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TECHNICAL NOTE

Decalcification of a Heavily Calcified Common Femoral Artery and its Bifurcation with a Cavitron Ultrasonic Surgical Aspirator

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Introduction: Surgical endarterectomy is the preferred method for treating occlusive disease of the common femoral artery (CFA). However, endarterectomy is not always straightforward in cases with heavily calcified plaque. To overcome this limitation, a new method for decalcification, which utilizes a Cavitron ultrasonic surgical aspirator (CUSA) has been developed.

Report: The method involves full exposure of the calcified lesion. Following an arteriotomy, protruding calcification is removed using the CUSA, taking care to avoid vessel perforation. Preservation of the medial calcified layer can be accomplished by the accurate control provided by the device, which enables smooth termination in the distal area of the normal wall and does not require a tacking suture. A total of 12 patients underwent decalcification of 13 common femoral artery (CFA) lesions using CUSA with vein patch angioplasty. Concomitant profundaplasty was performed in five cases. The only intra-operative complication was perforation of the arterial wall in one patient, while another had a wound infection that required reintervention.

Discussion: Decalcification of a heavily calcified CFA with CUSA appears to be feasible, although long-term follow-up examinations are warranted.

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INTRODUCTION

Surgical endarterectomy is the preferred treatment for occlusive disease of the common femoral artery (CFA) and its bifurcation, because endovascular treatment is not optimal in such cases.[1—3] However, the procedure can be challenging when there is heavily calcified plaque, as it is difficult to preserve the external elastic lamina of a calcified lesion, leading to problems with distal flap control. To overcome this limitation, a new method has been developed that utilizes a Cavitron ultrasonic surgical aspirator (CUSA) (SonoSurg, Olympus, Tokyo), which enables precise fragmentation and aspiration of calcified plaque.

SURGICAL TECHNIQUE

The CUSA is an ultrasonic device that destroys targeted tissue, then washes the area and aspirates the fragmented mass (Fig. 1). The hand piece contains a hollow titanium tube that vibrates along its axis at a frequency of 23,500 Hz and the ultra high frequency vibrations dislodge calcium from adjacent softer tissues, which are more able to absorb the vibration energy. An irrigation system that uses saline is also built into the hand piece. During the process of fragmentation, tissue debris is suspended in the irrigation fluid and then evacuated by a suction system.[4]

An 83 year old woman presented with rest pain and a non-healing ischemic left foot ulcer. Pre-operative lower extremity computed tomography angiography (CTA) showed severe stenosis of a calcified left CFA and its bifurcation (Fig. 2). Under general anesthesia, the arterial segment containing the calcified lesion was accessed via a vertical groin incision. Next, proximal and distal dissections were extended until secure clamp sites could be achieved by direct inspection and palpation of the artery (Fig. 3A). The deep femoral artery was exposed distal to the level of the lateral circumflex femoral artery. Preparation of a greater saphenous vein graft for a vein patch angioplasty was performed in the same surgical field. Following administration of heparin (100 IU/kg) and arterial clamping, a longitudinal arteriotomy was performed until the calcified lesion and normal site were fully exposed (Fig. 3B). The arteriotomy of the CFA was extended to the deep femoral artery. Then, the calcified lesion was removed using the probe included with the CUSA appliance. The goal for this case was to remove only calcification protruding from the

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Figure 1. Cavitron ultrasonic surgical aspirator (CUSA) system and hand piece. The CUSA probe consists of a transducer, connecting body, and surgical tip.

Figure 2. Pre-operative computed tomographic angiography of the lower extremities, demonstrating heavily calcified plaque in the left common femoral artery extending to the deep femoral artery (arrow).

arterial wall. As the tip of the device vibrates in a longitudinal manner, it was found that employing it at an angle can prevent arterial wall perforation (Fig. 3C). With this technique, the output of the CUSA device was initially set to 70% of its maximal level and then gradually increased, depending on plaque hardness. In this way, preservation of the medial calcified layer can be achieved by accurate control, which enables a smooth transition in the distal portion of the normal wall area, thus a tacking suture is not required (Fig. 3D). Next, decalcification of the arteriotomy line was performed in order to reduce the risk of fraying sutures. For this case, another arteriotomy was performed for the proximal superficial femoral artery and calcified plaque located at its orifice was removed in the same way (see Supplementary Video S1). After flushing residual debris in the vessel lumen with a heparinized saline solution, the arteriotomy was closed with a vein patch to ensure an adequate lumen (Fig. 3E; Supplementary Video S1). A 6-0 synthetic monofilament was used for the vein patch suture. When the medial calcified layer is too hard for

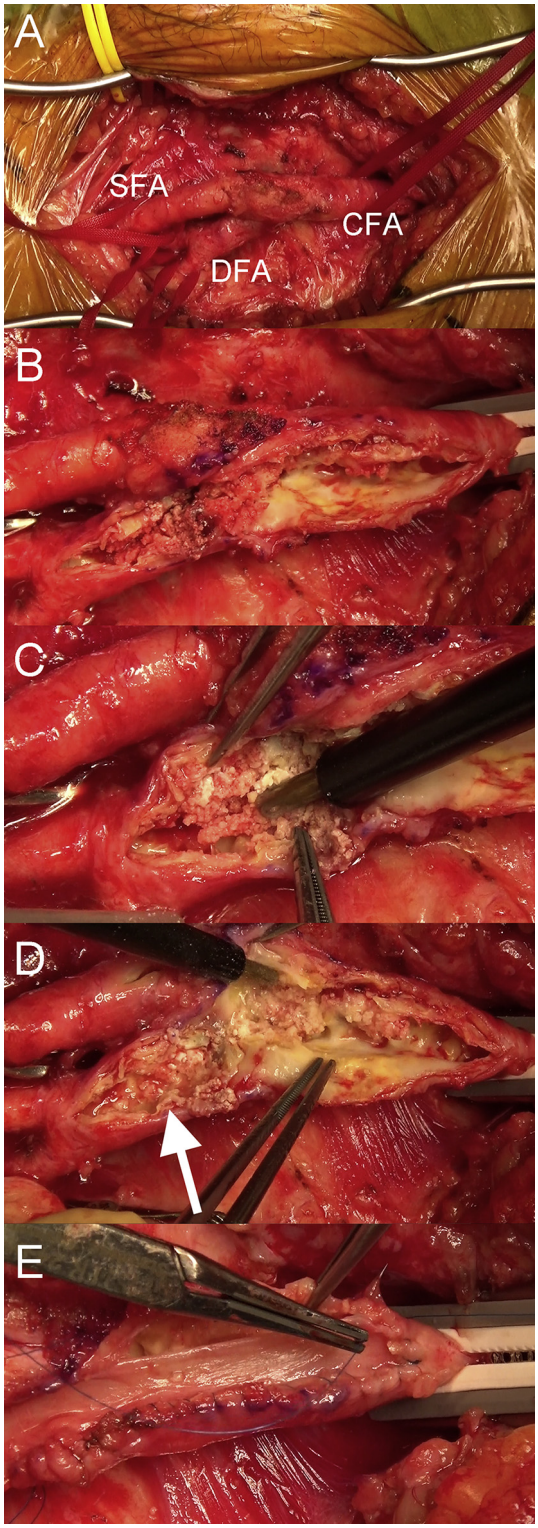

Figure 3. Procedure details. (A) The common femoral artery (CFA), superficial femoral artery (SFA), and deep femoral artery (DFA) were dissected until adequate exposure was attained. (B) An arteriotomy was performed from the CFA to DFA. (C) Protruding calcification was precisely removed by the Cavitron ultrasonic surgical aspirator (CUSA). (D) Decalcification of the arteriotomy line was performed. Shown is a representative image demonstrating a smooth termination in the distal area of the normal wall following CUSA (arrow). (E) Vein patch angioplasty was easily performed. Further details are shown in Supplementary Video S1.