Anesthesiology
1996; 85:913–9
© 1996 American Society of Anesthesiologists, Inc.
Lippincott-Raven Publishers

Tait and Caglieri

The First Spinal Anesthetic in America

Merlin D. Larson, M.D.*

WITH the approaching centennial anniversary of the first spinal anesthetic in 1998, it is appropriate to remember some of the personalities and events surrounding its early development. Most authorities have concluded that Corning¹ performed epidural anesthesia in 1884 and that Bier administered the first true spinal anesthetic in August 1898 in Kiel, Germany.²

Two San Francisco surgeons, F. Dudley Tait and Guido E. Caglieri, are credited with administering the first spinal anesthetic in America on 26 October 1899.³⁴ I offer an account of that first spinal, preceded by brief biographical sketches of the two men that I gleaned from interviews with their living relatives and information gathered from the archival files of La Societe’ Francaise de Bienfaisance Mutuelle and from the libraries of The University of California, San Francisco and the City of San Francisco.

Tait and Caglieri were born into affluent families. Both received their medical education in Europe and were exposed to the long-standing intellectual and experimental scientific traditions characteristic of the continent. One became the prototypical academic physician—scholar, investigator, teacher, politician—and the other was more of a “gentleman” physician, who combined clinical interests with an active career in finance and banking. Their work in spinal anesthesia proceeded at a time when medical education and research in California was still in its infancy. What motivated and sustained their interest and investigations can only be surmised. They received no support or encouragement from governmental or academic institutions. Perhaps Tait and Caglieri were intent on demonstrating the value of new medical ideas and scientific methods that they had observed in Europe. What followed was a bold and daring, but successful, attempt to introduce a new and unproved method of anesthesia into the diverse California medical community.

F. Dudley Tait

Frederick Dudley Tait (fig. 1) was born on 12 October 1862. His father, George L. Tait, was professor of ancient languages at the University of California, Berkeley, and later superintendent of schools in San Francisco. Dudley was the second of three sons, all of whom were educated in Europe after completing elementary school in San Francisco. At the age of 21, he returned to the United States to enroll in the Bellevue Hospital Medical School in New York City, from which he received his medical degree in 1886. After a 2-year period of general practice in Kansas City, where he wrote a short treatise on the use of methyl chloride to treat “neuralgic” pain,⁵ he returned to Europe to obtain the more advanced M.D. degree offered by the University of Paris.

On graduation in 1889, he returned to San Francisco to join his brother George in a general medical practice, but also became associated with the French Hospital, which was owned and operated by La Societe’ Francaise de Bienfaisance Mutuelle, the first health maintenance organization in California (founded in 1851). When the new French Hospital opened in 1895, he joined the staff, specializing in the practice of surgery, and, by 1899, was one of the new facility’s most successful clinicians, admitting more than twice as many patients as any of his colleagues.⁶

Despite appointment to the positions of chief of surgery and chief of staff, Tait reduced his association with the French Hospital in 1903 to become more involved in experimental surgical studies at the Affiliated Hospi-

---

*Clinical Professor of Anesthesia.

Received from the Department of Anesthesia, University of California, San Francisco, California. Submitted for publication October 30, 1995. Accepted for publication June 20, 1996.

Address reprint requests to Dr. Larson: Department of Anesthesia, University of California, San Francisco, 521 Parnassus Avenue, Room C450, Box 0648, San Francisco, California 94143-0648.

Key words: Anesthesia, spinal. History, spinal anesthesia.
Fig. 1. This photograph of F. Dudley Tait, M.D., appeared in the San Francisco Chronicle on 11 September 1907 when he was appointed to the San Francisco Board of Health. His name was in the news in May of the same year after the San Francisco College of Physicians and Surgeons sued him and Dr. Philip M. Jones, editor of the California State Medical Journal, for $75,000, claiming that an article by Tait, published in the California State Medical Journal, had slandered their institution. Attempts were made to bribe Tait but he would not be dissuaded from his views and was removed from the California Board of Examiners later that year. The Flexner report on medical education, published 3 y later,89 confirmed much of what Tait had already stated publicly about certain medical schools in California.

tals of the University of California, the future University of California, San Francisco, Medical Center. However, San Francisco’s four medical schools and 19 hospitals were then struggling desperately to survive, and institutional success was not necessarily enhanced through laboratory research. Thus Tait failed to become a dominant figure within the University of California School of Medicine—his name is absent from contemporary historical documents and accounts of prominent persons in the department of surgery.7 In 1913, after Dr. T. W. Huntington retired as chairman of the surgery department, Tait’s affiliation with the University of California ended.

Throughout his career, Tait was active in several medical organizations within California. A member of the French Surgical Society, the American College of Surgeons, and the Western Surgical Association, he also served terms as president of the California Academy of Medicine and the San Francisco Medical Society, and he was a member of the San Francisco Board of Health.

As a member of the California Board of Medical Examiners, Tait supervised the written examinations required to practice as a physician in California, promoting stringent qualifications for licensure. As president (in 1904) and subsequently associate secretary and treasurer of the Board, he became central to controversies surrounding the content of the questions asked of prospective candidates.8 By 1907, after 8 y on the Board, most of its 12 members voted to remove him from office because he denied California medical licenses to graduates of certain medical schools.†

Such political encounters did not appear to thwart Tait’s academic endeavors; he contributed extensively to the medical literature throughout his career. His 28 publications reflect a broad knowledge of contemporary surgical techniques, including diverse topics related to neurosurgery, thoracic surgery, orthopedics, urology, and gynecology. He was one of the first surgeons in San Francisco to operate within the thoracic cavity, reporting on this successful procedure in 1898.9

His experimental work was significantly influenced by French medical scientists of the period. Jean Athanase Sicard, the French neurologist who later introduced caudal anesthesia but who also was involved in early studies investigating subarachnoid block, is cited 15 times in Tait and Cagliéri’s manuscript on spinal anesthesia. Theodore Tuffier, who also studied spinal anesthesia and eventually became one of the most eminent Parisian surgeons of that era, probably was one of Tait’s mentors at the University of Paris. Tuffier graduated from the same institution 4 y before Tait and immediately became involved in surgical research.

Tuffier’s influence is clear when we examine Tait’s publications related to the practice of anesthesia. For example, in an article entitled “Differential Pressure,”10 Tait reviewed the difficulties encountered when operating within the thoracic cavity, also a research interest of Tuffier’s. Meltzer and Auer11 had recently introduced the simplified endotracheal catheter as an alternative to “Sauerbach’s box,” a device for containing both the patient (below the neck) and surgeon in a negative pressure chamber. Tait showed the superiority of the endotracheal method in animal studies and encouraged its rapid acceptance into clinical practice.

Another anesthetic-related study consisted of an analysis of the analgesic and anesthetic properties of electrical current applied to the brain.12 This was also a subject pioneered by the French medical research com-

†San Francisco Chronicle. 6 December 1907.
munity and one that Tuffier had studied. Tait and his coauthor, Raymond Russ, M.D., experimented on themselves as well as on other humans, dogs, cats, and rabbits. Their conclusion that the technique was dangerous and only occasionally effective was fiercely contested by Dr. L. G. Robinovitch, a leading proponent of electrical anesthesia. In a rebuttal to Tait's oral presentation at the 1909 Annual Session of the American Medical Association, Robinovitch stated bluntly that Tait and Russ had "used the wrong electric source, the wrong motor, the wrong interrupter, and the wrong batteries." Subsequent investigations however, have endorsed Tait and Russ's conclusions.

In Dudley Tait we see a scholar with a curious mind, working in an environment most often unsympathetic to his primary interest of experimental research. He presented an intolerant and scornful attitude toward many of his "professional" colleagues with comparatively less training. He was progressive and optimistic about the future of medicine but insisted that physicians should be properly trained in accord with the French model. In an address to the graduating class of the Oakland College of Medicine in 1911, he stated: "The teacher of the future must establish a forward outlook and instill hope in the student's mind. Hope, the dominant feature of modern thought, hope for the morrow, hope for the future, anticipation of something better, some improvement, or, at the very least, some change. Hope is the keynote of progress and the certain safeguard against retrogression." Such advice seems unusually appropriate 85 y later.

Tait's final publication was a letter entitled "Surgery and the War," dated February 1917, in which he criticized American medical journals for failing to report on the advances in surgical methods learned overseas during the war. He suffered from heart disease and died in the Adler Sanitarium of malignant endocarditis at age 55 y on 26 February 1918.

**Guido E. Caglieri**

Less is known about Guido Caglieri's (fig. 2) clinical career. He was born on 21 April 1871 in San Francisco. His father, George Caglieri, was one of the founding members of the Bank of Italy, which later changed its name to the Bank of America. Caglieri studied in California, receiving his medical degree from the University of California in 1892. After graduation, he furthered his education at Edinburgh and London, becoming a member of the Royal College of Surgeons in 1895. Returning to San Francisco, he became associated with the University of California and the French Hospital, where he probably encountered Dudley Tait.

After his father's death in 1904, Caglieri assumed his father's position as a director of the Bank of America but continued his medical practice in an office across the street from the bank. He prospered in his role as a bank director, becoming one of its largest stockholders by 1918. He also had an interest in politics and served a term as a supervisor of the City and County of San Francisco. An amateur geologist, he held financial interests in many California mining companies.

One can only speculate on why Caglieri collaborated with Tait in investigating spinal anesthesia. Their educational experiences in Europe may have provided the bond between them. Many medical schools on the West Coast were marginal proprietary schools consisting simply of 3-y apprenticeships accompanied by a few lectures in basic science. California was saturated with "doctors," but the term could signify a homeopathist, an "eclectic" physician, an osteopath, or a medical doctor with 2 to 5 y of education after high school. The older, more experienced Tait may have
fostered an association with Caglieri because the latter had passed the rigorous examinations for the Royal College of Surgeons and was therefore a "cut above" other regionally trained physicians.

In 1899, Caglieri was one of two adjunct surgeons at the French Hospital, where Tait was the newly elected chief of surgery. Together they contributed 38% of the private admissions to that hospital and would have had the authority to clinically introduce this new and unproved method of anesthesia. Caglieri also had an appointment at the Affiliated Colleges of the University of California, San Francisco, where a veterinary school was temporarily located at that time. This useful connection permitted them access to animal laboratories, where they conducted many experimental studies.

Compared with Tait, Caglieri was less motivated to pursue academic interests. His other contributions to the literature consisting of only two case reports and two letters to the editor. In the 1930s, he curtailed his surgical work and devoted himself to an office practice. He continued to practice as a physician until 6 months before his death from pancreatic cancer on 24 August 1951.

Report of the First Spinal Anesthetic

Tait and Caglieri studied seven cadavers, 11 patients, and an unknown number of cats, dogs, rabbits, guinea pigs, and horses in their effort to further understanding of how lumbar puncture could benefit patients. Although they do not clearly state their hypothesis, apparently they were trying to exploit the technique of lumbar puncture, discovered independently by Quincke39 and Wynter40 in 1889, for some therapeutic gain. Examination of cerebrospinal fluid was undoubtedly useful in certain diagnostic conditions, but the utility of fluid withdrawal or drug injections into the subarachnoid space was still not established. Infectious diseases of the central nervous system, such as syphilis, tuberculosis, tetanus, and gonorrhea, were important causes of morbidity at the turn of the century. Tait and Caglieri experimented in the treatment of tertiary syphilis by subarachnoid injections of mercuric salts and iodides, which, when given systemically, were thought to be beneficial in the treatment of primary syphilis. However, they showed that, when given intravenously, these drugs did not enter the subarachnoid fluid, although agents administered into the subarachnoid space did appear in the blood. Subarachnoid injection of mercuric cyanide into one patient with tertiary syphilis worsened the patient’s condition, a finding now not surprising given our knowledge of the neurotoxic effects of mercuric salts.

Tait and Caglieri were also interested in how microorganisms enter the central nervous system. Because dyes injected into the lumbar subarachnoid space quickly appear along the optic and olfactory nerves, they suggested that microorganisms infect the meninges by entering through the cribriform plate and the retrobulbar space, not via the lymphatics, as many other investigators believed. Their manuscript correctly asserts that cerebrospinal fluid is not simply a large collection of lymphatic fluid, as was believed by some of their contemporaries.

In addition to its utility in diagnosis, penetration of the subarachnoid space was reported to have a potential application with spinal anesthesia. The common anesthetic techniques at that time were inhalation of nitrous oxide, chloroform, or ether, or infiltration with dilute solutions of cocaine. None of these anesthetics provided adequate muscle relaxation. Furthermore, the side effects were considerable, ranging from vomiting to prolonged emergence, airway obstruction, and death. Spinal anesthesia offered a way to avoid these problems, particularly in frail patients. The primary focus of Tait and Caglieri’s report is therefore directed toward a more thorough understanding of spinal anesthesia.

Tait and Caglieri’s study was more extensive and thorough than any of the other three clinical papers published in the first year after Bier’s original document of April 1899. In October, the Russian surgeon Dr. J. B. Seldowitsch confirmed Bier’s results but added little to the understanding of how spinal anesthesia might be a useful alternative to other anesthetic methods in common use. Seldowitsch’s account, like Bier’s, was not an enthusiastic endorsement of the spinal method of anesthesia. His four cases, all performed at the Women’s Hospital in St. Petersburg, involved surgery of the lower extremities. All of his patients had alarming postoperative fevers (39 to 40°C), and he also reported chills, headache, mydriasis, vomiting, and dizziness. Because fever and mydriasis accompany cocaine toxicity, he attributed these side effects to an action of cocaine on higher brain centers.

Tuffier began his human studies 2 weeks after Tait.
and Caglieri and published two reports in November 1899 that were cautiously optimistic about the use of spinal anesthesia for procedures on the lower extremities and perineum. Tuffier’s publications presented his experience with five patients but did not try to clarify the reasons for postoperative side effects or grapple with issues of technique or block height.

A publication by Matas in December 1899 is little more than a case report of his use of 20 mg intrathecal cocaine to remove hemorrhoids in a 49-year-old man. Fever, headache, and nausea developed in the patient after surgery. Although this was actually the first published account of spinal anesthesia in America, it left open all the questions raised by Bier, Seldowitsch, and Tuffier.

In April 1900, Tait and Caglieri reported on 11 anesthetics using 5 to 15 mg intrathecal cocaine for procedures below the umbilicus (bone, rectum, hernia). Two patients experienced some surgical discomfort and three cases were outright failures. Nonetheless, unlike Bier, Tait and Caglieri enthusiastically endorsed the technique. One patient who “had collapsed” with both ether and chloroform underwent a bone curettement without complications after intrathecal injection of 10 mg cocaine. Thus relative to the constraints under which these investigators worked, modest success represented a ground-breaking effort.

Tait and Caglieri noted very few postoperative symptoms that could be attributed to lumbar subarachnoid injections of cocaine. Some of their ideas may have accounted for this success. For example, they promoted the use of a fine needle and slow injection of drug to prevent rostral spread. They also astutely recognized that the extent of diffusion was influenced by several factors, including the amount of drug injected, drug composition and density, and the pressure under which drug is injected. Analgesia was thought to be sufficient for all operations of the lower limbs and pelvis, and they recommended a trial in obstetrics, thus heralding the successful use of the spinal technique during labor reported later that same year by Kreis. They also experimented with the other available derivatives of benzoic acid, eucaine and nirvanin, and found that they offered no advantage over cocaine. One additional observation is relevant to current practice. When the modern anesthesiologist advises the patient with a postspinal headache to “drink plenty of fluids,” it recalls Tait and Caglieri’s simple observation that the flow of cerebrospinal fluid through an indwelling subarachnoid needle was markedly increased by intravenous administration of saline.

Spinal anesthesia was rapidly accepted in San Francisco. Morton reported on 253 successful cases at San Francisco County Hospital in 1901. Gwathmey noted in 1914 that the chief of surgery at the French Hospital operated on his own appendix after having been administered a spinal anesthetic.

Bier, Tuffier, and Matas all contributed subsequent papers on spinal anesthesia, but neither Tait nor Caglieri contributed further work. This is somewhat surprising, given the promise of future studies offered in their manuscript. The explanation becomes apparent when we recognize that some of their ideas were leading them in the wrong direction. For example, they thought that direct injections into the brain and spinal cord were innocuous. Consequently, three of their cases were cervical spinalis and the report of one of these cases suggests that the spinal cord was punctured. After the procedure, this patient suffered from a headache and weakness in the legs but recovered within 3 days. Undaunted, they encouraged further use of this approach. They also misunderstood the relationship between cerebrospinal fluid pressure and postspinal headache by attributing headache to an increase in pressure within the subarachnoid space and thus recommended withdrawal of fluid to avoid high intracranial pressure.

Compounding their difficulty was an apparent lack of knowledge or awareness of how spinal anesthesia might affect blood pressure. Sympathetic control of the vascular system was sufficiently known at the time for Tait and Caglieri to have determined that hypotension might result from a local anesthetic-induced sympathectomy. However, they did not mention hemodynamic alterations of spinal anesthesia. Before Cushing’s introduction of the Rivi Rocci method in 1903, blood pressure was not measured during anesthesia. Tait and Caglieri were also unfamiliar with other now-well-known factors that affect sensory level, such as position and baricity.

In addition, the acquisition of a sterile solution of cocaine was not a simple matter. Cocaine crystals obtained from pharmaceutical companies were not necessary sterile, and contaminated solutions produced disastrous consequences. Because Bier apparently used tap water to dissolve cocaine, it is somewhat surprising that complications were not more severe. Both Seldowitsch and Tuffier used aseptic technique to perform the procedure but did not discuss the preparation.

Anesthesiology, Vol 85, No 4, Oct 1996
of the solution in their early publications. Tait and Caglieri tried to ensure a sterile injectate by first dissolving the cocaine in ether, then recrystallizing the cocaine and dissolving it in filtered, boiled water. This method was later described by Bainbridge and used by Gwathmey. Although the cocaine solution was undoubtedly sterile, boiling cocaine decomposes the drug into methyl alcohol and the inactive benzoyl-cgonine. Prolonged boiling of the solution may have accounted for two of the three unsuccessful spinal blocks reported by Tait and Caglieri.

With these uncertainties, it is somewhat surprising that spinal anesthesia survived these early attempts. Fortunately, others were on the right track. In an elegant canine study, Tuffier noted the development of hypotension after spinal anesthesia and correctly determined it to be due to vasomotor paralysis of denervated segments. He also suggested that vasodilatation would not increase the amount of surgical bleeding because its effects were counterbalanced by lower blood pressure. In 1905, the introduction of procaine, a drug less toxic than cocaine, significantly enhanced the popularity of spinal anesthesia. Barker initiated studies beginning in 1907 with hyperbaric solutions, giving the spinal technique a firm scientific foundation.

Causative factors of the side effect of postspinal headache were not so easily determined. Tait and Caglieri's belief that the headache was due to increased intracranial pressure was still accepted, by some authorities, 25 y later. The extensive clinical study by Vandam and Dripps finally confirmed Bier's initial suggestion that headache was primarily due to leakage of cerebrospinal fluid through the dural puncture site.

An anonymous author writing in the January 1901 issue of Lancet stated that there were nearly 1,000 published accounts of spinal anesthesia in the 2 years after Bier's original account. Some might view Tait and Caglieri's manuscript as just another report on spinal anesthesia, albeit describing the first anesthetic in America. However, the issue of priority is of minor importance. Matas tried spinal anesthesia in New Orleans just 15 days after Tait and Caglieri, so the introduction of this technique in America did not depend on the San Francisco surgeons. In fact, Tait and Caglieri claimed no priority, deferring to Corning both for his originality and administration of the first spinal anesthetic in America, and to Bier, Tuffier, and Sicard for launching the technique within the wider medical community. However, they were careful to present an accurate and scholarly account of what was known about spinal anesthesia at the time. Furthermore, they presented direct and candid recommendations based on their findings. Their report thus represents a clear window in time, through which we can view the emerging thoughts about a technique that has survived, with significant improvements, the first 100 y firmly intact.

The author thanks Flori Berger (University of California, San Francisco History of Medicine Library); Hugh Vincent, M.D. (San Francisco Medical Society); Edmond S. Delmon and Marcelle Revel (La Societé Française); Craig Martel (Cypress Lawn Memorial Park); and Mandabach, M.D. (for useful historical references) for assistance and historical materials. William K. Hamilton, M.D., and Winifred von Ehrenberg made insightful comments on the manuscript. French and German language references were graciously translated by Veronica Segredo, M.D., and Paul Ulrich, M.D., respectively.

References

4. Tait D, Caglieri G. Experimental and clinical notes on the subarachnoid space. Trans Med Soc State California 1900; April 266–71
5. Tait D. Chloride of methyl in the treatment of neuralgic affections. Kansas City Medical Index 1886; 7:694–9
6. Annual Report, La Societè Francaise De Bienfaisance Mutuelle, 1899
15. Tait D. Surgery and the War. JAMA 1917; 68:2002
18. Puschmann F. A History of Medical Education. London, HK Lewis, 1891; pp 514–51

[Personal communication with Mr. Guido E. Caglieri Jr., January 1996.]
20. Wynter WE: Lumbar puncture. Lancet 1891; i:981–2
23. Tuffier T: Analgesie Chirurgicale par l'injection de cocaine sous l'arachnoide lombaire. La Presse Medicale 1899; 91:294–5
30. Braun H: Die Lokalanästhesie, ihre wissenschaftlichen Grundlagen und praktische Anwendung. Leipzig, Johann Barth, 1907, pp 102–4
34. Tuffier T, Hallion: Effets circulatoires des injections sousarachnoidienes de cocaine dans la region lombaire. Societe de Biologie 1900; Nov 18:897–9
35. Barker AE: Clinical experiences with spinal anesthesia in 100 cases. BMJ 1907; March 23:665–6
37. Vandam LD, Dripps RD: Long term follow-up of patients who received 10,098 anesthetics. JAMA 1956; 161:586–91
38. Anonymous: Surgical anaesthesia by the injection of cocaine into the lumbar subarachnoid space. Lancet 1901; January 12:137–8

Anesthesiology, V 85, No 4, Oct 1996