The Resistance to Antisepsis in the 19th Century: A Briefing on Two European Antisepsis Proponents

Ben Ouyang

Abstract

Hand washing is now considered an essential part of infection prevention practices, with signage and instructions in every hallway and washroom. However, the activity has not always been held in the same regard. In fact, doctors in the past had actively resisted hand washing before coming in contact with their patients, often unknowingly causing lethal infections. Why did they scoff at the idea of washing hands? In this essay, I turn to primary and secondary historical sources to describe the development of hand washing and antiseptic techniques through two important 19th-century European proponents: Ignaz Semmelweis and Joseph Lister, and why the medical society resisted their ideas. Poor communication, pride, and a resistance to change were major factors fueling the resistance. Eventually, scientific rigour and evidence convinced the medical community of hygiene's importance, and hand washing and antiseptic techniques became widely adopted.

In the historical rise of surgery, surgeons armed with ever-advancing tools struggled to overcome infection, one of the three principal obstacles they faced during the 18th and early 19th century. Even after the other two obstacles of controlling bleeding and pain had been addressed (albeit with only limited results), patients still died of post-surgical infections at frighteningly high rates of over 50%.[1] Yet, when solutions to recognize, combat, and prevent infections were proposed, much of the medical community rejected the ideas and resisted changing traditional practices. In this article, I will examine the stories of two major 19th-century contributors to the development of antiseptic technique in Europe: Ignaz Philipp Semmelweis and Joseph Lister. Semmelweis proposed the idea of chlorine hand washing, a technique he observed to reduce mortality rates due to puerperal (childbed) fever, and Lister proposed the idea of using chemical sterilization agents on surgical instruments and wounds to prevent infection and sepsis. Both cases encountered resistance from the medical community. I argue that Semmelweis' ideas were rejected and ridiculed because of his lack of scientific proof for his claims and his poor communication strategies. Lister's ideas were accepted, but the process was difficult and took years. I place additional emphasis on Semmelweis, whose unfortunate and complex story deserves more attention, respect, and credit than it has. Both proposals were counterintuitive to the then-accepted treatments and models of the human body. Furthermore, their theories implicated doctors as the vehicles for infectious disease, which some doctors arrogantly refused even to consider as a possibility. Finally, I argue that Lister's ideas took hold because his ideas were supported by scientific evidence that gave the medical community reasons to accept them.

The Failed Genius of Ignaz Semmelweis

Ignaz Philipp Semmelweis (1818 – 1865) was a Hungarian physician who began his career as an assistant in the First Maternity Clinic at Vienna General Hospital (VGH) in 1846.[2] During this time, hospitals were dangerous places to be. Semmelweis noticed this curious fact, writing: "To me, it appeared logical that patients who experienced street births would become ill at least as frequently as those who delivered in the clinic. [...] What protected those who delivered outside the clinic from these destructive unknown endemic influences?".[2] At VGH, there were two maternity clinics: the first employed doctors who practiced necropsies, and the second employed midwives who strictly delivered babies. The first clinic saw a two- to four-fold higher mortality rate due to post-partum (childbed) fever than the second clinic. Women admitted to the hospital were aware of this fact, and often begged to be admitted to the second clinic. Many theories arose to explain this discrepancy, such as poorer ventilation, rougher examinations that wounded the genitalia, more patients, an increased number of admitted high-risk patients in desperate circumstances, and various superstitions.[2] The issue perplexed Semmelweis for his entire term in the first clinic, and it wasn't until his return for a second term that he found the clue that led to his theory and treatment.

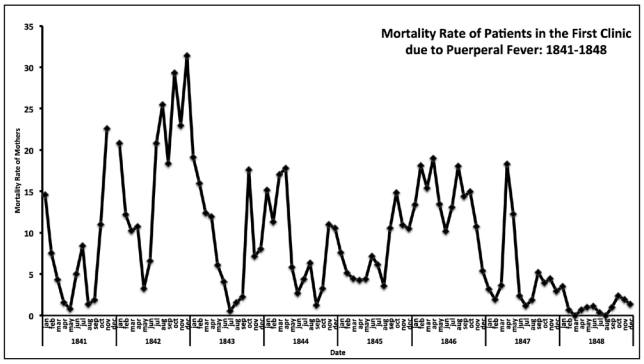

Figure 1. Monthly mortality rates in the first clinic at VGH. After chlorine hand washing was implemented, mortality rates dropped. However, similarly low rates occurred before the implementation as well. Adapted from The Etiology, Concept and Prophylaxis of Childbed Fever, Tables 3 and 7.

Professor Jakob Kolletchska, a dear friend of Semmelweis, had been cut by a knife used in cadaver dissection, and died exhibiting the same symptoms as women with puerperal fever. Semmelweis, upon looking through records to discover the cause of his friend's death, recognized this similarity and attributed his death to the contamination of the wound by cadaverous particles. He immediately linked the cause of childbed fever to these particles. This explained the higher death rate in the first clinic, where doctors practiced autopsies in an adjacent morgue. Physicians and students often travelled to the morgue while waiting for the delivery, and although they returned to the first clinic after a rinsing with soap, Semmelweis believed that their hands remained partially dirty, as evidenced by the "cadaverous smell that the hands retain".[2] Herein lies the foundation of his proposal. He hypothesized that these cadaverous particles were the source of disease, using established knowledge to support his claim: "This seemed all the more likely, since I knew that when decomposing organic material is brought into contact with living organisms it may bring on decomposition".[2] The cadavers were decomposing organisms, and Semmelweis believed that by bringing traces of cadavers into the genitals of birthing mothers, physicians were promoting decomposition within the women's bodies, and made the analogy to how mould can be transferred between loaves of bread. His proposed solution, therefore, was a method to rid the cadaverous particles entirely through chemical means by washing the hands using *chlorina liquida* or the less costly chlorinated lime. His rationale was that chlorine washing was much more effective than ordinary soap in removing the putrid smell of cadavers. Some sources suggest Semmelweis to be the first to insist on using nail brushes for hand cleansing before surgery.[4]

Semmelweis implemented this concept in mid-May of 1847 and saw incredible results. In the two months leading up to his use of chlorine-based hand washing, mortality rates of women were 18.27% and 12.24% in April and May 1847, respectively. In June 1847, the rate dropped to 2.38%, lower than that of the historically safer second clinic, and remained this way for the rest of his term at VGH. During the entire year of 1848, 3,556 women gave birth in the first clinic, of which there were 45 deaths. This death rate of 1.27% was lower than that of the second clinic (1.33%).[2]

Given the number of women dying of the disease, Semmelweis expected his solution to be widely adopted and celebrated throughout Europe. Indeed, the initial reaction to his lectures was good, but criticisms, resistance, and rejection soon followed. He saw an issue, followed a clue to implement a solution, and saved hundreds of women. So why were there doubts surrounding his discovery, if it so dramatically mitigated mortality? Historical records suggest that both Semmelweis and his colleagues were at fault: he could not support his claims and discrepancies with scientific explanation, but fellow physicians remained stubbornly fixated on traditional treatments even in light of his statistical evidence. Furthermore, rather than searching for the scientific explanation he so desperately needed, Semmelweis resorted to lashing out upon his colleagues in increasingly accusatory and angry letters that only decreased his credibility.[2]

The biggest challenge that his groundbreaking discovery faced was that it contradicted the most widely accepted medical opinions at the time, and, most importantly, while Semmelweis could prevent these deaths, he could not explain the findings in a way that was acceptable to the medical community. Without this, physicians wrote off his claims as laughable. Many believed it purely coincidental, given that the mortality rates of the first clinic had previously dropped to similar levels (see Figure 1).[2]

One after another, physicians published their doubts. At the turn of the 19th century, many physicians and patients still clung on to the humoral model of the body and believed that all sickness arose from an imbalance of humours, such as an excess of blood.[5] As well, at the time, many practitioners believed that each symptom was related to a unique cause. Women with childbed fever presented multiple symptoms, including lymphangitis, peritonitis, pericarditis, pleurisy, meningitis, and metastases,[2] so the common theory was that childbed fever must have resulted from a combination of causes. Karl Levy wrote in his 1848 letter that a single source, the cadaverous particles, could not cause these multiple symptoms.[2] Additionally, Levy reasoned that the number of cadaverous particles on the hands would be too minuscule to have such a significant and lethal effect.[2] Semmelweis did not seek to perform experiments to prove Levy wrong.

By 1849, Semmelweis began to express his frustrations at his colleagues' disbelief, and his aggressive attacks and publications likely led to his ultimate downfall. According to Josef Skoda, a professor of medicine at Vienna medical school, Semmelweis saw Wilhelm Friedrich Scanzoni as a critical opponent and spent more time addressing him. Scanzoni was the director of the hospital in Prague, and was not persuaded by Skoda's attempts to institute chlorine washings at the hospital. Scanzoni requested an unusual experiment in May 1848 to stop chlorine washings and observe if more women died. Semmelweis responded to this with biting sarcasm: "I cannot deny my wonder at Scanzoni's penetrating sagacity in dispensing with chlorine washings as an experiment. Any person with common sense would have taken the time from the opening day of the chlorine washings as the period in which the washings were not used." His address was extremely confrontational, explicitly stating on multiple accounts that Scanzoni, the director of a hospital, had little knowledge on the subject, and went as far as to accuse Scanzoni of being more concerned about getting credit than saving lives.[2] It is important to consider the social status of physicians and their notions of self-grandeur at the time. They refused to believe that they themselves could be the causes of disease. Charles Delucena Meigs best conveyed this arrogance and closed-mindedness: "Doctors are gentlemen, and gentlemen's hands are clean".[6]

When his term at VGH expired in 1849, Semmelweis was dismissed from his post and his teachings were ridiculed. In 1861, he completed his main publication, a book entitled "The Etiology, Concept, and Prophylaxis of Childbed Fever", in which he spent the second half attacking his colleagues, even accusing them for being murderers for not changing their practices.[7] He eventually took to the streets to warn couples of the infected hands of maternity doctors.[8] The medical community increasingly questioned his mental state, and in 1865, he was sent to an insane asylum. Ironically and tragically, Semmelweis died of an infection two weeks later.[9] He never learned of the work of a French chemist by the name of Louis Pasteur, whose

germ theory of disease paved the way for the eventual adoption of his ideas.

The Germ Theory and Resistance to Joseph Lister's Sterilization

Fifteen years after Ignaz Semmelweis proposed chlorine washings, the French chemist Louis Pasteur completed his work demonstrating the existence of microscopic organisms. His germ theory of disease disputed the commonly accepted ideas of spontaneous generation of disease.[10] Applying Pasteur's findings, Joseph Lister (1827 – 1912), a British surgeon, explained the causes of infection and developed preventative treatments and techniques for surgical procedures to solve finally the issue of post-operative mortalities due to infection. In fact, the father of antisepsis is so highly esteemed, that some have divided the history of surgery to "before Lister" and "after Lister".[11] But yet again, there was initial resistance to his teachings, and it was two or three decades of debate before his theories were fully accepted.[15, 16]

Lister learned of Pasteur's work on the germ theory in 1865. He reasoned that if chemicals could treat and remove the stench of sewage,[7] then they should be able to preserve open wounds on people from infection as well. In 1867, he published a paper describing the use of carbolic acid as an antiseptic in several case studies of healthy healing of compound fractures, an injury almost guaranteed to cause fatal sepsis or amputation at the time.[12] The resistance came quickly. James Young Simpson published his doubts in the same journal a few months later and asserted that Lister's work was "not in any way original".[13] One major contributor to the resistance to Lister was the fact that physicians failed to understand the evidence and had difficulty reproducing Lister's complicated methodology. George Thompson attempted Lister's published methods at the Oldham Infirmary and saw no beneficial results. He thus visited Lister to learn more about the technique, and upon seeing the familiar inflammation and discharge on antiseptic-treated wounds, believed the technique to be a total failure. Convinced that Lister's antisepsis techniques were not beneficial, he unfortunately overlooked the lack of putrefaction in the wound, which indicated that infection had not occurred.[14]

Next, some physicians still questioned the very basis of the germ theory: Francis W. Goss reported in his June 2, 1874 lecture that Pasteur's theories were unsound.[14] Even in 1879, physicians at a seminar in Paris cast doubt on the germ theory and the effects of hand washing.[15] Most did not appreciate the transition from spontaneous generation to the germ theory. The New England Journal of Medicine's film "From Rough to Refined: The Rise of Surgery" quotes leading physicians' disapprovals of Lister's work: "author is hasty, careless, and sometimes ambiguous"; "his own grave error"; "condemned by many distinguished surgeons".[16] Most importantly, Lister's claims brought controversy because they implicated surgeons as the vehicles of the diseases they were supposed to be curing.[16] This idea offended the surgeons, so again, the arrogance of doctors reappeared, echoing the same issue that plagued Ignaz Semmelweis 20 years earlier. Eventually, germ theory became accepted throughout the medical community. Then, Lister's scientific explanation and evidence became clear: it was realized that infection could be better avoided by primarily preventing bacterial exposure onto the wound. This led to the rise of aseptic surgery.

Conclusion

Lister's ideas were accepted because Louis Pasteur's germ theory paved the scientific foundation that provided the logical power that Semmelweis' ideas lacked. He supported his claims with scientific explanations, and communicated his ideas civilly. In 2012, Atul Gawande called Semmelweis a "failed genius" because Semmelweis observed the problem and provided solutions, but never published his work and his aggressive language did not convince his colleagues to change their protocols.[16]

Although Ignaz Semmelweis promoted the idea of chemical hand washing as early as the 1850s, it was decades later before it became a mandatory protocol for surgery. Even after Joseph Lister introduced a practical application of Louis Pasteur's germ theory of disease to reduce infection-related post-surgical mortality, many physicians shrugged off the evidence and questioned the basis of his work. Eventually, antisepsis in surgery became accepted.[17] Unfortunately, this shift in knowledge was paid for by the lives of countless victims of preventable puerperal fever and post-surgical infections. The stories of Semmelweis and Lister serve to emphasize the importance of effective communication and rigorous scientific explanation to proposed theories. All in all, this should be taken as an important lesson for present-day medical practitioners to employ constant vigilance, an open mind, and a trace of humility.

References

1. Wangensteen OH, Wangensteen SD. The rise of surgery: from empiric craft to scientific discipline. Minneapolis: University of Minnesota Press; 1978.
2. Semmelweis I, Carter KC (translator, extensive foreword). The Etiology, Concept and Prophylaxis of Childbed Fever (1861). Madison, WI: University of Wisconsin Press; 1983.
3. Dunker MFW. A History of Early Antiseptics. Journal of chemical education. 1938;15(2):58.
4. Gortvay G, Zoltán I. Semmelweis: His Life and Work (Budapest: Akadémiai Kiadó, 1968), p. 210f. Referenced in Ignaz Semmelweis, The Etiology, Concept and Prophylaxis of Childbed Fever. 3 p.
5. Nuland SB. The Doctor's Plague. New York: W.W.Norton & Company; 2003. (Nuland describes Lazare Rivière's, a 17th-century French physician's summary: "The causes of this suppression are a too great thickness of the blood".) 33 p.
6. Meigs CD. On the nature, signs, and treatment of childbed fevers. Philadelphia: Blanchard and Lea; 1854. 104 p.
7. Wheeler ES. The Development of Antiseptic Surgery. The American Journal of Surgery. 1974;127(5):575.
8. Mosley M. Blood and Guts - A History of Surgery: Bloody Beginnings. Produced by Shillinglaw K and directed by Mosley M. United Kingdom: BBC; 2008. Television.
9. Carter KC, Carter BR. Childbed fever. A scientific biography of Ignaz Semmelweis (Transaction Publishers, 2005). 76-78 p.
10. Ullmann A. Pasteur-Koch: Distinctive Ways of Thinking about Infectious Diseases. Microbe, American Society for Microbiology. 2007;2(8):383–7.
11. Cheever D. Lister: 1927-1927; An Address Before the Springfield Academy of Medicine, April 12, 1927. Boston Medical and Surgical Journal 1927; 196:984-993.
12. Lister J. On the antiseptic principle in the practice of surgery, The British Medical Journal. 1867:246-248.
13. Simpson JY. Carbolic Acids and its Compounds in Surgery. Boston Medical and Surgical Journal. 1867;77:390-392.
14. Goss F. The Dressing of Wounds. Boston Medical and Surgical Journal. 1874;91:73-80.
15. Case CL. Handwashing [Internet]. Atlanta: Access Excellence at the National Health Museum; c1993-2010 [cited November 23, 2012]. Available from: http://www.accessexcellence.org/AE/AEC/CC/hand_background.php.
16. Porter N. From Rough to Refined: The Rise of Surgery [film]. Produced and directed by N. Porter. Runtime 12:34. 2012.
17. Gawande A. Two Hundred Years of Surgery. The New England Journal of Medicine. 366;18:1716-1723.