

Surgical wound infections: A historical review

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Abstract

Until the 1860's surgical site infection was so severe that surgeons rarely operated. Erichsen, from University College Hospital in London coined the phrase 'hospitalism' for what we now call healthcare-associated infection'. He provided 13 recommendations for its prevention - many of which remain valid to-day. However it was his pupil Joseph Lister who first made surgery possible using his 'antiseptic method' based on a phenol-impregnated wound dressing. This was later developed into the 'aseptic surgery' of to-day.

Review

L'operation, comme operation a reussie mais – le malade est morte. The operation succeeded, but the patient is dead. As surgeons became more skilful, and introduction of anaesthesia in the 1850's allowed more complex operations – so this became a more heart-rending comment. The word 'Hospitalism' was introduced by Sir James Simpson in Edinburgh to describe what we now call hospital-acquired surgical-site infection. Shock, erysipelas (streptococcal infection) or pyaemia (staphylococcal infection) and hospital gangrene were the big post-operative killers.

Erichsen, the head surgeon at University College Hospital in London produced a 'hard hitting' book in 1874 (Figure 1). His statistics were horrendous; between 1870 and 1873 – 36% of those having major

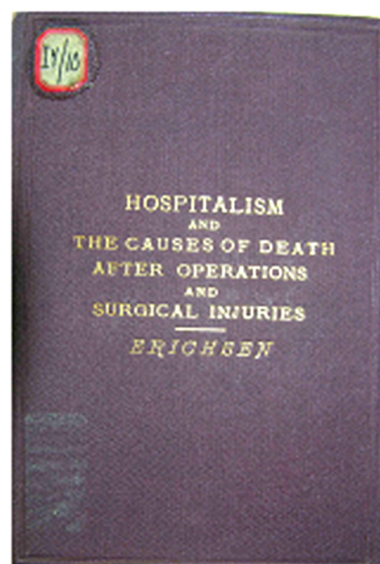


Figure 1. Erichsen's book (1874)

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amputations died (In four major London Hospitals this was 38% -Table B). This had not changed since he began work 25 years earlier. Figures collected from 'all the great centres of civilisation' (England, France, Germany, America) for amputations in the largest hospitals by surgeons of 'consummate skill' showed a 30 – 50% death rate after major amputations (Figure 2). In fact it was safer to be operated on at home, than in hospital.

Erichsen knew Lister, but was not convinced by his work: 'Of antiseptic treatment I can as yet say nothing positive, it has been tried in my wards with some success, but not enough for me to come to a definite conclusion.' He had heard of Semmelweis and reported his findings. Many of his recommendations remain true to-day:

1. Render all room surfaces as non-absorbent as possible.
2. Dry rub, rather, than wash, floors.
3. Frequent 'purification' of bedding especially blankets.
4. Remove all un-necessary furniture, carpets etc.
5. Store patient's clothes outside the wards.
6. Compel nurses to wear washable dresses.
7. Give patients hospital suits.
8. Have an abundant supply of carbolic water for washing.
9. Have no sponges on wards, and those in theatre should be soaked in strong carbolic.
10. No visits by hospital staff to the 'dead house' (shades of Semmelweis).
11. Isolation of patients with 'foetid' or 'cancerous' ulcers, and all those with septic disease.
12. Avoid overcrowding and have good ventilation in the wards.
13. Close every ward for one month each year for disinfection and re-decoration.

Joseph Lister's antiseptic technique revolutionised surgery. Lister always wanted to be a surgeon, and was encouraged to experiment by his father, who, although a wine merchant, invented a microscope lens, and gave his son a 'state of the art' microscope. Because they belonged to the 'Quakers' – he had to study medicine at University College in London – called the 'godless college' because it had no religious discrimination.

Even as a student he published several valuable researches. After his first medical jobs at University College Hospital (including working for Erichsen), he travelled to Edinburgh at the start of a 'gap year' to study surgery around Europe. Actually he never got beyond Edinburgh. He worked for Professor Syme, one of the leading surgeons of the time, and married Agnes Syme. Lister's researches into inflammation and blood clotting got him well known and he became Professor of Surgery in Glasgow in 1860 when he was only 33 years old.

As we have seen, mortality after amputation was very great; even in the newly built Glasgow Royal Infirmary, which had spacious well-ventilated wards, it was 48%. This was a cause of worry to Lister – even though he was unaware of Semmelweis' work he instituted piles of fresh towels in the wards for hand washing, but with no effect. However when he heard of Pasteur's work, which disproved 'spontaneous generation' he promptly set about repeating it using Swan-necked flasks filled with urine, which he boiled, and sealed with cotton wool. As long as particles were excluded the urine remained sterile. So – how to exclude particles from

20 RATE OF MORTALITY AFTER AMPUTATIONS.

TABLE B.—Summary of Results of Amputations in four Metropolitan Hospitals, in which Deaths from Pyæmia and Shock are recorded.

Hospital and Years	Total	Died	Pyæmia	Shock	Percentage of Deaths
PRIMARY AMPUTATIONS.					
A. 1866-70 . . .	21	15	4	0	62
B. 1861-72 . . .	140	67	54	8	46.4
C. 1869-70 . . .	18	8	2	5	44.3
D. 1867-71 . . .	8	2	0	2	37.5
Total primary . . .	187	90	50	21	48.6
SECONDARY AMPUTATIONS.					
A. 1866-70 . . .	20	16	9	2	80
B. 1861-72 . . .	53	30	10	1	56.5
C. 1869-70 . . .	5	1	1	0	20
D. 1867-71 . . .	6	3	2	0	50
Total secondaries . . .	84	50	22	3	59.5
FOR DISEASE.					
A. 1866-70 . . .	85	31	15	0	34.9
B. 1861-72 . . .	215	56	16	0	26
C. 1869-70 . . .	17	5	0	0	29.5
D. 1867-71 . . .	25	6	3	0	20.6
Total for disease . . .	350	98	34	0	27.4
Total of all amputations	631	239	86	24	37.8

Figure 2. Mortality statistics following surgery in four London hospitals (Erichsen)

wounds? He read about the successful use of carbolic acid for treating sewage in Carlisle, and so obtained some 'German Creosote' – a dark brown fluid. He thought that compound fractures would be a good challenge. He had to wait until August 1865, when James Greenlees (aged 11) was admitted after being run over by a cart. His wound was covered by lint soaked in creosote, covered with a sheet of tin then an absorbent dressing. Creosote was painted on daily. The blood and creosote formed a crust and the wound healed perfectly. During the next three years the death rate for amputations fell to 15% (and in one third of these the treatment had not been properly applied). Creosote was replaced with a pure carbolic acid, and Lister also washed his hands in it and for a while also

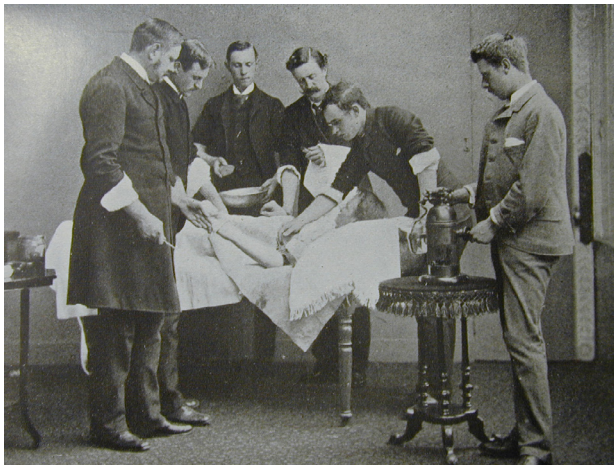


Figure 3. An 'antiseptic' operation in Dundee – note the carbolic spray

had it sprayed into the room air during the operation. The photograph (Figure 3) shows a typical set-up from Dundee. The fourth man from the left is Alexander Ogston, who was the first to show that *Staph aureus* caused abscesses.

After Symes' death in 1869, Lister returned to Edinburgh. Here his front room became a bacteriology laboratory, and in 1878 he achieved the first ever 'pure cultures' of bacteria (from milk) by using very dilute solutions. In 1877 Koch, while still working as a country doctor, followed up Lister's ideas on sepsis, by inoculating 'putrid materials' into animals. He used high-powered microscopy to demonstrate bacteria in wounds, and concluded that different bacteria were involved (Lister only thought of bacteria as particles – with no reference to type). Lister remained in contact with Pasteur, and had Koch's work on surgical wound infection translated into English. By 1881 Koch perfected the 'plate technique' that allowed identification of different bacteria from the appearance of the colonies. Lister invited him to London and demonstrate his technique, in the presence of Louis Pasteur. Pasteur shook hands with Koch and said 'C'est un grand progress Monsieur'. This must have been a great moment – three of the most important people in the history of surgical wound infection together.

As time went by, antiseptics were replaced by asepsis, but Lister's groundwork laid the foundations for today's surgery.