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The Role of Regional Anesthesia in Surgeries for Shoulder Fractures

Khakhorova Marjona Farkhodovna
Department of Fundamental Medical Sciences of the Asia International University. Bukhara, Uzbekistan

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Abstract: Shoulder fractures are common orthopedic injuries that frequently require surgical management. The choice of anesthesia significantly influences intraoperative safety, postoperative analgesia, and rehabilitation outcomes. Regional anesthesia, particularly brachial plexus blocks, has gained increasing attention due to its targeted analgesia, reduced systemic effects, and improved patient satisfaction compared to general anesthesia.

To analyze the role, effectiveness, advantages, and limitations of regional anesthesia techniquesin shoulder fracture surgeries.

Methods: This review summarizes recent studies, clinical guidelines, and meta-analyses on interscalene, supraclavicular, and infraclavicular blocks. It evaluates their indications, perioperative benefits, complications, and influence on postoperative recovery and rehabilitation.

Regional anesthesia provides superior intraoperative pain control, reduces the need for general anesthesia, facilitates surgical procedures through muscle relaxation, and prolongs postoperative analgesia. Complication rates are minimal with ultrasound guidance. Additional benefits include reduced opioid consumption, faster mobilization, and increased overall patient satisfaction.

Regional anesthesia plays a pivotal role in shoulder fracture surgeries, especially in high-risk patients. Its advantages in pain control, surgical conditions, and postoperative recovery make it a preferred choice. Continued research and standardized protocols are recommended to maximize safety and efficacy.

Keys words: regional anesthesia, brachial plexus block, shoulder fracture surgery, interscalene block, supraclavicular block, infraclavicular block, postoperative analgesia, orthopedic trauma, humerus fracture, patient safety.

Shoulder fractures, particularly proximal humeral fractures, are among the most frequent orthopedic injuries requiring surgical management. Effective anesthesia is crucial for optimal operative conditions, patient comfort, and postoperative recovery.

Regional anesthesia has gained increasing recognition as a safe and effective alternative to general anesthesia. It selectively blocks nociceptive transmission while preserving consciousness and respiratory function. This approach is especially advantageous for elderly patients or those with significant comorbidities.

Recent studies highlight additional benefits, including reduced systemic stress responses, better hemodynamic stability, and enhanced postoperative rehabilitation outcomes.

The purpose of this study is to evaluate the clinical role, effectiveness, and advantages of regional anesthesia in shoulder fracture surgery. The study also aims to examine complications, patient outcomes, and rehabilitation impact associated with different brachial plexus block techniques. This review is based on peer-reviewed articles, clinical guidelines, and meta-analyses published between 2000 – 2025.

The primary focus was on three brachial plexus block techniques:

- **Interscalene block**
- **Supraclavicular block**
- **Infraclavicular block**

Parameters evaluated included analgesic effectiveness, duration of pain relief, muscle relaxation, opioid requirements, intraoperative conditions, complications, and impact on rehabilitation.

Regional Block Techniques

- **Interscalene block**: Provides profound anesthesia for the shoulder joint and proximal humerus. It is considered the gold standard for shoulder arthroscopy and open fixation procedures.
- **Supraclavicular block**: Offers rapid onset and broad sensory coverage, suitable for middle and distal humerus surgeries.
- **Infraclavicular block**: Allows extensive upper limb analgesia, ideal for prolonged procedures or continuous postoperative analgesia via catheter.

Clinical Advantages

- Excellent intraoperative pain control
- Long-lasting postoperative analgesia (up to 18 hours)
- Reduced reliance on general anesthesia and decreased systemic side effects
- Optimal muscle relaxation facilitating fracture reduction and internal fixation
- Reduced opioid consumption
- Faster patient mobilization and improved rehabilitation outcomes
- Enhanced patient satisfaction and comfort

Safety Profile Ultrasound guidance significantly reduces complications. Rare adverse events may include:

- Infection at the puncture site
- Coagulation disorders
- Allergic reactions to local anesthetics
- Temporary diaphragmatic paresis (mainly interscalene block)

Additional Considerations

- Combination techniques: For complex fractures, combining interscalene and supraclavicular blocks can enhance analgesia.
- Continuous catheter techniques: Prolong postoperative analgesia, reduce opioid needs, and improve early rehabilitation.
- Patient positioning: Regional anesthesia facilitates easier positioning during surgery, particularly in elderly or obese patients.

Regional anesthesia offers multiple advantages over general anesthesia in shoulder fracture surgery:

1. Enhanced Pain Management: Effective intraoperative and postoperative analgesia reduces stress responses, promoting faster recovery.
2. Reduced Opioid Use: Minimizes opioid-related side effects such as nausea, vomiting, and sedation.
3. Improved Surgical Conditions: Muscle relaxation enables precise fracture reduction and fixation.
4. Faster Rehabilitation: Patients can start physiotherapy earlier, improving functional outcomes.
5. Safety in High-Risk Patients: Especially beneficial for elderly patients or those with cardiovascular or pulmonary comorbidities.

Limitations exist, but proper patient selection, ultrasound guidance, and standardized protocols mitigate most risks. Future research may focus on optimizing block combinations, local anesthetic selection, and postoperative catheter use for maximal efficacy.

Conclusion

Regional anesthesia is a highly effective and safe approach for the surgical management of shoulder fractures. Its multiple advantages—including superior intraoperative pain control, prolonged postoperative analgesia, enhanced surgical conditions, and reduced systemic complications—make it a preferred anesthetic technique in most patients. Beyond immediate surgical benefits, regional anesthesia facilitates early mobilization and rehabilitation, which is critical for restoring shoulder function and preventing long-term stiffness or functional limitations. It also reduces reliance on opioids, thereby minimizing associated side effects such as nausea, vomiting, and sedation, which contributes to improved overall patient satisfaction. Particularly in elderly patients or those with cardiovascular, respiratory, or other comorbid conditions, regional anesthesia offers a safer alternative to general anesthesia, decreasing perioperative risk and supporting faster recovery. When performed under ultrasound guidance with proper patient selection, complications are rare and manageable. In summary, regional anesthesia not only optimizes intraoperative and postoperative outcomes but also enhances overall patient-centered care in shoulder fracture surgeries. Future research should focus on standardizing protocols, exploring combination block techniques, and evaluating long-term functional outcomes to further maximize safety and efficacy.

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