

CASE REPORT

Intraoperative considerations in a patient with chondroblastic osteosarcoma and saddle pulmonary embolism undergoing amputation

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Abstract

In patients presenting to the operating room with a saddle pulmonary embolism for noncardiac surgery, it is best to take a multidisciplinary approach and involve the cardiac and vascular surgeons.

KEYWORDS

chondroblastic osteosarcoma, extracorporeal membrane oxygenation (ECMO), saddle embolus, transesophageal echo

1 | INTRODUCTION

Chondroblastic osteosarcoma involving the cardiovascular system is rarely described in the literature.¹ We present the case of a 21-year-old man with chondroblastic osteosarcoma of the right proximal humerus causing deep venous thrombosis of the right internal jugular and brachial veins with a large thrombus extending into the superior vena cava (SVC), inferior vena cava (IVC), right atrium (RA), and bilateral pulmonary arteries (PA). He presented to the hospital with a large saddle embolus pulmonary embolism. He was later taken to the operating room for amputation at the level of the right shoulder. Cardiac surgery was consulted preoperatively for evaluation and intraoperative assistance.

Chondroblastic osteosarcoma is the most common bony malignancy in children, adolescents, and young adults and typically presents in the first and second decades of life. Its most common metastatic location is the lungs and bones and rarely involves the cardiovascular system.¹ Chondroblastic osteosarcoma represents approximately 25% of all osteosarcoma diagnoses, and its diagnosis is based on the predominance of a chondroid matrix within the neoplastic cells.² Patients diagnosed with osteosarcoma typically present with

pain and swelling, and the diagnosis can be easily delayed due to other suspected and much more benign disease processes such as trauma, arthritis, or growing pains.³ Osteosarcoma is typically graded as low grade, high grade, or metastatic.⁴ High-grade/metastatic osteosarcoma is typically treated with chemotherapy prior to surgical resection if applicable.⁵ In localized nonmetastatic disease, the long-term survival is 70%-75% but it drops to only 30% when it is invasive or has metastatic lesions.⁶

The use of intraoperative transesophageal echo (TEE) in noncardiac surgery is growing as anesthesiologists have identified other applications and benefits. TEE as a monitoring modality apart from cardiac surgery is a fast and minimally invasive approach to obtaining real-time vital information regarding the patient's hemodynamics and pulmonary function.⁷ TEE allows for quick detection of sudden intraoperative changes allowing for efficient treatment. American Society of Anesthesiologists has recently updated the guidelines for intraoperative TEE and stated that perioperative TEE may benefit those with known or suspected cardiovascular compromise, pulmonary hypertension, persistent hypotension, persistent hypoxemia, and major thoracic or abdominal trauma.⁸

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At our institution, TEE for noncardiac surgery is typically used when there is a high probability hemodynamic instability from both blood loss and thrombotic events. To be set up for the best patient outcome, it is extremely important to take a multidisciplinary approach involving multiple surgical teams.

2 | CASE DESCRIPTION

A 21-year-old man with no significant past medical history initially presented to an outside hospital with right shoulder pain and swelling for the past five months and was treated with toradol and sent home. After no improvement in symptoms, he presented to our institution and was fully worked up and was found to have massive $23.5 \times 23.2 \times 21.1$ cm lesion of his right proximal humerus with lymph node involvement along with multiple metastatic lesions to the right lung. Given the size and involvement, this was presumed to be a chondroblastic osteosarcoma. After initial diagnosis, he was started on doxorubicin and cisplatin. During the course of chemotherapy, he developed chest pain and shortness of breath. In the hospital, he was found to have deep venous thrombosis in his right internal jugular and brachial veins and was started on therapeutic lovenox. He re-presented with worsening back and chest pain and worsening shortness of breath and was found to have a large saddle pulmonary embolus on computed tomography. He was then admitted to the intensive care unit and started on a heparin infusion. Following admission, echocardiogram demonstrated a thrombus in the superior vena cava (SVC), inferior vena cava (IVC), and right atrium extending into the bilateral pulmonary arteries with no flow seen into the left pulmonary artery. The right ventricle was moderately dilated, and function was reduced. Cardiothoracic and vascular surgery teams were consulted for possible open versus endovascular thrombectomy but due to the disease process and poor prognosis, no operative intervention was offered by these two services.

Due to severe pain and compression of the vasculature, the decision was made to proceed with amputation of the right arm at the level of the shoulder. Prior to the operation, a multidisciplinary meeting involving orthopedic surgery, cardiothoracic surgery, and anesthesiology was held to discuss best approach for the operation. Because of the high possibility of dislodgement of the intracardiac and pulmonary thrombus, it was decided to have cardiothoracic surgery involved in the case.

The patient was brought into the operating room and underwent an uneventful induction with lidocaine, etomidate, fentanyl, and rocuronium. After induction, a femoral central line was placed, and the cardiac surgeons placed guidewires in both the femoral artery and vein prior to the beginning

of the procedure. The guidewires were placed to facilitate extracorporeal membrane oxygenation (ECMO) cannulation in case the patient decompensated during the surgery. Femoral approach was chosen because of thrombosis of the SVC. Intraoperative TEE demonstrated a large clot extending from the SVC into the right atrium and right ventricle and into the pulmonary artery (Figure 1). Of note, the left brachial peripherally inserted central line (PICCF) extended into the right atrium and was likely incorporated into the large clot (Figure 2). During the procedure, the patient received

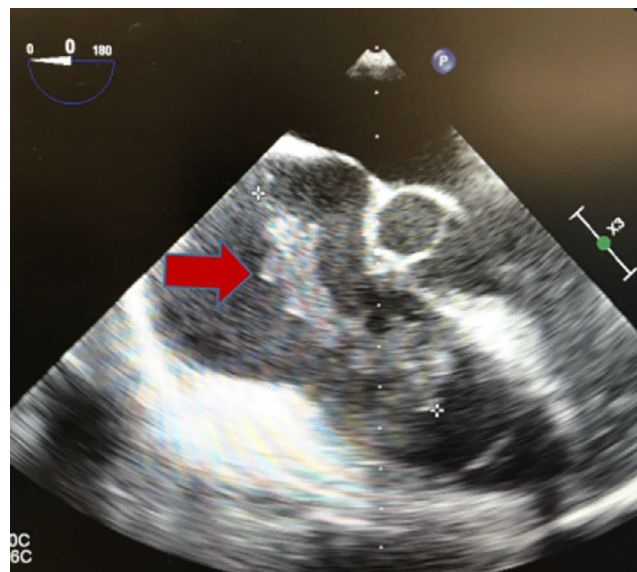


FIGURE 1 Midesophageal 4-chamber view of TEE showing large clot (red arrow) extending from the right atrium across the tricuspid valve and into the right ventricle

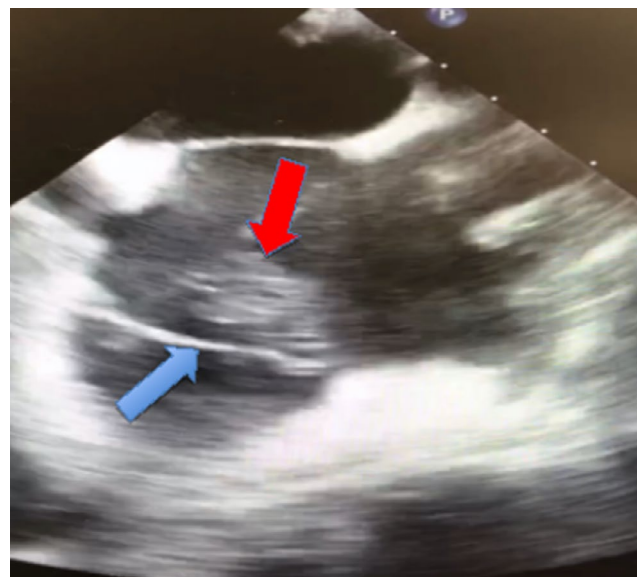


FIGURE 2 Midesophageal bicaval view of TEE showing PICC line (blue arrow) extending into the right atrium and a large thrombus (red arrow) attached to the tip of the PICC line

5 units of packed red blood cells and 3 units of fresh frozen plasma due to significant blood loss but remained hemodynamically stable throughout. The procedure was successful without further embolic event. Following the surgery, he was left intubated and was taken to the ICU for management. The patient was extubated on the following day, and PICC line was successfully removed without dislodging the intracardiac thrombus. He was sent to the floor on postoperative day 3.

3 | DISCUSSION

Our case echoes the literature on age, location, and presenting signs of chondroblastic osteosarcoma. Osteosarcoma is relatively rare but highly malignant. The proximal humerus is a common site for the primary osteosarcoma on the upper extremity, being the third most affected site after the distal femur and proximal tibia.⁹ It has an estimated incidence of three cases per million per year and typically presents in the first or second decade of life and primarily affects the long bones. Osteosarcoma incidence is slightly more in males and peaks in the second decade of life.⁹

Based on the etiology of the disease, compression of the venous system can occur and in conjunction with the pro-coagulant state caused by many malignancies. The risk of venous thrombosis and pulmonary embolism (PE) is increased up to sevenfold in patients with cancer.¹⁰ The overall incidence for venous thromboembolism with Osteosarcoma is more common compared to other sarcomas (17%), behind only malignant peripheral nerve sheath tumor (27%). In osteosarcoma patients, thromboembolism is more frequently located in the lower extremities and typically occurs in older patients.¹¹ Chemotherapy also appears to be a significant contributor to the risk of venous thromboembolism (VTE); however, the low incidence of chemotherapy-associated VTE in osteosarcomas and the low associated mortality does not point to routine prophylaxis.¹¹

Venous thromboembolism and pulmonary embolism in cancer patients can be prevented with the use of anticoagulation, especially in high-risk patients.¹⁰ Alteplase (tPA) is the only thrombolytic approved for the treatment of PE in the United States and is currently used for the treatment of PE with hemodynamic instability.¹²

This case demonstrates the importance of multidisciplinary preoperative planning as well as the role TEE can play in intraoperative management.

Intraoperative pulmonary embolism carries an overall mortality of ~15%, and with massive pulmonary embolism leading to cardiac arrest, the mortality rate is at ~50%.¹³ TEE plays an integral part of the intraoperative management and offers a real-time, rapid, and reliable diagnosis in the event the patient becomes unstable.

A literature search was performed with one case series reviewing images of osteosarcoma invasion of the cardiovascular system, but no mention was made of the anesthetic and intraoperative management.¹ The use of ECMO following massive pulmonary embolism with cardiac arrest has been found to be beneficial and potentially lifesaving.¹⁴ However, patient position along with the difficulty of groin cannulation in a hemodynamically unstable patient would jeopardize the rate of success of this approach. The decision was made to have cardiovascular surgery access the femoral artery and vein following induction but before the procedure began. The patient was positioned allowing rapid cannulation and establishment of ECMO in case of thrombotic event occluding the pulmonary artery. In using this approach, cardiovascular surgery, perfusionist team, and ECMO machine will need to remain on standby if ECMO is needed. During the operation, there were no major inciting events and ECMO was not needed but our anesthetic and surgical teams were prepared for many possible scenarios.

4 | CONCLUSION

In patients presenting to the operating room with a saddle pulmonary embolism for noncardiac surgery, it is best to take a multidisciplinary approach and involve the cardiac and vascular surgeons for the possibility of needing ECMO support in the case of total pulmonary occlusion by the thrombus. In the event of total pulmonary occlusion, ECMO can be lifesaving. The use of intraoperative TEE is an invaluable tool to the anesthesiologist and can be used for rapid assessment of cardiac function and pulmonary blood flow.

ETHICS APPROVAL

The patient gave permission to the authors to use the images and to publish the case report.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

William B. Smisson, MD, participated in the case study, wrote the original manuscript, and edited and reviewed the final manuscript. Henrique Vale, MD, participated in the case study, helped write the original manuscript, and edited and reviewed the final manuscript. Bryan Hierlmeier, MD, participated in the case study, and edited and reviewed the final manuscript. Arvind Chandrasekhar, MD, participated in the case study.

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