



The Contribution of Anesthesiology to Exercise and Sports Medicine

The Contribution of Anesthesiology to Exercise and Sports Medicine

Author: Fabricio Chaves de Melo Castelo Branco

Graduated in Medicine from the Federal University of Amazonas

Specialist in Anesthesiology, by the Brazilian Society of Anesthesiology

Summary

Anesthesiology plays a fundamental role in exercise and sports medicine, playing a decisive role in the treatment of injuries, orthopedic surgeries, and the rehabilitation of athletes. Pain management, the individualized selection of anesthetic agents, and a focus on functional recovery are elements that bring anesthesiologists closer to the realities of sports. This article analyzes the contribution of this specialty to optimizing athlete recovery, discussing the relationship between anesthesia, physical performance, and return to sport.

The research also examines ethical, regulatory and multidisciplinary implications, in addition to gathering clinical evidence through 2021.

Keywords: Anesthesiology; Sports medicine; Athletes; Pain management; Functional recovery.

Abstract

Anesthesiology plays a fundamental role in exercise and sports medicine, contributing decisively to the treatment of injuries, orthopedic surgeries, and the rehabilitation process of athletes. Pain management, individualized selection of anesthetic agents, and concern for functional recovery are key aspects that connect anesthesiologists to the sports field. This article analyzes the contribution of this specialty to optimizing athlete recovery, discussing the relationship between anesthesia, physical performance, and return to sports. It also examines ethical, regulatory, and multidisciplinary implications, while reviewing clinical evidence up to 2021.

Keywords: Anesthesiology; sports medicine; Athletes; Pain management; Functional recovery.

1. Introduction to the Interface between Anesthesiology and Sports Medicine

Exercise and sports medicine is a constantly expanding field, driven by the increase in sports participation at both the recreational and professional levels. High-performance athletes, as well as regular exercisers, face challenges related to injuries, orthopedic surgeries, and rehabilitation processes that require a multidisciplinary approach.

In this scenario, anesthesiology emerges as an essential specialty, not only for its support in surgical procedures, but also for its contribution to pain management, functional recovery, and the safe return to physical activities.

Historically, anesthesiology has been primarily associated with the operating room, involving the induction and maintenance of unconsciousness during medical interventions. However, in recent decades, the scope of anesthesiologists has significantly expanded. Advances in perioperative medicine and regional anesthesia have brought these professionals to the center of discussions regarding quality of recovery, preservation of function, and long-term impact—fundamental aspects in the sports world.

The increase in orthopedic injuries among athletes highlights the need for this integration. Fractures, ligament tears, and muscle injuries often require invasive procedures, in which the choice of anesthetic, the technique used, and postoperative pain control directly influence rehabilitation time. In this sense, the anesthesiologist plays a strategic role, ensuring not only safety during surgery but also optimal conditions for functional recovery.

The relationship between anesthesiology and sports medicine goes beyond surgery. In many cases, regional anesthesia is preferred because it allows for prolonged pain control and less systemic impairment, allowing the athlete to return to physical therapy more quickly.

This choice highlights the concern with preserving physical performance, since poorly controlled pain can compromise engagement in the rehabilitation process and prolong time away from sport.

Furthermore, the anesthesiologist participates in discussions about the side effects of certain medications on the athlete's body. Anesthetic drugs can temporarily impact balance, motor coordination, and respiratory function, factors that require careful evaluation in individuals whose bodies are their primary work tools. This differentiated perspective reinforces the importance of adapting anesthetic practices to the sports context, respecting its specific characteristics.

Another important aspect is the integration of anesthesiologists into multidisciplinary teams that monitor elite athletes. Sports physicians, orthopedists, physical therapists, and psychologists work together to optimize performance and reduce time away from work.

Within this structure, the anesthesiologist contributes not only with the anesthetic technique, but also with knowledge in physiology, pharmacology and intensive care, increasing safety in highly complex procedures.

Therefore, the interface between anesthesiology and sports medicine represents a fertile field for clinical and scientific advancements. By understanding that athlete care doesn't end with surgery but extends to the rehabilitation process and return to physical performance, the anesthesiologist establishes himself as a key player in an integrative medicine model focused on the patient's full and humane recovery.

2. Pain Management in Athletes: The Role of the Anesthesiologist

Pain management is one of the most critical aspects of monitoring athletes undergoing medical interventions. Acute postoperative pain, if not adequately controlled, can progress to chronic conditions, compromising adherence to physical therapy, and prolonging absence from sports. In this context, the anesthesiologist plays a central role, as they have advanced analgesia techniques at their disposal, ranging from regional blocks to the use of multimodal drugs. Personalized pain management is essential to ensure the athlete's recovery is efficient and with minimal impact on future performance.

Regional anesthesia, for example, has proven to be an important ally in common orthopedic surgeries in sports, such as anterior cruciate ligament reconstructions or meniscal repairs. Peripheral blocks enable effective pain control with less need for systemic opioids, reducing the risk of side effects such as nausea, constipation, and drowsiness. For athletes, this approach means a more comfortable recovery and an earlier return to physical therapy activities, essential for functional rehabilitation.

Studies up to 2021 indicate that multimodal analgesia techniques, which combine different pharmacological mechanisms, promote not only greater comfort but also shorter hospital stays. Research by Kehlet and Dahl (2003) already highlighted that effective analgesia is directly associated with accelerated postoperative recovery. This concept, widely adopted in enhanced recovery after surgery (ERAS) programs, finds direct application in sports medicine, where each day of absence can significantly impact the careers of high-performance athletes.

Another challenge is balancing pain relief with preserving motor function. Some anesthetic blocks, while effective, can cause temporary muscle weakness, which requires careful evaluation by the anesthesiologist. Choosing techniques that preserve mobility without compromising analgesia becomes essential in the sports context. This decision requires in-depth knowledge of the physiology of movement and the specific demands of each sport.

In addition to pharmacological techniques, the anesthesiologist provides guidance on non-pharmacological analgesic methods, such as cryotherapy, electrostimulation, and early physical therapy strategies. The integration of these approaches reflects a humanized and multidisciplinary approach to care, in which pain is not only suppressed but also managed to promote full recovery. This model highlights the anesthesiologist as a professional who goes beyond the surgical environment, taking an active role in the athlete's rehabilitation journey.

Another important point is the psychological impact of pain. Athletes often associate pain with performance limitations, which can lead to anxiety and even depression during the recovery process. Anesthesiologists, in collaboration with sports psychologists and psychiatrists, work to develop protocols that also consider emotional well-being, recognizing that pain is not just a physical phenomenon, but a subjective experience that directly influences performance.

Therefore, pain management in athletes, under the direct and indirect responsibility of the anesthesiologist, goes beyond symptom suppression. It is a practice that involves science, technique, and clinical sensitivity, balancing analgesia, functional preservation, and emotional support. This integrated approach establishes the anesthesiologist as an indispensable player in sports medicine, ensuring a fast, safe, and humane recovery process.

3. Anesthesia in Orthopedic Surgeries for Athletes

Orthopedic surgeries are among the most common procedures for high-performance athletes, given the high incidence of musculoskeletal injuries resulting from sports. Ligament tears, stress fractures, meniscal and tendon injuries are just a few examples of situations that frequently require surgical intervention. The anesthesiologist, in this context, plays a crucial role, as the choice of anesthetic technique influences not only intraoperative safety but also recovery time and the quality of the return to sports.

Regional anesthesia has emerged as the preferred option in several orthopedic surgeries.

Peripheral blocks, such as femoral nerve blocks in anterior cruciate ligament reconstructions, provide effective analgesia and reduce the need for systemic opioids. This approach results in a lower incidence of adverse effects, such as nausea and drowsiness, which could compromise early rehabilitation. Furthermore, regional anesthesia allows the patient to be awake or under light sedation, reducing the risk of major anesthetic complications.

However, the choice between regional and general anesthesia should be individualized. Athletes undergoing longer or more complex procedures may require general anesthesia, especially when absolute immobility is required. In these situations, the anesthesiologist must balance risk factors, the physiological impact of anesthesia, and the patient's specific needs.

clinical aspects of the athlete patient, taking into account aspects such as physical conditioning and possible comorbidities.

Studies show that the anesthesia chosen can influence the length of hospital stay and the start of physical therapy. Research such as that by Capdevila et al. (2005) shows that peripheral nerve blocks provide better pain control and greater patient satisfaction in lower limb orthopedic surgeries, accelerating functional recovery. This result is especially important in athletes, whose early return to training represents not only a clinical benefit but also a competitive advantage.

Another crucial point is minimizing effects that could compromise physical performance after surgery. Anesthetic and analgesic drugs must be carefully selected, considering their impact on muscle metabolism, cardiorespiratory function, and neurological recovery. The anesthesiologist, in this case, acts as the guardian of the athlete's physical integrity, ensuring that the procedure is not only safe but also preserves future performance potential.

In addition to the anesthetic technique, interdisciplinary communication is essential. The anesthesiologist communicates directly with the orthopedist, physical therapist, and medical team to align recovery expectations and adapt the anesthetic approach to the overall therapeutic plan. This interaction strengthens the vision of integrated care, in which each decision has a direct impact on rehabilitation and return to sports.

Therefore, working in orthopedic surgeries positions the anesthesiologist as a strategic player in sports medicine. Their role is not limited to ensuring the technical execution of the procedure, but extends to planning the entire recovery process, directly influencing the time to return to activities and the quality of athletic performance post-injury.

4. Impact of Anesthetic Drugs on Physical Performance

The use of anesthetic drugs in athletes raises specific questions regarding their impact on physical performance. Unlike non-athletes, athletes depend on the full integrity of their muscular, respiratory, and neurological functions to maintain high levels of performance. Therefore, the choice and administration of anesthetic agents require careful evaluation, taking into account both acute effects and, potentially, medium-term repercussions.

General anesthetics, such as propofol, are widely used for their safety and predictability. However, their depressant effect on the central nervous system can cause residual fatigue and decreased responsiveness in the first hours or days after the procedure.

In athletes, this recovery period must be carefully monitored to prevent an early return to activity from compromising performance or increasing the risk of further injury.

Inhaled agents, such as sevoflurane and desflurane, have a favorable pharmacokinetic profile, with rapid induction and recovery. However, some studies indicate that they can cause transient changes in cognitive function and balance, critical factors in sports that require high motor coordination. This reality reinforces the importance of recommending adequate time off, allowing athletes to return to activities only when fully recovered.

Opioids, frequently used in intra- and post-operative pain management, present additional risks for athletes. In addition to potential side effects such as sedation, nausea, and constipation, prolonged use can lead to dependence. Therefore, multimodal analgesia strategies that reduce the need for opioids are highly recommended. This approach reflects not only clinical care but also an ethical commitment to the athlete's overall health.

Local anesthetics, used in regional blocks, also require caution. Although they provide effective analgesia and preserve consciousness, they can cause transient motor blockages. In athletes in sports that rely on muscular strength and endurance, this effect can delay the resumption of specific activities, requiring appropriate monitoring and physiotherapy planning.

Beyond the physiological effects, there are important regulatory implications. Some substances used in anesthetics may be subject to restrictions by the World Anti-Doping Agency (WADA). It is the anesthesiologist's responsibility to stay up-to-date on the prohibited substance list to prevent the use of a particular drug from compromising the athlete's competitive eligibility. This responsibility reinforces the ethical dimension of the practice, highlighting the anesthesiologist as a defender not only of the patient's health, but also of their sports career.

Thus, the impact of anesthetic drugs on athletes' physical performance transcends the pharmacological sphere, encompassing clinical, functional, and ethical dimensions. By integrating science, safety, and responsibility, anesthesiologists make a decisive contribution to ensuring the anesthetic process is conducted in a manner that preserves health and athletic potential, ensuring a full and safe return to sports activities.

5. Post-Operative Recovery and Return to Sports

Postoperative recovery is one of the most critical moments for athletes, representing the transition between medical treatment and the gradual return to athletic performance. Anesthesiologists have a direct influence on this process, as their approach during anesthesia and pain management in the immediate postoperative period affect the quality of rehabilitation. The concept of enhanced recovery after surgery (ERAS) has proven increasingly relevant, and athletes

are ideal candidates for protocols that prioritize effective analgesia, early mobilization, and reduced hospital stay.

Postoperative pain management is crucial in this context. Athletes with poorly managed pain tend to be more resistant to physical therapy, have delayed functional healing, and are at increased risk of psychological complications.

Techniques such as continuous blocks, multimodal analgesia, and the judicious use of nonsteroidal anti-inflammatory drugs are strategies adopted to reduce this impact.

The anesthesiologist, by personalizing the analgesic plan, ensures that the athlete begins the rehabilitation process under favorable conditions.

Another determining factor is preventing anesthetic complications that could prolong the recovery period. Nausea, vomiting, excessive drowsiness, and fatigue are adverse effects that, while common, can be minimized with modern protocols. The use of prophylactic antiemetics, the selection of short-acting agents, and individualized anesthetic dosage are practices that promote a faster and more comfortable recovery, essential for athletes who need to return to their routines quickly.

Integration with physical therapists and sports medicine physicians is another pillar of recovery. By explaining the details of the anesthetic procedure, the anesthesiologist provides valuable information to the rehabilitation team, who can adjust exercises and techniques based on potential temporary limitations. This interdisciplinary dialogue allows for a safe return to sports planning, avoiding premature overload and reducing the risk of injury recurrence.

Studies also point to the relevance of individualized return-to-sports protocols.

Each sport presents specific physical demands, and the anesthesiologist must consider these aspects when developing the anesthetic plan. For endurance athletes, for example, preserving cardiorespiratory function is a priority, while in contact sports, the focus is on musculoskeletal recovery. This personalization reinforces the need for a holistic approach to care.

Another point worth highlighting is the psychological dimension of recovery. Anxiety about returning to sports can lead athletes to disregard medical recommendations, increasing the risk of complications. By participating in postoperative guidance, the anesthesiologist helps raise patient awareness of the risks of early return, helping to align expectations and prioritize adequate rehabilitation time.

Thus, from an anesthesiology perspective, postoperative recovery is not limited to a process of clinical stabilization. It is a strategic phase in which pain control, prevention of adverse effects, communication with the multidisciplinary team, and consideration of psychological factors combine to ensure a safe, rapid, and sustainable return to sport, maintaining a balance between health and performance.



6. The Role of the Anesthesiologist in the Athlete's Multidisciplinary Team

Caring for modern athletes requires a multidisciplinary approach that integrates different medical and healthcare specialties. In this scenario, anesthesiologists are no longer seen as professionals confined to the surgical center, but rather occupy a strategic position on teams that support athletes throughout all phases of treatment and recovery. Their role ranges from preoperative evaluation to emergency support, always focusing on preserving the patient's health and performance.

The anesthesiologist contributes directly to risk assessment and the definition of therapeutic strategies. In elite athletes, even minor clinical conditions can have a significant impact on performance, requiring a careful analysis of exams and medical history. This careful assessment allows surgeries and procedures to be conducted in a personalized manner, respecting both clinical safety and the specific demands of a sports career.

In the operating room, the anesthesiologist works closely with orthopedic surgeons, physical therapists, and sports medicine physicians. This interaction ensures that the chosen anesthetic technique is aligned with the postoperative rehabilitation plan. By opting, for example, for regional blocks that preserve motor function, the anesthesiologist facilitates early mobilization, a crucial aspect for a rapid return to sports activities. This coordination reflects an integrated, patient-centered care model.

Outside of the surgical setting, the anesthesiologist's role extends to monitoring chronic pain management, common in athletes with multiple injuries. This professional's expertise in using advanced analgesia techniques, such as image-guided injections and interventional therapies, expands available treatment options and strengthens the multidisciplinary team. This provides athletes with ongoing support to cope with the demands of high-performance sports.

Another fundamental aspect is communication. By integrating clinical reports and providing clear explanations about risks and procedures, the anesthesiologist helps athletes and coaches understand the recovery process. This transparency strengthens trust in treatment and promotes shared decision-making, in which everyone involved becomes jointly responsible for therapeutic success.

Furthermore, anesthesiologists play a key role in emergency situations, such as collapses during training or competitions. Their expertise in advanced life support makes them a key player in medical teams at sporting events, where rapid response can be crucial in saving lives and preserving careers. This role reinforces the comprehensive nature of anesthesiology, which goes beyond surgical anesthesia and connects directly with exercise medicine.



Therefore, the anesthesiologist's role in multidisciplinary teams transcends their technical role, becoming an indispensable element in the athlete's comprehensive care. By combining science, safety, and communication, this professional cements their place as a central player in sports medicine, ensuring that health and performance go hand in hand at every stage of a sports career.

7. Ethical and Regulatory Aspects in Sports Anesthesiology

The practice of anesthesiology in the sports context is not limited to technical and clinical choices, but also involves profound ethical and regulatory implications. Athletes are individuals who, in many cases, depend directly on their physical performance to sustain their careers, which presents the medical team with complex dilemmas. When administering medications and deciding recovery protocols, the anesthesiologist must balance the principles of beneficence, non-maleficence, and justice, ensuring that their actions respect the patient's integrity and the rules governing the sport.

One of the main points of concern concerns the use of substances that could be classified as doping. The World Anti-Doping Agency (WADA) establishes updated lists of prohibited substances, and it is the anesthesiologist's responsibility to stay informed to prevent medications used for pain control or surgical procedures from compromising the athlete's eligibility. This care not only preserves the athlete's career but also protects the credibility of the medical treatment itself.

Another relevant ethical aspect is patient autonomy. Many athletes, driven by the pressure to quickly return to competition, may request procedures or procedures that do not respect the appropriate recovery time. The anesthesiologist should act as a mediator in this process, explaining risks and reinforcing the need to follow safe protocols. This approach requires ethical firmness, as decisions made in haste can result in irreversible health damage.

Equity must also be considered. Access to advanced treatments, such as ultrasound-guided blockade techniques or multimodal analgesia protocols, may be restricted to elite athletes, leaving out amateur practitioners and lesser-known professionals. This inequality highlights the importance of public policies and regulations that ensure broader access, preventing sports anesthesiology from becoming a restricted privilege.

Furthermore, there is a need for well-structured clinical research, conducted ethically and transparently. Enthusiasm for advances in the field cannot override scientific prudence. When participating in studies involving athletes, anesthesiologists must ensure that research ethics principles are respected, guaranteeing informed consent and prioritizing safety over any competing interests.

Regulatory institutions also play a central role. In Brazil, the Federal Council of Medicine and specialized anesthesiology societies establish guidelines for the use of techniques and medications in sports. Following these recommendations is essential to ensure clinical practice adheres to ethical and legal standards, protecting both professionals and patients.

Thus, the ethical and regulatory aspects of sports anesthesiology constitute a fundamental dimension of the practice, ensuring that the pursuit of performance and recovery does not exceed the limits of safety and human integrity. By acting responsibly and conscientiously, anesthesiologists strengthen the ethical character of sports medicine and contribute to building a fairer and more sustainable environment for athletes at all levels of competition.

Conclusion

An analysis of anesthesiology's contribution to exercise and sports medicine reveals how this specialty extends beyond the confines of operating rooms and into the broader context of athletes' comprehensive health. By managing pain, conducting orthopedic procedures, and integrating multidisciplinary teams, anesthesiologists play a vital role in ensuring quality functional recovery and a safe return to athletic performance.

Pain management, approached individually and multimodally, represents one of the greatest contributions of this specialty. Regional techniques, combined with pharmacological and non-pharmacological strategies, have proven effective in reducing complications and accelerating rehabilitation. For athletes, this translates into less suffering and greater engagement in the recovery process, factors that directly impact their future performance.

Orthopedic surgeries, common in sports, exemplify the strategic importance of anesthesiology. The appropriate choice of technique, combined with interdisciplinary communication, not only ensures intraoperative safety but also influences rehabilitation time. At this point, the anesthesiologist ceases to be merely a technical executor and becomes a key player in planning the entire return-to-sports process.

The effects of anesthetic drugs on physical performance reinforce the need for a differentiated approach to athlete care. Concern about motor, cognitive, and respiratory impacts, coupled with regulatory requirements related to doping, positions the anesthesiologist as the guardian of the patient's physical and competitive integrity. This ethical dimension, combined with the technical dimension, highlights the unique role of this professional in sports.

Another fundamental element is the active participation of anesthesiologists in multidisciplinary teams. Their collaboration with orthopedists, physical therapists, sports physicians, and psychologists promotes an integrated care model that emphasizes not only injury healing, but also the overall well-being of patients.



but also the preservation of the athlete's overall well-being. This approach broadens the horizons of sports medicine and reinforces the idea that health must go hand in hand with performance.

Ethical and regulatory aspects reinforce that the practice of anesthesiology in sports requires responsibility, constant updating, and a critical approach. Anesthesiologists must balance external pressures, such as sponsor demands and expectations of early return, with the fundamental principles of medicine, ensuring that the patient's integrity always comes first. This ethical commitment legitimizes their work and protects the athlete's dignity.

Future prospects point to an even more promising field. The development of new drugs, the integration of monitoring technologies, and the combination of anesthesiology with psychotherapeutic and physiological approaches should further expand the specialty's impact. In this context, anesthesiologists will have the opportunity to assume an increasingly central role in exercise medicine, contributing to innovative and personalized protocols.

In summary, anesthesiology in sports medicine has established itself as a multidimensional practice, in which science, technique, and ethics intertwine to promote rapid, safe, and humane recovery. By integrating their expertise into the realm of sports, anesthesiologists reaffirm their role as guardians of health and performance, contributing decisively to athletes overcoming challenges, reaching their full potential, and preserving their longevity in sports.

References

CAPDEVILA, X. et al. Continuous peripheral nerve blocks in hospital wards after orthopedic surgery: a multicenter prospective analysis of the quality of postoperative analgesia and complications in 1,416 patients. *Anesthesiology*, vol. 103, no. 5, p. 1035-1045, 2005.

KEHLET, H.; DAHL, JB Anaesthesia, surgery, and challenges in postoperative recovery. *The Lancet*, vol. 362, no. 9399, p. 1921-1928, 2003.

WORLD HEALTH ORGANIZATION. *Global Recommendations on Physical Activity for Health*. Geneva: WHO, 2010.

WORLD HEALTH ORGANIZATION. *Depression and Other Common Mental Disorders: Global Health Estimates*. Geneva: WHO, 2017.

ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT. *Health at a Glance 2019: OECD Indicators*. Paris: OECD Publishing, 2019.

BRAZILIAN SOCIETY OF ANESTHESIOLOGY. *Guidelines for safe anesthetic practices*. São Paulo: SBA, 2018.

WORLD ANTI-DOPING AGENCY. *The World Anti-Doping Code: The 2021 Prohibited List*. Montreal: WADA, 2020.