John Howship (1781–1841) and growing skull fracture: historical perspective

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In the late 18th and early 19th centuries, Dr. John Howship, a pioneering British surgeon, described the clinical features and pathophysiology of various surgical disorders of the human body. His critical contributions to pediatric neurosurgery came in 1816 when he first described the features of an important childhood condition following head trauma, what he referred to as parietal bone absorption. This condition as depicted by Dr. Howship was soon to be christened by later scholars as traumatic cephalhydrocele, traumatic meningocele, leptomeningeal cyst, meningocele spuria, fibrosing osteitis, cerebrocranial erosion, and growing skull fracture. Nevertheless, the basic features of the condition as observed by Dr. Howship were virtually identical to the characteristics of the above-mentioned disorders. This article describes the life and accomplishments of Dr. Howship and his contributions to the current understanding of growing skull fracture.

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GROWING skull fracture (GSF) is a rare but significant late complication following head trauma. It accounts for 0.05%–1.6% of all childhood fractures^{6,13} and occurs almost exclusively in children under 3 years of age in whom the diastasis is greater than 3–4 mm.^{4,8,12,22,27,28} A GSF may remain undetected during the first few years of life. It has been described as a leptomeningeal cyst herniation through a dural tear without evidence of increased intracranial pressure, implicating physiological growth and brain cerebrospinal fluid pulsations as causative factors.¹⁷ Because a delay in diagnosis and/or improper management can exacerbate this condition,^{6,16} early identification of symptoms and prompt management are critical to achieving a good outcome. Although much is known about this uncommon condition, little is known about the British surgeon, Dr. John Howship, who described GSF for the first time.¹¹ Here we review the life

and accomplishments of Dr. Howship and his immense contributions to our understanding of GSF.

History

Biography of John Howship

John Howship (Fig. 1) was born in London, England, in 1781. Upon entering medical school in 1799, Howship worked as an assistant to Dr. John Heaviside (1748–1828), a distinguished surgeon and museum proprietor. “Museum medicine” of the 19th century focused students’ attention on particular anatomical sites of disease dissected out from the rest of the body. Under Heaviside’s tutelage, Howship became a skillful dissector, performed autopsies, and collected specimens from his dissections. These activities were considered gentlemanly pursuits in the late 18th century, and many of Howship’s specimens are pre-

ABBREVIATION GSF = growing skull fracture.

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FIG. 1. Portrait of John Howship. Courtesy of the Royal College of Surgeons of England. Figure is available in color online only.

served in the John Heavside museum (Hanover Square, London) (Fig. 2).

In 1805, Dr. Howship was appointed as an assistant surgeon at the St. George's Infirmary, London, and a lecturer at the school of the St. George's Hospital. In 1834, Dr. Howship moved to the Charing Cross Hospital as an assistant surgeon and was subsequently promoted to chief surgeon in 1836, after his predecessor, Dr. Thomas Joseph Pettigrew (1791–1865), was ousted for demanding and obtaining £500 from Dr. Howship for the assistant surgeon position. In 1833, Dr. Howship gave the Hunterian Lecture at the College of Surgeons and was a member of the council of the Royal College of Surgeons from 1828 until his death on January 22, 1841, of hemorrhage from an abscess of the lower leg due to a chronic disease of the tibia. By the time of his death, he was one of the most distinguished surgeons in England.

Howship's most noteworthy publication was his book, *Practical Observations in Surgery and Morbid Anatomy* (Fig. 3), published in 1816. This work contains the preliminary description of what is now known to us as "growing skull fracture." In addition to his observations on GSF, Howship made significant contributions to the understanding of disorders of bone, the gastrointestinal system, and the genitourinary tract. Some of his other notable publications on gastrointestinal diseases are *Practical Remarks Upon Indigestion* and *Practical Observations on the Symptoms* (1823), and *Practical Observations on the Symptoms, Discrimination, and Treatment of Some of the Most Important Diseases of the Lower Intestines, and*

FIG. 2. Interior of John Heavside's Museum, 1814, watercolor on paper, 41 × 58 cm, by John Howship. Courtesy of the Royal College of Surgeons of England. Figure is available in color online only.

Anus (1821). In urology he published *Practical Observations on the Diseases of the Urinary Organs* in 1816. He also described specific signs related to surgical disorders. The Howship-Romberg sign identifies obturator hernia³² and the Howship lacuna sign is a groove or pit containing osteoclasts indicative of bone resorption.

Howship and the Idea of the Growing Skull Fracture

The beginning of our current understanding of GSF dates back to 1816 when Dr. Howship reported in Section 1, Case 10 of *Practical Observations in Surgery and Morbid Anatomy*, partial absorption of the parietal bone in a 9-month-old female infant after she fell from stairs (Figs. 3 and 4).¹¹ The child presented in an unconscious state with a 3 × 1-in depressed fracture of the parietal bone. The condition was managed conservatively with leeches for pain management and saturnine lotion, a saturated solution of subacetate of lead consisting of 25% acid and

FIG. 3. Cover of Dr. John Howship's publication entitled *Practical Observations in Surgery and Morbid Anatomy*, which contained the original description of partial absorption of parietal bone, what is now known as growing skull fracture. Public domain. Figure is available in color online only.

CASE 10.

Partial Absorption of the Parietal Bone, arising from a Blow on the Head.

A child at the age of nine months, playing near a flight of stairs, fell down, and was taken up at the bottom in a state of insensibility.

There was no wound upon the head; but on examination, there was a broad line parallel with the coronal suture, where the right parietal bone was depressed for the length of three inches, and the breadth of one inch. At this part, from the form of the depression, it was supposed that the head had struck against the edge of one of the stairs.

The medical gentleman who attended, directed leeches to be applied to the temples, the seat of the injury being kept cool with a saturnine lotion. The infant remained insensible for a considerable length of time. Within a fortnight after the accident, the mother thought she perceived the pulsations of the brain where the blow had been received, and this in a little time became more decidedly manifest. The child improved, but slowly; and when, after some weeks, she had partially recovered some power of motion, it was perceived that the left side was completely paralytic. The insensibility remained, and for the first six weeks there were frequent attacks of convulsion.

Almost four months passed before the child was sufficiently restored to be observant of what passed around her; and long after this she remained exceedingly weak. She was in the third year of her age before she could stand unsupported; and even then, all the weight was evidently laid upon the right leg, the left having scarcely any power. Subsequent to this period her strength and health gradually improved, but at the age of four years the left side was still deficient, both in heat and strength, while the opening in the cranium remained undiminished. Upon laying the hand on the part, the pulsations of the brain were felt strong and distinct. The feel was much the same through the integuments, as if so much of the skull had been carefully taken out with a saw. The margin of the opening did not seem thickened, but felt smooth and equal.

The defect was not at this time attended with any material inconvenience, nor productive of pain. Whenever the child coughed or cried, the part became tense, so as to form an evident swelling: but in other respects she seemed to be pretty well recovered.

FIG. 4. Original case report by John Howship, which is taken from his famous book *Practical Observations in Surgery and Morbid Anatomy*. Courtesy of Bodleian Library, University of Oxford, England. Public domain.

75% lead, to keep the injury site cool. Two weeks after the accident, the mother felt pulsations of the brain at the site of injury. Four months after the accident, the child regained consciousness but was weak. Until her 3rd year of life, she could not stand unsupported, and weakness in the left leg persisted. However, her strength and health gradually improved. By age 4, her left leg was still defi-

cient in strength and the opening in the cranium remained undiminished. The pulsations of the brain could be felt over the site of injury and were distinct. Upon coughing or crying, the affected site became tense and swollen. On the basis of his observation, Dr. Howship implicated the pathophysiology of what is now known as the GSF to the disruption of blood supply to the fractured bone.

Historical Evolution of Growing Skull Fracture

Following the first description of GSF by Howship in 1816,¹¹ Carl von Rokitansky (1804–1878) provided the first pathological description in Vienna in 1856.²⁴ While performing an autopsy on an 8-month-old child, Rokitansky found a fluid-filled sac above and a dural opening and an underlying brain injury below the cranial aperture; this lesion measured 6 × 4 cm.²⁴ In 1862, Theodor Billroth (1829–1894) first used the term “meningocele spuria” to describe an external sac of CSF in a child who suffered an injury to the cranium via forceps delivery. This “spurious meningocele” progressively enlarged to the size of the head itself. At autopsy, Dr. Billroth noticed an opening in the dura mater corresponding with the cranial defect.² Until that time, the distinguishing feature of GSF was considered to be a collection of CSF exterior to the skull developing after a trauma, and meager, if any, attention was paid to the fractured cranial site.^{10,15,23} Later, Josef Weinlechner (1829–1906) broadened the clinical description by documenting an enlarging cephalhydrocele in a 5-month-old following a fall from height;³¹ however, the term “traumatic cephalhydrocele” appeared in the first American series reported in 1884 by Dr. P. S. Conner at the Medical College of Ohio.³ Subsequently, Dr. Thomas Smith reported another case of traumatic cephalhydrocele with a pulsatile cranial defect.²⁶ In 1885, Rickman John Godlee (1849–1925) reported on 2 infants in whom pulsating subcutaneous tumors developed after a simple skull fracture.⁷ In the same year, Alexander von Winiwarter (1848–1917) documented a large hiatus in the skull subsequent to head trauma.³⁰

The basis of a surgical approach to this condition was established following the 1907 operative report by Sir Charles Ballance (1856–1936), who described a 4-year-old male child who, after a fall from a height of 22 feet, developed a cephalhydrocele, widened fracture, dural defect, and underlying brain injury.¹ A scalp flap was pulled downward at the site of injury and exposed the herniated brain mass through the fractured parietal bone. The discontinuity in the parietal bone was observed extending obliquely downward and forward from the sagittal suture. The fragment of the parietal bone in front of the fracture was removed by disarticulation of the sagittal and coronal sutures. Similarly, a corresponding fragment of parietal bone posterior to the fracture site was also detached. The breached dural opening was enlarged by incisions made at right angles to the tear and the empty space in the cranium. The flap was then replaced, and the patient eventually made a full recovery 2 years later.¹ Soon after this, Sir Wilfred Trotter (1872–1939) operated on a patient in whom cystic dilation of the lateral ventricle extended out to the cranial defect. He designated the condition as “traumatic ventricular cyst.” The 3 characteristic features

noted by Trotter were a gap in the skull, associated pulsations, and a history of childhood injury.²⁹ With the advent of the roentgenogram as an aid to diagnosis, Cornelius Dyke (1900–1943) in 1937 first described the radiographic aspects of this condition and labeled it as a “leptomeningeal cyst.”³⁵ The roentgenological diagnosis was based on 3 features: widening of an old fracture, edging of the inner table of the skull, and an accentuated vascularity of the affected bone. In 1940, on the basis of pathological findings of the biopsy materials, H. K. Pancoast et al.¹⁹ termed this condition “fibrosing osteitis.” In 1941, Wilder Penfield and T. C. Erickson used the term “cerebrocranial erosion” to refer to an erosion of the skull overlying dural defects.²⁰ Likewise, in 1955 Dr. G. F. Rowbotham referred to traumatic meningocele and described the loss of bone as a traumatic malacia.²⁵ However, it was H. W. Pia and W. Tonniss, describing their findings of traumatic cephalohydrocele with enlargement of fracture developing into a hiatus in the skull, who coined the term “growing skull fracture” to describe such conditions.²¹

Modern Concept and Treatment Options for Growing Skull Fracture

There are currently 2 widely accepted 3-stage classifications of GSF.^{14,18} The original classification was based on the clinical progression of the disease,¹⁸ while the more recent classification relies on the radiological features present in the GSF.¹⁴ In this modern classification, GSF is subdivided into the following 3 subtypes: skull fracture with the presence of a leptomeningeal cyst; skull fracture with underlying, damaged, gliotic brain; and porencephalic cyst extending through the skull defect into the subgaleal space.¹⁴ Treatment strategies vary depending on the subtype of the GSF. Simple cases with leptomeningeal cyst have been treated with duraplasty and acrylic cranioplasty.^{14,17,28} The possibility of increased intracranial pressure should be evaluated in patients with gliotic brain and/or a porencephalic cyst. If elevated intracranial pressure is present, this should be managed with the placement of a ventriculoperitoneal shunt. The GSF can then be treated with dural repair and cranioplasty using autologous bone graft or methylmethacrylate.^{9,14,28} Children, especially those under 3 years of age, with linear skull fractures should be followed serially with clinical examination and palpation of the defect, and with radiographic imaging, if needed, to ensure healing of the fracture site.¹⁴

Conclusions

With the resources available in the 18th and 19th centuries, John Howship's achievements are nothing short of astonishing. The first depiction of GSF by Howship heralds a significant contribution to the field of pediatric neurosurgery and has helped our current understanding of the disease. He should be recognized in the field of neurosurgery for his contributions to the discovery and management of GSF.

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