

2.2_Closure

Possibly some of the greatest achievements in medical science have been those made in cardiac surgery.	The first successful example was carried out in 1896 by Dr Ludwig Rehn in Germany, who repaired a stab wound to the right ventricle. Open-heart surgery dates from the 1950s, while bypass operations began in the mid-1960s. By the 1980s, two-thirds of those receiving heart transplants survived five years or more. Today, heart surgery is robotized: incisions to the heart have been reduced to a minimum, and patient recovery time is down from six months to a few weeks.
One of the first pioneers in the field of cardiac surgery was Dr Dwight Harken, a US Army medic serving during World War II.	Initially, he operated on animals to improve his skills; he subsequently moved on to soldiers arriving from the European front with bullets lodged in their hearts. Dislodging them almost always proved fatal, but Harken developed a technique that enabled him to cut into the wall of a still-beating heart and successfully remove a bullet. With time, more and more of his patients began to survive, proving it was indeed possible to operate on the human heart.
Closed-heart surgery was the next stage in the development of cardiac surgery.	Closed – or ‘blind’ – heart surgery meant that the heart did not have to be cut open and then closed up again. It was accomplished by passing either a finger or a knife into the mitral valve through an incision in the left atrium in order to remove tissue. Following initial disastrous attempts, Harken’s technique was gradually improved upon, and eventually the procedure was made safe. Hospitals across the world began using the technique.
However, there was still a critical issue to be resolved if cardiac surgery was to develop any further.	Surgeons had to be able to work on the open heart without the patient bleeding to death. Stopping the circulation temporarily would give doctors just four minutes to carry out their intervention; however, the subsequent deprivation of oxygen to the brain would be critical, resulting in brain damage. Canadian surgeon Bill Bigelow set about finding a solution. Experimenting on dogs, he was able to show that by bringing down the patient’s body temperature, the body and the brain continued to function for an extra six minutes on a reduced level of oxygenated blood. This approach was known as ‘therapeutic hypothermia’.
In 1952, open-heart surgery was attempted for the very first time at the University of Minnesota.	The operation, on a five-year-old girl born with a hole in the heart, was carried out by Dr Walton Lillehei and Dr John Lewis. First of all, her body temperature was reduced to 27.2°C (81°F). Secondly, in the ten minutes that followed, Lillehei and Lewis were able to stop the flow of blood, cut open her heart and sew up the hole. Finally, the little girl was immersed in warm water and her body temperature brought back to normal. Her heart functioned properly for the first time.

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But what could be done for patients whose hearts were diseased beyond repair and for whom the only solution was a new heart?	Successful kidney transplants had been carried out in 1963, so why not the heart? In 1967, in South Africa, Dr Christiaan Barnard made the headlines when he transplanted the heart of a young woman into a middle-aged man. However, despite the use of drugs to suppress the rejection of the heart by the body, the patient subsequently died.
The complex problem of tissue rejection remained an issue throughout the 1970s.	It was Dr Norman Shumway's pioneering use of cyclosporine that would revolutionize transplant surgery. Cyclosporine, a substance found in fungus in soil samples taken from fjords in Norway, would soon be used in hospitals around the world to control organ rejection without cancelling out all resistance to infection.
The prognosis for heart transplant patients has greatly improved in recent years.	Survival rates for such patients is estimated at 88% after one year and 75% after five years (Mayo Clinic, 2017). In 2009, Tony Huesman died from cancer having been the world's longest-living heart transplant patient after 31 years, while Kelly Perkins, another noted recipient, regularly climbs mountains around the world to promote positive awareness of organ donation. Another example, Edward Daunheimer, who received his heart in 1997 at the age of 65 (the upper age limit for heart transplants), lived a healthy life for 12 years with his new heart, defying statistical probabilities by a large margin.
Such breakthroughs do have their limitations, however.	Crucially, numbers of donor hearts are often limited. For example, each year around 3,000 people in the US find themselves on a waiting list for a heart transplant, but only 2,000 donor hearts become available in any one year, leaving hundreds desperate for an alternative.