

THE DEVELOPMENT OF ANESTHESIA

(continued)

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MORROX forsook the practice of dentistry and discontinued his medical courses at Harvard in order to devote his full time to anesthesia. Without doubt he therefore can be considered to be the first professional anesthetist. The first qualified physician who devoted his full time to anesthesia was John Snow of London (fig. 12).

John Snow (23) was licensed as a member of the Royal College of Surgeons in 1838. In 1843 he received the degree of Bachelor of Medicine from the University of London, and in 1844 he was granted the degree of Doctor of Medicine by the same university. Snow had for some time been interested in gases, and when late in the year of 1846 the news arrived from America that surgical operations could be performed without pain, if patients previously submitted to the inhalation of sulfuric ether, he immediately became attentive.

According to Richardson (p. xiv, ref. 23), the first attempts at the production of anesthesia by the inhalation of ether in England "were not so successful as to astonish all of the surgeons, or to recommend etherization as a common practice. The distrust arose from the manner in which the agent was administered. Dr. Snow at once detected this circumstance; and, as he explains in the pages of the work now in the hands of the reader, remedied the mistake by making an improved inhaler."

Equipped with his new inhaler, Snow was soon administering ether to the outpatients of St. George's Hospital, London, for the prevention of pain in the extraction of teeth. Snow's success in the production of anesthesia for dental operations was noticed by a Dr. Fuller of Manchester Square. Fuller remarked to his colleagues on the superiority of Snow's method of the administration of ether over the method currently employed. As a consequence, Snow was invited to administer ether for major surgical operations at St. George's Hospital. He began to do so on January 28, 1847. Later, he administered ether at the University College of London for Robert Liston, the great English surgeon. Liston appreciated the efforts of his anesthetist and soon Snow became the leading anesthetist in London.

On January 19, 1847, Sir James Young Simpson (fig. 13) first used ether in his obstetric practice. About this time, as has been mentioned

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earlier, Long of Georgia was also using ether in obstetrics. According to Thoms (24), the first production of *anesthésie à la reine* * (that is, the administration of ether between each pain in natural labor) occurred in the United States. Dr. Nathan Colley Keep of Boston reported his use



John Snow

Fig. 12. John Snow, the first physician to devote his full time to anesthesia. (Reproduced from the *Aesclepiad*, 1887, vol. 4. Permission applied for from the publishers.)

of this procedure in a letter which was published in the *Boston Medical and Surgical Journal*, issue of April 14, 1847.

Because of the disagreeable qualities of ether, such as its persistent odor and its tendency to irritate the bronchi, Simpson (25) searched for different agents with which to replace ether. Among those he tried on himself and his associates were the chloride of carbon, acetone, nitric

* *Anesthésie à la reine*, literally "anesthesia in the manner of that used for the queen."

ether, benzine, the vapor of iodoform and chloroform. Of all the agents he tried, chloroform was the one that seemed to be the most suitable. He campaigned vigorously for its use.

The discovery of this important anesthetic agent occurred in 1831. During that year it was described independently by Samuel Guthrie (26) of Sacket Harbor, New York, Eugene Soubeiran (27) of France and Justus von Liebig (28) of Germany. According to Robinson (29),



J. Y. Simpson

FIG. 13. Sir James Young Simpson. (Reproduced from Gordon, H. L.: *Sir James Young Simpson and Chloroform*. London, T. Fisher Unwin, 1897.

Soubeiran's first article on chloroform was written for the October 1831 issue of *Annales de chimie et de physique*. However, it appeared in the issue of that publication for January 1, 1832. Liebig's initial communication was a note in *Poggendorf's Annalen* for November, 1831. Guthrie's announcement appeared in *Silliman's Quarterly* for October, 1831, which did not make its appearance, however, until January, 1832. The leading physical and chemical properties of chloroform were described by Jean Baptiste Dumas in 1835. Dumas (25) bestowed on the

drug its formula and name. In March, 1847, the French physiologist, Flourens (30), proved that the inhalation of chloroform caused in animals the same temporary type of anesthesia caused by the inhalation of ether.

The use of chloroform was suggested to Simpson by David Waldie, a chemist of Liverpool. On November 4, 1847, Simpson and his as-



The Queen in 1855

FIG. 14. Queen Victoria in 1855. (Reproduced from Lorne, V. R. I.: *Queen Victoria—Her Life and Empire*. New York, Harper & Brothers, 1902.)

sistants, Drs. Keith and Duncan, inhaled it.* Satisfied with these preliminary experiments, Dr. Simpson at once began to use chloroform in his obstetric practice. On the tenth of the same month (November) the use of chloroform analgesia in obstetrics was made known by Simpson in an address before the Medico-Chirurgical Society of Edinburgh.

* According to Clark (30) Dr. Matthews Duncan tried chloroform a day before Simpson and his colleagues inhaled it.

The Scotch Calvinist clergy and others objected to Simpson's use of chloroform to prevent the pain of childbirth. They contended that this pain should be endured with patience and complacence. Many influential members of the medical profession objected to the use of analgesia in obstetrics, including Charles D. Meigs of Philadelphia, Francis H. Rainsbotham of the British Isles and Friedrich W. Scanzani of Germany (29).

Simpson waged a successful campaign in behalf of the use of analgesia in obstetrics. When his adversaries quoted the Bible to show that pain was a fore-ordained penalty, Simpson quoted the Scriptures to prove that God was the first anesthetist. The quarrel lasted for several years, but when Queen Victoria (fig. 14) accepted the use of Simpson's chloroform on April 7, 1853 (24) during the birth of her eighth child, Prince Leopold, the continued use of chloroform in obstetrics was assured. Queen Victoria was attended during this confinement by Sir James Clark. John Snow served as analgesist. Chloroform was administered on a handkerchief. The drug was given intermittently and inhalation analgesia was induced for the patient, who was not unconscious at any one time.

In May of the same year in which Morton demonstrated the practicability of ether anesthesia (1846), a group of physicians met in New York City to hold a national medical convention. Delegates from medical societies and colleges of many parts of the United States were present. This was a successful meeting and it was deemed expedient for the medical profession of the country to reconvene the following year. At this meeting, held in Philadelphia, it was agreed that the name of the new organization be the American Medical Association. Standing committees were appointed to make annual reports. Such were the preludes to the first annual meeting of the American Medical Association, held in Baltimore in May, 1848.

At this first organized meeting of the American Medical Association, much prominence was given to the subject of anesthesia. This is attested to by the report of the Committee on Surgery (31).

After a discussion of the value of keeping statistical records and an illuminating account of many operations, the committee considered in detail the various anesthetic agents. The report of the committee is a most important co-eval record of the reaction of the medical profession to the introduction of anesthesia, and for that reason it will be considered somewhat in detail (fig. 15).

According to the report, some surgeons were afraid to use anesthesia in their surgical operations, feeling that the advantages afforded by the relief of pain might be offset by the risks involved:

The great question, which still divides medical opinion, is: Can the annulling of pain by anesthetic agents be produced without risk to life, or is the hazard so inconsiderable as to justify their employment in all cases where it is desirable to prevent the pain of surgical operations?

Apparently, even at this early date (1848), the authors of this report felt that a large group of surgeons were wholly in favor of anesthesia:

They look upon the dangers of etherization as so inconsiderable as to justify the induction of this state, prior to all surgical operations in which the pain is an important consideration, while they consider the advantages of anesthetic

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1848.

FIG. 15. Reproduction of title page of the transactions of the first meeting of the American Medical Association. The transactions gave much prominence to anesthesia.

agents to be especially manifest in all extensive ones, involving life, where the nervous shock (which they believe lessened by them) might increase the risks of a fatal issue.

The authors did, however, admit that some surgeons "would restrict the use of these agents to severe operations, and discourage their general employment, under a belief that their full effect cannot be attained without a degree of danger which would render their indiscriminate use unjustifiable. While a small proportion of the profession still

object altogether to anaesthetics as dangerous and hurtful in their tendency. . . .”

Mention is made in the report that after the introduction of ether anesthesia in Boston it was not until several months later that the method became generally popular in other communities in the United States. The favorable reports of its use in Boston and in Europe made for the more extensive use of ether anesthesia in American communities in 1847 and 1848.

The dangers of etherization were also considered. In some cases it was thought that convulsions, prolonged stupor, intense cerebral excitement, alarming depression of the vital powers and asphyxia apparently were caused by the inhalation of ether and chloroform. Secondary effects attributed to inhalation in a few cases were bronchitis, pneumonia and inflammation of the brain. Interestingly enough, according to this report (p. 190), ether was considered to be a safer drug than chloroform.

Gradually, other anesthetic agents were developed and many improvements were made in the administration of them. These factors contributed to the welfare of the patient.

To discuss another type of anesthesia, in which lack of sensation is obtained by the subcutaneous injection of certain substances, it will be necessary first to refer to certain pioneer efforts made prior to the period at which this narrative has now arrived.

The seeds of the white poppy when pressed and solidified form opium. This famous vegetable narcotic agent, as mentioned previously, was one of the important agents of the ancients in their production of artificial sleep. But, like the action of so many other drugs, the action of the drug was unpredictable. On some patients large doses of this drug apparently had little effect. The action of this drug on other patients often was very dangerous, and even might result in the patient's death. Because of this danger the more conservative members of the medical profession refrained from using it.

To bring about the safe use of this drug Friedrich Wilhelm Sertürner (fig. 16) of Paderborn, Westphalia, a chemist, devoted much of his time to research and experimentation. After experimenting with crude opium, mixing it with the better known solvents, he at one time (1806) poured liquid ammonia over the opium (2). This produced a white crystal residue.* Sertürner, after self-experimentation, found this residue, an alkaloid, to be the cause of the soporificity of opium. He named the drug “morphium” (later changed to “morphia,” “morphine” and “morphin”) after the Greek god of dreams, Morpheus (32).

Lafargue, in 1836 (33), came upon a new way to deaden pain. Using a needle trocar, he injected morphine paste subcutaneously near the affected part, with beneficial results. In 1839, Drs. Isaac E. Taylor and James A. Washington of New York began the practice of hypodermic medication (33). These physicians punctured the skin with a

* In 1804, Seguin discovered the same substance but did not fully investigate it.

lancet and, by means of Anel's eye syringe, forced a solution of morphine under the skin for the local relief of pain. In 1843, Dr. Alexander Wood of Edinburgh injected a solution of morphine under the skin in the vicinity of a painful part, affording relief from pain. In 1845, F. Rynd (34) of Edinburgh also carried out a similar means of subcutaneous medication.

In 1853 Wood invented the hollow needle, and in that same year Charles Gabriel Pravaz attached an improved hollow needle to a spe-



FIG. 16. Friedrich Wilhelm Sertürner who discovered morphine. (Reproduced from München. med. Wehnschr. 71: 77 [Jan. 18] 1924.)

cially constructed syringe. On the continent this is called the "Pravaz" syringe, in honor of its inventor. In England and the United States it is commonly referred to as the "hypodermic syringe." Thus the world was assured of the full benefit of the administration of morphine.

According to Archer (1), W. W. Greene of the Maine Medical School as early as 1868 advised the hypodermic use of morphine during inhalation anesthesia. He felt that his procedure prevented shock, delirium, nausea, and shortened the anesthetic influence. In 1869, according to Fülöp-Miller (2) (p. 355), the French physiologist, Claude Bernard, also advocated the same procedure.

Spessa (35) of Italy in 1871 injected a solution of morphine into a fistulous tract before surgical intervention, claiming that by doing this he was able to prevent pain during surgical operations.

The use of cocaine in anesthesia was the next important development. Its history is most interesting. According to Bumpus (36), in ancient times the natives of Peru knew about the anesthetic qualities of the coca plant. During the severe surgical procedure of trephination they obtained local anesthesia by chewing the leaves of the coca plant and allowing the resulting saliva to run into the fresh incision. The plant was also important in the religious and political lives of these people. Braun (37) quoted Novinny as saying that the coca plant was regarded as a gift from God which "satiated the hungry, gave renewed energy to the tired and weary, and caused the unfortunate to forget sorrows."

While on a trip to South America, Scherzer, according to Braun (37), noticed that the leaves numbed the tongue when they were chewed. He brought back with him a large quantity of these leaves and was the first to make a report in the literature concerning their anesthetic qualities.

In 1855, Gaedicke (2) * of Germany isolated an alkaloid of the leaves of this plant, naming it erythroxylin. A few years later (1860) Albert Niemann of Germany obtained the alkaloid of coca leaves in crystalline form and named it "cocaine." He also reported the numbing effect of this drug on the tongue.

Not much attention was paid to these important discoveries until 1873.† In that year Alexander Bennett (38) demonstrated the anesthetic properties of cocaine. Five years later (1878) Vasilii Konstantinovich von Anrep (39) made a thorough study of the pharmacologic properties of cocaine. Von Anrep injected a weak solution of cocaine under the skin of his own arm. He experienced a sense of warmth which was followed by anesthesia. Anesthesia lasted for about thirty-five minutes. This led him to suggest the possibility of the employment of cocaine as a local anesthetic agent. He also experimented on animals. He instilled a solution of cocaine into the conjunctival sac of animals, but he noticed its dilatatory effect on the pupil only. However, Coupart and Borderan, in 1880, were able to demonstrate the loss of the corneal reflex in animals after the use of solutions of cocaine. According to Braun (37), Fauvel, Saglia, and others had already learned to use coca leaves and their extracts in the treatment of painful diseases of the larynx and pharynx.

The development and use of cocaine as a local anesthetic agent was chiefly the work of Carl Koller (fig. 17). When Koller was house

* The *U. S. Dispensatory* gives the year 1844 and the investigator's name as Gaelken.

† According to Carl Koller, in a letter to M. G. Seelig (*J. A. M. A.* 117: 1284 [Oct. 11] 1941), Moreno y Mayz, the Peruvian army surgeon, in 1868 remarked that the sensory paralyzing effects of cocaine might be put to use in medicine.

surgeon at the Vienna General Hospital, his friend Sigmund Freud was studying the possibility of curing patients addicted to morphine by treating them with cocaine. Both Koller and Freud studied the physiologic aspects of cocaine. Freud turned his attention away from these investigations. Koller, however, continued his studies. He instilled a weak solution of cocaine into the eye of a frog and noticed that the eye became insensitive to pain. On September 15, 1884, Koller reported his observations to the Ophthalmological Congress held in Heidelberg.



FIG. 17. Carl Koller, who developed the use of cocaine as a local anesthetic agent. (Courtesy of Dr. J. S. Lundy.)

Soon afterward cocainization of the eye for the production of local anesthesia was generally adopted.

Not long after the acceptance of cocaine for the production of local anesthesia for surgery of the eye, cocaine was extensively used in laryngology and rhinology. Otis and Knapp used cocaine anesthesia for operations in the male urethra, and Fraenkel carried out experiments in which application of the agent to gynecology was demonstrated. Cocaine was also injected in solution into the tissues, and became extensively used in dentistry and in general surgery. William S. Halsted of the Johns Hopkins Hospital in 1884 injected cocaine into nerve

trunks, thus obtaining "conduction" anesthesia in peripheral regions. The nerve he first blocked was the mandibular. In 1922 the American Dental Association honored Dr. Halsted for his original researches, which greatly improved the use of anesthesia in oral surgery.



FIG. 18. J. Leonard Corning, who was the first to experiment with spinal anesthesia (Reproduced by courtesy of the New York Academy of Medicine.)

In 1885, J. Leonard Corning (fig. 18) (40) of New York, having shown experimentally that cocaine had a prolonged anesthetic effect when it was administered subcutaneously, experimented on the possibilities of spinal anesthesia (41). He injected hydrochlorate of cocaine

into the space situated between the spinous processes of two of the inferior dorsal vertebrae in a dog. Although this procedure did not affect the anterior extremities, he was able to obtain anesthesia of the hind legs. To Corning this suggested the local action of the drug. He next worked with a man who had long been suffering from spinal weakness and seminal incontinence. This time he injected a solution of hydrochlorate of cocaine between the spinous processes of the eleventh and twelfth thoracic vertebrae. Anesthesia of the legs and genitalia resulted. Encouraged by his results, Corning (42) in 1888 injected hydrochlorate of cocaine in the vicinity of the spinal cord. According to Bumpus (36), Corning was the originator of regional anesthesia. In 1887, he injected presumably a solution of cocaine around the median cutaneous antibrachii nerve, producing anesthesia of the skin supplied by it.

In 1891 Quincke (43) demonstrated the usefulness of spinal puncture as a diagnostic procedure.* Although he was unaware of the possibilities of spinal anesthesia, he showed that the introduction of a needle through the dura was feasible. After the work of Corning and Quincke, August Bier (44) of Greifswald, Germany, in 1898 produced true spinal anesthesia in animals and then in himself and an assistant, Hildebrandt, by injecting the spinal canal with a solution of cocaine. He was soon using it for patients with complete success. Theodore Tuffier (45), working independently of Bier, produced spinal anesthesia by injecting a solution of cocaine between the third and fourth lumbar spaces. Many other investigators reported their observations and spinal anesthesia became established on a firm basis.

A new method of anesthesia was contributed by Carl Ludwig Schleich. Before the German Congress of Surgeons in 1892, he demonstrated infiltration anesthesia by intracutaneous injection. In 1890, according to De Takats (46), Réclus, Pernice and Kummer had earlier made use of infiltration anesthesia. But Schleich apparently achieved better results by the use of a very dilute solution of cocaine. Schleich's method was used in 1894 in the United States, as reported by Würdemann. In 1896 Bransford Lewis reported his use of infiltration anesthesia.

In 1897 Braun demonstrated that the toxicity of cocaine was in direct ratio to its rate of absorption and that its efficiency was in reverse ratio. He therefore recommended the addition of epinephrine to cocaine to decrease the rate of absorption and to increase the duration of anesthesia.

Meanwhile, many investigators had developed derivatives of cocaine that were not so toxic. In 1891 Giesel isolated tropacocaine. Fournau introduced stovaine in 1903. Einhorn, in 1904, discovered novocain. Many other similar drugs were later developed.

* Dr. Essex Wynter of England discovered lumbar puncture, independently, at about this time.

(To be continued)

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