

## MEDICO-LEGAL

# Forensic Medicine: An Aid to Criminal Investigation

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### ABSTRACT

Forensic medicine is medicine as applied to the problems of the law. The origins of both are hidden in the mists of antiquity, dating from the beginnings of family and tribal life. Recorded human history goes back for 6000 years. Sumeria, Babylon and Egypt all contributed to the development of forensic medicine. Imhotep was probably the first real medicolegal expert. Hippocrates, the Greek physician, and Galen, the Roman, made considerable contributions. Little advance was made during the millenium of the Dark Ages. But Renaissance medicine gave this branch of medicine an impetus in the seventeenth, eighteenth and nineteenth centuries, and in the twentieth, interest in forensic medicine is worldwide. The physician, the coroner, the pathologist, the medical specialist and the forensic laboratory contribute to the investigation of crimes against the person, and to the solution of such problems as identification, untoward deaths, apparent drowning and many others.

### SOMMAIRE

La médecine légale est l'application de la médecine aux problèmes légaux. Son origine se perd dans la nuit des temps et remonte probablement aux débuts de la vie tribale. On trouve dans l'histoire de l'humanité des documents vieux de 6000 ans. Sumer, Babylone et l'Égypte apportèrent tous leur contribution à la naissance de la médecine légale. Imhotep a probablement été le premier spécialiste médico-légal. Hippocrate, le médecin grec et Galien, le Romain, apportèrent à cette science des contributions capitales. Puis, cette science cessa virtuellement de progresser pendant le Moyen-Age. Ce n'est qu'au cours de la Renaissance (17e, 18e et 19e siècles) que la médecine donna un véritable renouveau à cette branche de la science médicale. Au 20ème siècle, l'intérêt manifesté à l'égard de la médecine légale est universel. Le médecin, le coroner, le pathologiste, le spécialiste médical et le laboratoire médico-légal apportent tous leur concours à l'enquête sur les crimes contre la personne et à la solution des problèmes qui se posent à la justice, concernant l'identification des victimes, les morts mystérieuses, les noyades apparentes et nombre d'autres problèmes.

**F**ORENSIC medicine is medicine as applied to the solution of problems of law. It plays an important and, at times, indispensable part in the investigation of crimes against the person, in the prosecution of offenders in this field of crime, and in the solution of the legal problems arising in the investigation of untoward deaths.

The origins of law and of medicine are undoubtedly hidden in the mists of antiquity, and their establishment must date from the beginnings of family and tribal life. The head of the family and the tribal chief must have found it necessary, in the interests of group welfare, to formulate rules and regulations for the conduct of the individual member, and these, in the course of time, crystallized into law. At the same time, the temporary loss of the services of the individual through illness, or the permanent loss of those services through death, weakened the family or the tribe. Hence the health and the survival of the individual were mat-

ters of considerable concern to the group as a whole. In response to this concern, the "medicine man" emerged and became a valued member of society.

Offences against the person which resulted in disability or death were of special concern. In the investigation of such offences, and in the prosecution of such offenders, the prosecuting authority would, in all probability, call upon "the medicine man" to give evidence as to the injury suffered by the victim, and, possibly, in the case of death, to relate it to some action on the part of the offending member of society. The close relationship between law and "medicine", in this respect, would tend to give rise to what we now call forensic medicine. The practice of forensic medicine, in some form, dates back in all probability to the days of tribal life, at which time the only available medicolegal expert was the "medicine man", now pressed into service as the original practitioner of forensic medicine.

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### HISTORICAL OUTLINE

Human history has been recorded for nearly 6000 years. The earliest written history appears in cuneiform markings on clay tablets in Egypt, Sumeria and Babylon. Some of these tablets outline systems of law, listing criminal offences, together with punishments assigned, including death, bodily mutilation and forced labour. In Egypt, forced labour must have materially contributed to the building of the great pyramids at Gizeh, near Cairo.

In Egypt, the use of clay tablets eventually gave way to the use of the paper-like papyrus in the form of scrolls, many of which came to light in the 19th century A.D. The Edwin Smith papyrus carried hieroglyphic inscriptions dealing largely with surgical matters, while the Ebers papyrus dealt with medical subjects. The training and qualifications of physicians were outlined. Physicians were paid from the Royal Treasury. There appears to have been a form of "state medicine" in Egypt as early as 3000 B.C. Then, too, specialization had begun, for one physician had been designated as "Keeper of the Anus".

The outstanding figure in early Egyptian medicine was Imhotep, who about 3000 B.C. combined in his person the offices of Chief Justice and of physician to the Pharaoh Zoser, builder of one of the great pyramids at Gizeh. He thus was one of the early practitioners of forensic medicine. Like some English coroners, he had dual qualifications in law and medicine.

Babylon, around 2000 B.C., was a leading world power. Its ruler, Hammurabi, was one of the more famous figures of early ancient history. The code of Hammurabi systematized the law and the medicine of his time. In 1850 B.C., in Sumeria, the proceedings of a murder trial were recorded, perhaps the first transcript of evidence in history.

With the ascendancy of Greece and Athens in the 5th and 4th centuries B.C. came great advances in the fields of law and medicine. The Greek physician Hippocrates achieved world-wide fame. His work and his writings earned for him a title which is still accorded to him, that of the "Father of Medicine". The Hippocratic oath, still administered on graduation to medical graduates in most parts of the world, proscribes such offences as poisoning and abortion. Many of his writings dealt with medicine in its relation to the law. Imperial Rome in the 1st century A.D. adopted and modified the medicine of Greece. The outstanding Roman physician, Galen, organized medical diagnosis and treatment. The "Dicta" of Galen were recognized as the basic principles of the practice of medicine, and were followed by physicians throughout the four centuries of the Empire. These precepts held sway, not only throughout the succeeding millennium known as the Dark Ages, but even after the onset of the Renaissance and into the 17th century A.D. Thereafter advances in medical science and knowl-

edge gradually established principles in the practice of medicine which replaced many of those laid down by Galen. It is interesting to note that, in the investigation of the assassination of Julius Caesar, in 44 B.C., a Roman physician gave evidence that but one of the 27 stab wounds was mortal, since it was the only one that injured a vital organ.

After the fall of Rome, the Code of Justinian set out, in the 6th century A.D., medicolegal principles and gave a definition of the medical witness. In the 13th century A.D. a Chinese textbook entitled "H'si Yuan Lu" dealt with the medical and legal aspects of the investigation of untoward deaths, and was widely accepted as a sort of coroner's handbook.

In the 16th century A.D., Germany took the lead in the advancement of forensic medicine. The Bamberger and Carolingian Codes stressed the necessity for medical testimony in the prosecution of those accused of crimes against the person. In France, the military surgeon, Ambroise Paré, wrote a four-volume work on forensic medicine, and in Italy, Zacchia, the Pope's physician, wrote a five-volume work on the same subject.

In the 17th century, the newer discoveries in medical science stimulated interest in forensic medicine, particularly in England, France and Italy. In the 18th century, England and France added much to forensic medical literature.

In the 19th century the remarkable advances in the development of the medical sciences resulted in equally remarkable advances in forensic medicine. Germany had her Casper, whose four-volume work on the subject was a classic. France had her Tardieu, her Brouardel in forensic pathology, and her Orfila in toxicology. Scotland had her Professor Duncan and Professor Littlejohn in the chair of Forensic Medicine at the University of Edinburgh. England had her Taylor, whose "Principles and Practice of Medical Jurisprudence", now in its 11th edition, is still a leading authority in the English-speaking world. The United States came strongly into the field of forensic medicine with such leading publications as the two-volume "Legal Medicine and Toxicology" of Peterson, Haines and Webster.

The 20th century has witnessed steady progress in the adaptation of the newer developments in the medical sciences to the service of medical jurisprudence. There has been a resurgence of interest in this field throughout the civilized world. Germany, France and Italy have been active in the field. Britain has had her Glaister of Glasgow, her Sir Sydney Smith of Edinburgh, and the late Sir Bernard Spilsbury of London. She presently has Professor Keith Simpson and Professor Francis Camps, Home Office pathologists of London, and many other eminent workers in the larger centres. The United States has Professor Milton Helpert of New York City, Ford of Harvard, Fisher of Baltimore, Moritz of Cleveland, Curphey of Los Angeles and a host of others. Canada has an active Canadian

Society of Forensic Science. The United States has its American Academy of Forensic Sciences. There is now the International Society of Forensic Sciences, holding meetings at three-year intervals, the next meeting to be held in Copenhagen in 1966.

#### A MEDICOLEGAL SYSTEM

The medicolegal system of Ontario may perhaps serve to illustrate the extent to which forensic medicine enters into the administration of criminal justice, especially as regards crimes against the person. The agencies involved include the coroner, the crown attorney, the investigating police officer, the regional pathologist and the forensic laboratory.

In Ontario, the coroner is normally a practising physician. He is appointed for life and is paid by a system of fees. He deals with untoward deaths, in which cases he takes complete charge of the investigation, calling in when necessary the forensic pathologist and the forensic laboratory. The crown attorney, appointed for life and paid by salary, is the legal adviser to the coroner, on points of law. The investigating police officer, municipal or provincial, undertakes the non-medical part of the investigation. The regional forensic pathologist is called in when an autopsy is required. In Ontario, the regional pathologist is normally a certified specialist in pathology, practising as a hospital pathologist and paid by a system of fees. The Attorney General's Forensic Laboratory is called into service when ballistic, toxicologic or other specialized types of laboratory study are required. Its services are available to all law enforcement agencies in the province.

#### CRIMES AGAINST THE PERSON

In the investigation of these crimes, and in the prosecution of offenders, forensic medicine and pathology play a very important part. The medicolegal services of the coroner, the pathologist and the practising physician are usually required. In cases of homicide the investigation may require, in addition, the services of the forensic laboratory. Crimes against the person include (1) bodily harm, (2) rape, (3) abortion, (4) infanticide and (5) homicide.

##### 1. *Bodily Harm*

In these cases, the physician—general practitioner or specialist—may be called upon to give to the court a description of the injuries suffered, and an opinion of the degree and the duration of any associated incapacity, and of the extent of recovery to be expected. The forensic laboratory may be called upon to examine weapons or other exhibits related to the case.

##### 2. *Rape*

In these cases, the physician—general practitioner or specialist—is usually called upon to make a

physical examination of the victim, for evidences of violence, and to take the specimens required for a search for spermatozoa,<sup>1</sup> which are to be referred to a pathologist or to the forensic laboratory for examination.

##### 3. *Abortion*

In these cases, the physician or the specialist in gynecology will be called upon to make a physical examination of the victim for evidences of recent delivery and of attempted or completed abortion. The forensic pathologist may be called upon to examine fetal remains or tissue which may give evidence of pregnancy, and, in fatal cases, to carry out postmortem examination. In cases of death of the mother or of a viable fetus, the coroner will take charge.

##### 4. *Infanticide*

Cases of infanticide<sup>2</sup> are not common, and cases of prosecution for this offence are rarer still. They call for much medicolegal activity. The services of the physician or obstetrician will be needed to establish the fact of a recent delivery. The services of the forensic pathologist will be required to make a postmortem examination of the deceased infant, with a view to determining its age, its viability, the cause of death, and whether it had a separate existence. The psychiatrist will be called upon to report upon the psychiatric state of the accused mother, since mental disturbance sometimes sets in about the time of delivery or in the early stage of lactation. The coroner (in Ontario, a physician) will be called upon to investigate the death of the infant. In the case of a viable infant an inquest may be necessary.

##### 5. *Homicide*

In cases of murder or manslaughter the complete range of forensic medical service is likely to be required. The coroner takes complete charge of the body and carries out the routine medical investigation. He calls in the forensic pathologist to make a careful postmortem examination of the body together with any laboratory studies indicated. The pathologist may, and probably will, avail himself of the services of the forensic laboratory for any biological, toxicological or ballistic examinations required. Any given case may call for opinions in evidence from appropriate medical specialists. The coroner must endeavour to find out how, when, where and by what means death occurred. The forensic pathologist assists by determining the cause of death and by relating the death to some criminal action. Other fields of forensic medicine may be called upon to help. The forensic laboratory will undertake such medicolegal laboratory procedures as the examination of blood and urine for alcohol, of blood stains and of seminal stains.

## SOME INVESTIGATION PROBLEMS

Among such problems are those of (1) identification, (2) unexplained deaths, (3) apparent drowning, and (4) the relation of alcohol to motor accidents.

### 1. Identification

The identification of human remains<sup>3</sup> is a basic problem for forensic medicine. Normally it is not difficult, but at times it may call for the services of a full range of medicolegal agencies, and even then failure may result. It is usually established by the finding, on or near the remains, of materials or documents, or of some person or persons acquainted with the deceased. Photographs of the body and fingerprints will of course be taken by the investigating police. When all this fails, the problem is one for forensic medicine. The coroner will make an external examination of the remains. He will call in the forensic pathologist who will, in addition to a meticulous external examination, conduct an equally meticulous internal postmortem examination, recording in detail all characteristics or peculiarities. He will note and record stature, sex, race, facial features, body weight, and the condition of the teeth for possible comparison with a dental chart. Where possible, he will ascertain the blood group and check the blood for alcohol. A complete record of all such characteristics will be of the greatest possible assistance in identification.

### 2. Untoward Death

Unexpected or unexplained deaths<sup>4</sup> may or may not be the result of criminal activity. The investigation of such deaths imposes much responsibility on most of the forensic medical agencies. The coroner takes full charge of the body and of the investigation, and with the police officer, the forensic pathologist and the forensic laboratory, determines whether the death is due to natural causes or to unnatural causes. Of the latter, some may be criminal in character, in which case the forensic pathologist and the forensic laboratory are usually called upon to provide important evidence in the prosecution of the offender.

### 3. Drowning

All individuals found dead immersed in water or other fluid are not cases of drowning,<sup>5</sup> and this poses a problem. When a body is taken from the water, the responsibility for investigation lies with the forensic pathologist. The anatomical evidences of death from asphyxia associated with drowning can be made out during the early stages of immersion, but advancing postmortem degeneration soon obscures them. Two problems may arise in the case of bodies recovered from the water. The anatomical evidences of asphyxia from drowning, if present, and the absence of other postmortem evidence of death from other causes, definitely make it a case of drowning. The absence of these findings, in a

body recovered a few hours after immersion, will indicate the need for a careful search by the pathologist for other causes of death.

Another problem often raised in court or inquest proceedings is the time necessary after immersion before death results. It varies, of course, with the individual and with the circumstances, but animal experimentation would seem to indicate that not more than five minutes of complete immersion is necessary. Asphyxiation from other causes may require a little more time, but in either case artificial respiration should be undertaken at once and continued for at least an hour, although some authorities believe that it should be continued until *rigor mortis* begins. Skilled examination by the forensic pathologist in cases of death associated with immersion is necessary if these problems are to be solved.

### 4. The Alcohol Problem

Alcohol, in relation to injuries and deaths caused by automobile accidents, poses many problems in forensic medicine. The physician becomes involved when asked to give an opinion regarding sobriety, or to collect a blood or urine sample for laboratory analysis. The forensic laboratory undertakes the analysis, and the toxicologist or the forensic pathologist is called upon for interpretation of the results in terms of the degree of impairment of ability to drive a motor vehicle. This is, after all, a physiological and basically medical problem. Impairment should refer to the individual's normal ability to drive and not to what the court might consider to be the ability of the average driver. The three factors vital to the proper driving of a motor car are perception (vision and hearing), reflex action, and judgment. There is not the slightest doubt that impairment of these faculties begins at a low level of blood alcohol, and by many this is considered to be .05% or .5 part per thousand. If it be an offence to drive a car with a blood alcohol level sufficiently high to indicate impairment of these faculties, then some level should be adopted as a borderline. The beginning of impairment of perception, reflex action and judgment, which for most if not all people occurs at the .05% level, is not detectible by the examination of the police officer or the examining physician, but it would become apparent during examination in the physiological laboratory.

## SUMMARY

Forensic medicine in some form is probably nearly as old as the human race, and as old as the law itself. As an aid to the solution of the problems inherent in the investigation of crimes against the person, and of untoward deaths, it plays a well-nigh indispensable part. Its development marches with that of medical science and medical knowledge. The application of such basic medical sciences as bacteriology, serology, chemistry, physics and pathology to the solution of forensic problems has resulted in great advances in

the forensic sciences over the past century, and particularly since the beginning of this century.

Nevertheless, in a certain percentage of autopsies, particularly in infants, we are still unable to demonstrate an anatomical or physiological cause of death, although, with the steadily increasing scope of the laboratory study of these cases, the percentage is being lowered. We cannot yet say that a given blood stain is that of a certain individual although we can say, under certain conditions, that it is not. The day appears to be approaching, however, when we may be able to say that a given blood stain, a given sample of seminal fluid or specimen of hair is that of a given individual, or when a given infant is the offspring of a given father, in consideration of advances in the fields of hematology, immunology, physics and electronics. We

still have difficulty in getting the courts to decide what level of alcohol in the blood of the driver of a motor car so alters his physiological reactions of perception, reflex action and judgment as to impair his ability to drive, using his own ability to drive without any alcohol in his blood as the standard of comparison, rather than the ability of others or of the average individual.

The application of medical science to forensic medicine will bring about steady improvement in the attack upon these problems which confront the physician, the law enforcement agencies and society at large.

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## CASE REPORT

## Spontaneous Evisceration Through a Ventral Hernia

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**S**PONTANEOUS evisceration is a rare complication of incisional ventral hernia. Helmig<sup>1</sup> described a series of 17 cases in 1958, and occasional reports have appeared in the English-language literature during recent years. The following case study records a further instance of this unusual occurrence.

An 81-year-old white man was a patient in the chronic geriatric ward of the University of Alberta Hospital for five years. He was a thin, frail, mild-mannered person who had been admitted with a diagnosis of cerebral arteriosclerosis. Despite some degree of senility he was able to care for himself with a little help, and was ambulant and usually active in the ward. He had a large ventral hernia extending from the umbilicus to the symphysis pubis through a midline lower abdominal incision. The thin overlying skin was excoriated and showed evidence of chronic infection. The original operation had been performed about 25 years previously for a "prostatic condition".

During his hospital stay recurrent ulceration of the attenuated skin over the hernia was treated with compresses, local antibiotics, and dressings.

At 1.40 p.m., March 31, 1959, while straining at moving his bowels, about two feet of small bowel and mesentery suddenly eviscerated through a recently ulcerated area of skin overlying the hernia. The patient was assisted back to his bed. With the exertion, more bowel protruded on to the abdominal wall. The bowel could not be replaced through the small opening, and a moist sterile dressing was applied.

He was taken to the operating theatre at 3.00 p.m. The dressing was removed and revealed several feet

of congested, inflamed and edematous small bowel lying on the anterior abdominal wall. The skin opening was enlarged in a transverse direction. The bowel appeared viable and was returned to the abdominal cavity. No adhesions involving bowel or hernia sac were present. The fascia was widely dissected and the edges were overlapped and sutured. Redundant skin and the hernial sac were resected, and the subcutaneous tissue space was drained.

The postoperative course was uneventful, and the wound healed satisfactorily.

Several months later the patient was transferred to a chronic nursing home where he subsequently died in June 1960, aged 82.

## DISCUSSION

Sudden protrusion of intra-abdominal contents through the skin of an incisional ventral hernia requires immediate surgical intervention. The skin opening is usually small, and strangulation of protruded viscera may occur within several hours. O'Donoghue<sup>2</sup> described the case of an obese 56-year-old woman in whom spontaneous evisceration through a massive ventral hernia six hours prior to admission resulted in strangulation and gangrene of an extruded loop of small intestine. In our case it was fortunate that the rupture occurred while the patient was in hospital and operative repair could be performed with minimal delay.

## ETIOLOGY

Incisional ventral hernia is not an uncommon postoperative complication. A variety of mechanical and nutritional factors, including improper wound

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