PERINATAL LESSONS FROM THE PAST

Ignac Semmelweis (1818–1865) of Budapest and the prevention of puerperal fever

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As a junior obstetrician in Vienna in 1847, Semmelweis discovered the cause of puerperal fever and introduced a method for its prevention. Although his findings were hailed by some as comparable to Jenner's introduction of vaccination, for various reasons his ideas failed to gain general acceptance until after his death.

Ignac Philipp Semmelweis (fig 1) was born on 1 July 1818 in Buda on the north bank of the Danube in Hungary. He was the fifth of eight children in a German speaking bourgeois family. His father was a well to do grocer. Naci, as he was known to the family, was educated at the Catholic Gymnasium on Castle Hill. There he learnt to speak Hungarian. In 1837 he enrolled as a law student in the University of Vienna, but a year later transferred to the medical faculty. After a year's study there and two more at the University of Pest, Semmelweis returned to Vienna to complete his studies and receive the degrees of Doctor of Medicine and Master of Obstetrics. This was in 1844. He was 26. At this time he came under the influence of three remarkable young academic physicians, Joseph Skoda (1805–1881) who taught general medicine and statistics, Ferdinand Hebra (1816–1880) a dermatologist, and Carl Rokitansky (1804–1878), professor of pathologic anatomy.[1–5]

In July 1846, Semmelweis was appointed first assistant to the Professor of Obstetrics, Johann Klein (1788–1856), at the Allgermeines Krankenhaus in Vienna. At the time, the maternal mortality from childbed fever had reached epidemic proportions. Within one and a half years, Semmelweis had, through clinical and post-mortem observations and epidemiological studies, identified the cause of the problem and instigated a successful strategy for its prevention. Although his ideas received the strong backing of Skoda, Hebra, Rokitansky, and others, Klein was of the old school and was not supportive. In March 1849, he declined to reappoint Semmelweis. In part Semmelweis's failure to achieve recognition for his thesis was due to his own failure to publicise his discoveries. Only in May 1850 did he finally present his work to the Medical Society of Vienna.[1–5] Although his presentation was well received, he then failed to prepare it for publication, as was the usual practice. Only 11 years later in 1861 was a full account of his research published.[6] Unfortunately Semmelweis's account was: ''long, repetitive and at times almost impenetrable''. The following brief excerpts have been taken from the English translation[7] with a view to highlighting and clarifying his most important observations and conclusions.

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On childbed fever in Vienna in the 1840s[7]

> ''The maternity hospital in Vienna was opened on 16 August 1784. In the eighteenth century and in the early decades of the nineteenth century, medicine was concerned with theoretical speculation, and the anatomical foundations were neglected… From 1784 until 1823, over a period of twenty-five years, less than one percent of the patients cared for in the maternity hospital died…. Thus in 1822, of 3066 patients only 26 died (0.84%). In 1841, after the Viennese medical school adopted an anatomical orientation, of 3036 patients 237 died (7.7%). In 1842 of 3287 patients 518 died (15.8%)…
> The large gratis Viennese maternity hospital is divided into two clinics… (in) October 1840, all male students were assigned to the first clinic and all female students to the second… From the time the first clinic began training only obstetricians until June 1847, the mortality rate in the first clinic was

Figure 1 Ignac Semmelweis (1818–1865).

consistently greater than in the second clinic, where only midwives were trained (9.9% v 3.4%)… While I was still unable to find a cause for the increased mortality rate in the first clinic, I became aware of other inexplicable circumstances. Those whose period of (cervical) dilation was extended over twenty-four hours or more almost invariably became ill either immediately during birth or within the first twenty-four or thirty-six hours after delivery. They died quickly of rapidly developing childbed fever. An equally extended period of dilation in the second clinic did not prove dangerous…

Not only these mothers but also their newborn infants, both male and female, died of childbed fever. I am not alone in speaking of puerperal fever of the newborn. With the exception of the genital areas, the anatomical lesions in the corpses of such newborn infants are the same as the lesions in the corpses of women who die of puerperal fever… But if the maternity patients and the newborn die from the same disease, then the etiology that accounts for the deaths of the mothers must also account for the deaths of the newborn. Since the difference in mortality between the maternity patients in the two clinics was reflected in the mortality rates for the newborn, the accepted etiology for childbed fever no more accounts for the deaths of the newborn than for the deaths of the maternity patients…

I was aware of many facts for which I had no explanation. Delivery with prolonged dilation almost inevitably led to death. Patients who delivered prematurely or on the street almost never became ill, and this contradicted my conviction that the deaths were due to endemic causes. The disease appeared sequentially among patients in the first clinic. Patients in the second clinic were healthier, although individuals working there were no more skilful or conscientious in their duties. The disrespect displayed by the employees toward the personnel of the first clinic made me so miserable that life seemed worthless. Everything was in question: everything seemed inexplicable; everything was doubtful. Only the large number of deaths was an unquestionable reality.''

On the cause of childbed fever[7]

On 20 March 1847, the Professor of Forensic Medicine, Jakob Kolletschka, whom Semmelweis greatly admired, died from a disease similar to childbed fever. Semmelweis wrote:

''Since the identical results were found in Kolletschka's autopsy, the inference that Kolletschka died from the same disease was confirmed. The exciting cause of Professor Kolletschka's death was known; it was the wound by the autopsy knife that had been contaminated by cadaverous particles. Not the wound, but contamination of the wound by the cadaverous particles caused his death. Kolletschka was not the first to have died in this way. I was forced to admit that if his disease was identical with the disease that killed so many maternity patients, then it must have originated from the same cause that brought it on in Kolletschka. In Kolletschka, the specific causal factor was the cadaverous particles that were introduced into his vascular system. I was compelled to ask whether cadaverous particles had been introduced into the vascular systems of those patients whom I had seen die of this identical disease. I was forced to answer affirmatively….

Because of the anatomical orientation of the Viennese medical school, professors, assistants, and students have frequent opportunity to contact cadavers. Ordinary washing with soap is not sufficient to remove all adhering cadaverous particles. This is proven by the cadaverous smell that the hands retain for a longer or shorter time. In the examination of pregnant or delivering maternity patients, the hands, contaminated with cadaverous particles, are brought into contact with the genitals of these individuals, creating the possibility of resorption. With resorption the cadaverous particles are introduced into the vascular system of the patient…''

On the prevention of childbed fever[7]

''Suppose cadaverous particles adhering to hands cause the same disease among maternity patients that cadaverous particles adhering to the knife caused in Kolletschka. Then if those particles are destroyed chemically, so that in examinations patients are touched by fingers but not by cadaverous particles, the disease must be reduced…

To destroy cadaverous matter adhering to hands I used chlorina liquida. This practice began in the middle of May 1847… Both the students and I were required to wash before examinations. After a time… I adopted the less expensive chlorinated lime. In May 1847, during the second half of which chlorine washings were first introduced, 36 patients died—this was 12.2% of 294 deliveries. In the remaining seven months of 1847, the mortality rate was below that of the patients in the second clinic… In 1848, chlorine washings were employed throughout the year and of 3556 patients, 45 died (1.27%). In the second clinic in the year 1848, of 3219 patients 43 died (1.33%)… Chlorine washings had the same effect on the incidence of disease among the newborn… Since the chlorine washings were instituted with such dramatic success, not even the smallest additional changes in the procedures of the first clinic were adopted to which the decline in mortality could be even partially attributed. The instruction system for midwives is so instituted that pupils and instructors have less frequent occasion to contaminate their hands with cadaverous matter than is the case in the first clinic. Thus, the unknown endemic cause of the horrible devastations in the first clinic was the cadaverous particles adhering to the hands of the examiners…. (But) childbed fever is caused not only by cadaverous particles adhering to hands but also by ichor from living organisms. It is necessary to clean the hands with chlorine water, not only when one has been handling cadavers but also after examinations in which the hands could become contaminated with ichor.''

On understanding the epidemiology of the childbed fever in Vienna[7]

''Once the cause of the increased mortality in the first clinic was identified as cadaverous particles adhering to the hands of the examiners, it was easy to explain why women who delivered in the street had a strikingly lower mortality rate than those who delivered in the clinic. This was so because once the infant was born and the placenta separated, there was generally no longer opportunity for instruction; thus there were no examinations… Also, women who delivered prematurely became ill less often because they were not examined either. The first

> requirement in premature births is to delay birth if possible. Consequently, these persons were not used for open instruction, and decaying organic matter was not conveyed to their genitals.
> Early (each) morning I (had) conducted my gynaecological studies in the morgue. I then went to the labour room and began to examine all the patients, as my predecessors and I were obliged to do, so that I could report on each patient during the professor's morning rounds. My hands, contaminated by cadaverous particles, were thereby brought into contact with the genitals of so many women in labour… In consequence of my conviction I must affirm that only God knows the number of patients who went prematurely to their graves because of me. I have examined corpses to an extent equalled by few other obstetricians. If I say this also of another physician, my intention is only to bring to consciousness a truth that, to humanity's great misfortune, has remained unknown through so many centuries. No matter how painful and oppressive such a recognition may be, the remedy does not lie in suppression. If the misfortune is not to persist forever, then this truth must be made known to everyone concerned.''

Semmelwies was, as a student, a happy, outgoing man with a sensitive nature. At the same time he had an inferiority complex because of his Hungarian origin and provincial German accent. This made him reluctant to publish his ideas. Yet in spite of this he was, paradoxically, deeply disturbed that they were not immediately accepted. In October 1850, six months after his presentation to the Medical Society of Vienna, Semmelweis abruptly left the city and returned to Pest. He failed even to tell his supporters, some of whom never forgave him. No doubt he was upset at only being offered an unsatisfactory teaching post. In addition, 1848–1850 was a time of great social unrest within the Austro-Hungarian Empire, and Semmelweis was an ardent believer in wishing to see Hungary emerge from its second class status.

A year after returning to Pest, he was made the unpaid director of obstetrics at St Rochus Hospital. Applying the same methods as in Vienna, he was able to reduce the maternal mortality at the hospital to under 1%. In 1855 he was appointed professor of theoretical and practical obstetrics in the University of Pest. It was at this time in 1857 that, at the age of 39, Ignac married Maria Weidenhofer, 20 years his junior. They had five children, three of whom survived. 1857 also saw the end of censorship in Hungary following the earlier uprising, and Semmelweis began to write up his experience and thoughts on childbed fever. While some obstetricians accepted his theories, many did not. This prompted him to publish open and abusive letters in the press against his opponents. His style was ''egotistic and bellicose''. By the time his major work was finally published in 1860–1861, Semmelweis was showing signs of premature aging and serious mental deterioration with bouts of depression and periods of elation. Some have attributed this to neurosyphilis, while others have suggested Alzheimer's disease. In 1865 he became overtly psychotic, and his wife and colleagues took him by train to Vienna where he was committed to the Lower Austrian Mental Home. His wife was forbidden to visit him. Two weeks later he was dead. It was circulated that he had died from septicaemia after a needle stick injury, though more recent research suggests that he probably died from injuries sustained while under restraint.[8] He was buried in the Schmelz cemetery in Vienna, but in 1894 his remains were removed to the Kerepesi cemetery in Pest. Then in 1965 he was given a final resting place in the garden wall of the house where he had been born, now the Semmelweis Museum of Medical History.[1]

Figure 2 Louis Pasteur (1822–1897).

Semmelweis's story provides us with a number of important lessons: the value of serendipity, of epidemiology, and of correlating clinical and postmortem observations; the essential need to publicise new discoveries; the need to be patient and tolerant when sound evidence is rejected out of hand; and above all perhaps the need not to be too far in advance of one's contemporaries with respect to challenging new conclusions. In spite of the brilliance of Semmelweis's thesis, his ideas had not won wide support by the time of his death. This is perhaps all the more surprising in that many of

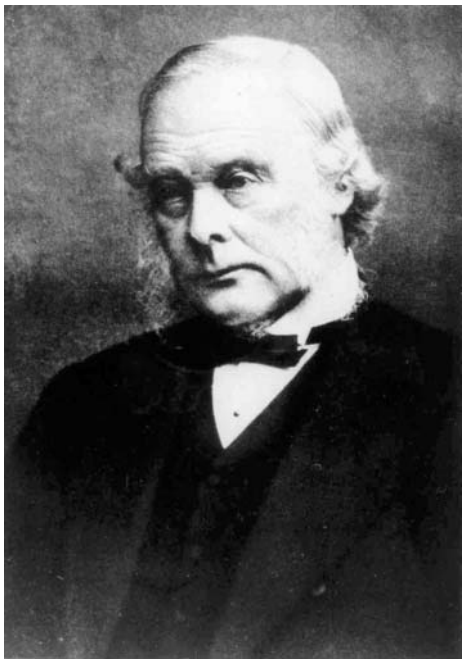

Figure 3 Joseph Lister (1827–1912).

his observations had already been made during the previous hundred years by men such as Thomas Denman, Charles White, Alexander Gordon, Joseph Clarke, James Blundell, Robert Collins, and Oliver Wendall Holmes. However, within a few years of Semmelweis's death, the discoveries of Louis Pasteur (1822–1897) (fig 2) and Joseph Lister (1827–1912) (fig 3) had thrown light on the bacterial nature of disease, including wound infection. In 1879 Pasteur finally identified the haemolytic streptococcus responsible for childbed fever.[9]

REFERENCES

1 **Trafford PA**. Ignac Fülöp Semmelweis: saviour of women (1818–1865). *Proceedings of the Bristol Medico-Historical Society* 2000–2004;**IV**:in press.
2 **Baskett TF**. *On the shoulders of giants: eponyms and names in obstetrics and gynaecology*. London: RCOG Press, 1996.
3 **Speert H**. *Obstetric and gynaecologic milestones*. New York: The Parthenon Publishing Co, 1996.
4 **O'Dowd MJ**, Philipp EE. *The history of obstetrics and gynaecology*. London: The Parthenon Publishing Co, 1994.
5 **Graham H**. *Eternal eve*. London: W Heinemann, 1950.
6 **Semmelweis IP**. Die aetiologie, der begriff, und die prophylaxis des kindbettfiebers. Pest, Wien u Leipzig, CA Hartleben, 1861.
7 **Semmelweis I**. *The etiology, concept and prophylaxis of childbed fever*. Translated by K Codell Carter. Madison: The University of Wisconsin Press, 1983.
8 **Nuland SB**. The enigma of Semmelweis: an interpretation. In: *The etiology, the concept and the prophylaxis of childbed fever by IF Semmelweis*. Translated by FP Murphy. Birmingham: The Classics of Medicine Library, 1981. Foreword, xv–xlii.
9 **Pasteur L**. Septicémie puérperale. *Bull Acad Méd Paris* 1879;**8**:271–4.