

Johann Otto Leonhardt Heubner and Heubner's Artery – Brief Historical Note

Johann Otto Leonhardt Heubner e a Artéria de Heubner – Breve Nota Histórica

Louise Makarem Oliveira¹
Nícollas Nunes Rabelo²
Vitor Hugo Honorato Pereira²
Neiffer Nunes Rabelo³
Carlos Umberto Pereira⁴

ABSTRACT

Johann Otto Leonhardt Heubner (1843-1926) was an exceptional physician who devoted his work to the Charité Children's Clinic of Berlin University, where he earned the title of "father of German pediatrics". However, Heubner's scientific discoveries were not limited to a specific field. His early research, for instance, focused on anatomical studies of the brain's circulation, and culminated in the description of both Heubner's disease (syphilitic endarteritis) and the recurrent artery of Heubner: a structure of utmost importance to neurosurgeons. This article aims to make a brief history of Heubner and depict some of his most remarkable contributions to medicine.

Key-words: Johann Otto Leonhardt Heubner; Heubner's artery; Neurosurgical history; Recurrent artery of Heubner; Historical note; Bibliography

RESUMO

Johann Otto Leonhardt Heubner (1843-1926) foi um médico excepcional, que dedicou seu trabalho à Clínica Pediátrica do Hospital Universitário Charité, de Berlim, onde ganhou o título de "pai da pediatria alemã". No entanto, as descobertas científicas de Heubner não se limitaram a um único campo. Suas pesquisas iniciais, por exemplo, focaram em estudos anatômicos da circulação cerebral, culminando na descrição tanto da doença de Heubner (endarterite sífilítica), quanto da artéria recorrente de Heubner: uma estrutura de suma importância para neurocirurgiões. Este artigo visa revisar a biografia de Heubner, além de descrever algumas de suas mais valiosas contribuições para a medicina.

Palavras-chave: Johann Otto Leonhardt Heubner; Artéria de Heubner; História da neurocirurgia; Artéria recorrente de Heubner; Nota histórica; Bibliografia



Figure 1. Photograph of Johann Otto Leonhardt Heubner

BRIEF HISTORY

Childhood and Adult Life

Johann Otto Leonhardt Heubner (Figure 1) was born in Mühlthoff, in the State of Saxony, on January 21, 1843. His father's misfortune marked his childhood: Justice Otto Leonhard Heubner was sentenced to death for participating in the Dresden uprising of May, 1849. Despite his father's sentence reduction to a life-term prison, later, a decision revoked as full pardon in 1859. Otto Heubner and his family did not return to their former socioeconomic status and he attended the Royal School in Grimma, a public institution¹.

In 1876, Heubner married Martha Haussner and had two sons and two daughters². Known from his strong-minded personality, Heubner was a fan of both music and

¹ Universidade Federal do Amazonas, School of Medicine, Manaus, AM, Brazil

² Department Neurosurgery of Hospital Santa Casa, Ribeirão Preto, São Paulo, Brazil

³ UniAtenas, School of Medicine, Paracatu, MG, Brazil

⁴ Department of Neurosurgery of FBHC and Neurosurgery Service, Aracaju, Sergipe, Brazil

art, and was also said to be lively and extroverted. While dealing with children, his main patients, the physician usually displayed tenderness². Despite his outstanding case presentations and although always making accurate observations, the doctor was not a popular teacher².

Heubner's work vigorously continued up to 1913, when he retired, being replaced by Adalbert Czerny (1863–1941) and becoming an emeritus professor of pediatrics at the University of Berlin^{2,3}. During the following years, he won several awards. Honoring his 70th birthday, the German Society of Pediatrics, where Heubner was Chairman from 1901 to 1905, established the "Otto Heubner prize" for his contributions to the field⁴. Heubner died on October 17, 1926, at the age of 83, in Loschwitz. In 1999, the pediatric clinics at the Charité were combined and the "Otto Heubner Centre for Paediatrics and Adolescent Medicine" was inaugurated^{2,3}.

Overall Academic Achievements and Contributions

Heubner's medical education took place at the University of Leipzig, ending in 1866, when he took the *examen rigorosum pro licentia et pro venia legendi*⁵. Despite his interest in surgery, Heubner decided to study internal medicine under Carl Reinhold August Wunderlich (1815–1877)⁴. Whilst in his tutelage, the young physician not only improved his examination techniques, but also learned the importance of scientific observation, finishing his dissertation *Über die Unvollständige Reaktion im Choleraanfall* (On Incomplete Reaction to Attacks of Cholera), which earned him a promotion to Privatdozent (private lecturer) in internal medicine, in 1868^{1,5}. In 1873, Heubner was promoted to a full professorship in internal medicine at the University of Leipzig, and three years later he became director of the district polyclinic^{2,3,5}.

Due to the belief that pediatrics should not be an independent academic discipline, the University of Leipzig refused to appoint Heubner as a full professor of such field, in 1896. This refusal led Heubner to accept a full professorship at the Charité Children's Clinic of Berlin University in 1894^{1,5,6}.

At his new workplace, which was then managed by Eduard Heinrich Hensch (1820–1910), the doctor found poor hygiene, limited water availability and a mortality rate that reached 80%^{2,3}. Assisted by the bacteriologist Robert Koch (1843–1910), Heubner started to fight malnutrition and infection². First, the physician, along with the physiologist Max Rubner (1854–1922), created a "nutrition quotient" in order to address

infant feeding^{2,3,4}. The quotient referred to the number of calories kg/day required for patients and led to the notion that caloric intake was age-dependent⁴. Secondly, he combated diphtheria, by supporting the early use of the antitoxin discovered by Emil Behring (1854–1917)^{1,2}. Thirdly, Heubner took an interest in food composition and, in 1892, discovered the relationship between sterilization of milk and infantile scurvy (Barlow's disease)¹. These measures and findings helped to reduce the mortality rate of the clinic to less than 10%². The success earned Heubner the title of first German professor of pediatrics and his clinic started to be known as "Mecca of pediatrics"².

Heubner also played a significant role when it comes to central nervous system infection. He reported the presence of *meningococci* in the cerebrospinal fluid for the first time in a living patient, in 1896, contributing to childhood meningitis comprehension, and published a manuscript on syphilis of the brain in 1870⁷. Although being firstly described in 1868 by Allbutt, syphilitic cerebral endarteritis was named "Heubner's disease" after this doctor's pathological studies, which gave a better insight into the disease^{4,8}.

In 1898, the physician associated the precocious puberty noticed in a boy to a pineal tumor and, between 1903 and 1906, he wrote *Lehrbuch der Kinder heilkunde* which would later become a two-volume publication, for long considered a "contemporary pediatric bible"².

In his article 'On severe digestive insufficiency in children past infancy', published in 1909, Heubner described coeliac disease: a gluten enteropathy also called Heubner-Herter disease¹.

Moreover, Heubner was interested in renal diseases. He was the first to address the solely functional characteristics of orthostatic albuminuria in a girl whose proteinuria disappeared when she lied down^{3,10}.

The physician was additionally responsible for introducing electrocardiography in children in 1908⁴.

Heubner's anatomical studies: Heubner's artery

Ernst Leberecht Wagner (1829–1888), a remarkable pathologist associated with Wunderlich, was responsible for the laboratory in which Heubner conducted his early anatomical investigations, whose cornerstone was cerebrovascular studies. Heubner soon started to question the neuroanatomical descriptions of his time, such as those made by Friedrich Gustav Jakob Henle (1809–1885) and Hubert von Luschka (1820–1875)⁹. Trying to describe

the relation between vascular disease and specific brain regions, he administered 60 injections of Berlin blue solution into 30 cadaveric human brains, thoroughly assessing the course of each artery through a distal to proximal approach, and therefore defining the irrigation area of each arterial branch⁹. About the artery that nowadays bears his name, Heubner wrote in 1872⁹.

His original description was: ‘Artery from the base of the cerebral anterior artery, which lies between the median cerebral artery and the communicating anterior artery, there constantly arises a very small artery, close to the later that provides blood to the head of the corpus striatum.’⁹.

The described vessel is the medial striate artery, which arises from the proximal A2 segment of the anterior cerebral artery in 78% of the cases¹⁰. It can also arise from the same artery’s A1 segment (14%)¹⁰. Less commonly, it can be found at the communicating anterior artery level (8%)¹⁰.

H. F. Aitken, an artist at the Massachusetts General Hospital was the first to call it “Heubner’s artery” in 1909. For five years, Aitken performed thorough cerebral circulation dissections, concluding that Heubner’s descriptions were more precise than those made by Henri Duret (1849–1921) a student of Jean-Martin Charcot (1825–1893) at the Salpetriere Hospital in Paris, who was thought to be the leading authority on cerebral circulation^{11,12}.

Joseph Shellshear, an anatomist at St. Bartholomew’s Hospital in London, was the one who labeled Heubner’s as “recurrent”, in an article published in 1920^{12,13}. It travels caudally until it reaches the perforate substance. Lateral to this artery, the perforating branches of the middle cerebral artery can be found².

Heubner’s artery supplies both the caudate nucleus and the internal capsule. Especially the inferior part of the former and the anterior limb of the later. Thus, occlusions of this structure can lead to caudate-striatal infarction². Anatomical variants include absence and duplication of this vessel^{10,12,14}. However, the frequency of these findings is not defined.

A proper understanding of the anatomy of this artery is of utmost importance for the neurosurgeons, once proximal control of A1 during the clipping of anterior communicating artery aneurysms often requires the dissection of this artery.

Anatomists state that the Heubner’s artery emerges within 2–5mm of the anterior communicating artery, either from the A2 or A1 segment of the anterior cerebral artery^{4,15}. Frequently,

dissection of this artery is necessary to obtain proximal control of the A1 part. The medial striate artery of Heubner arises from the A2 section in 78% of cases. Perlmutter and Rhoton¹⁰ found absence (only on one side) in 2% of cases and duplicated (also only on one side) in 2% of cases. By contrast, Gomes and colleagues¹² found this artery to be absent in 3% of cases and duplicated in 12% of cases.

During the initial retraction of the frontal lobe, the recurrent artery of Heubner is more commonly encountered before the A1 segment, because the medial striate artery of Heubner courses anterior to the A1 section in 60% of cases¹⁰. On average, the diameter of the recurrent artery of Heubner (mean 1 mm, range 0.2–2.9 mm) is approximately one third of the diameter of the A1 segment (mean 2.6 mm)¹⁰. In comparison, the length of the recurrent artery of Heubner (mean 23.4 mm, range 12–33 mm)¹² is on average twice the length of the A1 segment (mean 12.7 mm). The greater length of the recurrent artery of Heubner increases its exposure to injury during surgery. During surgery, Heubner artery may be confused with the orbitofrontal artery, which is typically the second major branch of the A2 segment. The recurrent artery of Heubner is commonly (88%) the largest vessel arising from the proximal 5-mm portion of the A2 part and has an average diameter of 1 mm^{10,18}.

By contrast, the orbitofrontal artery originates on average 5 mm (range 0–15 mm) from the ACoA junction and has an average diameter of 0.9 mm (range 0.4–2 mm)¹⁶. Based on its average diameter alone, the orbitofrontal artery can be mistaken for the recurrent artery of Heubner. An examination of their courses, however, is essential in distinguishing them. Whereas the recurrent artery of Heubner follows the path of the A1 segment, the orbitofrontal artery courses perpendicularly over the gyrus rectus and across the olfactory tract¹⁶. The recurrent artery of Heubner supplies the anterior striatum (*caudate nucleus* and *putamen*), a portion of segment of the *globus pallidus*, the anterior hypothalamus, and the anterior limb of the internal capsule¹⁰. Injury to this vessel results in moderate paresis of the contralateral upper extremity and mild paresis of the contralateral face¹⁷. Injury also causes dysfunction of the tongue.

In his later years, Heubner received numerous awards and abundant praise for his achievements in pediatrics. In honor of his 70th birthday, the German Society of Pediatrics, where he was chairman for five years (1901–1905), established the Otto Heubner Prize for contributions to the field of pediatrics⁴.

Although the endowment's capital was lost to inflation after World War I, the Society reestablished the award in 1930 and, again, in 1954. Heubner's achievements in academics became evident in the large number of disciples who directed pediatric clinics throughout Germany and adopted his philosophy of pediatrics.⁴

CONCLUSION

Otto Heubner, who described the medial striate artery that today carries his name, was a leader in the field of German Pediatrics in Leipzig and Berlin. Heubner made significant contributions to the areas of infectious, gastrointestinal, and renal disease.

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CORRESPONDING AUTHOR

Nicollas Nunes Rabelo, MD
Hospital Santa Casa de Ribeirão Preto
Av. da Saudade, 456
ZIP CODE 14085000 - Ribeirão Preto, SP
E-mail: nicollasrabelo@hotmail.com

Os autores referem que não existe conflito de interesse.