e-ISSN: 2807-6257

Open Access Indonesian Journal of Medical Reviews

[OAIJMR]

https://hmpublisher.com/index.php/oaijmr

Ultrasound-Guided Supraclavicular Block as a Primary Anesthetic for Humerus Biopsy in a High-Risk Patient with a Compressive Goiter and Atrial Fibrillation: A Case Report

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ARTICLE INFO

Keywords:
Difficult airway
High-risk patient
Regional anesthesia
Supraclavicular block
Ultrasound-guided

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/oaijmr.v5i6.795

A B S T R A C T

The anesthetic management of patients with multiple severe comorbidities presents a formidable clinical challenge. Pathological fractures secondary to metastatic disease often require procedural intervention in individuals with pre-existing cardiopulmonary, airway, and cerebrovascular compromise. General anesthesia in such patients carries a prohibitively high risk of hemodynamic collapse, airway loss, and perioperative mortality. We present a case where a targeted regional anesthetic technique was pivotal in ensuring patient safety. A 59-year-old woman with a pathological fracture of the right humerus, suspected to be a metastasis from thyroid carcinoma, was scheduled for a core needle biopsy. Her medical history was profoundly complex, including a massive, airway-compressing thyroid goiter, persistent atrial fibrillation, recent ischemic stroke with residual hemiparesis, bilateral pneumonia with pulmonary edema, uncontrolled type 2 diabetes mellitus, and acute-on-chronic kidney disease. Given the extreme risks associated with general anesthesia and airway manipulation, we opted for an ultrasound-guided right supraclavicular brachial plexus block as the sole anesthetic. The block was performed successfully using 20 mL of 1.5% lidocaine with epinephrine, providing dense sensorimotor anesthesia of the upper limb. The patient remained hemodynamically stable, spontaneously breathing, and comfortable throughout the procedure, with no perioperative complications. In conclusion, this case demonstrates that an ultrasound-guided supraclavicular block is a safe, effective, and hemodynamically superior alternative to general anesthesia for upper limb procedures in a patient with a confluence of critical airway, cardiac, pulmonary, and neurological comorbidities. This approach obviates the need for airway instrumentation, preserves spontaneous ventilation, and minimizes systemic physiological trespass, thereby enhancing patient safety in the highest-risk surgical populations.

1. Introduction

The intersection of advanced malignancy and complex medical comorbidities creates one of the most challenging scenarios in modern perioperative medicine.[1] Pathological fractures, a common and debilitating complication of metastatic cancer, frequently necessitate surgical or procedural intervention for diagnosis, stabilization, and palliation. While the procedure itself, such as a core needle biopsy, may be minimally invasive, the anesthetic management can be fraught with peril, particularly when the patient's physiological reserves are severely depleted. The choice of anesthetic technique is not merely a procedural detail but a critical determinant of patient outcome, demanding a nuanced assessment of the risks and benefits of general versus regional anesthesia.[2]

General anesthesia, long considered the default for many surgical procedures, induces a state of reversible coma, neuromuscular paralysis, and profound sympatholysis.[3] While effective, this induced state can unmask or exacerbate underlying

pathologies. In a patient with a large, compressive goiter, the induction of general anesthesia and neuromuscular blockade can lead to the catastrophic loss of airway patency, culminating in a "can't intubate, can't ventilate" emergency. Furthermore, patients with pre-existing cardiac conditions like atrial fibrillation (AF) are exquisitely sensitive to the hemodynamic fluctuations inherent to general anesthesia.[4] The negative inotropic and vasodilatory effects of anesthetic agents can precipitate hypotension, while the stress response to laryngoscopy and surgical stimulation can trigger a rapid ventricular response, leading to heart failure or myocardial ischemia.[5] The presence of concurrent pulmonary disease, such as pneumonia, further complicates matters by reducing the patient's tolerance for apnea and increasing the risk of postoperative pulmonary complications following positive pressure ventilation.[6]

In this high-stakes environment, regional anesthesia emerges as a compelling alternative. By targeting the neural pathways subserving the surgical site, regional techniques provide profound anesthesia and analgesia while sparing the central nervous, cardiovascular, and respiratory systems from the systemic trespass of general anesthetic agents.[7] Ultrasound-guided peripheral nerve blocks, in particular, represent a significant advancement, allowing for the precise deposition of local anesthetic around target nerves while visualizing and avoiding critical adjacent structures such as the pleura and major blood vessels.[8] The supraclavicular approach to the brachial plexus, often termed the "spinal of the arm," offers a dense and reliable block for procedures on the humerus, elbow, and forearm from a single injection site.[9]

This case report details the successful anesthetic management of a 59-year-old woman with a perfect storm of comorbidities, including a massive compressive goiter, atrial fibrillation, a recent stroke, and active pneumonia, who required a core biopsy of a pathological humerus fracture. We hypothesized that a primary anesthetic strategy utilizing an ultrasound-guided supraclavicular block would obviate the risks of general anesthesia and provide a safer pathway for her necessary diagnostic procedure. The novelty of this case lies in its demonstration of the pivotal role of a targeted regional technique in navigating a rare and extreme confluence of airway, cardiac, pulmonary, and neurological risks, providing a clear blueprint for managing similarly complex patients.[10] This report aimed to elucidate the pathophysiological rationale behind this anesthetic choice and to advocate for the consideration of regional anesthesia as a primary modality in the highest-risk surgical populations.

2. Case Presentation

A 59-year-old, 55 kg woman was referred to the orthopedic department of Dr. Moewardi Regional General Hospital with a three-month history of progressively worsening, deep, aching pain in her right upper arm. The pain was initially intermittent but had become constant over the preceding month, significantly aggravated by movement and causing severe sleep disturbance. She reported hearing a "snap" in her arm two weeks prior while attempting to lift a small object, after which the pain became excruciating and she was unable to move her arm. She denied any history of significant trauma.

Her history of present illness was further complicated by systemic symptoms. She reported a 10 kg unintentional weight loss over the past six months, generalized fatigue, and occasional dysphagia with solid foods. For the past two months, she had noted a progressively enlarging, painless mass in her neck. Over the week prior to admission, she developed shortness of breath, initially only on exertion but later also at rest, accompanied by a productive cough with yellowish sputum.

Her past medical history was extensive and significant (Table 1). A known case of persistent atrial fibrillation (AF) for the past five years, for which she was intermittently treated with digoxin. Her CHA_2DS_2-VASc score was calculated to be 6 (age, female gender, hypertension, diabetes, prior stroke), indicating a high

risk of thromboembolism. However, she was not on therapeutic anticoagulation due to a perceived high bleeding risk by a previous physician. She also had a long-standing history of hypertension, with poor adherence to amlodipine. She had suffered an ischemic stroke one month prior to this admission, resulting in residual dysarthria and moderate right-sided hemiparesis, which had been slowly improving with physical therapy. She was diagnosed with type 2 diabetes mellitus ten years ago, managed with oral hypoglycemic agents with poor glycemic control. She also had a multinodular goiter, diagnosed 15 years prior, which she had neglected until its recent rapid growth. There was no prior history of malignancy. There was no family history of thyroid or other cancers.

Table 1. Summary of clinical findings.

Summary of Clinical Findings

Patient: 59-Year-Old Female with Pathological Right Humerus Fracture

SYSTEM / DOMAIN	CLINICAL FINDING	DETAILS & CLINICAL SIGNIFICANCE
Airway (Critical)	Massive Compressive Goiter	• **Size:** Approx. 12 × 8 cm, causing significant tracheal deviation to the left. • **Airway Exam:** Mallampati Class IV, thyromental distance ~5 cm, limited neck extension. • **Significance:** Extreme risk of "can't intubate, can't ventilate" scenario with general anesthesia. A primary contraindication for airway instrumentation.
Cardiovascular	Persistent Atrial Fibrillation	• **ECG:** Irregularly irregular rhythm, rate 92 bpm (controlled). • **Thromboembolic Risk:** CHA_2DS_2-VASc score of 6 (High Risk); not anticoagulated. • **Significance:** High risk of hemodynamic instability (hypotension, rapid ventricular response) under general anesthesia. Loss of "atrial kick" reduces cardiac output.
	Congestive Heart Failure & Hypertension	• **Vitals:** BP on admission 185/59 mmHg. • **Signs:** Elevated JVP, bilateral pitting edema. • **Echocardiogram:** Grade II diastolic dysfunction, mild pulmonary hypertension (PASP 45 mmHg). • **Significance:** Poor tolerance to fluid shifts and myocardial depressant effects of anesthetic agents.
Pulmonary	Bilateral Pneumonia & Pulmonary Edema	• **Symptoms:** Dyspnea at rest, productive cough. • **Vitals:** SpO_2 92% on room air, RR 26/min. • **Chest X-Ray:** Cardiomegaly, bilateral opacities, pleural effusions, pulmonary nodules (suspected metastases). • **Significance:** Severely reduced respiratory reserve, high risk of rapid desaturation during apnea, and worsening V/Q mismatch with positive pressure ventilation.
Neurological	Recent Ischemic Stroke	• **History:** 1 month prior to admission. • **Deficits:** Residual dysarthria and right-sided hemiparesis. • **Significance:** Brain is vulnerable to secondary injury from hypotension or hypoxia, which are significant risks of general anesthesia in this patient.
Metabolic/Renal	Multiple Derangements	• **Diabetes:** Uncontrolled (Random Glucose 229 mg/dL, HbA1c 9.8%). • **Renal:** Acute-on-chronic kidney injury (BUN 132, Cr 1.3). • **Nutrition:** Hypoalbuminemia (3.0 g/dL). • **Significance:** Indicates severe systemic illness, poor physiological reserve, and increased risk of perioperative complications like poor wound healing and drug clearance issues.
Oncological	Suspected Metastatic Thyroid Cancer	• **Primary Finding:** Pathological fracture of right humerus. • **Imaging:** Large lytic lesion with soft tissue mass on X-ray/MRI. • **Neck Ultrasound:** Thyroid masses highly suspicious for carcinoma. • **Significance:** The underlying pathology driving the need for the diagnostic procedure. Indicates advanced, systemic disease.

On examination, the patient appeared chronically ill, frail, and in moderate distress from arm pain. Blood pressure was 185/59 mmHg, heart rate was 92 beats per minute and irregular, respiratory rate was 26 breaths per minute with shallow breaths, temperature was 38.1°C, and oxygen saturation was 92% on room air, improving to 96% with a 3 L/min nasal cannula. A large, firm, multinodular mass was visible in the anterior neck, extending from the thyroid cartilage inferiorly toward the clavicles, measuring approximately 12 x 8 cm in total. The mass was predominantly on the right side, causing a visible deviation of the trachea to the left. The mass was non-tender and moved minimally with swallowing. Her Mallampati score was Class IV, with only the hard palate visible. Thyromental distance was approximately 5 cm, and neck extension was limited to 20 degrees due to the mass. Stridor was not present at rest but was inducible with mild exertion. The pulse was irregularly irregular. The S1 and S2 heart sounds were audible but variable in intensity. A grade II/VI pansystolic murmur was heard at the apex. Jugular venous pressure was elevated at 8 cm above the sternal angle. There was 2+ pitting edema in both lower extremities up to the knees. She was using accessory muscles of respiration. On auscultation, there were diffuse crackles in the bilateral lung bases and scattered rhonchi throughout both lung fields. Percussion was dull over the lung bases. The right upper arm exhibited significant swelling, particularly in the distal third, with overlying ecchymosis and warmth. There was exquisite tenderness over the distal humerus. Any passive movement of the elbow or shoulder elicited severe pain, and the range of motion was severely limited. The distal neurovascular status was intact, with a palpable radial pulse and normal sensation in the hand. The patient was alert and oriented. Cranial nerves were intact except for a mild right facial droop (upper motor neuron type). Speech was mildly dysarthric. Motor examination revealed right-sided hemiparesis with strength graded at 3/5 in the upper extremity (proximal to the fracture) and 4/5 in the lower extremity, according to the Medical Research Council (MRC) scale. Sensation was intact. Reflexes were brisk on the right side with a positive Babinski sign.

An extensive diagnostic workup was initiated to assess the extent of her pathologies. A comprehensive metabolic panel and complete blood count were performed, with key results summarized in Table 2. Notable findings included normocytic anemia, leukocytosis with a left shift, severe hyperglycemia, acute-on-chronic kidney injury (AKIN Stage III), and hypoalbuminemia. Her thyroid function tests were consistent with euthyroid sick syndrome in the setting of her acute illness (TSH 0.12 mIU/L, FT4 4.70 pmol/L).

Anteroposterior and lateral views of plain radiograph and bone survey of right humerus revealed a large, poorly circumscribed, lytic and destructive lesion involving the distal metadiaphysis of the right humerus (Figure 1). There was evidence of a transverse pathological fracture through the lesion, with significant cortical erosion and a large associated soft tissue mass, highly suspicious for a metastatic deposit or a primary bone malignancy.

The anteroposterior chest X-ray was highly abnormal. It demonstrated cardiomegaly and findings consistent with pulmonary edema, including cephalization of pulmonary vessels and small bilateral pleural effusions. Additionally, there were patchy, inhomogeneous opacities in both lung bases, consistent with bilateral pneumonia. A large soft tissue mass was noted in the superior mediastinum, corresponding to the neck mass, causing significant deviation of the tracheal air column to the left. Several discrete pulmonary nodules were also identified, raising suspicion for pulmonary metastases. The 12-lead ECG showed atrial fibrillation with a controlled ventricular response at an average rate of 92 bpm. There was left axis deviation, poor R-wave progression in the precordial leads, and nonspecific ST-T wave abnormalities, but no acute ischemic changes. computed tomography (CT) of the head performed during her admission for stroke one month prior confirmed a lacunar infarct in the right corona radiata

and left basal ganglia, and a subacute amorphous infarct in the left parietal lobe, with no evidence of hemorrhage. Magnetic resonance imaging (MRI) of the right humerus with contrast provided exquisite detail of the lesion, confirming a large, infiltrative mass replacing the bone marrow of the distal humerus. The mass measured 6.6 x 8.7 x 10.3 cm, demonstrating avid, heterogeneous contrast enhancement. It had breached the cortex extensively and invaded the surrounding soft tissues, including the triceps and brachialis muscles. The findings were highly characteristic of bone metastasis (Figure 2). An ultrasound of the neck revealed a large, heterogeneous, hypoechoic solid mass replacing most of the right thyroid lobe, measuring 4.6 x 4.6 x 4.3 cm. A separate, similar-appearing mass was in the left lobe, measuring 3.9 x 4.2 x 5.15 cm. Both masses showed irregular margins, internal microcalcifications, and significant intralesional vascularity on color Doppler imaging, features highly suspicious for thyroid carcinoma. Several enlarged cervical lymph nodes were also noted.

Table 2. Admission laboratory data.

Admission Laboratory Data

Analysis of key biochemical and hematological markers upon presentation.

PARAMETER	RESULT	REFERENCE RANGE	CLINICAL SIGNIFICANCE
Complete Blood Count (CBC)			
Hemoglobin	**9.8 g/dL**	12.0 - 15.5 g/dL	Normocytic anemia, likely anemia of chronic disease/malignancy.
White Blood Cell Count	**15,200 /µL**	4,500 - 11,000 /µL	Leukocytosis with neutrophilia (85%), indicative of acute infection (pneumonia).
Platelet Count	280,000 /µL	150,000 - 450,000 / µL	Within normal limits.
Comprehensive Metabolic Panel (CMP)			
Glucose (Random)	**229 mg/dL**	70 - 140 mg/dL	Severe hyperglycemia, reflecting poorly controlled Type 2 Diabetes.
BUN / Creatinine	**132 / 1.3 mg/dL**	7-20 / 0.6-1.2 mg/dL	Acute-on-chronic kidney injury (AKIN III), likely pre-renal azotemia.
Albumin	**3.0 g/dL**	3.5 - 5.2 g/dL	Hypoalbuminemia, indicating malnutrition and chronic illness/inflammation.
Bicarbonate	**20 mmol/L**	22 - 29 mmol/L	Mild metabolic acidosis, possibly related to renal dysfunction or sepsis.

Figure 1. Bone survey.

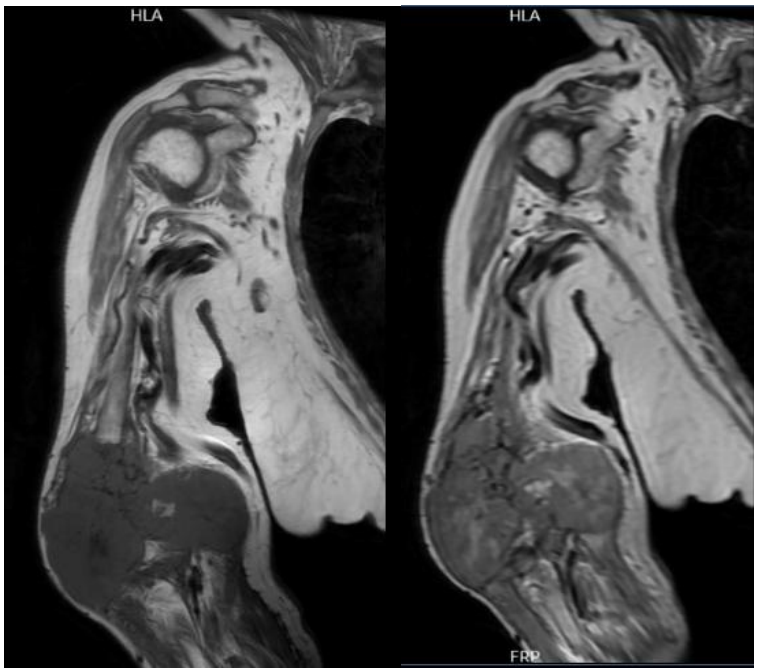

Figure 2. Magnetic resonance imaging (MRI) of the right humerus with contrast.

The patient was admitted and managed by a multidisciplinary team including orthopedics, internal medicine, pulmonology, cardiology, and anesthesiology. A core needle biopsy of the humeral lesion was deemed essential to establish a histological diagnosis and guide further oncological management. Her preoperative optimization was intensive: Cardiovascular: Cardiology was consulted for

management of her AF and heart failure. She was started on intravenous furosemide for diuresis, and her blood pressure was controlled with intravenous nicardipine and amlodipine 10 mg daily. Given the upcoming procedure and her high thromboembolic risk, a decision was made to initiate a therapeutic heparin infusion once her renal function stabilized; Pulmonary: For her community-acquired pneumonia, she was started on broad-spectrum intravenous antibiotics. Aggressive pulmonary toilet, incentive spirometry, and supplemental oxygen were administered; Endocrine: Her severe hyperglycemia was managed with a continuous intravenous insulin infusion with a target blood glucose of 140-180 mg/dL; Renal: Her acute kidney injury was managed with intravenous fluids and avoidance of nephrotoxic agents; Nutrition: She received nutritional support and albumin infusions for her hypoalbuminemia.

The anesthetic plan was a subject of extensive discussion. General anesthesia was considered to be of extremely high risk. The massive goiter with tracheal deviation presented a critical airway challenge; induction and paralysis could lead to total airway collapse. Her severe cardiopulmonary disease made her a poor candidate for the hemodynamic swings of general anesthesia. Therefore, the consensus decision was to proceed with an ultrasound-guided right supraclavicular block as the sole anesthetic modality. This approach would provide dense anesthesia for the surgical procedure while completely avoiding airway manipulation, preserving spontaneous ventilation, and maintaining hemodynamic stability. The patient and her family were extensively counseled on the risks and benefits of this approach versus general anesthesia, and they provided informed consent.

The patient was brought to the operating room after four days of medical optimization. Standard ASA monitoring was applied, including non-invasive blood pressure, 5-lead ECG, pulse oximetry, and end-tidal CO_2 via a nasal cannula. An arterial line was placed in the left radial artery for continuous blood pressure monitoring. The patient was placed in a semi-recumbent (30-degree head-up) position to ease her breathing and was given supplemental oxygen. Premedication consisted of intravenous ondansetron 4 mg, dexamethasone 5 mg, and fentanyl 25 mcg for sedation and comfort during the block placement.

Using a high-frequency linear ultrasound probe (SonoSite) and a strict aseptic technique, the right supraclavicular fossa was scanned. The subclavian artery was identified, and the brachial plexus was visualized as a hypoechoic bundle of nerves clustered in the "corner pocket" superolateral to the artery. The pleura was clearly identified as a hyperechoic line deep to the plexus and artery.

Using an in-plane approach, a 22-gauge, 50-mm insulated nerve block needle was advanced. After careful hydrodissection with normal saline to confirm correct needle placement, a total of 20 mL of 1.5% lidocaine with 1:200,000 epinephrine was slowly injected incrementally around the brachial plexus, with visualization of the local anesthetic spread. Within 15 minutes, a dense sensorimotor block was confirmed. The patient had a complete loss of sensation to cold and pinprick from the shoulder to the fingertips (C5-T1 dermatomes) and complete motor paralysis of the right arm.

The orthopedic surgeon then proceeded with the core needle biopsy. Three core samples were obtained from the pathological lesion in the right humerus under fluoroscopic guidance. The procedure lasted 25 minutes. Throughout the entire intraoperative period, the patient remained awake, calm, and hemodynamically stable. Her heart rate remained in the 80-95 bpm range, and her mean arterial pressure was maintained between 75-90 mmHg without any vasopressor requirement. Her oxygen saturation remained stable at 97-99% on 3 L/min of oxygen. A summary of intraoperative vitals is shown in Figure 3.

Figure 3. Intraoperative hemodynamic stability.

The patient was transferred to the Post-Anesthesia Care Unit (PACU) for monitoring. She reported a pain score of 0/10 on the Visual Analog Scale (VAS), and her hemodynamics remained stable. A chest X-ray was performed in the PACU to rule out pneumothorax, which was negative. There were no signs of phrenic nerve palsy, such as dyspnea or paradoxical abdominal wall movement. The sensory and motor block gradually receded over the next 3-4 hours, and she was transitioned to oral analgesics. She was discharged from the PACU back to the medical ward in stable condition. The final histopathology report of the biopsy later confirmed metastatic follicular carcinoma of the thyroid.

3. Discussion

This case report presents a complex clinical scenario where the anesthetic management was the lynchpin to a successful outcome. The patient's constellation of a critically compromised airway, unstable cardiovascular physiology, active pulmonary infection, and recent cerebrovascular event placed her at the highest echelon of perioperative risk. A conventional approach with general anesthesia would have been fraught with potential for life-threatening complications at every stage, from induction to emergence.[11] The deliberate choice of an ultrasound-guided supraclavicular block was predicated on a deep understanding of the patient's intersecting pathophysiologies and the unique ability of regional anesthesia to circumvent these risks.[12]

The patient's massive goiter with significant tracheal deviation represented a classic "difficult airway." The primary pathophysiological concern during the induction of general anesthesia is the loss of pharyngeal muscle tone (Figure 4). In a conscious, spontaneously breathing patient, these muscles actively maintain airway patency. The administration of induction agents and neuromuscular blocking agents ablates this protective tone, which can lead to the collapse of soft tissues around the larynx and the external compression from the goiter to cause complete, irreversible airway obstruction. Intubation in such cases can be impossible due to anatomical distortion, and mask ventilation may be equally futile.[13] This culminates in a "can't intubate, can't ventilate" scenario, an anesthesiologist's ultimate nightmare, leading to rapid desaturation, hypoxic brain injury, and cardiac arrest. By choosing a regional technique, we entirely bypassed the airway, allowing the patient to maintain her own protective muscle tone and spontaneous ventilation throughout the procedure.

Atrial fibrillation fundamentally alters cardiovascular hemodynamics. The loss of coordinated atrial contraction ("atrial kick") can reduce cardiac

output by up to 30%, a deficit that is poorly tolerated in patients with diastolic dysfunction, as was the case here. Furthermore, patients with AF are highly susceptible to rapid ventricular rates (RVR) in response to surgical stress, which shortens diastolic filling time, compromises coronary perfusion, and can precipitate acute heart failure or myocardial ischemia.[14] General anesthetic agents are typically myocardial depressants and vasodilators, which can cause profound hypotension in a patient with already compromised cardiac output. The supraclavicular block, by contrast, has minimal systemic hemodynamic effects. It provides dense surgical anesthesia without affecting cardiac contractility, preload, or afterload, thereby maintaining the delicate hemodynamic balance in this fragile patient. This stability is crucial for ensuring adequate perfusion to vital organs, including the brain, which was already vulnerable from a recent stroke.[15]

The patient's pre-existing pneumonia and pulmonary edema significantly reduced her physiological reserve. These conditions lead to ventilation/perfusion (V/Q) mismatch and intrapulmonary shunting, reducing functional residual capacity (FRC) and making the patient prone to rapid oxygen desaturation during periods of apnea. General anesthesia, with its requisite period of apnea during intubation and the effects of positive pressure ventilation, could have worsened this V/Q mismatch and potentially caused barotrauma to the infected lung tissue. Moreover, residual effects of anesthetic agents and opioids can cause postoperative respiratory depression, atelectasis, and an inability to clear secretions, increasing the risk of worsening the pneumonia. The preservation of spontaneous ventilation with regional anesthesia was a critical advantage, maintaining the patient's own respiratory mechanics and avoiding the harms of mechanical ventilation.[16]

The supraclavicular approach to the brachial plexus was chosen for its efficiency and reliability. At this level, the plexus is a tightly packed bundle, allowing a complete block of the entire upper limb (sparing only the skin of the axilla) with a single, relatively low-volume injection.[17] This makes it ideal for procedures on the humerus. The advent of ultrasound guidance has revolutionized the safety and efficacy of this block. Real-time visualization of the needle tip, the plexus, the subclavian artery, and—most importantly—the pleura allows the practitioner to deposit the local anesthetic with unparalleled precision while actively avoiding complications. The primary historical concern with the supraclavicular block was the risk of pneumothorax; with ultrasound, this risk is dramatically reduced to less than 0.1% when the pleura is clearly visualized.[18]

Furthermore, the ultrasound-guided technique ensures a higher success rate and faster onset compared to traditional nerve-stimulator or paresthesia-based techniques. This efficiency was beneficial for our patient, minimizing the time spent in the potentially stressful operating room environment.[19] The chosen anesthetic agent, lidocaine with epinephrine, provided a rapid onset (appropriate for a short procedure) and a moderate duration of action, ensuring the patient was comfortable through the procedure and into the initial postoperative period without the need for systemic opioids.

This case underscores a paradigm shift in modern anesthesiology: the procedure should be tailored to the patient, not the patient to the procedure. For high-risk individuals, regional anesthesia should not be considered a niche alternative but rather a primary, life-sustaining strategy. The ability to perform a necessary diagnostic procedure safely in this patient allowed her to receive a definitive diagnosis, which is the crucial first step toward appropriate oncological and palliative care.[20] It is important to acknowledge the limitations of this report. As a single case study, the observations cannot be generalized to all patients. The success of the procedure is highly dependent on the skill and experience of the anesthesiologist with ultrasound-guided regional techniques.[21] Furthermore, not all patients or surgical procedures are amenable to a regional anesthetic approach. However, this case serves as a powerful proof-of-

concept, illustrating the immense potential of regional anesthesia to improve safety and enable necessary procedures in the most medically complex patient populations. Future prospective studies could compare outcomes between regional and general anesthesia in high-risk cohorts undergoing intermediate procedures, although randomizing such fragile patients would pose significant ethical challenges.

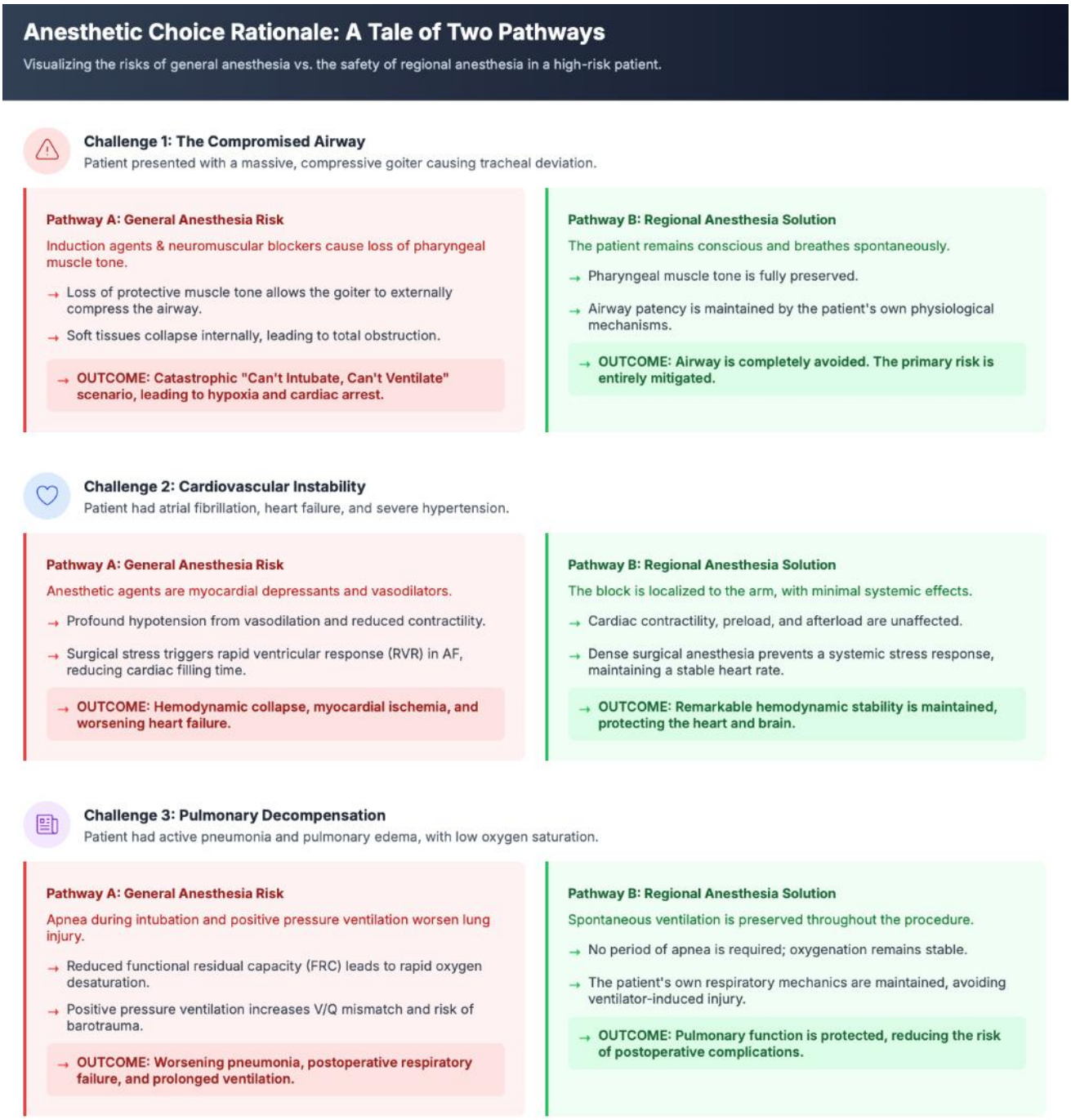

Figure 4. The pathophysiological rationale for avoiding general anesthesia.

4. Conclusion

The successful anesthetic management of this critically ill patient with a pathological fracture highlights the profound benefits of a patient-centered, pathophysiology-driven approach. In the face of a critically compromised airway, severe cardiorespiratory disease, and neurological vulnerability, an ultrasound-guided supraclavicular block provided a safe, effective, and hemodynamically stable anesthetic for a core needle biopsy of the humerus. This technique successfully circumvented the formidable risks associated with general anesthesia and airway instrumentation. This case strongly advocates for the consideration and utilization of regional anesthesia as a primary modality, not an afterthought, in the perioperative care of high-risk patients, thereby expanding the scope of safe procedural care for the most fragile individuals in our healthcare system.

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