Surgery Through The Ages

Surgery during the Medieval Era

During medieval times Surgery and knowledge of the Anatomy was developed as dissection was allowed. Doctors would, as part of their training, be lectured on the theories of Galen and often a dissection would form part of this teaching. However it was a demonstrator, rather than the doctor, who performed this and often mistakes would be made or inaccuracies blamed upon poor workmanship rather than ill-informed theories: meaning that for a long time the anatomical works of Galen and the Islamic physicians went unchallenged in Western Europe.

The age-old problem of unsuccessful surgery was however partially dealt with. Doctors recognised that infection and pain were the primary causes of death during surgery. To combat this they started to use wine as an antiseptic and drugs to ease pain. Surgery was still limited to the removal of cists, cataracts and minor operations to cure wounds, a procedure which developed as a result of conflicts (although each time doctors worked out how to remove a type of arrow head from the body a new type of arrow was introduced).

The American physician, Oliver Wendell Holmes (1809-1894) coined the term 'anaesthesia' from the Greek word meaning 'lack of feeling'. In London, on 19 December, Robert Liston (1794-1847) at University College Hospital, removed the leg of Frederick Churchill under the influence of ether. Accustomed to operating at speed without the benefit of anaesthesia, Liston amputated in 28 seconds. The following day, ether anaesthesia was tried in Paris. By the beginning of March 1847, it had been used in Berne, Vienna, Berlin, and the Netherlands. The ability to put patients 'to sleep' at will with anaesthetics such as chloroform, caused public misgivings. One case became famous. William Wilde (1815-1876), the son of a doctor and father of the playwright, Oscar Wilde (1854-1900), was born in Castlereagh, Northern Ireland. In 1863, he was appointed Surgeon Oculist in Ireland to Queen Victoria, and was knighted the following year. In that year, too, a former patient, Mary Travers, issued a pamphlet claiming that he had made 'an abortive effort on her virtue through the instrumentability of chloroform'. Her allegation was also published in the press. Lady Wilde wrote to Travers' father protesting against the

accusation of attempted rape, and Travers sued her for libel. The case went to court where it was settled in favour of Travers who was awarded a farthing damages.

The scandal raised questions about the administration of anaesthesia by doctors in situations where both they and their patients were at risk of compromise. By the time of Wilde's court case, qualified doctors were legally the only people who could administer anaesthetics, a measure intended to protect against their criminal abuse. The idea that doctors might use their privileged position to perpetrate abuse had not been fully addressed.

Surgeons spread disease

The need for cleanliness in surgical practice was influenced by prevailing ideas about wound putrefaction and the spread of disease. Although Greek healers used wine and vinegar in wound dressings, they also developed the concept of 'laudable pus'. Pus was believed to derive from vitiated blood and needed to be expelled in order to promote healing. Wound suppuration was therefore encouraged. In the mid-17th century, the scientific adventurer, Sir Kenelm Digby, invented the 'wound salve'. This was applied to the weapon rather than the wound although it was intended to heal the latter. In 1848, the Viennese surgeon, Ignaz Semmelweiss (1818-1865), showed that the deadly puerperal fever which sometimes followed childbirth, could be carried from woman to woman by doctors. He instigated a procedure whereby doctors scrubbed their hands with soap and water, and rinsed them in chlorine water.

There was much antagonism towards this concept because doctors did not believe themselves to be the transmitters of disease. Nevertheless, by 1860, the English surgeon, Thomas Spencer Wells (1818-1897), established a practice of washing in cold water before an operation. He would admit no one to the operating room unless they testified in writing that they had not attended a *post-mortem* for 7 days. Both Semmelweiss and Spencer Wells were influenced by the theory that fevers originated in miasmata (emanations from evil-smelling air), or by contagions (emanations from fever sufferers). They aimed to prevent infection and putrefaction by adopting cleanliness.

In London and other European cities, it was contested whether large hospitals with their filthy, crowded wards, and blood-encrusted operating theatres constituted a danger to patients. Many surgeons believed that wound infection, if not a normal process of healing, was

generally unavoidable.

Joseph Lister and antisepsis

On 12 August 1865, an 11-year-old boy, James Greenless, was admitted to Glasgow Royal Infirmary with a compound fracture of the leg after being run over by a cart. The severe wounds caused by these fractures nearly always resulted in putrefaction, and many surgeons still advocated immediate amputation. However, this time, the Professor of Surgery, Joseph *Lister (1827-1912), splinted the leg and applied a dressing of undiluted carbolic acid (creosote) which he covered with tinfoil to prevent evaporation. The dressing was changed after 4 days, and thereafter, at intervals of about a week. The wound did not putrefy and James walked out of the hospital 6 weeks later. In 1867, Lister published the results of his 'antiseptic' method of wound treatment whereby he claimed to destroy or suppress the agents of wound infection by disinfectants. His practice was based on the 'germ theory' of French microbiologist, Louis *Pasteur (1822-1895), who believed that living organisms caused putrefaction and wound infection. This theory was by no means accepted by all surgeons since it conflicted with ideas about the spread of disease through evil-smelling air (miasma) or evil-smelling people (contagion). The public health movement was already attempting to clean up urban environments and their inhabitants. The concept of hospital cleanliness and hygiene was more appealing than images of Lister in his filthy frock coat applying poultices of foul-smelling creosote. Nevertheless, the alternative could be just as repulsive.

Sir Frederick Treves (1853-1923), surgeon at the London Hospital between 1879-1898, claimed that the first post-operative dressing following amputation was changed by the most junior surgeon, because the stench was only tolerated under compulsion. Maggots in a dressing were regarded as normal. Despite opposition, Lister continued to perfect his antiseptic method throughout the 1870s-1880s. He eventually disinfected not only wounds but surgical instruments, sutures, and even the air, using a carbolic spray.

Antisepsis and asepsis

Joseph *Lister's (1827-1912) practice of 'antisepsis' whereby germs were destroyed or excluded from wounds through the application of antiseptic solutions, was gradually reconciled with 'asepsis'. This practice aimed to create an environment which was free from the presence of germs. Asepsis appealed to Victorian notions of cleanliness

in both medical and moral matters. Cleanliness and hygiene were fundamental to the public health movement which aimed to sanitise environments and the people within them. Enthusiasm for asepsis led to improvements in hospital cleanliness, design, and ventilation, as well as the ritual of sterilising gowns, masks and gloves. In the late 1870s, the German bacteriologist, Robert *Koch (1843-1910) showed that Louis *Pasteur's (1822-1895) germ theory was essentially correct. He cultured and identified bacteria which caused specific infections.

In 1874, *Pasteur suggested that surgical instruments could be sterilised in boiling water and then passed through a flame. This was an alternative to chemical antiseptics such as the carbolic used by Lister. Pasteur and Koch built the earliest steam sterilisers. Pressure steam sterilisation was introduced by the Swiss surgeon, T Kocher (1841-1917), and his colleague, E Tavel (1858-1912), a bacteriologist. During the 1880s, the German surgeons, Ernst von Bergmann (1836-1907), and Johannes von Mikulicz-Radecki (1850-1905), established bacteriological laboratories within their hospital clinics. By testing for the presence of bacteria on individuals and even entire hospitals, bacteriologists could audit the efficacy of aseptic or antiseptic measures. In this way, von Mikulicz-Radecki proved that speaking during operations encouraged droplet infection (a term coined by him).

This could be minimised by wearing face masks (except when the surgeon was bearded). However, in 1890, the American surgeon, William S Halsted (1852-1922), introduced rubber gloves. These were initially worn by his operating room nurse, Caroline Hampton, (who was also his fiancée) because she developed eczema of the hands from the carbolic acid and bichloride of mercury solutions used as antiseptics. Halstead asked the Goodrich Rubber Company to make special surgical gloves. The first batch reached the elbow. By the final years of the century, aseptic and antiseptic techniques were adopted in one combination or another by all surgeons.

Surgical instruments

In Britain, by the early 19th century, there was a flourishing trade in surgical cutlery. As well as the growing numbers of surgeons at home, cutlers and instrument makers also supplied the Army and Navy, and exported to the colonies. Large pharmacists such as Allen & Hanbury, who already sold instruments, also set up their own workshops. Surgical instrument makers often worked with individual surgeons, designing instruments to match individual operating techniques. The

London firm of Krohne & Seseman (founded 1860) made ratchet artery forceps to the design of Thomas Spencer Wells (1818-1897). In Paris, Joseph Charrière (1806-1876) designed the screw action lithotrite, an instrument passed through the urethra which facilitated the crushing of a bladder stone. This was later modified by the English firm of John Weiss for the urologist, Sir Henry Thompson (1820-1904).

Weiss's ingenuity and design skills were particularly appreciated by Everard Home (1756-1832), the protégé and brother-in-law of John *Hunter (1728-1783). Instrument handles were often made of decoratively cut ebony or ivory and knife blades of carbon steel. Cannulae and probes were usually made of silver. From the 1870s, as sterilisation techniques were adopted, all-metal instruments became popular because they were easier to clean. These instruments also distinguished surgeons' tools from those of the physician which continued to be made of materials such as wood and ivory. As surgery became more hospital-based during the second half of the century, the craft of the instrument maker changed. Surgeons no longer needed their own instrument sets since hospitals purchased equipment for use by staff or visiting doctors. Small firms of instrument makers declined as mass production by companies such as Allen & Hanbury and Maws increased.

Pioneering procedures

Developments in anaesthesia and antisepsis/asepsis extended operating times and enabled surgical procedures to be refined. The concept of 'cellular pathology' introduced by German pathologist, Rudolph Virchow (1821-1902), influenced the course of surgery. This theory implicated pathologically altered tissues as the origin of disease, and their removal as the cure. During the 1870s, the Viennese surgeon, Theodor Bilroth (1829-1894), attempted laryngectomies (removal of larynx) and oesophageal resection in cancer patients. In 1881, he performed the first successful gastrectomy (removal of the stomach) for cancer. The patient was Thérèse Heller, aged 43, and the operation, under chloroform, lasted 1½ hours. Thérèse died 4 months later of secondary cancer. By 1890, Bilroth and his team reported 41 such operations with post-operative survival in 46%.

In 1882, Carl Langenbach (1846-1901) of Berlin, removed the gall bladder (cholecystectomy) of a 42-year-old man with gallstones. He suggested that gallstones were formed by the gallbladder and removal of the stones alone would not prevent their recurrence. In 1883,

Scottish surgeon, Robert Lawson Tait (1845-1899), operated on a woman whose fallopian tube had ruptured due to an ectopic pregnancy. A champion of aseptic techniques, he boiled his instruments and cleaned the patient's skin with turpentine followed by soap and water. Within 5 years, Tait had carried out 39 similar operations with only 2 deaths. The first appendectomy in North America was performed in 1883 by Abraham Groves (1847-1935), a rural practitioner in Canada. The patient was a 12-year-old boy whose father administered the chloroform. By 1924, Groves claimed to have removed 6000 appendices.

In 1902, the British surgeon, Frederick Treves (1853-1923), was knighted for draining Edward VII's inflamed appendix. Sadly, Treves' youngest daughter had died 2 years previously from acute appendicitis. In 1879, Sir William Macewen (1848-1924) of Glasgow was the first to remove a brain tumour. The patient was a girl of 14. By 1893, he had operated on 24 cases of cerebral abscess with 23 recoveries. Another British surgeon, Victor Horsley (1857-1916, later knighted), was the first to remove a spinal tumour. The year was 1887 and Horsley was assisted by Charles Ballance (1856-1936, later knighted). In 1895, Ballance successfully removed the ruptured spleen (splenectomy) of a 10-year-old boy who had been struck by a cricket ball. The first splenectomy had been performed in Germany 2 years previously. German surgeons were amongst the first in Europe to publish their own surgical literature.

Four surgical journals appeared between 1861-1886, and a national surgical society was founded in 1872. The American Surgical Association was established in 1880 and its journal, Annals of Surgery, first appeared in 1885. Britain and France were slower to publish. The British Journal of Surgery was not founded until 1913.

Conquest of the body

By 1910, surgeons claimed to have 'conquered' all body cavities and organs. They were operating not only in the abdominal cavity but in the thorax, the brain, and nervous system. They were presenting papers at meetings and publishing surgical journals. In 1905, the Société Internationale de Chirurgie held the first of its triennial meetings in Brussels. Surgical clinics and hospitals were attended by rich and middle-class patients whereas they had once been 'practice grounds' on the poor. In 1909, the German surgeon, Theodor Kocher (1841-1917), won a Nobel Prize for his work on the thyroid gland. The French-American surgeon, Alexis Carrel (1873-1944), received his in

1911 for innovations in blood vessel suturing and organ transplantation. The discovery of X-rays in 1895 was enormously important for the progress of surgery. It was the first non-invasive diagnostic technique.

Important, too, was the rise of professional nursing. The first trained theatre nurses were in post by the beginning of the century. Mistakes learned through surgery generated the need for interdisciplinary research in the laboratory and the clinic. In 1883, Kocher had 'discovered' myxoedema (under-secretion of thyroid gland) simply because he had removed too much thyroid gland in his patients with over-secretion (toxic goitre). The science of endocrinology was born out of this error. In the United States, one of the most important endocrine research centres was the Mayo Clinic, founded in 1889 by surgeon brothers, William James Mayo (1861-1939) and Charles Horace Mayo (1865-1939). Gradually, radical or 'heroic' procedures became more conservative as the needs of the patient and not the surgeon were increasingly considered. Attention was given to physiological factors during surgery such as control of blood pressure, circulation, shock, electrolyte balance, and to post-operative care such as pain control, intravenous feeding, replacement of body fluids, blood transfusion, and wound drainage. Surgeons no longer performed operations on every part of the body but specialised in body parts such as ENT (ear, nose and throat), gynaecology (women's reproductive system), neurosurgery (brain and nervous system), ophthalmology (eyes), orthopaedics (bones), urology (urinary system), thoracic (chest) and cardiac (heart) surgery. Later, as procedures became more complex, sub-specialities were developed such as transplantation, plastic and reconstructive surgery, maxillofacial surgery, vascular surgery, and microsurgery.

Military surgery

In Britain, the Royal Army Medical Corps was established in 1898 and first deployed in the *Boer War (1899-1902). A new kind of wound treatment emerged under the pressure of warfare. At this time, abdominal wounds which punctured the intestines were invariably fatal. Sir William MacCormac (1836-1901), Consulting Surgeon to the South Africa Field Force, and Sir Frederick Treves (1853-1923), who spent 6 months in charge of a field hospital, believed that soldiers were more likely to survive abdominal wounds if surgery was not attempted. This became official policy during the *Russo-Japanese War (1904-1905). The Mauser bullets used in South Africa and the Japanese 'humane' bullets were believed to cause less internal damage than the old ball shot and supposedly could be left to lodge in tissues.

This was challenged by Russian surgeon, Vera Gedroits, who operated in an ambulance train as soon as possible after injury.

During the First World War (1914-1918), it was British policy (from 1915) to operate, although a mortality rate of 50% was considered a good result. By the time of the Spanish Civil War (1936-1939), early surgery was the usual method of dealing with abdominal wounds. More injured limbs were amputated during the First World War (up to 80%) than they had been at Waterloo (1815: 12%), in the Franco-Prussian War (1870-1871: 16.7%), or the Russo-Japanese War (0.5% among the Japanese). The bacteriologist, Sir Alexander *Fleming (1881-1955), examined wounds in France during the First World War. He discovered that carbolic acid, advocated as a wound cleanser by Joseph *Lister (1827-1912), often destroyed leucocytes (white blood cells which help fight infection) faster than it killed bacteria. Fleming's discovery of penicillin, and its bulk manufacture by the American pharmaceutical industry during the Second World War was instrumental in preventing amputations due to secondary infection.

The horrific limb and facial injuries sustained by troops during the First World War advanced the techniques of skin grafting and plastic surgery. In 1869, Swiss surgeon, Jacques Louis Reverdin (1842-1928), had grafted small slivers of skin from the right arm of a man whose left arm had been stripped of flesh during a fall. Within a few weeks, these slivers had united to form a total graft. In 1916, the British surgeon, Harold Gillies (1882-1960), moved from the Cambridge Military Hospital to set up a plastic surgery unit for military personnel at Aldershot, Hampshire. He developed the 'pedicle' graft whereby a piece of skin was lifted but not completely detached from one part of the body and sewn to the operative site.

Once the graft was successfully established, the connection could be severed and the skin shaped to repair the injured part. In 1597, the Italian surgeon, Gaspar Tagliocozzi (1549-1599), had described an identical technique to repair mutilated noses. In 1932, Gillies was joined by his cousin, Archibald Hector *McIndoe (1900-1960). During the Second World War, McIndoe founded a 'reconstructive surgery' unit at Queen Victoria Hospital, East Grinstead, Sussex. Here, he performed individualised surgery on injured war veterans who became known as the 'guinea pigs'. The *Battle of Britain (1940) brought him the first badly burned aircrew from Hurricanes and Spitfires, and by the end of the war there were 649 guinea pigs.