

## Thromboaspiration for massive pulmonary embolism following open heart surgery

*Açık kalp cerrahisi sonrası gelişen masif pulmoner embolide uygulanan tromboaspirasyon*

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Massive pulmonary embolism (PE) is a common life-threatening condition, requiring rapid recanalization of the pulmonary artery. The standard treatment is systemic thrombolysis. However, approximately one third of the patients are not suitable for thrombolysis due to major contraindications. When thrombolysis is not indicated or unsuccessful, catheter thrombectomy with thromboaspiration or open surgical embolectomy can be applied as an alternative treatment option. In this article, we present a case of massive PE developed in the early postoperative period following coronary artery bypass graft surgery. The patient was admitted to the hospital with dyspnea and clinically deteriorated in hours. The patient recovered after a thromboaspiration procedure.

**Key words:** Open heart surgery; pulmonary embolism; thromboaspiration.

Massive pulmonary embolism (PE) is a common life-threatening condition. It has a 30-day mortality rate approaching 30%, and the majority of deaths occur within one hour of presentation.<sup>[1]</sup>

Survival depends on rapid recanalization of the pulmonary arterial occlusion to reduce right ventricular afterload and prevent recurrent PE. The standard medical management for patients with massive PE is systemic thrombolysis. However, approximately one-third of the patients with this condition are not eligible for thrombolysis because of major contraindications, such as prior surgery,

Masif pulmoner emboli (PE) pulmoner arterin hızlı rekanalizasyonunu gerektiren ve yaşamı tehdit eden sık görülen bir hastalıktır. Standart tedavisi, sistemik trombolizdir. Bununla birlikte, hastaların üçte biri, majör kontraendikasyonlar nedeniyle trombolize uygun değildir. Trombolizin endike veya başarılı olamadığı olgularda, tromboaspirasyon yapılan kateter trombektomi veya açık cerrahi embolektomi, alternatif tedavi yöntemleri olarak uygulanabilir. Bu yazıda koroner arter baypas greft ameliyatı sonrası erken dönemde masif PE gelişen bir olgu sunuldu. Hasta nefes darlığı ile hastaneye başvurdu ve kısa bir süre içinde klinik olarak kötüleşti. Hasta tromboaspirasyon işlemi sonrası düzeldi.

**Anahtar sözcükler:** Açık kalp cerrahisi; pulmoner emboli; tromboaspirasyon.

trauma, stroke, or advanced cancer. In lieu of achieving recanalization, catheter thrombectomies with thromboaspiration and open surgical embolectomies are alternative treatment options. For patients who are deemed to be poor surgical candidates, thromboaspiration is the only alternative treatment modality.

Herein, we present a patient with massive PE who had recently undergone coronary artery bypass graft (CABG) surgery. The patient clinically deteriorated in a matter of hours and recovered only after a thromboaspiration procedure.



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## CASE REPORT

A 76-year-old male patient with known chronic obstructive pulmonary disease (COPD) who had recently undergone a CABG operation 13 days previously was admitted to the emergency department with acute onset dyspnea. The surgery had gone well, and the patient was discharged home in good condition on the fifth postoperative day with acetylsalicylic acid treatment. On physical examination after being readmitted, the blood tension was 80/50 mmHg, and the heart rate was 115 beats/min in atrial fibrillation rhythm. A chest roentgenogram showed mild pleural effusion in the left costophrenic sinus. D-dimer and fibrinogen degradation product levels were 4629 ng/ml and 20 µg/ml, respectively. Due to the evidence, PE was suspected. Thoracic multislice computed tomography (CT) with contrast was performed, and a filling defect in the main pulmonary artery (MPA) that advanced to the right pulmonary artery (RPA) was found (Figure 1a). The RPA branches were almost totally occluded, and there were filling defects in the inferior and superior branches of the left pulmonary artery (LPA) (Figure 1b). The superior vena cava (SVC) was occluded subtotally (Figure 2). These results confirmed the diagnosis of massive PE diagnosis. In addition, venous sonography was performed, and no thrombi were observed in the lower extremities.

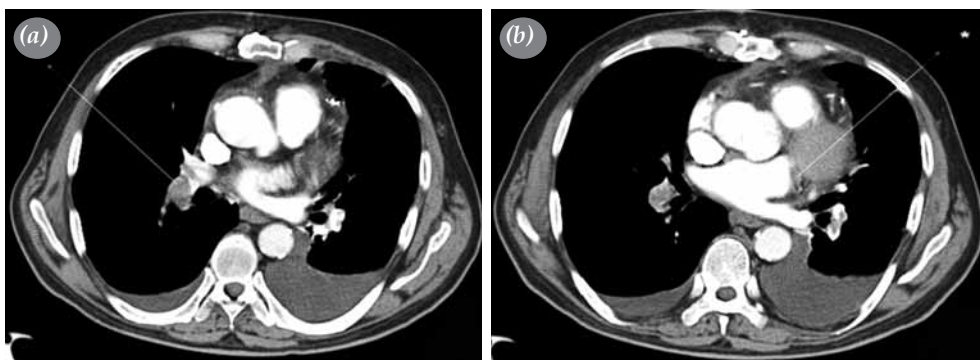
The patient was admitted to the intensive care unit (ICU) for full monitorization. The arterial oxygen saturation was 60% without oxygen inhalation, and the central venous pressure was between 15 and 20 mmHg. The systolic blood pressure started to fall despite treatment with dopamine and adrenaline, so the patient was anticoagulated with unfractionated heparin infusion. Due to the recent cardiac surgery, fibrinolysis was avoided. The patient was followed up for 12 hours;

however, the arterial oxygen saturation and blood pressure remained low in spite of the aggressive treatment. The patient was then taken to the catheter laboratory for a thrombectomy and the thromboaspiration procedure.

Under local anesthesia, femoral vein puncture in the right groin was performed under sonographic guidance, and a 6F introducer sheath was placed in the common femoral vein. Then a 5F pigtail catheter was advanced through the inferior vena cava (IVC) to the pulmonary truncus, and a pulmonary arteriography was obtained. A saddle embolus at the origin of the RPA extending to all of the branches was detected. There was also partial thrombus formation at the origin of the LPA. Next, a 6F guiding catheter was advanced through the RPA, and with the help of a 0.035 inch hydrophilic guidewire, the guiding catheter was advanced beyond the thrombus. Recurrent thromboaspirations were performed; hence, the fragmentation was achieved (Figure 3). In the control angiogram obtained after retrieval, the thrombus in the MPA had disappeared. At the end of the procedure, the patient had respiratory arrest followed by cardiac arrest. He was immediately intubated and resuscitated with cardiac massage and then transferred back to the ICU. In the following four days, the patient was weaned from inotropic support. He was extubated on the third day. In the interim, the patient was also treated for acute renal insufficiency. The patient stayed in the ICU for a total of five days and was discharged home on the 12<sup>th</sup> day on warfarin treatment. Fourteen days after discharge, control multislice CT was performed and revealed recanalized pulmonary artery branches with a totally patent MPA (Figure 4).

## DISCUSSION

The incidence of PE is fairly high after CABG operations, but several studies researching postoperative



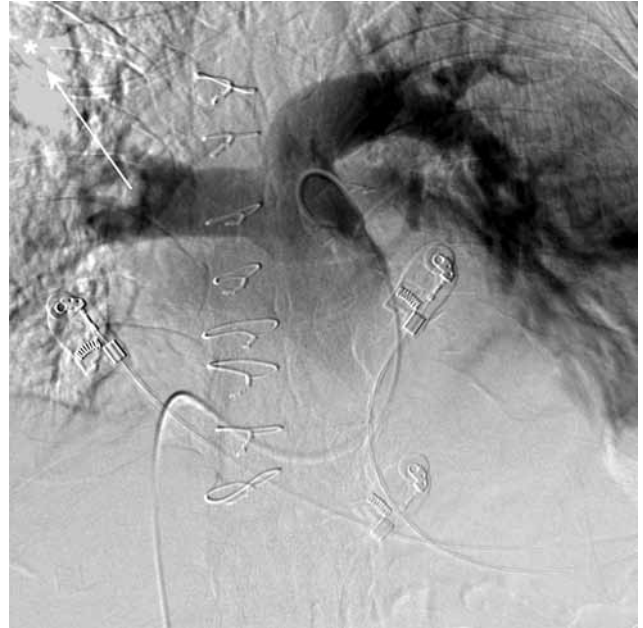
**Figure 1.** (a) Thoracic multislice computed tomography of the thorax showing a saddle embolus extending to the right pulmonary artery. (b) Thoracic multislice computed tomography showing an embolus in the left pulmonary artery.



**Figure 2.** Thoracic multislice computed tomography demonstrating an organized thrombus adherent to the vessel wall in the superior vena cava.

CABG patients have reported a 0.6-0.8% incidence rate.<sup>[2]</sup> Pulmonary embolism is difficult to diagnose with a 10% immediate mortality rate and a 30% mortality rate for those who initially survive.<sup>[3]</sup> Most deaths occur within the first few days after diagnosis due to acute right ventricular failure.<sup>[4]</sup>

The standard medical management for patients with massive PE is systemic thrombolysis and rapid initiation of anticoagulation with intravenous unfractionated heparin. A catheter thrombectomy with thromboaspiration or a surgical embolectomy are alternative treatment modalities to thrombolysis,

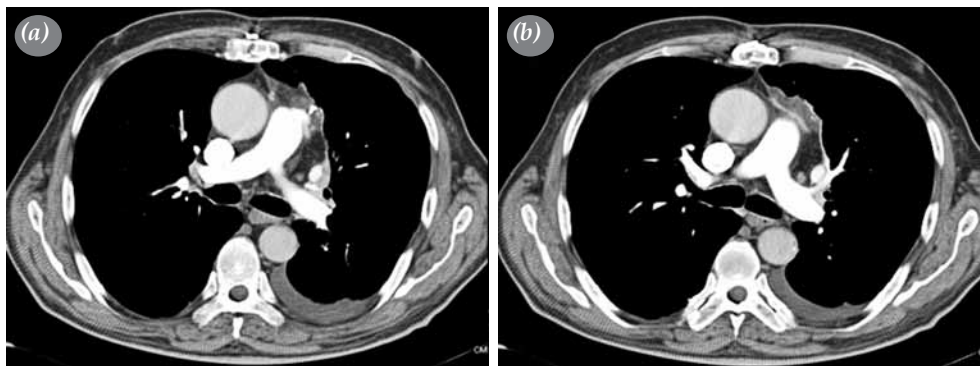


**Figure 3.** Angiographic view during thromboaspiration showing the thrombus material in the pulmonary artery.

particularly in the presence of an increased risk of bleeding.

Thromboaspiration has some advantages, such as reducing the time for recanalization, lowering the hemorrhagic risk, preventing distal clot migration, and decreasing the dose of thrombolytic agents related to bleeding complications.<sup>[5]</sup> It is more efficiently performed with a fresh, nonadhesive clot, as was observed in our case. While catheter thrombectomies are not always the preferred alternative, there is general agreement regarding the three main criteria for performing this procedure in a patient with acute PE (Table 1).<sup>[4]</sup>

There is currently no widely accepted protocol for thromboaspiration.<sup>[6]</sup> Kucher et al.<sup>[4]</sup> suggested



**Figure 4.** (a) Thoracic multislice computed tomography showing the patent right pulmonary artery after thromboaspiration. (b) Thoracic multislice computed tomography showing the patent left pulmonary artery after thromboaspiration.

**Table 1. Widely accepted patient selection criteria for thromboaspiration associated with massive pulmonary embolism**

Criteria for thromboaspiration associated with massive pulmonary edema

1. Hemodynamic instability:
  - Systolic blood pressure (sbp)  $\leq$ 90 mmHg
  - Drop in sbp  $\geq$ 40 mmHg for 15 minutes
  - Ongoing administration of catecholamines for hypotension
2. Filling defect in chest computed tomography or pulmonary angiography
  - Subtotal or total in the left and/or right pulmonary artery
3. Presence of one or more contraindications to thrombolysis
  - Active bleeding
  - History of intracranial bleeding
  - History of head injury
  - History of ischemic stroke
  - History of brain tumor
  - History of neurosurgery, surgery, delivery, or organ biopsy within the last 10 days
  - History of gastrointestinal bleeding within the last 15 days
  - History of major trauma within the last 15 days
  - History of active cancer with a known hemorrhagic risk
  - Platelet count  $\leq$ 50,000 cells/dl
  - International normalized ratio  $\geq$ 2
  - Pregnancy

performing early thromboaspiration for patients who have contraindications for thrombolysis and whose shock index (heart rate/systolic blood pressure) is greater than 1. Our patient was in atrial fibrillation rhythm and hypotensive when admitted to the emergency unit. Since he had undergone a CABG operation 13 days previously, thrombolysis and a surgical embolectomy were ruled out. Heparin infusion was initiated immediately. The patient deteriorated hemodynamically in the hours after he was admitted; therefore, he was put on dopamine and adrenaline treatment. As the arterial oxygen saturation gradually decreased, we decided to perform thromboaspiration. Following this procedure, the patient recovered significantly over the next six hours.

Complications with catheter thrombectomies are rare, with the most serious being the perforation or dissection of a major pulmonary arterial branch. Other complications include bleeding from heparin anticoagulation, contrast-induced nephropathy, an anaphylactic reaction to the iodine contrast, and vascular access complications, such as hematoma, pseudoaneurysm, or arteriovenous fistula.

In conclusion, when patients are poor candidates for systemic thrombolysis and surgical embolectomies, thromboaspiration may be the only viable treatment option and should be pursued if at all possible. Although reperfusion therapy was rapidly successful in our patient, randomized studies are needed to find out whether this strategy can have a similar benefit for all patients with PE and right ventricular dysfunction.

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#### REFERENCES

1. Markel A, Manzo RA, Bergelin RO, Strandness DE Jr. Valvular reflux after deep vein thrombosis: incidence and time of occurrence. *J Vasc Surg* 1992;15:377-82.
2. Cenal AR, Tataroglu C, Tekumit H, Uzun K, Akinci E. Treatment of massive pulmonary embolism after on pump coronary artery bypass surgery: a case report. *Turk Gogus Kalp Dama* 2010;18:321-3.
3. Kasirajan K, Gray B, Ouriel K. Percutaneous AngioJet thrombectomy in the management of extensive deep venous thrombosis. *J Vasc Interv Radiol* 2001;12:179-85.
4. Kucher N. Catheter embolectomy for acute pulmonary embolism. *Chest* 2007;132:657-63.
5. Oğuzkurt P, Tercan F, Ince E, Ezer SS, Hiçsönmez A. Percutaneous treatment of portal vein thrombosis in a child who has undergone splenectomy. *J Pediatr Surg* 2008;43:e29-32.
6. Kuo WT, van den Bosch MA, Hofmann LV, Louie JD, Kothary N, Sze DY. Catheter-directed embolectomy, fragmentation, and thrombolysis for the treatment of massive pulmonary embolism after failure of systemic thrombolysis. *Chest* 2008;134:250-4.