Surgical Management of Pes Cavus Deformity in a Foot Replantation Case

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Abstract

Pes cavus is a deformity of the foot characterized by an abnormally increased arch and hyperextension of the toes that gives the foot the appearance of a claw. We encountered a case of a 54-year-old male patient who presented with total right foot amputation due to injury with the tea harvesting engine. During physical examination, we observed a right foot amputation in the level of the metatarsophalangeal area and a bilateral idiopathic pes cavus deformity. In this unusual case, we aimed to report the difficulties experienced in bone stabilization and tendon repair, which are the first steps in limb replantation, and the tendon lengthening technique used to correct the pes cavus deformity, which is a novel technique for this deformity, along with a review of the related literature. The surgical outcomes of the case were successful.

Keywords: Foot, lengthening, pes cavus, replantation, tendon

INTRODUCTION

Pes cavus is a deformity of the foot in which the sole makes a very high arch on the sagittal plane. While most cases are secondary to neuromuscular disorders, it can also be of traumatic or idiopathic (congenital) origin. Anterior pes cavus is its most prevalent form. Anterior pes cavus is described when the plane of the forefoot is depressed relative to the plane of the rearfoot and usually presents with an equinus deformity in the midtarsal joint or in the Chopart’s joint. Pes cavus is seen in about 10% of the population and 60% of these cases cause severe foot pain, however, medical literature has shown less interest in its treatment compared to pes planus.

Characteristic deformities of pes cavus are forefoot equinus, higher plantar arch, heel varus, calcaneal deformity, plantar fascia contracture, claw toe deformity, contracture/subluxation of metatarsophalangeal joints, and Achilles tendon contracture. In severe claw toe deformities, because the toes don’t touch the ground and don’t serve their function, metatarsal bones bear the weight of the body, hence lead to painful calluses.

The purpose of a surgical treatment is to adapt the sole of the foot to the ground plane and to correct muscular imbalance. Many techniques have been suggested for the surgical treatment of pes cavus. Bone tissue procedures constitute its basic surgeries. Soft tissue procedures are performed for preventing advancement in children and for supporting bone procedures in adults.

In extremity replantations the typical sequence of reconstruction is first performing bone and tendon reconstruction under tourniquet, and then proceeding to the reconstruction of the blood vessels. Adequate access to the anastomosis line bears vital importance for the surgeon.

This study aims to present the challenges experienced and the different technique used in the foot replantation procedure which was performed at the metatarsophalangeal joint level in a patient presenting with pes cavus deformity.
CASE PRESENTATION

A 54-year old male patient presented to our clinic with a severed right foot caused by a tea pruning machine. The physical examination revealed total amputation at the metatarsophalangeal joint level of the right foot extending obliquely to involve the first four digits. The amputated piece was found to have been stored under suitable conditions (Figure 1a, b). Systemic examination found a pes cavus deformity accompanied by severe clawing of the toes in the patient’s intact left foot.

Patient anamnesis revealed no history of neurologic disorders and that both of his feet presented the same condition before the accident. Since the patient was found in good general health and the heel of the severed foot unharmed, he was taken to emergency surgery. The patient was prepared for surgery under tourniquet and general anesthesia. First the surface of the bones was filed along the equinus axis of the forefoot, and then the bone was fixed using K-wires. Intraoperative examination found that, given the pes cavus deformity and its associated intrinsic muscle imbalance-primary suturing of the extensor tendons would lead to a claw toe deformity, and reconstruction of the tendons in this position would create a deep concavity that would technically endanger the anastomosis of the digital anastomotic artery line.

Following the reconstruction of the flexor tendon, extensor tendons were extended by 3 cm and reconstructed with a plantar tendon graft harvested from the other foot. All other anatomic structures were found to permit primary reconstruction. Following the reconstruction of the dorsal nerves, the tourniquet was removed and arteria metatarsalis dorsalis 1, 2, 3, 4, and three vena digitalis dorsalis pedis were reconstructed using the end-to-end anastomosis technique. Since the circulation in the foot was found natural, the procedure was finalized with superficial fascia fasciotomy and by loose suturing of the skin tissue. The foot was stabilized with a splint. Penrose drains were removed 48 hours after the surgery (Figure 2), and sutures were removed on the 14th day. Radiographic imaging of the foot on the 45th postoperative day.
ascertained that the bones had united and cavus deformity was corrected; hence K-wires were removed and physiotherapy initiated (Figure 3). At the end of a six-month physiotherapy, the first digit of the foot was observed to be able to stretch by 20 degrees, the second digit by 15 degrees, the third digit by 10 degrees, and the fourth digit by 5 degrees, all with no restriction in flexure. One year after the surgery the result was satisfactory and further gratifying for both the patient and the surgeon (Figure 4).

DISCUSSION

Although the formation of pes cavus is controversial, its pathogenesis is generally deemed to be caused by the imbalance of the intrinsic and extrinsic muscles at the various levels of the foot.10

Apart from physical and radiological findings, careful neurologic examination should be performed to identify the primary problem in patients who present with pes cavus and its variants. Most common reasons reported in the literature are Charcot–Marie–Tooth disease, spinal dysraphism and poliomyelitis, whereas pes cavus cases with no neurological and traumatic findings are described to be idiopathic.11 Our presented case had no neurological disorders or traumatic findings.

Conservative treatment methods for pes cavus are used in younger age groups and do not provide a total cure. While many surgical techniques have been suggested for its treatment, the suitable surgical method is determined depending on the type and extent of the deformity.12

Soft tissue surgeries are commonly used in young patients and in cases with flexible feet, whereas procedures for the bone tissue are additionally used in older patients and in cases with rigid feet.12 The most commonly used soft tissue procedures are loosening and tendon transfer surgeries. Plantar loosening is a procedure commonly used for releasing the contracted strictures on the plantar surface in children. Calcanevervarus deformity occurrences associated with triceps surae muscle paralysis can be treated with a tendon transfer.7,12

Tendon transfer procedures are also used for reconstructing claw toe deformities by transferring the long extensors to the metatarsal neck or to the cuneiform.14

Once rigid bone deformity has formed, osteotomy at different levels are performed for rectifying the deformity, namely, metatarsal osteotomy, tarsometatarsal osteotomy, and midtarsal osteotomy. Corrective osteotomy is planned so that the cavus deformity rests on the apex of the angle. Triple arthrodesis is used in severely advanced or recurrent cases.15

In our presented case, the amputation line extended from the metatarsal head level obliquely so as to involve the joint. The apex of the cavus deformity angle was located in the tarsometatarsal region. The pes cavus deformity in our patient was reconstructed, hence the muscle imbalance of the replanted foot was rectified by tendon extension using tendon grafting. In the review of the literature we have found no reports of a replantation case for this kind of a deformity nor of a treatment described for rectifying this type of a pes cavus deformity. This case presentation has intended to describe an alternative technique for rectifying a pes cavus deformity, and to once more emphasize the importance of microsurgery in performing successful replantation procedures for sparing the limbs in such technically challenging cases.

Informed Consent: Written informed consent was obtained from patient who participated in this case.
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**REFERENCES**