

## Off-pump pulmonary embolectomy: a complication of shoulder amputation

### *Pompasız pulmoner embolektomi: Bir omuz amputasyonu komplikasyonu*

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Acute tumor embolism complicating the course of elective shoulder amputation for high grade pleomorphic rhabdomyosarcoma caused intraoperative cardiac arrest and was salvaged successfully by emergency pulmonary embolectomy without utilizing cardiopulmonary bypass.

**Key words:** Echocardiography; embolectomy; pulmonary artery; pulmonary embolism/diagnosis/etiology/surgery.

Yüksek dereceli pleomorfik rabdomiyosarkom için gerçekleştirilen elektif omuz amputasyonunu komplike eden akut tümör embolisi ameliyat sırası kardiyak areste neden olmuş ve kardiyopulmoner baypas kullanılmadan acil pulmoner embolektomi ile temizlenmiştir.

**Anahtar sözcükler:** Ekokardiyografi; embolektomi; pulmoner arter; pulmoner emboli/tanı/etyoloji/cerrahi.

The incidence of tumor embolism has been reported to vary from 0.9% to 2.4% in two retrospective autopsy studies.<sup>[1]</sup> However, intraoperative embolization of large tumor fragments to the heart and lungs occurs very infrequently. Should a massive tumor embolus occur, survival is rare.<sup>[2]</sup> Successful management of intraoperative pulmonary embolisms has been reported utilizing cardiopulmonary bypass (CPB).<sup>[3-6]</sup>

An off-pump pulmonary embolectomy<sup>[7]</sup> is rarely performed in acute situations. The decision-making process is obviously influenced by multiple factors, particularly in the setting of extensive tumor surgery where systemic heparinization can be of great concern to the primary team.

We report a case of an acute, intraoperative, massive pulmonary tumor embolism which occurred during resection of a pleomorphic rhabdomyosarcoma of the right shoulder and caused cardiac arrest. An off-pump pulmonary embolectomy was performed as an emergency procedure while open cardiac massage was in progress. The patient was discharged from the hospital three months after surgery.

### CASE REPORT

A 30-year-old male suffering from recurrent high-grade pleomorphic rhabdomyosarcoma of the right shoulder

region underwent resection of his tumor followed by adjuvant chemotherapy and radiotherapy. His tumor showed no response to neoadjuvant chemotherapy prior to his first surgery in the past. Being mindful of the nature of his tumor, its recurrence despite clear surgical margins in previous surgery, and the patient's poor response to chemotherapy, he was scheduled for an elective four-quadrant amputation of his right upper limb. A preoperative computed tomography (CT) scan of the chest confirmed a tumor thrombus in the right subclavian vein and superior vena cava, but distant metastases were ruled out with appropriate investigations, and the patient underwent surgery. Under general anesthesia with endotracheal intubation in the supine position, the patient was positioned in the semi-left lateral position for maximum access to the right upper limb and shoulder region. Resection was planned through an extensive incision encircling the shoulder region. The tumor mass was removed from the subclavian vein as much as permissible, but due to an inadvertent injury to the vein during the procedure, formal exploration was not performed, and the vein was repaired to achieve hemostasis. After completion of the tumor resection, the patient went into cardiac arrest while being repositioned to the supine position. Cardiopulmonary resuscitation was initiated. After transient response to volume and inotropes, he

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remained severely hypotensive and needed intermittent boluses of epinephrine. An urgent cardiology consult was requested, and transesophageal echocardiography (TEE) was arranged which confirmed a large tumor thrombus in the main pulmonary artery with severe right ventricular impairment. The patient developed bradycardia and arrested again with no cardiac output while TEE was still being performed. Chest compressions were started, and a cardiac surgical team was summoned for urgent help. An emergency sternotomy along with a pulmonary embolectomy were performed by the cardiac surgical team without utilizing CPB while open cardiac massage was in progress. Because of hemorrhage from the wide tumor resection site, heparin was not used. The main pulmonary artery was opened longitudinally between two hanging sutures of 4/0 prolene. Two suction tips connected to a cell saver were utilized to keep the surgical field dry and prepare the patient's blood for re-transfusion. A large tumor thrombus (Figure 1) was found in the main pulmonary artery extending into the right pulmonary artery. The hemodynamics normalized immediately after the removal of the thrombus, and repeat on-table TEE confirmed a patent pulmonary artery with no residual mass. The patient was transferred to the intensive care unit with stable hemodynamics and minimal inotropic support. The postoperative course was complicated by deterioration in renal function and prolonged drowsiness requiring mechanical ventilation and an eventual tracheotomy. A CT scan of the brain was negative for any focal ischemic or embolic insult. Renal and mental function improved gradually with conservative management provided by the nephrology and neurology teams, and the patient was discharged from the hospital three months after surgery.



**Figure 1.** A tumor thrombus removed from the main pulmonary artery.

## DISCUSSION

Survival after massive intraoperative pulmonary embolism is rare,<sup>[2]</sup> particularly if it happens in operating suites which are not equipped for cardiac operations. It is even rarer if cardiac surgical services are not available. Successful management of intraoperative pulmonary embolisms of various origins has been reported utilizing CPB.<sup>[3-6]</sup> Off-pump pulmonary embolectomies<sup>[7]</sup> are rarely performed in acute situations where a massive intraoperative pulmonary embolism can cause cardiac arrest and sudden death. On the other hand, waiting for and initiating CPB in non-cardiac operating suites can be counterproductive for logistical reasons. Moreover, the nature and extent of the primary surgery and risk of hemorrhage secondary to systemic heparinization for CPB also influences decision making. Acute intraoperative hemodynamic instability during prolonged operations in a patient with no known cardiac pathology mandates urgent attention. In such situations, prompt and correct diagnosis and targeted treatment are crucial for the salvage and survival of the patient. Mere cardiopulmonary resuscitation with chest compressions, volume, and inotropes may not be effective for too long when the right ventricular outflow tract is mechanically obstructed by large thrombus.

The role of intraoperative TEE for early diagnosis, surgical management, follow-up, and overall decision making in acute situations of hemodynamic compromise in patients with unknown cardiac illnesses is well documented in the literature.<sup>[8,9]</sup> Transesophageal echocardiography was found to be comparable with spiral CT for diagnostic power during hemodynamically significant acute or chronic pulmonary embolism. Although CT was slightly more sensitive than TEE (90% versus 80%), both had a specificity of 100%.<sup>[10]</sup>



**Figure 2.** Transesophageal echocardiography showing a tumor thrombus in the main pulmonary artery.

In acute life-threatening pulmonary embolisms, rapid TEE diagnosis facilitates decision making and may improve the survival rate.<sup>[11]</sup> In our case, TEE was readily available at our institution, and it promptly detected a mass in the pulmonary artery which was highly suspected of being a tumor thrombus (Figure 2). It also showed impaired right ventricle function due to right ventricular outflow tract obstruction secondary to a tumor thrombus. The patient was subjected to an emergency sternotomy while the TEE probe was still in place. Immediate post-thrombectomy TEE confirmed a patent pulmonary artery with no residual mass and improved right ventricular function.

Prompt and targeted treatment is as crucial as an expeditious diagnosis. Decision making should not be delayed, although it may be influenced by multiple factors. Bleeding from the primary surgical site or hematoma formation at the same location can be a major concern due to systemic heparinization if CPB has to be utilized. Moreover, timely arrangement of a facility capable of CPB in non-cardiac surgical operating suites may delay treatment and result in a poor outcome.

Although rare, off-pump pulmonary embolectomies<sup>[7]</sup> have been reported with good results. In our case, an immediate sternotomy and a pulmonary embolectomy were successfully performed without utilizing CPB. Two cell saver devices were utilized concomitantly to maintain reasonable clarity of the surgical field and for salvage of the patient's own blood for immediate re-transfusion. Effective communication between the surgeons, anesthesiologists, perfusionists, cardiologists, and other ancillary operating room staff maintained reasonable hemodynamics while the sternotomy and pulmonary embolectomy were being performed.

An off-pump pulmonary embolectomy can be safely performed if other concerns exist or a CPB facility is not readily available. Prompt diagnosis and targeted treatment with a team approach is crucial for a successful outcome in such scenarios. Transesophageal echocardiography must be considered in cases of acute intraoperative hemodynamic instability of a previously unknown pathology.

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