

Loco-Regional Anesthesia: Building on the Past to Solve Tomorrow's Challenges

Philippe Harris¹

¹Université de Montréal, Montréal, QC, Canada

Correspondence

Philippe Harris

Email: philippe.harris@umontreal.ca

Publication Date

May 25, 2026

MJM 2026 (23) 1

[10.26443/mjm.v23i1.1154](https://doi.org/10.26443/mjm.v23i1.1154)



www.mjmmed.com



This work is licensed under a Creative Commons BY-NC-SA 4.0 International License.

For most, anesthesia is often solely perceived as putting patients to sleep and waking them up shortly after. It encompasses much more than that.

Medicine progresses through continuous improvement, with new technologies and medications building on previous innovations. What may seem obvious today was a revolution yesterday. There are always new challenges to tackle. Improving pain management remains a priority, specifically the balance between increasing efficacy and mitigating the inherent risks of intervention.

KEYWORDS

Local Anesthesia, Regional Anesthesia, Medical History, Opioid Crisis, Medical Innovation

0.1 | A brief history on the evolution of regional anesthesia: Targeting medication where it counts

The fundamental triad of anesthesia comprises three primary components: unconsciousness, muscle relaxation, and analgesia. This short essay will explore the latter through the advent of anesthesia restricted to specific anatomic regions (termed loco-regional anesthesia), ensuring pain management without the risks of general anesthesia.

As an alternative to general anesthesia, some procedures can be managed with local or regional anesthetic interventions where the patient stays awake, but pain is managed by numbing the relevant region. Such techniques allow for reduced risks associated with ventilation and hemodynamic control, especially in patients with preexisting concomitant medical conditions such as pulmonary or heart diseases. Endotracheal intubation also presents a risk to the respiratory tract, but also to the musculoskeletal system as seen in patients with

rheumatoid arthritis who are at increased risk for cervical injuries.

By the end of the 19th century, the benefits and risks of general anesthesia using ether had been well established following the first public demonstration by the dentist William T. G. Morton in Boston, Massachusetts, in 1846.(1)

In this context in 1884, ophthalmologist Carl Koller and colleagues, were experimenting with several substances at the Vienna General Hospital, looking for a viable alternative to general anesthesia that would ensure pain control during ophthalmologic surgeries while limiting risks. Through experimentation with animals, he eventually stumbled upon cocaine.(2)

Cocaine is extracted from the leaves of the coca plant. Native to the forests of South America, it was imported to Europe by an 1859 Austrian expedition.(2) Peruvian and Bolivian indigenous communities were aware of coca's euphoric properties from chewing its leaves.(3) In the mid-1800s, European explorers and scientists grew increasingly curious about its psychotropic effects and were soon experimenting on it by extracting its active chemical compound – cocaine.(3,4)

The first recorded successful attempt at local anesthesia was performed by Koller in 1884, when he self-administered drops of cocaine into his eyes and took note of its local anesthetic properties after surgical manipulation on himself. (5)

Following Koller's self-experimentation, the value and ease of local anesthesia rapidly gained global recognition. Other physicians and surgeons quickly shared new anesthesia techniques using cocaine. One such surgeon was William Stewart Halsted in New York City. Through experimentation on himself, fellow physicians, and students, he discovered and described the nerve block that resulted from injecting cocaine into the trunk of a sensory nerve.(6) Unfortunately, Halsted's experiments led to a dependency on cocaine. His addiction later forced him out of New York City's medical scene and into a new chapter as a teacher and founding figure of the newly formed Johns Hopkins University Medical School.

A few months later, in 1885, once again in New York

City, a neurologist mistakenly injected cocaine too far into a patient's back and likely became the first to perform a spinal block.

Years later, in 1898, Einrich Quincke devised the theory of the spinal block, which involved guiding a needle through the skin, the subcutaneous tissues, between the vertebrae, and the dura before reaching the subarachnoid space. Once in place, a local anesthetic, cocaine, would be injected to provide temporary anesthesia starting at that spinal level and below. This technique was then performed in August of 1898 by August Carl Gustav Bier, a German surgeon, on his assistant.(7)

The field of regional anesthesia was further developed in 1921 when Fidel Pagés, a Spanish military surgeon, developed epidural anesthesia. In his paper, "Anesthesia metamérica", Pagés described a technique similar to the spinal block, but without perforating the dura.(8) His epidural technique allowed long-acting anesthesia at a specific level of the spine by placing a catheter in the epidural space and continuously pumping an anesthetic solution.(9)

As with any scientific discovery, epidural anesthesia was made possible by building on earlier discoveries and innovative techniques now forgotten by history. Unfortunately, credit is not always given to the pioneers but is instead given to those who publish or speak out the loudest. Such was perhaps the case of Vassily von Anrep, a Russian doctor who may have been the first to use cocaine as a local anesthetic in 1880 before Carl Koller's first recorded attempt in 1884. Von Anrep's techniques and results were published in Russian and outside of mainstream scientific journals and he was therefore forgotten.(2,10)

Nevertheless, the advent of loco-regional anesthesia in all its forms has opened a new chapter and is still widely used in medicine today. The epidural anesthesia technique is a secure and effective method for pain management. While it requires technical skills, the insertion of a catheter across the ligamentum flavum allows the administration of an anesthetic – nowadays usually bupivacaine, ropivacaine, or solutions of those anesthetic agents mixed with other drugs – into the epidural space, thereby achieving regional anesthesia. A

well-executed epidural block reduces the need for general anesthesia, airway management, and postoperative opioid use. It has also been associated with lower pain scores, shorter postoperative hospital stays, and fewer complications.(11)

0.2 | Tackling the public health challenge of dependency

Today, loco-regional anesthesia is still making progress with the development of additional techniques and new delivery systems. However, one problem persists. Anesthesia is effective for the period during which an anesthetic solution is given, but what happens once the anesthesia wears off? The patient's pain begins. For several decades, opioids have been the only available ambulatory treatment for postoperative pain. While they are effective analgesics, they are also very addictive drugs.

In Canada, the increase in opioid prescriptions over the last few decades has played a significant role in opioid overuse. Many factors have also contributed to the increase of opioid consumption, including increased use of illegal opioid drugs and increased potency of opioid substances, such as Fentanyl and Carfentanyl, outpacing the use of other less potent opioids. All the while, prescription drugs remain a major driver of opioid usage. Consequently, many patients have developed opioid dependence, contributing to the current opioid crisis.

According to the 2018 Canadian Community Health Survey, opioid prescriptions and long-term opioid therapies are decreasing.(12) Still, approximately 12.7% of Canadians were estimated to be using opioids that same year.(12) From the end of the 1990s to 2020, opioid overdose deaths increased four to fivefold in both Canada and the United States.(13,14) The Centers for Disease Control and Prevention (CDC) reports that 21% of those deaths involved prescription opioids.(13)

Although tackling the opioid crisis extends far beyond what goes on in operating rooms and chronic pain management clinics, finding an alternative to oral opioids could help alleviate the current crisis. Fortunately, new developments in modern loco-regional anesthesia may provide such an alternative in the management of

postoperative and chronic pain. New drug combinations such as dexamethasone (a long-acting corticosteroid) or dexmedetomidine (a selective alpha-2 adrenoceptor agonist with vasoconstriction and anesthetic properties) combined with local anesthetics could provide patients with longer-lasting local analgesia.(15) Furthermore, innovative techniques of peripheral nerve blocks for ambulatory patients following upper or lower extremities surgeries (16) have also decreased the need for postoperative opioids. These techniques include different approaches to brachial plexus blocks alongside several regional anesthesia options for the lower extremities including lumbar plexus, psoas compartment, or femoral nerve blocks.(16) Therefore, exposure to these addictive medications could either be delayed or prevented.

By building on previous discoveries, continuously improving techniques, and searching for alternatives to current anesthetic options, new frontiers in anesthesia may hold promising tools to tackle the serious medical and public health challenge of the opioid crisis. Building on the past may hold insights to tackle one of medicine's key challenges: pain management.

0.3 | Acknowledgments

The author thanks anesthesiologists Dr. Sylvie McKenty and Dr. Sébastien Garneau for their reviews and suggestions.

REFERENCES

1. William Thomas Green Morton | Dentistry, Anesthesia Surgery | Britannica [Internet]. 2023 [cited 2023 Dec 11]. Available from: <https://www.britannica.com/biography/William-Thomas-Green-Morton>
2. Harrop-Griffiths W. The History of Local Anaesthesia [Internet]. 2017 Feb 6; Gresham College. Available from: <https://www.gresham.ac.uk/watch-now/history-local-anaesthesia>
3. Cocaine. In: Grolier Encyclopedia. 12th edn. Canada: Grolier; 1956. p. 333.
4. Cocaine | Definition, Uses Addiction | Britannica [Internet]. 2026 [cited 2026 May 9]. Available from: <https://www.britannica.com/science/cocaine>
5. The Royal College of Anaesthetists. The History of Anaesthesia [Internet]. 2023 [cited 2023 Dec 11]. Avail-

able from: <https://www.rcoa.ac.uk/about-college/heritage/history-anaesthesia>

6. Halsted, William S. [Internet]. 2023 [cited 2023 Dec 11]. Available from: <https://medicalarchives.jhmi.edu/portrait/halsted-william/>

7. Bier A. Versuche über Cocainisirung des Rückenmarkes. Deutsche Zeitschrift für Chirurgie. 1899 Apr;51(3-4):361-9. doi:10.1007/BF02792160

8. Pagés F. Anesthesia metamérica classical file. Surv Anesthesiol. 1961;5:326.

9. López Álvarez S, Casas Reza P, del Río Fernández S. Centenary of epidural anaesthesia. Revista Española de Anestesiología y Reanimación (English Edition). 2022 Jan 1;69(1):4-11. doi:10.1016/j.redare.2021.03.007

10. Yentis SM, Vlassakov KV. Vassily von Anrep, Forgotten Pioneer of Regional Anesthesia. Anesthesiology. 1999 Mar 1;90(3):890-5. doi:10.1097/0000542-199903000-00033

11. Avila Hernandez AN, Singh P. Epidural Anesthesia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 Dec 11]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK542219/> PubMed PMID: 31194376.

12. Government of Canada SC. Pain relief medication containing opioids, 2018 [Internet]. 2019 [cited 2023 Dec 11]. Available from: <https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00008-eng.htm>

13. Opioid Overdose | Drug Overdose | CDC Injury Center [Internet]. 2023 [cited 2023 Dec 11]. Available from: <https://www.cdc.gov/drugoverdose/deaths/opioid-overdose.html>

14. Cook JL. The opioid epidemic. Best Practice Research Clinical Obstetrics Gynaecology. 2022 Dec 1;85:53-8. doi:10.1016/j.bpobgyn.2022.07.003

15. Reel B, Maani CV. Dexmedetomidine. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2024 Jan 8]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK513303/> PubMed PMID: 30020675.

16. Klein SM, Evans H, Nielsen KC, Tucker MS, Warner DS, Steele SM. Peripheral Nerve Block Techniques for Ambulatory Surgery. Anesthesia Analgesia. 2005 Dec;101(6):1663. doi:10.1213/01.ANE.0000184187.02887.24