Carl von Rokitansky, the Linné of pathological anatomy

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Abstract

Carl von Rokitansky was one of the most important figures in pathological anatomy, and was largely responsible for the resurgence of Vienna as the great medical center of the world in the mid-19th century. He was born in current Hradec Králové, studied medicine in Prague and Vienna and was graduated in 1828. He was greatly influenced by the anatomy, embryology and pathology studies of Andral, Lobstein and Meckel. At the Vienna School, he was Johann Wagner pathological anatomy assistant and became a pathology professor, where he remained until four years before his death. Rokitansky emphasized the importance of correlating patient symptoms with postmortem changes. It is possible that he had access to between 1,500 and 1,800 cadavers annually to be able to perform 30,000 necropsies; in addition, he reviewed several thousand more autopsies. In *Handbuch der pathologischen Anatomie*, published between 1842 and 1846, he made numerous descriptions: lobar and lobular pneumonia, endocarditis, diseases of the arteries, cysts in several viscera, various neoplasms and acute yellow atrophy of the liver. With his brilliant work on gross pathology, Rokitansky established the nosological classification of diseases, for which Virchow named him “the Linné of pathological anatomy”.

KEY WORDS: Carl von Rokitansky. History of pathology. New Vienna Medical School.

Carl von Rokitansky, el Linneo de la anatomía patológica

Resumen

Carl von Rokitansky fue una de las figuras más importantes en la anatomía patológica y el responsable, en parte, del renacimiento de Viena como centro de la medicina a mediados del siglo XIX. Nació en la actual Hradec Králové, estudió medicina en Praga y Viena y se graduó en 1828. Tuvo gran influencia de los estudios de anatomía, embriología y patología de Andral, Lobstein y Meckel. En la escuela de Viena fue asistente de anatomía patológica de Johann Wagner y se convirtió en profesor de anatomía patológica, donde permaneció hasta cuatro años antes de su muerte. Rokitansky hizo énfasis en correlacionar la sintomatología del enfermo con los cambios post mortem. Es posible que haya tenido acceso a entre 1500 y 1800 cadáveres al año para que pudiera realizar 30 000 necropsias; además, revisó varios miles más de autopsias. En *Handbuch der Pathologischen Anatomie*, publicado entre 1842 y 1846, realizó numerosas descripciones: de la neumonía lobular y lobular, endocarditis, enfermedades de las arterias, quistes en varias vísceras, diversas neoplasias y de la atrofia aguda amarilla del hígado. Con su brillante labor de patología macroscópica, Rokitansky estableció la clasificación nosológica de las enfermedades, por lo cual Virchow lo llamó “el Linneo de la anatomía patológica”.

PALABRAS CLAVE: Carl von Rokitansky. Historia de la patología. Nueva escuela de medicina de Viena.

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*The mediocre teacher tells. The good teacher explains.
The superior teacher demonstrates. The great teacher inspires.*

WILLIAM ARTHUR WARD (1921-1994)

Introduction

Between 1860 and 1910, Vienna became Europe's cultural capital and had a high turnout of talented people, which resulted in an astonishing cultural and intellectual flourishing. Personalities like Freud, Mahler and Klimt, among others, were to be found there.¹ In particular, the knowledge of the human body that Klimt captures in his paintings, was due to the fact that the artist witnessed several dissections in corpses with Rokitansky. Rokitansky, Škoda and von Hebra were the pillars of the so-called "New Vienna School", a world-renowned academic group. Škoda improved clinical diagnostic methods, von Hebra stood out for his diagnostic and therapeutic abilities in dermatology, and Rokitansky's contributions were essential to the development of pathological anatomy.²

By late 19th century, the practice of autopsy was seen with great hostility by the medical community. It would take the untiring work of a remarkable man, Carl Rokitansky, to change the course of medicine thanks to the knowledge he was able to acquire from the study of autopsies. Rokitansky is one of the most important figures in pathological anatomy and played the leading role in an authentic academic revolution by establishing the so-called "new pathological anatomy".³

Rokitansky's life and works

Carl Joseph Wenzl Prokop Rokitansky (in Czech *Karel Rokytanský*, 1804-1878) was born in Königgrätz, today Hradec Králové, current Czech Republic, in house number 42 at the main square near the Cathedral of the Holy Spirit, on whose façade there is a plaque in his honor that was unveiled one year after his death (Fig. 1). Rokitansky went to elementary school in Königgrätz and, at age 14, he moved to Prague to study philosophy at *Univerzita Karlova*, surely attracted owing to the great admiration he had for philosopher and epistemologist Bernard Bolzano (1741-1848), an Immanuel Kant (1724-1804) follower; later, Rokitansky was an admirer of Schopenhauer's philosophy.^{4,5}

In 1821, Rokitansky started his medical education in Prague, where he studied anatomy with Johann Evangelist Purkyně (1787-1869), and completed studies in zoology, mineralogy, botany, physiology, chemistry,

pharmacy, and general pathology.⁶ According to Steiner, Rokitansky was not a brilliant student, since he obtained an "E" grade (excellent) only in the anatomy and theoretical surgery courses.⁴ When he turned 20, and after three years of study in Prague, Rokitansky moved to Vienna arguing that his teachers were not interested in teaching students; in Vienna he found a much more stimulating academic environment. He graduated in medicine in 1828 defending the thesis *De varioloide vaccinica*, which addressed the disease that had been a plague in Europe until the end of the 18th century.^{7,8}

During his medical training, he was particularly interested in the works of Johann F. Lobstein (1777-1835), Friedrich S. Meckel, the younger (1781-1833) and Gabriel Andral (1797-1876), and thus he decided to dedicate himself to pathological anatomy. He did not practice clinical medicine, but interacted with renowned physicians of those days, such as Josef Škoda (1805-1881) and Ferdinand von Hebra (1816-1880), among others (Fig. 2).

A few months prior to completing his undergraduate training, he accepted an unpaid prosector position in the autopsy area (*Leichenhaus*) of the Vienna General Hospital (*Wiener Allgemeines Krankenhaus*). There, he worked with Professor Johann Wagner (1800-1833), whom he helped to perform Beethoven's autopsy, on March 27, 1827.^{5,9} Upon Wagner's premature death in 1832 (he died at 33 years of age from tuberculosis), Rokitansky was appointed associated professor and head of the pathological anatomy department, thus becoming the first full-time pathologist. In 1844, he was appointed professor and head of the Pathological Anatomy Department, and the pathology subject was established in the medical curriculum (the University of Vienna was the second one to establish the Pathological Anatomy professor position; the first one was the University of Strasbourg in 1791). In 1849, he was appointed director of Vienna's Faculty of Medicine; in 1852 he was elected *Rector Magnificus*, and ten years later, he was appointed culture and education medical adviser (*Medizinalreferent*). He was admitted to the Academy of Sciences in 1848, and as of 1850, and for 28 years, he served as president of the Vienna Medical Society. In 1874 he was distinguished with the title of baron (*Freiherr*) (Fig. 3).

Rokitansky's experience in autopsies

The problem of pathological anatomy at the time Rokitansky was starting his professional life was that

Figure 1. Memorial plate that is found at the place where Rokitsansky was born in the city of Hradec Králové, Czech Republic. The text reads: "Karel Rokitsansky was born here on February 19, 1804." This bas-relief was created by Czech sculptor Josef Václav Myslbek (1848-1922) and was unveiled in 1879, one year after Rokitsansky's death.

this discipline was often regarded as unimportant. In those days, explaining anatomical changes in terms of clinical findings was attempted, i.e., anatomical findings were interpreted according to particular clinical data. Famous French physiologist François Magendie (1783-1855) considered that pathological anatomy was of little use and, by 1839, he declared:

... I set but little value on minute examination of the traces left by disease upon organs, though that pursuit has been pompously styled pathological anatomy. The lesions found at our autopsies are frequently produced after death and, consequently, the plan hitherto followed in such inquiries is fallacious, and can only lead to vague information and error...

This is the scenario Rokitsansky was faced with, and perhaps one of the most important contributions of this distinguished pathologist was that he was able to convince, not without considerable academic confrontations, clinicians of those days to accept that clinical observations had to be interpreted based on anatomical findings.²⁻⁴ As Giovanni Battista Morgagni (1682-1771) well had said, symptoms are "the weeping of organs that suffer". Rokitsansky studied morphological alterations and reconstructed the process of

disease, correlating the findings with the symptoms the patient had had in life, and tried to investigate the etiology and pathogenesis of disease, as well as the outcomes of the therapies that were employed. This brought clinicians closer to the autopsy room in order to learn about anatomical lesions, thus establishing the anatomical-clinical correlation and the bases of current anatomopathological sessions. All this generated annoyance among numerous doctors, to the point of demanding for Rokitsansky's license to practice medicine to be revoked.^{10,11}

From 1834 to 1862, Rokitsansky worked in the "old autopsy room" (Fig. 4), a very poorly conditioned place for the work, with poor lighting and bad ventilation (students used to call it "the miserable hut") and, therefore, the quantity and quality of the work carried out under those circumstances is admirable. It was not until 1862, during a medical congress in Vienna, that German doctors strongly criticized the Empire for the conditions of the pitiful facilities Rokitsansky worked in, and, as a consequence of this, the new Institute of Pathology was opened in Vienna months later.¹¹ There, pathological anatomy work was enormous.

Owing to a decree signed in 1753 by Maria Theresa I of Austria (1717-1780), every patient who died at the General Hospital of Vienna was brought to the Institute of Pathology to have an autopsy practiced, and it is therefore highly likely that Rokitsansky had access to nearly 1,800 corpses annually. Rokitsansky performed 30,000 autopsies in his entire life, and there are protocols about this in his own handwriting.^{11,12} In addition, he supervised nearly 40,000 autopsies and, thus, if we consider that he carried out the last autopsy at age 62, and that he began his pathology studies at 23, 30,000 autopsies represent two to three daily autopsies, all 365 days of the year, for 38 years. The first protocol is dated October 23, 1827, and number 30,000 is dated 1866.¹¹⁻¹³ And as if all this work was not enough, he published more than 400 articles and 20 books.

In numerous articles, and in his phenomenal three-volume book entitled *Handbuch der Pathologischen Anatomie*, published in 1842, he showed anatomical findings of various diseases (Fig. 5). He masterfully described numerous anatomical alterations of various medical conditions, such as intestinal obstruction due to internal hernia, acute stomach dilatation, various tumors of the gallbladder and superior mesenteric artery syndrome, and proposed that its cause was an obstruction of the third portion of the

Figure 2. Fifteen members of the Vienna University in 1853. Standing, from left to right: Josef Hyrtl, Karl Ludwig von Sigmund, Josef Redtenbacher, Franz Unger, Carl Haller, Ernst Wilhelm von Brücke, Johann von Oppolzer, Theodor Helm, Ferdinand Ritter von Hebra, Johann Dlauhy. Seated, from left to right: Franz Schuh, Anton von Rosas, Karl von Rokitansky, Josef Skoda, Johann H. G. von Dumreicher. Lithograph by Auguste Prinzhofer (1817-1885). Available at Wellcome Collection website.

Figure 3. A) Carl Rokitansky bust placed on the corridors of the Graz Pathology Department in Vienna (picture taken by the author). **B)** Coat of arms granted to Rokitansky in 1874 when was made Baron (Freiherr).

duodenum due to compression of the mesenteric artery (Rokitansky syndrome).

In the *Handbuch*, Rokitansky was the first one to describe suprahepatic veins obstruction by thrombi in cirrhotic patients, a condition that was subsequently

observed by George Budd (1808-1882) in 1845 and by Hans Chiari (1851-1916) in 1889, which currently is known as Budd-Chiari syndrome.^{6,14} In addition, he described diverticular dilatations of the bladder mucosa (Rokitansky-Aschoff sinuses), acute esophageal

Table 1. Original descriptions and eponyms with Rokitsansky's name

Superior mesenteric artery syndrome (Rokitansky-Wilkie syndrome)	Aortomesenteric clamping due to intermittent compression of the third portion of the duodenum, caused by an anomalous origin of the superior mesenteric artery
Mayer-Rokitansky-Küster-Hauser syndrome	Vaginal agenesis with primary amenorrhea
Rokitansky's diverticulum	Traction diverticulum of the esophagus
Rokitansky's pulmonary stenosis	Pulmonary stenosis. Subaortic septal defect of the aortic right lateral position
Rokitansky-Aschoff sinuses	Invaginations of the mucosa reaching the muscle layer or serosal tissue
Rokitansky-Cushing ulcer	Ulcers that sometimes accompany severe lesions of the central nervous system and affect the esophagus, stomach and duodenum
Rokitansky-Maude Abbott syndrome	Atrioventricular septal defect
Rokitansky nodule (in ovarian teratomas)	Internal nodule composed of mature embryonic tissue (generally tooth) in an ovarian teratomous cyst.
Rokitansky sarcoma (phyllodes sarcoma of the breast)	Phyllodes tumor of the breast
Rokitansky's incision	Incision in the lateral peritoneal reflection to have access to the retroperitoneum
Rokitansky endometriosis	Ovarian endometriosis
Rokitansky's periarteritis nodosa (<i>Diathesis aneurysmatica</i>)	Periarteritis nodosa
Von Rokitsansky's syndrome	Corrected transposition of the great arteries
Lobes of Rokitsansky	Supernumerary lung lobes, with these isolated masses of lung tissue usually being separated both from the tracheobronchial tree and the pulmonary vascular system.
Rokitansky's disease (Budd-Chiari syndrome)	Suprahepatic veins thrombosis

dilatation, acute yellow atrophy of the liver, hepatic infarctions, villonodular synovitis, polyarteritis nodosa, lobar and interstitial pneumonia, tracheal diverticula, spontaneous aortic rupture, pulmonary stenosis (Rokitansky stenosis), various congenital heart malformations, absence of vagina with primary amenorrhea/Müllerian partial agenesis (Mayer-Rokitansky-Küster-Hauser syndrome; Eva Braun, Hitler's wife, possibly had this syndrome),¹⁵ phyllodes tumor of the breast (Rokitansky's cystosarcoma), presence of a tubercle within a cystic ovarian teratoma that projects towards the lumen of the cyst (Rokitansky nodule), which corresponded to adipose tissue, hair, teeth or bone; double uterus, nodular goiter, pleomorphic adenoma of the parotid gland, polycystic ovaries, ovarian endometriosis and uterine adenomyosis; in addition, he made the first description of spondylolysis,¹⁶ among many other contributions³ (Table 1).

Rokitansky also coined the terms "pigmented melanoma", "hamartoma" and "osteoid", and he is attributed metaphorical descriptions such as "coffee ground vomitus" which corresponds to hematemesis, or "pea soup" diarrhea, which occurs in some infectious diarrheas.^{5,17,18}

Figure 4. House where Rokitsansky carried out autopsies. Source: Center for Forensic Medicine, Medical University of Vienna [website]. At: <https://www.meduniwien.ac.at/hp/en/forensic-medicine/general-information/history/>

The *Handbuch* earned Rokitsansky the Austrian Cross of Honor for First Class Science and Art "Litteris et Artibus" (Österreichisches Ehrenkreuz für Wissenschaft und Kunst 1. Klasse "Litteris et Artibus").¹⁹

Another of his extraordinary books was the one published in 1875, entitled *Defects in the septum of the heart* (*Die Defekte der Scheidewände des Herzens*), where he expressed his observations on congenital heart disease and presented his theory on the

Figure 5. Cover of the book *Handbuch der Speziellen Pathologischen Anatomie*, which earned Rokitansky the Austrian Cross of Honor for First Class Science and Art “*Litteris et Artibus*” (Österreichisches Ehrenkreuz für Wissenschaft und Kunst 1. Klasse “*Litteris et Artibus*”).

transposition that derives from the deviation of the aortic septum.²⁰ In addition, Rokitansky demonstrated accurate details of the anatomy of the interatrial and interventricular septum and was the first one to describe the differences between ostium primum and ostium secundum defects. This book represents the complement to *On some of the most important diseases of the arteries* (*Über einige der wichtigsten Krankheiten der Arterien*), which he had published a few years earlier, in 1852.²¹

As regards cancer, he designated as “epithelial cancer” those malignancies in which, upon microscopic examination of some tumors of the skin, lip, scrotum and foreskin, cells that were analogous in all aspects to normal epidermal cells could be identified. Based on this observation, he suggested the epithelial origin of cancer, while other pathologists, including the renowned physician Virchow, mistakenly considered cancer to be of connective tissue origin.

As time passed and his fame increased, Rokitansky acquired numerous assistants who came from various points of Europe. The *Institut für Pathologische* of the Vienna General Hospital, became an important center

of Austrian medicine and left numerous students such as Hans Chiari (1851-1916), Ferdinand von Hebra (1816-1880), Ignác Fülöp Semmelweis (1881-1865), Carl Wedl (1815-1891) (Moritz Kaposi’s teacher), anatomist Josef Engel (1816-1899), and his favorite disciple, Hans Kundrat (1845-1893), who coined the term lymphosarcoma (Kundrat’s disease) and was his successor in the direction of the Pathological Anatomy Laboratory.²²

Of particular interest is the relationship that Rokitansky’s school had with Semmelweis, who was appointed assistant in one of the maternity clinics of the Vienna General Hospital, and it was there where he observed that Rokitansky’s students, after performing autopsies, went to assist deliveries and some women died from puerperal sepsis. He thought that students carried some kind of “rotten material” and the solution was simple; he indicated that all personnel should wash their hands in a chlorine solution prior to examining pregnant women and, thus, almost immediately, mortality became much lower.²²

Going back to Rokitansky’s academic life, noticing that many corpses had no obvious gross anatomic

Figure 6. Some microscopic observations Rokitansky illustrated in his book *Handbuch der Speziellen Pathologischen Anatomie*. **A)** The drawing shows a “colloid metamorphosis” (amyloid) in a patient with paralysis. **B)** Drawing of a histological section of what he called “mammary cystosarcoma”, currently known as phyllodes tumor or Rokitansky’s cystosarcoma.

alterations, he developed the hemato-humoral hypothesis (*Krasenlehre*).¹³ According to it, blood was responsible for the disease process as a result of a lack of balance between fibrin and albumin. When the elements (which he called *blastema*) left the vessels and passed to the interstitium, they had the ability to coagulate and solidify and form tissue components.

Rokitansky was severely criticized by young Virchow (who was then 25 years old).¹³ Rudolf Ludwig Carl Virchow (1821-1902) was not his student, but one of his harshest critics. Rokitansky, attributed the cause of disease to changes in blood proteins’ (fibrin and albumin) chemical properties that resulted from *blastema* local formation, which in turn were transformed into some of the lesions he observed on the autopsy table. For Virchow, despite the admiration he had for Rokitansky, this “hemato-humoral theory” was a tremendous anachronism (*ungeheure Anachronismus*). In his famous review published in December 1846 (in two supplements of the Prussian Medical Journal (*Preussische Medizin-Zeitung*), he blamed him of proposing a theory without scientific evidence. Rokitansky accepted the criticism, and many of the concepts censored by Virchow were modified in the new edition of his book entitled *Lehrbuch der pathologischen Anatomie*, published in 1855.²³

It is true that Rokitansky preferred gross over microscopic examination, but there is a considerable number of microscopic observations that are illustrated in his books (Fig. 6). In his autobiography, he described that he used the microscope mostly when he suspected cancer; however, it is true that he did not give the microscope the same importance Virchow did.⁸

As for his personal life, he was attributed a pessimistic and depressive attitude, with constant financial concerns, which forced him to teach anatomy and pathology private lessons. Adolf Kussmaul (1822-1902) who worked with Rokitansky for some time, described him as sad and melancholic in nature, essentially pessimistic and gloomy, and this was possibly the reason for his fondness for Schopenhauer’s philosophical readings.²⁴ Rokitansky even declared once that...^{4,5,24}

...in animal life, and especially in human life, suffering is much more prevalent than joy, and joy is nothing more than a satisfied desire, a suffering off one’s chest, a denial thereof...

However, other biographers say that this was only a small trait of his personality and that he was basically happy.^{6,10} In 1834, when he turned 30, he married opera singer Maria Anna Weiss, who bequeathed her artistic talent to two of her sons, Hans (1835-1909) and Viktor (1836-1896), while the other two, Karl (1839-1898) and Prokop (1843-1928), became physicians. Actually, the couple had seven children, three of whom died at a young age. Rokitansky used to say, regarding his children that “*die Einen heilen, die Anderen heulen*” (some are healers, the others are howlers). On Sundays, Rokitansky invited his students to his place to have tea and tarts and to be able to talk about various cultural topics and listen to his wife and children sing.^{5,24}

Rokitansky was the first president of the Anthropology Society and, in 1863, he published two essays on university organization (*Zeitfragen, betreffend die Universität, mit besonderer Beziehung auf Medecine* and *Die Conformität der Universitäten mit Rücksicht auf gegenwärtige Österreichische Zustände*), where he expressed his conviction that the university should have

various faculties and that all Austrian universities should have a uniform academic standard, with a dual role of teaching and research.^{5,23} In addition to medical books, Rokitansky wrote essays on the intrinsic value of the mind (1867) and the solidarity of all animal life (1869).^{5,11}

When a party was celebrated for his 70 years of life, the streets of Vienna were adorned, there was music everywhere and several former students came from various parts of Europe to congratulate “father Roki”, as they used to call him. Rokitansky was awarded by the Austrian government a certificate of honor that read “... you are the glory of Austria and an honor of the University...”.⁵

Sir William Osler (1849-1919), called the “father of modern medicine”, was one of the guests at the celebration, who described it as follows:^{11,13}

At the appointed time, there was no room left in the large auditorium... there were numerous people to celebrate the pioneer of modern pathology. At the conclusion of the ceremony, a beautiful bust was unveiled amid the applause of the audience. At least 34 personalities from different parts of Europe were hosted, each one presenting their congratulations... approximately 150 students, all of them with torches and many wearing their university uniforms, walked through the streets of Vienna alluding to the professor's celebration... The inhabitants of the city leaned out of their windows to watch the procession...

Rokitansky declared:

... I have earned such an important place for pathological anatomy in German science that I can designate it as a basis for the science of pathological physiology and as the foundation for research in the sphere of medicine...

Three years after retirement, and afflicted by chronic bronchitis, asthma, chest pain and dyspnea, Rokitansky died at the age of 74, on the morning of July 23, 1878. He is buried in the *Hernalser Friedhof* cemetery in Vienna, where also lie von Hebra and his son Hans.^{24,25} In Mexico City, Rokitansky is painted in the upper left corner, in the second mural Diego Rivera carried out in the auditorium of the National Institute of Cardiology.

Rokitansky is considered the most important personality in the reorientation of medicine in Vienna of the 19th century, and the initiator of modern pathology. It was for all the above that Virchow called him the “Linné of pathological anatomy”.⁵

Conflicts of interest

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