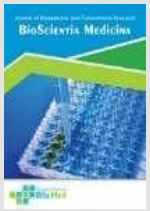
eISSN (Online): 2598-0580



Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: www.bioscmed.com

Thoracic Epidural Anesthesia Facilitating Upper Abdominal Surgery in the Presence of Malignant Pleural Effusion and Hepatic Metastases: A Case Report

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ARTICLE INFO

Keywords:
Hepatic metastases
Malignant pleural effusion
Metastatic breast cancer
Thoracic epidural anesthesia
Upper abdominal surgery

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

https://doi.org/10.37275/bsm.v9i7.1343

A B S T R A C T

Background: Upper abdominal surgery in patients with advanced metastatic cancer, particularly with significant pulmonary and hepatic involvement, presents substantial perioperative challenges. Malignant pleural effusion (MPE) and hepatic metastases compromise cardiorespiratory reserve, increasing the risks associated with general anesthesia and surgical stress. Thoracic epidural anesthesia (TEA) offers potential benefits by providing effective analgesia, reducing pulmonary complications, and attenuating the surgical stress response. **Case presentation:** We report the case of a 65-year-old male patient with metastatic breast cancer involving the lungs, liver, and spine, complicated by recurrent malignant pleural effusion. He presented with dyspnea and abdominal pain, requiring a laparotomy for liver biopsy to guide further oncological management. Given his ASA III status, significant pulmonary compromise (pre-operative SpO_2 93-94% on room air, effusion requiring drainage), and the nature of the surgery, TEA was chosen as the primary anesthetic technique. An epidural catheter was successfully placed at the T9-T10 interspace, achieving a T4 sensory block using ropivacaine 0.5%. The laparotomy and liver biopsy proceeded with stable intraoperative hemodynamics and adequate surgical conditions. **Conclusion:** TEA provided effective anesthesia and analgesia for upper abdominal surgery in this high-risk patient with extensive metastatic disease and compromised pulmonary function. This approach facilitated the procedure while maintaining hemodynamic stability and avoiding the potential respiratory complications associated with general anesthesia and tracheal intubation. TEA should be considered a viable anesthetic option in carefully selected high-risk patients undergoing abdominal oncological surgery.

1. Introduction

The perioperative management of patients undergoing major upper abdominal surgery presents significant challenges, particularly in the context of advanced malignancy with multi-organ involvement. Patients with metastatic cancer often harbor numerous comorbidities, compounded by the systemic effects of the malignancy itself and prior oncological treatments, rendering them physiologically vulnerable to the stresses of surgery and anesthesia. Upper abdominal surgeries, such as laparotomy for liver biopsy or resection, inherently involve significant surgical trauma, potential for substantial blood loss, and postoperative pain, all contributing to a profound

neuroendocrine stress response. This stress response can have detrimental effects, including immunosuppression, hypercoagulability, and increased catabolism, potentially impacting patient recovery and even long-term oncological outcomes. Furthermore, these procedures can significantly impair postoperative pulmonary function through mechanisms like diaphragmatic dysfunction, pain-induced splinting leading to shallow breathing, and atelectasis. In patients with pre-existing pulmonary compromise, such as those with pulmonary metastases and MPE as seen in this case, these effects are magnified, substantially increasing the risk of postoperative pulmonary complications (PPCs), including pneumonia, respiratory failure, and prolonged mechanical ventilation. MPE itself poses a direct threat by compressing lung tissue, causing dyspnea, hypoxemia, and further reducing pulmonary reserve. Management often requires invasive procedures like thoracentesis or chest drain insertion, which provide temporary relief but underscore the patient's fragile respiratory status.[1,2]

The choice of anesthetic technique in such high-risk patients is critical. General anesthesia (GA) with endotracheal intubation and mechanical ventilation remains the standard for many major abdominal surgeries. However, GA is associated with known risks, including hemodynamic instability (hypotension), potential for ventilator-induced lung injury, atelectasis, delayed recovery of bowel function, postoperative nausea and vomiting (PONV), and the need for significant postoperative opioid analgesia, which itself can contribute to respiratory depression and sedation. In patients with severely compromised pulmonary function, the risks associated with GA and mechanical ventilation, particularly the difficulty in weaning and extubation, are heightened.[3,4]

Regional anesthesia techniques, particularly thoracic epidural anesthesia (TEA), have emerged as valuable alternatives or adjuncts to GA for major thoracic and abdominal surgeries. TEA involves the placement of a catheter into the thoracic epidural space, allowing for the administration of local anesthetics and/or opioids to provide segmental blockade of somatic and sympathetic nerve fibers innervating the surgical site. The purported benefits of TEA are numerous, including superior perioperative analgesia compared to systemic opioids, reduced opioid consumption and associated side effects, attenuation of the surgical stress response, improved postoperative pulmonary function (facilitating deep breathing and coughing), earlier return of bowel function, and potentially reduced incidence of PPCs. For high-risk patients, particularly those with significant cardiac or pulmonary comorbidities, these benefits may translate into improved outcomes, including reduced morbidity and potentially shorter hospital stays. Some studies even suggest a potential, though controversial, benefit of regional anesthesia in reducing cancer recurrence, possibly mediated through attenuation of the surgical stress response and reduced opioid requirements, although large randomized trials have yielded conflicting results.[5,6]

Despite its advantages, TEA is not without challenges and risks. Placement of a thoracic epidural catheter is technically more demanding than lumbar epidural placement due to the angulation of thoracic spinous processes and the proximity of the spinal cord, increasing the theoretical risk of neurological injury. Potential complications include dural puncture with subsequent post-dural puncture headache (PDPH), catheter misplacement (subdural, intravenous), infection (epidural abscess), epidural hematoma (especially in patients with coagulopathy), hypotension due to sympathetic blockade, urinary retention, and motor block. Careful patient selection, meticulous technique by experienced practitioners, and vigilant monitoring are essential to minimize these risks. Furthermore, the rise of minimally invasive surgical techniques has led some to question the necessity of TEA, as alternative regional blocks (e.g., paravertebral blocks, transversus abdominis plane blocks, erector spinae plane blocks) may offer comparable analgesia with potentially better safety profiles for certain procedures.[7,8]

This case report describes the successful utilization of TEA as the sole anesthetic technique for an open laparotomy and liver biopsy in a high-risk male patient with metastatic breast cancer, extensive pulmonary and hepatic metastases, and significant malignant pleural effusion. We detail the preoperative assessment, anesthetic management strategy, intraoperative course, and postoperative outcome, highlighting the feasibility and potential benefits of TEA in navigating the complex perioperative challenges posed by such a patient profile. The case underscores the importance of individualized anesthetic planning in high-risk oncological surgery, weighing the benefits and risks of different techniques to optimize patient safety and facilitate surgical intervention.[9,10] This study aimed to illustrate the feasibility and potential benefits of utilizing thoracic epidural anesthesia as a primary anesthetic technique to avoid general anesthesia during upper abdominal surgery in a patient with advanced metastatic breast cancer and significant cardiorespiratory comorbidities, including malignant pleural effusion and hepatic metastases.

2. Case Presentation

A 65-year-old male patient presented to the Emergency Department of Arifin Achmad General Hospital, Pekanbaru, Indonesia, with a chief complaint of progressively worsening upper right abdominal pain over the preceding two months. The pain intensity had significantly increased in the week prior to presentation, was exacerbated by physical activity, and showed poor response to standard analgesics. Associated symptoms included nausea and shortness of breath.

The patient carried a known diagnosis of breast cancer with a history of prior chemotherapy treatment. He also reported experiencing black stools for the past week, suggesting possible gastrointestinal bleeding, although specific investigations for this were not detailed beyond initial lab work. He denied symptoms of jaundice. A history of cough was noted, which had reportedly improved prior to admission. Importantly, he had a history of recurrent pleural effusion managed previously with an indwelling pleural catheter (IPC), which had been removed approximately three months before this admission.

On initial physical examination, the patient appeared weak but was alert and oriented (compos mentis). He exhibited signs of respiratory distress, including tachypnea (respiratory rate 28 breaths/min) and dyspnea, finding more comfort in a semi-recumbent position. Auscultation of the chest revealed decreased vesicular breath sounds over the right lung field. Preoperative vital signs were: blood pressure 105/67 mmHg, pulse rate 98 beats/min, respiratory rate 28 breaths/min, temperature 37.1°C, and peripheral oxygen saturation (SpO_2) of 93-94% while breathing room air.

Laboratory investigations revealed several pertinent findings: mild anemia (Hemoglobin 11.3 g/dL), moderate thrombocytopenia (Platelets 106,000/µL), slightly prolonged prothrombin time (PT 16.6 seconds, INR 1.36), elevated blood urea nitrogen (BUN 67 mg/dL) suggesting possible dehydration or renal impairment, normal creatinine (1.1 mg/dL), and elevated liver enzymes (AST 78 U/L, ALT 43 U/L), consistent with hepatic involvement. Electrolytes were reported within normal limits. Initial chest radiography confirmed a significant right-sided pleural effusion, estimated to reach the T4 vertebral level or the 4th-5th intercostal space (ICS) (Figure 1), along with findings suggestive of underlying pulmonary pathology. The cardiac silhouette appeared normal. An abdominal computed tomography (CT) scan provided further crucial information, confirming the presence of hepatic metastases and pulmonary metastases. The CT also characterized the right pleural effusion as a "trapping effusion" associated with pleural wall thickening and irregularities, consistent with malignancy-related changes (Figure 2). Additionally, inferior displacement of the right hepatic lobe was noted, likely due to the mass effect from the effusion or hepatic enlargement. Based on these comprehensive assessments, the diagnosis was established as right breast cancer with metastases to

the lungs, liver, and spine, complicated by improving pneumonia, thrombocytopenia, and the large recurrent MPE. The patient was classified as American Society of Anesthesiologists (ASA) physical status III (Table 1).

Table 1. Summary of patient's clinical findings.

Category	Finding	Details / Specifics
Demographics	Age & Gender	65-year-old Male
	Occupation	Retired Civil Servant
	Marital Status	Married
Anamnesis (History)	Chief Complaint	Worsening upper right abdominal pain (Duration: 2 months, worsened last week. Exacerbated by activity, poor response to analgesics. Associated nausea and shortness of breath).
	History of Present Illness	Besides pain/nausea/dyspnea, also reported melena (black stools) for 1 week. Denied jaundice. History of cough which had improved.
	Past Medical History	**Malignancy:** Known breast cancer (Invasive Ductal Carcinoma, ER/PR+, HER2-) with prior chemotherapy. Confirmed metastases to lungs, liver, spine. **Pulmonary:** Recurrent pleural effusion, previously managed with IPC (removed ~3 months prior). Improving pneumonia.
Physical examination (Preoperative)	General Appearance	Weak appearance, alert and oriented (Compos Mentis). Comfortable in semi-recumbent position.
	Vital Signs (Initial)	BP: 105/67 mmHg; Pulse: 98 bpm; RR: 28/min; Temp: 37.1°C; SpO_2: 93-94% (Room Air)
	Vital Signs (Post-WSD)	BP: 125/78 mmHg; Pulse: 102 bpm; RR: 24-26/min; SpO_2: 94-95% (Room Air)
	Respiratory Exam	Signs of dyspnea, rapid/shallow breathing. Decreased vesicular sounds right lung. Accessory muscle use minimal post-WSD, improved air entry right post-WSD but still reduced vs left.
	Cardiovascular Exam	Regular rhythm, normal S1/S2, no murmurs or gallops noted.
	Abdominal Exam	RUQ tenderness, no guarding/rebound. Bowel sounds present/hypoactive. No definite palpable mass/organomegaly besides reported inferior liver displacement.
Laboratory findings	Hematology	Hb: 11.3 g/dL (Mild Anemia); Platelets: 106,000 /µL (Moderate Thrombocytopenia)
	Coagulation	PT: 16.6 sec; INR: 1.36; APTT: 26.2 sec
	Renal Function	BUN: 67 mg/dL (Elevated); Creatinine: 1.1 mg/dL (Normal)
	Liver Function Tests	AST: 78 U/L (Elevated); ALT: 43 U/L (Elevated)
	Electrolytes	Within normal limits (Na 138, K 4.1, Cl 102 mEq/L)
Imaging findings	Chest X-Ray (Pre-WSD)	Right pleural effusion (up to T4 level / 4th-5th ICS). Normal cardiac silhouette.
	Chest X-Ray (Post-WSD)	Improved lung expansion on the right.
	Abdominal CT scan	Findings: Hepatic metastasis; Pulmonary metastasis; Right trapping pleural effusion (pleural wall thickening/irregularities); Inferior displacement right hepatic lobe.
Clinical diagnosis	Primary Diagnosis	Right Breast Cancer with Metastases (Lungs, Liver, Spine)
	Complicating Factors	Recurrent Malignant Pleural Effusion (Right); Improving Pneumonia; Thrombocytopenia
	ASA Physical Status	ASA III
	Planned Procedure	Laparotomy for Liver Biopsy

Notes: Abbreviations: ASA = American Society of Anesthesiologists; AST = Aspartate Aminotransferase; ALT = Alanine Aminotransferase; BP = Blood Pressure; BUN = Blood Urea Nitrogen; CT = Computed Tomography; Hb = Hemoglobin; ICS = Intercostal Space; INR = International Normalized Ratio; IPC = Indwelling Pleural Catheter; PT = Prothrombin Time; RR = Respiratory Rate; RUQ = Right Upper Quadrant; SpO_2 = Peripheral Oxygen Saturation; Temp = Temperature; WSD = Water-Seal Drainage.

To alleviate the patient's respiratory distress and optimize his condition for surgery, a water-seal drainage (WSD) chest tube was inserted preoperatively. This procedure successfully drained 1200 mL of clear, yellow pleural fluid. Following drainage, the patient's vital signs showed some improvement: blood pressure rose to 125/78 mmHg, pulse rate slightly increased to 102 beats/min, respiratory rate decreased to 24-26 breaths/min, and SpO_2 improved slightly to 94-95% on room air. A post-WSD chest X-ray confirmed lung re-expansion, although underlying parenchymal abnormalities (metastases) remained visible (Figure 1). The Digestive Surgery Department planned an open laparotomy for liver biopsy to obtain tissue for pathological analysis, crucial for determining further oncological treatment strategies.

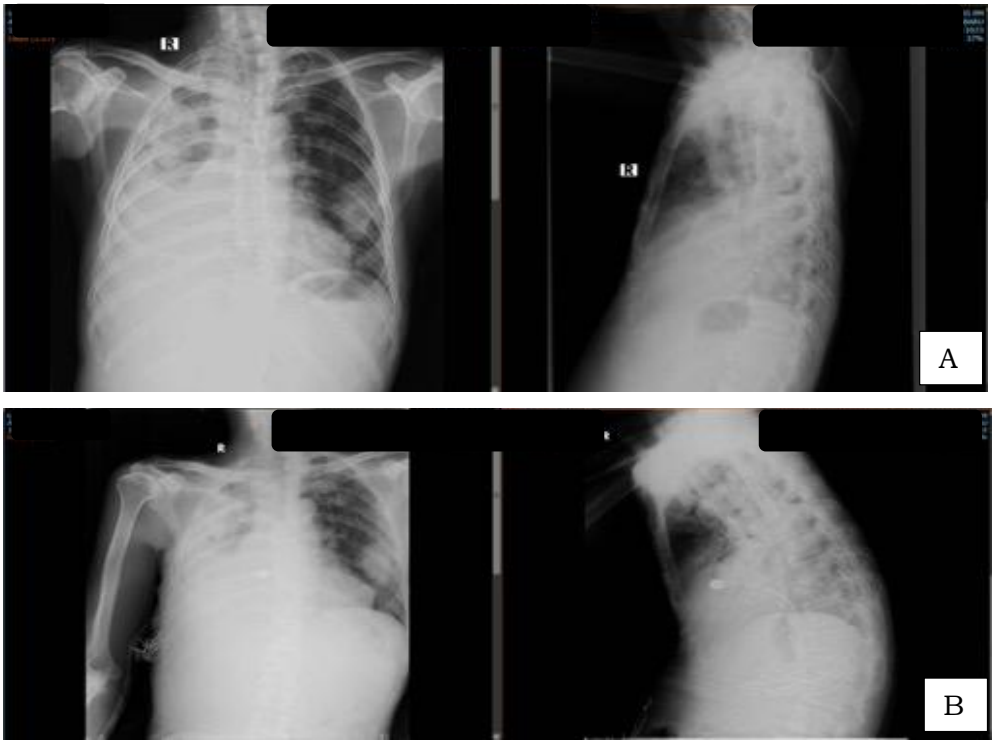

Figure 1. Chest X-ray imaging. (A) Pre-WSD insertion; (B) post-WSD insertion.

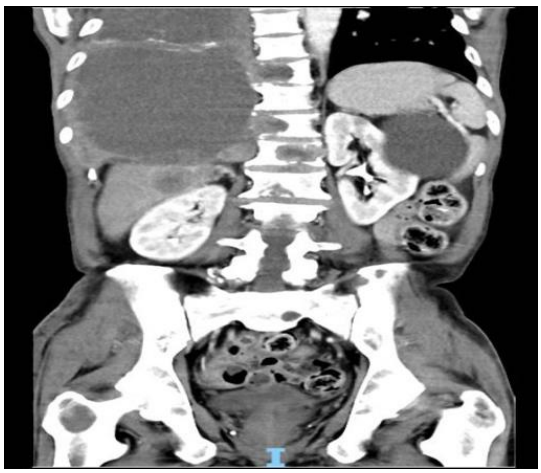

Figure 2. Abdominal CT scan.

Given the patient's high-risk status, significant pulmonary compromise despite WSD placement, and the nature of the upper abdominal surgery, a decision was made to proceed with TEA as the sole anesthetic technique, aiming to avoid the potential complications of GA and mechanical ventilation. The patient was instructed to fast for 6 hours preoperatively. Premedication consisting of ondansetron 4 mg and ranitidine 50 mg was administered intravenously approximately 1 hour before the procedure. In the operating room, standard ASA monitoring was applied, including non-invasive blood pressure (NIBP), electrocardiography (ECG), and pulse oximetry (SpO_2). Supplemental oxygen was administered. Prior to epidural placement, the patient received intravenous premedication with midazolam 1 mg for anxiolysis and fentanyl 50 mcg for analgesia and sedation. The epidural catheter insertion was performed with the patient in the sitting position under aseptic conditions. An 18-gauge Tuohy needle was used to access the epidural space via a median approach at the T9-T10 intervertebral space. The epidural space was identified using the loss of resistance (LOR) to saline technique, with LOR encountered after injecting 2-3 mL of saline at a needle depth of 3 cm from the skin. The LOR to saline technique was chosen over air, citing potential complications associated with air, such as pneumocephalus, PDPH, air embolism, and catheter insertion difficulties. The epidural catheter was then advanced 5 cm into the epidural space (tip presumably at 8 cm depth from skin) and secured. A test dose of 3 mL of lidocaine 1.5% combined with epinephrine 1:200,000 was administered through the catheter. Careful observation revealed no signs of intravascular injection (tachycardia, tinnitus) or intrathecal injection (rapid onset of extensive motor block), confirming correct epidural placement. Subsequently, the primary anesthetic dose, consisting of 6 mL of ropivacaine 0.5%, was administered incrementally via the epidural catheter. Prior to the surgical incision, the adequacy of the sensory block was assessed. The block level was confirmed to extend superiorly to the T4 dermatome, deemed sufficient for the planned upper abdominal laparotomy.

The laparotomy and liver biopsy proceeded under TEA. Intraoperatively, the patient remained hemodynamically stable, with vital signs maintained within acceptable limits. No significant intraoperative complications related to the anesthesia or surgery were reported. The surgical procedure lasted approximately 1 hour. Estimated blood loss was minimal, around 80 mL. Intravenous fluids were administered as per standard practice. Following the procedure, the patient was transferred to the general surgical ward for recovery and postoperative care, bypassing the need for intensive care unit (ICU) admission. Postoperative analgesia was presumably managed via the epidural catheter. The patient's hemodynamic status remained stable throughout the postoperative period. His hospital stay was relatively short, lasting 3 days, after which the epidural catheter was removed. He was discharged to continue outpatient management, including further chemotherapy based on the biopsy results.

3. Discussion

This case report details the successful perioperative management of a high-risk, 65-year-old male patient with widely metastatic breast cancer undergoing open laparotomy for liver biopsy, utilizing thoracic epidural anesthesia (TEA) as the sole anesthetic modality. The patient presented a formidable constellation of challenges: advanced malignancy with pulmonary, hepatic, and spinal metastases; significant, recurrent malignant pleural effusion causing respiratory compromise; and the inherent physiological stress of upper abdominal surgery. The decision to employ TEA over general anesthesia (GA) was pivotal and warrants detailed discussion regarding its rationale, technical execution, observed benefits, and potential limitations within the context of current evidence.

Table 2. Summary of treatment procedures and follow-up.

Phase	Procedure / Management area	Details
Preoperative	Pleural Effusion Management	Water-Seal Drainage (WSD) chest tube placed on the right side. Drainage: 1200 mL of clear, yellow fluid obtained initially. Outcome: Improved respiratory status (RR 24-26/min, SpO_2 94-95% on RA post-drainage).
	Pre-Anesthesia Fasting	Patient instructed to fast for 6 hours prior to surgery.
	Premedication (1 hr prior)	Ondansetron 4 mg IV. Ranitidine 50 mg IV.
Intraoperative	Monitoring	Standard ASA monitoring: Non-invasive blood pressure (NIBP), Electrocardiography (ECG), Pulse Oximetry (SpO_2). Supplemental Oxygen via nasal cannula provided.
	Anesthesia Premedication	Midazolam 1 mg IV (anxiolysis). Fentanyl 50 mcg IV (analgesia/sedation).
	Anesthetic Technique	**Thoracic Epidural Anesthesia (TEA) as Sole Anesthetic**
	Epidural Placement	Position: Sitting. Needle: 18G Tuohy. Approach: Median. Interspace: T9-T10. Identification: Loss of Resistance (LOR) to 2-3 mL saline. Needle Depth: 3 cm from skin. Catheter Advancement: 5 cm into epidural space (tip at 8 cm).
	Epidural Test Dose	Agent: Lidocaine 1.5% with Epinephrine 1:200,000. Volume: 3 mL. Result: Negative (confirmed epidural placement).
	Epidural Anesthetic Dose	Agent: Ropivacaine 0.5%. Initial Volume: 6 mL. Sensory Block Level Achieved: T4 dermatome (assessed prior to incision).
	Intraoperative Management	Hemodynamics: Reported as stable throughout the procedure. Fluid Management: Standard IV fluids administered.
	Surgical Procedure	Type: Open Laparotomy with Liver Biopsy. Purpose: Obtain tissue for pathological analysis. Duration: Approximately 1 hour. Estimated Blood Loss (EBL): Approx. 80 mL.
Postoperative	Immediate Post-op Location	Transferred to General Surgical Ward (avoided ICU).
	Analgesia	Epidural analgesia continued. Pain Score: Numeric Rating Scale (NRS) reported as 2-3 during stay.
	Monitoring	Routine vital sign monitoring on the ward. Hemodynamics remained stable.
	Epidural Catheter Management	Catheter maintained for postoperative analgesia. Removed prior to discharge on postoperative day 3.
	Mobilization & Diet	Gradual mobilization starting POD 1, diet advanced as tolerated.
	Wound & Drain Care	Standard surgical wound care; WSD chest tube managed per protocol until removal (timing not specified).
	Length of Stay (LOS)	3 days total postoperative hospital stay.
	Discharge Condition	Stable for discharge.
Follow-up	Immediate Plan	Discharged home to continue outpatient treatment.
	Oncological Management	Continue chemotherapy based on liver biopsy results (specific regimen/timing determined post-report). Referral back to Oncology.
	Long-Term Surveillance	Regular oncological follow-up, including clinical assessment, tumor markers, and interval imaging per standard protocols for metastatic breast cancer.
	Pain Management	Transitioned to oral analgesics as needed, management plan provided on discharge.

Abbreviations: ASA = American Society of Anesthesiologists; BP = Blood Pressure; EBL = Estimated Blood Loss; ECG = Electrocardiography; ICU = Intensive Care Unit; IV = Intravenous; LOS = Length of Stay; LOR = Loss of Resistance; NIBP = Non-Invasive Blood Pressure; NRS = Numeric Rating Scale; POD = Postoperative Day; RA = Room Air; RR = Respiratory Rate; SpO_2 = Peripheral Oxygen Saturation; TEA = Thoracic Epidural Anesthesia; WSD = Water-Seal Drainage.

The decision to employ thoracic epidural anesthesia (TEA) as the principal anesthetic modality in this complex case was predicated fundamentally upon the patient's profoundly compromised pulmonary status, a condition representing the most immediate and significant threat to perioperative safety. This patient presented a challenging confluence of factors severely limiting his respiratory reserve: intrinsic parenchymal disease secondary to confirmed pulmonary metastases, further compounded by the mechanical constraints imposed by a large, recurrent malignant pleural effusion (MPE). Although preoperative intervention via water-seal drainage successfully evacuated a substantial volume (1200 mL) of pleural fluid, providing demonstrable, albeit modest, improvements in respiratory rate and peripheral oxygen saturation, the patient's baseline SpO_2 remained suboptimal at 94-95% while breathing ambient air. This persistent hypoxemia underscored the severity of the underlying gas exchange impairment, likely stemming from a combination of ventilation-perfusion mismatch, intrapulmonary shunting through non-ventilated metastatic lesions, and potentially reduced functional residual capacity (FRC) due to pleural thickening or 'trapped lung' phenomena sometimes associated with chronic MPE. Such a precarious respiratory baseline rendered the patient exceptionally vulnerable to any further physiological insult, particularly the well-documented negative impacts of major upper abdominal surgery and general anesthesia on pulmonary mechanics.[11,12]

In this context, the selection of general anesthesia (GA) coupled with endotracheal intubation and positive pressure ventilation (PPV) was deemed to carry an unacceptably high risk profile. While GA/PPV remains a cornerstone for facilitating complex surgical procedures requiring muscle relaxation and absolute airway control, its application in patients with pre-existing severe pulmonary pathology is fraught with potential complications. The imposition of PPV, particularly in lungs already stiffened or heterogeneous due to metastatic infiltration and pleural disease, significantly elevates the risk of ventilator-induced lung injury (VILI). VILI encompasses a spectrum of iatrogenic damage, including barotrauma (injury from excessive pressure), volutrauma (injury from excessive volume/overdistension), atelectrauma (injury from cyclical opening and closing of unstable alveolar units), and biotrauma (release of inflammatory mediators triggered by injurious mechanical stress). These processes can exacerbate existing lung injury, impair gas exchange further, and potentially lead to acute respiratory distress syndrome (ARDS). Furthermore, the volatile anesthetics, intravenous induction agents, and opioids integral to GA regimens possess inherent respiratory depressant effects, blunting hypoxic and hypercapnic drives and impairing protective airway reflexes, which can delay emergence and increase the risk of postoperative hypoventilation. The presence of an endotracheal tube bypasses natural airway humidification and defense mechanisms, increasing susceptibility to nosocomial infections, including ventilator-associated pneumonia (VAP) – a major source of morbidity and mortality in ventilated patients. Perhaps most critically in this scenario, the likelihood of difficult or prolonged weaning from mechanical ventilation postoperatively was considered substantial. Factors contributing to weaning failure in such patients include the underlying restrictive and obstructive pathophysiology, potential diaphragmatic dysfunction exacerbated by surgery and anesthesia, surgery-induced systemic inflammation, fluid shifts, and the catabolic state associated with advanced cancer, all conspiring against the successful resumption of spontaneous, unassisted ventilation.

Therefore, a strategy centered on completely avoiding endotracheal intubation and PPV offered compelling advantages. TEA, when administered as the sole anesthetic, allows the patient to maintain spontaneous respiration throughout the surgical procedure. This preserves the physiological benefits of negative pressure ventilation, promotes more homogenous gas distribution compared to PPV (particularly in diseased lungs), maintains

diaphragmatic function (which can be impaired by neuromuscular blockade used in GA), and mitigates the risks directly associated with instrumentation of the airway and mechanical lung stress. Circumventing the need for an artificial airway eliminates the risks of laryngeal injury, tracheal stenosis, and significantly reduces the likelihood of developing VAP.[13,14]

The selection of TEA was not merely an exercise in risk avoidance; it offered distinct positive attributes highly suited to the demands of this case. Thoracic epidural blockade provides highly effective, targeted analgesia by blocking nociceptive transmission at the spinal cord level across the specific dermatomes relevant to the surgical field. By administering local anesthetics, often combined with low-dose opioids, into the thoracic epidural space (T9-T10 in this instance, achieving a T4 sensory level), profound somatic and visceral analgesia encompassing the upper abdomen and lower thorax can be achieved. This level of pain control is frequently superior to that provided by systemic opioids alone, particularly during movement or coughing postoperatively. Crucially, this profound analgesia can be achieved without inducing deep sedation or requiring the neuromuscular paralysis characteristic of GA. The patient remains conscious, cooperative (albeit lightly sedated with premedication), and breathing spontaneously, while surgical conditions are facilitated by the dense sensory block and some degree of abdominal muscle relaxation from motor nerve involvement, depending on the local anesthetic concentration used.[15,16]

Beyond analgesia and preservation of spontaneous ventilation, TEA confers additional systemic benefits. The blockade of sympathetic efferent fibers within the targeted spinal segments leads to a measurable attenuation of the neuroendocrine stress response to surgical trauma. This includes a reduction in the release of key stress hormones like cortisol and catecholamines, potentially lessening the extent of perioperative hyperglycemia, catabolism, and immunosuppression often triggered by major surgery. By modulating the sympathetic nervous system, TEA may also favorably influence the inflammatory cascade, potentially reducing the systemic release of pro-inflammatory cytokines implicated in postoperative organ dysfunction. Furthermore, the reduced reliance on systemic opioids minimizes their associated side effects, such as sedation, respiratory depression, nausea and vomiting (PONV), pruritus, and delayed bowel function (ileus) – all of which can impede recovery and prolong hospital stay. Improved gut motility, often observed with TEA due to sympathetic blockade allowing parasympathetic predominance, is particularly beneficial after abdominal surgery.

An intriguing, though still debated, aspect relates to the potential influence of anesthetic technique on long-term oncological outcomes. Several hypotheses propose mechanisms by which regional anesthesia, including TEA, might be beneficial. These include the attenuation of surgical stress-induced immunosuppression (which could theoretically inhibit metastatic spread), the opioid-sparing effect (as opioids themselves may have some immunosuppressive properties or promote tumor growth in preclinical models), and potential direct anti-tumor effects of local anesthetics observed in vitro. However, robust clinical evidence confirming a significant impact of regional anesthesia on cancer recurrence or long-term survival remains largely elusive. Large randomized controlled trials comparing regional versus general anesthesia techniques have yielded conflicting or inconclusive results, often hampered by methodological heterogeneity. Consequently, while this potential benefit provides an interesting avenue for ongoing research, it cannot currently serve as a primary justification for choosing regional anesthesia over GA in cancer surgery.[17,18]

In the specific context of this patient, the decision-making process was firmly anchored in the principle of immediate perioperative risk mitigation. The overarching goal was to ensure the patient's safety through a critical, albeit diagnostic, surgical intervention by minimizing the substantial and clearly identifiable risks of postoperative pulmonary

complications associated with GA/PPV in the setting of his severely compromised respiratory system. The successful execution of the laparotomy under sole TEA, with subsequent stable recovery and avoidance of respiratory deterioration, validates this tailored anesthetic approach as a prudent and effective strategy in navigating the formidable challenges presented by this high-risk oncological case. It underscores the value of individualized anesthetic planning, leveraging the specific physiological benefits of TEA to navigate complex comorbidities and facilitate essential surgical care.

The epidural catheter was placed at the T9-T10 interspace using a median approach. While the paramedian approach is sometimes favored for thoracic epidurals due to spinous process angulation, the median approach remains a viable option, particularly at lower thoracic levels where angulation is less acute. The use of the LOR to saline technique is standard practice, preferred by many practitioners over air due to concerns about potential complications like intravascular air embolism or pneumocephalus, although LOR to air is also widely used. Achieving a T4 sensory block with an initial dose of 6 mL of 0.5% ropivacaine from a T9-T10 insertion site indicates appropriate cephalad spread of the local anesthetic, providing adequate anesthesia for the upper abdominal incision and exploration. Ropivacaine 0.5% provides dense sensory and motor blockade suitable for surgical anesthesia. The reported stable intraoperative hemodynamics suggest that the sympathetic blockade, while extensive (up to T4), was well-tolerated, likely managed with appropriate fluid administration and potentially low-dose vasopressors if needed. This contrasts with potential concerns about significant hypotension with high thoracic blocks. The relatively short duration of surgery (1 hour) also likely contributed to the smooth intraoperative course.

The presence of both MPE and hepatic metastases significantly influenced the perioperative risk profile. MPE management primarily focuses on symptom palliation (dyspnea relief) and fluid control. Preoperative drainage via WSD was crucial in improving the patient's respiratory mechanics before surgery. However, the underlying pleural malignancy and pulmonary metastases remained, posing an ongoing risk for postoperative respiratory deterioration. Avoiding GA and mechanical ventilation via TEA directly addressed this risk. Hepatic metastases, while the target of the biopsy, also imply potential hepatic dysfunction (reflected partly in elevated liver enzymes) and potential coagulopathy (mildly elevated INR), although the patient's thrombocytopenia was moderate. TEA itself does not directly impact hepatic function, but the choice of local anesthetic (ropivacaine) is appropriate, as it undergoes hepatic metabolism but generally has a good safety profile. Careful consideration of coagulation status is always paramount before performing neuraxial blockade; the patient's platelet count (106,000/μL) and INR (1.36) were borderline but likely considered acceptable for epidural placement in this clinical context, although institutional guidelines vary.[19,20]

The successful use of TEA as a sole anesthetic for major abdominal surgery, particularly in high-risk patients, is supported by literature, although it often requires careful patient selection and experienced practitioners. Many centers might prefer combined GA-TEA or GA with alternative regional blocks for upper abdominal laparotomy. ESP blocks, for instance, are gaining popularity due to their perceived technical ease and safety profile, potentially providing good visceral and somatic analgesia with fewer risks of sympathetic blockade and motor weakness compared to TEA. However, the reliability and extent of visceral block with ESP for major open abdominal surgery compared to TEA is still under investigation. Given the goal of completely avoiding GA and intubation in this severely compromised patient, TEA offered the most reliable and established method for providing adequate surgical anesthesia as a sole technique. The postoperative course, with stable hemodynamics, effective analgesia (NRS 2-3), avoidance of ICU admission, and a short hospital stay

(3 days), further supports the appropriateness of the chosen strategy in this instance. While the anesthetic management principles remain similar regardless of gender, the rarity of male breast cancer (MBC) is noteworthy. MBC accounts for less than 1% of all breast cancers. It often presents at a later stage than in females, potentially due to lower awareness and screening, and frequently involves hormone receptor positivity. Treatment often involves mastectomy, systemic chemotherapy, radiation, and endocrine therapy, extrapolated largely from female breast cancer protocols. The presence of metastatic disease in this patient underscores the advanced stage often encountered in MBC.

4. Conclusion

This case demonstrated the successful and safe application of thoracic epidural anesthesia as the sole anesthetic technique for open laparotomy and liver biopsy in a high-risk, 65-year-old male patient burdened with metastatic breast cancer, extensive pulmonary and hepatic metastases, and significant malignant pleural effusion. TEA provided adequate surgical anesthesia and effective postoperative analgesia while maintaining hemodynamic stability and, crucially, avoiding the need for general anesthesia and endotracheal intubation in a patient with severely compromised respiratory function.

The perioperative management of complex oncological patients demands meticulous assessment and individualized anesthetic planning. In select patients with significant pulmonary comorbidities undergoing major abdominal surgery, TEA can be a valuable tool, offering potential advantages in reducing postoperative pulmonary complications and facilitating recovery. While technically demanding and carrying inherent risks, careful execution by experienced practitioners can provide significant benefits, particularly when avoidance of general anesthesia is a primary goal. This case contributes to the understanding of anesthetic options in challenging oncological scenarios, supporting the consideration of TEA as a primary anesthetic modality in appropriately selected high-risk patients. Further research, including comparative studies with alternative regional techniques like ESP blocks in similar patient populations, is warranted.

5. References

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