

# Mechanical Rotational Catheter Thrombectomy in Six Patients: Case Report

## Altı Hastada Mekanik Rotasyonel Kateter ile Trombektomi Uygulaması

Celalettin KARATEPE,<sup>a</sup>  
Levent ALTINAY,<sup>b</sup>  
Onur S. GÖKSEL<sup>c</sup>

<sup>a</sup>Department of Cardiovascular Surgery, Mustafa Kemal University Faculty of Medicine, Hatay

<sup>b</sup>Department of Cardiovascular Surgery, Yunus Emre Hospital, Eskişehir

<sup>c</sup>Department of Cardiovascular Surgery-İstanbul University İstanbul Faculty of Medicine, İstanbul

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Yazışma Adresi/Correspondence:

Onur S. GÖKSEL  
İstanbul University  
İstanbul Faculty of Medicine,  
Department of Cardiovascular Surgery,  
İstanbul,  
TÜRKİYE/TURKEY  
onurgoksel@hotmail.com

**ABSTRACT** Left superficial femoral artery occlusion was detected in 6 patients (4 male, 2 female, mean age 65±10 years) who attended to emergency department with a sudden-onset severe pain and pallor in the left lower extremity. As the patients were given a high-risk for open surgery (American Society of Anesthesiologists- ASA 4 for all patients), thrombectomy with mechanical rotational catheter was preferred to the open surgery due to short operation time, and no need for a surgical incision. Complete revascularization was achieved. No evidence of restenosis was seen after 6 months. In conclusion, we think that mechanical thrombectomy with rotational catheter is an alternative treatment in the high-risk patients for surgery.

**Key Words:** Thrombectomy; peripheral arterial disease

**ÖZET** Sol alt ekstremitte krural bölgede ani başlangıçlı şiddetli ağrı ve renk değişikliği şikayeti ile acil servise başvuran 6 hastada (4 erkek, 2 kadın, ortalama yaş 65±10 yıl) sol yüzeyel femoral arterde oklüzyon (lezyon uzunluğu 2-10 cm, ortalama 6,1 cm) saptandı. Hastaların açık cerrahi girişim için yüksek riskli bulunmaları (Amerikan Anestezistler Derneği- ASA-4) ve operasyon süresinin kısa olması ve cerrahi insizyona gerek duyulmaması nedeniyle, hastalarda mekanik rotasyonel kateter ile trombektomi, açık cerrahiye tercih edildi. Hastaların tümünde tam revaskülerizasyon sağlandı. İşlem sonrası 6. ayda kontrol bilgisayarlı tomografi anjiyografide restenoz saptanmadı. Sonuç olarak, mekanik rotasyonel kateter ile trombektominin, açık cerrahi için yüksek riskli hastalarda uygulanabilecek bir alternatif tedavi yöntemi olduğunu düşünmekteyiz.

**Anahtar Kelimeler:** Trombektomi; periferik arteriyel hastalık

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Arterial occlusive disease of the lower extremities is a very common disorder affecting 20% of the population older than 75 years of age. Atherosclerosis is the main cause of peripheral arterial occlusive disease, with lesions located in the femoropopliteal segment in more than half of the cases. Claudication is the main clinical manifestation in the chronic occlusion of the superficial femoral artery (SFA), and it may lead to chronic critical limb ischemia.<sup>1</sup> Because of high morbidity and mortality rates of peripheral arterial disease, different treatment options have been suggested, including femoropopliteal bypass surgery, combined thromboendarterectomy techniques with optional stenting, and percutaneous revascularisation.<sup>2,3</sup> The aim of this study is to evaluate the effectiveness of mechanical thrombectomy with rotational catheter operation in patients with arterial occlusive disease.

## CASE REPORT

Four male and 2 female patients (mean age  $65 \pm 10$  years) with subacute superficial femoral artery (SFA) occlusion (mean lesion length 6.1 cm, range 2-10 cm) present less than 4 weeks included in this report. Of these patients, 50.0% (n=3) had Diabetes Mellitus (DM), 100 % (n=6) had Smoking, 100% (n=6) had Hiperlipidemi, 50.0% (n=3) had Conges-tive Heart Failure (CHF), 66.6% (n=4) had Chronic Atrial Fibrilasyon (AF), 100% (n=6) had Hyperten-sion (HT), Table 1.

All patients attended to emergency depart-ment with a sudden-onset Rutherford grade 2 is-chemia (severe rest pain and pallor) in the cruris of the left lower extremity. Acute thrombosis of the SFA was detected in the urgent arterial Doppler ul-trasonography (USG). All patients were he-parinized while preoperative evaluations were ongoing. All patients were evaluated to have a high risked for general or regional anesthesia by the car-diology and anesthesia consultants (American So-ciety of Anesthesiologists-ASA 4 for all patients). Because of short operation time and no need for a surgical incision, thrombectomy with mechanical rotational catheter was preferred to the open sur-gery. Thus, mechanical thrombectomy was per-formed after patients' informed consents were obtained.

### MECHANICAL TROMBECTOMY PROCEDURE

The mechanical thombectomy system is composed of 3 parts: Aspirex<sup>®</sup>S catheter (Straub Medical AG, Wangs, Switzerland), magnetic control unit, and

|                                       |                           |
|---------------------------------------|---------------------------|
| Age (Mean $\pm$ SD)                   | 65 $\pm$ 10               |
| Gender                                |                           |
| Male                                  | 4                         |
| Female                                | 2                         |
| <b>Comorbidities and risk factors</b> | <b>Number of patients</b> |
| DM                                    | 3                         |
| Smoking                               | 6                         |
| HL (LDL >150 mg/dl)                   | 6                         |
| KHF                                   | 3                         |
| Chronic AF                            | 4                         |
| HT                                    | 6                         |

DM: Diabetes mellitus; HL: Hyperlipidemia; KHF: Congestive heart failure; AF: Atrial fibrillation; HT: Hypertension.

electronic motor unit. The catheter tip is made up of two cylinders, placed one within the other. The motor unit rotates the spiral helix about 40.000-60.000 rounds/min, enabling it to achieve 80.000 cuts per minute. The vortex formed by the rota-tional movement of the catheter generates 5.8 kPa (=43.5 mmHg) negative pressure on the tip of the catheter. When the catheter is made active, solid and non-solid occlusion materials are collected by the pores on the tip of the catheter, transported to the proximal reservoir by the spiral helix and then emptied to the plastic collecting bag (Figures 1a, b).

Unfractionated heparin in doses sufficient to reach a target activated clotting time (ACT) level >250 seconds were administered before the inser-tion of the rotational catheter. ACT levels were verified every 30 minutes, and additional doses of unfractionated heparin were applied when neces-



**FIGURE 1:** a) The magnetic control unit. b) The electronic motor unit.

sary to maintain the target ACT level. Local anesthesia was achieved in the left femoral region with 5 ml prilocain (Citanest) injection. Left common femoral artery (CFA) was punctured with a 21G needle using Seldinger technique. A 6F angiography catheter was placed in the CFA, and the occluded segment was visualized in the arteriography. Guidewire was introduced through the lesion into the popliteal artery. A 6F mechanical thrombectomy catheter (Straub Medical AG, Aspirex® S) was primed with a heparin-treated saline solution, and then introduced over the guidewire under the fluoroscopy. The mechanical rotation was started, and the thrombectomy catheter was advanced through the acute thrombus with back and forth movements to aspirate the thrombus. The same action was repeated backwards. This method favors the inflow of fresh blood, which helps to maintain the catheter cool, and serves as a transport medium for the debris. In order to minimize the risk of peripheral embolization, the distal end of the stenosis should be passed over very slowly to allow the catheter to aspirate all loose material before full blood flow is restored into the vessel. The minimum expected recanalization is at least that of the size of the catheter head's own diameter. Several passages may lead to larger recanalized diameters. Where less mature stenotic material is found, a lumen of up to three times the catheter's diameter may be recovered.<sup>4</sup>

Technical success was defined as successful completion of the procedure, and  $\leq 30\%$  diameter residual stenosis after revascularization. After the completion of the procedure, total recanalization of the SFA was observed in the control angiography. After the procedure, patients were followed-up 2 hours in the intensive care unit. A total improvement of the flow of the SFA was observed in the Doppler USG after 24 hours.

#### PATIENT FOLLOW-UP

Patients were offered to use low molecular weight heparin (LMWH) for 2 weeks combined with oral 300 mg acetylsalicylic acid (ASA) tablets once a day. ASA tablet treatment continued after cessation of LMWH treatment. Patients were examined at 1, 3

and 6 month follow-ups. Patients had no complaints and no side effects or complications were observed. At 6th month follow-up, patients also had computerized tomography angiography, and no signs of restenosis or occlusion were observed.

#### DISCUSSION

We had satisfactory results with rotational embolectomy catheter. We achieved complete revascularization of the affected limbs (100%) in all of the patients. We used this treatment method for the patients who had a high risk for open surgical intervention. In addition, clinical worsening signs such as motor movement deficit of the affected extremity occurred in all of the patients despite appropriate medical treatment.

General treatment for grade 1 ischemia is heparinisation with delayed revascularisation if necessary, and surgical revascularisation either by Fogarty balloon catheter or bypass with grafts for grade 2 ischemia. However, amputation rate is between 11-37% with these techniques, depending on the causes of ischemia.<sup>5</sup>

The percutaneous revascularisation techniques include laser angioplasty, rotational and directional atherectomy, mechanical rotational thrombectomy, cutting balloon angioplasty and crioplasty.<sup>6-11</sup>

Percutaneous aspiration thrombectomy is another treatment method for occlusions distal to CFA with recanalisation rates over 90%.<sup>12</sup> Mechanical rotational thrombectomy with Aspirex mechanical thrombectomy system can be assessed as an easy and safe procedure with the advancement of the device over a guidewire, and with a low arterial dissection risk within a relatively short procedural time. Furthermore, the different length and sized catheters make ipsilateral and contralateral approach possible, which is particularly important in case of diseased access sites and variable diameters of the diseased target vessels.

Desgranges et al. reported best results for mechanical thrombectomy with short lesions (less than 12.8 cm).<sup>13</sup> Lesion lengths in our patients ranged from 2 cm to 10 cm (mean 6.1 cm). We achieved complete revascularisation, similar to this finding.

Some authors reported distal embolization in the literature, and it is theoretically possible. Duc et al. used another rotational embolectomy device for recanalization in native vessels for stenosis, and reported distal embolization in 26%.<sup>14</sup> However we did not observe such an event.

Post-interventional restenosis may also occur. In the literature, a patency rate of 61% was reported after mechanical rotational thrombectomy at 1-year follow up.<sup>14</sup> The risk factors for restenosis can be broadly classified as patient-specific and lesion-specific. Diabetes is a factor that increases the risk for restenosis because it is related with endothelial dysfunction associated with increased platelet activity, and more aggressive cellular response to injury. Female gender is also shown to be a predictor of restenosis in most of the studies. In addition, systemic inflammation and plasminogen activator inhibitor-1 antigen levels are related with unfavorable outcomes.<sup>15</sup>

Vessel diameter, lesion length, plaque burden and the quality of the distal vessel run-off can be counted as lesion-specific risk factors for restenosis. After 6 months follow-up, no restenosis occurred in our patients.

Mechanical thrombectomy-related complications are reported as arterial perforation, that may occur in the presence of severely calcified arteries, formation of arteriovenous fistulas and distal embolisms, all of which can also be seen in other endovascular treatments.<sup>16</sup>

In conclusion, mechanical thrombectomy may be considered as an alternative treatment method for acute peripheral arterial thrombosis in high-risk open surgery patients, as it can be performed safely and efficiently.

### **Conflict of Interest**

*Authors declared no conflict of interest or financial support.*

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