

# Complications of intravenous therapy in the context of sports: a literature review and strategies for prevention and treatment

## Abstract

**Objective:** To conduct a literature review on complications related to intravenous therapy in the context of physical activity and sports, as well as to identify the most effective interventions for their prevention and treatment.

**Methodology:** UMB, PubMed, Scopus, Scielo, and NCBI databases were searched with the terms “venous infiltration,” “intravenous inflammation,” “physical therapy,” “extravasation,” without language restrictions, and published in the last 10 years.

**Results:** The review found a limited amount of literature available on this topic. However, different risk factors and complications associated with the use of peripheral venous catheters were identified, including infiltration, extravasation, and obstruction. The role of sports professionals in the prevention and treatment of these complications through the application of techniques such as massage, warm-up, exercise, and elevation is highlighted.

**Discussion:** There are various methodologies that report significant results in improving adverse events caused by venous infiltration.

**Conclusions:** It is important to continue researching in this field to provide a solid scientific basis for the prevention and treatment of complications associated with intravenous therapy in the context of sports.

**Keywords:** intravenous therapy, physical activity, sport, peripheral venous catheter, extravasation

Volume 7 Issue 1 - 2024

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**Received:** February 05, 2024 | **Published:** March 29, 2024

## Introduction

The use of peripheral venous catheters is common in hospital care for the administration of fluids and medications. According to García-Martínez, Murcia-Sánchez, and Luján-Torné,<sup>1</sup> complications related to these devices are common, including intravenous infiltration, extravasation, and thrombosis, which can cause pain and injuries to patients. These complications can increase the risk of morbidity and mortality, thus representing a significant challenge for healthcare professionals.

In this context, it is essential to emphasize the relevance of preventing and managing complications related to intravenous infiltration in physical activity. Patients requiring peripheral venous catheters often need to remain active to improve their quality of life and recover from their illnesses. However, complications from intravenous infiltration can limit their ability to exercise, negatively impacting their recovery. Therefore, it is crucial for healthcare and sports professionals to work together to prevent and manage these complications.

Intravenous infiltration is a common issue that can be caused by various risk factors. According to Liu et al.,<sup>2</sup> age, obesity, diabetes, and the duration of intravenous therapy are significant risk factors. Additionally, several preventive measures have been proposed to reduce the incidence of these complications, such as patient and nursing staff education, appropriate catheter insertion site selection, and continuous monitoring of the insertion site.<sup>3,4</sup> To promote the quality of life, sports experts can play a significant role in the prevention and management of complications related to intravenous infiltration. According to Foss, sports have been shown to be an effective tool for improving the quality of life for patients and

treating various conditions, including pain. Sports experts can assist patients in strengthening their blood vessels and preventing the onset of complications through the prescription of specific exercises and training regimens. Furthermore, these professionals can collaborate with nursing staff and physicians to provide comprehensive and personalized care to patients.

Given the aforementioned context, there is a need to conduct a literature review on the occurrence of complications related to short peripheral venous catheters and intravenous infiltration in general, as well as the role of sports professionals in these complications. It is worth noting that one of these complications, as highlighted by Fandiño involves “the diversion of fluid intended for the vein to another area, such as the muscle mass, which is the primary site for physical activity.” This diversion leads to symptoms such as inflammation, swelling, redness, pain, burning, and loss of mobility, among others, thereby creating difficulties in carrying out the activities or training prescribed by sports professionals in pursuit of improving the quality of life. The objective of this article is to synthesize the available information and provide a comprehensive overview of the occurrence of these complications and the role of sports experts in their prevention and management. Within this work, several studies addressing the prevention and management of complications related to intravenous infiltration in physical activity have been identified. For instance, Jansson and Johansson<sup>5</sup> report that patient education regarding the importance of reporting any complication symptoms and the appropriate selection of catheter insertion sites can reduce the incidence of complications. Furthermore, Li et al.,<sup>6</sup> propose the use of a transparent dressing for the catheter insertion site as an effective preventive measure.

Over time, sports have played a significant role in managing users with pain and resulting alterations in functionality and mobility, regardless of the cause or consequence of such pain. This has enabled the provision of comprehensive and personalized care to patients through the implementation of exercise regimens, which help patients lead a more functional and practical life without complications related to blood flow. Therefore, this review aims to integrate strengthening and preventive actions that have yielded excellent results in vascular disorders with traditional practices (physical modalities, training, relaxation muscle-skeletal massages, and various types of currents). These approaches are applicable to individuals experiencing secondary, traumatic, or visceral pain that affects the sympathetic system, leading to alterations in heart rate and respiratory rate in a reflexive manner, which are related to complications caused by inflammation and intravenous infiltrations.

## Methodology

A systematic literature review was conducted in the UMB, PubMed, Scielo, and Science Direct databases in June 2022. The search focused on complications related to intravenous infiltration and its sporting intervention, using search terms such as “intravenous catheter infection children,” “venous catheter infection children complications,” “catéter\* OR catheter\* AND flebit\* OR phlebitis\*.” A temporal limit of the last 10 years was applied, and no language restrictions were set.

The initial search results yielded a total of 38 relevant articles. The research team members independently reviewed the title and abstract of each article to assess its relevance, and the most relevant aspects such as the study type, participants, procedures, variables and tests used, objective, conclusions, classification, level of evidence, population, source, and country were extracted.

Article selection considered inclusion criteria, such as the relevance of the title and abstract, the central theme of the search, and the study's quality. Articles that were not related to the central theme of the search, were inaccessible, or had insufficient methodological quality were excluded. Selection criteria included studies on intravenous infiltration and its relationship with sports and physical activity available in the selected databases.

The procedures for reviewing the articles included evaluating the title and abstract of each article, followed by reading the full text of the selected articles. The instruments and measurement protocols used in the included studies varied, but all addressed the central theme of the review and were evaluated for their relevance and methodological quality.

Data analysis varied depending on the type of study and the results reported in each article, but all the studies included in the review presented statistical analyses to assess the relationship between intravenous infiltration and physical activity. The systematic literature review allowed for a broad and detailed understanding of the complications of intravenous infiltration in physical activity and the relevance of the sports expert's intervention in this context. Furthermore, various preventive and intervention measures were identified that can be useful in preventing and managing these complications. The data from the analysis, concerning sports intervention in these complications, objectives, instruments used in the methodology, were summarized without considering the cause.

## Bias risk assessment

The methodological quality of the included studies was independently assessed. To identify the risk of bias, the relationship

between infiltration, its complications, and the intervention from sports professionals were considered, and disagreements were resolved through consensus.

## Results

The results of the literature review conducted in the UMB, PubMed, Scielo, and Science Direct databases show that intravenous infiltration and the occurrence of complications related to peripheral venous catheters are significant concerns in the fields of medicine and physical activity.

When an intravenous infiltration procedure is performed incorrectly, it can trigger inflammation, which occurs due to the obstruction of blood flow around or through the catheter, an inflammatory process, or mechanical forces displacing the catheter. Once the infiltrated fluid comes into contact with subcutaneous tissue, injury occurs due to osmotic differences, pH, ischemia, compression, and direct toxicity, which in many cases leads to compartment syndrome or complex regional pain syndrome. This is the moment for physiotherapy intervention and physical activity, such as mobilizations, to modulate and mitigate symptoms and signs while preventing a loss of functionality in terms of movement.

In this regard, the results of the literature review indicate that physiotherapy and physical activity can be helpful in managing complications arising from intravenous infiltration. Furthermore, early intervention by sports professionals can prevent the development of severe and potentially life-threatening complications.

Additionally, the importance of sports professionals' intervention is emphasized since there is evidence that early mobilization and muscle strengthening can be beneficial in preventing muscle atrophy and reduced functionality often observed in patients with intravenous infiltration complications. The literature also suggests that the use of compression devices and the application of bandages can be useful in reducing inflammation and edema associated with intravenous infiltration. Therefore, the role of sports professionals in the prevention and management of intravenous infiltration complications is emphasized. Sports professionals, in collaboration with medical teams, play a crucial role in preventing and managing complications related to intravenous infiltration in athletes. To do so, they must be trained in advanced techniques for assessing, diagnosing, and treating vascular injuries and complications. They should also have knowledge of the impact of pharmacological application on athletic performance and athlete health.

One way sports professionals can help prevent complications is by educating athletes about the risks associated with intravenous infiltration and the preventive measures that should be taken. They can also regularly assess the infiltration site to detect potential complications early and take preventive measures.

Table 1 summarizes the steps that sports professionals can follow for intervention in cases of complications related to intravenous infiltration in athletes. It is important to emphasize that this intervention should be carried out by qualified and experienced professionals in the sports field in order to ensure comprehensive and personalized care for athletes. In the event of complications, sports professionals can collaborate in the assessment and treatment of these complications by applying advanced physiotherapy techniques and mobilizations, in combination with other conventional therapies. Furthermore, they can design and oversee personalized exercise and training programs to assist athletes in recovering from injuries and vascular complications related to intravenous infiltration.

**Table 1** Sports professional intervention

Step of the intervention	Description
Initial assessment	Conduct a detailed evaluation of the injury and/or complication, including medical and sports history, current symptoms, physical examination, functional assessment, and relevant diagnostic tests.
Development of a Personalized Treatment Plan.	Create an individualized treatment plan that includes specific therapeutic goals, recommended interventions, and follow-up timelines.
Prevention	Provide education and guidance on preventive measures, including proper intravenous infiltration techniques, appropriate care and monitoring of the infiltration site, and early recognition of complications.
Physio therapeutic treatment	Apply physical therapeutic techniques such as massage, manual therapy, specific exercises, heat or cold modalities, and compression therapy.
Prescription of specific physical activity condition	Recommend individualized and progressive physical activity programs that include specific exercises and sports training, based on the athlete's current injury and physical condition.
Follow-up and evaluation	Regularly monitor and evaluate the progress of the treatment and the athlete's response, and make necessary adjustments to the treatment plan as needed.

**Source:** Author's own work, 2023.

One practical proposal could be the creation of specialized training programs in physiotherapy and physical activity for athletes with complications related to intravenous infiltration. These programs could include specific strengthening and flexibility exercises, mobilizations, myofascial release techniques, and other physical and therapeutic treatments tailored to the individual needs of each athlete.

Additionally, establishing a collaboration network between sports professionals and the medical services of hospitals and clinics could facilitate the care and follow-up of athletes with complications related to intravenous infiltration. This would allow for comprehensive and coordinated care among the various professionals involved, ensuring effective intervention and optimal recovery for athletes.

Another important measure would be the education and awareness of athletes, coaches, and other sports professionals about the importance of preventing and properly managing complications related to intravenous infiltration. This could include the dissemination of relevant and up-to-date information about best practices for the prevention and treatment of these complications, as well as the promotion of preventive measures and the proper use of intravenous devices.

## Discussion

During the literature search in the UMB, PubMed, Scielo, and Science Direct databases, 30 references related to complications of intravenous infiltration and its sports intervention were identified. In particular, it was found that sports professionals play an important role in the prevention, diagnosis, and treatment of these complications. The reviewed studies have evaluated different types of catheters, materials, gauges, or types of infusions to assess the risk of complications in peripheral venous access. In this way, these interventions are identified as risk factors. However, there is a limited amount of literature that relates physical activity and sports to intravenous therapy complications. Furthermore, catheter duration is evaluated as a secondary variable, making it difficult to establish recommendations for access duration. Likewise, the heterogeneity of the studied populations, differences in follow-up time, and even the different complications that occur also make it difficult to draw clear conclusions.<sup>7,8</sup>

In a study conducted by Hackenberg et al.,<sup>9</sup> conservative treatments was highlighted, including pain control, limb elevation, application of heat or cold, immobilization, elastic bandaging, manual lymphatic drainage, and local dressings, to treat complications in children and neonates. Similarly, Kirstine et al.,<sup>10</sup> implemented an intervention

plan based on stimulating lymphatic drainage in a 68-year-old patient who suffered a complication due to extravasation. In all case reports, the treatment was non-surgical with compression garments and physiotherapy, cold compresses, and arm elevation using a skyhook.<sup>11</sup> Furthermore, it was found that physiotherapy and physical activity are fundamental in the intervention of complications related to intravenous infiltration in athletes. According to Kargarfard et al.,<sup>12</sup> physiotherapy can improve motor function, muscle strength, flexibility, and reduce pain in patients who have suffered musculoskeletal injuries. Physical exercise can also have beneficial effects on the prevention and treatment of chronic diseases, such as diabetes and hypertension.<sup>13</sup>

Additionally, it is understood that the intervention of the sports professional must be personalized, taking into account the needs and characteristics of each athlete. In a study conducted by García-Gutiérrez the importance of clinical assessment, which includes the evaluation of muscle strength, flexibility, and balance, is highlighted in order to design an exercise program adapted to the individual needs of the patient. This work aligns with others where the limited amount of literature related to intravenous infiltration in athletes becomes evident. Despite this therapy being used in hospital processes with little influence from physical activity and sports, there is a need to understand the risk factors to minimize risks during physical activity mediated by therapy.

In conclusion, professionals are necessary for the prevention, diagnosis, and treatment of complications related to intravenous infiltration in athletes. Personalized physical activity can improve motor function, reduce pain, and prevent chronic diseases. It is important for sports professionals to continuously educate and update themselves on this topic in order to provide comprehensive and quality care to athletes. It has been evidenced that sports can be an effective treatment for complications caused by intravenous infiltration in athletes. Scientific foundation and experience in its treatment provide useful tools for rehabilitation every day. Different studies conducted over time have allowed for the establishment of the effectiveness of each treatment, considering each symptom and applying techniques such as massage, warming up, exercise, and elevation.<sup>9</sup>

Therefore, more research focusing on the relationship between physical activity and sports with intravenous therapy complications is necessary. This research can help establish clear and precise recommendations for the prevention, diagnosis, and treatment of these complications. In this regard, sports professionals play a fundamental role in the prevention, diagnosis, and treatment of complications related to intravenous infiltration in athletes, providing comprehensive

and personalized care and allowing athletes to maintain their level of physical activity and improve their quality of life.<sup>14,15</sup>

## Acknowledgments

Declaration of the original nature of the work and non-plagiarism:

We affirm that the work presented in this manuscript is original, and all materials used and cited in the text have been duly acknowledged and referenced. We have conducted a thorough process of research and analysis, relying on reputable sources and adhering to the ethical principles of academic research. We have not plagiarized or improperly used third-party material without proper permission or attribution. Any similarity to other published works is purely coincidental and a result of the use of common sources of knowledge.

## Conflicts of interest

We confirm that there are no conflicts of interest related to this work. None of the authors have any employment, financial, or personal affiliations that could influence our judgment regarding the publication of this manuscript. We have no relationships or interests that could bias the results or interpretations presented in this work. Furthermore, there are no personal relationships, academic rivalries, or other conflicts of interest that could affect the objectivity and integrity of this work.

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