



Case report

Penile revascularization using the descending branch of the lateral circumflex femoral artery: An alternative vascular graft

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ABSTRACT

Introduction and relevance: Microsurgical revascularization stands as the preferred method for addressing erectile dysfunction (ED) resulting from traumatic penile arterial insufficiency. Traditional microarterial bypass surgery (MABS) techniques have typically relied on utilizing the inferior epigastric artery (IEA) as the graft vessel. However, issues such as endothelial dysfunction in the vessel and alterations in abdominal tissue can negatively impact surgical outcomes. MABS using the descending branch of the lateral circumflex artery of the femur (DLCFA) should be proposed as a surgical option for penile arterial revascularization.

Case presentation: A 29-year-old who experienced ED after a pelvic bone fracture with hypogastric vascular injury was referred to our center. Preoperative penile Doppler ultrasound (PDU) examination documented the presence of arterial insufficiency. Selective hypogastric angiography pointed out the interruption of arterial blood flow at the level of the distal right internal pudendal artery.

Case discussion: Access to the dorsal penile artery was gained through an infrapubic incision, the DLCFA pedicle was isolated through an incision along the anterolateral right thigh. After its transposition, the arterial bundle was anastomosed to the dorsal penile artery in an end-to-end fashion. Intraoperative PDU has been used to verify the patency of the anastomosis. At 6 months follow-up, optimal flow parameters on PDU were persistently registered, and the patient had consistent clinical improvement on the IIEF-5 score.

Conclusion: DLCFA grafting for penile revascularization is a suitable therapeutic option in traumatic ED due to its size and accessibility. Further experience is necessary to compare clinical outcomes among different revascularization techniques.

1. Introduction

1.1. Background

Penile vascular insufficiency is considered a major cause of ED along with neurogenic aetiology, Peyronie's disease, and endocrinological disorders [1].

Microarterial bypass surgery (MABS) has historically been proposed as the treatment of choice in patients who presented focal occlusion of penile arterial vessels with reduced blood inflow due to arterial injury as a result of hip bone fractures or perineal blunt traumas [2]. In these settings, revascularization plays a crucial role as it may be considered the only treatment able to restore penile erection avoiding permanent

PDE5i intake, intracavernous injection (ICI) of vasoactive drugs or penile implants [3].

Most of the penile revascularization techniques described so far involve the harvesting of the IEA, which requires a wide pararectal incision between the inguinal ligament up to the transverse sub-umbilical line [4]. To mitigate the impact of open surgery, it was described the isolation and harvesting of the artery with laparoscopic technique [5]. In this scenario, the IEA has established itself as the graft vessel preferably used in penile MABS procedures. However, it should be noted that some patients who have sustained pelvic and abdominal injuries may present subfascial adhesions that make IEA harvesting and transposition a challenging procedure. Furthermore, the anastomosis between the dorsal penile artery and the IEA is a critical step due to the

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difference in calibre between the two vessels, an aspect that could explain the tendency of the anastomosis to stenosis with worsening of the post-operative outcomes. Therefore, alternative donor vessels to perform MABS are being under investigation. The descending branch of the lateral circumflex femoral artery (DLCFA) has been widely described as a graft vessel in cardiac surgery, plastic surgery, and neurosurgery [6,7].

The following case report wants to provide a description of an innovative technique of penile revascularization using the DLCFA instead of the IEA as the donor artery. In the upcoming sections, there will be explained the clinical preparation, the surgical details and the post-operative follow-up after performing a microarterial bypass surgery between the DLCFA and dorsal penile artery, reported in line with the SCARE criteria [8].

1.2. Indications for the procedure

The MABS is suitable for young males who have sustained blunt pelvic or perineal trauma which led to hypogastric arterial axis injury, reduced penile blood inflow and hence deterioration in cavernous perfusion pressure [9]. It should be considered in males younger than 55 years without cardiovascular risk factors, who are affected by ED following a pelvic trauma which caused an isolated stenosis of the internal pudendal artery in the absence of peripheral vascular disease [10,11].

On the contrary, penile surgical revascularization should be avoided, because of the high risk of surgical failure, in patients who present any cardiovascular risk factors such as metabolic syndrome, diabetes, atherosclerosis and peripheral artery disease [12].

2. Case presentation

2.1. Preoperative diagnostic workup

A man of about thirty years who experienced arteriogenic ED because of pelvic blunt trauma came to our referral center. The diagnostic workup included the collection of a detailed clinical history, physical examination and laboratory tests to exclude other organic causes and concurrent psychogenic aetiology of ED [13]. The clinical

examination did not report any comorbidities or chronic drug intake. The preoperative International Index for Erectile Function (IIEF-5) score was 11 out of 25, and the patient was only able to achieve penile tumescence with the help of ICI vasoactive drug.

Preoperative PDU documented the arterial vascular insufficiency with a peak flow of 8.3 and 16.5 cm/s in the right and left penile arterial axis, respectively, below the inferior limit of 25 cm/s [14]. In this case, it was mandatory to integrate the diagnostic procedure with selective angiography of the hypogastric arteries to identify the site of the interruption of blood flow within the hypogastric-cavernous vascular branches and exclude the presence of multiple vessel stenoses responsible for penile arterial insufficiency [15]. In the proposed clinical case, the amputation of blood inflow was identified at the distal portion of the right internal pudendal artery (Fig. 1A and B). Lastly, a preoperative CT angiography revealed the patency of the arterial axis of the right lower extremity.

3. Discussion

3.1. Intra-operative considerations

The patient was positioned supine on the operating table with the right thighs slightly extended. Through an infrapubic surgical incision and with the aid of a 2.5× magnifier, the dorsal penile vessels were identified, and the initial dissection of the receiving dorsal penile artery was performed.

A second longitudinal incision was made along the right antero-lateral thigh at the projection between the vastus lateralis and rectus femoris muscles. Subsequently, the DLCFA was identified between the two muscles, dissected in a craniocaudal direction, and isolated from the origin of the femoral artery to its confluence with the superior lateral genicular artery. Special care should be taken at this stage to preserve the femoral nerve and other branches of the circumflex femoral artery (Fig. 2). Once the artery was cleared at the distal level, it was ligated and then transected. Therefore, the pedunculated DLCFA was transposed under the vastus medialis muscle to achieve the inguinal region (Fig. 3). A pathway for artery tunnelling was created through the subcutaneous tissue using blunt dissection. The right dorsal artery was completely mobilized and divided with the exclusion of the proximal stump of the

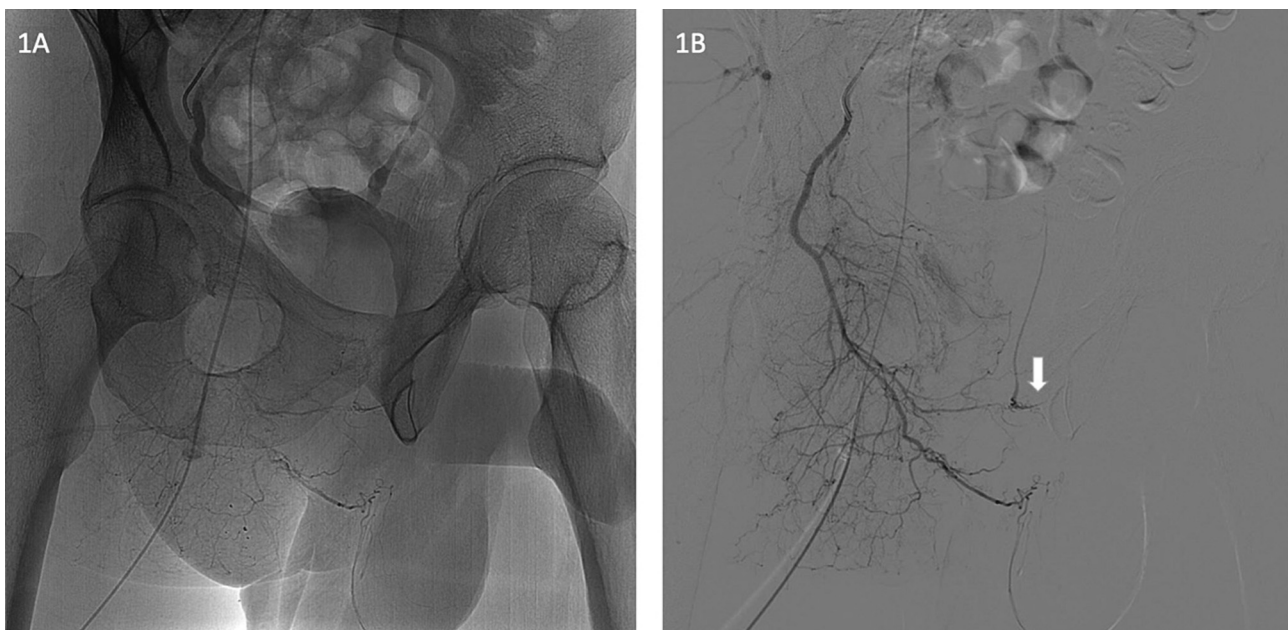


Fig. 1. A and B: Preoperative selective hypogastric angiography (1A) and super-selective catheterization of the right pudendal artery (1B) demonstrate arterial flow interruption at the distal internal pudendal artery (arrow).

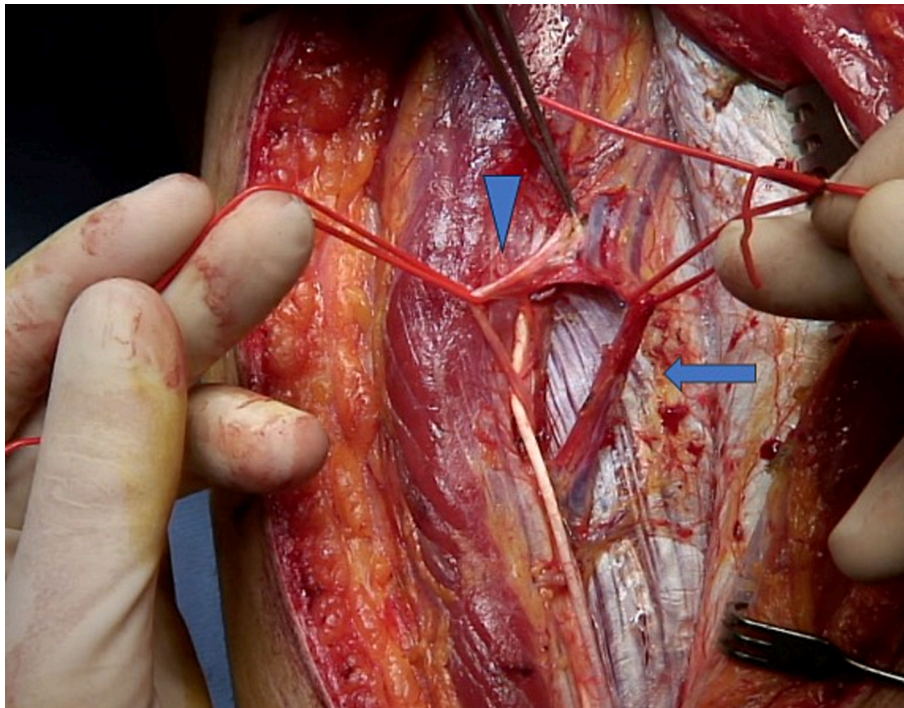


Fig. 2. Isolation, preparation and suspension of the DLCFA (arrow) between the vastus lateralis and rectus femoris muscles, taking care to preserve the respective nerve (arrowhead) and other branches of the circumflex femoral artery.

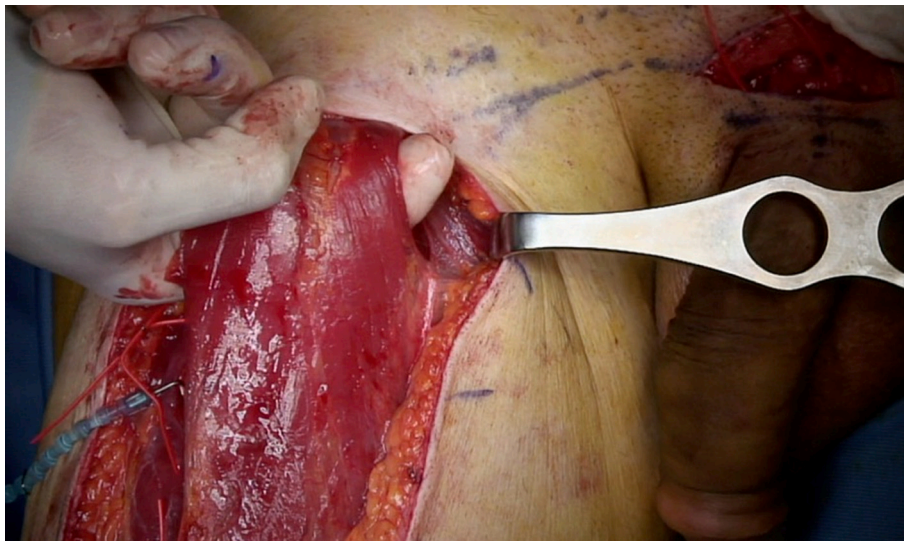


Fig. 3. Transposition of the DLCFA under the vastus medialis muscle (suspended with the finger) to reach the right dorsal penile artery through the infra-pubic incision.

vessel. The surgical microscope is introduced in the operative field. Aneurysmal clips are placed on the distal stump of the right dorsal artery and the DLCFA graft (Fig. 4). To prevent thrombosis of the anastomosis, the adventitia is carefully bluntly excised with micro-scissors from the edges of both arteries. It should be noted that the DLCFA had a calibre equal to the dorsal penile artery, facilitating the microvascular anastomosis which was performed in an end-to-end fashion with Nylon 8-0 interrupted suture (Fig. 5). The aneurysm clips were removed, and the suture was checked for blood leakage (Fig. 6). Moreover, the patency of the arterial graft was studied by intraoperative PDU, which documented the presence of arterial inflow through the anastomosis. Later tissue layers of dartos and dermis at the lower abdominal and thigh incisions

were stitched using absorbable material. Two drainages were placed, respectively at the level of the infrapubic region and at the thigh under the longitudinal suture. Finally, a light compressive dressing was applied to the surgical wounds.

3.2. Post-operative management and follow-up

Prescribing a continuous intake of 100 mg acetylsalicylic acid is essential to prevent thrombotic risk at the anastomosis site. On the fourth postoperative day, the patient underwent a PDU examination without the injection of vasoactive agents to prevent stretching of the anastomosis. The exam documented the patency of the anastomoses and

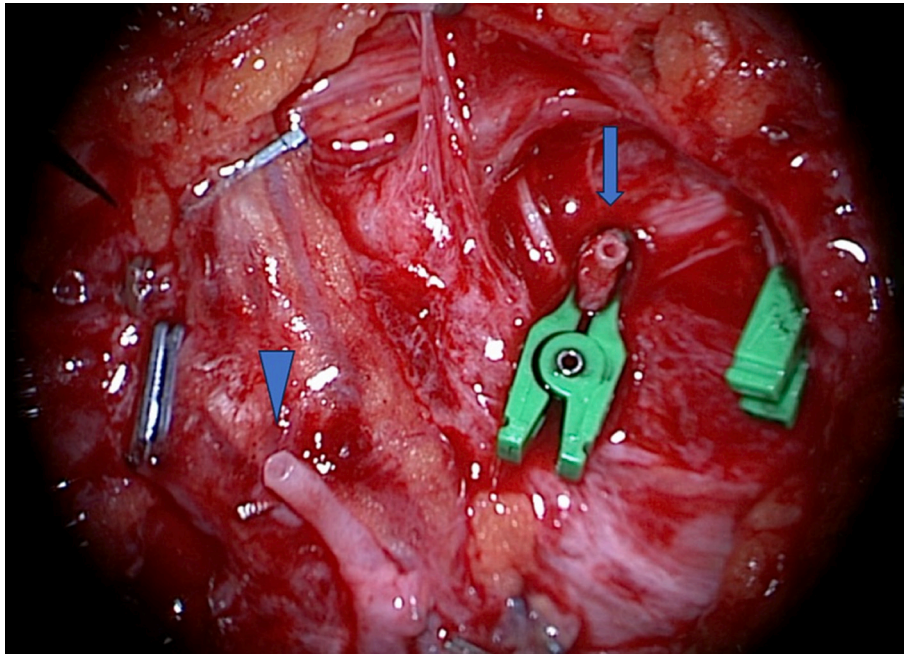


Fig. 4. Microscopic view through the suprapubic incision of the transposed right DLCFA (arrowhead) and the distal stump of the right dorsal penile artery (arrow), which have been prepared and clamped.

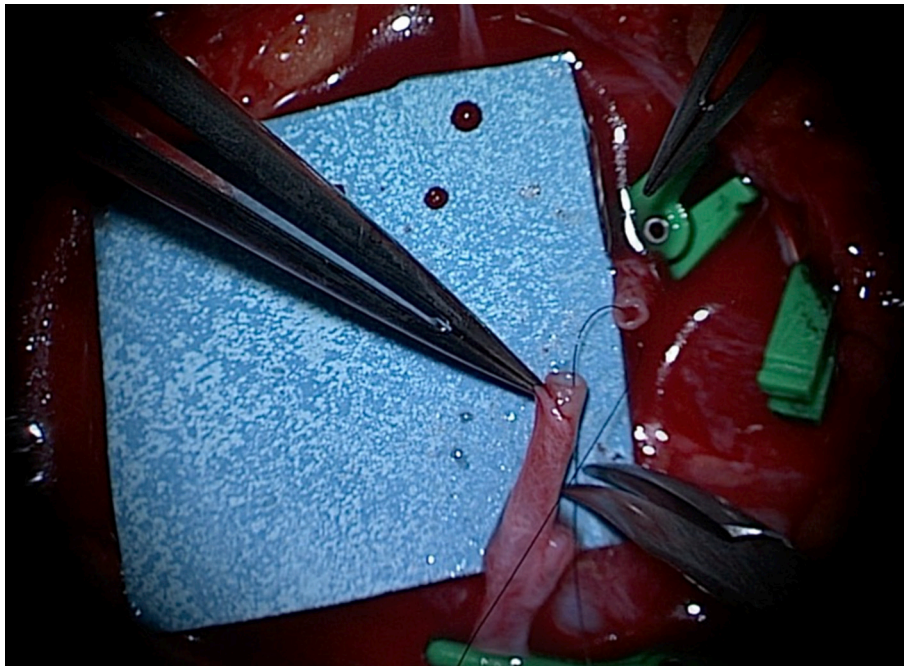


Fig. 5. At this point, the DLCFA and the distal stump of the dorsal penile artery are cautiously brought together with 8-0 nylon suture to perform the end-to-end anastomosis.

cavernous arteries and related helicine vessels and the improvement of the arterial flow parameters. Moreover, during the post-operative hospital stay the patient reported spontaneous penile tumescence. He was discharged home on the sixth postoperative day. The PDU performed two weeks after intervention documented an increase in peak systolic velocity in both cavernous arteries, with values ranging between 40 and 60 cm/s (Fig. 7). Additionally, it established the excellent representation of the dorsal penile arteries, helical arteries, and spongio-cavernous communicating vessels, along with the patency of the anastomosis.

4. Conclusion

4.1. Clinical outcomes

In the presented case, PDU with ICI performed 3 and 6 months after surgery still documented the patency of the anastomosis and the presence of cavernous arterial flow in the normal range (>35 cm/s). At the 6 months follow-up, the patient reported a gradual increase in spontaneous erection tumescence without the need for oral pharmacotherapy.

In this clinical case, we did not observe any postoperative

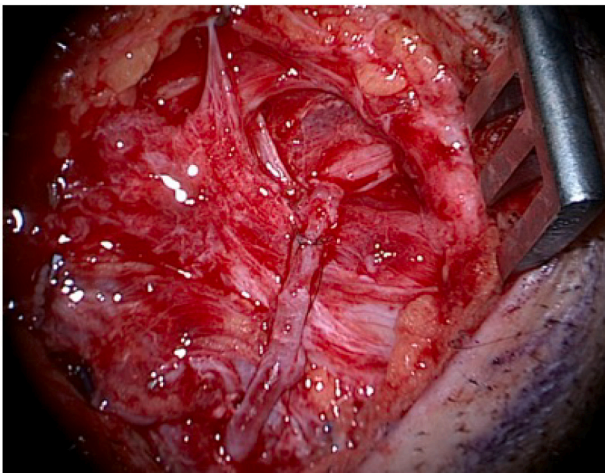


Fig. 6. Final view of the completed microanastomosis with the simple interrupted suture between DLCFA and dorsal penile artery, which has been reperfused after clamps removal.

complications following DLCFA harvesting, although anecdotal consequences such as partial calf necrosis have been described [16]. Hematoma formation and thigh dysesthesia could be considered transient and self-limiting postoperative symptoms.

4.2. Take home message

In summary, penile MABS using the DLCFA as a graft vessel presents a promising and innovative approach for the treatment of arteriogenic ED resulting from pelvic trauma. This surgical technique offers several advantages, including a reduced risk of anastomotic stenosis due to the DLCFA's similar size to the penile dorsal artery, its accessibility, and ease of isolation compared to the IEA.

Our experience suggests that DLCFA-based penile MABS can yield positive clinical outcomes, providing patients with the potential to

regain erectile function without the need for long-term medication or more invasive interventions. This is particularly valuable for young males who have already undergone surgery for pelvic trauma.

However, we acknowledge the necessity for further research, additional procedures, and long-term follow-up data to refine and expand our understanding of this surgical approach.

In conclusion, penile revascularization procedures utilizing the DLCFA as a graft vessel offer a promising avenue for specific patients suffering from arteriogenic ED due to pelvic trauma, particularly those without cardiovascular risk factors. With ongoing research and clinical experience, DLCFA-based penile MABS may become a valuable addition to the armamentarium of treatment options for this challenging condition.

Ethical approval

Since the manuscript describes a single case report, the study is exempt from ethical approval in our institution (University of Trieste – Department of Surgical and Health Science) because the patient has already given consent for the anonymous treatment of personal details and health information.

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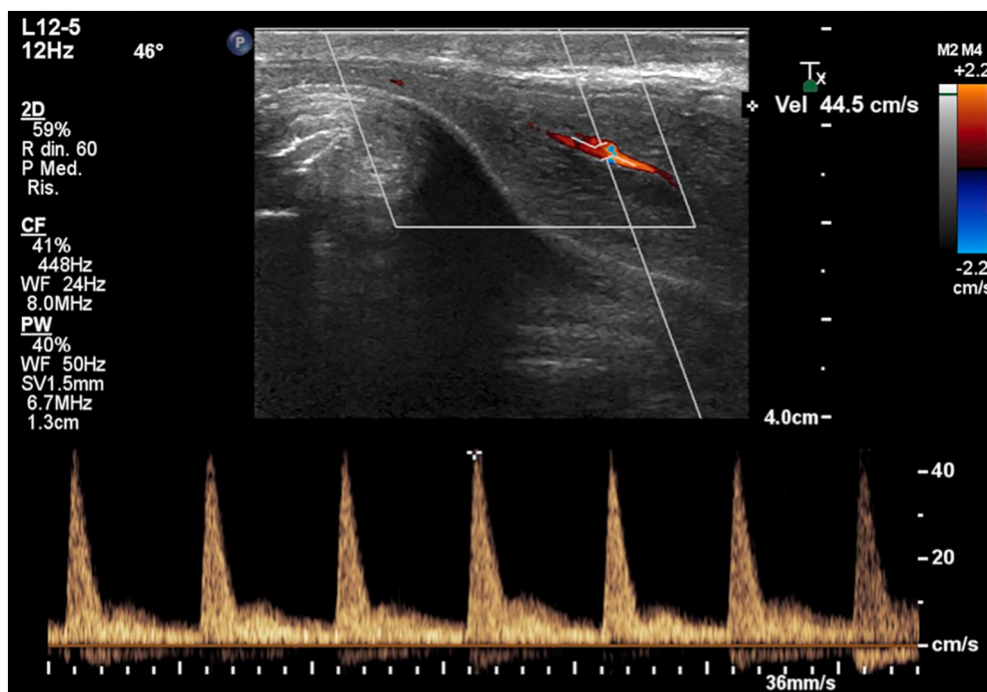


Fig. 7. Two weeks postoperatively, the PDU after injection of vasoactive drugs demonstrates the increased of arterial peak systolic flow until 44.5 cm/s of the common penile artery downstream of the surgical anastomosis.

Guarantor

Prof. Giovanni Liguori

Research registration number

The manuscript doesn't describe a "First in Man" study; therefore it shouldn't be registered prospectively in accordance with the Declaration of Helsinki 2013.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. The personal details of the individual are hidden while identifying characteristics are described in a manner to protect anonymity.

Conflict of interest statement

The authors have no conflict of interest or financial and personal relationships with people or organizations that could have influenced the work.

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