Chapter

1

Evolution of Anaesthesiology

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This chapter covers the following competency:

AS 1.1 Describe the evolution of anaesthesiology as a modern speciality.

INTRODUCTION

The name anaesthesia (Greek *an*, 'without', and *esthesia*, 'sensation') was suggested by Oliver Wendall Holmes in a letter to Morton in November 1846. This was after a new medical speciality, called 'Anaesthesiology' was born on 16th October 1846, when a young dentist, William Thomas Green Morton, first publicly demonstrated the use of ether to anaesthetise a young patient, Edward Gilbert Abbot, who was to undergo excision of a congenital vascular tumour of the neck by surgeon, John Collins Warren.

The French Academy of Sciences named Horace Wells as the one who discovered Anaesthesia in 1848. Unfortunately, however, Wells had committed suicide by that time.

1.1 Discovery of Inhaled Anaesthetic Agent

Although the demonstration by WTG Morton was dramatic, it was preceded by painstaking efforts by inquisitive minds and several misses. One of them was another dentist, Horace Wells. He was bothered about the painful tooth extractions and wanted to do something to relieve the pain of such extractions. Gardner Quincy Colton had attended two years of medical school. While in school, he perfected the manufacture of nitrous oxide by heating ammonium nitrate. Horace Wells requested Colton to administer nitrous oxide to him for extraction of his molar tooth by a fellow dentist. Horace felt only slight pain during the extraction. This encouraged him to use inhaled nitrous oxide to extract his patients' teeth. Horace Wells, just 29 years of age, planned a public demonstration of the effects of nitrous oxide at Harvard Medical School. The patient, who was to undergo amputation of his leg, refused to inhale nitrous oxide. Instead, one male student agreed to inhale nitrous oxide to extract his tooth. However, he moved and groaned during the procedure, and Wells was discredited. He finally committed suicide in 1848, before he could learn that the French Academy of Sciences had named him as the one who discovered anaesthesia.

WTG Morton witnessed Wells's failed demonstration of nitrous oxide and started thinking of an alternative. Charles T Jackson, a professor of Chemistry at Harvard

Medical School, offered him the idea that sulphuric ether may be used as an alternative to nitrous oxide. Morton tried ether on himself and his pet animals and then successfully on a patient for the upper bicuspid tooth extraction. He then went on to organise the public demonstration on 16th October at the age of 27 years. This discovery, though pathbreaking, did not bring much honour or wealth to Morton in his lifetime. He died at the age of 49, broken and despondent. Charles T Jackson, too, had to be admitted to a mental asylum, where he died seven years later.

Horace Wells and WTG Morton, credited with the discovery and demonstration of anaesthesia, were both dentists and died a sad death early in life. Charles T Jackson, who discovered ether, too, died in a mental asylum.

James Simpson, an obstetrician from Edinburgh, Scotland, developed chloroform in 1847. Chloroform soon became popular as an inhaled anaesthetic agent in England. Unfortunately, chloroform was associated with several unexplained intraoperative deaths and numerous cases of hepatotoxicity.

Nitrous oxide gas was the first inhaled anaesthetic synthesised in 1772 by the English chemist and author, Joseph Priestley.

Halothane, a halogenated inhalational agent, was introduced clinically in 1956 by Michael Johnstone, and in India, in 1960. It had definite advantages over ether and cyclopropane because of its more pleasant odour, higher potency, favourable kinetic characteristics, nonflammability, and low toxicity. It gradually replaced the older agents. Following this, several other inhalational agents like enflurane, isoflurane, desflurane and sevoflurane were introduced. Of these, the last three are being used extensively today.

1.2 Intravenous Anaesthetic Agents

Till then, anaesthesia could be induced only by inhalation of gases or vapours, which was unpleasant for many patients. So, researchers were in search of an agent which could be administered intravenously. Pierre-Cyprien Oré was the first to attempt anaesthetising humans with an intravenous agent—chloral hydrate, in 1872. During and after the First World War, paraldehyde was used. None of them became popular. A combination of morphine and scopolamine ("Twilight Sleep") became popular, particularly in obstetric anaesthesia. This combination also was gradually abandoned because of unpredictable side effects. In 1864, Adolf von Baeyer discovered the first barbiturate, barbituric acid (from Barbara as it was discovered on Saint Barbara's Day). Helmut Weasel is credited with the introduction of intravenous anaesthetic methods, using hexobarbital in the 1930s. Sodium thiopental was introduced in 1934. John Lundy of Mayo clinic was the first to describe the detailed analysis of its use. With this, the concept of balanced anaesthesia (whereby anaesthesia was achieved by using multiple agents with different properties) started gaining ground. Lundy believed that general anaesthesia could be administered safely with multiple agents because any particular agent's dose was small, so fewer adverse effects were observed. Thiopentone was used widely, particularly on the injured after the Pearl Harbour bombing in 1941. It was observed that when administered to the injured personnel, it was associated with frequent mortality. This was attributed to its depressant effect on the cardiovascular

system, particularly in hypovolaemia and with higher doses. There were several attempts to replace barbiturates with shorter-acting intravenous anaesthetic agents with lesser adverse effects on the cardiovascular system.

Barbiturates are so-called because they were discovered on Saint Barbara's Day.

1.3 Neuromuscular Blocking Agents

Harold R Griffith and Enid Johnson, inspired by the native Indians, who used curare-tipped arrows to immobilise and kill animals, introduced it to clinical practice. In 1942, they reported the successful use of curare in 43 patients to provide muscular relaxation during surgical anaesthesia. However, gallamine, a similar drug, was found to be associated with undesirable side effects. Daniel Bovet won the Nobel Prize in 1957 for discovering gallamine and succinylcholine. Succinylcholine, a depolarising muscle relaxant, continues to be used today. However, over the years, many other steroid-based synthetic neuromuscular agents like pancuronium, vecuronium, rocuronium, etc. have been introduced and are being used.

1.4 Other Sedatives and Hypnotics

Benzodiazepines are a group of drugs that relieve anxiety with less sedation than barbiturates. The first of this group, chlordiazepoxide, was introduced in 1960, followed by diazepam in 1963 and the one most widely used today, midazolam, in 1978.

Ketamine, a phencyclidine derivative, was introduced as an anaesthetic agent in 1966. It was used intramuscularly or intravenously and touted as a complete agent by itself. However, reports of postoperative hallucination after using ketamine led to a re-evaluation of its use, though it continues to be an essential tool in the armamentarium of anaesthesiologists because it was devoid of any cardiovascular depression, even during hypovolaemia.

Several other agents like althesin, propanidid, and eltanolone were introduced but withdrawn soon because of unwarranted side effects. Finally, etomidate was introduced in 1973, which produced minimal cardiovascular depression, even in existing hypovolaemia and cardiovascular disease. However, it was later found to cause myoclonic movements during induction and adrenal suppression in the postoperative period.

Propofol was introduced in 1977. It is an alkylphenol compound with several advantages over thiopentone, like, antiemesis, suppression of laryngeal reflexes, and early recovery. It may be administered as an infusion for a prolonged effect. It was observed that propofol infusion and analgesics like opioids could provide all the components of adequate general anaesthesia. This method of providing anaesthesia without inhalational agents is called total intravenous anaesthesia (TIVA). The disadvantages of propofol include pain at the site of injection and profound cardiovascular depression.

Along with the quest for general anaesthetic agents and sedatives, Carl Koller introduced cocaine for topical anaesthesia of cornea in 1884. Cocaine 4% was first reported as a local anaesthetic agent in 1894 to remove a facial tumour. Many other local anaesthetic agents followed suit.

1.5 Central Neuraxial Blocks

Neurologist James Leonard Corning of New York City first described the use of cocaine in subarachnoid space in 1885. After his experiment of spinal anaesthesia in a dog, he attempted the same in a man in the T11–T12 space. He injected cocaine intrathecally once and repeated it after 8 minutes in a man because he noticed no effect of the first dose. The man complained of numbness in his lower limbs after 10 minutes of the second dose. Since there was no mention of CSF outflow, he had, in all probability, inadvertently performed an epidural injection. Jean Sicard and Fernand Cathelin were the first to intentionally perform epidural anaesthesia at the turn of the 20th century. They performed caudal nerve blocks for genitourinary procedures. In the third decade of the twentieth century, Italian surgeon Achille Dogliotti demonstrated the loss of resistance (LOR) technique, while almost simultaneously, Argentine surgeon Alberto Gutierrez described the 'sign of the drop' or the hanging drop method for confirmation of the epidural space. Augustus Karl Gustav Bier used cocaine intrathecally on six patients in 1898. He experimented on his own body by injecting himself with cocaine intrathecally. As a result, he developed post-dural puncture headaches (PDPH). Subsequently, his assistant Dr Otto Hildebrandt had the procedure performed on him. Dr Bier tested the efficacy of intrathecal cocaine by needle pricks, cigar burns, incisions on the thighs, avulsion of pubic hairs, strong blows with a hammer to the shins and torsion of the testes of the assistant! Dr Otto also developed PDPH and bruising and pain in his legs.

Initially, anaesthesia practice was about rendering patients unconscious and ensuring the absence of pain and movement during surgery. However, the twentieth century saw the advent of new knowledge, technology and medicines, enabling anaesthesiologists to manage physiologic derangements caused by anaesthetic agents and surgery. With time, the practice of anaesthesia expanded to include managing all types of pain. As anaesthesiologists became known for their expertise in physiology, pharmacology and resuscitation, they were well positioned to develop critical care. Danish Anaesthesiologist, Bjorn Ibsen, established the first intensive care unit in Copenhagen during the 1950s. Critical care requires expertise in airway management, continuous monitoring of physiological parameters, cardiovascular and respiratory support, pain control and resuscitation.

Anaesthesiologist John Bonica was the first to establish a multidisciplinary pain clinic in the 1960s and also declared that pain was a "fundamental element of human suffering" and that pain relief was a fundamental human right.

1.6 India's Contribution to the Evolution of Anaesthesia

While all of these happened in the west, India did not lag. Within six months of its demonstration, ether was used in Calcutta Medical College hospital on 22nd March 1848, under surgeon Dr O'Saughnessy. Similarly, India was also prompt at using chloroform anaesthesia on 12th January 1848, within two months of its first use in Edinburgh, UK, by Simpson. David Wildie, the chemist who introduced chloroform in clinical anaesthesia, migrated to Calcutta in 1853 and lived there till his death in 1889. Although this was the beginning of modern anaesthesia in India, our ancient physicians practised anaesthesia long back. It started with Sushruta way back in 500 B.C. when anaesthesia was administered using opium, wine and Indian hemp. In 527 B.C.

Raja Bhoj underwent a cranial operation using 'Sammohini' for induction and 'Sanjivani' for recovery.

Augustus Bier and his assistant Dr Otto both received intrathecal cocaine. They developed post-dural puncture headache.

In 1890, after 20 years of using chloroform, the world started to discard it because of concerns regarding its safety. However, India continued to use it until 1928 as the sole anaesthetic available. Even Mahatma Gandhi underwent appendicectomy under chloroform anaesthesia by Dr Date on 12th January 1925 in Sassoon Hospital, Pune.

In 1880, British Medical Association concluded that chloroform was unsafe. In 1888, Edward Lawrie, who practised in Hyderabad Medical School, claimed that he had administered it to 40,000 people without a single fatality! He formed the "First Hyderabad Chloroform Commission". They conducted 141 animal experiments and concluded chloroform was safe "if only respiration is carefully attended to". The British did not accept this opinion, and the "Second Hyderabad Chloroform Commission" was formed. Lancet journal deputed an expert, Sir Thomas Lauder Brunton from London, to supervise the proceedings of the second Hyderabad Commission in 1889. From several animal and human experiments, they concluded that chloroform was not safe. In addition, the incidence of fulminant hepatitis raised doubts about its safety.

India can boast of the first use of premedication to ensure a smoother course of chloroform anaesthesia, in the form of hypodermic morphine, by Alexander Crombie of Presidency General Hospital, Calcutta in 1880.

Thiopentone, the first intravenous anaesthetic agent, was introduced in India in the early 1940 s by Dr M M Desai and Dr B N Sircar in Bombay at the G. S. Medical College. Unfortunately, Dr Desai was the first and perhaps the only anaesthetist to die in a dental chair following thiopentone given by his resident!

The world's first qualified lady anaesthesiologist, Roopabai Furdoonji, trained and practised at Hyderabad Medical School.

Incidentally, the world's first qualified lady anaesthetist, Roopabai Furdoonji, trained and worked under Edward Lawrie in Hyderabad in 1889. Lawrie was also the Principal of Hyderabad Medical School and a chloroform expert. Lawrie appreciated Roopabai's proficiency in administering chloroform. She later went to Edinburgh for further studies. Roopabai trained the medical students in administering chloroform. She worked with distinction in India and also in Saudi Arabia.

CONCLUSION

Anaesthesia came into existence due to the painstaking efforts and the concern of the dentists to relieve the patient's pain from tooth extraction. Anaesthesia evolved due to the sacrifices of several luminaries, who did not hesitate to test any new development of medicines or procedures on themselves in the true spirit of science. Be it inhaling nitrous oxide, thiopentone, or spinal anaesthesia; they experienced them first-hand before trying it on others. Indians never lagged the Western advances in anaesthesiology and wholeheartedly embraced the drugs and adopted the procedures. Indians even enriched the practice of anaesthesiology, for instance, by starting the practice of premedication and organising the two Hyderabad chloroform commissions.

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