

## Case Report

### *Percutaneous Aspiration Thrombectomy in Acute Upper Limb Ischemia: A Case Report*

Eka Prasetya Budi Mulia<sup>1\*</sup>, MD; Ivana Purnama Dewi<sup>1</sup>, MD; Rerdin Julario<sup>1</sup>, MD; Mohammad Budiarto<sup>1</sup>, MD

#### ABSTRACT

**Introduction:** Acute upper limb ischemia (AULI) is an unusual presentation of limb-threatening emergency. Only a few cases of percutaneous thrombectomy in AULI have been published.

**Case Presentation:** A 55-year-old woman presented with sudden burning pains in the right hand of 11 hours' duration. Duplex ultrasound identified a thrombus along the proximal brachial artery to the distal radial artery. Arteriography revealed total occlusion in the proximal brachial artery. Transfemoral percutaneous aspiration thrombectomy (PAT) with the result of a red thrombus was subsequently performed. Successful recanalization with a flow from the brachial artery to the distal radial artery was obtained after PAT. Unfortunately, the patient died from septic shock and respiratory failure 4 days later.

**Discussion:** Successful PAT on the right brachial artery was performed in our case with the prior procedural identification of the occluded artery using duplex ultrasound and angiography.

**Conclusions:** AULI is a limb- and life-threatening condition. PAT can be an option for vasculature recanalization in upper limb extremities. (*Iranian Heart Journal 2021; 22(1): 117-124*)

**KEYWORDS:** Acute upper limb ischemia, ALI, Percutaneous aspiration thrombectomy, Thrombus, Technique

<sup>1</sup> Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Hospital, Indonesia.

\*Corresponding Author: Eka Prasetya Budi Mulia, MD; Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Hospital, Indonesia.

Email: eka.prasetya.budi-2017@fk.unair.ac.id

Tel: +628562765365

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**A**cute limb ischemia (ALI) is a rapid decrease in the limb blood flow due to the acute occlusion of the peripheral artery. ALI is a severe disease requiring urgent intervention. The prognosis of ALI is poor unless appropriate and quick treatment is given.<sup>1</sup> Acute upper limb ischemia (AULI) is an unusual and less common presentation of limb-threatening emergency than acute lower limb ischemia.<sup>2</sup> Percutaneous thrombectomy is a technique to eliminate acute thrombus in various blood vessel occlusions such as arteries, veins, and vascular grafts. Percutaneous thrombectomy can be used as individual therapy or adjunct therapy for other thrombus removal methods such as thrombolysis. The 2 main methods of percutaneous thrombectomy are percutaneous aspiration thrombectomy (PAT), whereby the thrombus is removed via suction with the help of wide-bore catheters, and mechanical thrombectomy, whereby the thrombus is broken down or eliminated using various automated devices.<sup>3</sup> However, reports on the use of PAT in the treatment of AULI are limited. Herein, we report a case of successful PAT in a patient with AULI.

## CASE PRESENTATION

A 55-year-old woman presented with complaints of sudden burning pains in the right hand of 11 hours' duration. The patient's right hand was also colder and paler than her left hand. She had no complaints of pains and weakness in other limbs, chest pain, and shortness of breath. She had a 2-year history of hypertension, uncontrolled hyperthyroidism, and an unknown heart rhythm disorder of 2 years' duration. There was no prior history of the Reynaud phenomenon or cold exposure. She denied any history of smoking before.

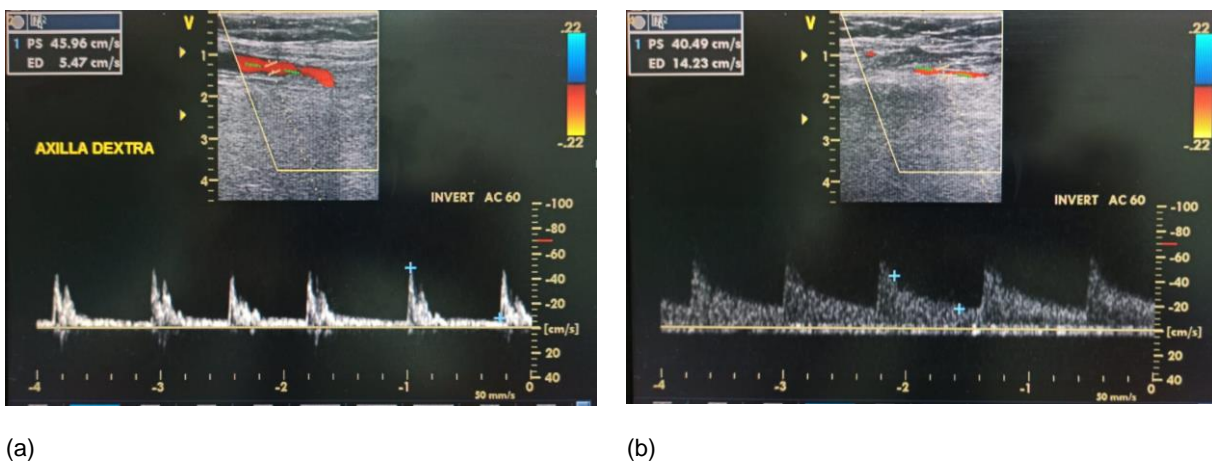
The examination of vital signs showed a left upper extremity blood pressure of 106/73 mm Hg, an irregular pulse rate of 79 bpm, a respiration rate of 22 breaths per minute, an axillary temperature of 36.9°C, and a left upper extremity SO<sub>2</sub> level of 97% on room air. Physical examination revealed irregularly irregular heart sounds without a murmur. The examination of the right upper limb showed a palpable axillary pulse, but no brachial, radial, and ulnar pulse. Right upper limb saturation digiti I and V were not measurable; however, digiti II was 53%, digiti III was 60%, and digiti IV was 67%. There was a minimal sensory loss at the tip of the fingers without motoric deficiency (Rutherford IIa). Electrocardiography (ECG) demonstrated atrial fibrillation with a ventricular response rate of 80 bpm, a normal axis, and a nonspecific ST depression in leads II, III, aVF, and V<sub>4</sub>–V<sub>6</sub>. Chest X-ray showed cardiomegaly with normal lungs. The hemoglobin level was 11.4 mg/dL, and the white blood cell count was 12 730/μL of blood. The platelet count was normal at 394 000/μL of blood.

Duplex ultrasound (DUS) identified biphasic waves at the right axillary and monophasic waves in the right proximal brachial artery, and no flow from the right middle brachial artery to the distal radial artery and the ulnar artery (Fig. 1). There was a thrombus along the proximal brachial artery to the distal radial artery. Transthoracic echocardiography showed normal ejection fraction and normal left ventricular kinetics with no intracardiac thrombus. Intravenous administration of heparin was then given to the patient.

Urgent angiography was performed on the patient. A 6F introducer sheath (Radiofocus Introducer II; Terumo Corporation) was placed into the right common femoral artery. A Catheter JR 4.0

5F (Radifocus Optitorque, Terumo Corporation) was then delivered through the right common femoral artery to the proximal part of the right subclavian artery. Arteriography revealed total occlusion in the proximal brachial artery (Fig. 2). A guiding catheter JR 4.0 7F (Launcher Guiding Catheter, Medtronic) was delivered to the proximal right subclavian artery and subsequently, a Whisper MS Guide Wire (Hi-Torque Whisper MS, Abbott) was delivered to the right brachial artery and the lesion was successfully penetrated. Thromboaspiration with the result of a red thrombus was subsequently performed using Capturer 7F (iVascular) (Fig. 3). Successful recanalization with a flow from the brachial artery to the distal radial artery was obtained after PAT (Fig. 4).

The patient had immediate symptom improvement, as well as improvement of hypoperfusion signs. In the examination of the right upper limb extremities after PAT, the pulse in the axillary artery up to the distal radial artery and the distal ulnar artery was palpable. Oxygen saturation in the right upper limb showed improvement (digiti I to V: 90%, 93%, 67%, 75%, and 52%, respectively). DUS following PAT showed triphasic waves in the axillary artery, triphasic waves in the proximal-distal brachial artery, and monophasic waves in the radial and ulnar arteries. Unfortunately, the patient died from shock septic and respiratory failure 4 days afterward.



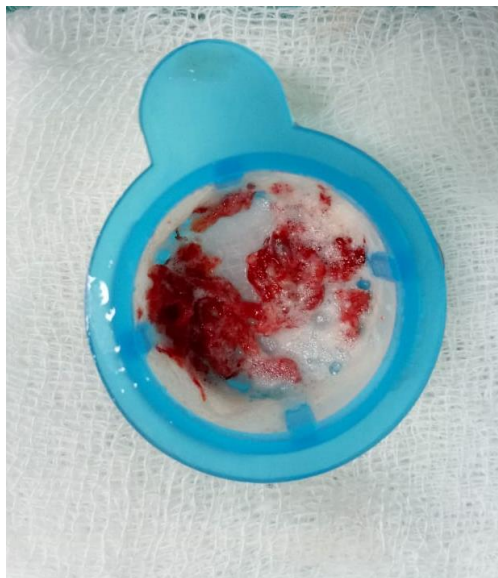
**Figure 1:** Duplex ultrasonography of (a) the right axillary artery shows a biphasic waveform (peak systolic velocity/PSV = 45.96 cm/s) and of (b) the right proximal brachial artery shows a monophasic waveform (PSV = 40.49 cm/s). Both show a reduced velocity.



(a)

(b)

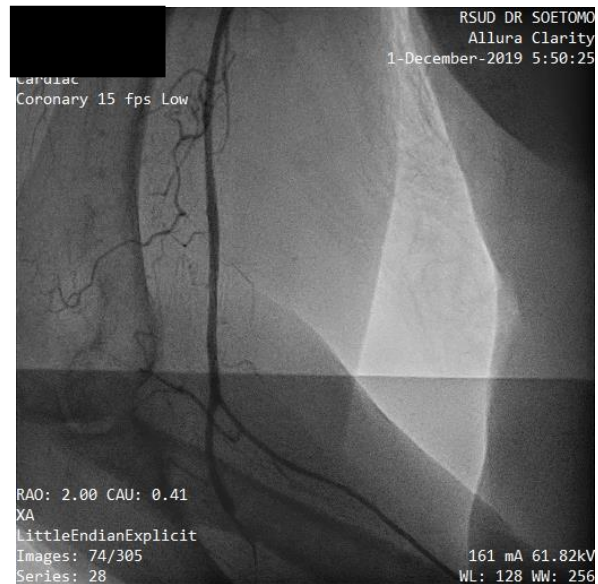
**Figure 2:** Angiogram shows total occlusion in the proximal right brachial artery.



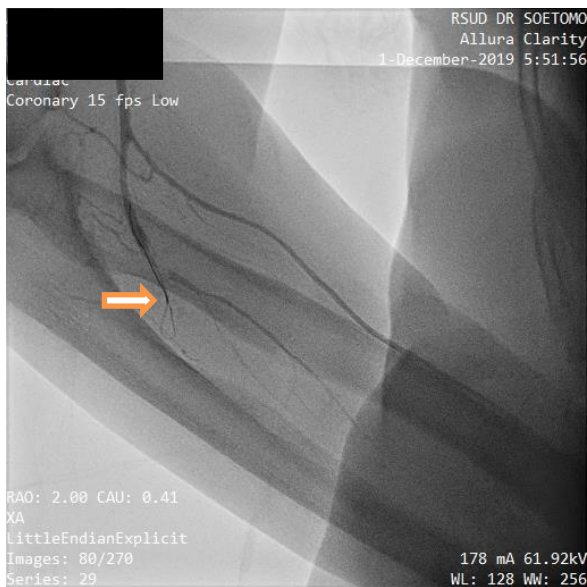
**Figure 3:** Red thrombus obtained from aspiration is presented herein.



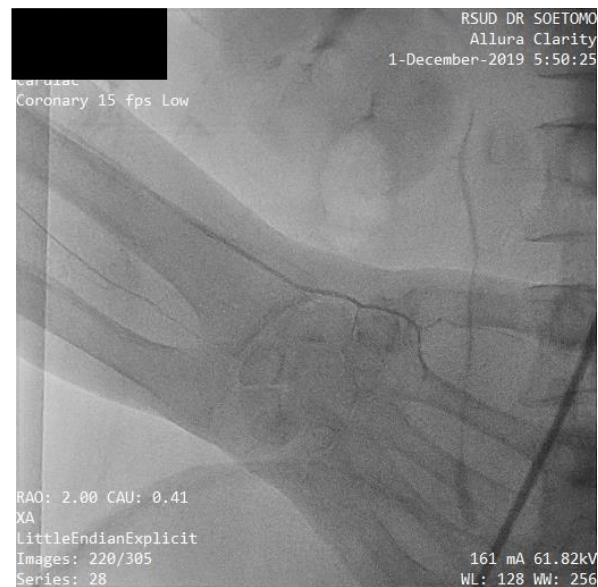
(a)



(b)



(c)



(d)

**Figure 4:** Angiogram shows successful recanalization after percutaneous aspiration thrombectomy (a) in the middle brachial artery, (b) in the distal brachial artery, and (c) in the proximal radial-ulnar artery. There was significant stenosis (90%) in the proximal ulnar artery (arrow). (d) Angiogram shows the distal radial artery.

## DISCUSSION

AULI is not as prevalent as acute ischemia in lower limbs. According to previous data,

the annual incidence of AULI is 1.3 cases per 100 000 patients, including 2% to 18% of surgical procedures for critical limb ischemia and only around 17% of all cases

of acute extremity ischemia.<sup>2,4</sup> In contrast to lower ALI, which mainly occurs as a peripheral vascular disease complication, AULI is generally caused by trauma, thromboembolism, or iatrogenic conditions.<sup>2</sup> There is debate as to whether surgical interventions are mandated in all patients with AULI, particularly in cases where the arm is ischemic but viable. Conservative therapy with anticoagulation, hydration, and the treatment of underlying medical conditions is advocated by some, while others believe that revascularization is obligatory given that studies have suggested that conservative therapy results in claudication in the majority of patients. Embolectomy for AULI has good outcomes in terms of limb function, but the long-term mortality rates are high. Endovascular treatments have been reported, although small patient numbers make comparisons with other procedures difficult. Successful recanalization and salvage of limbs depend on prompt diagnosis and arterial occlusion localization.<sup>2,4</sup>

Owing to reduced morbidity and mortality in ALI, we opted for endovascular therapy in our patient because of her severe comorbidities such as hypertension, hyperthyroidism, and atrial fibrillation. Percutaneous thrombectomy, including thrombus extraction, thromboaspiration, and surgical thrombectomy, is indicated in the case of neurological deficit, while catheter-directed thrombolysis is more appropriate in less severe cases without neurological deficits.<sup>5</sup> We detected neurological deficits (Rutherford IIa) in the patient, hence our selection of percutaneous thrombectomy for limb salvation.

Introduced over 20 years ago, percutaneous thrombectomy is the removal of an acute thrombus via nonsurgical procedures. The 2 main methods of percutaneous thrombectomy are PAT, whereby the

thrombus is removed via suction with the aid of wide-bore catheters, and mechanical thrombectomy, whereby the thrombus is broken down or eliminated with the use of various automated devices. PAT is also often used as adjunctive therapy to thrombolysis in an acutely occluded artery or as rescue therapy to eliminate distal embolism after an iliac or femoropopliteal intervention. Mechanical thrombectomy is useful in the treatment of thrombosis in dialysis grafts and is increasingly being used for the treatment of iliofemoral or ileocecal deep venous thrombosis and massive pulmonary embolism.<sup>3</sup>

PAT is usually used in acute lower limb ischemia,<sup>6,7</sup> although it can also be performed in the upper limb and visceral arteries.<sup>8,9</sup> Indications for PAT in ALI are fresh and non-adherent thrombotic matter or emboli.<sup>10</sup> Several studies have described that the success rate of PAT in ALI is quite good.<sup>8,11</sup> Recently, the Multicenter PRISM Trial study on XTRACT assessed vacuum-assisted PAT with the Penumbra Indigo Mechanical Thrombectomy System in patients with ALI and reported that complete or almost complete revascularization was achieved in 87.2% of the study patients immediately after the XTRACT procedure and before other interventions. Successful revascularization was achieved in 79.5% of the patients as initial therapy and in 92.5% as rescue or secondary therapy after catheter-directed thrombolysis (CDT) failure. Complete thrombus elimination and restoration of normal flow was achieved in 77.2% of the patients after endovascular therapy was completed. No patients needed surgical revascularization.<sup>11</sup> The primary use of PAT as first-line treatment in non-iatrogenic acute lower limb ischemia can also reduce the need for CDT, with no significant cost difference compared with the first-line use of conventional CDT.<sup>12</sup>

A study by Kim et al<sup>8</sup> evaluated the usefulness of PAT via a transbrachial approach in patients with AULI and showed that successful recanalization after PAT was achieved in all the patients. A case report by Gordhan<sup>9</sup> also stated that the vascular recanalization of the upper arm through safer femoral access could be achieved with sufficient length thromboaspiration catheters. Antegrade access through the brachial artery for the manual thromboaspiration of acute radial artery occlusion as a complication following heart catheterization has been reported.<sup>13</sup> Successful PAT on the right brachial artery was performed in our case with the prior procedural identification of right brachial artery occlusion using DUS and angiography. The worsening of the patient's condition, in this case, might have been caused by the basic ALI condition and other comorbidities that have a poor prognosis.<sup>1</sup>

## CONCLUSIONS

AULI is an unusual presentation of ALI. AULI is a limb- and life-threatening condition. Early recognition and early revascularization are essential. PAT with the prior identification of the occluded lesion using DUS and angiography might be a choice of vasculature recanalization in upper limb extremities. However, although urgent revascularization has been done successfully, the natural history of ALI itself is poor in prognosis.

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