

SHORT HISTORY OF THE AUTOPSY

PART I. FROM PREHISTORY TO THE MIDDLE OF THE 16TH CENTURY

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We present the first part of work concerning the history of autopsy. During the development of the pathology the role of autopsy was changing. The attitude towards the human body was often a result of struggles between human will to learn and religious beliefs. The knowledge was built upon religious procedures (mummification) through medical and surgical care of the victims of fights and wars and first autopsies. Until the 13th century dissections were seldom performed, sometimes in public. The aims varied from strictly scientific and practical (surgery) to artistic (human body in arts). Later on physicians were learning how to draw conclusions from autopsy results including malformations, pathologies, diseases, causes of death in order to try to put right diagnoses.

Key words: history of pathology, autopsy, anatomy, dissection.

Introduction

The attitude towards the human body was always a result of struggles between human will to learn and religious restrictions, later combined sometimes with philosophical cogitations. Through the times it meandered from total negation to full opening and public autopsies in *theatra anatomica*. At the beginning it was only to learn about the structure of human body, however in the 18th century it turned to identify the cause of death and developed anatomopathology. And again, firstly anatomopathological autopsies were frequent (e.g. Karl Rokitansky), later on they became considered as less important.

At the beginning of the 20th century great meta-analysis was performed in the USA to check the correlation of post mortem findings with pre mortem diagnoses. The result was shocking, mainly for the clinicians who learnt how far sometimes they were from the truth. Again such query was made at the beginning of the 21st century [1, 2] showing that the autopsies still play a major role in learning and an increased rate of autopsies performed in the hospitals is parallel to a diminished rate of major clinical diagnostic errors.

Prehistoric times

The interior of human body fascinated people at the very early stage of development of human culture. Long before organized cultures, prehistoric men performed some particular rituals with human and animal remains which indicates general knowledge of gross anatomy. The Inuits and Australian Aborigines hunting and slaughtering big animals developed a detailed knowledge of mammalian anatomy. If the hunting was not so lucky the knowledge applied also to humans.

Ancient world

The ancient Egyptians got the knowledge about particular areas of human anatomy mainly in accordance with preparation of the cadavers for the burial ceremony. They also performed primitive surgical procedures, though only to a very limited degree. The Egyptians with their knowledge of human anatomy opened the abdomen by short cut on the left side to extract internal organs (liver, intestines and lungs) in the process of mummification. They also got into the cranial cavity

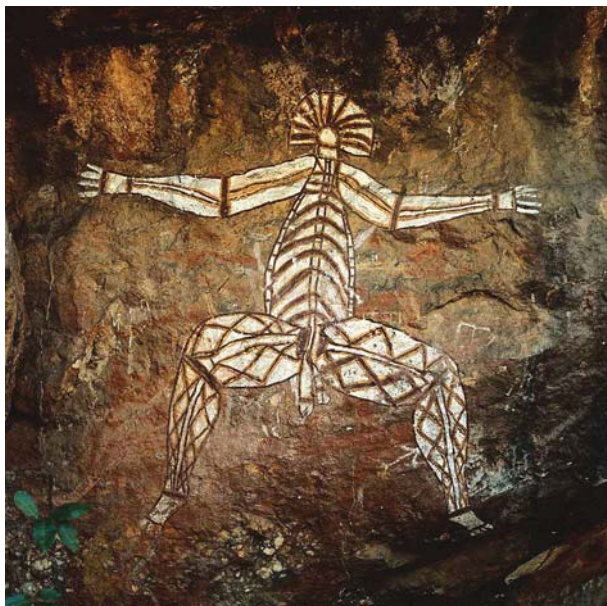


Fig. 1. Rare rock paintings from the Neolithic Era found in Africa and Australia Rock painting, ca. 6000 B.C.E. © Archivio Iconografico, S.A./Corbis - Aboriginal "X-ray style" figure. Kakadu National Park, Northern Territory, Australia) show schematic and expressive representations of the human interior. Source: http://www.nlm.nih.gov/dreamanatomy/da_g_X-1.html Dream Anatomy

through the nostrils to remove the brain tissue, which required the knowledge of the skull anatomy [3]. Nevertheless their general skills in autopsy were limited to religious activities and were never meant to expand their medical horizons, partly because they were not performed by physicians but parashites, people specializing in mummification procedures. The information about that is rather scarce in papyrus and cartouches (Edwin Smith Papyrus, The Ebers Papyrus) [3].

In ancient Greece, Aristotle (4th century BC) was one of the first "physika's" (hence the name: physician) to perform dissection, though only on animals, not humans. Nevertheless by comparisons and examining mutilated soldiers' bodies he and his students were getting their knowledge of gross anatomy. Almost at the same time (3th century BC) Herophilus of Chalcedon was performing autopsies in public explaining all procedures to the auditory. He was the first to describe the circulation system, differentiate veins from arteries and nerves, give a general description of the central nervous system (the confluence of the sinuses was originally named torcular Herophili after him), and genital organs [4].

Herophilus with his student Erasistratus founded the Medical School in Alexandria with the first "department of anatomy" in the history [5]. The apprentice became then a great anatomist often quoted even by Galen e.g.: "The vein arises from the

part where the arteries, that are distributed to the whole body, have their origin, and penetrates to the sanguineous [or right] ventricle [of the heart]; and the artery [or pulmonary vein] arises from the part where the veins have their origin, and penetrates to the pneumatic [or left] ventricle of the heart" [6]. This statement says how close he was to discover the circulation of blood, so long before Harvey. But it was him who described the work of tricuspid valves, though Galen puts it onto one of the followers. Herophilus performed his studies thoroughly during autopsies, and it is rumoured, also on some vivisections performed on criminals which was allowed by Ptolemeian law (quoted after Celsus and Tertulian) [5]. Later on the rulers of Alexandria expelled all Greeks which ended this famous Medical School, along with the school of anatomy and autopsy.

Galen, though for many centuries considered as Oracle in medicine, writing more than four centuries after Herophilus, speaking of autopsies and anatomy still operated on apes and perhaps Rhesus monkeys (which he states clearly in his work "De anatomici administrationibus": Choose those apes which most closely resemble humans, with short jaws and small canines. You will find their other parts also resembling those of the human beings...). Galen gained vast experience in the muscular and skeletal systems treating wounded gladiators and soldiers. Problems began with internal organs, which, as Vesalius pointed out, he never managed to assess.

Far from Europe, in the 1st century BC in India the Sushruta Samhita – the first Indian written medical book – instructed how to prepare the human body for the autopsy. Basing on these instructions Charaka Samhita described 300 bones, 500 muscles, 210 articulations, the structure of the heart (so long before Harvey) and 70 channels, as he called blood vessels.

Middle Ages

In the following centuries the Greek anatomical legacy almost disappeared in Europe. But fortunately it remained preserved in the Islamic world. Many of ancient papers deriving from ancient Greece, Rome, Persia and even India were translated to Arabic by Yuhanna ibn Masawaih (Masue) and six generations of the Bukhtishu family and many others, later to be translated to Latin. Al-Razi (Rhazes) (865-925) in his "K al-Masuri", later printed in Latin "Liber de medicina ad Almansorem" or "Liber Almansoris", put 26 chapters treating about anatomy. He contributed to neuroanatomy describing cranial and spinal nerves [7]. Ibn Sina (Avicenna) (980-1037) in his "Al Canun fi al Tibb", known in Europe as "Canon", one of the most influential medical books up to the 18th century, systemized

anatomy and included a chapter with a detailed description of functional neuroanatomy [8, 7].

In the Islamic world the knowledge of anatomy was to be practically introduced to surgery. Ibn Zuhr also known as Avenzoar (1091-1161) famous for his work "Al-Taisir" performed first autopsies on humans and animals in order to implement knowledge into physicians' practice. He was the first to give a full and proper description of tracheotomy as a life-saving procedure in suffocating patients, basing on his experience of anatomy.

In Europe the conviction of importance of human autopsy weakened over time.

Although, there are scarce proofs of these, like chronography by Theofanes, Byzantine monk from the 9th century mentioning a case of a renegade handed to doctors, who "opened him from abdomen to thorax while still alive" in order to assess his human structure [9].

In the 13th century, thanks to Emperor Frederick II of Hohenstaufen and his regulation for physicians (1240), the anatomy and surgery became very important parts of medicine. At the beginning it affected only a small area around Salerno, famous for its University founded in the 7th century, but later it was spread also to Naples, and then to Montpellier, where the medical school was founded by Saracen and Jewish physicians, who moved from Salerno. The general knowledge of human anatomy for physicians became obvious and obligatory. The surgeons had to prove particular knowledge of anatomy to be allowed to practice. Emperor Charles IV made it a condition sine qua non for every student of medicine to perform an autopsy after attending the Holy Mass.

In Salimbene Chronicle [9] we can read that in Cremona in 1286 an autopsy was performed on a cadaver, a victim of the plague, in order to find the cause of death. There are also some notes that in 1260 at the University of Bologna, the human autopsies were performed during courses of anatomy [10].

In 1302, at the same University, Bartholomeo de Varignana issued the first forensic expertise opinion after an autopsy witnessed by three other physicians, stating in a written protocol, that in contrary to suggestions the victim was not poisoned.

After the Alexandrian school, again it was Italy where in 1316 "Anatomia" by Mondino de Lucci (1275-1326) was issued (first time in print in Venice in 1478). This book was not a theoretical treaty, but a set of practical guidelines and conclusions.

In 1299, Pope Boniface VIII issued Bull De Sepulturis according to which every person dissecting the human body or boiling his bones was to be excommunicated. Although some authors state that it stopped progress of anatomy for a short while, others quote that it was only limited to a situation where soft tissues were removed from the body in



Fig. 2. Title chart of Anatomia Mundini. Source: W. Kożuszek "Rozwój anatomii patologicznej na Uniwersytecie Wrocławskim oraz w Akademii Medycznej we Wrocławiu wraz z zarysem historycznym". Wrocław 2007. Wydawnictwo Uniwersytetu Wrocławskiego. p. 28-60

order to allow for transport at long distances, mainly victims of crusades [11, 10].

Nevertheless valid or not, the Bull did not stop other anatomists from expanding their skills and knowledge. For example, Guy de Chauliac from Lyon, being a surgeon, performed many autopsies which resulted in many descriptions of hernias and anatomical relations of organs involved [5]. He appreciated learning anatomy from an autopsy so much that he used to say "a surgeon who was ignorant of anatomy carved the human body in the same way a blind man carved wood".

Renaissance up to Vesalius

Pope Boniface VIII, however, not only did not stop autopsies, but it happened that even anti-pope Alexander V, after his death in 1410 was sectioned (though we have no details about proceedings and the results). Later on, even Ignatius de Loyola, founder of the Jesuit order, in 1556 was diagnosed post mortem with having nephro-, uro- and cholelithiasis.

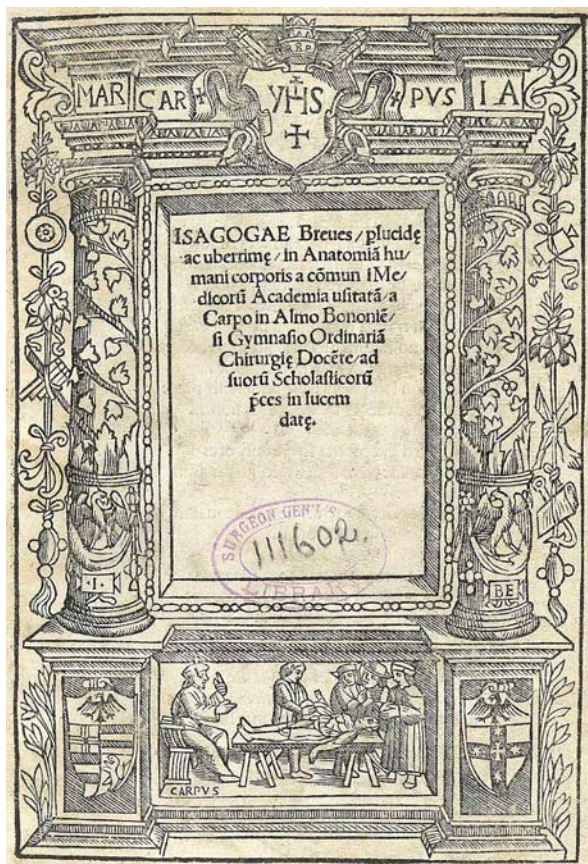


Fig. 3. "Anatomia Carpi, Isagogae breves". Source: http://www.nlm.nih.gov/exhibition/historicalanatomies/berengario_home.html Historical Anatomies on the Web

The same year professor Fallopius from Padua sent a written request to the emperor for permission to dissect cadavers of the executed.

In Padua, professor Alessandro Benedetti (ca. 1460-1525), built a transportable "theatrum anatomicum" (using wooden panels and stable elements) in which he was performing autopsies which resulted in a description of several cases of cholelithiasis and some other pathologies.

In the meantime another silent revolution took place. At the beginning of the 16th century Berengario da Carpi, professor of the University of Bologna, was one of the first who personally performed over 100 autopsies but with a changed routine. Before him, the autopsy was performed not to learn from, but in order to find descriptions read by the lecturer sitting above from e.g. "Anatomia" by Mondinus (not minding the autopsy itself at all), and correlate them with in situ findings. Carpi knew that to learn meant to observe during an autopsy. Thus, he published first a commentary on Anatomia Mondini in 1521 and later his manual "Anatomia Carpi, Isagogae breves" was printed in Venice in 1535. It is mentioned that he was the first to describe processus vermiformis [12, 13].

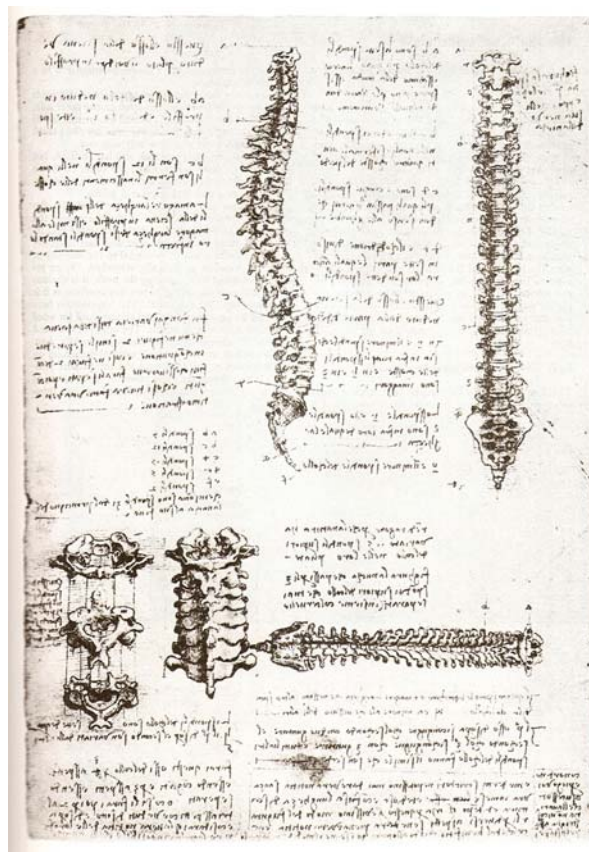


Fig. 4. Skeleton from da Vinci's sketchbook. Source: Ch. O'Malley and J.B. de C.M. Saunders. Leonardo da Vinci on the Human Body. Reprint 2003. Gramercy Books. p. 42

At the same time illustrious Leonardo da Vinci (1452-1519) lived. Among all his interests the knowledge of human body and its anatomy resulted from observation of the living nature as well as post mortem. He was acquainted with Alessandro Benedetti and Marco Antonio della Torre, professor of anatomy in Pavia [10]. We have documents proving that at least 35 autopsies were performed by him personally. For example he described in detail cardiac valves and the mechanism of their work. He was also the first to describe atherosclerotic changes in blood vessels in elderly people. Despite his great gift of observation, Leonardo believed Galen and others on many occasions, which resulted in several obvious mistakes. His sketches and drawings showed human anatomy with great accuracy in the areas that were accessible to the artist. But some, like "pores in interventricular sept", after Galen, remained erroneous.

Antonio Benivieni (1443-1502) from Florence performed over 100 autopsies. He declared that the necropsy had to be done in order to find "not the secret, but hidden cause of death" [14]. His later notes and thorough descriptions of interesting cases, very similar to present autopsy protocols, were prepared to be published. Unfortunately, his friend

Rosati managed to do already in 1507, five years after Benivieni's death, with the title of the work *De Abditis Morborum Causis* ("The Hidden Causes of Disease") which is now considered one of the first works in anatomopathology [14].

In the meantime in northern Europe, Brussels, in 1514 Andreas Vesalius (1514-1564) was born. Sent for studies to Jacques Sylvius, a great supporter of Galen, Vesalius quickly showed a great talent for anatomy. He performed many autopsies finding many errors in Galen's works. Accidentally when performing an autopsy of the ape he found many correlations with his great predecessor's papers. It resulted in a conclusion that Galen never dissected a human body, and all his findings were based on comparisons with animals. Working on his "*De humani corporis fabrica libri septem*" he did not hesitate to steal cadavers to perform autopsies at home. In his book, wonderful drawings by Calcar, a student of Titian, were used. But in some of them we can see an erroneous position of the skeleton e.g. in "The skeleton in reverie", p. 164, we can see a straight vertebral column and improper position of the pelvis, which clearly proves that he could not have relied on Leonardo's sketches as some authors suggest [15, 16].

Summary

During this time physicians and scientists, fighting with obstacles of a philosophical or religious nature, were gaining general knowledge of the human body. Autopsies performed revealed more and more details previously hidden from the eye. But still it was the time when most were satisfied with the autopsy itself or finding parallels with acknowledged writings, very rarely thinking about anomalies or pathologies. Though it is impossible that forensic examiners did not observe and find those pathologies, and many of them wrote about them, still in the majority it was not the general aim. The next step to fully comprehend the result of an autopsy was to be taken in later years and centuries.

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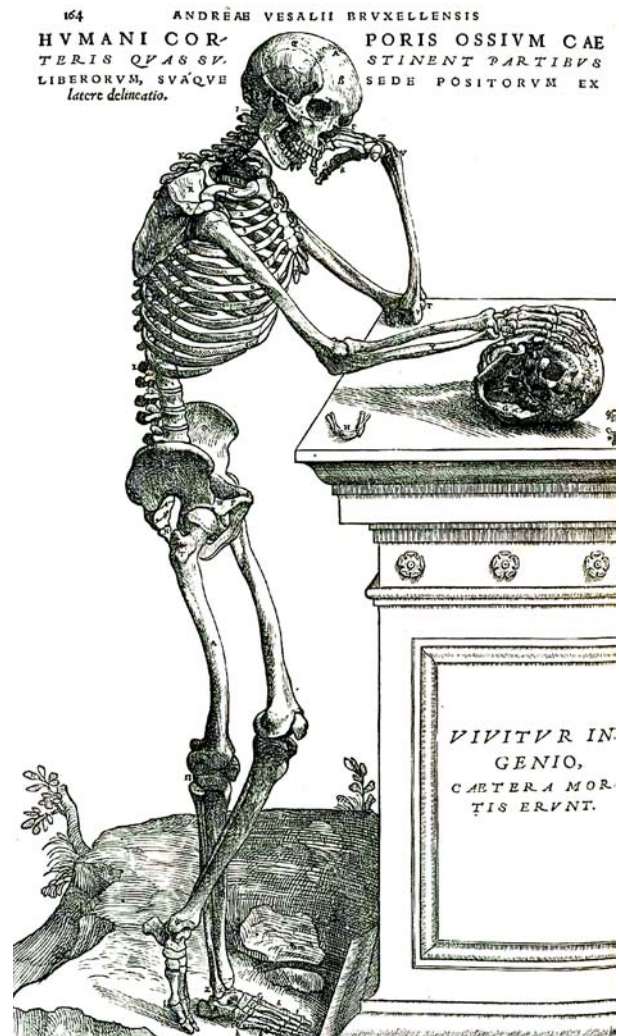


Fig. 5. "The skeleton in reverie" from Vesalius' "Fabrica". Source:

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