



E-ISSN: 2707-8353  
P-ISSN: 2707-8345  
IJCRO 2024; 6(2): 27-29  
[www.orthocasereports.com](http://www.orthocasereports.com)  
Received: 06-07-2024  
Accepted: 14-08-2024

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## Single-stage correction of severe rigid ankle Equinus deformity caused by Volkmann's ischemic contracture: A case report

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**DOI:** <https://doi.org/10.22271/27078345.2024.v6.i2a.217>

### Abstract

Fibrotic contracture of skeletal muscle can follow weeks or months after the severe ischemic insult of compartment syndrome. Commonly known as Volkmann's ischemic contracture (VIC), the affected limb often becomes dysfunctional and painful, and may lose sensibility. The pathogenesis of the muscle contracture includes prolonged ischemia, myonecrosis, fibroblastic proliferation, contraction of the cicatrix, and myotendinous adhesion formation. Resultant shortening or overpull of involved muscles in leg leads to ankle stiffness and equinus deformity. Here we describe a case of 40-year-old male who had presented with severe rigid equinus deformity due to VIC following compartment syndrome 10 years back. We did distal fibular osteotomy, talectomy, tibiocalcaneal fusion using 3.5 Dynamic compression plates and screws, tibionavicular fusion using 4mm Cannulated Cancellous screw to achieve single-stage correction of the deformity. At One year follow-up, patient had painless, plantigrade foot, satisfactory aesthetic and functional outcome. Severe rigid ankle equinus deformity in adults can be corrected by midfoot osteotomies and/or gradual correction using external fixator in the absence of soft tissue contracture. When there is soft tissue contracture due to VIC, the deformity can be corrected by single stage surgery. The purpose of presenting this case report is to demonstrate and share satisfactory outcome of the same (single stage surgery) and thus avoiding the need of bulky external fixators for corrections. American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score pre-operatively it was 30% improved to 83% post-operatively.

**Keywords:** Severe Rigid Equinus, Volkmann's ischemic contracture, Single stage surgery, Talectomy, Tibiocalcaneal fusion

### Introduction

A severe ischemic insult resulting from compartment Syndrome may lead to fibrotic contracture of the skeletal muscle which may develop in weeks or even months after injury. This condition known as Volkmann's ischemic contracture (VIC) is a condition that is associated with severe disability, pain and in some cases loss of sensation of the affected limb. Muscle contracture in patients with VIC is a multifactorial phenomenon.

Myonecrosis occurs due to the prolonged lack of blood flow. The immediate event that follows the ischemic injury is fibroblastic proliferation where new fibroblast cells are produced in large number and are involved in the formation of new collagen to form scar tissue within the muscle. It contracts and shortens the muscle fibers because the fibrous tissue that forms a scar replaces the muscle tissue that was injured. Furthermore, myotendinous adhesions that develop enhances the contracture.

Contractures of muscles in the leg region make the ankle to become stiff and a position commonly called as equines where the foot turn downward. This deformity in combination with reduced flexibility and muscle strength affects the performance of the individual and thereby decreases the productivity and quality of life.

Understanding the pathophysiology of VIC enables formulation of therapeutic strategies that may prevent or delay the progression of VIC. The role of the surgery involves early fasciotomy which aims at reducing the pressure within a particular muscle compartment with the intention of increasing blood supply to the affected muscles to decrease the degree of the muscle contracture. Lack of physical therapy and rehabilitation decreases the muscle strength and increases disability.

**Case report**

The present case report describes detailed long-term follow up of a 40-year-old male with a severe rigid equinus deformity of the left lower limb due to Volkmann’s ischemic contracture that had occurred a decade back as a complication of compartment syndrome.



**Fig.1:** Presenting clinical image with severe rigid equinus deformity



**Fig 2 & 3:** Pre-operative radiograph images

The patient recall having a fall from height a decade ago, which caused pain and swelling in the leg to seek osteopathic splinting by a bonesetter. He later developed severe pain and formed blebs due to tight splintage which led to Compartment syndrome. However, his condition was treated by fasciotomy and the application of external fixator was done for fracture in the hospital. After these interventions, split skin grafting was done for wound closure.

At present, the patient ambulates with a limp, bearing weight solely on the toes due to the rigid equinus deformity

(Fig.1). Desiring a painless plantigrade foot, the patient sought further intervention.

Preoperatively, Doppler imaging of the affected lower limb showed a normal blood flow. Surgical correction was undertaken through a lateral approach, distal fibular osteotomy was done. Complete talectomy was performed and it was crushed and used as Bone graft to enhance tibiocalcaneal fusion (Fig.4). The articulating surfaces of the tibia and calcaneum were then freshened and fused with 3.5 Dynamic compression plates and screws. Also, tibionavicular fusion was done with a 4mm cannulated cancellous screw. Distal Fibular osteotomy was fixed with Recon plates and tibiocalcaneal fixation was obtained by using Kirschner wire fixation through the plantar direction. After surgery, the patient was put on below-knee cast for three months. Patient had 3cm shortening for which shoe raise was used to compensate limb length discrepancy.



**Fig.4:** Intraoperative images of complete talectomy through lateral approach



**Fig 5 & 6:** Immediate post-operative radiograph

At the one-year follow-up, the patient exhibited a painless, plantigrade foot with satisfactory aesthetic and functional outcomes, indicative of successful intervention and rehabilitation (Fig.9 &10). American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Score pre-operatively it was 30% improved to 83% post-operatively.



**Fig 7&8:** One year post-operative x-ray showing tibio-calcaneal fusion



**Fig 9&10:** Clinical picture after one year follow-up showing painless plantigrade foot with shortening corrected by shoe raise

This case also highlights the issue and considerations faced during the treatment of Volkmann's ischemic contracture as a complication of compartment syndrome. Furthermore, it demonstrates the reconstruction by surgery as a comprehensive technique that restores both the anatomy and function outcome thus improving the patient's Quality of life

### Discussion

The present approach for the management of rigid severe equinus deformity, especially those caused by Volkmann's ischemic contracture, or other aetiologies, involves a multidimensional process that addresses the structural deformity as well as the functional losses.

- 1. Non-Surgical Management:** If there is no deformity or marked rigidity, one can first try conservative measures such as stretching, bracing and physical therapy. However, they are insufficient for contracted deformities of a more severe and rigid nature [1].
- 2. Surgical Interventions:** Equinus deformity may be managed surgically by the process of soft tissue release (tendons and ligaments). Surgical procedures including gastrocnemius recession, Achilles tendon lengthening or plantar fascia release might be done depending on the cause and the severity of the deformity [2]. Reconstructive surgery might be required in some cases, to alter the position of bones in order to improve joint congruity and biomechanics of ankle joint. These procedures include changing the angles of the bones through direct cutting and repositioning of the bones to alter the mechanical axis and joint congruency [3]. In the case of equinus deformity surgical procedures like calcaneal osteotomy or midfoot osteotomies may be considered. For those few patients with significant deformity or joint instability, fusion operations may be required to maintain stability and prevent relapse of the

deformity. Surgical procedures like Tibio-calcaneal arthrodesis is frequently used to treat rigid equinus deformity. In cases of irreducible or severe rigid equinus deformity, partial or total talectomy may be contemplated as a last resort measure [4]. Following the surgery, rehabilitation is required for good functional outcome like strengthening the muscles, enhancing range of motion and proprioception. Custom orthotics can be prescribed for better stability and facilitate functional recovery [5].

### Conclusion

In cases of Volkmann's ischemic contracture and compartment syndrome directly affecting the ankle, a single-stage correction of severe rigid equinus deformity could be a reasonable alternative to traditional methods of gradual correction and the use of external fixators, especially in the presence of soft tissue contractures due to VIC. Furthermore, in patients who may not otherwise satisfactorily follow the requirements of the gradual correction techniques that require long-term immobilization and regular follow-up, one operation provides a shorter, more efficient solution. And, a single-stage procedure is preferred since it has the advantage of providing early revision and fixation of the deformity leading to decreased patient pain and faster rehabilitation. In addition, the non-use of bulky external fixators also provide comfort to the patient and do not impose the attendant risks of pin tract infection, skin damage and psychological alligator.

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#### How to Cite This Article

Naik RB, Kammar SF, Manikya R. Single-stage correction of severe rigid ankle Equinus deformity caused by Volkmann's ischemic contracture: A case report. *International Journal of Case Reports in Orthopaedics* 2024; 6(2): 27-29.

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