DNA sample obtained from the nail material is included a transfer DNA of the other victim (the corpses were found adherent and fragmented to each other in the pipe). In other words, the DNA material examined includes the DNA of both victims and both attackers. When the genetic characteristics of both bodies are removed, the remaining genetic material fits the STR in conformity with the suspect who was previously convicted and was examined since he was a descendant of the male. The mistake is that it is not thought that the biological materials of both bodies may have been mixed. A new laboratory study has not been carried out at the University, where the second expertise was requested, only the existing data was reinterpreted with a new perspective.

The only problem in the study was that the possibility of the mixture was not taken into consideration. In this case, the probability of the material obtained to comply with suspects decreases from 99.99% to 98% (16). Achieving 98% probability of a trace amount of millimeter evidence obtained under the nail in a highly decayed corpse is a great success for a forensic geneticist (17). As a matter of fact, the Forensic Medicine Institute Biology Specialization Department in Turkey, which made the first examination, found this possibility sufficient and stated that the perpetrator came from the male line of the person identified in the conclusion part of his report.

The relevant prosecution opened an investigation again on the second report. During the investigation, after examining the digital evidence (cell phone trace) belonging to these persons, it was determined that they were at the scene of the incident.

The testimony of a victim, who had been detained and raped at the time of the incident but was still resorted, stated that he had heard that the suspects had spoken among them that they had detained two little girls. When asked why he did not say before; He said that his age was too young at the time of the incident, he was very afraid, that he could not think that the conversations he had heard could be important, he only described what had happened to himself. People were arrested and sent to court with these evidences.

At the trial, the lawyer of the suspects demanded that there was a contradiction between the first report and the second report, and that the Forensic Medicine Institution's 5th Specialization Department should be applied to resolve the contradiction (5). The Specialization Department did not make a new laboratory examination, but only reinterpreted the existing data based on the expertise of a medical geneticist. After writing that the DNA material obtained in his report was 98% likely to belong to the suspects, he stated in the conclusion section under the separate heading that "there is no medical evidence that the material belongs to the suspects in the analysis of the DNA material obtained". Upon this notification, the court released the suspects from lack of evidence.

The fact that three different experts who examined the same DNA material came to completely different conclusions makes clear that the court needs a clear understanding about "What is DNA evidence?"

Conclusion

Forensic genetics is a branch of science that is completely based on probability theory and on exclusion. Its value is within the fact that when no other evidence is found, it is likely to

detect the perpetrator with a trace amount of evidence, even a small amount of invisible material, such as a drop of blood, a mosquito, a nail-sized underwear with semen. Unless we forget that the science of genetics is a science of probability and the expert's interpretation can affect justice in completely different directions, we can also say that it is a revolutionary invention in forensic science. According to the fact that personal comment differences on the same data can affect the result so much; We think that there is a need for "forensic geneticists" not forensic scientists who know genetics or medical geneticists who have an idea about forensic science. We think that the establishment of "forensic genetics" expertise as a separate and independent department and having compulsory forensic courses in law faculties are essential for the concept of "manifestation of justice".

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The dual system approach to clinical decision making/reasoning, cognitive biases and medical malpractice

Sinem YILDIZ İNANICI

Clinical decision-making can be defined as making inferences about the patient's condition by collecting data from various sources, creating and executing the appropriate treatment plan based on these inferences, obtaining appropriate information about the results of the intervention and continuing the decision-making behavior related to the process. The clinical reasoning process underlying the decision is a multi-layered and multi-component competence that frequently occurs under conditions of uncertainty (1).

Given its complexity, it is inevitable that the clinical decision making/reasoning process is related to many factors: personal variables such as cognitive, emotional, meta-cognitive and social capacity of the decision maker; contextual factors such as organizational structure, corporate culture, physical conditions; situational factors such as variability and inconsistency of clinical data; physiological variables such as insomnia, hunger, fatigue, and attributable variables such as how people perceive and interpret the decision closely interact with each other etc. (2). Since the evaluation of all related factors would exceed the purpose of a single chapter, here it is aimed to address clinical decision making/reasoning with a dual system approach and

cognitive biases that may be related to medical malpractice are exemplified in the context of this model.

Clinical decision making proceeds with the process of collecting data based on the patient's history, developing hypotheses related to the situation, and proving these hypotheses. Following this process, the treatment is planned and put into effect after the investigation/evaluation of the clinical impression that develops and the final diagnosis or a comprehensive representation of the situation (3). Decision making is not a process that ends with the implementation of the treatment, and it may require re-planning according to the data obtained from patient follow-up. Considering the steps and details of the decision-making cycle, it can be easily seen that each of them requires mental effort at different levels and types (here mental means all of the emotional, intellectual and motivational processes), critical thinking skills and reflective approach. These complex processes become even more complicated when the personal characteristics and attributions of the decision maker, the characteristics of the context, the variability of the characteristics of the decision and the task to be done is taken into account. Therefore, efforts to understand this complex process led to the emergence of various models. These models can be placed in different positions on the intuition-analytical line of thought according to the way they attribute the decision-making cycle to intuitive or analytical processes (4).

An example of a decision-making approach that may be near the intuitive edge can be based on Gestalt principles. These principles suggest that perception is organized according to certain principles (proximity, similarity, etc.), and therefore, in the early period when the stimulus is encountered, its information is organized in different ways long before it is passed through a

logical filter. An example for the other end of the line (analytic) is norm-based reasoning. One of the main acknowledgments of this approach is that the decision maker has a “rational” nature. Therefore, according to this approach, one should attribute weight and probability to the options subject to the decision, make risk calculations, and make a decision as a result (5).

One of the recent approaches that try to explain decision-making processes is the dual process approach, which addresses both intuitive and rational processes, taking into account recent neuroscience findings. Dual process theories assume that there are two separate mental processing in the performance of a cognitive task, one is (Type 1) fast, automatic, unconscious, and the other is (Type 2) slow, controlled and conscious. These two processes may work with different mechanisms and create conflicting results. The first of these is defined as associative, heuristic or intuitive, and the second as rule-based, analytical or reflective. What is meant by dual system theories are systems of reasoning, expressed as System 1 and System 2, where the first supports the Type 1 process and the second supports the Type 2 process (6).

At the point of relating the dual system approach to clinical decision making, we see that Croskerry (4) discusses this theory in order to understand diagnostic reasoning and its errors. Accordingly, the main way of execution of the author’s model is pattern recognition. The physician initially encounters the medical condition directly or indirectly. The situation is recognized or not recognized relatively early in the process. If the physician has recognized the situation, Type 1 processes diagnose quickly and without effort, and nothing else is required. If the situation is not recognized, linear, analytical and demanding Type 2 processes come into play. A dynamic oscillation between the two

systems has also been described.

What Stanovich (7) stated about the possible sources of error regarding the functioning of the model is as follows: A certain process that uses Type 2 logical execution repeatedly can transfer the work it is doing to Type 1. Type 1 processes can seize Type 2, or Type 2 processes can detain Type 1, and finally, the system wants to make the least cognitive effort while operating in a defined way. Diagnostic error may be related to the physician's inability to recognize the pattern correctly at first glance. Recognizing the pattern is related to the experience and how the illness presents itself. From time to time, experiences gained without repeating Type 2 processes enough may cause the decision to be left to Type 1 before it matures. In other words, based on a small number of experiences, one can quickly compare what they see to something, think they know. The other process of Type 2 can be weakened due to its monitoring position, time limitations, cognitive load, physiological needs, and this may cause error. Another source of error is situations in which Type 1 precedes Type 2, such as excessive self-confidence or precluding individual clinical judgment from decision-making principles.

II. Cognitive biases, clinical decision making/ reasoning

In this section, cognitive biases that can be observed during decision making and reasoning will be discussed. Decisions in daily life are made based on associations that are not thought on and develop in series (8). Croskerry reports that these associations are mostly driven by heuristics. Heuristic means the general principle used in decision making, brief ways of thinking, intelligent guessing or just common sense. Their use is particu-

larly effective in situations where information is lacking or uncertainty is high. On the other hand, as heuristic means looking at the situation with a predetermined pattern, it causes bias. In other words, these mental structures, on the one hand, cause us to make decisions, especially in uncertainty conditions, quickly, effectively, with the least mental effort, eliminating interference and distraction, on the other hand, they create bias. Cognitive biases are a part of the natural functioning of the human mind and physicians are open to them like everyone else (9).

Researchers have mentioned a large number of bias types. Here, to illustrate the nature of mental functioning and its relationship with clinical practice, a few of the most frequently reported studies by researchers in the review of Saposnik, Redelmeier, Ruff, and Tobler (10) will be cited [for more detailed information see Blumenthal & Krieger (11); Croskerry (12)]. One of these biases is called the framing effect. Framing is the process of defining the context surrounding a question, problem or event in a way that affects how the context is perceived and evaluated (APA dictionary). The framing effect in the medical decision-making condition can be described as the way the person who will make the diagnosis sees the situation can be strongly influenced by the framing of the problem. For example, the physician's decision about the risk of the patient's condition may be affected by how the treatment results are expressed. Whether the results are expressed in terms of probability of death or probability of survival will affect how the problem is perceived (12).

Another type of bias is a diagnostic bias. What we mean here is that once the patient is diagnosed, this diagnosis sticks more and more to him. In other words, the diagnosis initially considered as a possibility may become a label and cause other

possibilities not to be seen (12). Search satisfying is the tendency to diagnose and stop the research as soon as something is found before the data mature (13). In addition, people may not be able to focus on a number of remarkable situations related to the patient in the early period of the diagnosis process and organize this first impression with the information coming later (anchoring effect). Again, universally, the tendency to believe that we know more than we have is called the overconfidence bias and reflects the tendency to behave according to insufficient knowledge and intuition. This excessive belief takes precedence over carefully collected evidence (12).

III. Medical malpractice and cognitive biases

Clinical decision-making has been shown to be influenced by many factors such as external effects such as the emergence of new drugs and technological developments, case-related variables (time limitation, urgency, etc.), patient-related factors such as the patient's age, gender, and the physician's personality and cognitive characteristics. It is a complex multi-component process (14).

Among these components, cognitive biases, which manifest as a natural part of the functioning of the mind, can be experienced by both the healthcare professional who committed the error and the people responsible for the legal decision regarding the error in the case of medical malpractice. It is thought that health service quality should be evaluated by considering the structure, process and result trio, and especially the process should be addressed (15). Based on this proposition, evaluating the process in cases of medical malpractice may expose the decision process to cognitive errors, especially since the result is known to both the physician, the expert and the judge. Most

of the time, initiation of the medico-legal process is due to the presence of an undesirable and obvious result. Because of this condition, people who evaluate the case may fall under the effect of “outcome bias”. That is, in the most general sense, evaluators may tend to focus their case-related decisions on the outcome of the event rather than on concrete data from different sources. Gupta, Schriger, and Tabas (16) tested this bias in a study they conducted with emergency physicians, and presented short scenarios involving frequently encountered cases in emergency services to different groups with positive, negative and neutral results. The outcome bias seen in the scenarios where the health service quality is presented as moderate is the highest. In these scenarios, when the result related to the case was presented as good, the physicians scored the quality of healthcare service as high, and low when the result was presented as poor. The authors caution that in real-life situations, evaluators have little knowledge of the overall quality of care provided to the patient and may be vulnerable to the negative impact of the outcome of the event.

Again, a study conducted with emergency physicians reported higher rates of blind spot bias and representation bias in individuals compared to the control group (17). In other words, people can be overly confident in their own abilities and skills as in blind spot bias, and they may not notice their own while catching the thought errors of others. In medical education, the student is generally taught to recognize typical patterns (prototypes). The patient’s signs and symptoms are matched with the mental patterns of the physician in terms of their representation. Therefore, the decision as to whether something belongs to a particular category is usually based on how well it fits the characteristics of that category’s members. While this is beneficial in

ordinary circumstances, it can lead to the assignment of some diagnoses when an atypical situation is encountered and there is much reliance on such thinking.

The aforementioned outcome bias can come into play when a physician evaluates the care that another physician provides to the patient. The harshness of the judgments made by the evaluator and the degree of willingness to make judgments increase as the negative result of the case increases (18). Also, knowing the outcome of the case by someone evaluating the case may trigger the hindsight bias. In other words, knowing the result makes it easier to perceive the probability of that result as if it could be predicted (19). In particular, situations such as not noticing certain fractures and/or cancer onset may be associated with bias in evaluating the quality of patient care in the fields of radiology and pathology in terms of physician negligence. Another expert, who examines the x-ray in the case file of the person who has been sued, will examine the film with a different attention because he knows what he is looking for. Considering that this expert also knows the outcome of the case, the probability of being in a hindsight bias increases (19).

Satya-Murti and Lockhart (20) talked about confirmation bias, base rate bias and good old days bias in addition to hindsight bias in clinical and forensic neurology fields. Accordingly, the physician can focus on the evidence suitable for his own assumptions, consciously or unconsciously ignore those that contradict his assumptions. Again, the physician should keep in mind that the occurrence rates of diseases may vary according to variables such as age and gender, but focusing only on the frequency of the symptom/disease is one of the distortions that may lead to misdiagnosis. One of the main variables on which the physician's clinical decision is based on the information

from the patient. However, it should be remembered that this information also can be distorted consciously or unconsciously. For example, it is reported that people tend to describe the pre-accident symptoms that cause their visit to the physician as milder or as if there are no symptoms at all.

A number of debiasing strategies can be suggested so that cognitive distortions do not interfere with the physician error and the process of evaluating the error: Medico-legal examinations can be made by making the results of the cases anonymous; courses involving reflective thinking and reflective practice can be included in both undergraduate and specialty trainings so that individuals can be critical of their own reasoning styles while examining the cases; information on cognitive distortions can be included in every practice aimed at improving clinical reasoning skills in undergraduate and specialty education.

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Sotiri KALFOGLOU, Editor

Sotiri Kalfoglou, studied “Political Sciences and International Relations” in the University of Marmara in Istanbul-Turkey. Following his undergraduate studies, he got his graduate degree in the Criminology Department of University of Leicester, specifically in the “Terrorism, Security and Policing” Program. Currently he is lecturing Criminology in Istanbul Yeni Yüzyıl University and he is appointed as the coordinator of the Forensic Sciences Laboratory of the Medical Faculty in the same university.