Neurosurgery before Science

Neurosurgery before Science:

Taking a Chance

By

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PREFACE

There are many books in which the history of surgery is either the sole topic or is part of a more general history of medicine. Surgery involves skill, risk, pain, and frustration. It has been both desired and feared and there have been concerns about maintaining standards and regulation. This book is concerned with the evolution of cranial surgery from ancient times to the beginning of the nineteenth century when modern safe surgery developed. Some of the topics concern the cranium alone reflecting the author's area of experience. Some affect the whole body of which the cranium is a part. The preparation for this book has made the author aware of two characteristics of surgery. The first is, no matter how much effort is put into controlling it and limiting it, there remains a spark of curiosity which returns to maintain and improve it. The second in contrast with the first is the perpetual desire for the safety of rejecting what is new and clinging to what is known.

Over and above the successes and errors in surgery's struggle to survive and improve there has been another area of confusion. This has been retrospective and concerns the interpretation of the past through the prism of the present. It did not affect the past while it was happening but has distorted our current understanding of the past. It mainly applies to infection which was such an unavoidable complication of surgery prior to antisepsis and asepsis.

The earliest part of the book traces the origins of surgical practice and training from pre-history and Ancient Egypt up to the end of the Roman Empire. This is followed by material about the changing priorities and patterns of practice from the Middle Ages to the late eighteenth century. The final section of the book deals with specific topics some of general and some of neurosurgical interest to outline the quirkiness of the development of our understanding.

Writing this book has emphasised for the author the importance of Claude Bernard's statement that:

> "Man is by Nature metaphysical and proud'. He has gone so far as to think that the idealistic creations of his mind, which correspond to his feelings, also represent reality".

This is realistic but negative because the persistence of surgery in spite of Bernard's characterisation reflects the words of Robert Browning:

"Ah but a man's reach must exceed his grasp or what's a heaven for?".

This book is concerned with the interplay between these two behaviour patterns of safety and adventure. It is hoped the reader will find it as exciting and fascinating as has the author.

Finally, the book is not a sequential narrative. It considers a diversity of factors which influenced the practice of pre-scientific surgery. Each chapter is a short essay on different influences which affected the evolving practice of surgery and in particular neurosurgery. As each chapter can be read as an isolated essay, there is inevitably some repetition. The text is very much from the point of view of a surgeon rather than an historian. The author fully realises the book lacks the historical authority required by the use of primary sources. On the other hand, it is hoped that insights arising from a lifetime of experience as a surgeon may also prove of value.

ACKNOWLEDGEMENTS

During the course of preparing this text the author has had the benefit of seeking the advice of two leading experts in the field. Professor Vivian Nutton has been most generous with advice about the history of surgery. Professor Michael McVaugh has also been quick with advice about the medieval surgeons concerning whom he is perhaps the leading expert in the world. It should be emphasised that any residual errors in the text are the sole responsibility of the author. Also, the author is at best an amateur historian and is grateful to Professor Sir Geoffrey Lloyd for his consistent encouragement.

Most importantly the author wishes to express his gratitude to his wife Annie Gao without whose patience and support no book would have been possible.

CHAPTER 1

WHAT MAKES A SURGEON?

Introduction

The Oddity which is Surgery.

Nobody wants an operation if it may be avoided. The possibility of pain free surgery has only been available for just over 170 years. The techniques for controlling infection following surgery have only been available for just over 150 years. Yet surgery antedates literacy with evidence that it has been carried out since 10,000 BC (Rose 2003). From that time on, virtually every society of which we are aware has engaged in surgery. With even the speediest and most superficial consideration this is odd. It means that for all of history and before history, people were prepared to undergo painful procedures of dubious therapeutic worth and accompanied by many complications. Yet, beyond question, that is what happened, and it remains inexplicable. It is not the purpose of this book to try and explain the inexplicable. Instead, it is proposed that examination of the changing reality of the surgical profession and how they coped with the many difficulties of their practice may at least expand our understanding of one of the strangest aspects of human behaviour.

Before Hippocrates

The oldest evidence of surgery is provided by the numerous trepanned skulls dug up in many countries around the world. In many cases they came from a time prior to literacy so there is no means of knowing what gave someone the right to drill holes in other people's heads. Moreover, there is no evidence from these skulls which unequivocally show why the operations were performed. The Egyptian Edwin Smith papyrus describes surgical cases showing a sensible grasp of anatomy and reasonable suggestions on how to treat patients. However, the language of the papyrus would not be available outside Ancient Egypt until Breasted's translation in 1930 (Breasted 1992). It would thus have no influence on the development

of surgery in subsequent millennia. It also gave no clue as to the path the authors of the papyrus had taken to become in a position to manage injured patients.

Classical Times

Hippocrates ca. 460 BC – ca. 370 BC

Hippocrates, the Father of Medicine, was the son and grandson of physicians, known as Asklepiads because they followed the teachings of Asklepios, the Greek god of medicine who was possibly a real person around 1250 B.C. (Singer and Underwood 1963). However, there is no record of how Hippocrates came to be accepted as an independent practitioner. He advised that physicians should be exemplary citizens in all ways. In his time medicine and surgery were undertaken by the same individual and he made no separate annotation of the qualities required of a surgeon. In 'The Physician' he specified the requirements for a clinician in the opening paragraph.

> "The dignity of a physician requires that he should look healthy, and as plump as nature intended him to be for the common crowd consider those who are not of this excellent bodily condition to be unable to take care of others. Then he must be clean in person, well dressed, and anointed with sweet-smelling unguents that are beyond suspicion. For all these things are pleasing to people who are ill, and he must pay attention to this. In matters of the mind, let him be prudent, not only with regard to silence, but also in having a great regularity of life, since this is very important in respect of reputation; he must be a gentleman in character, and being this he must be grave and kind to all." (Hippocrates 1995a).

There is advice in this text on details of operative technique.

> "Where surgery is performed by a single incision, you must make it a quick one; for since the person being cut usually suffers pain, the suffering should last for the least time possible…. When many incisions are necessary, you must employ a slow surgery for a surgeon that was fast would make the pain sustained and great, whereas intervals provide a break for the patients." (Hippocrates 1995a)

Nonetheless, there is another book in the Hippocratic Corpus entitled 'Surgery' (Hippocrates 1995b). This text contains practical advice for the surgeon's person and his behaviour in the operating room.

> "The nails should be neither longer nor shorter than the points of the fingers: and the surgeon should practice with the extremities of the fingers, the index-finger being usually turned to the thumb." (Hippocrates 1995b)

> "The operator whether seated or standing should be placed conveniently to himself, to the part being operated upon and to the light." (Hippocrates 1995b)

> "Operative requisites in the surgery; the patient; the operator; the assistants; the instruments; the light, where and how placed; their number which he uses how and where; the patient's person and the apparatus; time, manner and place" (Hippocrates 1995b).

There follow more details including how the patient and the assistants help to place and steady the patient during an operation. An assistant may present the surgeon with the required instruments. It may be mentioned that the largest part of the text on 'In the Surgery' is devoted to bandaging.

Thus, Hippocrates described in broad outline the social requirements for success in medicine. In addition, he described some of the requirements of the place where operations would be undertaken. He did not specify the personal qualities required by a surgeon as opposed to a physician.

Celsus (ca. 25 BC – ca. 50 AD)

There were a number of Roman men of substance who were teachers of medicine, but one towers above all the others; Aulus Cornelius Celsus. Little is known of his private circumstances, but his name indicates an aristocratic family, since the Cornelians were a most superior Roman House. He is famous to all medical students for being the first person to characterize inflammation. His description of rubor, calor, tumor and dolor holds good today. Celsus wrote a multi-volume encyclopaedia on agriculture, warfare, rhetoric, medicine, and jurisprudence. Only the text on medicine remains; 'De Medicina'. After his death it disappeared until the sixteenth century. There was an opinion expressed by Pliny the Elder not that long after Celsus' death. He stated: (Marganne and Sanchez 2014)

> "if medical treatises are written in a language other than Greek they have no prestige even among unlearned men ignorant of Greek, and if any should understand them they have less faith in them".

This may in part be the reason for the loss of Celsus' work. It may be assumed that Celsus was just as aware of the prestige of Greek as Pliny. He must have been conversant with Greek because of his familiarity with the

works of Hippocrates. It may be that he wrote in Latin to make his work more accessible to less well-educated Romans than himself. Whatever the reason, it is unfortunate given the quality of his writings that they remained unavailable until the fifteenth century. In 1478, De Medicina became the first medical text to be printed with the new printing press.

In the present context, it was Celsus who described the essential mental and physical characteristics required by would be surgeons. In translation the statement reads: (Celsus 1938)

> "Now a surgeon should be youthful or at any rate nearer youth than age; with a strong and steady hand which never trembles, and ready to use the left hand as well as the right; with vision sharp and clear, and spirit undaunted; filled with pity, so that he wishes to cure his patient, yet is not moved by his cries, to go too fast, or cut less than is necessary; but he does everything just as if the cries of pain cause him no emotion.".

This would inspire surgeons in later generations who quoted or paraphrased the above statement.

Galen (ca 130 AD – ca 210 AD)

There is plentiful evidence of Galen's expertise as a surgeon. He had a lengthy education including time in Alexandria. It is well known that his first clinical appointment was in Pergamum where he was employed to treat the injuries sustained by gladiators. Nutton suggests that this appointment could partly have been the result of his contact network amongst distinguished citizens known to his family but that Galen's expertise in surgery was also important (Nutton 2013). He characteristically boasted of how the mortality amongst gladiators fell after he was put in charge of treating their injuries (Mattern 2013). However, the greatest evidence of his skill has to be his physiological experiments as detailed in 'Galen on Anatomical Procedures' and 'Galen on Anatomical Procedures, The Later Books' (Galen 1956, 2010). His vivisections illuminated with sunlight alone and with no modern methods of haemostasis available are little short of miraculous. Nonetheless, he regarded the surgery of patients as a last resort and only to be undertaken when all else failed. Despite his surgical skill he remained a physician at heart. As Nutton puts it:

> "After all, the best physician was the one most capable of treating surgical conditions by means other than the knife, and particularly by diet and drugs" (Nutton 2013).

To date no statement of Galen's has been found about what was required of a surgeon equivalent to the statements of Hippocrates and Celsus.

Paul Ægineta (ca.625 – ca.690)

It was a Christian empire into which Paul Ægineta was born in around 625 AD on the island of Ægina, just over 30 km south of Athens in the Saronic Gulf, which was within the Byzantine Empire (see figure 1.1). Paul was a physician and surgeon of both great repute and seemingly great skill. It is thought he was educated and worked in Alexandria in Egypt. He did not add new concepts to the teaching of the Ancients. Nonetheless, he assembled a large medical text which is noteworthy for its clarity and simplicity of expression. It is largely influenced by Hippocrates and Galen. What Paul wrote was essentially an encyclopaedia about medicine and surgery: since the same person was still both physician and surgeon.

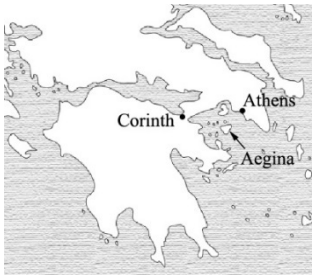

Figure 1.1
A map of the outline of Greece showing where Paul Ægineta came from

Paul's work would be immensely influential in the years to come. He provided elegant descriptions of situations where surgery was required and in addition the techniques involved. He did not however make any statement on what qualities were necessary for a person wishing to practise surgery.

Medieval Surgery

The Roman Empire in its last years was a vehicle for the spread of Christianity. When it disintegrated the Christian church survived and would slowly evolve into the institution responsible for academic pursuits. These inevitably became coloured by the prime requirement of the Church which was obedience to the tenets of the religion it subserved. An authoritarian religion is not the best background for innovative thought which rather died out for a few centuries. However, it could not be extinguished for ever and with regard to surgery it began to re-merge in the tenth century. The first of the new authors was Albucasis.

Albucasis (936 – 1013)

Figure 1.2
Map of Spain showing Cordova's location.

Abū al-Qāsim Khalaf ibn al-'Abbās az-Zahrāwī known as Albucasis was born, lived and died near Cordova in Spain (see figure 1.2). He wrote the first textbook limited to surgery alone. His book was also unique in having the first illustrations of surgical instruments, even if the illustrations are not really very helpful (see figure 1.3). It may be mentioned that for Albucasis the working end of the instrument was the source of his focus (Wangensteen 1974). Albucasis began his text with a comment on the fallen status of his profession (Albucasis 1973a).

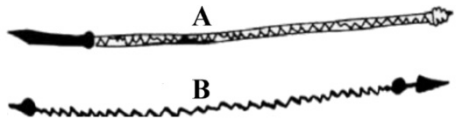

Figure 1.3
This shows the limited value of the illustrations. 'A' represents a chisel and B represents a drill.

> "After finishing for you, my sons, this book which is the part of knowledge dealing with medicine in its entirety; and having made it as clear and explicit as possible, I thought it well to complete it for you by adding this treatise which concerns surgical operating. For the skilled practitioner of operative surgery is totally lacking in our land and time; so that the knowledge of it is on the point of being blotted out and it remains lost; and there is nothing left of it except a few traces in the books of the Ancients; where, however, it has been so corrupted by the hands of scribes, and subjected to error and confusion, that its meaning has become obscured and its value diminished. Therefore I decided to revive this art by expounding, elucidating, and epitomizing it in this treatise; and to present the forms of the cauterizing irons and other operative instruments, since this is an adjunct to explanation and a vital necessity."

He was thus the first to comment on what would become an important element in the development of the profession of surgery, lost status. He did not comment on the qualities required of a surgeon. Nonetheless, his book

had great influence so that three centuries later another distinguished surgeon, Guy de Chauliac quoted him (Chauliac 2007a).

Another two centuries would pass before new studies in surgery began to emerge. There was however a change in emphasis concerning what mattered to these 'modern' surgeons. Over and above their clinical work, the main concern was the need for a formal academic education which was worthy of a study such as medicine and which required books as part of the learning process. They were united in their criticism of practitioners who did not meet these fine standards to whom they applied the unpleasant epithet '*ydioti*'. The period under advisement was the time when universities and hospitals were being founded. There follow various surgeons' comments on the need for book reading.

On Academic Training

Bruno da Longoburgo (died 1286)

Bruno travelled from Longoburgo in Calabria in the south of Italy through a number of locations which remain undetermined. He ended up in Padua where he established a practice and where eventually he died. On academic training he wrote the following.

> "Surgeons should be fond of reading and they should learn from someone who has had his own book-learning. I cannot condone the belief that someone who is unfamiliar with the surgical literature can learn surgery" (Tabanelli 2003).

This is a clear enough statement of intent.

Theodoric Borgognoni (1205 – 1298)

Theodoric was born in Lucca (figure 1.4). He may have been the son of a famous surgeon who left no writings called Hugh of Lucca. Theodoric clearly admired him and praised him repeatedly in his text on surgery. Theodoric was an outspoken supporter of academic surgery as indicated by the quotation below. He wrote:

Figure 1.4
A map of the outline of Italy showing the locations relevant for medieval

> "Damascenus...says, the native talent of a physician aids his skill, and on the other hand, his control of natural forces. They must needs be well-read, and even if they be aided sometimes by experience, yet frequently will they fall into error and into confusion. I scarcely think that anyone can understand surgery without schooling." (Theodoric 1955)

This is a powerful statement supporting the need for surgeons to receive academic training and includes what is a fairly characteristic contempt for those who do not reach the standards laid down by the writer.

William of Saliceto (1210 – 1277)

William was born in a small village near modern day Piacenza. He was educated in Bologna. He had a tremendous reputation as the finest surgeon of his time (Malgaigne 1965). He again emphasised the need for theoretical education for surgeons. He stated the following:

> "Surgery is a science that teaches the principles behind the procedures for manual operations on the soft tissues, nerves and bones…Yet, it is held to be true that one can learn surgery without ever having performed an operation (ie by following the general principles). However, that body of knowledge, along with others, is united with the basics of Surgery by a practical experience in the performance of particular operations in particular cases." (Saliceto 2002)

This author again required the need to combine learning with practical experience but without the contempt of Theodoric.

Lanfranc (1250 – 1306)

Lanfranc was born in Milan. His training was in Bologna, but he set up practice in his home city (Malgaigne 1965). Falling foul of the authorities in Milan he left and set up eventually in Paris. His major teacher was William of Saliceto, but he may well have known Theodoric. His description of the requirements for surgical education is a lot less verbose than those of his predecessors. He simply states:

> "He should be well-lettered in philosophy and logic and have a clear knowledge of the Scriptures"

> "Heed what the Great Masters say, They who preceded us, and who Left a trail of disciples who wrote down What the Masters taught" (Lanfranc 2003).

These two statements emphasise that a surgeon could not be an unlettered technician.

Henri de Mondeville (1260 – 1316)

Henri was born in Mondeville a small village near Caen. He was trained by Jean Pitard, a celebrated French surgeon who left no written text. He was also influenced by Lanfranc, Theodoric, and Hugh of Lucca. He wrote two of a planned five-volume textbook on surgery. It was not completed and not properly published until centuries later. A possible explanation is that the Black Death distracted people from this work which did not receive the attention its contents deserved (Malgaigne 1965). He wrote the following about the required education for a surgeon.

> "Surgery is not just operating. Coming before the handwork is a theoretical science, something no lay surgeon ever will learn. And, beyond just knowing theory, one's confidence is bolstered and one is better prepared to learn and to understand the technical aspects if he knows the concepts behind them. He knows the etiology (ie of the diseases) and the rationale for doing precisely such and such and not something else. Furthermore, if the cleric (ie the educated surgeon) is intelligent and has good physical attributes there is no reason why he can't operate even more skilfully than the lay man." (de Mondeville 2003).

It may be noted that while Henri is verbose and authoritarian, he does not exclude the possibility of lay surgeons.

Jehan Yperman (ca. 1260 – ca. 1331)

Yperman is thought to have been born in Poperinge near Ypres in Belgium. He was most probably trained in Paris and he acknowledges his debt to Lanfranc in his book on surgery. The following statement is to be found in his text.

> "The surgeon should be broadly educated beyond the realm of medicine. He should have studied the books of science and philosophy, including grammar, logic, rhetoric, and ethics. With a background of knowledge in those four subjects he will have learned to assess rationally all that he will face." (Yperman 2003).

Here it is emphasised that a broad education is a requirement, not just the acquisition of the science on which surgery is based.

Guy de Chauliac (ca. 1300 – 1368)

Guy was born in the village of Chauliac in south central France (see figure 1.5). The date of his birth is uncertain as is his training. There is evidence that he received instruction in Montpellier, Toulouse, and Bologna. His book on surgery came to be a standard text for generations to come. His succinct comments on surgical education were as follows.

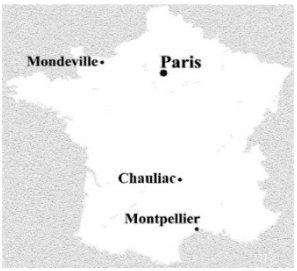

Figure 1.5
A map of the outline of France showing the locations relevant for medieval and early Renaissance surgeons.

> "Therefore, the surgeon must be well educated, not only in the principles of surgery, but also in the theory and practice of medicine" (Chauliac 2007b).

Thus, it may be seen that the education of surgeons was a major consideration for these medieval practitioners. Surgery had come back to Europe with a lost reputation which was commented upon by especially Albucasis and Guy de Chauliac (Albucasis 1973b; Chauliac 2007a). With the exception of Jehan Yperman, all the surgeons mentioned in this section were ordained priests. The significance of this will be considered in more detail in the next chapter. However, the need to educate surgeons with book learning in addition to practical instruction was important in relation to practitioners' prestige and probably in the last analysis the fees they could charge. It is of interest that the surgeons of this period, under social threat from physicians with their superior social standing found it necessary to state what was required to make a surgeon. This would change.

Renaissance and Later

Up to the Renaissance all books were in the form of manuscripts, so that their production was time consuming, and they were necessarily very expensive (Malgaigne 1965). The introduction of the printing press in 1450 changed all that. Thereafter, surgical texts could be produced in large numbers at an affordable price. It would seem that the nature of surgery and its practitioners had become clear and accepted so that only twice thereafter is there mention of the requirements of a surgeon. Ambroise Paré, that most distinguished and respected of French barber surgeons wrote:

> "For my part I very well like the saying of Celsus; A Chrirugeon must have a strong, stable and intrepid hand, and a minde resolute and mercilesse; so that to heale him he taketh in hand, he be not moved to make more haste

> than the thing requires; or to cut lesse than is needful; but which doth all things as if he were nothing affected by their cries; not giving heed to the judgement of vaine common people, who speake ill of Churgions because of their ignorance" (Johnston 1649).

This is the modest Paré who stated of a patient:

> "I dressed him. God cured him".

Even so he stands apart from the criticism of 'common people' understanding how a surgeon must on occasion harden his heart if his patient is to benefit from the operation. Another sensible remark in the same vein is from Heister, a celebrated eighteenth-century German surgeon, whose original textbook on surgery, published in German was translated into a number of languages including Latin and Japanese. He paraphrased Celsus thus:

> "for the Number wounded, on the Side of the Hollanders only, amounted to above five thousand. I had here therefore an ample Occasion to extend the Bounds of my Practice, and was obliged to put on that Intrepidity of Mind which Celsus requires as an essential Qualification in a Surgeon, and for want of which some, who are in other Respects skilful Operators, do frequently miscarry" (Heister 1743).

All these surgeons seem to agree that in the surgeon patient relationship, it was the surgeon who was the leader and who must not become too familiar with the patient. Thus, surgeons must be confident on the one hand without slipping from confidence to arrogance. It is probably impossible to be totally successful in this endeavour but the effort to keep the right balance must never be relaxed.

Quotations

A few quotations are included to give a flavour of the life of a surgeon. The profession of surgery is complex and involves all sorts of complicated relationships between the practitioner and patients, colleagues, employers, the public and politicians. These relationships are unfamiliar to non-surgeons.

Surgeon	Quotation
	Principles
Max Thorek (1880 – 1960)	The surgeon should always remember that operation is not synonymous with surgery, and that the primary aim of surgery is not operation, but the cure of the patient.
Anon	Fast surgeons do not hurry, they save time by not wasting motions.
	Communication
Ambroise Paré (1510 – 1590)	Always give the patient hope, even when death seems at hand
	Learning
Joseph Lister (1827 – 1912)	You must always be students, learning and unlearning till your life's end, and if, gentlemen, you are not prepared to follow your profession in that spirit, I implore you to leave its ranks and betake yourself to some third-class trade
Richard Wiseman (1621 – 1676)	I have thought it no disgrace to let the world see where I failed of success, that those that come after me may learn what to avoid: there being more instructiveness often in an unfortunate case than in a fortunate one
	Teaching
Harvey Cushing (1869 – 1939)	The best any of us can do as successful teachers of medical students is to instill principles, arouse interest, put the student on the right track, give him methods, show him how to study, and early to discern between essentials and the unessential
	Relations with the Public
J Chalmers Da Costa (1863 – 1933)	Any surgeon, who looks for repute to the general public, rather than to his own professional brothers, has the spirit of the quack.

Table 1.1
Comments by distinguished surgeons down the years which illustrate some of the qualities needed.

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CHAPTER 2

REGULATION OF SURGICAL PRACTICE

Introduction

In the modern world, the regulation of surgical practice is strict and formal. Its components are as follows. Firstly, a would-be surgeon must obtain a qualification in general medicine which will include information on the diseases treated by surgery and observation of some operations. That is however the limit of undergraduate surgical education. Following qualification, the candidate for a surgical career will undergo a lengthy training first in general surgery and then in the speciality of his/her choice. This will include taxing examinations and a many year apprenticeship during which operative technique will be taught. At the end of this training, the successful candidate will receive an official license to practice their surgical speciality. The final step in the process is to apply for a job as an independent practitioner in the relevant speciality. At this stage, the opinion of those who trained him/her will have considerable influence on the success of the application. Finally, the surgeon's independent practice will be under constant assessment by colleagues, employers, professional bodies, and patient protection organisations. It was not always so.

The Earliest Regulation

It must have been obvious from earliest times that while surgery might provide benefit, it was also a high-risk procedure. Thus, from earliest times societies have found it appropriate to write laws to direct surgical practice, which given the risks is very understandable. The oldest regulations of which we are aware came from ancient Babylon. The Code of Hammurabi (1811 BC - 1750 BC) consists of 282 laws. Of these laws 215 to 223 relate to surgery. They are as follows: (Ascaco and Huerva 2013; Hammurabi 1904)

> If a physician operate on a man for a severe wound (or make a severe wound upon a man) with a bronze lancet and save the man's life; or if he open an

> abscess (in the eye) of a man with a bronze lancet and save that man's eye, he shall receive ten shekels of silver (as his fee).
>
> If he be a freeman, he shall receive five shekels.
>
> If it be a man's slave, the owner of the slave shall give two shekels of silver to the physician.
>
> If a physician operate on a man for a severe wound with a bronze lancet and cause that man's death; or open an abscess (in the eye) of a man with a bronze lancet and destroy the man's eye, they shall cut off his fingers.
>
> If a physician operate on a slave of a freeman for a severe wound with a bronze lancet and cause his death, he shall restore a slave of equal value.
>
> If he open an abscess (in his eye) with a bronze lancet, and destroy his eye, he shall pay silver to extent of one-half of his price.
>
> If a physician set a broken bone for a man or cure his diseased bowels, the patient shall give five shekels of silver to the physician.
>
> If he be a freeman, he shall give three shekels of silver.
>
> If it be a man's slave, the owner of the slave shall give two shekels of silver to the physician.

Five shekels was equivalent to the yearly rent of a good type of house and represented 150 times the daily wage of a workman. However, Hammurabi´s Code might have discouraged the pursuit of a career in Ophthalmology given the severity of the penalties for surgical misadventure. It is noteworthy that the penalties were related to the socioeconomic status of the patient. So, even at this early date, surgical practice was to be guided by the law of the land, and the guidance was stringent.

Of Celsus there is no record that he ever was medically or surgically qualified. However, he wrote like a professional and the process of qualification at his time is simply not known. There is no record on how the celebrated surgeons of the ancient world were perceived to be qualified. For Hippocrates there is no clue as to his training. Galen underwent a lengthy education but his appointment as surgeon to the gladiators in Pergamum seems to have been at the discretion of the priest in charge, the high priest or (Archierius) who likely belonged to the same privileged class as Galen’s father (Mattern 2013). So, while there is no information about the selection process it might reasonably be assumed to be influenced by social position and contacts.

The Fall of the Roman Empire

Roughly half a millennium later another society found it necessary to write regulations, to guide the work of surgeons which have survived (Scott 1910). The fall of Rome was the work of so-called barbarians. These folk were Goths, specifically Visigoths who were the Western Goths, the Eastern Goths were called Ostrogoths. They are thought to have arisen from southern Scandinavia. In the late fourth century they converted to Christianity. In 410 AD under the leadership of Alaric I they sacked Rome. At the beginning of the sixth century, a successor Alaric II (458 – 507) promulgated the Breviarium Alaricianum, a body of laws compiled mainly from the Codes of Justinian and Theodosius. Over a century later between 649 AD and 652 AD, the Forum Judicum, or Visigoth Code was formed. It contains a few short paragraphs relating to medical professionals.

I. No Physician shall Presume to Bleed a Woman, in the Absence of her Relatives.

Absence of her Relatives. No physician shall presume to bleed a freeborn woman without the presence of her father, mother, brother, son, uncle, or some other relative, except urgent necessity should demand it; and where it happens that none of the abovenamed persons can be present, the woman must be bled in the presence of respectable neighbours or slaves, of either sex, according to the nature of her illness. If a physician should do this without the presence of any of the aforesaid persons, he shall be compelled to pay ten solidi to the husband or the relatives of said woman; for the reason that it is not at all improbable that, on such an occasion, wantonness may sometimes occur.

II. No Physician shall Visit Persons Confined in Prison.

No physician shall presume to enter a prison when governors, tribunes, or deputies, are excluded therefrom, without being accompanied by the jailer, lest the prisoners, influenced by fear, may obtain from said physician the means wherewith to commit suicide; for should any poison be furnished or administered by physicians, under such circumstances, the course of justice would be greatly obstructed. Should any physician be guilty of this offence, he shall be liable to punishment for the same.

III. Where a Physician Treats Disease under a Contract.

Where any person demands that a physician treat him for disease or cure his wound under a contract; after the physician has seen the wound, or diagnosed the disease, he may undertake the treatment of said sick person

under such conditions as may be agreed upon and set forth in an instrument in writing.

IV. Where a Sick Person Dies, while a Physician is Treating him under a Contract.

Where a physician undertakes the treatment of a sick person under a contract reduced to writing, he must restore said sick person to health; and, if the latter - should die, the physician shall not be entitled to the compensation stipulated in said contract, and no liability shall attach to either of the parties to the same.

V. Where a Physician Removes a Cataract from the Eye.

Where a physician removes a cataract from the eye of any person, and restores the invalid to his former health, he shall be entitled to five solidi for his services.

VI. Where a Freeman or a Slave Dies from Being Bled

Where a physician bleeds a patient, and the latter is greatly weakened in consequence, said physician shall be compelled to pay him forty solidi. If the patient should die as the result of being bled, the physician shall be delivered up to the relatives of said patient, to be disposed of at their pleasure. Where the patient is a slave, and is seriously weakened, or dies, the physician must give his master another slave of equal value, in his stead.

VII. Concerning the Compensation to be Received for the Instruction of a Student in Medicine.

Where a physician receives a slave for the purpose of instruction in medicine, he shall be entitled to twelve solidi by way of compensation.

VIII. No Physician shall be Imprisoned without a Hearing.

No physician shall be imprisoned without a hearing, except in case of homicide. Where he is charged with debt, he must provide a surety.

The penalties would appear to be somewhat milder than those of Hammurabi, although the risks outlined in paragraph one, suggest that sexual impropriety was more expected than it had been in Babylon. However, once again there is no suggestion that surgery was carried out by anyone other than qualified professionals who were subject to the above laws. Paragraph III specifically states: ‘after a physician has seen the wound or diagnosed the disease’. Since wounds require surgical management this statement alone seems to justify the combined functions in one individual.

Moreover, it establishes that in the history of Europe, there have been periods when surgery would be guided by laws for the protection of the public. It is worth noting, that the translator uses the word physician and not surgeon. In the seventh century AD the two professions were still undertaken by the same person. The solidi mentioned were the gold coins of the Byzantine Roman Empire from the time of Constantine up to the tenth century. A soldier's annual pay would be around twelve solidi, so that the financial punishment for misbehaving with a woman or the fee for instructing medical students were both close to the annual income of a soldier.

The above texts outline the efforts of the state to regulate surgical practice. They do not however enlighten us on how a given person could qualify as a surgeon, only the consequences of his professional practice. As time passed the regulation of surgeons would become intimately associated with the way in which they were educated.

Early Middle Ages

Contemporary with the Visigoth Code were the writings of Paul Ægineta (ca.625 – ca.690). After him medical education gradually fell into the hands of the church since the clergy were responsible for all education from the parish school to the monastic or cathedral school (MacKinney 1955; Malgaigne 1965). There was a gradual move from the scientific spirit of Galen to preference for authoritative texts (Temkin 1956), which would be highly acceptable to the church. Surgery was not a priority in this education.

There was nothing new written on the subject of surgery until the eleventh century AD when Albucasis (936 – 1013) wrote the first textbook ever devoted to surgery alone (Albucasis. 1973a.). This text largely based on the writings of Paul Ægineta was also the first with illustrations, albeit not very useful ones (see figure 1.3). Paul's text had been translated from the Greek into Arabic by Hunayn ibn-Ishaqw, who had also translated works of Galen and Hippocrates, who are both mentioned in Albucasis' text (Johna 2002). From available information today, nobody knows the nature of Albucasis' qualifications to practise surgery though he certainly would seem to have been proficient.

Early Medical Schools

A century later, surgery began to return to Europe in earnest, starting in Salerno and subsequently involving Bologna, Padua, Verona, Milan, Paris, and Montpellier. In the ancient world medicine had been a skill learned by apprenticeship (Temkin 1956). There arose a succession of surgeons who were motivated to demonstrate that surgery was a science requiring the book learning of its principles as well as manual skills (McVaugh 2006): as related in the previous chapter. This movement occurred at the time when centres of education were changing their format with the founding of universities. It has been pointed out that three things changed medical education at this time. They were the translation of ancient texts, the rise of urban centres and the formation of universities (Temkin 1956). In the context of the regulation of surgical practice, the formation of universities was crucial. They did not arise in a vacuum but were mostly evolved from existing schools which the church took over (Malgaigne 1965). After all, at this time most learning was an ecclesiastical monopoly.

The most distinguished medical schools at the beginning of this period were at Salerno and Bologna. The evolution from school to university was different in the two places but the end result was the same. Universities included an organisation and a set of processes ending in the granting of a confirmation of the acquisition of knowledge on which a professional career might be based. This confirmation was called a degree. There was a graded importance of university employees from those qualified to teach up to those qualified to grant a degree. Salerno lay within the realm of the Kingdom of Sicily and in 1231, King Frederick II commanded that nobody could qualify in the field of medicine without a degree granted by the University of Salerno. In Bologna the control of medical practice began with the appointment by the city of a surgeon to the community, Hugo of Lucca (Rashdall 2010). This appointment was made in 1214 (McVaugh 2006). However, the foundation of a School of Medicine was not established until 1260 (Rashdall 2010). The importance in the current context is that surgery was included in the subjects taught and these administrative changes meant that a would-be surgeon had to satisfy a public authority of his competence before receiving a license. In the laws of Frederick II, the surgeon had to undergo a study of anatomy but the story that human dissection was a component of this process is not supported by the evidence (Kristeller 1945).