Papers and Originals

Joseph Lister, 1827-1912

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Modern surgery began one hundred years ago, when the first of Joseph Lister's articles, entitled "A New Method of Treating Compound Fractures," appeared in the *Lancet* of 16 March 1867. The first published account of the application of the new system to operation wounds appeared in an article entitled "The Antiseptic Principle in the Practice of Surgery" in the *British Medical Journal* of 10 August that same year. These contributions opened a campaign that was destined to revolutionize surgery.

Joseph Lister's education and upbringing prepared him for a life of scientific research. Born on 5 April 1827 at Upton, then near but now in London, he was the son of Joseph Jackson Lister, a prosperous city merchant whose spare time was devoted to study and research, especially optical research, in which he distinguished himself by discovering the best method of correcting chromatic aberration; for this and other work he was elected a Fellow of the Royal Society of London.

The family were devout members of the Society of Friends, and Joseph was brought up to regard useful work almost as a sacred duty. At two private schools he had a good grounding in the classics, modern languages, mathematics, and natural history. Even as a schoolboy he performed some dissections, and at an early age he expressed a wish to become a surgeon. Owing to the religious tests he was not able to go to either Oxford or Cambridge University, but he was trained at University College, London, and took his B.A. at London University in 1847. He then had an attack of smallpox that left him in a depressed state and compelled him to take a long holiday.

His father wrote him a letter of encouragement saying: "It is indeed a mistake to believe thyself required to bear burthens on account of the states of others, whilst in fact thou hast to suspend even the pursuit of thine own avocation." Fortunately he soon recovered his mental poise, but all through his life he retained that same deep pity for human ills. In his medical course at University College he came under the influence of several distinguished men—William Sharpey, Wharton Jones, John Erichsen, R. E. Grant, Thomas Graham, and Viner Ellis—and he passed the M.B. London, with honours, in 1852. In the same year he obtained the F.R.C.S. England. Towards the end of his time at University College he carried out an excellent microscopical research on the involuntary muscles of the iris and skin.

Visit to Edinburgh

William Sharpey then advised him to visit the famous surgical clinic of James Syme at Edinburgh, and thither he went in 1853. He found Syme so friendly and helpful and the work so congenial that he prolonged his stay with a view to pursuing a surgical career. In a letter to his father he weighed his chances of success, and shrewdly estimated his own character as follows: "Certain it is I love surgery more and more, and

that is one good thing. I believe my judgement is pretty sound which is another important point. Also I trust I am honest and a lover of truth which is perhaps as important as anything. As to brilliant talent I know I do not possess it, but I must try to make up as far as I can by perseverance."

In this remarkable self-assessment Lister omitted the important facts that he possessed a scientifically trained mind imbued with a spirit of research, and well equipped for carrying out experimental work. He served as house-surgeon and private assistant to Syme, and in 1856 was elected Assistant Surgeon to the Royal Infirmary. In that same year he married Syme's eldest daughter, who proved to be an ideal helpmate. While in Edinburgh he undertook several important researches on the early stages of inflammation, the cutaneous pigmentation of the skin of the frog, and the coagulation of the blood, and in 1860 he was elected a Fellow of the Royal Society. In that year the important post of Regius Professor of Surgery at Glasgow University fell vacant, and Lister applied for and gained this desirable position.

In Glasgow his lectures were at first sparsely attended, but they gradually became more popular, and when, a year later, he took charge of surgical wards he had crowded audiences. Yet he became unhappy because so many of his surgical cases developed serious or even fatal septic complications. As Hector Cameron put it: "Lockjaw, erysipelas, blood-poisoning of various kinds, and hospital gangrene were never absent from the hospital wards at any one time, and repeatedly gangrene and pyaemia—a most fatal form of blood-poisoning—became alarmingly epidemic."

Lister had worried about hospital sepsis at Edinburgh, and Godlee relates that as early as 1855 Lister had shown Batty Tuke a wound that was healing without suppuration, and had said: "The main object of my life is to find out how to procure this result in all wounds." At Glasgow the problem was constantly before him, and fortunately he had a mind prepared to receive new ideas. The illuminating idea came in 1865 during a talk with Professor Thomas Anderson, who mentioned that in France the famous chemist Louis Pasteur had proved that fermentation and putrefaction did not occur in susceptible fluids that had been kept free from contact with air; moreover, he had shown that the common souring of milk and the fermentation of grape-juice were caused by the growth and action of minute living particles (microbes) that could be carried in the air. Lister at once saw the main point—microbic infection from the air—and determined to test whether, by interposing a shield of antiseptic substance between the wound and the surrounding air, the decomposing process caused by the microbes might be prevented so that septic complications would not occur.

Antiseptic Method

As an antiseptic shield he chose carbolic acid, of which an impure form (creosote) had been successful in purifying and

deodorizing the sewage of Carlisle. As a critical test he tried it first on a series of cases of compound fracture, which were notoriously subject to serious septic complications. He covered the open wound with lint soaked in the carbolic acid, and over the lint put a piece of block tin to prevent evaporation. By this means between 1865 and 1867 a series of eleven cases of compound fracture were treated, of which nine healed without suppuration. Of the two failures one needed amputation and the other patient died from secondary haemorrhage. Compared with the usual course of events these results were remarkable, and Lister fully described them in the *Lancet*.

He next tried the antiseptic method for operation wounds. On 20 April 1867 he operated for the removal of a tumour from a man's arm, using 1 in 20 carbolic acid as a lotion for the raw wound, and applying an antiseptic carbolic paste to the sutured wound. The result was excellent. During the succeeding four months Lister successfully used the antiseptic method for several amputations, and for a large ventral hernia that required removal of a great deal of omental fat. These cases he reported before the meeting of the British Medical Association held in Dublin in August 1867 (see *Brit med. J.*, 1867, 2, 246).

For these operations his technique was simple. The skin over the site of operation was cleansed by washing with 1 in 20 carbolic lotion (never with soap and water), instruments were immersed in a similar solution for 15 minutes before operation, and the hands of Lister and his assistants were also soaked in that strong lotion. At a later period towels wrung out in 1 in 20 or 1 in 40 carbolic lotion were placed around the operation wound. No gown or mask was worn, but Lister took off his coat and rolled up his shirt sleeves before operating. From 1871 to 1887 Lister also made use of a spray of 1 in 100 carbolic lotion that was intended to purify the air over the area of operation, but it was found to be unnecessary.

Lister was a perfectionist, and often changed the type of dressing. Between 1867 and 1870 he preferred non-absorbent dressings, but from 1870 onwards he used absorbent dressings. In the earlier period he changed from pure carbolic acid to a solution of the acid in olive or linseed oil (1 in 4), and a later modification was to mix the carbolized oil with powdered chalk to form a sort of putty that was applied to the wound. Finally, after trying a paraffin-wax carbolized dressing he adopted a mixture of carbolic acid in shellac. From 1870 he used absorbent gauze impregnated with various antiseptic substances—carbolized resin, thymol, oil of eucalyptus, a solution of perchloride of mercury, then a mixture of mercuric and ammonium chlorides (sal. alembroth), and finally he used gauze impregnated with the double cyanide of mercury and zinc—a dressing dyed a pale heliotrope colour that was still in common use when I was a surgical dresser 64 years ago. In the days when he used pure carbolic acid Lister interposed an innocuous substance—usually specially prepared oiled silk—between the wound and the carbolic dressing. These frequent changes must have been confusing to those who did not fully understand the underlying principle.

Mixed Reception

The new doctrine met with a mixed reception. It was acclaimed by those who worked with Lister, by those who came to see and learn his methods, and by those who studied his writings carefully and followed his directions; on the other hand, the new system was disparaged by those who read his writings carelessly or tried his methods negligently, and of course by those who thought they had little to learn in the treatment of wounds. In Britain it was chiefly the junior surgeons who welcomed the new system; the seniors tried it half-heartedly, if at all. In Germany, however, many distinguished surgeons—Thiersch, von Volkmann, von Nussbaum, von Bergmann—were loud in their praise of the new technique, and hospitals that had been hotbeds of sepsis were converted

into healthy places of healing. In most countries those who tried it valued it.

In 1869 Lister left Glasgow to succeed Syme as Professor of Clinical Surgery at Edinburgh, and there for eight years he lectured to large classes of students, demonstrated his principles to the many visitors from all parts of the world, and practised many operations that had previously been unsafe to attempt. In 1875 he gave a most impressive demonstration of some of his cases before the members of the British Medical Association in Edinburgh. He was now world-renowned, and a visit he paid to some of the German universities developed into a triumphal progress. However, London was still neutral, if not antagonistic, but in 1877 Lister accepted the invitation to become Professor of Clinical Surgery at King's College Hospital. Here his personality, his integrity, and his friendliness made their influence felt, and at a meeting of the South London Division of the British Medical Association held at St. Thomas's Hospital in 1879 (at which Lister was present and spoke) many surgeons expressed agreement with his views. Spencer Wells, then in his prime, said that his results for ovariectomy had been very definitely better since he adopted the antiseptic method. Yet there were some "diehards" who saw little good in the new doctrine, and when in 1883, at the meeting of the Medical Society of London, Lister showed six patients on each of whom he had successfully operated for fracture of the patella, one of the members said: "C'est magnifique, mais ce n'est pas la chirurgie." In that year Lister was created a baronet.

Debt to Pasteur

Lister always acknowledged his great debt to Pasteur, and, on his part, Pasteur greatly admired Lister's surgical application of his work; on the occasion of the celebration of Pasteur's seventieth birthday at the Sorbonne, when Lister came forward to present the laudatory address from the Royal Societies of London and Edinburgh, there was a moving scene when Pasteur rose up and embraced him.

By 1890 nearly the whole surgical world had accepted Lister's great innovation, and by this time the microbes that caused sepsis had been identified and cultured. Many surgeons had adopted the aseptic technique, which, as Lister pointed out, was but a modification of the antiseptic method and sometimes needed antiseptic support.

Lister contributed many other improvements to surgery. To him we owe the introduction of sterilized hardened catgut as suture or ligature material. He also devised several useful surgical instruments and invented an aortic tourniquet. He was probably the first ever to treat varicose veins by the injection of carbolic acid, and it was Lister who was the first surgeon in Britain to use a rubber drainage-tube, and the patient on this occasion was none other than Queen Victoria.

The loss of his wife in 1893 was a terrible blow to Lister, who had been immensely sustained by her constant care and co-operation, and from that time he lost much of his interest in life. Many honours came to him. In 1895 he became President of the Royal Society, in 1897 he was raised to the Peerage, and in 1902 he was awarded the Order of Merit. In 1908 he retired to Walmer, where he lived quietly with gradual failure of his powers, and he died on 10 February 1912.

A very impressive memorial service was held in Westminster Abbey, and he was buried (by his expressed desire) in West Hampstead cemetery, where Lady Lister had been laid to rest in 1893. In the service in the Abbey the anthem sung by the choir contained the following words: "Kindness, meekness, and comfort were in his tongue. If there was any virtue, and if there was any praise, he thought on those things. His body is buried in peace, but his name liveth for evermore." As his nephew Godlee said, these words were peculiarly applicable to the occasion.

JOSEPH LISTER 1827–1912

Upton House, Upton, Essex. (From a photograph by J. Gregory.) Lister was born in this Queen Anne house on 5 April 1827. It has now been in disrepair for some time. Recently the Greater London Council withdrew its application to the Ministry of Housing and Local Government for a building preservation order.

Joseph Lister. (From a photograph in the Wellcome Historical Medical Museum and Library.) Though the precise date of this photograph is not known, it is thought to have been taken when Lister was about 40—that is, during the time he was professor of surgery at Glasgow and was working on the control of bacterial infection.

Lister's original choice of carbolic acid as an antiseptic was based on his reading that it had been used successfully to "purify" sewage in Carlisle. The original spray was worked by hand, but later, as in this illustration (on left-hand side), it was worked by steam. "If we could dispense with the spray, no one would rejoice more than myself; but until somebody wiser than I am can supply some better means, we must continue to use it." (Lister, J., *Edinb. med. J.*, 1876, 21, 481.)

JOSEPH LISTER 1827–1912

Lister presiding at the Royal Society. (From the *Illustrated London News*, 1897.) Among the honours Lister received was his election to the Fellowship of the Royal Society in 1860, of which he was the President from 1894 to 1900. He was President of the British Association in 1896. Lister had a baronetcy conferred on him in 1883, and in 1897 he was created Baron Lister of Lyme Regis—the first peerage to be conferred on a surgeon. In 1902 he was one of the 12 original members of the newly founded Order of Merit.

Lister greeting Pasteur at the celebration of the latter's 70th birthday in 1892. Pasteur, who had had a stroke, is seen leaning on the arm of Carnot, the President of the Republic. (From the painting by Rixens.) "The philosophical investigations of Pasteur long since made me a convert to the Germ Theory, and it was on the basis of that theory that I founded the antiseptic treatment of wounds in surgery." (Lister, J., *Trans. roy. Soc. Edinb.*, 1875, Vol. 27.)

(Illustrations by courtesy of the Wellcome Trustees.)