

SHORT HISTORY OF THE AUTOPSY: PART II

FROM THE SECOND HALF OF THE 16TH CENTURY TO CONTEMPORARY TIMES

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We present the second part of our review concerning the history of autopsy. During the development of medicine the role of autopsy was obviously changing. Concurrently with the progress in the anatomical knowledge, the anatomists observed and noted both single anomalies and repetitive changes which correlated with symptoms in living patients. This is how anatomopathology came into being. We present the most famous people engaged in autopsy comprehension. We discuss main trends and ideas influencing the phenomenon of autopsy in the analyzed period: from sporadic public dissections, through *theatra anatomica*, introduction of autopsy to the hospital medicine and separation of anatomopathology as a medical speciality. The golden age of autopsy was the 19th century and the first half of the 20th century, with a consecutive decline in frequency. Nevertheless, despite the progress in diagnostics *in vivo*, it seems that autopsy will keep its important place in medicine according to the old motto “*Mortui vivos docent*” (the dead teach the living).

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

Introduction

The history of anatomopathology is mostly the history of discoveries made during autopsies which allowed to correlate the post mortem findings in body including affected organs with the medical history of the patient, the symptoms and functional disorders. The history of autopsy reveals how observation and interpretation depend on the attitude toward death and the dead.

In the second part of our work we will concentrate mainly on Europe. Since the Vesalian times in the 16th century, European anatomists have had an opportunity to perform autopsies, often open to public, not only to show, but to teach and learn as well. The rules of the “performance” were clearly put in

“*Historia Corporis Humani, sive Anatomice*” by Alessandro Benedetti (1450-1512) mentioned in the first part of our work. As a civilised man, he did not recommend opening living bodies “as only barbarians do so”. The men of science could perform an autopsy on cadavers in order to explore the secrets of nature. The bodies should be carefully selected to make proper material for autopsy, but also to let the observers have a good view. The spectators should sit around a table according to the social status and prestige but giving enough space for the obducent to work. The autopsies should be performed preferably in winter as low temperatures prevent the body from quick decomposition [1].

Even though Vesalius openly pointed out to over 200 errors in Galen’s works, still there were many

lessons of the ancient scientist he and many others fully accepted [2, 3].

The anatomical knowledge increased fast, though. The monographies concerning “case-reports” written after autopsies performed became more and more frequent. The so-called hospital medicine was a great opportunity for open minds, when the physician having many patients observed the symptoms in the living, and during autopsy compared them with anatomical or pathological findings. This correlation yielded enormous progress in the next centuries [4].

Vesalius’ successors

Miguel Serveto (1511-1553), physician and theologian, studied medicine in Paris at Sylvius’ and was

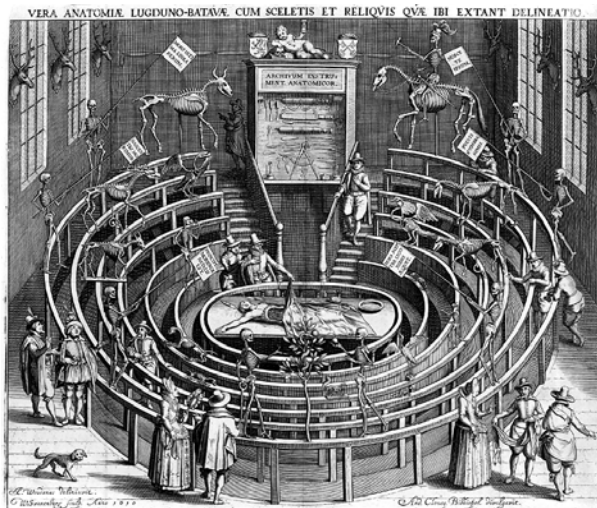


Fig. 1. Theatrum anatomicum in Leiden 1610

Source: http://www.en.wikipedia.org/wiki/File:Anatomical_theatre_Leiden.jpg



Fig 2. Anatomical theatre in Padua (1594), reconstruction

Source: <http://de.wikipedia.org/w/index.php?title=Datei:Tb%C3%A9%C3%A2tre-anatomique-Padoue.JPG&filetimestamp=20080515134120>

also described as one of the most talented assistants in dissections. It is probably then, when he found out small circulation which he decided to describe in a published work. Unfortunately Serveto was burnt at the stake along with his books, both medical and religious, sentenced to death by the Holy Inquisition. But in 1559, Realdo Colombo, student of Vesalius, later a professor of anatomy at the University of Padua, in his book “De re anatomica”, described small circulation confirming it on animal circulation as well [2].

In the 16th century Padua was the capital of anatomy in Europe. Hieronymus (Giolamo) Fabricius ab Aquapendente (1537-1619), successor of Gabriel Fallopius (1523-1562) author of “Observationes anatomicae” (1561) was another on a long list of great anatomists working and publishing at the Padua University. Thanks to his great reputation as a professor, he attracted many students from all over Europe. In 1594, he built the first permanent theatre in the world designed especially for public anatomical dissections. It was in use until 1872. The theatre itself was also a marvel of construction. It consisted of six concentric galleries with a capacity for 300 people who could stand not more than 30 feet from the dissected body (Fig. 2). By the way, in 1597 a similar one was created in Leiden, Netherlands, in 1648 – in Frankfurt am Oder, and in 1650 – in Altdorf, both in Germany. In the second half of the 18th century, Wrocław, Poland also had its theatre, with the inscription “Dla dobra chirurgii i prowincji” (“For the benefit of surgery and the province”) [2].

Fabricius, after almost 40 years of teaching and practicing medicine, spent his last 20 years publishing. In “De Visione, Voce, Auditu” (1600), he discussed the anatomy and physiology of senses. In the same year he wrote the first work in the Renaissance on embryology and developmental anatomy, “De Formato Foetu” (1600), which laid foundations for those sciences [5].

One of Fabricius’ favourite students was William Harvey (1578-1657) of Folkestone. During this time they both developed a firm friendship. After graduation Harvey returned to England. As a Fellow of the College of Physicians he worked in St Bartholomew Hospital and in 1616 he started working on appointment of a lecturer to Lumleian Office. He was travelling around England giving lectures and performing autopsies in public [6]. Harvey created his own theories and he discovered more secrets of the circulatory system. But as he wrote in the “Motives for Writing” in the preface to his great work “The Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus”: “I found the task so truly arduous, so full of difficulties, I was almost tempted to think, [...] that the motion of the heart was only to be comprehended by God.” [7]. Harvey understood

that the autopsy was pivotal in anatomical knowledge and to compare clinical observations with post mortem findings was more than important. While dissecting, he laid out canons of the work, among which we can read: “To show as much as may be at a glance, the whole belly for instance, and afterwards to subdivide the parts according to their positions and relations; not to praise or dispraise other anatomists, for all did well, and there was some excuse even for those who are in error; to state things briefly and plainly, yet not letting anything pass unmentioned which can be seen; to allot a definite time to each part of the body (i.e. first day’s lectures dedicated to the abdomen, the second to the thorax, the third to the brain and so on)” [6].

In 1592, Daniel Bucretius, also known as Rindfleisch, performed one of the first public forensic autopsy on a courtyard of the Wrocław Town Hall [2]. He was the anatomist, who published “De humani corporis fabrica libri decem” by Spigelius (Adriaan van de Spiegel 1578-1616) along with 78 copperplate engravings created by Giulio Cesare Casseri (1552-1616) purchased from Casseri’s heirs. Casseri was the successor after Fabricius for the chair in surgery and anatomy at the University of Padua.

In 1613, the first public foetal autopsy in central and northern Europe was performed in Gdańsk, Poland. Adam Joachim Olhavius (1570-1630), professor and lecturer of Atheneum Gedanense (1603-1630), sectioned a malformed foetus. The result was published in print in the same year. It was probably the first public autopsy in northern and middle Europe [8]. Educated in Padua Olhavius transferred procedures of public autopsies to Poland. His interest in pathology (mainly foetal, but not only) affected doctor Johann Adam Kulmus (1689-1745). His experience in anatomy and surgery resulted in “Tabulae anatomicae” printed in 1722 in Gdańsk, a treaty illustrated by the author himself. Later on it became so popular that it was translated to seven languages with many reprints in Europe, but first of this kind in Japan in 1774 (Kaitai Shinsho). It is said that it was the milestone which triggered the medical development in Japan, despite its political and geographic isolation. Johann Kulmus still has a very important place in history of development of Japanese medicine up to now [8-10].

The 17th century in medicine was a new era – empiric and experimental with modern scientific attitude. The next European scientist who had a great contribution to the development of anatomy and anatomopathology was Marcelo Malpighi (1628-1694), a professor and lecturer at the University of Bologna. Completing the work of Harvey, he added the function and anatomy of lungs in the process of oxygenation of blood. In his works he also pointed out that to advance anatomy it should be

based on dissection of cadavers. He also indicated the importance of observation of clinical cases in life, but the lesions of internal organs post mortem as well [11, 12].

Meanwhile, in 1679, “Sepulchretum sive anatomia practica ex cadaveribus morbo denatis” by Teophilus Bonnetus (Teophile Bonet of Neuchatel) was published in print. This vast review covered about 3000 autopsies representing some 450 authors from Galen to contemporaries. Some of the cases were described in just a few lines, the others even on a folio page. The second edition in 1700 consisted of three big volumes [4]. At the same time other scientists devoted to anatomy, started to report the anomalies and pathological lesions of the organs. They observed and noted them separately, not as previously as “lusus naturae” or “error loci”. Giovanni Maria Lancisi (1654-1720) in a book published posthumously “De motu cordis et aneurysmatibus” (1728), described clearly pathologies like aneurysms or cardiac syphilitic changes, but also put the first classification of heart diseases [11, 12].

At the same time in Amsterdam, Nicolaes Tulp (1593-1674) lived. This great politician and the Mayor of the City for several terms, was a graduate of the famous University of Leiden and became a most respected physician. In 1628, Tulp was appointed Praelector Anatomiae at the Amsterdam Guild of Surgeons, where one of his duties was to dissect hanged victims in public. The procedure could be performed only on male criminals previously considered outside the Church. The interesting thing was that spectators had to pay for attendance, and money gathered were spent later on a public supper for themselves. Thanks to young Rembrandt van Rijn, who won the commission of a group portrait of the Guild members we can admire the famous painting “The Anatomy Lesson of Dr Tulp” (Fig. 3).



Fig. 3. “The Anatomy Lesson of Dr Tulp” Rembrandt van Rijn, 1632

Source: http://commons.wikimedia.org/wiki/File:The_Anatomy_Lesson.jpg



Fig. 4. "The Anatomy Lesson of Dr Frederic Ruysch" Jan van Neck, 1683

Source: http://en.wikipedia.org/wiki/File:De_anatomische_les_van_Dr._Frederick_Ruysch.jpg

Another important person to be mentioned is Frederic Ruysch (1638-1731). He also graduated from the Leiden University, though he started his career in pharmacy, but fascinated by anatomy he soon became personally interested in dissections. As the corpses were very scarce and hard to obtain, he got involved in finding out the way to prepare and preserve organs. Thanks to this, it was his dioramas and "Museum of Curiosities" that made him famous in the whole Europe, rather than his anatomical findings. He was portrayed as Praelector Anatomiae on a painting by Jan van Neck (Fig. 4).

His ability to prepare and preserve (with secret methods known only to him) different pathologies, anomalies, as well as the way to exhibit them, made him the first to create the private museum of anatomopathology. His first collection was bought as a whole by the Russian Emperor, Peter the Great, who made it the base for Kunstkamera in Sankt Petersburg, where part of it can be still seen. The second collection went to the Polish and Saxon king, August the Strong [13]. Such collections and museums started to be created throughout Europe and some of them still exist and function.

In the 18th century, autopsies, at least in "private" cases required expressed separate permission. On the other hand, patients dying in hospitals or victims of violence could be dissected at colleges without permission, but primarily for the benefit of anatomy students [4]. This time autopsies became often, though the procedures and interpretation varied in different areas. The next great contributor to anatomopathology was Hermann Boerhaave (1668-1738) who published two monographs on autopsy. He put great emphasis on the history of the patient, but being very rationalistic he attended the autopsy with prior concepts trying to find the confirmation of the diagnosis corresponding with clinical symptoms. When

found, the autopsy was no longer performed [4, 12]. However, Gianbattista (Giovannbattista) Morgani (1682-1771) was the one who moved anatomopathology to new courses. He avoided any speculations made a priori. Basing on the clinical data, he was looking for any pathological symptoms that might contribute to either confirmation or expansion of the diagnosis. He collected all pathological findings, which when isolated seemed irrelevant, but combined with other details, and often analyzed in groups, resulted in a completely new point of view on many diseases [4]. This was the first attempt to show conclusively existence of definite correlations between clinical symptoms and anatomical findings.

Xavier Bichat (1771-1802) in his short scientific life managed to combine preclinical and clinical aspects of medicine. His interest in anatomy and pathology went side by side with interest in the living patient. He distinguished 21 different kinds of tissues in the body without microscope, basing on dissections and physical and chemical procedures. In his work published posthumously we can read: "We should dissect in anatomy, experiment in physiology, follow the disease and make the necropsy in medicine; this is the threefold path, without which there can be no anatomist, no physiologist, no physician". He was sure that secrets of health and disease lay within the tissues of the body itself [4].

At about the same time William (1718-1783) and John Hunter (1728-1793) in Scotland, along with their nephew Matthew Baillie (1761-1823) as well, all extraordinary physicians were collecting specimens. Baillie wrote the first systematic textbook of pathology in 1793. He is credited with first identification of transposition of great vessels and situs inversus.

In Paris, Jean Nicolas Corvisart (1755-1821), the physician of Napoleon Bonaparte, performed autopsies in the Charité hospital, paying specific attention to cardiac pathology and published many volumes on his cases. Yet not all physicians subscribed to the usefulness of autopsies. Thomas Sydenham, called the English Hippocrates, decried the procedure preferring bedside observations as more useful.

In the 19th century the acceleration of the progress in industry also had some impact on education and science. The development meant also specialization and medicine was involved too. At the beginning of the 19th century, dissection rooms appeared in most bigger hospitals, firstly in Europe, later on other continents. At the same time anatomopathology was introduced as the basis for diagnostics and nosology. The clinicians defined disease entities more clearly, discovered new diseases, observed timing of pathological events. Parallel progress in physiology and chemistry and development of the microscope revolutionized anatomy and

pathology. In 1819, the University of Strasbourg established the first separate Institute of Pathology and Georg Lobstein was the first professor there.

Microscopy since its discovery by Loewenhoeck (ca 1677) was for a long time only a research and academic subject. However in 1844 Bennett wrote that gross pathology is no longer sufficient in advance of science, “has limitations and should be accomplished with microscopical exam” [4].

In the second half of the 19th century, being the golden age for autopsy and anatomopathology, two scientists made an absolutely incomparable contribution [2, 3, 4]. They were Karl Rokitansky and Rudolph Virchow. Their approach to post mortem examination, both on levels of anatomy and later histology, set the directions for contemporary science. While Rokitansky was responsible for making pathology an independent branch of medicine, it was Virchow who made it a scientific and essential aspect of medicine. Karl Rokitansky (1804-1878) was one of most capable gross pathologists in medicine. Professor and dean of the University of Vienna, very studious in his work as he allegedly performed 30 000 autopsies and had access to several thousand others for review. He used to warn young scientists that “the patient is a conscious and free-willing subject” and basing on it they can follow their urge toward knowledge. The feeling of humanity would be lost if physicians regarded human beings purely as research objects [4, 14]. His “Handbuch der pathologischen Anatomie”, published between 1842 and 1846, later translated into many languages, was a work that far surpassed previous texts of the time, and became a manual which set some still useful standards to the work of gross pathologists. His approach to performing autopsies usually without any knowledge of the clinical record had its advantages, but may well have been the beginning of the belief that pathologists live in ivory towers.

The second scientist and even more influential, called “the father of pathology” (or even “pope of pathology” [16]) Rudolf Virchow (1821-1902) born in Schivelbein (now Świdwin, Poland), graduated from the Berlin University, where he studied medicine and chemistry. He entered the world of pathology while microscopy was already settled. Nevertheless, he became an outstanding contributor to the basic and cellular theories of pathology. He also published a small book in 1876 which dealt with the autopsy technique. One of the most important changes was that earlier a clinical doctor stated which organs were affected by the disease and the autopsy was mostly confined to this area. Virchow urged that all organs were to be examined, so the autopsy usually lasted at least three hours [4, 16, 17]. His enormous impact on autopsy art can be exemplified by the fact that still one of two methods

of brain sections is called after him. Interested not only in medicine but also anthropology and archaeology, he created an enormous collection of scientific specimens. His motto “No day without a specimen” resulted in anatomic and pathological museum which possessed 1500 exhibits when started, but reached over 19 000 objects in 1890. His successors expanded it to 26 000 before World War II. Its scant remnants (after World War II, when Berlin was heavily bombed, and the fire of the museum in 1950) have grown again to about 10 000 specimens [www.bmm.charite.de].

This popularization of practicing of autopsy in clinics widespread through Europe. In the first half of the 19th century in Vilnius and Cracow, later in other university centres anatomopathology separated from anatomy and clinics becoming a new and important separate branch. In 1851 at the Cracow Jagiellonian University Professor Józef Dietl (1804–1878) wrote three sets of lectures based on autopsy reports, which became the basis for first Polish manual “Pathological Anatomy” by Nikodem Bętkowski (1812-1864) published in Cracow in 1852 [2]. Anatomopathology was also developing outside Europe and we have to note Francis Delafield, an American, who published in 1872 “A handbook of postmortem examination and morbid anatomy” which not only gave directions of how to proceed with the autopsy, but also discussed some principal pathological findings as well [4].

Ludwik Paszkiewicz, great Polish pathologist, who published the first Polish manual about 1890 “Technika sekcji zwłok” (“The technique of autopsy”) with 297 figures, was the former student of a well known anatomist, professor Zygmunt Laskowski. Paszkiewicz had also personal input in the conservation of anatomical exhibits publishing “O utrwalaniu i przechowywaniu preparatów anatomicznych z utrzymaniem ich barwy naturalnej” (“Treaty about how to preserve and store anatomical preparations with their natural colour maintained”).

The role of autopsy in the clinics increased even more when Richard C. Cabot (1868-1939) in his infamous publication in 1910 [18] proved that autopsies can detect misdiagnoses showing discrepancies between pre- and postmortem diagnoses. This, along with the Flexner Report published in the same year, criticized the state of medical education in the USA and was responsible for increasing the rate of autopsies in the USA. In fact, the reputation of an American hospital in the early 20th century was often judged by its autopsy rate.

In the 1980s the rate of autopsies in Western Europe decreased considerably partly because of development of other imaging methods and partly due to reluctance of families and regulations allowing it. The teaching, along with the development of

digital techniques, more often used plates, slides, digital and virtual models.

A query similar to Flexner's was made again at the beginning of the 21st century [19, 20] showing that the autopsies still play a major role in learning and an increased rate of the autopsies performed in the hospitals is related to the diminished rate of major clinical diagnostic errors. Basing on this, the return to the idea of importance and need of autopsy appeared again. What is more, even now there is a growing need for more complete answers in autopsy reports [19-22].

There are still medical specialities which are irrespectively connected with autopsy, namely forensic medicine, cardiac pathology, perinatal pathology and neuropathology. Nowadays the autopsy has many dimensions – gross-, micro- sometimes even radiologic autopsy or microbiological one, but more often a new one is mentioned – molecular autopsy [19-21]. Autopsy could be directed towards emerging infections, aging processes, neuroscience and metabolic disorders, but also environmental poisons, occupational disorders, and changes in disease patterns due to surgical procedures, drug actions and their side-effects [22-24]. Vital epidemiological statistics may be assessed only through autopsy-related data and this has a great impact on public health monitoring [22, 25, 26]. Autopsies assist in genetic counselling and still help in the identification of familial and inherited disorders. Last but not least, various tissues for transplantation, qualification a person as an organ donor and scientific work may be obtained just during necropsy as well [23, 24]. Finally, autopsies most often help to eliminate suspicion, provide reassurance to families. What is more important, they provide facts rather than hypotheses, usually giving definitive answers. They may also provide better medico-legal defence when required [21, 22, 24].

We have to keep in mind, however, that anatomy and pathology did not affect physicians only. Artists benefited from the knowledge of the human body, painting and sculpting figures that started to resemble real life. Then, they moved forward and painted the autopsy itself presenting the opened body. Still human, yet motionless and soulless at the moment. In the 17th and 18th century in Florence and Bologna, artists like Gaetano Zumbo, Ercole Lelli, Giovanni Manzolini and his wife Anna Morandi used to make wax models of human bodies and organs, later painted to give them a natural look. They served as a three-dimensional aid for medicine students, more realistic and detailed, but also spatial – opposite to two-dimensional drawings, no matter how precise [27]. Ruysch decided to use cadavers as models and works of art, putting them in poses while spectators could walk around

and among them. This is somehow what Gunther von Hagens is nowadays trying to copy in his so controversial body plastination – The Body World [28]. Other artists use the procedure of autopsy and anatomy as a knowledge to get inside the things that are not human, yet around human beings all the time.

Summary

The role of the autopsy in its long history was changing [28]. The body sectioning was obviously pivotal for anatomy development but later on it gave rise to anatomopathology. Autopsy became a widely used medical routine procedure in the second half of the 19th century. The contribution of autopsies to modern medicine can help not only in proper diagnosing and in medical education, but also in evaluation of contemporary clinical procedures [23, 29]. The incidence of autopsies varies worldwide, most often depending not only on religious attitudes, superstitions, but also nationality, legislation and other social factors [18, 26]. The general belief that the contribution of autopsy to science is less important now than before, was corrected by data showing that the incidence of gross error in diagnosis, which contributes to death or illness in patients, has remained roughly the same over decades [20, 24, 25]. So the words written in an anatomical theatre in Padua (Fig. 2), but also in many other autopsy rooms remain true and valid *Hic locus est ubi mors gaudet succurrere vitae* – “This is the place where death delights to help the living”.

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