

Autopsy marks on anthropological material contributing to research on history of anatomy in Poland

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Summary:

In this publication on the development of anatomical studies in Poland we used anthropological (from archeological excavation sites in Poland) as well as written sources. Bone material found in our region bears signs of removal (sawing off) of the cranial vault. It is difficult to determine whether these autopsies were judicial or anatomopathological. Few of such skulls were examined, but there is data indicating that post-mortem examinations were commenced in the late middle Ages. They were probably not public, as such autopsies have been conducted in Poland since the 17th century. Doctors and barbers were undoubtedly curious what the human body holds. Anatomical textbooks from the middle Ages showed how to conduct an autopsy. Most skeletons with traces of post-mortem examination are dated to modern times, period of greatest development of surgery and anatomopathology itself. The need for anatomical studies for scientific as well as didactic purposes has been noted since renaissance.

Key words: anthropology, anatomopathology, anatomical studies, history of medicine, post-mortem examinations.

Human body, physique and functions of specific organs have been the subject of interest for doctors and philosophers since antiquity. Initially, in prehistoric times, people involved in therapeutics could acquire anatomical knowledge during management of companions' wounds and traumatic injuries. Such information can be also obtained from the corpses of hunted animals. By observing animal anatomy, the hunters concluded that a human must be built in a similar fashion [1].

In the ancient Egypt, internal organs were removed from the body using special tools during mummification. However, ancient Egyptians' knowledge on the location of organs in a human body was rather ritual and they did not take advantage of it during treatment. It was

mainly supposed to preserve the body, so that the deceased Pharaoh or other official could use it after death [2].

Alcmaeon of Croton (4th century B.C.) stated, that philosophical considerations are not sufficient to understand anatomy and post-mortem examinations are necessary. He performed animal autopsies. Based on his observations, he came to a conclusion that all thoughts and impressions are formed in the brain.

Rapid development of anatomical studies occurred in the 3rd century B.C. in Alexandria, which became the focus of the scientific world in the ancient times. Autopsies as well as vivisections were conducted on convicts. Two famous

anatomists-doctors, Herophilus and Erasistratos, worked there.

In the Roman world, autopsies of human remains were prohibited due to ethnic and religious reasons. Anatomy known from the writings of Galen (a doctor, who lived in the 2nd century A.D.) is that of animals: pigs and apes.

In the Middle Ages, knowledge of anatomy was based on schematic pictures and writings by Hippocrates and Galen. A papal or royal permission was required for performing an autopsy. A human being was considered a microcosmos — reflection of the surrounding macrocosmos [4].

Thanks to artists, painters and sculptors, interest in human physique increased during renaissance. In the history of medicine, the 16th century is known as a “century of anatomists.” In 1543, Andreas Vesalius published his work: *De humani corporis fabrica libri septem*, where he pointed out two hundred of Galen’s errors. This date is considered the border between medieval and modern anatomy. Vesalius’ drawings portray the skeletal, cardiovascular systems and musculature, with the corpse depicted in a vertical position instead of lying down on the examination table [5].

At the turn of the 15th and 16th century the first anatomical theaters are created in Padua, Montpellier and Basil. They were particularly numerous in the 17th century.

In this publication, based on anthropological data (acquired from archeological excavation sites), we will try to demonstrate how anatomical studies developed in the region of Poland and when they were commenced. We will try to compare these data with written sources. Traces of post-mortem examinations found on the skulls and other parts of the skeleton prove that barbers and doctors were interested in how a human being is built.

Skulls found during archeological excavations with openings encompassing the entire or almost entire skull vaults are examples of probable post-mortem examinations. We possess several such skulls from Poland, but most of them are not precisely dated. It is difficult to unequivocally assess whether these autopsies were anatomopathological or judicial.

Names of the medics appear for the first time in the written sources from 13th century. There were 25 medics and physicians noted during that time. Wroclaw was the greatest medical center of the 13th century. There are several doctors from this city mentioned in the published documents. There were also doctors in Cracow, Legnica and Poznan. The number of qualified medics increased in the 14th century. Written sources list doctors in Cracow, Wroclaw, Glogow, Bytom, Gniezno, Wloclawek as well as in Pomerania. Physicians focused around princely and bishops’ courts, as well as Jagiellonian University in the 15th century [6].

In the 14th century, the first post-mortem examinations were performed in Italy: Padua, Venice, Florence and in France: Montpellier. In renaissance, many artists, including Leonardo da Vinci, were interested in studies on human anatomy. His biographers report that he witnessed autopsies in the Santa Maria Novella hospital and perhaps performed some of them personally. He undertook the trouble to study all stages of human development, beginning with infancy and ending with senescence. He described the skeletal, cardiovascular, nervous systems and musculature [7].

According to the written sources, the first known public autopsy in Poland was performed in 1613 in a village called Pruszcz, located near Gdansk, on a deformed newborn baby. In the 16th century, a gymnasium in Gdansk was the only place where regular lectures on anatomy took place. In 1580, a separate chair of anatomy and medicine was formed in Gdansk [8]. The first autopsy was performed at the Jagiellonian University in Cracow by Rafal Jozef Czerwiakowski in 18th century [9]. Thus, written data indicate that post-mortem examinations were first performed in Poland at the turn of 17th and 18th century.

The first skull to be discussed was found in Opole, in a cemetery dated to the 14th century. Articles by prof. Adam Paluch describe it as a trepanation skull [10, 11]. However, it stands out between other trepanation skulls due to orifice dimensions and technique of its execution. This opening is particularly wide and was performed after death. The skull was found during excavations in the Opole Market Square and its features

indicate male sex of the deceased. Unfortunately, no postcranial skeleton was found [12].

A large bone fragment was removed posthumously from the skull: a fragment of coronal suture (coronal suture forms a border of the orifice, suture pattern is visible at the superior margin), part of the right parietal bone and a large fragment of left occipital bone, reaching all the way to the left temporal bone. Opening encompasses almost entire sagittal suture (a fragment of sagittal suture is visible as it joins with lambdoid suture) and has the following dimensions: 102x94mm (external lamina) and 95x84mm (internal lamina). Possibly, such large skull fragment was removed for bone amulets or a drinking goblet (such practice was known in the Middle Ages and previous eras). Thus, this procedure was performed after persons' death for magical reasons. In Middle Ages, bones of the dead and pieces of their clothing were often used for magical or therapeutic purposes. They were used for bewitchments. We can present an example of such procedure from Lithuania, where four female skulls (14th-16th century) were found with round orifices performed posthumously. Bone fragments serving as amulets were acquired this way [13]. There is a suspicion that in folk medicine, human skull grated into powder, served with food or drinks, was considered treatment for some ailments [14].

There is also another possible explanation. Such large opening was done in order to look inside the human head and curiosity was the reason for post-mortem examination. The margin of the orifice is uneven and jagged, particularly on the right side, while the inferior orifice margin is evenly filed off. Part of calvaria was probably removed using a saw (sharp and smooth) and the bone was broken at the coronal suture.

A canon from Opole, master Pawel, who served as a town physician in 1261, was mentioned in published documents [15]. Opole lies near Wroclaw, which in the Middle Ages was the focus of qualified physicians. The doctors acknowledged in written sources practiced in Cracow, Bytom and Glogow in the 14th century. Names of doctors who practiced in Silesia were also preserved: Tomasz — the titular Bishop of Serepta, Jan of Grodkow, Jan of Glogau. There were two centers

of development of Polish medicine in the 14th-15th century – Cracow and Wroclaw [9].

The second skull in question (also containing a large opening) comes from the St. Nicholas Church in Torun. Skeletons found during archeological excavations are dated to 14th and 18th century. A large, oval fragment of calvaria, including a fragment of left and right parietal bones and posterior part of frontal bone were removed from a male skull. Body of the sternum was also cut with a sharp instrument, which may be an evidence of attempted removal of internal organs [16]. The person performing the autopsy was probably not very experienced in such maneuvers. Orifice margins are quite even, thus a sharp tool with a smooth blade was possibly used and tool marks are visible on the edges of the opening. Superior part of the skull (entire cranial vault) was sawn off, while the posterior portion of frontal bone lamina was broken off. In this case, the resected bone was found together with the skull and only the fragment of broken off frontal bone is lacking. The 15th century documents mention a doctor who practiced in the region of Torun. This autopsy may be also related to the activity of the Academic Gymnasium in Torun, which offered anatomy lectures. This facility was created in the 16th century, but its development falls on the period of 17th century.

Similar skulls from 16th and 18th century bearing traces of autopsies (the superior part of calvaria was also removed) were discovered at the excavation site in Holy Spirit in Brzesc Kujawski (Kujawsko-Pomorskie Province). There were a total of 5 such skulls excavated at cemeteries near the hospital and the church. An iron saw was probably used here to remove calvaria [17]. Functioning of the first hospital in Brzesc is dated to 13th-14th century. Medieval hospitals functioned mainly as shelters, taking care of the poor and ill travelers. With time, since renaissance, they gained increasingly more medical character.

Another skull, which is an example of post-mortem examination, was dug out from a cemetery in Dabrowna (Warmia and Mazury Province) dated to 14th-17th century. It belonged to an adult male. Calvaria was removed (part of frontal bone, large fragments of parietal bones, part of occipital bone) using a metal saw — the cut ran over the

supraorbital arches. Bones were not broken off in this case [18].

Three skeletons found in a cemetery in Sandomierz dated to the end of 18th and mid-19th century also wore the signs of post-mortem examinations, as indicated by the marks found on skulls – cut-off cranial vaults as well as rib cuts (thoracic cavity was opened in this fashion). The poor and the homeless who died in the hospital or in prison were buried in this cemetery [19]. In such cases autopsy could be performed in order to identify the cause of death (when it was difficult to determine it otherwise – such autopsies were judicial) or to train future doctors. These autopsies could be related to the activity of the provincial physician in Sandomierz or the Jagiellonian University.

Three skulls with removed calvarias were found during rescue works conducted in the cemetery in Wrocław, which was used from the 2nd half to the end of 19th century. Due to poorly preserved material, it is difficult to draw more precise conclusions with regard to these remains [20]. Hospital care has been developing in Wrocław since medieval times. In the 19th century, some of Wrocław hospitals contained autopsy rooms [21, 22]. Anatomopathological studies developed particularly rapidly during this period. History of Faculty of Medicine in Wrocław reaches the beginnings of 19th century; therefore these autopsies could be didactic in character.

Openings in the skulls collected in Toruń, Brzesk Kujawski and Dąbrowna are similar in shapes; similar autopsy techniques were used here with cranial vaults likely removed using a saw. Skulls found at the two latter sites have calvarias removed above the supraorbital arches. In case of the skull found in Opole, this procedure was conducted carelessly and the orifice is asymmetric. Skulls found in Toruń and Dąbrowna bear cutting marks at the bone edges, indicating little experience of the operator. Skulls from Opole and Toruń bear signs of broken off bone fragments. Since there were hospitals in Brzesk Kujawski and Dąbrowna, they could constitute sources of anatomical knowledge but it is also possible that these autopsies were judicial.

In the surgical school in Boulogne post-mortem examinations were conducted as early as in 13th

century. Anatomy handbook by professor of medicine, Mondina de Luizzi (1270-1326) from Boulogne, became the fundamental literature used for teaching anatomy and autopsies were performed based on it. Mondina de Luizzi conducted the first autopsy in the presence of students in 1315 on the corpse of a woman condemned to death. His publication does not resemble modern anatomy handbooks, which describe specific organs. It is rather a guide to performing a post-mortem examination and gaining access to the organs of the abdomen, thoracic cavity and head [23]. One of the illustrations from a book “Anathomia” by Guido da Vigevano (1280-1349) from 1345 depicts a doctor performing an autopsy and opening the skull. He removes the skull vault by making an incision above supraorbital arches, through parietal bones and occipital bone. He uses a knife (perhaps a kind of chisel) and a hammer. He hits the end of the knife with a hammer in order to remove the superior portion of the skull [24]. Interestingly, the corpse is depicted in a vertical, not horizontal position (as in the later work by Vesalius). Six of eighteen illustrations from this handbook concern neuroanatomy. Frontal and sagittal sutures are shown on the skull; dura mater and brain are also revealed. Guido da Vigevano probably did not distinguish the arachnoid in his studies [23].

Such autopsy technique described in this handbook had to be widespread. Skulls from Toruń, Dąbrowna and Brzesk Kujawski bear signs of autopsies conducted in such manner, although the last incision ran throughout the entire head, from supraorbital arches, through parietal bones to the occiput. On the skulls from Opole and Toruń, incisions were made along coronal suture or by the posterior part of frontal bone lamina and do not pass through occipital bone. This technique was also used in the skull from Opole, but symmetry was not preserved while cutting off the cranial vault.

It is worth noting that anthropological material bearing signs of autopsy was also found during excavations in other European countries. Material from England is most often dated to 18th and 19th century and comes from cemeteries located by shelters and hospitals for the poor as well as cemeteries located near medical schools. Bodies of criminals were often subjected to post-mortem examinations. Signs of autopsies were noted on

the skulls (removed calvaria), ribs, clavicles and vertebral bodies.

Bone marks indicate that autopsies were performed in order to establish the cause of death, but also served the purpose of educating future doctors. For example, limb amputations were practiced on cadavers. Autopsies were conducted on female, male cadavers, but also on bodies of children and fetuses. There is a lot of anthropological material from 18th and 19th century London showing that autopsies were frequent at that time [25].

Italian anatomist, Giovanni Battista Morgagni (1682-1771) thought that it is a duty of a doctor to perform post-mortem examinations of his patients. He supposed that disease is localized in a particular organ [4].

Great development of anatomical studies occurred from the second half of 20th century, as indicated by anthropological excavation data as well as written sources. This fact is related to progress in the field of surgery and anatomopathology itself. General anesthesia and introduction of antiseptics and aseptics to operating rooms, improved hemostasis led the surgeons to broaden the range of procedures and advance deeper into human tissues. The significance of anatomopathological studies in clinical medicine was also emphasized. Doctors linked disease symptoms they saw in their patients with anatomopathological picture seen on an autopsy table. Therefore, post-mortem examinations were supposed to be a way to explain pathological changes. Karl von Rokitansky (1804-1878), a Czech who co-created the new Viennese school also known as anatomopathology school in the history of medicine, had great contributions to pathological anatomy [4, 26].

Modern medical textbooks pertaining to the issue of post-mortem examinations also describe cranial opening. Soft tissues should be first separated: skin, dense connective tissue layer, tendinous cap of the epicranial muscle, loose connective tissue layer and periosteum of calvaria. Incision runs about 2.5 cm above the superior margin of the orbit and posteriorly about 1 cm above the external occipital tuberosity. External lamina is cut with a saw and separated from the diploe using a chisel. External and internal

lamina can be also simultaneously cut with an oscillation saw [27]. Therefore, in the medieval times soft tissues also had to be removed before uncovering the bone. Saws and chisels were used for cutting bones.

Autopsy techniques evolved together with the progress of medical sciences. Particularly the 19th century is related to development of post-mortem examinations. During that time, Rudolf Virchow (1821-1902) — the creator of cellular pathology — and previously mentioned Karl Rokitansky (1804-1878) exerted great influence on the examination technique [28].

Medical historians also use art for their studies. In the 17th century, many painters depicted doctors performing autopsies. The painting by Rembrandt “The Anatomy Lesson of Dr Joan Deyman” (1656) depicts a medic performing an autopsy of human brain using a scalpel. An assistant standing to the right of doctor Joan Deyman holds calvaria, removed (sawn-off) in order to uncover the brain. We find signs of such procedures in anthropological material. Unfortunately, only the middle portion of the painting remained, while three quarters of it was burnt in the anatomical theater fire [29, 30].

Osteologic data suggest that autopsies were commenced in Poland during late Middle Ages. They were not public. Material acquired from historical cemeteries indicates (we analyzed six archeological sites for the purpose of this publication) that sections were carried out earlier than suggested by written sources. However, development of anatomical studies in Poland as well as in other European countries falls on 18th and 19th century. Possibly, cadavers for the autopsy came from cemeteries by the hospitals and churches. First autopsies resulted from scientists’ curiosity, need to search for the cause of the disease and death. Didactics played a smaller role.

At the turn of Middle Ages and renaissance as well as in renaissance, people began to realize the necessity of performing anatomical studies for educational purposes. Until 18th century, public autopsies excited emotions from both municipal and church officials and they usually involved convicts’ bodies. Cadavers for anatomopathologic autopsies could come from warfare, they could belong to the homeless, prisoners

or victims of epidemics. However, acquiring cadavers for autopsies without school's approval was not easy.

Judicial autopsies were quite superficial. They were conducted by surgeons (with guild education) under supervision of medical doctors. Skulls bearing signs of autopsy from the region

of Poland are dated from the 14th until 19th century, i.e. from Middle Ages until modern times. Anatomy and its teachings came a long way during that time. In the Middle Ages, people still based on the teachings of Galen. Beginning with renaissance, judicial as well as anatomopathological autopsies provided increasingly more knowledge on human physique.

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