

Spinal anesthesia in the out-of-hospital setting: a case report

Anestesia espinal en el ámbito extrahospitalario: a propósito de un caso

Introduction

Spinal or subarachnoid anesthesia (SA) is a technique widely used in surgical settings. It provides sensory and motor blockade of the lower part of the body, allowing surgical procedures with excellent pain control and rapid recovery. However, its use in out-of-hospital emergencies (OHE) is uncommon, although it has potential value for pain management in trauma patients.

Case report

A 45-year-old male patient, a gardener by profession, suffered an occupational accident involving a fall from a height of 2 meters, resulting in an open tibial fracture. He presented with intense pain and resistance to movement even after receiving intravenous sedoanalgesia (fentanyl 100 µg + 100 µg and propofol 30 mg + 30 mg). Due to persistent pain that led to syncope, and to facilitate safe mobilization to a hospital, spinal anesthesia was performed.

Out-of-hospital management

After careful physical and neurological examination under sedoanalgesia and ruling out contraindications such as vertebro-medullary

injuries, the procedure was explained to the patient to ensure cooperation. The procedure was performed under strict aseptic conditions with continuous monitoring of vital signs.

A 25G Quincke needle was used to administer 2.5 mL of 2 % mepivacaine into the subarachnoid space at the L3–L4 level. The patient experienced immediate pain relief, with a sensory block up to T10 and no adverse effects. This allowed proper immobilization, a more thorough examination, and safe transport to the hospital.

Hospital management

The patient underwent trauma surgery without complications, achieving early recovery and a hospital stay of 2 days.

Discussion

Out-of-hospital management of trauma patients poses challenges due to clinical complexity, variability of scenarios, and available resources. This highlights the importance of establishing protocols that enable efficient and standardized responses in OHE. Former studies, mainly focused on regional anesthesia through peripheral blocks in emergencies, indicate that the absence of clear guidelines increases variability in initial care quality and may negatively impact clinical outcomes.¹

Therefore, as indicated by Fichtner *et al.*,² there is a need to conduct clinical studies that also analyze the out-of-hospital setting in depth, whose key points are discussed below (Table 1):

– Feasibility and safety. SA represents an effective, viable, and safe alternative to other anesthetic modalities, particularly when facing logistical limitations or specific clinical conditions.

Compared to general anesthesia (or sedoanalgesia), SA presents significant advantages, as described by Ledesma *et al.*,³ including a lower rate of respiratory complications, especially in patients with cardiorespiratory comorbidities.

Furthermore, SA shares with locoregional anesthesia the advantage of requiring less complex equipment, making it particularly suitable for use in OHE with difficult access, complex handling, or operational challenges, as described in the cases by Moser *et al.*⁴

The administration of SA requires trained personnel and access to appropriate resources to ensure correct application. Studies such as that of Anderson *et al.*⁵ state that SA and other regional blocks are not new in complex scenarios, having already been described in the Oxford Handbook of Expedition and Wilderness Medicine (2015),⁶ and may be useful for pain management in more extreme situations.

On the other hand, Schubert *et al.*⁷ demonstrate the safety of different local anesthetics as safe pharmacological alternatives in out-patient surgery.

However, the lack of comparative data limits the ability to generalize these findings.

– Comparative benefits. Evidence appears to support a superior safety pro-

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Tabla 1. Benefits and limitations of spinal anesthesia in the out-of-hospital setting

	Potential benefits	Limitations and considerations
Patient selection	Especially useful in isolated lower limb trauma in cooperative and hemodynamically stable patients.	Not universally applicable. Requires individualized assessment and strict exclusion of contraindications.
Pain control	Rapid, deep, and predictable analgesia. Effective sensory block when systemic sedoanalgesia is insufficient. Reduces suffering and physiological stress associated with severe acute pain.	Specific evidence in the out-of-hospital setting is still limited. Duration of the block depends on the anesthetic used, which may affect subsequent care planning.
Respiratory stability	Avoids airway manipulation. Reduces the risk of respiratory depression associated with opioids or deep sedation. Particularly useful in patients with cardiorespiratory comorbidities.	Risk of hypotension due to sympathetic blockade. Requires continuous hemodynamic monitoring and immediate treatment capability.
Safety during transport	Facilitates proper immobilization. Reduces reflex movements and risk of fracture displacement. Allows a more thorough secondary assessment.	Potential progression of block level if not properly monitored. Requires continuous monitoring throughout transport.
Technical requirements	Relatively quick technique in trained hands. Does not require advanced mechanical ventilation equipment. Applicable in logistically limited scenarios.	Requires strict aseptic conditions in potentially hostile environments. Needs specific materials (spinal needles, local anesthetics, monitoring).
Complication profile	Lower incidence of nausea, vomiting, and respiratory complications compared to general anesthesia. Avoids risks associated with urgent intubation.	Rare but serious risks such as infection, spinal hematoma, or high block. Contraindicated in coagulopathy, suspected vertebral injury, or significant hemodynamic instability.
Organizational impact	May optimize prehospital pain management. Potential reduction in need for deep sedation. Improves patient experience.	Lack of standardized protocols in most emergency systems. Limited robust comparative evidence. Requires specific training and ongoing education.

Source: Authors' own elaboration.

file of SA in various contexts. For example, Ledesma *et al.*³ observed that its use in outpatient procedures was associated with lower rates of nausea, vomiting, and cardiorespiratory complications—factors highly relevant in the immediate management of patients in OHE.

– Technical considerations. Its technical simplicity makes SA a valid option in OHE, where resources are usually limited, as indicated by Moser *et al.*⁴ and Carness *et al.*⁸ in special evacuation scenarios. Although SA is not directly used in those cases, the technique does not require intubation or mechanical ventilation, reinforcing its usefulness in resource-limited environments.

The speed, effectiveness, and relative simplicity of the technique compared to general anesthesia make it a viable option, particularly suitable for difficult OHE scenarios.

– Pain control. In our case, SA provided immediate pain relief that was not achieved with conventional sedoanalgesia, improving patient comfort. It has been shown that pain relief with regional anesthesia is quantitatively superior to that provided by systemic analgesic treatment in certain situa-

tions.² However, data specifically related to SA remain limited.

– Fewer complications. As observed in our patient, the achieved sensory block allowed more effective immobilization and stabilization of the affected limb, significantly reducing the risk of worsening the fracture during transport. According to studies such as Gros *et al.*,⁹ regional anesthesia—although not specifically SA—has been shown to reduce the incidence of secondary injuries related to the handling of trauma patients. Unfortunately, there are no studies confirming this specifically for SA.

Additionally, SA avoids the need for deep sedation, reducing the risks of respiratory and hemodynamic depression associated with general anesthesia in emergency situations. Ledesma *et al.*³ found that, in OHE, nerve blocks have a superior safety profile compared to general anesthesia.

The reduction in complications is also reflected in a lower incidence of adverse effects such as nausea and vomiting, which are common after general anesthesia in patients undergoing outpatient surgery, as shown in the study by Schubert *et al.*⁷

Considerations and limitations in the out-of-hospital setting

– Staff training. The success of SA in OHE depends on having trained and experienced personnel capable of managing potential complications. Specialized training and practice are essential to ensure the safety of these procedures outside hospital settings, as indicated by Graglia *et al.*¹ and Wolmarans *et al.*¹⁰ The new specialty of Emergency Medicine in Spain should consider incorporating this specific training.¹¹

– Adequate resources. Although outpatient procedures with regional anesthesia are generally safe, it is essential that the medical team has appropriate monitoring equipment and rapid access to resuscitation resources in case of complications. The availability of medications to treat adverse reactions is crucial. In Spanish OHE systems, this would not initially represent a logistical problem, given the standard equipment of advanced life support units.¹²

– Patient selection. SA is not suitable for all patients. Its use should be restricted to those with a low risk of complications, primarily those without

contraindications such as vertebro-medullary injuries, coagulation disorders, or significant anatomical abnormalities.

Conclusions

SA in OHE may be an effective and safe tool for the management of acute pain in trauma patients. This case illustrates its successful application in a patient with an open tibial fracture, highlighting immediate pain relief and facilitation of safe transport to the hospital. Although the literature is limited, it appears to support its use in selected patients, provided that trained personnel, appropriate equipment, and strict aseptic techniques are ensured.

With proper planning and a controlled environment, its implementation could significantly improve out-of-hospital care.

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