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Low-Volume Superior Trunk and Superficial Cervical Plexus Block With Sedation as the Sole Regional Anesthetic for Proximal Humerus Fracture Fixation in a Patient With Alzheimer Disease

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
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Patient: Female, 68-year-old
Final Diagnosis: Proximal humerus fracture
Symptoms: Pain
Clinical Procedure: Low-volume superior trunk and superficial cervical plexus block with sedation
Specialty: Anesthesiology
Objective: Unusual setting of medical care

Background: Proximal humerus open reduction and internal fixation (ORIF) is usually performed under interscalene brachial plexus block (ISB) or general anesthesia (GA). ISB causes ipsilateral phrenic nerve paresis in nearly all patients, and GA may raise the risk of postoperative neurocognitive disorders in elderly patients with cognitive impairment. We report the feasibility of a low-volume regional technique, used as the sole regional anesthetic with sedation, in a patient in whom GA avoidance was desirable.

Case Report: A 68-year-old woman (American Society of Anesthesiologists physical status II) with Alzheimer's disease underwent ORIF of a closed right proximal humerus fracture via a deltopectoral approach under superior trunk block (STB) with 5 mL of 0.5% bupivacaine, combined with superficial cervical plexus block (SCPB) with 3 mL of 0.5% bupivacaine, totaling 8 mL, with propofol and dexmedetomidine sedation. Surgery lasted 174 minutes without intraoperative rescue analgesia. Heart rate ranged from 48 to 68 beats/min during dexmedetomidine infusion without anticholinergic treatment, and oxygen saturation remained at 100% with spontaneous ventilation preserved. The block provided analgesia for about 12 hours, with pain score 1/10 at rest at 24 hours, and satisfaction 10/10. No clinically evident respiratory compromise, Horner's syndrome, or postoperative delirium was observed, although diaphragmatic and cognitive function were not formally assessed. The patient was discharged on postoperative day 2.

Conclusions: In this single patient, low-volume STB combined with SCPB was a feasible sole regional anesthetic technique, supported by sedation, for proximal humerus ORIF, completed without conversion to GA or clinically evident respiratory compromise. Respiratory and cognitive outcomes were clinically uneventful but not formally measured; broader utility remains to be established.

Keywords: Alzheimer Disease • Anesthesia, Local • Brachial Plexus Block • Cervical Plexus Block • Humeral Fractures

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Introduction

Proximal humerus fractures are among the most common fractures in the elderly population, frequently requiring surgical fixation. The interscalene brachial plexus block (ISB) remains the most commonly used regional anesthesia technique for shoulder and proximal humerus surgery, providing analgesia through blockade of the C5-C6 nerve roots. However, ISB is associated with ipsilateral hemidiaphragmatic paresis in nearly all cases due to the inevitable spread of local anesthetic to the phrenic nerve at the interscalene level [1,2].

Burckett-St Laurent et al [3] described the superior trunk block (STB), which targets the brachial plexus at the level where the C5 and C6 roots converge into the superior trunk, slightly more distal than the traditional ISB. Because the injection point is farther from the phrenic nerve, STB has attracted interest as a potentially diaphragm-sparing approach for shoulder surgery. Clinical and cadaveric studies suggest that lower local anesthetic volumes at the superior trunk level may reduce phrenic spread while still providing effective analgesia [4,5].

Despite increasing interest in STB, most published reports have focused on postoperative analgesia or its use as a supplement to general anesthesia (GA) for arthroscopic shoulder procedures. STB has been evaluated as a sole anesthetic technique, without GA, in a randomized trial of shoulder arthroscopy [6]. In humerus surgery, Sinha et al [7] compared STB with ISB using 15 mL of local anesthetic in patients undergoing plating for proximal or mid-shaft humerus fractures; in that trial, however, the blocks were used for analgesia and all patients received GA with tracheal intubation, and no cervical plexus block was added. Reports describing STB at substantially lower volumes, combined with superficial cervical plexus block (SCPB), as the sole regional anesthetic for proximal humerus open reduction and internal fixation (ORIF) through a deltopectoral approach therefore remain limited. This is relevant because the deltopectoral incision involves cutaneous innervation from the supraclavicular nerves (C3 and C4), which arise from the superficial cervical plexus rather than the brachial plexus, so brachial plexus blockade alone may not provide complete surgical coverage.

In the present report, we describe the successful use of low-volume STB combined with SCPB as the sole regional anesthetic technique, supported by sedation, for proximal humerus ORIF in a 68-year-old patient with Alzheimer disease, in whom avoidance of GA was particularly desirable to minimize the risk of postoperative neurocognitive deterioration [8]. Our aim is to illustrate the technical feasibility and anatomical coverage of this low-volume combination in a single selected patient, rather than to establish its comparative effectiveness or routine suitability.

Case Report

A 68-year-old Thai woman (weight 50 kg, height 160 cm, body mass index 19.5 kg/m^2, American Society of Anesthesiologists physical status II) presented with a closed fracture of the right proximal humerus following a fall from stairs 1 week prior to surgery. Her medical history included Alzheimer disease and dyslipidemia. Her regular medications were donepezil 5 mg daily and rosuvastatin 10 mg at bedtime. Her preoperative heart rate was 70 beats/min. Given her cognitive impairment, the anesthesia team elected to avoid GA by using peripheral nerve blocks with sedation to minimize the risk of postoperative delirium and cognitive deterioration. Perioperative data are summarized in **Table 1**.

Regional Anesthesia Technique

Standard intraoperative monitoring comprised noninvasive blood pressure measurement, continuous electrocardiography, pulse oximetry, and respiratory-rate monitoring. The patient was positioned supine with the head turned to the left. All peripheral nerve blocks were performed under ultrasound guidance with a high-frequency linear probe and a 22-gauge, 80-mm insulated echogenic needle.

Superficial Cervical Plexus Block

The transducer was placed transversely on the lateral neck and moved caudally along the posterior border of the sternocleidomastoid (SCM) muscle until the C4 transverse process came into view. With an in-plane approach, the needle tip was placed in the fascial plane just superficial to the posterior border of the SCM, where 3 mL of 0.5% bupivacaine was deposited. We avoided going deeper than the SCM to minimize local anesthetic tracking toward the phrenic nerve.

Superior Trunk Block

The transducer was repositioned to identify the superior trunk where the C5 and C6 roots converge, distal to the interscalene groove and proximal to the takeoff of the suprascapular nerve. Using an in-plane technique, 5 mL of 0.5% bupivacaine was injected around the superior trunk. The total local anesthetic volume was 8 mL (40 mg bupivacaine).

Dexamethasone 4 mg was administered intravenously after block application as an adjuvant for block prolongation. Block adequacy was assessed before surgical incision. Sensory blockade was tested using cold sensation with an alcohol swab over the supraclavicular nerve territory (C3-C4) and the lateral upper arm (axillary nerve, C5-C6), and motor blockade was confirmed by weakness in the C5-C6 distribution. Surgery was permitted to proceed after complete sensory loss to cold and motor weakness in the relevant distributions had been documented.

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Table 1. Summary of perioperative data.

Parameter	Value
Age / sex	68 years / Female
Weight / height / BMI	50 kg / 160 cm / 19.5 kg/m^2
ASA physical status	II
Comorbidities	Alzheimer disease, dyslipidemia
Medications	Donepezil 5 mg/day, rosuvastatin 10 mg at bedtime
Diagnosis	Closed fracture, right proximal humerus
Surgery / approach	ORIF, locking plate, deltopectoral approach
Operative time	174 minutes
Regional anesthesia	
SCPB	0.5% bupivacaine 3 mL
STB	0.5% bupivacaine 5 mL
Total LA volume	8 mL (40 mg bupivacaine)
IV adjuvant	Dexamethasone 4 mg IV
Sedation	
Propofol TCI	Total 300 mg
Dexmedetomidine	0.4 µg/kg/h (total 80 µg)
Fentanyl (during block)	50 µg IV
Sedation level	Moderate to deep
Sedation-depth monitoring	Clinical assessment only; no processed EEG monitor or sedation scale
Intraoperative monitoring and course	
Monitoring	NIBP, ECG, SpO_2, respiratory rate (thoracic impedance)
Heart rate (preoperative/intraoperative)	70/48-68 beats/min; no anticholinergic treatment required
Lowest blood pressure	85/57 mm Hg
Respiratory rate	16-24 breaths/min
SpO_2	100% throughout (O_2: 3 L/min nasal cannula)
IV fluid/EBL	Acetated Ringer's solution 600 mL/200 mL
Vasopressor	Ephedrine 6 mg for each of 2 hypotensive episodes (total 12 mg)
Rescue analgesia	None
Postoperative	
NRS at PACU	0/10
NRS 24 h (rest / movement)	1/10 / 3/10
NRS 48 h / discharge	3/10 / 2/10
Scheduled analgesia	Parecoxib IV → celecoxib PO + pregabalin HS
Rescue analgesia	Tramadol/acetaminophen 2 tablets total
Block duration	≈ 12 hours

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Table 1 continued. Summary of perioperative data.

Parameter	Value
Horner's / dyspnea / O_2 on ward	No / no / not required
ICU admission	Not required
Postoperative delirium	Not observed
Patient satisfaction	10/10
Length of stay	POD 2 (total 3 days)

BMI, body mass index; ASA, American Society of Anesthesiologists; ORIF, open reduction and internal fixation; SCPB, superficial cervical plexus block; STB, superior trunk block; LA, local anesthetic; IV, intravenous; TCI, target-controlled infusion; EEG, electroencephalography; NIBP, noninvasive blood pressure; ECG, electrocardiography; SpO_2, peripheral oxygen saturation; EBL, estimated blood loss; NRS, numeric rating scale (for pain); PACU, post-anesthesia care unit; PO, orally; HS, at bedtime; ICU, intensive care unit; POD, postoperative day.

Sedation and Surgical Procedure

During the block procedure, 50 µg of fentanyl was administered intravenously for anxiolysis and procedural comfort. Intraoperative sedation was provided using propofol target-controlled infusion (total 300 mg) and dexmedetomidine infusion at 0.4 µg/kg/h, started before block placement and continued until skin closure (total 80 µg), achieving moderate to deep sedation. Sedation depth was assessed clinically by continuous observation of the patient's responsiveness, respiratory pattern, and hemodynamic response. No objective sedation-depth monitor, such as a processed electroencephalographic or bispectral index monitor, was used, and no standardized sedation scale score was formally recorded; no numerical sedation-depth values are therefore available for this case. Supplemental oxygen was delivered via nasal cannula at 3 L/min throughout the procedure.

Respiratory monitoring during sedation consisted of clinical observation of ventilatory pattern together with continuous pulse oximetry and respiratory-rate monitoring derived from thoracic impedance on the electrocardiogram; a nasal capnography sampling line was additionally used to support respiratory-rate detection, although quantitative end-tidal carbon dioxide values were not recorded. Respiratory rate ranged from 16 to 24 breaths/min, and peripheral oxygen saturation remained at 100% throughout the procedure. Spontaneous ventilation was maintained at all times, and no apnea, airway obstruction, desaturation, or airway intervention occurred.

ORIF was performed with a proximal humerus locking plate via a standard deltopectoral approach, with the patient supine and the right shoulder elevated. The operative time was 174 minutes. Estimated blood loss was 200 mL, and the patient received 600 mL of acetated Ringer's solution.

Intraoperatively, during the dexmedetomidine infusion, the patient's heart rate ranged from 48 to 68 beats/min, compared with a preoperative value of 70 beats/min. The lowest recorded heart rate of 48 beats/min was transient, was not accompanied by hemodynamic compromise or symptoms, and required no anticholinergic treatment or adjustment of the infusion rate. Two episodes of intraoperative hypotension occurred, with a lowest recorded blood pressure of 85/57 mm Hg; each was treated with ephedrine 6 mg (total 12 mg), after which blood pressure returned to baseline. No intraoperative rescue analgesics or additional opioids were required beyond the initial 50 µg of fentanyl.

Postoperative Course

Upon arrival in the post-anesthesia care unit (PACU), the patient reported no pain, with a numeric rating scale (NRS) score of 0/10. Residual sensory and motor blockade in the C5-C6 distribution was still present. There was no evidence of Horner's syndrome, dyspnea, or other respiratory complications. Supplemental oxygen via nasal cannula was discontinued within 1 hour after surgery. The patient met standard PACU discharge criteria and was transferred to the ward without additional oxygen support or postoperative ICU care. Postoperative analgesia included intravenous parecoxib 40 mg every 12 hours during postoperative days 0 to 1, followed by oral celecoxib 400 mg daily and pregabalin 75 mg at bedtime. Tramadol 37.5 mg combined with acetaminophen 325 mg was prescribed as needed for breakthrough pain, although only 2 tablets were used during admission. The nerve block provided analgesia for approximately 12 hours, and pain was mild thereafter. At 24 hours postoperatively, the NRS pain score was 1/10 at rest and 3/10 with movement. At 48 hours, the NRS pain score was 3/10, decreasing to 2/10 on the day of discharge. The patient reported high satisfaction with the anesthetic technique, with a score of 10/10. No postoperative

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Table 2. Perioperative chronology.

Time point	Event
1 week before surgery	Fall from stairs; closed right proximal humerus fracture
Day of surgery, preoperative	Standard monitoring applied; SCPB (3 mL) followed by STB (5 mL); dexamethasone 4 mg IV
Before incision	Block adequacy confirmed (sensory loss to cold and motor weakness in C3-C4 and C5-C6)
Intraoperative	ORIF via deltopectoral approach, 174 minutes; sedation with propofol and dexmedetomidine; no rescue analgesia
PACU arrival	NRS 0/10; residual C5-C6 block; no Horner's syndrome or respiratory distress
Within 1 h after surgery	Supplemental oxygen discontinued; PACU discharge criteria met; transferred to ward
≈ 12 h after block	Block analgesia resolved; scheduled multimodal analgesia continued
24 h postoperatively	NRS 1/10 at rest, 3/10 with movement
48 h postoperatively	NRS 3/10; no delirium observed
Postoperative day 2	Discharged; NRS 2/10; patient satisfaction 10/10

SCPB, superficial cervical plexus block; STB, superior trunk block; IV, intravenous; ORIF, open reduction and internal fixation; PACU, post-anesthesia care unit; NRS, numeric rating scale.

delirium or clinically significant cognitive decline was observed during hospitalization. The patient was discharged uneventfully on postoperative day 2. The perioperative chronology is summarized in **Table 2**.

Discussion

This case illustrates that, in a single carefully selected patient, low-volume STB (5 mL) combined with SCPB (3 mL) was a feasible sole regional anesthetic technique, supported by sedation, for proximal humerus ORIF via a deltopectoral approach—a procedure lasting nearly 3 hours—completed without GA and without intraoperative rescue analgesia.

Several aspects of this case are noteworthy. First, the total local anesthetic volume was only 8 mL, substantially lower than the 15 mL used for both the STB and ISB arms in the randomized comparative trials cited here [4,7,9]. Mistry et al [10] previously reported successful STB with 5 mL of 0.75% ropivacaine for humeral shaft fracture fixation; however, that case involved a mid-shaft rather than a proximal fracture, and no supplemental cervical plexus block was used. The proximal humerus is a more demanding target because it requires concurrent coverage of the axillary, suprascapular, and supraclavicular nerves.

Second, adding SCPB is anatomically logical for a deltopectoral approach. The skin incision and shoulder cap area are supplied by the supraclavicular nerves (C3-C4), which arise from the superficial cervical plexus, not the brachial plexus, and are therefore not covered by any brachial plexus block alone. Vijayakumar et al [11] reported a related strategy in a case series of 3 shoulder surgeries performed exclusively under regional anesthesia in high-risk patients, combining SCPB with blockade of both the superior and the middle trunk. Our case differs in that a single superior trunk injection was sufficient for a proximal humerus ORIF through a deltopectoral approach, and that the total local anesthetic volume was 8 mL. Relative to these prior reports, the specific advance offered by our case is the demonstration that a superior trunk plus superficial cervical plexus strategy remained feasible as the sole regional anesthetic at a notably low local anesthetic volume in our patient.

Third, although the STB was selected partly for its potentially phrenic-sparing profile and GA was avoided because of concern about postoperative delirium in a patient with Alzheimer disease [8], these considerations represent the rationale for our approach rather than demonstrated protective effects. Avoiding GA eliminates exposure to volatile anesthetic agents and limits overall anesthetic depth, both of which have been associated with postoperative neurocognitive disorders in vulnerable elderly patients [12]. In this patient, surgery was completed without clinically evident respiratory compromise and without observed postoperative delirium. As diaphragmatic ultrasonography and standardized cognitive testing were not performed, these favorable observations should be interpreted as the clinical course in a single case rather than as confirmation of phrenic-sparing or neurocognitive benefit for the general patient population.

The anatomical features of the superior trunk may explain the effectiveness of this low-volume technique. At this level, the

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C5 and C6 roots have already merged into a compact structure, and the suprascapular and axillary nerves arise nearby, which may allow adequate shoulder coverage with a small volume of local anesthetic while potentially limiting spread toward the more medially located phrenic nerve.

Sedation was provided with propofol and dexmedetomidine while spontaneous ventilation was maintained throughout. The patient remained comfortable, no airway intervention was needed, and conversion to GA was not required. Dexmedetomidine is known to reduce heart rate and blood pressure, and both a modest reduction in heart rate and 2 episodes of hypotension were observed in our patient. Both findings were transient and readily managed, but they illustrate that hemodynamic monitoring remains essential when dexmedetomidine is used in patients of advanced age undergoing this approach. The moderate to deep sedation used here contributed to overall anesthetic adequacy, so the success of this approach should be understood as the result of a multimodal strategy rather than the nerve blocks alone.

The rescue analgesic in this case, tramadol combined with acetaminophen, was ordered by the surgical team as part of their routine postoperative regimen rather than having been chosen specifically for this patient's neurocognitive profile. Tramadol has been associated with an increased risk of delirium in older adults, and an alternative rescue agent might have been preferable in a patient with Alzheimer disease. Total exposure was limited to 2 tablets and no delirium was observed, so no causal inference can be drawn; nonetheless, this observation highlights the value of aligning rescue analgesic orders with the neurocognitive risk profile when a GA-avoiding strategy is chosen specifically to protect cognition.

The feasibility shown here is limited to a carefully selected patient undergoing a deltopectoral approach, with ultrasound-guided block performance, supplemental sedation, and multimodal analgesia. Applicability to other surgical approaches, to patients with different risk profiles, or to routine practice remains unestablished.

This report has several limitations. First, diaphragmatic function was not evaluated with ultrasonography; although the patient showed no clinical signs of respiratory compromise and supplemental oxygen was discontinued within 1 hour after surgery, subclinical phrenic nerve involvement cannot be excluded. Second, this report describes only a single patient; therefore, the reproducibility and generalizability of the technique remain uncertain and require further evaluation in larger case series or prospective studies. Finally, although no postoperative delirium or obvious cognitive decline was observed during hospitalization, standardized cognitive assessment tools were not applied before or after surgery. In addition, sedation depth was assessed clinically rather than with a processed electroencephalographic monitor, and quantitative capnographic values were not recorded, so the depth of sedation and the adequacy of ventilation can be described only within the limits of the monitoring actually performed.

Conclusions

In this single patient with Alzheimer disease, low-volume STB combined with SCPB, supported by sedation and multimodal analgesia, was a feasible sole regional anesthetic technique for proximal humerus ORIF, allowing the procedure to be completed without GA and without clinically evident respiratory compromise during the observed admission. Respiratory and cognitive outcomes were clinically uneventful but were not formally verified. The broader utility of this approach remains to be established and warrants evaluation in larger studies with objective diaphragmatic and cognitive assessment.

Institution Where Work Was Done

Thammasat University Hospital Pathum Thani, Thailand

Ethics Statement/Patient Consent

This case report was reviewed by the Human Research Ethics Committee of Thammasat University, Thammasat University Hospital (Certificate of Exemption No. 023/2569, Project ID TUH-EC-MD-0-029/69, granted on 30 April 2026), which determined that the report was exempt from full ethics review in accordance with The Declaration of Helsinki, The Belmont Report, the CIOMS Guidelines, and the ICH-GCP Guidelines. Written informed consent for publication of clinical details was obtained from the patient's legal guardian, given her cognitive impairment.

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