

EDITORIAL NOTE

Joseph Lister's Surgical Revolution

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ABSTRACT

Joseph Lister (1827–1912), renowned British surgeon–scientist, introduced to the world the use and appreciation of the antiseptic method for the prevention of wound sepsis. Armed with the ideas of Louis Pasteur (1822–1895) regarding the role of microorganisms in infections or the so-called germ theory of disease, he advanced the surgical field by using antiseptics, such as carbolic acid, in the treatment of contaminated wounds. These developments constituted a real surgical revolution. No breakthrough before Lister's, except perhaps the discovery of anesthesia, had contributed to such an incredible advancement in relationship to the surgical arena. After 1867, the year in which Lister published his remarkable paper in *Lancet*, it was possible to appropriately treat or prevent wound infections with the use of antiseptics at the site of the operated wound. Lister's method was complicated but produced its desired effect—to diminish wound morbidity and patient mortality. His contribution was secured for future generations and a surgical revolution had begun!

Keywords: Joseph Lister, surgeon–scientist, antiseptic method, surgical revolution, surgical advances

Joseph Lister (1827–1912), without any doubt, represented the most accomplished scientific surgeon of his time. He made contributions in the field that became the basis upon which the surgery of today relies in all its vigor and expression. Lister brought to the surgical field the understanding and appreciation of antiseptic principles, identifying the direct relationship between microorganisms and surgical disease, and this knowledge was conducive to decreasing surgical morbidity and mortality.

Lister created antiseptic surgery and, therefore, a true surgical revolution that saved thousands of patients from lethal infections acquired during and after surgery. No other procedure or surgical discovery that had been introduced before had such a great impact on the surgical specialty as antiseptic surgery when applied locally or systematically.

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ANTISEPTIC SURGICAL REVOLUTION

In March 1867, Lister (Figure 1) claimed to have found a new method for treating compound fractures and advancing the cure of suppurations from the bone and soft tissues of patients suffering from injuries resulting in these fractures [1, 2]. The mortality associated with these conditions was staggering. Nothing proposed before Lister had any demonstrable effect on these untreatable septic problems.

Lister described 11 cases with only one death, a result previously unheard [1–13]. What was occurring was not understood. Surgeons could not believe that Lister's concepts or Listerism was the cause of it. Indeed, the surgical and medical world was completely apathetic to Lister's developments.

How, then, did Lister implement a consistent solution to the giant mortality that followed the treatment of compound fractures? How did he change the paradigm of treatment for unsolved surgical or operative infections? What did he use that would modify the world's management and treatment of infected



FIGURE 1. Joseph Lister on the late stages of his surgical contributions to the antiseptic method (obtained from sciencemuseum.org.uk).

surgical wounds? What was so different in his approach and his way of understanding the disease?

I believe Lister's solution to the dismal management of surgical wounds was reached based on three different fundamental factors: one, his knowledge and practice of basic sciences applicable to surgery; two, his belief on the germ theory of the disease; and three, his understanding that antiseptics were needed to overcome the presence of infection. We have already written about the fundamental conditions upon which Lister based his theory and results [3–8]. Now, the idea is to place them into perspective regarding the overall effect these monumental findings, published in 1867 [1], had on surgery then and now.

The revolutions in surgery, in any area of medicine, or for that matter, in any particular field of scientific endeavor or humanistic approach, require a vastly different consideration. Revolution is a radical change, compatible only with a cataclysm, a new way to see things, something never seen before. Moreover, that was what the antiseptic method of Lister represented.

LISTER'S REASONS FOR THE APPLICATION OF THE ANTISEPTIC METHOD

The factors determining the manner in which Lister approached the problem of sepsis during and immediately after surgery were generated from the basic understanding he had of wound suppuration and in-

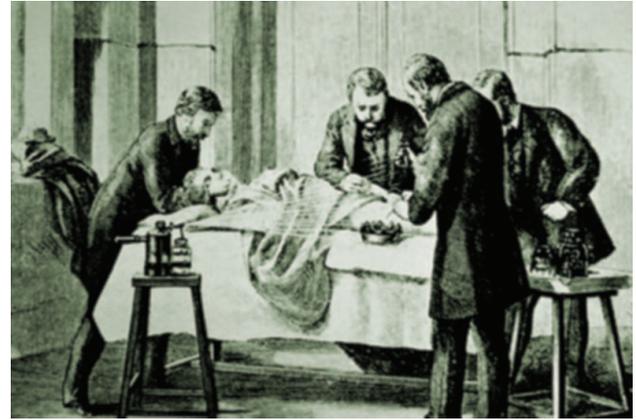


FIGURE 2. Representation of Lister's antiseptic method (obtained from the microbial world lectures, Kenneth Todar, PhD, department of bacteriology at textbookofbacteriology.net of University of Wisconsin-Madison).

fection occurring after operation. This consideration, united with his knowledge of Pasteur's findings on the germ theory of the disease, was critical to Lister's application of the antiseptic method in 1865 (Figure 2), the results of which were published in 1867 [1, 2].

Lister had a clear understanding of the science behind the presence of infections in surgical wounds. The microorganisms were the evident culprit and something that needed to be combated. Pasteur had opened the doors and Lister, using the French scientist's knowledge, followed a logical path to understanding how the wounds got infected. In order to think like Lister, it is necessary to think about the germ theory of disease, or to think like Pasteur, if you prefer to see it in that way [2].

Now, how did Lister change the paradigm of unsolved surgical infections? Consider the larger equation, because believing in the germ theory would clarify the whys and why nots of this complex and unsolved problem. Lister followed his convictions, applied his knowledge and reached the solution. Wounds were infected by microorganisms, which he needed to get rid of to improve a patient's condition. In hindsight, this solution appears very simple. Get rid of the infection and the patient will be fine!

What did Lister use that would modify the world's management and treatment of infected surgical wounds? As we have said before, he used his surgical principles of wound management, which were based on no germs, no infected wounds, and no disease. It is hard to understand why others before Lister had not seen these relationships. The reason resides in the preparation and ideas of Lister, which culminated in his extraordinary results.

What was so different in Lister's approach and understanding of wound and surgical disease? Quite simply, it was his acceptance and knowledge of basic sciences as phenomena caused by forces within the natural world, where a plausible explanation regarding the source of disease could be found. Lister applied his scientific theories very well and solved the puzzle of surgical wound infections. Bugs or microorganisms were causing the surgical diseases, and it was absolutely required that these be eliminated when treating serious wounds.

LISTER'S ANTISEPTIC METHOD

Lister's antiseptic method was not readily understood because it was very complex, according to many contemporary surgeons, who were not used to painstakingly slow and delicate surgery. Surgeons were impatient and had, in general, no interest or knowledge of scientific principles. In reality, the routine application of science to surgery did not begin until the latter part of the 19th-century surgery, when pioneers like Halsted, the Mayos, Crile, Murphy, and others offered better means of cure and improved management [14].

The complexity of Lister's method began with the use of antiseptics—such as carbolic acid—that potentially eliminated the germs present in the infected wound by washing, bathing, cleaning, and spraying the wound. Instruments, surgeons' hands, and the whole surgical environment were also cleansed. For a great number of surgeons, this seemed unnecessary, as maintaining a clean wound was more than enough for them. There was no incentive in the surgeons' professional career to advance the theoretical knowledge based on the germ theory of the disease. Results were only at the basis of their comprehension and acceptance, because science was not considered in their approach to wound treatment.

Lister required that every element associated with the surgical act, directly or indirectly, should come in contact with the antiseptic compound in many forms, so that assurance could be given to all elements involved regarding the absence of infection. Lister was absolutely convinced about the virtues of antiseptics in preventing surgical wound sepsis. For Lister the antiseptic method was simple to understand, based as it was on the germ theory of the disease. Germs had to be eliminated at all costs. As other surgeons did not believe in the germ theory, they were not pressured to accept the use of antiseptics and, indirectly, the germ theory. Today it is quite easy to correlate germs with disease, but this connection was much less obvious to practicing surgeons who typically lacked scientific involvement.

Lister's antiseptic method was scientific. All principles were explained through well-designed objectives and demonstrated results that were better than the results observed without antiseptic principles. Lister's method rested on theory, a hypothesis, clear aims, and, finally, well-carried out results. There was no doubt as to the characterization of the principles. A full proof of correlation existed among microorganisms, surgical disease, and antiseptics. The whole thing had been sealed from the scientific point of view. Lister had reached the summit of surgical inquiry and had presented a new perspective on the treatment of surgical wounds. A real surgical revolution!

CONCLUSION

Lister culminated his extraordinary work with the full acceptance of his antiseptic method. In spite of his well-recognized advances in the treatment of contaminated wounds, as we know it today, it took many years and even decades before everyone fully accepted his method.

Today we look back and realize Lister's unique contribution to the progress of surgery. Today we appreciate its full impact, and admire and cheer the clarity of his findings and the conception of a surgical revolution!

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