A Brief History of the Literature on Postmortem Changes to the 19th Century

Christopher M. Milroy

ABSTRACT

The fact that the body changes following death must have been known for the whole history of mankind. But myth and superstition surrounded the changes. This led to such entities as the ordeal of the bier being used as criminal proof, even though other forms of trial by ordeal had long been abandoned. The scientific literature in the English language did not start until the late 18th century and was still surrounded with ignorance and some superstition. The main concern of the early writers was the correct determination of death. In the 19th century, an understanding of postmortem changes developed and the first attempts to accurately classify sequences of putrefaction were made. This paper analyzes the early forensic medicine writing and the progress of knowledge to the later 19th century, through examination of forensic medicine textbooks published in the English language. *Acad Forensic Pathol.* 2016 6(1): 2-11

AUTHOR

Christopher M. Milroy MBChB MD LLB BA LLM FRCPath FFFLM FRCPC DMJ, The Ottawa Hospital -Anatomical Pathology

Roles: Project conception and/or design, data acquisition, analysis and/or interpretation, manuscript creation and/or revision, approved final version for publication, accountable for all aspects of the work, principal investigator of the current study.

CORRESPONDENCE

Chris Milroy MBChB MD LLB BA LLM FRCPath FFFLM FRCPC DMJ, 501 Smyth Road, Ottawa ON K1H8L6, c.milroy@btopenworld.com

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Jesus said, Take ye away the stone. Martha, the sister of him that was dead, saith unto him, Lord, by this time he stinketh: for he hath been dead four days.

John 11, 39, King James Bible

INTRODUCTION

As soon as humans recognized death, they must have recognized that postmortem changes occur to the deceased body. The famous miracle of Lazarus's resurrection related in the Gospel of St. John involves postmortem changes. While the changes must have been recognized for millenia, the true understanding of the order and significance of postmortem changes would come much later and the English forensic medicine literature did not start until the 18th century. Ignorance of the true nature of postmortem changes allowed some practices to exist until the early modern era and some of these were used in criminal cases, including the ordeal of the bier.

This paper examines the early textbooks on forensic medicine and the analysis of postmortem changes. The early literature was actually little concerned with postmortem changes and when it was discussed it was in the context of determining the fact of death. The dating of postmortem changes began to appear in mid-19th century literature. The determination of death included the lack of breath and circulation, but René Laennec did not invent the stethoscope until 1816 and the science of microbiology did not start until the second half of the 19th century (1, 2).

DISCUSSION

The Ordeal of the Bier

Ordeals of various kinds, including trial by water, trial by fire, and trial by combat had formed part of the evidence of proof up to the Fourth Council of the Lateran in 1215, which was convoked by Pope Innocent III. Canon 18 stated that clerics may neither pronounce nor execute a sentence of death, nor may they act as judges in extreme criminal cases, or take part in matters connected with judicial tests and ordeals (3, 4).

This change led to the abolition of ordeals in England and the development of the jury system.

Although ordeals by fire, water, and combat, which were based on superstition, were stopped, a separate form of superstitious evidence, the ordeal of the bier, also known as the ordeal of the touch, the ordeal of blood, or bierricht is recorded into the late 17th century. The idea was that a corpse would recognize the killer and start to re-bleed from its wounds if the murderer approached or touched the body. The test was recommended by King James VI of Scotland (later King James I of England) in his 1597 *Daemonologie*, a book that endorses witch hunting and states:

In a secret murther if the dead carcase be at any time handled by the murtherer, it will gush out of blood, as if the blood was crying out to heaven for revenge of the murtherer (5).

In 1688, Philip Stanfield was convicted of parricide having undergone the "ordeal of the bier" in Scotland.

The body of Sir James Stanfield of New Mills was found in a stream near Haddington. It appeared he had met his death by strangling. James Muirhead, surgeon and another person swore that when Philip Stanfield [Sir James Stanfield's disinherited son] was helping to place the body into a coffin, blood started from the left hand side of the neck upon his touch and he exclaimed "lord have mercy upon me!" On this slight evidence he was on 7th February 1688 pronounced guilty of parricide, and was publicly executed on 24th of the same month, and his body hung in chains. He protested his innocence to the last (6).

Sir Walter Scott describes the test in *The Fair Maid of Perth* and it is also mentioned in Shakespeare's *Richard III*,

O gentlemen see, see! Dead Henry's wounds open their congealed mouths and bleed afresh! (7).

Because it was still used in England at the time, it was transferred to colonial America.

Mary Martin lived there with her sister after their father had departed for England, entrusting them to the guardianship of a Mr. Mitton. Massachusetts Bay Governor John Winthrop said that Mr. Mitton was:

...taken with her, and soliciting her chastity, obtained his desire, and having diverse times committed sin with her, in the space of three months, she then removed to Boston and put herself in service to Mrs. Bourne and finding herself to be with child and not able to bear the shame of it, she concealed it.

Mary delivered her baby alone in the back room of Mrs. Bourne's home on the evening of December 13, 1646. After she had recovered somewhat from her labor, Mary killed her baby daughter and concealed the body in a chest. Soon, the child's body was discovered and Mary and her daughter's corpse were brought before a jury which ordered her to endure the ordeal of touch. When Mary touched the face of her dead child, "*the blood came fresh to it.*" After confessing to murdering her daughter, Mary was tried, convicted and hanged on March 18, 1647 (8).

The last known case in Virginia was in 1679:

Twelve subscribers were sworn to view the body of the dead child, which had been removed from a shallow grave in the garden near the Carter house. The twelve subscribers, all women, were sworn and brought to view the body of the dead child. The twelve women required Sarah Carter, not Mary Andrews, the mother, to stroke the child. Sarah stroked the body of her grandson as the twelve subscribers watched. Mary Watts, Elizabeth Cutler, Jane Taylor, Mary Hill, Margaret Jenkins, Matilda West, Mary Mikell, Mary Anderson, Amey Parker, Mary Sipple, Elener Calvert, and Ann Fenn reported that "we saw no alteration in the body of ye childe."

The subscribers called Paul Carter next. He stepped forward and stroked the body of the child. The subscribers reported that "immediately whilst he was stroking ye childe the black & sotted places about the body of the childe grew fresh and red so that blud was redy to come through ye skin of the child" (9, 10).

We can speculate that moving the body caused purge fluid to emerge, or possibly changes in the location of hypostatic lividity that was mistaken for bleeding. It illustrates the lack of knowledge of forensic medicine until well past the Middle Ages into the early modern era. It was not until a century after the trial of Philip Stanfield that the first books on forensic medicine were published in England, the first being Farr's *Elements of Medical Jurisprudence* (11).

The early forensic textbooks do not discuss the ordeal of the bier, which presumably had fallen out of favor by the start of the 18th century. They are concerned mostly with differentiating apparent from real death by using postmortem changes. Attempts at dating of the changes were first recorded in textbooks in the mid-19th century.

Farr's *Elements of Medical Jurisprudence*

Farr's *Elements of Medical Jurisprudence* is considered the first text on forensic medicine written in the English language (11). It was first published in 1787 and based upon a text, *Elementa Medicinae Forensis* by Faselli published in Geneva in 1767 (12). It does not deal with postmortem changes, beyond recommending that bodies be buried quickly and in linen, rather than woollen material as it was Farr's opinion that wool was a retainer of infection.

Dease's *Remarks on Medical Jurisprudence*

In Dease's *Remarks on Medical Jurisprudence*, he states there were three situations in which Surgeons are particularly called upon to ascertain by dissection the cause of death (13). These were firstly, where external injury has been suffered, secondly, where it is suspected poison has been administered, and thirdly,

where a woman had been accused of murdering her child. Dease was aware of the problem of postmortem changes interfering with the ability to conduct a valid autopsy and quotes the case of Captain Donnellan, who he reports was executed ten years before the publication of his text for the murder by poison of Sir Theodosius Boughton. He reports that eight or nine days after he was buried, a surgeon had the body exhumed and dissected, although another physician and surgeon declared that from the putrid state of the body, no information could be obtained on which any opinion could be grounded. John Hunter (1728-1793), the famous surgeon, swore it was impossible to investigate the cause of death in such a state of general putrefaction. Hunter would have been all too familiar with the problems of putrefaction from his anatomy school. Dease warned his readers that the sooner after death a body is inspected, the more accurate the investigation will prove. An account of the trial, which took place on 30th March 1781, is given in John Gordon Smith's *An Analysis of Medical Evidence* published in 1825 (14). The allegation was poisoning with laurel water. Smith did not view Hunter's evidence particularly favorably in comparison with the prosecutions experts.

Dease was aware of needing to distinguish between injuries and postmortem changes. He states that:

...we should distinguish between those bloody suffusions and putrid distensions which always rapidly take place after sudden death, in full habits, from those that arise from contusion or disease. Those are the circumstances that require the utmost caution in the surgeon, for people not used to inspect dead bodies are very apt to be struck by such appearances, and instantly decide that such person's death was caused by some injury (13).

Male's *An Epitome of Juridical or Forensic Medicine; For the Use of Medical Men, Coroners, and Barristers*

The next major textbook published was Male's text, which was published in 1816 with a second edition in 1818 (15). Postmortem changes are dealt with un-

der the title of apparent death. He records that the true signs of death:

... have been supposed to be coldness and rigidity of the body, sinking of the eyes, dimness and flaccidity of the cornea, lividness of the back, the open state of the anus and the peculiar cadaverous odour (15).

It was further stated that the authors Plenck and Haller did not think these signs infallible. It was recorded that in deaths from prussic or zootic acid (hydrogen cyanide), the "*cornea does not collapse, but retains, for a considerable time, its fullness and lustre*" (15). Male also recorded that in death as a consequence of exposure to carbonic acid gas, the body retains its heat longer than when it has been occasioned by other means. He stated that in doubtful cases the body should not be interred till some degree of putrefaction was present. Male said that when the ordinary and indisputable signs of death do not take place within 24 hours a medical man should be called to inspect the body.

Male stated that:

...the hearing is supposed to survive longer than the other senses when the vital senses are suspended and appear to be annihilated. Hence the custom has arisen prevalent among the Romans, and other nations of antiquity of conclamation, which consisted in calling the name of the deceased, with a loud voice, for eight days successively, and sprinkling the body with water. It was then said conclamatum est (he has been called, and is without hope) (15).

He stated the practice was still prevalent in some provinces of France.

Paris and Fontblanque *Medical Jurisprudence* (1823)

Paris was concerned with determining real from apparent death and the fear of being interred alive (16). Paris discussed cases of lack of putrefaction in real death and cases:

...that, if the body cannot be said actually to enter into a state of putrefaction, it may at least assume the appearances so analogous as to be mistaken for it (16).

He quoted numerous examples from ancient history and more recent times where death had been inappropriately diagnosed. He described the case of the daughter of Henry Laurens (1724-1792), President of the Continental Congress 1777-1778, who was laid out as dead from smallpox, but recovered. (Laurens was the only American ever to be held prisoner in the Tower of London and the first American to be formally cremated).

In diagnosing death, Paris discussed the value of determining the presence of respiration and regarded respiration as the most essential and it was impossible for a human being to survive for more than a short period of asphyxia. The medical observer should be able to determine some sign of vitality. He regarded the absence of feeling the pulse as fallible as a sign of death, as he stated:

...it is beyond reasonable doubt that a person may live for several hours without it being possible to perceive the slightest movement in the parts just mentioned (16).

Paris discussed the limitations of diagnosing a dead body from being cold, particularly in drowning cases. With respect to stiffening of the body, quoting the work of Orfila, he stated that it may occur in a person who is frozen, but not yet dead. He stated it could be separated from cadaverous stiffening, because in a frozen body it was present everywhere, which was not observed in cadaverous stiffening. He recorded that there was a noise from particles of ice rupturing when the limb was moved. He also referred to what the author Nysten had called convulsive stiffness and distinguished it from cadaveric stiffness by stating that when moved, a limb in convulsive stiffness went back to its previous position, unlike cadaveric stiffness. He then discussed syncopal stiffness and noted that it is immediate and when the body is warm, but that cadaveric stiffness does not develop for hours

and when the body is cold. Paris also noted that a body that had been dead for a long time may be cold and flexible, but without putrefaction, should not be buried hastily.

Paris finally discusses the state of the face as attributed to Hippocrates and concludes with a discussion of the changes of the globe of the eye, which becomes soft and flabby, a state not seen in life.

Beck's Elements of Medical Jurisprudence

Beck's textbook is considered the first American textbook of forensic medicine (17). Previously American publications had been re-publications of English texts. Beck describes the stages of putrefaction and was interested in it because of the problems of conducting autopsies. There was a general concern that putrefaction rendered the dissection unsafe. Beck recognized the variability in the process of putrefaction, stating it differs in different bodies, according to previous diseases, the season of the year, and its temperature. *"It produces an extensive disorganization, confounding the cause of death and rendering it dangerous for anyone to examine the body"* (17).

Quoting Dr Boisseau, he details four stages of putrefaction:

First degree. A tendency to putrefaction. It consists in a slight alteration of the body, a softness of the flesh, and a disagreeable odour. Dissection is practicable and useful.

Second degree. Commencing putrefaction. A foetid odour is present; the fleshy parts become light and assume a dark colour. Dissection is already dangerous, and can be of no use except in particular cases.

Third degree. Advanced putrefaction. The parts exhale an ammoniacal odour mixed with a putrid smell. They fall into dissolution, and their colour is constantly altering. Dissection is impracticable and useless.

Fourth degree. Complete putrefaction. This is known by the complete dissipation of the ammoniacal odour, and also by the putrid loosing its strength. The volume and weight of the parts is much diminished, and they separate into a gelatinous mucus, which gradually dries, and at last becomes an earthy and friable mass (17).

Guy's Principles of Forensic Medicine and Dean's Principles of Medical Jurisprudence

Guy's *Principle of Forensic Medicine* was written in 1844, with the first American edition published in 1845 (18). William Guy was Professor of Forensic Medicine at Kings College London. Dean was Professor of Medical Jurisprudence in the Albany Medical College, New York His work was published in 1850 (19).

In discussing real and apparent death, Guy writes that:

...it is true that it has rarely happened in this country (England) that persons have been treated as if they were dead when they were really alive, although one or two authors who have taken great pains to collect examples of so melancholy a mistake, have not found their search altogether fruitless.

In consequence of the supposed or actual infrequency of such events in England, no medical author of reputation has written at any length on this subject; the only work devoted expressly to it in our own language being from the pen of a clergyman, the Rev. Mr. Whiter, whom Dr. Gordon Smith accuses of "having laboured under one mistake from the title-page to the concluding paragraph."

The little attention which has been given to this subject in England is attributable to the popular usages in respect of interment – the body being never committed to the grave until putrefaction has taken place (18).

Guy goes on to state that with respect to real and apparent death:

There is no subject in Forensic Medicine which can boast so large a collection of strange and improbable fictions; but mixed with them are doubtless some well authenticated cases (18).

Later Guy describes a case of a woman reported in the St Louis Republican who was revived during ritual washing of the body (the person being Jewish) and commented that "*interment in this country, is altogether too speedy; it should never take place till signs of putrefaction are observed*" (18).

Guy listed ten principal signs of death, which was repeated in Dean's work. The ten signs were listed as:

1. Cessation of the circulation – determined by feeling the wrist or the heart. This was not considered infallible.
2. Cessation of respiration – ascertained by whether a feather could be moved, a looking glass soiled, or whether any motion is communicated to a cup of water placed upon the chest or abdomen. This was not considered infallible.
3. The facies of Hippocrates. This was not regarded as a reliable sign.
4. The state of the eye – i) loss of transparency of the cornea and ii) collapse of the globe. He states that i) was not reliable and ii) may not occur in deaths from apoplexy, carbonic acid, hydrocyanic acid etc.
5. State of the skin – pallor, lividity and loss of elasticity. He states the first two may occur in life, but that loss of elasticity may have value.
6. Insensibility and immobility – these were not reliable.

7. Extinction of muscular irritability. It was stated that where muscular irritability was totally extinct, life may be assumed to be so too. If a muscle did not contract when pricked with a pin, or on the application of the galvanic or electric fluid, the person is undoubtedly dead. It was stated the muscles of the trunk and extremities retained their irritability longer than involuntary muscles, with the exception of the right auricle of the heart.
8. Extinction of animal heat. It was stated that the extinction of heat was a gradual process, depending on the mode or manner of death. It depended on a number of factors including a) the surrounding temperature and moisture b) the condition of the body, in regard to corpulency or emaciation and the exposed state of the body, c) the age. The bodies of the aged cool much faster than those of the young and vigorous and d) the mode of death. In cases of chronic disease or hemorrhage, the body cools much quicker than all forms of sudden death.
9. Rigidity. This was stated to set in whenever muscular irritability ceases, which is generally a few hours after death. It was confined to the muscular system and may be regarded as the first certain sign of death. It commenced with the muscles of the trunk and neck, next the upper extremities and lastly the lower. Its disappearance is nearly in the same order. It takes place more speedily in the bodies of the aged, and those who have died of diseases accompanied by great debility; while in those who died from acute inflammation of the stomach, or by irritant poisons, it is strongly developed, and lasts a considerable time. In case of death from spasmodic cholera, it commences soon after extinction of the vital principle, and may continue four or five days. Warmth retards, and cold accelerates, the period of time which rigidity commences. It was stated that to distinguish rigidity in life from cadaveric rigidity, was to bend the extremity, the limb would be restored to its

original position if vital, but not in cadaveric rigidity and this could be regarded as a certain sign of death.

10. Putrefaction. This was a certain sign of death. It was described as causing a softening, and bluish, greenish, or brownish discolouration of the structures and is characterized by a peculiar odor. Putrefaction was recognized to be associated with the development of gases in several cavities of the body, especially the abdomen and forcing blood towards the head and neck, causing the face to swell, the eyes to become prominent, and the mouth and nostrils to discharge mucous or bloody fluid (18).

Caspar's *A Handbook of the Practice of Forensic Medicine Based Upon Personal Experiences*

Caspar's *Handbook* is a detailed work on forensic medicine and was translated from German into English in 1864 (20). With respect to death Caspar comments that "*at the instant of death the organism commences to an equilibrium with the outer. It is dead.*" He further comments that men have endeavored to discover more certain signs of death. He refers his readers to Frank's statement regarding the separability of the conjunctiva from the cornea, Nasse's thanometer, etc., but states these are scientific curiosities. He records that the usual well-known signs of death are amply sufficient to determine the actual period of death and "*legal medicine might well be proud had it as convincing an answer for every question*" (20). Caspar lists the sequence of phenomena between the extinction of death and putrefaction as follows:

1. *Respiration and circulation have completely ceased.*
2. *The eye loses its lustre. Light no longer has any action on the pupil.*
3. *No stimulus has any power of producing a reaction.* (He omits as irrelevant electrical experiments).

4. *The whole body grows ashy-white (but people with florid complexion retain this for days), ulcer edges keep their livid hue, icteric hue remains, tattoos remain and ecchymoses retain the hue they had at death.*
5. *The animal heat at the time of death is retained for some time. He recognized environmental factors affecting rate of cooling and he notes it is reported that lightning deaths retain heat longer, but had not seen a case. He did note that suffocation deaths retain longer. Caspar stated generally bodies are quite cold 8-12 hours after death.*
6. *Immediately after death a general relaxation of the muscular system occurs. A body which shows the features in 1-6 may be regarded as dead from 10-12 hours at the longest.*
7. *From 12-18 hours there was a loss of the vital turgidity of the eyeball.*
8. *The loss of vital turgidity occasions the well known flattening of the muscles of those parts of the body on which it lies.*
9. *Hypostases result from gravitation of the blood in the capillaries in obedience of the laws of inert matter. They form between 8 and 12 hours and increase in size until the commencement of putrefaction. They are themselves sufficient evidence of the reality of death. Caspar was aware of the problem of the inexperienced confusing hypostases with ecchymoses.*
10. *Cadaveric rigidity is discussed in some detail. He states "it passes from above downwards, begins on the back of the neck and lower jaw, passes then into the facial muscles, the front of the neck, the chest, the upper extremities and last of all, the lower extremities. Usually it passes off in the same order, and once gone never returns. Cadaveric rigidity comes on at any period after death*

during a tolerably wide interval of time, in general, however, between eight, ten and 20 hours and it may continue from one to nine days." He further states that a body, that only present the above signs in 1-10 may be presumed to be that of a person who died within two to three days.

11. *A detailed discussion of putrefaction follows cadaveric rigidity. Caspar reports that "the circumstances that influence and modify the putrefactive process are so numerous as to demand the utmost caution in endeavouring to establish any fixed rule."* He quotes Orfila with some approval, who stated that *"to ask a medical man to determine the probable period of death of a putrefied corpse, is to require what is wholly 'beyond the power of man.'"* But Caspar goes on to state that this should be possible by scientific means. But he was also critical of recent authors who related their own experience including Orfila. While acknowledging the value of individual observations, he stated their observations were :

... of no practical value to the medical jurist, partly from being overlaid by too many and too minute details, and partly from the absence of a correct generalization and classification of the phenomena observed.

Caspar then goes on to give detailed descriptions of the putrefactive processes. Caspar gives a chronological succession for bodies that have been lying in the open air as follows:

- a) *Green discolouration of the abdominal coverings – 24-72 hours.*
- b) *After 3-5 days the green discolouration becomes deeper, spread over the entire abdomen. A bloody froth (especially in deaths from asphyxia) wells from the nose and mouth. Large or small green begin to make an appearance in other parts of the body.*

c) *In 8-10 days the discolouration has become darker and more generally spread over the body. Gaseous distension of the abdomen occurs, with the gas combustible. The cornea has fallen in, the cuticular veins, particularly on the extremities, wind like dirty-red cords amid patches of paler skin.*

d) *Fourteen to 20 days the hues of putrescence have spread uniformly across the entire body. The epidermis is raised here and there in blisters the size of a walnut, and in other parts, patches of it, the size of dinner-plate or larger are quite stripped off. The development of gas has increased to such an extent that the body has a gigantic appearance. Caspar also states that innumerable maggots cover the body. Caspar states that "bodies green from putridity, blown up and excoriated, at the expiry of one month, or from three to five months after death, cannot with any certainty be distinguished from one another."*

e) *Colliquative putrefaction commences ordinarily from four to six month, or sooner in cases which have lain in warm or moist media. The continuous development of gases has burst the covering and exposed the cavities of both thorax and abdomen. Even the sutures of the skull have yielded to the pressure and are burst, the brain run out, the orbital cavities empty (20).*

Caspar goes on to give chronology of the changes in internal organs. He states the first organ to become changed by putrefaction is the trachea, inclusive of the larynx, followed by the brain of newborn infants and children, the stomach then the intestines, then the spleen, the liver, the adult brain, the heart, the lungs, the kidneys, the urinary bladder and the gullet. He states that there must be a completely putrefied body for the pancreas to be affected by putrescence. He also states that the diaphragm is late in putrefying and the aorta putrefies late. He finally commented that the uterus had the greatest resistance to putrefaction (in opposition to the opinion of Orfila).

Tidy's Legal Medicine

Tidy was Professor of Forensic Medicine at the London Hospital. His textbook was first published in 1882 and in the USA in 1884 (21). He recognized that there were two issues, the fact of death and how long a body had been dead. He stated that concerns about apparent death and premature burial belonged to the domain of the novelist rather than the scientist. He discusses the signs of death under the topics:

- i. *Cessation of hearts action.*
- ii. *Cessation of respiration.*
- iii. *Insensibility, and inability to move.*
- iv. *Minor signs of death (effects of flame and heat, action of caustic, changes in the face and countenance, position of the hands, transparency of the hands and the odour of death).*
- v. *Changes in the eyes.*
- vi. *Changes in temperature.*
- vii. *Changes in muscle (rigor mortis).*
- viii. *Putrefaction.*
- ix. *The formation of adipocere.*
- x. *Mummification (21).*

Tidy stated that putrefaction should not be a reason to decline to perform an autopsy.

CONCLUSION

The history of our understanding of postmortem changes has developed over many centuries and has moved from myth and superstition, as evidenced by the belief that the corpse would bleed on approach of the murderer and that hearing could last longer after death than other senses, to a more scientific basis. The

main concerns of the early exponents of medical jurisprudence were in accurately determining the fact of death. There were also concerns at the start of the 19th century that a putrefied body was dangerous, but these beliefs had resided by the mid-19th century. The problem of determining reliable evidence from a putrefied body was recognized by Dr. Hunter in the late 18th century. Timing of death does not appear to have been of such great concern to the late 18th and early 19th century practitioners, although by the second half of the 19th century, attempts to place timing upon the changes seen after death were being made. It is also noteworthy that from having people executed on the basis of the ordeal of the bier, a century later John Hunter was advising caution on the determination of poisoning in a corpse that had been buried for a number of days and the later 19th century authors also recognized limitations caused by postmortem changes. The details provided were on the basis of individuals observations, experiences and biases, rather than on more rigorous scientific analysis and laid the foundation for assertion that have little true observational basis rather than individual anecdotal evidence. But one can see a progression in the textbooks towards what is now more accepted modern knowledge, and the limitations in an era without stethoscopes, knowledge of microbiology, and other modern techniques left our forebears of forensic medicine with only their observations to build the science we know today.

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