Historical Vignette

Percivall Pott: an 18th century neurosurgeon

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This paper examines neurosurgery in the 18th century and suggests that the origins of the specialty can be recognized at the time when surgeons began to use the neurological status of the patient as a guide for surgical intervention. Percivall Pott (1714–1788) was one of the leading surgeons in London in the 18th century. He is remembered through eponyms of Pott’s puffy tumor, Pott’s fracture, and Pott’s disease. A review of his writings and those of his contemporaries indicates that these surgeons were aware of the importance of changes in level of consciousness after head injury. The recognition and significance of the lucid interval was described and understood as a neurological sign in the 18th century. Because of Pott’s pre-eminence in the surgery of his time through his writings and lectures, he should be considered one of the founders of neurosurgery as a separate surgical discipline.

KEY WORDS • history of neurosurgery • lucid interval • Percivall Pott • historical vignette

Nullum capitis vulneris conternendum. — Hippocrates

Two hundred years after his death, Percivall Pott (1714–1788) is still remembered through the eponyms of syndromes he described. He was born, received his training, and worked within a small radius of London’s St. Bartholomew’s Hospital, yet his influence was felt throughout Europe and America in the 18th century. He was born on Threadneedle Street where the Bank of England now stands. The details of his life, few as they are, come from a brief biography by his son-in-law, the surgeon Sir James Earle (1755–1817). This biography first appeared in 1790 and served as an introduction to many editions of the collected works of Pott (Fig. 1).1,9,11,17,26,30,48

In the present era of highly specialized surgical disciplines, it is hard to imagine how one surgeon could work and publish in the fields of neurosurgery, orthopedics, ophthalmology, oncology, and urology as Pott did. His works indicate that he was more than a casual observer of clinical phenomena in these areas. He sought out and recognized underlying surgical principles to serve as the basis for his recommendations. This can be demonstrated in Pott’s writings on neurosurgical topics.9 Pott’s puffy tumor and Pott’s disease come immediately to mind. His books on head injury41,42 and the two works on disease of the spine39,43 make it quite appropriate to consider Pott as an 18th century neurosurgeon, long before the specialty came to be recognized.

Pott’s Professional Development

Pott entered his surgical apprenticeship with Mr. Edward Nourse (1701–1761) in 1729 at 15 years of age. As an apprentice, Pott was responsible for preparing Nourse’s lectures on anatomy and surgery which began in 1731.9 Upon completion of his training in 1736, Pott was examined and received the freedom of the Company of Barber-Surgeons as well as the Great Diploma. In 1745, he was appointed Assistant Surgeon to St. Bartholomew’s Hospital when Nourse became Surgeon, a position that Pott eventually obtained in 1749 and held until 1787, the year before his death at the age of 74 years.

Pott continued his association with Nourse by participating with him in lectures on anatomy and surgery at St. Bartholomew’s. This is one of the earliest documented series of surgical lectures in London, preceded only by those of Cheselden. A more significant event linking the two men occurred in 1755. It was Nourse who prevailed against other surgeons and prevented the
amputation of Pott's leg when Pott sustained a compound fracture. The most important outcome of Pott's fracture was the time it gave him, as he was recuperating, to begin his writings. Although he had published only one brief paper prior to this, he now embarked on a course of surgical writings that would produce no fewer than 12 books over the next 25 years. A review of the publication history of Pott sheds some light on his influence and position in 18th century surgery. Almost all of his books went through many editions and were translated into French, German, Italian, and Dutch. Evidence of his influence can be inferred from the publication of numerous collected editions in London in 1771, 1775, 1779, 1783, 1790, and 1808; in Paris in 1777 and 1792; in Dublin in 1778; in Berlin in 1787; and in Philadelphia in 1819. Although many works of surgery were translated into English, no English surgical monographs before those of Pott were published in other languages.

The question of why Pott published so many separate tracts and no generalized system of surgery, as was common in the 17th and 18th centuries, is answered by Pott himself in the preface to his work on head injuries in 1760. He points out that separate works on specific surgical topics are better suited for conveying the important clinical details needed to make them helpful in the management of patients. His monographs present his extensive experience in surgery and are free of the abstract, theoretical considerations that characterized much of the surgical literature of the 18th century.

This brief chronology can be completed by noting that, in 1753, Pott was appointed Lecturer of Anatomy at Surgeons' Hall. Pott was elected to Fellowship in the Royal Society in 1765. He became the first Honorary Fellow of the Royal College of Surgeons of Edinburgh in 1786, and was admitted to the freedom of the Irish College of Surgeons in 1787, the year before his death.

The mid-18th century was a period of major reorganization of the regulatory bodies that controlled surgery in both France and England. In France, at the turn of the 18th century, surgery emerged once again as an independent discipline under the patronage of Louis XIV and Louis XV. Surgery was separated from the Faculty of Medicine in 1724; the Royal Academy of Surgery was chartered in 1731, and in 1743, by royal decree, surgery could only be performed by those trained in the discipline. The ties between the Barbers and Surgeons were dissolved. In England, the final separation between the Barbers and Surgeons, who had been in the same Company since the reign of Henry VIII, occurred in 1745, by an Act of Parliament that severed the 200-year-old ties of the United Company of Barber-Surgeons. This act established the Corporation of Surgeons, which remained the surgical organization of London until the Royal College of Surgeons was chartered in 1800. Pott became involved in this development and held many positions within the Corporation over the next 30 years.

Surgical Principles

The reduced use of cauterity, the simplification of many surgical techniques, and the ever-present concern for the welfare of his patients is apparent in all of Pott's surgical writings. He emphasized the need for surgical technique rather than speed, and condemned "...a most absurd custom of measuring the motion of a surgeon's hand, as jockeys do that of the feet of a horse, viz. by a stop-watch; a practice which though it may perhaps have been encouraged by the operators themselves, must have been productive of most mischievous consequences." Pott continued in this vein in the preface to his 1760 work on head injuries by pointing out that a surgeon needs more than manual dexterity to be successful. He stressed the need for judgment as to when not to operate as being an important asset for the successful surgeon. This, he said, can be gained only from years of experience and not from reading about surgery or spending a few months on hospital rounds. Pott went on in a very modern-sounding tone that approaches the issue of

Fig. 1. Engraving of a portrait of Percivall Pott, after a painting by Sir Joshua Reynolds. (Reproduced from Earle's biographical introduction.)
Percivall Pott, an 18th century neurosurgeon

informed consent (pp xxii–xxxiii):42 “To be able to foetel approaching mischief, is as necessary to a practitioner, as to predict success; friends and relations have a right to be informed of the motives of a surgeon’s conduct; and what is still more, he should be able to satisfy himself that it is rational, and that he does his duty.”

In his later years, Pott summarized his feelings about surgical achievement which included his own contributions:37 “Many and great are the improvements which the chirurgic art has received within these last fifty years; and much thanks are due to those who have contributed to them; but when we reflect how much still remains to be done, it should rather excite our industry than inflame our vanity.”

Pott’s Disease

The compression of the spinal cord due to the collapse of vertebral bodies infected with tuberculosis has long been referred to as Pott’s disease. While it is true that his description of the condition in 177941 and his second work on the topic in 178242 were preceded by a little-known work by Jean-Pierre David (1737–1784),9 also published in 1779, it was Pott’s works that were frequently cited, republished, and translated (Fig. 2).

Pott did not make a direct association of the diseased vertebrae with tuberculosis, but referred to the condition as a manifestation of scrofula. The precise connection between tuberculosis and the diseased spine was suspected but not established until the 19th century. Pott described the neurological findings associated with myelopathy of spinal cord compression. Subtle differences in motor and sensory examinations are not described in either of the two books dealing with this subject, but the loss of bladder control was noted. While the exact relationship of tuberculosis to the bone lesions is unclear in Pott’s works, the illustrations in the second monograph leave no doubt about the condition he was describing. In his second book on the condition, Pott notes that the paralysis could occur without the spinal deformity being present. He also observed that the upper extremities could be involved if the spinal lesion was in the cervical region.

Pott reasoned that curvature of the spine was not the cause of the disease but the result of the diseased state of the vertebrae and the intervertebral discs. He attributed the palsy to compression of the dural tube by an epidural abscess. In addition to the clinical descriptions, Pott proposed several forms of therapy. The use of surgical intervention, in this case the formation of a draining sinus tract, is one of the earliest examples of surgical treatment of a disorder of the spinal cord. Pott treated several patients by creating a draining sinus adjacent to the spinal deformity. He placed a seton or preferably a kidney bean into a cauterized area to maintain a draining sinus tract in communication with the paravertebral abscess. While this is far from current methods of management, some rationale to this approach can be seen. It could not have escaped the attention of a keen observer like Pott that drainage of pus relieved the compression of the spinal cord. The clinical descriptions, the fine engravings (Fig. 3), and the widespread association of this condition with Pott by contemporary and later writers have maintained the eponymous designation of Pott’s disease in spite of the excellent description by David at the same time. No lesser authorities in French neurology than Ollivier d’Angers,32 Charcot,6 and Marie28 referred to the condition as “Pott’s disease.”

Head Injuries

For 2000 years after the Hippocratic writings, most authors on head injury repeated the classifications in De Capitis Vulneribus44 and added their own commentaries. These dealt with injuries of the scalp and skull. Prophylactic surgery was advised, in theory to
prevent the formation of epidural collections but, in fact, such surgery itself often became the cause of an infected epidural or subdural collection. The basis for the classification was the nature of the skull fracture itself. Little regard was given to the effects of the head injury on the brain.

It was not until the 18th century that a literature devoted to the effects of trauma on brain function began to develop. Among the French surgeons of this period, several can be singled out as having special interest in the problem of head injuries and their management. Jean Louis Petit (1674–1750) was the leading surgeon in Paris during the first half of the 18th century. He was appointed the first Director of the Royal Academy of Surgery from its inception in 1731 until 1738. Petit drew a clear-cut distinction between the loss of consciousness accompanying a blow to the head and the drowsiness (assoupissement) that appeared later. The first he attributed to concussion, the latter to the formation of a collection or effusion (épanchement) producing compression of the brain.34

Petit was not alone among his colleagues in recognizing that the signs of cerebral compression, rather than bone lesions, should serve as the indication for trephination. Henri François Le Dran (1685–1770), another founding member of the Royal Academy of Surgery, published his surgical observations in 1731. He pointed out that drowsiness must not be attributed to the fracture of the skull but rather to injury of the brain, and that the delayed appearance of drowsiness was a sign of compression due to a collection of blood beneath the skull. There is no suggestion of an understanding of the temporal events associated with head injury in the general surgical works of most of the leading surgeons of this period such as Hildanus, Wiseman, Dionis, or Heister. They focused their writings on descriptions of the varieties of fractures that should or should not be trephined. Many surgeons utilized trephination as a last resort when the patient was moribund, but none before Petit and Le Dran attempted to establish clinical criteria for the operation.47

Although many books on head injury preceded Pott’s publication, the vast majority of them were commentaries on the Hippocratic text De Capitis Vulneribus. To be sure, the 1518 work of Berengario da Carpi1 and the 1561 publication of Ambroise Paré2 are highlights in an otherwise dismal array of surgical tracts on wounds of the head. Although Pott cited a number of the French surgeons of his time and acknowledged his debt to them, none of them published specialized works on head injury. The two most influential figures of the period were Le Dran and Petit. Le Dran’s observations on head injuries are contained in several general surgical works.20,22,25 Petit’s major surgical work was not published until 1774, 24 years after his death.5 The only French tract of this period that is strictly devoted to head injuries is a small work by a surgeon in Avignon, Louis François Manne who died in 1755.27 A testimonial letter from Petit appeared in this book, and Manne acknowledged his indebtedness to Petit and his observations on head injuries. From this we may conclude that, as is often the case in medical disciplines, much information was available and transmitted prior to actual publication.

A better picture of the state of head-wound management can be obtained from Lorenz Heister’s A General System of Surgery. This work was widely circulated, and was translated and went through many editions. It can be regarded as a summary of the state of the art of 18th century surgical techniques. The writings of Heister (1683–1758) on head injury set the stage for the entrance of Pott. For head injuries, we find Heister still recommending X-shaped incisions, plasters rather than sutures to close incisions and lacerations, and the Hippocratic method of exfoliation of the inner table after trephination rather than drilling through the full thickness of the skull.13

Although review of the surgical monographs of a period often uncovers interesting observations, the standard works must be taken as the contemporary state of the art. In Heister’s text, we find little to indicate that the management of head injuries had progressed much beyond standards of the 16th century. It should be

Fig. 3. Illustration from Pott’s 1782 work showing the vertebral changes he described in the text.
recalled that the first English translation of Heister’s *A General System of Surgery* appeared in 1743, more than 20 years after it was originally written. Heister appears to have been aware of the delayed accumulation of intracranial clot (p 90). He was also much more cautious in his recommendation of trephination; it was to be applied only after more conservative methods had failed, including bleeding, purging, and fomentations with medicated bags applied to the head. Only then should the surgeon resort to the trephine. With this approach it is hard to image how success in true surgical situations could have been achieved. The lack of impact of Petit and Le Dran on the contemporary management of head injury can be inferred from the absence of reference to them in one of the standard French surgical texts of this period by Antoine Portal (1742–1832). The contemporary French views were summarized by François Quesnay (1694–1774) in several papers that appeared in the *Memoires de l’Académie Royale de Chirurgie*. These call attention to the principles developed by Petit and Le Dran, but this journal was aimed at the members of the Académie and was not widely circulated.

Pott was a major proponent of an aggressive approach to the management of head injuries. He credited Le Dran for calling attention to the lucid interval that occurs prior to the onset of coma due to cerebral compression from an epidural collection. Pott’s bibliography shows two different titles for works dealing with head injuries. The first, *Observations on the Nature and Consequences of those Injuries to Which the Head is Liable from External Violence*, appeared in 1768 as a new work (Figs. 2 and 4). Although the 1768 book appeared with a different title and is considerably longer than the earlier publication, it is organized along the same lines and does not contain any different views. Pott supported his arguments with additional cases, which accounts for the lengthening of the book. The preface to the 1760 edition, not reprinted in the 1768 edition, sheds considerable light on Pott’s deeper understanding of surgery and the role of a surgeon as a neurosurgeon.

It was apparent to Pott that the depression of consciousness following a concussion could merge with that due to a collection causing cerebral compression. Thus, it became difficult at times to separate these two causes of prolonged depression of consciousness. A further source of confusion lay in the inability of surgeons to separate the depression of consciousness due to blood clot from those due to the formation of an epidural abscess or subdural empyema. Pott tried to distinguish between epidural clot and infection by noting that the latter more often was associated with a febrile course and localized pain. In addition, he noted that symptoms due to an infected collection developed later than those due to extravasated blood.

Fig. 4. Illustration of the devices available to Pott to elevate depressed skull fractures taken from his *Observations on the Nature and Consequences of those Injuries to Which the Head is Liable from External Violence*.41
The lack of any understanding of the nature of infectious processes continued to confound surgeons at this time. Since the 17th century, most writers believed that any extravasation of blood would suppurate. Pott denied this and advanced the hypothesis that damage to vessels bridging between the skull and dura or the dura and brain was the cause of inflammation and suppuration.

**Pott's Puffy Tumor**

Although the alliteration of the name of Pott's puffy tumor has probably done more for its place in history than its clinical significance, it did represent an interesting observation by Pott that focused attention on the clinical significance of the diploic veins. Pott's theory about the occurrence of infected epidural collections was used to explain the occurrence and significance of the puffy tumor. It was used as a sign of "matter," the poorly defined concept of an infected collection occurring some time after a head injury. While the reasoning behind its etiology may have been faulty, the indication for surgical intervention was on firm grounds.

Based on the hypothesis that the formation of a collection could be prevented, Pott advocated early trephination for most head injuries even if this meant an unnecessary operation for some. Although Pott was aware of the significance of the delayed appearance of drowsiness following a head injury, he too was unable to discard all of the old osteological indications for neurosurgical intervention. Pott believed that there was still a role for prophylactic trephination. Speaking of nondepressed fractures of the skull he wrote (p 276, cf p 130): "The reasons for trepanning in these cases are first, the immediate relief of present symptoms arising from pressure of extravasated fluid; or second, the discharge of matter formed between the skull and dura mater in consequence of inflammation; or third, the prevention of such mischief."

Other surgeons of the latter part of the 18th century had difficulty in reconciling the importance of the clinical signs of cerebral compression and the results of surgical intervention. In England and Ireland, William Dease (1752–1798) and Sylvester O'Halloran (1728–1807), while recognizing the importance of distinguishing between concussion and compression, concluded that the results of trephination were worse than reliance on expectant treatment, which utilized bleeding and purging. In France, a similar backlash to surgical intervention occurred. Desault, the successor to Petit as the leader of French surgery, abandoned the use of the trephine at the Hôtel-Dieu because of the high mortality rate due to infection. This reactionary position was forced upon these surgeons not because of an error in understanding the significance of cerebral compression, but because of the limitations of surgery in the pre-Listerian era.

**Pott's Contributions**

Although Pott's puffy tumor is the cause of the usual historical association of Pott and neurosurgery, his writings on the management of head injuries and the role of the trephine were the most influential during the 18th and early 19th centuries. Some allowance must be made for a surgeon writing before any understanding of the role of bacteria in infection. To Pott must go the credit for disseminating the observations of several French surgeons who worked earlier. Pott may have become aware of these important contributions through the English translations of Le Dran's writings.

The major flaw that a reader today finds with Pott's beliefs concerns his ideas about the use of trephination to prevent the development of a collection in the epidural or subdural space. All too often Pott failed to distinguish between a hematoma that occurs as a result of trauma and the development of an empyema which he called "matter." Pott argued that the early use of the trephine would prevent the occurrence of matter. He failed to recognize the risk of introducing infection and the lack of prevention by trephination when no infection or collection existed. Nevertheless, he was quite clear about the need for trephination if a collection is suspected. The occurrence of an altered neurological state, particularly an altered level of consciousness, was sufficient reason to employ the trephine. According to Pott, it was better to trephine and find nothing than fail to remove a collection of blood or pus.

In 1760, Pott gave a good example of the differences between neurosurgery and surgery in general. He pointed out that some injuries to the head leave no external marks; their seriousness can only be judged by the disorders they produce, that is, by their effects on nervous system function. This remark, which is in contrast to the management of lacerations and open fractures, marks the beginning of awareness of the neurological examination as an important factor in determining the need for surgical intervention. I would suggest that this principle was quite original for Pott, and marks one of the origins of neurosurgery as an independent surgical discipline. The best example of the increased awareness of this important neurosurgical principle is seen in one of the standard systems of surgery in English of the latter part of the 18th century. Benjamin Bell (1749–1806), advanced this concept further by restating the importance of the lucid interval and recommending against the use of preventative trephination. It should be noted that all works printed up to this time did not refer to injuries of the brain but rather stressed the injury of the head. Not until the publication of *A System of Surgery* by Benjamin Bell in which the relevant section, appearing in 1785, is titled "On affections of the brain from external violence" do we encounter this shift in emphasis.

In addition to directing attention to the brain as the primary organ of interest, Bell took the lead from Pott and re-emphasized the importance of using clinical signs to determine the need for surgical intervention rather than the appearance of the skull fracture: "Although it is proper for every practitioner to inquire into the nature of the cause by which a fracture has been
Percivall Pott, an 18th century neurosurgeon

effected, yet we are by no means to imagine that any material advantage is to be derived from this source. . . . As it is impossible to ascertain the extent of any injury done to the brain by this circumstance, little or no dependence ought to be placed upon it."

One further advance in neurosurgical ideas beyond those advocated by Pott can be found in Bell's writings. Prophylactic trephination is finally rejected as an appropriate method of preventing neurological symptoms: "For, although I am perfectly clear and decided upon the propriety of applying the trepan wherever it is indicated by symptoms of a compressed brain; and where these symptoms must in all probability prove fatal, if the cause which produced them is not soon removed; yet I am equally satisfied, that it is the presence of such symptoms only which ought to indicate this operation; and that it ought never to be employed, as it too frequently has been, merely with a view to prevent them." This discussion and the indications for and utility of trephination would continue for years to come. Here, however, between Percivall Pott and Benjamin Bell, a clear beginning of neurosurgery was established.

Pott was the first surgeon in England to adopt the concept of the lucid interval as first defined by the French surgeons of the 18th century. Bell made the important generalization to regard the surgery of these lesions as that of the brain not simply the head or skull. Through the many editions and translations into French and German, the writings of Pott and Bell were widely disseminated throughout continental Europe.

The earliest reference to Pott in the medical writings of America appears in the first surgical work written in this country, John Jones' (1729-1791) Plain Concise Practical Remarks, on the Treatment of Wounds and Fractures; to which is added, a Short Appendix on Camp and Military Hospitals: Principally Designed for the Use of Young Military Surgeons in North America.95 This brief work was designed as a manual for surgeons of the Continental Army. The appearance of two editions in the same year, one printed in Philadelphia and another in New York, may be taken as an indication of the demand for this work which incorporates Pott's ideas as guidelines for the surgeons of America. Jones refers to Pott in the introduction as "the first and most distinguished rank" among the surgeons of this time (p 12).19 His own discussion of head injuries closely follows Pott's organization, and he recognized the importance of the lucid interval. There is a good description of Pott's puffy tumor although it is not attributed to Pott. The indications for trephination still included 1) extravasation, 2) inflammation, and 3) prevention. He emphasized (p 83) that the risks of surgery are far less than the dangers of omission of this procedure.19

Pott produced a number of popular surgical monographs in the second half of the 18th century. A number of them can be grouped together to form the beginning of neurosurgical principles. It is not just because of the original descriptions, but also the clarity of the writing, the range of topics, and the pattern of publishing that led to widespread familiarity with his work that allows Pott to stand as a very early "neurosurgeon."

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