From history of proctology

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SUMMARY

The authors of this paper presented the key moments in the development of proctology, a medical discipline which is an integral part of surgery, whose development path was inseparable from the historical development of operational medicine. Even in the ancient Egypt, proctology was an important branch of medicine. Out of eight of so far known medical papyri in the history of proctology, the most important one is the Beatty`s (Chester Beatty) papyrus from the 13th century BC, which is actually a short monograph on diseases of the anus and their treatment. In the ancient period, operative proctology reached the highest level in the time of Hippocrates. In detail, and with special care, the operative procedures of the large intestine, primarily perianal fistula and hemorrhoids were described in the Hippocratic writings. One of the most famous Roman medical writers, Celsus (Cornelius Celsus Asullus) described the surgery of hemorrhoids by their ligature and the surgery of anorectal fistula in two ways: ligation of the fistula channel by string of raw flax and fistula incision through the probe placed through the fistula channel. Doctors of the 18th and the 19th century introduced into practice some more complicated surgical procedures in the treatment of anorectal diseases. The French surgeons were the leaders. In 1710, Littré performed, for the first time, anus praeter naturalis and Jacques Lisfranc (1790-1847) pioneered the method of perineal resection of the rectum for cancer. The first rectoscope was constructed in 1895 and in 1903 it was introduced into practice by Kelly (Kelly Howard Atwood). A sudden progress in the diagnosis and treatment of anorectal diseases occurred after the Second World War and the trend has continued to this day.

Key words: *History of Medicine; Colorectal Surgery; Anus Diseases; Rectal Diseases; Rectal Fistula; Hemorrhoids*

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Proctology, as a medical discipline, is an integral part of surgery and its development path was associated with the historical development of operational medicine.

ANCIENT EGYPTIAN MEDICINE

Even in the ancient Egypt, proctology was an important branch of medicine, which is confirmed by archaeological and written historical sources. The reason for this was the climate along the Nile river, which was abounded with different parasites, especially intestinal parasites, which caused the widespread diseases of the digestive organs, including the final part of the colon. It was therefore not surprising that the pharaohs, in addition to other doctors in their service, had special doctors for that part of their body. This was confirmed in 1926 by a stone slab which had been found by the German archaeologist Hermann Junker in one of the tombs in Giza, near the pyramids of kings Cheops, Khafre and Menkaure of the fourth dynasty (2723–2563 BC). The slab is showing a person for whom the hieroglyphic record, when it was deciphered, discovered that it was Iry, „the chief court physician, ophthalmologist and the guardian of the king's anus" („*...pharaoh's Guardian of the anus*").

For the study of ancient Egyptian medicine, the most important are *ancient medical papyri* written between the years 3000 and 1200 BC. Until now, eight medical papyri were discovered, two of which are the most important, Ebers`, regarding internal medicine and Smith's surgical papyrus. In a therapeutic part of the *Ebers' papyrus*, plant medicines are mentioned, mineral and animal products for indoor and outdoor use. In addition to various coverings and fats, such as lard with acacia leaves against hemorrhoid pain, the most significant is the cleanser (castor oil, different medication enema, etc.). Moreover, until the late Roman era, a legend circulated that the Egyptian doctors first discovered and introduced into medical practice one of the most practiced therapeutic procedures against the accumulation of feces in the lower digestive tract, *bowel flush, i.e. enema*, which they learned from the *bird ibis (god Toth)*, a permanent resident of the coastal areas of the Nile river. The Egyptians believed that by standing in the Nile, the bird ibis introduced water into the rectum with its long beak thereby flushing the final part of the colon. God Toth held an important position among the Egyptian deities related to medicine, and was presented in the form of the bird ibis (1–3).

The ancient Egyptians paid great attention to hygiene, and within the framework of the hygiene measures, in addition to control of water and food, sexual hygiene, removal of feces and other procedures, they recommended regular taking of preventive purgative drugs during three days of each month, with the aim of digestion regulation, which was considered one of the main factors of health.

The Smiths' (Edwin Smith) surgical papyrus, in addition to description of different bandages and the correct treatment of wounds also described methods of hemostasis by cauter application, which was used in the treatment of hemorrhoids.

Out of eight of so far known medical papyri in the history of proctology, the most important one is the *Beatty`s papyrus* which was copied in the 13th century BC according to the older original and published in 1935. It is kept in the British Museum in London, where it was donated by the British Egyptologist Chester Beatty. The whole papyrus is actually a short monograph of the diseases of the anus and their treatment (4, 5).

ANCIENT INDIAN MEDICINE

Surgery as a discipline was strongly present and advanced in ancient Indian Ayurvedic medicine. One of the most significant ancient Indian

medical writers was *Sushruta*. No one knows exactly when, but it is believed that he had lived before and during the first years of our era. He wrote a medical book, a collection (samhita), which covered the whole of medicine, and a special place was occupied by surgery. In addition to amputation, lithotomy, rhinoplasty, hernia surgery, the Sushruta section titled *„Sushruta Samhita"* speaks about the perianal fistulas and their treatment by burning with hot iron (cauterization), and pulling the fibers soaked with plant alkaloids that destroy callus tissue of fistula and encourage fresh growth of granulation tissue („Ksharasutra therapy") (6–8).

ANCIENT GREEK HIPPOCRATIC MEDICINE

In the ancient period, operative proctology, as well as the entire surgery, reached their highest level in *the time of Hippocrates* (460–377 BC). In detail, and with special care, the operative procedures of the large intestine, primarily perianal fistula and hemorrhoids were described in the Hippocratic writings. Although most surgeries were carried out with a knife, Hippocratic physicians used cauter primarily for burning piles, and open blood vessels for hemostasis.

Fistula surgeries were carried out by Hippocratic school doctors by pulling of the linen threads through the fistula using a tin probe, with its gradual tightening, which led to cutting of the fistula, followed by a skin excision and ligation of the fistula channel. In addition to this surgery procedure, the Hippocratic school doctors introduced into the medical practice a chemical cauterisation of fistula, which was performed in several ways: by burning sulfur powder over an open fistula as described above, during five to seven days, by pulling of the linen thread fiber, wrapped like a wick soaked with the spurge juice and sprinkled with sulfur powder into the fistula channel, which was left for five days, as well as by injection into the fistula channel of sulfur and saltpeter myrrh powder, dissolved in the urine with a special bubble. Before the injection of the mixture, the probe was placed into the opening of fistula, which showed the way and facilitated the injection.

Hippocrates also treated hemorrhoids in two ways. More frequently he performed cauterization with hot iron, which he described as follows: „Anus is pushes by fingers out as much as possible, the metal is glowed and hemorrhoid nodes are burned until they are dry ... During incineration, the patient is held by the head and the hands so as not to move, but it was possible for him to cry, which was desirable, because thus, the intestine better moved outside". The second procedure was based on a combination of a surgery and chemical cauterization. Resection of hemorrhoid nodes was performed after their previous ligation, which was followed by placing of medical chemicals which cause shrinkage and erosion, such as fats and suppositories of cones, alum, copper flower, vitriol and other. The healing occurred after drying hemorrhoids by these agents (4, 6, 9).

ANCIENT ROMAN MEDICINE

It is known that the Romans had a warrior-conquering politics, thus making surgery an important medical discipline in the ancient Rome. However, in addition to treatment of war wounds and injuries, Roman doctors were involved in peacetime surgery, which was brought to Rome by Greek doctors. There were also some medical writers. One of the most prominent was Celsus (Aullus Cornelius Celsus). He lived in the first half of the first century and was a Roman patrician, although almost all prominent Roman physicians, including the great Galen, were of Greek origin. Celsus had high general education, including medical, and wrote a great scientific *encyclopedia „Artes"*, of which only a small part of its medical content was saved, where he described the entire medical knowledge of the time, even surgery. Although he was not a doctor, Celsus, in his work, showed extensive medical knowledge and independence of judgment regarding medical problems. He was the first to describe four main symptoms of inflammation (tumor, rubor, calor, and dolor). Among other things, he described the operation of hemorrhoids by ligature and fistula surgery in two ways: ligature and incision. In the first case, a raw linen thread runs through the entire length of the fistula, which was tightened a little bit every day. When you wanted a quicker healing, the thread was tightened more often with moisturizing by the medical agents that cause erosion. In the other mode of perianal fistula treatment, Celsus advised fistula incision through the probe passing through the fistula channel, with leaving of the skin flap in the middle, below which the thread was to be placed, while on the right and the left from it, some smaller skin incisions were made (4, 6).

The greatest Roman physician and one of the greatest physicians of all time, *Galen*, was the first to describe anatomically the anus muscles. Fistulas were treated by pulling out the pus from fistula channel with a syringe and needle and then tamping by medical agents for healing. He was also known as the inventor of *„syringotom"* used for fistula incision.

BYSANTINE MEDICINE

Since the Byzantine medicine was a direct continuation of the Greco-Roman medicine, it is worth mentioning a handful of doctors and medical writers, who, in their works, expressed experiences of Hippocrates, Galen, Celsus and other famous ancient physicians, supplemented by their experiences and emphasized the advantages and disadvantages of certain medical and surgical procedures of ancient medicine.

Oreibasios of Pergamon (325–400), a personal physician and friend of the Emperor Julian the Apostate described in his monumental medical encyclopedia of 70 books, among other things, a surgical treatment of perianal fistulas, in a way that it had been performed in the second century by Greek physicians Antyllus and Helyodorus. Through the probe pulled through the fistula channel, which showed the direction of fistula, the skin and the subcutaneous tissue incision was performed, and then the remaining callus tissue was excisioned. As a complication of this surgery, even then, Oreibasios mentioned incontinence, which may occur if the anal sphincter had been cut off completely by negligence.

A court physician of the Emperor Justinian *Aetios Amidenos* (500–570) performed the hemorrhoids' surgery by pulling out the hemorrhoid nodes extra-anally by the special hooks, which were then cut, tied and cut off. Anal fistulas were incised, callus mass removed by excision and the wound filled with incense.

The last representative of the Greco-Byzantine medicine, before flourishing of the Arab medicine, *Aegineta Paulos*, (625–690), who lived in

Alexandria and stayed there even after the arrival of the Arabs, incised the perianal fistulas by a curved knife, running it through the fistula channel. He also warned the surgeons to avoid cutting the anal sphincter when performing this surgery, because of the risk of alvi incontinence (6, 10, 11).

ARABIC MEDICINE

The legacy of Greco-Roman medicine was taken over by the Arabs from the Byzantine physicians, when in the 7th century they occupied the Mediterranean. They complemented and enhanced it with their own experiences, saved it and reported it to Western Europe, where medicine continued its development during the Renaissance. Beside advances in therapy, introduction of many new drugs, the beginnings of pharmacy, improvement of dietary science and ophthalmology, as well as the establishment of the first hospital, a great contribution to the progress of surgery was given by the Arab doctors. As they did not use a knife in surgery, they performed almost all surgical procedures with cauter, except amputation. The most famous Arab surgeon *Abul Qasim* (Abu al-Qasim az-Zahrawi, died in 1013), in his encyclopedic work *„Al Tasrif"*, which was mostly devoted to surgery, described a large number of surgical procedures. He speaks extensively about how to use cauter to stop the bleeding, the sewing of wounds, treatment of fractures and dislocations, obstetric, eye and other surgeries. Penetrating perianal fistulas are cured by Abul Qasim by cauter, which ran through the entire length of the fistula channel, while a complete fistula was excised below the sphincter, after which the styptic tampons were pulled into the fistula channel, and ligation of the fistula was done in accordance with the Hippocratic method. Fistulas that ended up in the urinary bladder or pelvic joints were considered incurable by Abul Qasim.

A statement that the Arab doctors seriously dealt with anorectal surgery is supported by the fact that *Rhazes* (Abu Bakr Mohammad Ibn Zakariya al Razi) (865–923), one of the most famous Arab physician and one of the most recognized clinicians of middle ages, among other things, wrote a discussion on treatment of fistulas. The most famous Arab physician and one of the greatest physicians of all time, *Avicenna* (Abu Ali al Husain ibn Abdallah ibn Sina) (980–1037), in the first book of his *„Canon" („Canon medicinae")*, described the anatomy of the anal sphincter and explained his procedure in the surgical treatment of perianal fistulas by using the silk thread for their ligature. In 1465, a book appeared in the Arabic language, edited by *Sharaf ed Din* and illustrated with over 140 drawings that showed the procedures of the treatment of many different diseases, including the treatment of anorectal diseases with hot iron (4, 6, 9).

MEDICINE IN MEDIEVAL EUROPE

Europe's oldest medical schools were founded in Italy, first at Salerno, then in Bologna and Padua, and in France, in Montpellier and Paris. Although universities were primarily used for training of doctors-physics, scientific surgery was also nurtured there, which, among others, dealt with the surgical treatment of anorectal diseases. *The Master Roger of Palermo*, a student and later a professor of Salerno Medical School, in his book *„Practica chirurgiae"*, published in 1170, described the treatment of perianal fistulas in two ways: by fistula ligation with horse hair and destruction of the fistula channel with „Unguentum ruptorium", which consisted of soap and quicklime. Later, one of the most famous professors of the Bologna Faculty of Medicine, *Mondino de Luzzi* (1270–1316) and one of the founders of the School of Medicine in Padua, *Pietro D'Abano*, also wrote about the treatment of anorectal disorders (4, 6).

It can be concluded that the teachings of the Western school of medicine had an impact on the Serbian medieval medicine because of the content of texts of the „therapeutic collections" of old Serbian medicine („Hilandar Medical Code", „Hodok Code", etc.), for which it was proved that were written on the basis of the Salerno medical school. Among other things, the anorectal disorders and their treatment were discussed in these collections. Thus, for example, the „Hodok code" provided guidance for the treatment of a prolapsed rectum ("Jegda komu izlazi črevo prohodno", meaning "the one who has a movable intestine") as follows: „Si prežde izmivaj s vinom toplijem, po tom imei sija gotova: plževu ljusku izdeženu i rastrenu jako brašno i smesiv s belim timjanom i posipuj črevo" (Prior to reposition of a prolapsed intestine, it is advised to rinse with warm wine and to sprinkle with powdered snail shells mixed with incense) (12, 13).

At the end of the 13th century, *Henry de Mondeville* (1260–1320) and *Lanfranco de Milan* (died around 1300), conveyed Italian surgical experiences to France, and soon, the French surgery took a leading role in Europe. The Paris surgeons formed a special guild organization in the 13th century, „The Brotherhood of St. Cosmas and Damian" which greatly contributed to the reputation of surgeons. In the 17th and the 18th century, it assumed a form of some kind of a surgical faculty and became a rival of Medical Faculty in Paris. *Guy de Chauliac* (1300–1368), a student of Montpelier, the most famous surgeon of the 14th century and the pope's personal physician in Avignon, was well familiar with the methods of the Arabian treatment of anorectal diseases. He healed the fistulas by hot knife incision and ligation so that after pulling in of the linen thread, he used to cut off the tissue covering the fabric with the curved knife, and when the thread was thus freed, the wound would heal per secundam.

A great French surgeon and renaissance surgery reformer *Ambroise Paré* (1510–1592) treated the perianal fistulas with threaded horse hair. This thread was infiltrated with a probe, which had a thread hole at the top. If he would encounter an obstacle of the callus tissue during the puling in of the thread, in order to remove it, he would place in a thin knife along the probe which was cutting of the callus tissue and thus paved the way for the probe (4, 6).

Surgical treatment of anal fistulas was the specialty of the 14th century British surgeon *John Arderne* (d. 1377). He gained great popularity as a skilled surgeon who has successfully performed, for that period, difficult and dangerous, and even lethal surgical procedures. He cut off a fistula by a special syringotom, with four threads previously pulled in through the probe with a head at its tip. This is the method described in the book *„The Practice of fistula in ano"* printed in London in 1588, in which he presented the instruments he used and constructed. A copy of the original manuscript of the book, which was written in 1348, is kept in the British Museum in London. He also performed phlebotomies, and he was also an astrologer (6, 14, 15).

The reform of the anatomy, which was started in Bologna, reached its full swing at the University of Padua.

MEDICINE IN RENAISSANCE

The Renaissance reformer of anatomy, first a student, then a professor at the University of Padua, *Andreas Vesalius* (1514–1564), in his monumental work „De humani corporis fabrica", first described the technique of dissection of the final part of the colon. In addition, he described the external anal sphincter, and two muscles, anal levators.

Girolamo Fabrizio ab Acquapendente (1533–1619), an anatomy professor at Padua, also did the surgery. In his book *„Opera Chirurgica"* he described anal fistulas and their treatment, and supported the surgical methods of Celsus, which he slightly modified. A linen thread was replaced by a „dark red silk, which holds stronger and has a better grasp with hard and late decaying." Then he described two types of syringotom: one that was spiky and the other for penetrating fistulas, which had a rounded top, with the small ball. In addition, he also was responsible for the invention of modified syringotom, as well as some other proctologic instruments. He was an opponent to fistulas' ligation, believing that such treatment is too painful and too long. Some consider him „the greatest proctologist of renaissance" (4, 6).

MEDICINE IN EUROPE FROM 17TH TO 19TH CENTURY

From the 16th to the 19th century, surgery was continually evolving. The development of techniques and improvement of social position of the surgeons was accompanied by improvement of surgical methods, construction of new instruments and the discovery of new surgical procedures. The development of surgery was contributed by the advances in our understanding of normal and pathological anatomy. The founder of pathological anatomy *Giovanni Battista Morgagni* (1682–1771) described the anatomy of the anal canal and the elements that are crucial for the development and therapeutic treatment of hemorrhoid disease: jagged line and the anal crypts. He was the first one to explain that the cause of hemorrhoid disease is an upright position of a man. In addition to the description of a series of pathoanatomical changes at different organs, he described the changes occurring in rectal cancer (3, 4).

In the book *„Traite de la fistula del anus" („Treatment of perianal fistula")*, which was published in 1689, a French surgeon, *Louis le Monnier* described three types of surgeries of perianal fistulas: fistula ligation with the linen thread, which he did not apply „because it is painful and the treatment is too long", then red-hot burning of fistulas, which also he did not apply deeming it „terrible", while he advocated the incision of fistula channel by a curved knife. Fistula incision was the method of choice of a French surgeon *Pierre Dionis*, who pointed to its advantages over the other methods at the course of operative surgery, held in Paris, in the Jardin Royal in 1707. He opposed the use of the medical means which erode, as well as ligation, which is painful and lasts over several weeks, while „incision, truly causes pain, but it does not last long" (6, 16).

The treatment of the perianal fistula of the Sun King, Louis XIV, can serve as curiosity in the history of proctology. After the king's chief physician Aquin tried all conservative methods of treatment without success and described the whole procedure in detail in his „Diary of health of King Louis XIV," the king, angry with his doctors, decided to have an incision. The surgery was performed by the method of Fabricio Aquapendente in the salon „Oeil de Boeuf" at Versailles. The incision was performed by a special curved knife and the scars and adhesions were removed with scissors. The healing occurred only after the surgeons Felix and Besieres performed three consecutive surgical procedures in one year (January 15th, 1686, December 1st, 1686 and January 1st, 1687). King's healing brought misfortune to the palace musician Jean Lulli. He hurt his foot by conductor's baton at the ceremony that was staged in honor of the king's recovery. However, being distrustful of the doctors, Lulli confided the treatment of his foot to some kind of a quack and died of secondary infection and consequent sepsis two months after the ceremony. Operation of Louis XIV which consisted of incision and removal of callus masses was applied for the treatment of perianal fistulas for a long time. However, because attitudes regarding their surgical treatment changed over time, in the 18th century, a famous French surgeon *Pierre Joseph Desault* brought back ligation into use, because of the risk of bleeding after the incision (6, 9).

DEVELOPMENT OF PROCTOLOGY IN MODERN MEDICINE

In the 19th century, particularly the French dealt with anorectal disorders. Thus, in 1826, *Jacques Lisfranc* (1790–1847), a famous French surgeon, *Dupuytren* student and a professor of surgery in Paris first described a new method performed on perineal resection of the rectum due to cancer. *Johann Friedrich Diefenbach* tried to perform a resection of the rectum in Berlin in 1840 (4,6), and even in 1750, an English surgeon *William Cheselden* (1688–1752) recommended resection for rectal prolapse, while *Dupuytren* combined resection and cauterization. Guillaume Dupuytren (1777–1835) was known for a successful treatment of hemorrhoids of Napoleon Bonaparte (9, 17).

Anus praeter naturalis (a colostomy) was performed for the first time in 1710 by the French anatomist and surgeon *Alexis Littré* in one case of anal atresia (9, 18).

In the early 19th century, a conservative therapy by drugs for hemorrhoid disease was introduced (suppositories with astringent agents), and in Dublin, in 1860, Morgan was the first to cure hemorrhoids by sclerotherapy, injecting the solution of ferrous sulfate in the nodes. However, in spite of it the surgical procedures did not lose the importance and ligation with excision of hemorrhoid knots was actually a modified method of the classical period. It was performed in many different forms by Langenbeck, Anderson, Milles, and Gabbriella Lockahardt – Mummery. *Conrad Langenbeck* (1810–1887) most usually performed a so-called *„paquellinisation"*. With Paquellin device, he burned the hemorrhoid nodes pulled out by the gripper.

St' Marks Hospital in London became famous in the 19th century as one of the most important centers for the development of modern proctology (6, 9). The first rectoscope was constructed in 1895 and in 1903 it was introduced in practice by an American gynecologist and surgeon, professor of gynecology and obstetrics at Johns Hopkins University, *Howard Atwood Kelly* (1858–1843). Even before him, a French surgeon, *Antoine Jean Desormeaux* (1815–1894), in 1865, presented at the French Academy of Sciences in Paris his endoscope with a built-in light apparatus (Bozzini's

lighter) with a mirror, which was used for examination of the final part of the colon. The occurrence of these inventions, a period of endoscopic diagnosis and therapy in medicine was initiated (19, 20).

A sudden progress in diagnostics and treatment of anorectal diseases occurred after the Second World War and continued to this day. Better conditions, more perfect rectoscopes and rapid progress in all fields of medicine, especially surgery, caused an increasing interest of today's surgeons in anorectal pathology, who choose to deal with this branch of medicine, and to achieve excellent results in this area.

Conflict of interest

We declare no conflicts of interest

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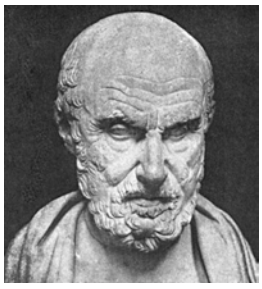
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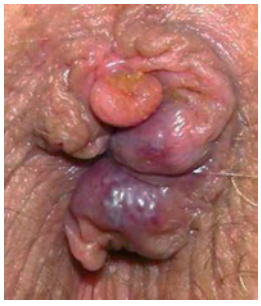
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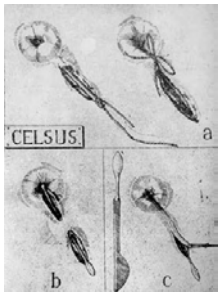

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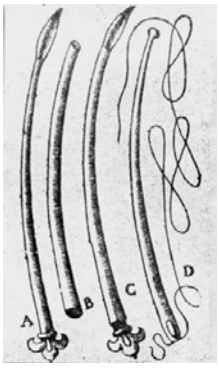
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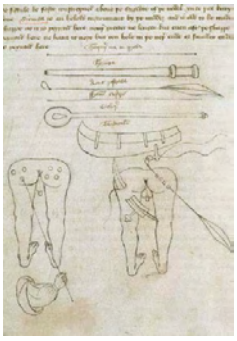
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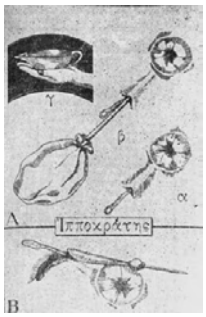

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1. Stele of Iry,the guardian of royal anus, ca 2300 BC; 2. Pharaoh's Guardian of the anus; 3. Bog Thoth u liku ptice ibis; 4. Chester Beatty medical papyrus; 5. Hippocrates (460–377) – British museum; 6. Ancient Greec and Roman rectal speculum; 7. Haemorrhoids; 8. Perianal fistula; 9. Hippocrates fistula operation; 10. Celsus' book; 11. Celsus fistula operation; 12. Abulcasis al Zahrawi – surgical instruments from book Al Tasrif; 13. From book Sharaf ed Din – anorectal examine; 14. Haemorrhoid operation – XI century; 15. Cauterisation in middle age; 16. Ambroise Pare`sinstruments for fistula operation; 17. John Arderne's Medical treatise of fistula; 18. From book by John Ardern – instruments for fistula operation; 19. Hieronymus Fabricius ab Aquapendente (1533–1619); 20. Aquapendente`s book with illustration of rounded syringotomes; 21. Louis le Monnier`s-work of cureing perianal fistulas; 22. Complete rectal prolapse; 23.William Cheselden (1688–1752); 24. Jacques Lisfranc (1790–1847); 25. Guillaume Dupuytren (1777–1835); 26. Bernhard von Langenbeck (1810–1887); 27. Howard Atwood Kelly (1858–1943); 28. Rectoscopic examine by Kelly specula in Sims-attitude; 29. Jean Desormeaux (1815–1894); 30. Desormeaux-endoscope; 31. Anorectal examine – middle age; 32. Chemical cauterisation performed by hippocrates`s