Turk Gogus Kalp Dama 2016;24(2):347-349
doi: 10.5606/tgkdc.dergisi.2016.12310

Treatment of pulmonary embolism with ultrasound-accelerated thrombolysis after coronary revascularization

Koroner revaskülarizasyon sonrası pulmoner embolinin ultrasonla hızlandırılmış tromboliz ile tedavisi

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ABSTRACT

Pulmonary embolism after cardiac surgery is an uncommon, but fatal complication. Herein, we report a 46-year-old male case of high-risk pulmonary embolism after coronary revascularization who was treated with ultrasound-accelerated thrombolysis.

Keywords: Coronary artery bypass; pulmonary embolism; thrombolysis.

ÖZ

Kalp cerrahisi sonrası pulmoner emboli nadir görülen, fakat ölümcül bir komplikasyondur. Bu yazıda, koroner revaskülarizasyon sonrası yüksek riskli pulmoner emboli gelişen, ultrasonla hızlandırılmış tromboliz ile tedavi edilen 46 yaşında bir erkek olgu sunuldu.

Anahtar sözcükler: Koroner arter baypas; pulmoner emboli; tromboliz.

Pulmonary embolism (PE) is a well-known fatal complication after cardiac surgery, occurring with an incidence of 3.4%.[1] Early detection and adequate treatment is crucial. Treatment modalities include pulmonary embolectomy, catheter embolectomy, systemic anticoagulation, systemic thrombolysis, and catheter-directed thrombolysis.[2]

In the literature, there are few publications addressing the ultrasound-accelerated thrombolytic treatment (USAT) for acute PE after major cardiothoracic surgeries. Herein, we report a case of high-risk PE after coronary artery bypass grafting (CABG) treated with USAT.

CASE REPORT

A 46-year-old male patient, without any comorbidities and normal echocardiographic findings, had four vessel on-pump CABG. Postoperative period was uncomplicated and he was discharged in the sixth postoperative day with normal blood test results and postoperative echocardiographic findings. Medical treatment included acetylsalicylic acid, clopidogrel, beta-blocker, and statin. In the 11th postoperative day, the patient was admitted to emergency unit with dyspnea. He had tachypnea, tachycardia, and hypotension with arterial desaturation as assessed by pulse oxymetry. He was transferred to the intensive care unit and was intubated immediately. He was hemodynamically unstable. Echocardiography confirmed hypokinesis of the apex and apical septum with a slightly decreased ejection fraction. There was moderate tricuspid insufficiency with increased pulmonary artery pressure (80 mmHg) which resulted in a dilated right ventricle and deviated interventricular septum towards the left ventricle. Anticoagulation with heparin infusion was initiated. The patient promptly underwent pulmonary computed tomography (CT) angiography which revealed massive PE with clots starting from the level of bifurcation, extending into the lobar and segmental branches, and completely occluding the right inferior lobe and left upper lobe branches (Figure 1).

Available online at
www.tgkdc.dergisi.org
doi: 10.5606/tgkdc.dergisi.2016.12310
QR (Quick Response) Code

Received: August 21, 2015 *Accepted:* October 02, 2015

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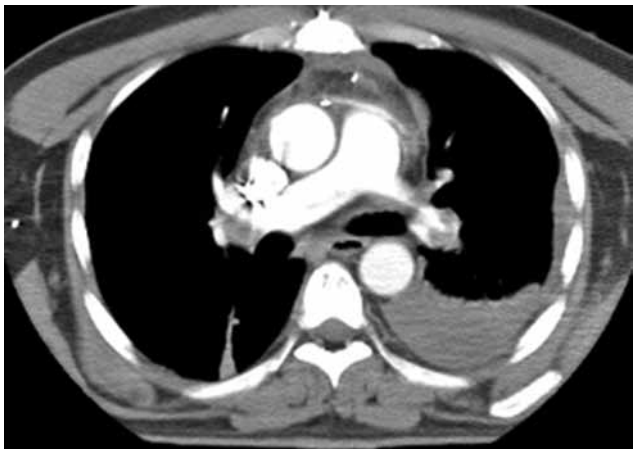

Figure 1. A computed tomography image showing pulmonary embolism in the division of the pulmonary arteries.

A written informed consent was obtained from the patient. He received thrombolytic treatment via EkoSonic® Endovascular System (EKOS Corporation, Bothell, Washington, USA) which provides ultrasound-accelerated thrombolysis. This system was preferred to provide thrombolysis with much lower doses of thrombolytic agent by local administration of recombinant tissue plasminogen activator (rtPA) directly into the pulmonary arteries. Catheter system insertion was performed at the cardiac catheterization laboratory. Venous access was obtained at the common femoral vein with a double-lumen introducer sheath for bilateral catheter insertion. Treatment zone catheters were placed under fluoroscopy (Figure 2) and the patient was continuously monitored in the intensive care unit during the infusion of the drug. A total of 15 mg of rtPA was used within 24 hours.

This procedure resulted in a rapid restoration of the pulmonary blood flow with a substantial clinical improvement. Post-procedural echocardiographic findings showed a progressive improvement in the right ventricular function. Resolution of PE resulted in normalization of the pulmonary artery pressure (30 mmHg) and cardiac dysfunction. On Day 12, pulmonary CT angiography revealed no residual thrombi in the pulmonary artery branches (Figure 3). The patient had a small hematoma formation at the central jugular venous catheterization site which resolved spontaneously. He is still asymptomatic, in NYHA Class I, and one-year follow-up echocardiography and CT angiography findings are normal.

DISCUSSION

Although PE after CABG is an uncommon complication, occurring with a mean incidence of 3.4% it is fatal in 0.5% of cases.[1] Systemic thrombolytic treatment, surgical embolectomy, and percutaneous catheter-based treatment with or without local thrombolysis are the main options for revascularization treatment in high-risk PE.[2] There is a consensus on the treatment of patients with the diagnosis of high-risk PE and hemodynamic instability via systemic thrombolytics, unless absolute contraindications preclude the therapy.[2] Unfortunately, the rate of major bleeding complications with systemic thrombolysis has been reported to be as high as 20% in the clinical registries.[3,4] Recent major surgery (within the preceding three weeks) is one of the absolute contraindications for systemic thrombolysis.[2]

Surgical embolectomy is another therapeutic option in patients with high-risk PE in whom thrombolysis

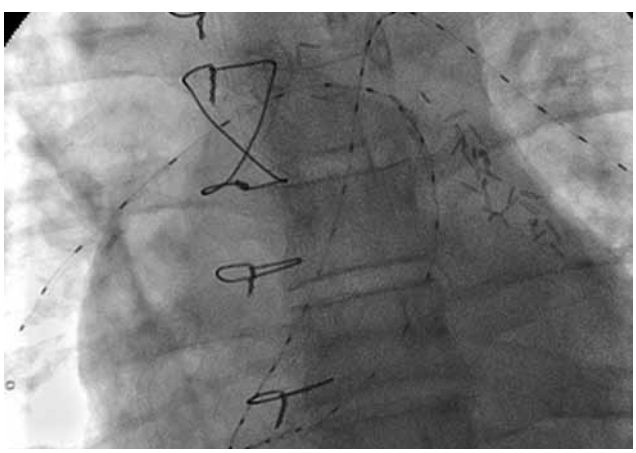

Figure 2. A fluoroscopic view after placement of two EkoSonic devices.

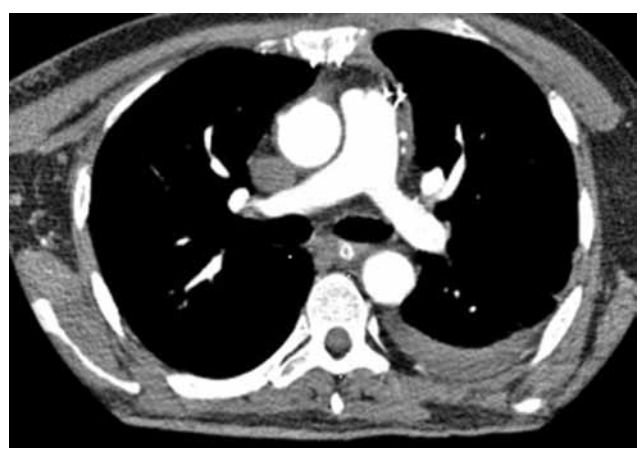

Figure 3. A computed tomography image after ultrasound-accelerated thrombolytic treatment.

is absolutely contraindicated. However, the overall mortality associated with pulmonary embolectomy remains high with a rate of 6 to 8%.[2]

In high-risk patients who are ineligible to receive thrombolytic therapy or whose critical status does not allow sufficient time for systemic therapy to be effective, the use of interventional catheterization techniques which are safer than systemic thrombolysis should be considered.[5] In a case report, Ozker et al.[6] reported catheter thrombectomy and aspiration of massive PE in a patient with recent CABG procedure with rapid recovery of clinical status. Ultrasound-assisted catheter directed thrombolysis combines catheter-directed thrombolysis with a specific catheter which uses high-frequency, low-power ultrasound, offering rapid revascularization without increased complication rates.[5] There are few publications focusing on the utilization of the USAT in high-risk PE patients. Kennedy et al.[7] reported 98% complete or near complete clearance of the thrombi among 60 patients with acute PE who were treated with anticoagulation and USAT. The authors reported that it was a safe and effective treatment modality. In a recent clinical research by Engelberger et al.,[8] of 52 patients with high- and intermediate-risk PE treated with USAT, rapid improvement in hemodynamic parameters with low rates of major bleeding complications (3.8%) was reported. In addition, a recent systematic review including seven studies on the USAT treatment among 197 PE patients demonstrated a rate of major bleeding complications of 3.6% without any fatal or intracranial bleedings.[5] The authors concluded that, although catheter-based therapies were accepted as alternative revascularization strategies to systemic thrombolysis for intermediate-risk patients and were still unproven for high-risk patients, they might be indicated in selected cases when bleeding risk was high.

Hemodynamically unstable patients with shock and hypotension require an emergency diagnostic algorithm and primary reperfusion therapy.[2] Treatment decision should be made by an interdisciplinary team and depend on the patient's status and institution's facilities. Due to recent CABG surgery, our patient had an increased risk for bleeding; therefore, we required a strategy using reduced dose of thrombolytic, and surgery would carry the risk of both bleeding and injury to the coronary grafts. Then, we decided to use USAT as the treatment modality, since it would be the least risky and effective option for this case, compared to surgical embolectomy and systemic thrombolysis. Pulmonary embolism resolved completely with a rapid clinical improvement and without major hemorrhagic complications.

In conclusion, our experience may add data which suggest that ultrasound-accelerated thrombolytic treatment may be an effective and safe therapeutic option in patients with high-risk pulmonary embolism with hemodynamic instability and contraindications for systemic thrombolytic treatment.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

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