

# History of Anaesthetics Drugs and Evolution of Anaesthesiology: A Comprehensive Review

D VENKATA NAGA SAI KRISHNA SANKA<sup>1</sup>, VIVEK CHAKOLE<sup>2</sup>, SHYAMOLIMA BHUYAN<sup>3</sup>

## ABSTRACT

Anaesthesia is the loss of sensation partially or totally with or without loss of consciousness. It has been estimated that its origins lie in ancient civilisations, where such natural substances as opium and mandrake were employed to alleviate pain. The 19th century marked the start of the scientific age of anaesthesia following the discovery of gases such as nitrous oxide and ether. That discipline has now developed into anaesthesiology - a multidisciplinary, complex speciality encompassing pharmacology, physiology and perioperative care of patients, including surgery, critical care and pain management. The history of anaesthetics is one of sheer wonder, awe and amazement as to how the simple sedative herbs of the ancient civilisations have given way to the highly advanced drugs and methods of the modern medical world. The ancient societies used opium and mandrake, which are natural substances, to alleviate pain during operations. The 18<sup>th</sup> and 19<sup>th</sup> centuries provided the scientific basis for anaesthesia when nitrous oxide, ether and chloroform were discovered, making it possible to have painless surgeries. The 20<sup>th</sup> century saw safer inhalational agents, local anaesthetics, intravenous drugs and muscle relaxants as well as improved patient monitoring systems. The history of anaesthetics and anaesthesiology is one of the greatest developments in the field of medicine. Anaesthesia has transformed patient care and surgery practice; from agonising surgical operations to risk-free and pain-free interventions. This review is the only one to cover the timeline of anaesthetic drugs and the timeline of the anaesthesiology as a medical speciality. Through the combination of historical landmarks, pharmacological developments and technological innovations, the study offers a broad look at how the contemporary anaesthetic practice developed out of the primitive experimental methods. This paper draws attention to the ongoing interaction between drug development, clinical practice, and patient safety unlike other works that emphasise isolated discoveries and provides a comprehensive picture of the evolutionary process anaesthesiology is going through.

**Keywords:** Clinical practice development, Medical equipment innovation, Patient safety standards, Pharmacological advancements, Surgical techniques progress

## INTRODUCTION

It is a critical aspect of modern medicine making anaesthesiology essential in the provision of comfort, safety, and pain management of patients during surgical and diagnostic procedures. It is an amazing field which has developed during the centuries under the influence of discovery and perfection of anaesthetic agents and methods. This review gives insight into the history and evolution of anaesthetic drugs and history of anaesthesiology as a medical speciality. It follows major milestones of the very first experiments using natural and chemical substances up to the development of the modern methods of anaesthetics, major scientific discoveries, modification of clinical practice, and the standards of patient safety.

### History of Anaesthesia and Anaesthetic Drugs

In earlier times, each country developed at its own pace, and the progress of science and medicine varied from one region to another, with the use of anaesthetic agents such as ether, chloroform, and nitrous oxide emerging at different periods across the world. So, each country has its own story of the success of the first anaesthetics used. It is obvious that more advanced countries had an edge in the development of anaesthesia but it cannot be overlooked that traditional methods also existed. As far back as ancient and premodern periods in Chinese, Egyptian and Indian culture, the use of pain relievers was common. Usage of opium, alcohol, and mandrake root has been documented in various traditions. In India, around 600 BCE, Sushruta, the father of surgery in India, suggested the usage of opium and wine during surgery for the anaesthesia effect [1]. The history of medicine is inseparably connected with the human desire to ease pain and suffering, and this story is spectacularly represented by the history of anaesthesia

development. Throughout thousands of years, surgery was inevitably associated with immense pain, which profoundly influenced the practice of medicine and the patient experience. Surgery, before the discovery of effective anaesthetic agents, was an excruciating experience and surgeons had to work at lightning-fast speeds in a pathetic bid to ensure that the patient was subjected to the least amount of suffering [2]. The speed of surgical performance often affected accuracy and greatly increased the risk of complications. Historical records paint a grim picture, indicating that between 5-50% of patients died during surgery or from postoperative complications, while severe infections occurred in up to 80% of cases. Faced with this harsh reality and the prospect of undergoing surgery without anaesthesia, many patients chose to endure the pain of their injuries or illnesses rather than risk the operation [3].

The motivation to alleviate suffering in medical procedures is firmly established in humanity, with some record of efforts to do so stretching back as far as 4000 BCE. One of the first to discover and make use of ethanol (alcohol) as a sedative was the Sumerians in Mesopotamia. The practice spread among ancient civilisations and the Egyptians and Assyrians also practised similar, primitive procedures by pinching the carotid artery to achieve unconsciousness during simple medical procedures such as eye surgery or circumcision [4]. In many cultures, herbal treatments were the foundation of ancient pain treatment. Surgery is documented in the Ebers Papyrus, an Egyptian text of medicine of around 1550 BCE, where opium-like preparations were used. The Sushruta Samhita (c. 400 BC), one of the foundational texts on Ayurvedic medicine, recommended the use of wine into which cannabis incense was mixed, as an anaesthetic. The East Asian traditions had their important contribution; the legendary Chinese doctors such as Bian Que (c. 300 BC) and Hua Tuo (c.

270 AD) were reported to have used powerful herbal formulae, such as the combination of mafeasant with wine to produce a deep unconscious state even during major surgical procedures, such as resection of gangrenous intestines. The 13th century saw significant growth in Europe. The Italian physician and bishop, Theodoric of Lucca, is attributed with surgical pain relief by the use of a “sponge saturated with opium and mandragora”. Innovation continued throughout the Islamic Golden Age, and physicians such as Ibn SINA wrote of the so-called soporific sponge, a sponge saturated with narcotics and aromatics and held under the nose of the patient to achieve inhaled anaesthesia. This procedure later rubbed off on Western medicine. The dwale potion used in medieval England (1200-1500 AD) was just another alcohol-based mixture of several powerful substances: opium, henbane, hemlock, and even human bile, which testified to the largely unscientific, but often desperate, attempts to find suitable sedatives. Incan shamans in the Americas realised the anaesthetic effect of coca leaves and used cocaine-rich saliva as a general anaesthetic [5].

In addition to pharmacological substances, physical techniques were investigated. Local anaesthesia in the 16<sup>th</sup> and 17<sup>th</sup> centuries was done by nerve compression and the use of snow and ice. Non-pharmacological methods consisted of “mesmerism” (later to become hypnosis) introduced by Franz Anton Mesmer in 1766 in which patients placed under hypnosis were insensitive to pain. Acupuncture is one of the major constituents of traditional Chinese medicine, which has been used in China since as early as 1600 BC [6]. The pioneering efforts at intravenous therapy were thus hampered by considerable setbacks, the injection of opium into the vein of a dog successfully demonstrated the principle, Sir Christopher Wren operated in 1656, but the injection of blood into the veins of a human being in France about 1667 proved fatal, and efforts at intravenous therapy in human beings were quickly abandoned for nearly two hundred years [5].

This enormous historical archive of pain relief practices utilised in various civilisations and throughout the Middle Ages is firm evidence of the existence of a very deep-rooted and universal human need to eliminate suffering in the course of surgical procedures. Yet the uniformity with which surgery is termed a “grisly experience” and the patient expresses a desire to be left to allow injuries/diseases to fester rather than undergo an operation demonstrate the fundamental weakness and indeed perilousness of these early empirically derived solutions [7]. It is this sharp contrast that helps us to understand that though the need to have efficient anaesthesia always existed, the scientific knowledge of pharmacology and physiology to make it safe and dependable did not exist in any substantial way until modern times. These initial, frequently clumsy and risky experiments emphasise the desperate clinical vacuum that would be filled by the subsequent chemical revolution [8].

Recreational use also led to many early anaesthetic observations accidentally rather than through scientific experimentation, including the insensitivity to pain observed at “ether frolics” or “laughing-gas parties”. The soporific sponge is an early intuitive step toward inhaled anaesthesia. Human intravenous therapy efforts were immediately abandoned, however, following a lethal blood transfusion in 1667, demonstrating the harsh limitations caused by ignorance of sterile technique, proper dosage, and physiological effects [9]. This era was marked by a trial-and-error approach, where certain observations showed promise but could not be safely or consistently reproduced. This limitation highlighted the need for a more scientific and controlled method, which began to develop in the 19th century as researchers moved beyond basic observation to gain deeper understanding of chemical properties and their effects on the human body.

## Nitrous Oxide

The laughing gas, or nitrous oxide (N<sub>2</sub>O), was originally produced in 1772 by an English chemist Joseph Priestley. Its pain-killing effect

was later documented by Humphry Davy in 1800 who saw that it could be used medically. First, N<sub>2</sub>O was infamously known due to its intoxicating properties during so-called laughing gas parties, where people noticed that persons under its influence did not seem to feel the pain of injuries [10]. Dentist Horace Wells in 1844 was the first to use N<sub>2</sub>O in dental extractions after having undergone such an observation himself. Unfortunately, though, his demonstration at the Harvard Medical School failed in front of a crowd and the patient in his demonstration made a noise during the operation hence this led to ridicule by the people and the following disgrace of Wells. Crushed by all these losses and personal failures, Wells later killed himself in 1848. Irrespective of this initial disappointment, nitrous oxide has favourable characteristics, as it is non-flammable; and at acute doses, it has negligible effects on most organ systems. Edmund Andrews later in 1884 suggested that N<sub>2</sub>O should be mixed with oxygen, an important measure for safer administration as it helped counteract the hypoxia effect [11].

## Ether

Diethyl ether was made as early as 1540 by Valerius Cordus and its pain relieving property was noticed as early as 1525 by Paracelsus. Similar to nitrous oxide, it was primarily used recreationally in “ether frolics” for centuries, where observers noted its pain-dulling effects [12].

The first documented surgical application of ether occurred privately on March 30, 1842, when Crawford W. Long, a physician in Jefferson, Georgia, successfully excised a tumour from a patient’s neck. Though Long did use ether in several minor surgical operations during the next few years, he failed to publicise his discovery until after a more publicised demonstration to the people, an action which later cost him wide acknowledgement of the finding [13].

The breakthrough of modern anaesthesia is generally accepted to have been October 16, 1846. On this day, a dentist by the name of William TG Morton in collaboration with surgeon John Warren administered the sulfuric ether in the first demonstration of the success of anaesthetising a patient in front of a crowd at the Massachusetts General Hospital (MGH) [14]. Morton initially attempted to patent his “discovery” under the name “Letheon,” even disguising the ether with colour and aromatics to conceal its identity [14]. Morton’s successful public demonstration, often referred to as the “Ether Dome” event, rapidly propelled the widespread adoption of general anaesthesia in surgical and obstetrical practices globally. However, ether did have some intense drawbacks including flammability which posed a threat of using it in the vicinity of lamps and fires and common side-effects of postoperative vomiting and sore throats. The swift introduction of ether and chloroform despite their major disadvantages including flammability, postoperative nausea as well as the potentially fatal cardiac arrest and subsequent death highlights just how desperate the situation was in regards to pain relief during surgery [15].

## Chloroform

In 1831, Samuel Guthrie in the USA, Eugene Soubeiran in France and Justus von Liebig in Germany independently discovered chloroform. Obstetrician Sir James Young Simpson administered chloroform in clinical practice first in Scotland on November 8, 1847, after testing the effect of the substance on himself. Chloroform soon became popular in surgery and dental operations because it was easy to inhale and fast-acting. Being administered to Queen Victoria at the birth of Prince Leopold (1853) and Princess Beatrice (1857) by John Snow, its use greatly enhanced its popular and medical acceptance and overcame religious and medical objections to pain relief in childbirth [16]. The dangers of it were highlighted by the sad demise of a 15-year-old girl named Hannah Greener in 1848 who died due to an overdose during a procedure to remove her toenails, thus becoming the first recorded anaesthesia death. Although the

mechanism of anaesthetic death was not completely appreciated then, the research queries were investigated by elite physicians worldwide, and it is now established that inappropriate administration may result in cardiac arrest. Certain military surgeons such as in the British army, initially prohibited its use because they believed patient pain was a rich source of diagnostic information [17] [Table/Fig-1] presents the significance of anaesthetic agents [11,12,18-21].

Year of publication	Anaesthetic agent	Key figure(s)	Significance/First clinical use
1772	Nitrous Oxide [18]	Joseph Priestley	Discovery
1800	Nitrous Oxide [18]	Humphry Davy	Analgesic properties described
1831	Chloroform [19]	Samuel Guthrie, Eugène Soubeiran, Justus von Liebig	Robert Mortimer Glover is credited with independently discovering chloroform as an anaesthetic in 1842 after studying its anaesthetic qualities in laboratory tests. Glover did not, however, advocate for its clinical application. Its use was later made more widely known in 1847 when James Young Simpson independently discovered its usefulness for obstetric and surgical anaesthesia.
1842 (Mar 30)	Ether [12]	Crawford W Long	On March 30, 1842, Dr. Crawford W. Long, a physician in Jefferson, Georgia, used ether to remove a neck tumour from a patient named James Venable. This was the first recorded surgical use of ether. Being the first recorded use of ether as an anaesthetic during surgery, this procedure represented a major breakthrough in medical practice. The surgery went well; Venable recovered without any problems and stayed unconscious and pain-free the entire time. Dr. Long did not, however, publish his results right away, and his use of ether was not acknowledged by the general public until 1849. Debates over who should be given credit for discovering anaesthesia resulted from this publication delay.
1844	Nitrous Oxide [11]	Horace Wells	Joseph Priestley's discovery of nitrous oxide (N <sub>2</sub> O) was recorded in 1772. In the late 1790's, Humphry Davy experimented with the psychotropic properties of N <sub>2</sub> O, describing his observations in a book, published in 1800. A dentist, Horace Wells discovered anaesthesia with N <sub>2</sub> O in 1844.
1846 (Oct 16)	Ether [20]	William TG Morton & John Warren	On October 16, 1846, Massachusetts General Hospital in Boston hosted the first ether anaesthesia surgical demonstration in public. While John Collins Warren operated on patient Edward Gilbert Abbott to remove a tumour from his neck, William T.G. Morton gave him ether. Modern surgical anaesthesia began when the patient remained pain-free and unconscious during the entire procedure.
1847 (Nov 8)	Chloroform [21]	Sir James Young Simpson	James Young Simpson used chloroform for the first time in Edinburgh in 1847 for obstetric and surgical purposes. Simpson used chloroform to ease labour pains and then expanded its application to include surgery. The anaesthesia quickly became well-liked in obstetrics and surgery because his patients tolerated it well.

**[Table/Fig-1]:** Significance of anaesthetic agents [11,12,18-21].

## Local Anaesthetics

The drawbacks and systemic dangers of general anaesthesia, combined with the requirement to produce pain relief in minor surgical procedures where a complete loss of consciousness was

not required, motivated the invention of local anaesthetics. They paralyse a given area but leave the patient alert [22].

The earliest local anaesthetic to be introduced in medicine was cocaine, a naturally occurring alkaloid, extracted by German chemist Albert Niemann in 1860, from coca leaves. The medicinal potential was an advocacy of Sigmund Freud, the famous Austrian psychoanalyst who urged his friend and Austrian ophthalmologist Dr. Carl Koller, to explore its pain-relieving qualities [23]. This innovation spread quickly all over the world.

Its use was further promoted by American surgeons William Stewart Halsted and Richard John Hall who in 1884 introduced the use of cocaine to produce nerve blocks in the United States, allowing painless extractions of teeth [24]. Procaine rapidly became the local anaesthetic standard, but it needed to be mixed with high concentrations of adrenaline to work well and it produced allergic reactions in some patients. A giant step was taken when lidocaine, the prototype of amino amide-type local anaesthetic, was synthesised by a Swedish chemist Nils Lofgren in 1943. Lidocaine had better safety and efficacy properties and his colleague Bengt Lundquist was the first to inject himself with experiments of local anaesthetic injections [7,25].

## Intravenous Anaesthetics

The idea of using drugs intravenously to make one sleep is as old as 1656 when Sir Christopher Wren is credited to have successfully injected opium into a dog with a goose quill [8]. Nevertheless, the initial experiments of humans with intravenous therapy were greatly hampered by the high fatality rate and thus the attempts were abandoned for almost 200 years. The discovery of a practical hollow hypodermic syringe and needle by Alexander Wood in 1853 was to play an essential role in the subsequent reintroduction of intravenous drug administration, opium and morphine [26].

Ludwig Burkhardt in 1909 was the first surgeon to deliberately use intravenous ether (in a 5% solution) to sedate patients undergoing head and neck surgery, observing that stronger solutions produced thrombophlebitis and haemolysis, and weaker solutions were not effective enough. An important step forward was the introduction of barbiturates; hexobarbital in 1932 and thiopental in the 1930s, which produced a more controlled and faster onset of anaesthesia than the inhaled agents [27].

Modern pharmacology of intravenous sedation began with the introduction of propofol in 1989 when the first propofol lipid emulsion formulation was introduced. Propofol has become a mainstay of contemporary anaesthesia practice, employed as an induction agent and as a maintenance agent in almost every surgery, whereas in the past inhaled anaesthetics had held sway in the operating room [28,29]. The search for the "ideal" intravenous agent is still continuing and the properties of ultrarapid action, minimal cardiorespiratory depression, rapid metabolism, high potency, reversibility, stability, low cost, and ease of administration are being sought. Modulation of Gamma-Aminobutyric Acid (GABA) receptors, and enhancement of inhibitory neurotransmission, is the mechanism of action of many modern intravenous anaesthetics. More recently approved agents such as dexmedetomidine in the 2010s provide sedative-analgesic properties with little respiratory depression [30,31].

The sequence of the early inhalational agents that caused a generalised state of unconsciousness and muscle flaccidity to the local, intravenous and Neuromuscular Blocking Agents (NMBA) is a true paradigm shift in the speciality of anaesthesiology. The idea of using drugs intravenously to make one sleep had occurred as early as 1656 when Sir Christopher Wren, the then famous injected an opium dose into a dog with a goose quill. However, the initial experiments of men with intravenous therapy were greatly discouraged by the high fatality rate and the practice was abandoned for almost 200 years. This required the development of a practical

hollow hypodermic syringe and needle, invented by Alexander Wood in 1853, which also became key to the later reintroduction of intravenous drug administration of opium, and later morphine [32].

Modern pharmacology of intravenous sedation started in 1989 when the initial lipid emulsion formulation of propofol was introduced [29]. Propofol has become a pillar of contemporary anaesthesia practice, employed as an induction and maintenance agent in almost every surgery, although, historically, inhaled anaesthetics had reigned in the operating room. The hunt is still on to develop the so-called ideal intravenous agent with properties that include ultrarapid onset, little or no cardiorespiratory depression, fast metabolism, high potency, reversibility, stability, low cost, and easy administration. Modulation of GABA receptors, and potentiation of inhibitory neurotransmission is the mechanism of action of many modern intravenous anaesthetics. More recent agents, such as dexmedetomidine which gained approval in the 2010s provide sedative-analgesic properties with minimal respiratory depression [29].

The sequence of the early inhalational agents, that produced a generalised state of unconsciousness and muscle flaccidity, to the introduction of local, intravenous, and NMBAs is a shift of paradigm in anaesthesiology [33].

### Neuromuscular Blocking Agents (NMBA)

NMBAs are useful in highly complex surgeries. NMBAs have become an essential part of the contemporary anaesthesia practice, as they facilitate profound muscle relaxation enhancing the effects of narcosis and analgesia, thus, ensuring optimal surgical conditions. Before their use, obtaining the necessary muscle relaxation during complex procedures, especially abdominal surgeries, was a major concern and in most cases, very deep and dangerous levels of general anaesthesia were necessary [34].

NMBAs trace their roots to the South American arrow poison "curare" which was utilised by natives to stump prey and resulted in stories of "flying death" by early explorers. Early scientific exploration by Sir Benjamin Brodie showed that curare paralysed respiratory muscles but enabled animals to be maintained alive by artificial respiration, pointing to its specific effect on muscle contraction rather than consciousness. Further clarification on the specific sensitivity of curare as a NMBA came from French physiologist Claude Bernard who stated that the neuromuscular junction was specifically inhibited resulting in the inability of nerve impulses to reach muscles [35].

In 1942, after work by Richard Gill and Squibb & Sons scientists, the alkaloid d-tubocurarine was isolated from raw curare, leading to its clinical use. In 1942, the residents Enid Johnson and Harold Randall Griffith, attempted the use of NMBAs to produce muscle relaxation in surgical anaesthesia when they injected curare into a young patient whilst performing an appendectomy in Montreal, the first major step towards the use of NMBAs as muscle relaxants in surgical anaesthesia. This was a ground-breaking experience, as it indicated that it is possible to achieve controlled muscle relaxation, avoiding excessive general anaesthesia [36].

The later introduction of synthetic NMBAs, such as gallamine (the first synthetic used in clinical practice), suxamethonium (succinylcholine), pancuronium, vecuronium, atracurium, and rocuronium, in the 1940s-1960s, rabbit-boostered the safety and effectiveness of muscle relaxation during surgery greatly. NMBAs are especially useful in procedures that need a fighter surgical field e.g. abdominal surgeries and in the provision of advanced airway management procedures such as tracheal intubation which is very essential in patient safety when using general anaesthesia [37].

### Evolution: Impact on Patient Safety and Modern Surgery

Since the evolution of anaesthesia, it has been established and documented that it helped in performing the surgical procedures to be completed safely. The risk factor has been considerably reduced

provided a safe and permitted amount of anaesthesia is used along with continued patient monitoring. The evolution of anaesthesiology from a primitive practice to a highly specialised field of medicine has significantly and indisputably influenced the safety of patients, the scope of surgery, and the net effect on health care. Before the invention of modern anaesthesia, the risks of a surgical operation used to be extremely high [38]. As indicated, in about 80 percent of the surgical procedures, serious infections resulted and about half of the patients succumbed during the operation or due to postoperative infections. The later development of anaesthesiology, however, has resulted in a dramatic decrease in anaesthesia-related mortality rates. Research shows that this has reduced by about 97 percent of what it was in the late 1940s and the present adverse events due to the use of anaesthetics are happening in around 0.82 per 100,000 of inpatient surgical populations. Within the last 20 years reported anaesthesia-associated death rates have been between 0.5 and 1.0 per 10,000 anaesthetics, or less, a minimum of tenfold decrease in reported rate over the 1948-1952 period which had a reported rate of 6.40 per 10,000 anaesthetics [39]. A number of safety improvements, such as better monitoring methods, the formulation and near-universal acceptance of practice guidelines, and other checklist-like methods of reducing errors have contributed greatly to this important improvement. Even with these developments, they are still faced with challenges, especially in the care of the critically ill, obese and frail patient groups, as well as patients who are having urgent or emergency operations as these are classified at a much higher risk of mortality [40].

This is because patient monitoring has been a major part of anaesthesiology practice since the speciality began, having progressed into advanced technological units. Traditionally, physical examination was made by simple vital signs, which included hands on the pulse, listening to breath and heart sounds through an ear or stethoscope, and visual inspection of chest motion and skin colouring. Anaesthesia records medical students E. Amory Codman and Harvey Cushing created one of the first attempts at formal documentation, in which respiratory rate and palpated pulse rate were recorded. By 1901, Cushing incorporated blood pressure by means of a Riva-Rocci sphygmomanometer. In 1950 the idea of Post-Anaesthesia Care Units (PACUs) and Intensive Care Units (ICUs) was proposed, which provided additional support to postoperative monitoring [41].

The next milestone in monitoring technology came in the 1980s with the introduction of pulse oximetry, which enabled non-invasive, continuous oxygen saturation of blood measurements [30]. This was succeeded by capnography in 1991, which gives quick and dependable real-time feedback with each breath a patient takes, ensuring the breathing tube is positioned correctly, and that ventilatory failure is not likely to happen. In the modern era, the standards of minimal mandatory monitoring established by such organisations as the American Society of Anaesthesiologists (ASA) comprise ECG, Non-Invasive Blood Pressure (NIBP), pulse oximetry, and capnography, whereas nerve stimulators and temperature probes are easily accessible. The future of patient monitoring is non-contact technologies, artificial intelligence-based predictive analytics, and computer-controlled drug delivery systems (TCI pumps), which will be able to automate physiological correction, making it even safer and more accurate [40].

The transformation of patient monitoring that started as a simple intermittent observation and progressed into a continuous, complex, and finally predictive monitoring paradigm shifted the way patients were treated. Originally, the monitoring was of the reactionary variety, where the alertness of the anaesthetist would note the change and take action. As technology developed, monitoring became preferential and offered real-time information to enable early identification and intervention, and patient safety ceased to be a qualitative measurement but became a quantitative science [42].

## CONCLUSION(S)

The history of anaesthesiology is evidenced by humanity trying desperately to reduce the pain and improve the safety of surgery. Since the early herbal and physical techniques in the early 19th century, to the inhalational agents in the 19th century, the next development of local, intravenous, and neuromuscular blockers it has continued to advance through constant innovation. Professionalisation that encompassed formal training, certification boards, and even academic departments took anaesthesiology to the rank of primary specialty of medicine. These advancements have had a significant positive effect as they have led to the improvement of patient safety, mortality and morbidity rates of the anaesthesia procedure, as well as facilitating the execution of more complicated surgical operations. Modern surgery owes its success to the constant advances in anaesthesiology achieved by diligent effort, research and innovation.

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### PARTICULARS OF CONTRIBUTORS:

1. Junior Resident, Department of Anaesthesia, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Professor and Head, Department of Anaesthesia, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
3. Senior Resident, Department of Anaesthesia, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

D Venkata Naga Sai Krishna Sanka,  
Junior Resident, Department of Anaesthesia, Jawaharlal Nehru Medical College and AVBRH, Sawangi Meghe, Wardha, Maharashtra, India.  
E-mail: [sanka.dileep3@gmail.com](mailto:sanka.dileep3@gmail.com)

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