Scholars Journal of Medical Case Reports

OPEN ACCESS

Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

Overcoming Barriers to Implement Regional Anesthesia in Orthopedic Surgery of Upper Extremity with Lymphedema – A Case Report

Tuhin Mistry[1*], Bhagyashri Soor[1], Kartik Sonawane[1], Senthilkumar Balasubramanian[1], Raghav Gupta[2], Chelliah Sekar[1]

[1]Department of Anaesthesiology, Ganga Medical Centre & Hospitals Pvt Ltd, Coimbatore, India
[2]Department of Onco-Anaesthesia & Palliative Medicine, Dr. B.R.A. Institute-Rotary Cancer Hospital, AIIMS, New Delhi, India

DOI: 10.36347/sjmcr.2021.v09i10.019 | **Received:** 03.09.2021 | **Accepted:** 11.10.2021 | **Published:** 16.10.2021

***Corresponding author:** Tuhin Mistry

Abstract **Case Report**

Anesthetic management of patient with lymphedematous extremity undergoing orthopedic surgery is not well documented in the literature. Regional anesthesia may be the only viable option for upper limb orthopedic surgery in patients with multiple comorbid conditions. However, it may be technically challenging because of the altered nature of surrounding tissue. We report the perioperative challenges and management of an elderly female patient with multiple comorbidities scheduled for an emergency orthopedic surgery of the lymphedematous upper extremity.

Keywords: Lymphoedema, regional anesthesia, acute pain management, infraclavicular brachial plexus block, peripheral nerve stimulation, breast carcinoma.

INTRODUCTION

Lymphedema or lymphatic edema is a localized swelling due to abnormal fluid accumulation in soft tissue caused by obstructed lymphatic circulation. Secondary/acquired lymphedema of the upper extremity is one of the most disabling complications of breast carcinoma. It occurs due to inflammation and scarring from metastasis to the lymph nodes, surgical removal of breast tissue, axillary lymph node dissection, chemotherapy, and radiation therapy [1]. It can lead to infection (cellulitis or lymphangitis), pain, cosmetic deformity, decreased limb function, and rarely lymphangiosarcoma [2].

Extremity with pre-existing lymphedema is prone to injury, leading to further exacerbation of lymphedema and infection [3]. Recently, recommendations regarding safety and patient outcomes have been laid for surgical management of elective hand surgery in breast cancer patients with pre-existing lymphedema [4]. The elective hand surgeries mainly included carpal tunnel release, conducted under intravenous regional anesthesia (IVRA) or axillary brachial plexus block (BPB). However, there is a paucity of literature regarding the anesthetic management of patients with lymphedema in trauma orthopedic surgeries. To the best of our knowledge, this is the first case report describing the application of infraclavicular brachial plexus block as the sole anesthetic technique for emergency orthopedic surgery of the upper extremity with pre-existing lymphedema.

CASE PRESENTATION

A mid-70-year-old American Society of Anaesthesiologists (ASA) physical grade III female was admitted with the closed middle third of shaft of left radius fracture following a slip and fall at home (Figure 1a). She underwent lumpectomy with axillary node dissection, adjuvant radiotherapy, and chemotherapy for stage III breast carcinoma ten years ago. She was on regular medications for multiple comorbid conditions, including hypertension, diabetes mellitus, bronchial asthma, and ischemic heart disease. Six years ago, she had undergone primary percutaneous coronary intervention for anterior wall myocardial infarction. Four years back, she developed lymphedema of the left upper extremity extending to the left anterior chest wall and underarm (Figure 1b). All her routine blood investigations were within normal limits. Her 2-dimensional electrocardiography revealed old ischemic changes, anterior wall & apical hypokinesia, mild mitral & tricuspid regurgitation, a sclerotic aortic valve with a trivial aortic regurgitation, ejection fraction of 60%, and mild pulmonary arterial hypertension (40 mm Hg). She was scheduled for open reduction and plate fixation of the left radius under the infraclavicular approach of the BPB. The patient and her relatives provided informed

and written high-risk consent for the surgical procedure and consent to publish this case report.

Figure 1: a. Skiagram showing closed middle third of shaft of left radius fracture; b. left upper extremity with lymphedema

On the day of surgery, the patient was kept in the block room connected to all standard ASA monitors with secured intravenous access with an 18-gauge cannula. With the patient in the supine position, head turned to the opposite side, and the arm abducted to 90 degrees, a high-frequency linear transducer (Sonosite HFL 38xp/13-6 MHz; Fujifilm SonoSite Inc., Bothell, WA, USA) was placed in the parasagittal plane just medial to the coracoid process below the clavicle (Figure 2a). After identifying axillary vessels and hyperechoic cords of the brachial plexus around the axillary artery, a 100-mm insulated nerve block needle was inserted in-plane from the cephalad-to-caudal direction aiming the cords around the artery. An appropriate evoked motor response upon electrostimulation of each cord was confirmed. After careful aspiration of blood and air, 20 ml of local anesthetic (LA) (0.75% ropivacaine + 8 mg dexamethasone) was deposited around the cords (Figure 2b).

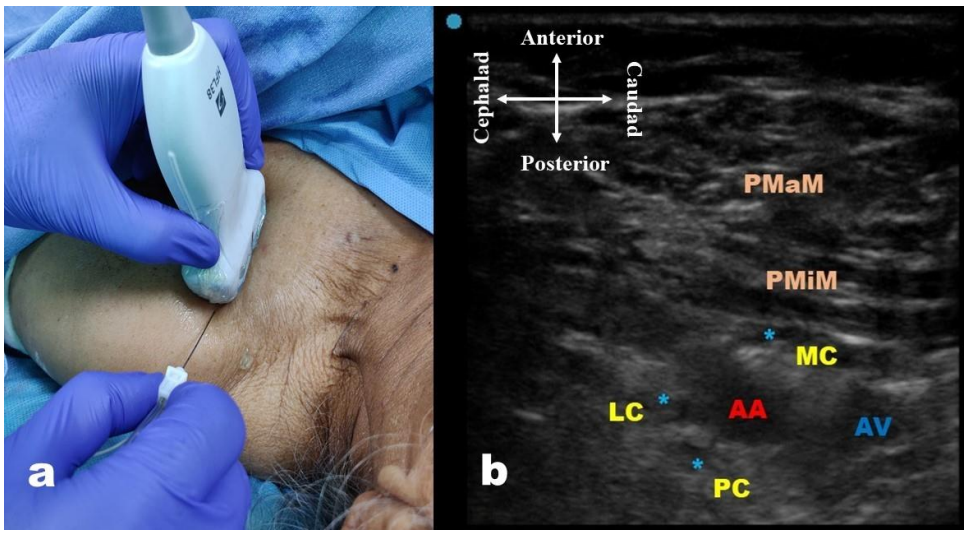

Figure 2: a. Transducer position and needle entry point; b. ultrasound image of the infraclavicular brachial plexus; PMaM = pectoralis major muscle, PMiM = pectoralis minor muscle, AA = axillary artery, AV = axillary vein, LC = lateral cord, MC = medial cord, PC = posterior cord, blue star = local anaesthetic around cords.

Intraoperatively, the patient remained hemodynamically stable. The total estimated blood loss was 400 ml for surgery of ninety minutes duration performed under arm tourniquet (pressure 350 mm Hg). Postoperatively, she was comfortable with a pain score of 0/10 for the next 18 hours and 1-3/10 for 48 hours on the numeric rating scale. She was started on a multimodal analgesia regimen (oral 15 mg/kg

paracetamol six hourly and 50 mg tapentadol eight hourly) and was discharged on the fifth postoperative day.

DISCUSSION

We successfully managed a patient with upper limb lymphedema who had undergone open reduction and plate fixation of the left radius with infraclavicular block given under dual guidance.

The radiotherapy and chemotherapy used in breast cancer management have several implications in application of regional anesthesia (RA). Radiotherapy can lead to soft tissue damage like ulceration, necrosis, and fibrosis called radiation wound [5]. Depending upon the dose and technique of irradiation, radiotherapy can also lead to neural damage due to loss of myelin sheath and obliteration of blood vessels surrounding the nerve fibers - eventually leading to fibrosis and entrapment of neural tissue [6]. This damage is irreversible and progressive, severely affecting the quality of life [7]. Extravasation of chemotherapeutic agents (like Taxanes or Anthracyclines) can cause severe skin and underlying soft tissue damage. It also leads to hypoesthesia, allodynia, hyperalgesia, and abnormal sensations in the upper extremity due to damage to dorsal root ganglion, axonal degeneration, and disruption of the microtubular structure of axons [8, 9]. The pathological changes associated with lymphedema and possible regional anesthesia implications are depicted in Table 1.

Table 1: Pathological changes associated with lymphedema and regional anesthesia implications

Pathological changes associated with lymphedema	**Regional anesthesia implications**
Skin and subcutaneous tissue thickening Skin and soft tissue edema	Difficult intravenous access for intravenous regional anesthesia Difficulty in the identification and location of target nerves Increased depth of target structures than usual
Edematous limb Hyperplasia of soft tissues	Restricted limb movement Abnormal sensations Sensorimotor assessment of block is difficult
Increased Compartment pressure	Compressed vasculature leading to high intravascular pressure - dilatation of blood vessels proximal to the affected area - hyperdynamic circulation in the proximal area - faster uptake of the local anaesthetic. Compression of the neural elements – existing neuropraxia changes - double crush phenomenon. Compression of vasculatures – ischemic changes -inflammatory mediators release - hyperalgesia
Frequent infections and inflammations	Change in pH of the tissue affecting local anesthetic action

The regional anesthetist's skill and experience play an essential role in selecting the most appropriate approach of RA among available options to increase the overall success rate. IVRA was not a feasible option in our patient due to difficult intravenous cannulation and the possibility of LA systemic toxicity due to improper application of arm tourniquet. Thus, BPB was chosen as a safer alternative for our patient. We avoided proximal BPB (approaches above the clavicle) in our patient due to compromised respiratory function and the possibility of inadvertent phrenic nerve palsy leading to subsequent pulmonary complications. The reported incidence of hemidiaphragmatic palsy following ultrasound-guided SCPB is 29.4% with 20 ml of LA [10]. Among available approaches of BPB below the clavicle, the axillary BPB was inappropriate due to the presence of lymphedema and hypertrophic contracted scar from previous surgery. On scanning the costoclavicular space, the brachial plexus cords could not be visualized or identified separately due to fibrosis and painful abduction of the arm.

In such cases, distorted anatomy (due to lymphedema and fibrosis) may lead to suboptimal location or visualization of the target structures using peripheral nerve stimulator (PNS) or ultrasound alone. The dualguidance (combined use of ultrasound and PNS) remains the technique of choice that may increase the block success rate to overcome these challenges. Hence, we opted for dual-guidance infraclavicular BPB for our patient.

Gharbaoui *et al*., [11] observed a higher rate of complications like lymphedema, delayed healing, infection, complex regional pain syndrome in patients undergoing surgery under GA compared to RA. By providing the best suitable intraoperative surgical anesthesia and postoperative analgesia, the RA avoided all possible complications associated with polypharmacy of GA in our patient with multiple comorbidities. However, further studies on larger groups are needed to understand the difficulties, success, and complications related to lymphedema and evaluate the advantages of various other RA techniques.

CONCLUSION

Dual-guidance infraclavicular brachial plexus block was successfully used as a stand-alone regional anesthetic technique for lymphedematous upper limb surgery. It also helped to overcome the challenges associated with this pathological condition and avoid the risks associated with general anesthesia.

Authors Contribution

TM: conception, planning, review of the literature, data collection, preparation of the manuscript and photo editing.
BS: preparation of the manuscript, data collection, review of the literature.
KS: preparation of the manuscript and table, analysis and interpretation of data.
SB: conception, preparation of the manuscript, data collection.
RG: preparation of the manuscript, review of the literature.
CS: approve the idea of TM and SB, supervision and manuscript editing.

Acknowledgment

The authors acknowledge Dr. Ankita Chaki for her support in proofreading of the manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

Funding: The authors have no sources of funding to declare for this manuscript.

REFERENCES

1. Ayre, K., & Parker, C. (2019). Lymphedema after treatment of breast cancer: a comprehensive review. *Journal of Unexplored Medical Data*, 2019.
2. Dawson, W. J., Elenz, D. R., Winchester, D. P., & Feldman, J. L. (1995). Elective hand surgery in the breast cancer patient with prior ipsilateral axillary dissection. *Annals of Surgical Oncology*, 2(2), 132–137.
3. Rivere, A. E., & Klimberg, V. S. (2018). Lymphedema in the Postmastectomy Patient. In The Breast (pp. 514-530.e4). Elsevier.
4. Paton, M., Kovar, A., & Iorio, M. L. (2020). An evaluation of safety and patient outcomes for hand surgery following prior breast cancer treatment: Establishing new recommendations in lymphedema: Establishing new recommendations in lymphedema. *Plastic and Reconstructive Surgery*, 145(2), 459–467.
5. Goitz, R. J., Tomaino, M. M., Smith, P., Hannallah, D., & Sinha, R. (2007). Treatment of radiation-induced soft-tissue fibrosis and concomitant acetabular osteonecrosis: a case report. *American Journal of Orthopedics (Belle Mead, N.J.)*, 36(4), E56-8.
6. Warade, A. C., Jha, A. K., Pattankar, S., & Desai, K. (2019). Radiation-induced brachial plexus neuropathy: A review. *Neurology India*, 67(Supplement), S47–S52.
7. Delanian, S., Lefaix, J. L., & Pradat, P. F. (2012). Radiation-induced neuropathy in cancer survivors. *Radiotherapy and Oncology: Journal of the European Society for Therapeutic Radiology and Oncology*, 105(3), 273–282.
8. Hammond, E. A., Pitz, M., Lambert, P., & Shay, B. (2019). Quantitative sensory profiles of upper extremity chemotherapy induced peripheral neuropathy: Are there differences in sensory profiles for neuropathic versus nociceptive pain? Revue Canadienne de La Douleur, *Canadian Journal of Pain*, 3(1), 169–177.
9. Smoot, B., Boyd, B. S., Byl, N., & Dodd, M. (2014). Mechanosensitivity in the upper extremity following breast cancer treatment. *Journal of Hand Therapy: Official Journal of the American Society of Hand Therapists*, 27(1), 4–11.
10. Ueshima, H., & Otake, H. (2019). Incidence of phrenic nerve paralysis after ultrasound-guided supraclavicular brachial plexus block. *Journal of Clinical Anesthesia*, 56, 37–38.
11. Gharbaoui, I. S., Netscher, D. T., Thornby, J., & Kessler, F. B. (2005). Safety of upper extremity surgery after prior treatment for ipsilateral breast cancer: Results of an American society for surgery of the Hand membership survey and literature review. *Journal of the American Society for Surgery of the Hand*, 5(4), 232–238.