

Endoscopic Management of Nonunion of the Tuberosity of the Fifth Metatarsal



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Abstract: Tuberosity avulsion fractures of the fifth metatarsal are common and the lateral band of the plantar aponeurosis as the structure more likely to cause these fractures. Most tuberosity avulsion fractures heal by 8 weeks with conservative treatment. Symptomatic nonunion can occasionally occur. Internal fixation with or without bone graft is the treatment of choice for painful nonunion if conservative treatment fails. The purpose of this Technical Note is to describe the details of endoscopic management of nonunion of the tuberosity of the fifth metatarsal without diastasis. This includes endoscopic release of the nonunion site, debridement of the fibrous tissue, microfracture of the sclerotic bone surfaces, and percutaneous screw fixation.

There are 3 distinct fracture patterns that occur in the proximal fifth metatarsal: tuberosity avulsion fractures, acute Jones fractures, and diaphyseal stress fractures.¹ Tuberosity avulsion fractures are the most common in this region of the foot and the lateral band of the plantar aponeurosis as the structure more likely to cause these fractures.¹ Most tuberosity or base fractures are transverse to slightly oblique, minimally displaced, and are either extra-articular or have limited intra-articular involvement.² The treatment of the vast majority of tuberosity avulsion fractures consists of symptomatic care in a hard-soled shoe or walking cast. Most tuberosity avulsion fractures heal by 8 weeks.¹ Symptomatic nonunion can occasionally occur.¹

Internal fixation with or without bone graft is the treatment of choice for painful nonunion.³⁻⁶

Gastrocnemius-soleus recession can be considered if there is gastrocnemius-soleus tightness.⁷ This can remove the aggravating and possibly causative factor and allow the nonunion site to heal.⁷ Lui⁸ has described the technique of endoscopic debridement and bone grafting of nonunion of tuberosity avulsion fracture with diastasis. This minimally invasive approach eliminates the need for extensive soft tissue dissection.⁸ However, this technique is not feasible in the nonunion without diastasis. This report describes the technical details of endoscopic management of nonunion of the tuberosity of the fifth metatarsal. It is indicated for symptomatic nonunion of the tuberosity of the fifth metatarsal without diastasis. This procedure is contraindicated if the nonunion is not the source of pain, the patient is a heavy smoker, or there is active infection of the operated site. It is also contraindicated if the tubercle fragment is too small to accommodate a 4-mm screw (Table 1).

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Table 1. Indications and Contraindications of Endoscopic Management of Nonunion of the Tuberosity of the Fifth Metatarsal

Indications	Contraindications
1. Symptomatic nonunion of the tuberosity of the fifth metatarsal without diastasis	1. The nonunion is not the source of pain 2. Heavy smoker 3. Active infection of the operated site 4. The tubercle fragment is too small to accommodate a 4-mm screw

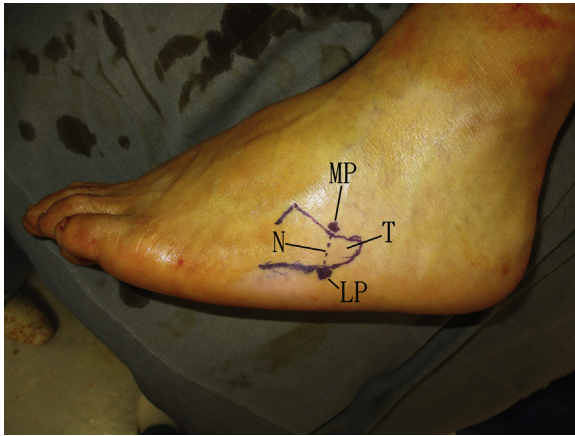


Fig 1. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of left foot. The patient is in lateral position. The base of the fifth metatarsal and the nonunion site is outlined. The medial and lateral portals are marked. (LP, lateral portal MP, medial portal; N, nonunion site; T, tuberosity of the fifth metatarsal.)

Technique

Preoperative Planning and Patient Positioning

The surgeon should make sure that the nonunion of the tuberosity of the fifth metatarsal is the source of pain. Oblique view radiograph of the foot shows the nonunion site. The patient should have pain and local tenderness at the nonunion site.

The patient is in lateral position. A thigh tourniquet is applied to provide a bloodless operative field. The base of the fifth metatarsal and the nonunion site is outlined. The medial and lateral portals are marked. The nonunion site is usually immobile and should be

outlined under fluoroscopy. A 2.7-mm 30° arthroscope (Henke Sass Wolf, Tuttlingen, Germany) is used for this procedure.

Portal Placement

This procedure is performed via the medial and lateral portals, which are located at the respective medial and lateral ends of the nonunion site (Fig 1). Three- to 4-mm longitudinal skin incisions are made at the portal sites. The subcutaneous tissue is bluntly dissected down to the bone by a mosquito hemostat. The soft tissue over the nonunion site is stripped by a small periosteal elevator via the portal incisions. This is the initial endoscopic working space. Endoscopy of the working space dorsal to the nonunion site is performed via the portals.

Identification of the Nonunion Site

The lateral portal is the viewing portal. The remaining soft tissue covering the dorsal bone surface is cleared with an arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) until the nonunion site is identified as a whitish line of fibrous tissue. It is marked with a G18 needle and its position is confirmed under fluoroscopy (Fig 2). This needle serves as an endoscopic landmark of the nonunion site.

Endoscopic Release of the Nonunion Site

The lateral portal is the viewing portal. The tight fibrous tissue at the medial part of the nonunion site is released with an arthroscopic osteotome (Acufex; Smith & Nephew) via the medial portal (Fig 3). The arthroscope is switched to the medial portal, and the tight fibrous tissue at the lateral part of the nonunion

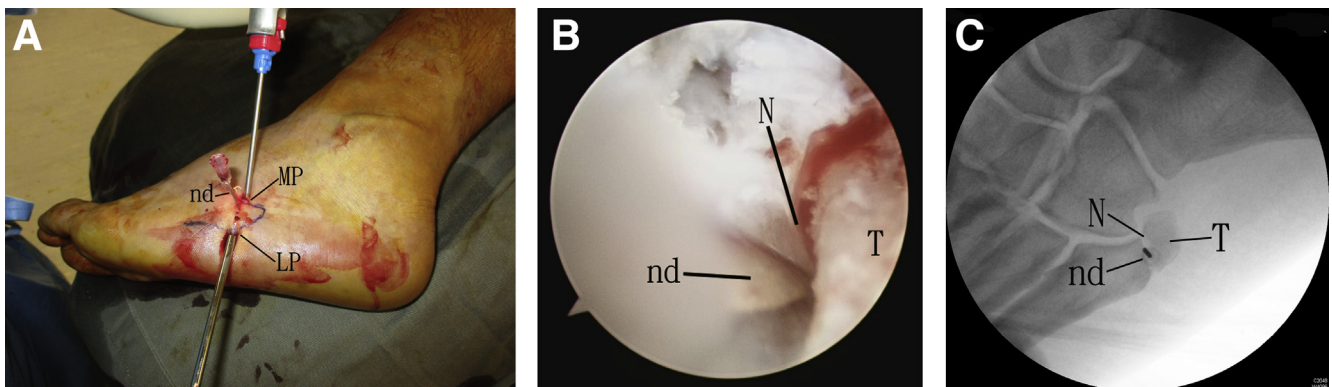


Fig 2. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of left foot. The patient is in lateral position. (A) Endoscopy of the working space dorsal to the nonunion site is performed via the portals. The nonunion site is marked with a G18 needle. (B) Lateral portal is the viewing portal. Endoscopic view shows insertion of the needle into the nonunion site. (C) Fluoroscopy confirms the position of the needle into the nonunion site. (LP, lateral portal; MP, medial portal; N, nonunion site; nd, needle; T, tuberosity of the fifth metatarsal.)

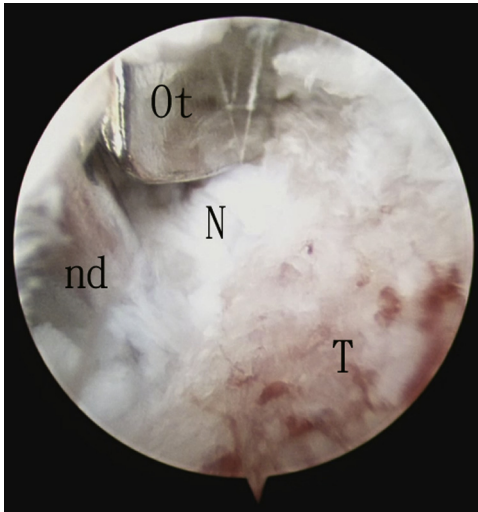


Fig 3. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. The lateral portal is the viewing portal. The tight fibrous tissue at the medial part of the nonunion site is released with an arthroscopic osteotome via the medial portal. (N, nonunion site; nd, needle; Ot, arthroscopic osteotome; T, tuberosity of the fifth metatarsal.)

site is released with an arthroscopic osteotome via the lateral portal (Fig 4).

Endoscopic Debridement of the Nonunion Site

The medial portal is the viewing portal and the lateral portal is the working portal. Because of the tight space of the nonunion site, the arthroscopic shaver or curette

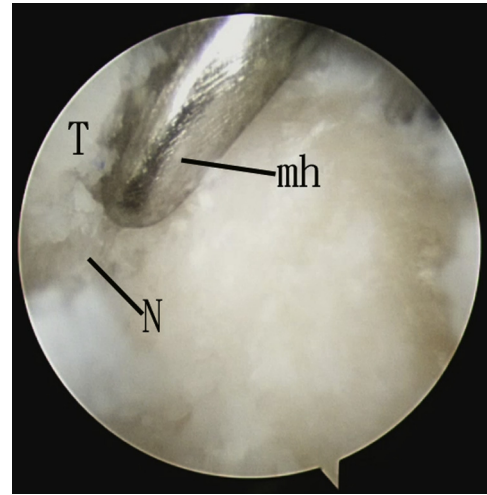


Fig 5. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. The medial portal is the viewing portal. The fibrous tissue of the nonunion site is loosened and curetted out by a fine-tipped mosquito hemostat. (mh, mosquito hemostat; N, nonunion site; T, tuberosity of the fifth metatarsal.)

is too thick to be used for debridement of the fibrous tissue of the nonunion site without excessive bone removal. A fine-tipped mosquito hemostat can be used to loosen and curette out the fibrous tissue (Fig 5). After removal of the fibrous tissue at the lateral half of the nonunion site, the arthroscope is switched to the lateral portal. The fibrous tissue of the medial half of the

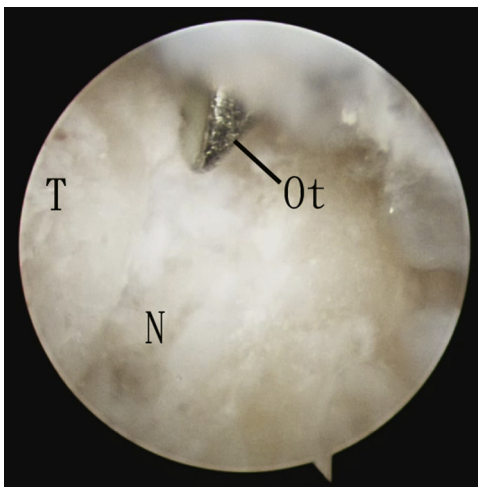


Fig 4. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. The medial portal is the viewing portal. The tight fibrous tissue at the lateral part of the nonunion site is released with an arthroscopic osteotome via the lateral portal. (N, nonunion site; Ot, arthroscopic osteotome; T, tuberosity of the fifth metatarsal.)

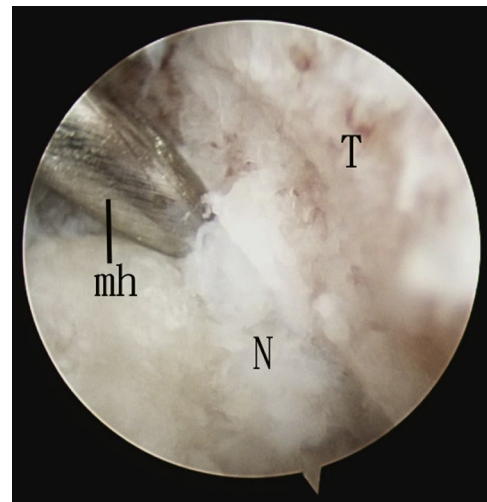


Fig 6. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. The lateral portal is the viewing portal. The fibrous tissue of the medial half of the nonunion site is curetted out with the hemostat via the medial portal. (mh, mosquito hemostat; N, nonunion site; T, tuberosity of the fifth metatarsal.)

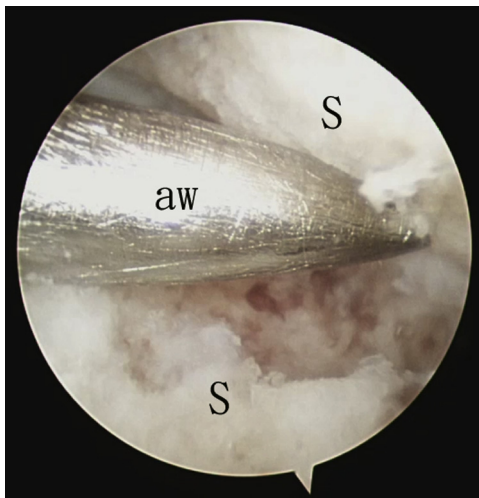


Fig 7. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. The lateral portal is the viewing portal. The sclerotic bone surfaces of the nonunion site are freshened by microfracture with an arthroscopic awl. (aw, arthroscopic awl; S, sclerotic bone surfaces of the nonunion site.)

nonunion site is curetted out with the hemostat via the medial portal (Fig 6).

Preparation of the Fusion Surfaces

The lateral portal is the viewing portal. The sclerotic bone surfaces of the nonunion site are freshened by microfracture with an arthroscopic awl (Acufex; Smith & Nephew) (Fig 7).

Percutaneous Screw Fixation

After preparation of the fusion surfaces, the nonunion site is transfixated with a 4-mm cannulated screw (Fig 8, Video 1, Table 2). The entrance point of the guidewire should be slightly plantar so that the intramedullary screw can provide compression force to the plantar side

of the nonunion site. This can prevent formation of a plantar gap, which may have an adverse effect on the healing of the nonunion site.⁹

Postoperatively, the patient is instructed on non-weight bearing status for 4 weeks. Patient is then advanced to weight bearing in a short walker boot and transitioned to running shoes with an orthosis once the patient is asymptomatic and radiographic healing is present, often at 10 to 12 weeks.¹⁰

Discussion

An avulsion fracture of the proximal fifth metatarsal may result in a symptomatic nonunion and hinder athletic performance.⁴ Nonoperative management is often successful in alleviating symptoms.⁴ Shock wave therapy¹¹ or pulsed electromagnetic fields¹² can be used to stimulate bone healing. When symptoms persist, surgery can be undertaken to repair the nonunion or excise the avulsed fragment depending on the size of the tuberosity fragment.⁴ If the fragment is sizable, internal fixation is preferred to preserve the integrity of peroneus brevis tendon. The reported technique provides a minimally invasive approach of debridement and freshening of the fusion surfaces even if there is no diastasis of the nonunion site. If the patient has evidence of varus hindfoot alignment, postoperative varus unloading orthotic insert with lateral hindfoot and forefoot posting can be helpful to facilitate healing.¹³

Endoscopic management of nonunion of the tuberosity of the fifth metatarsal has the advantages of better cosmetic result, less pain, and less surgical trauma. The potential risks of this technique include screw breakage, refracture, nonunion, injury to the branches of the sural nerve, periarticular fibrosis, and stiffness of the fifth tarsometatarsal joint. This technique is not technically demanding and can be attempted by the average foot and ankle arthroscopist (Table 3).

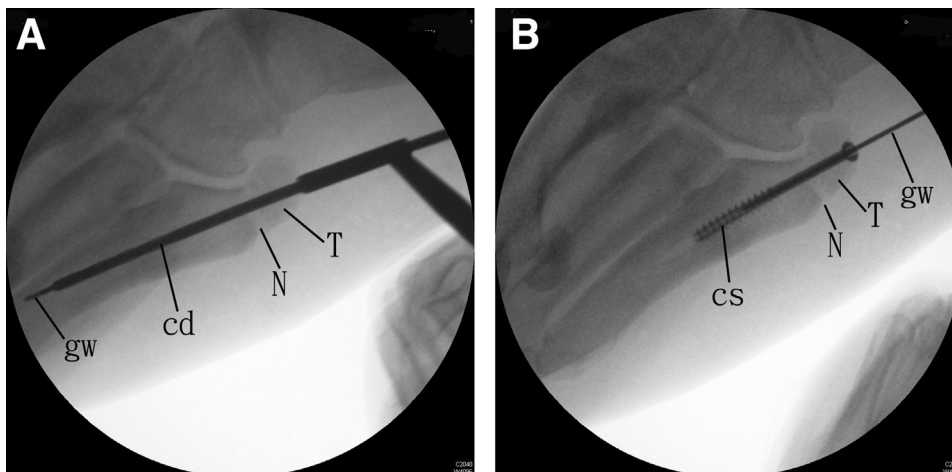


Fig 8. Endoscopic management of nonunion of the tuberosity of the fifth metatarsal of the left foot. The patient is in lateral position. (A) The guidewire is transfixing the nonunion site. A cannulated drill is inserted along the guidewire. (B) The 4-mm cannulated screw is inserted along the guidewire. (cd, cannulated drill; cs, cannulated screw; gw, guidewire; N, nonunion site; T, tuberosity of the fifth metatarsal.)

Table 2. Pearls and Pitfalls of Endoscopic Management of Nonunion of the Tuberosity of the Fifth Metatarsal

Pearls	Pitfalls
1. The nonunion site and the portals should be marked under fluoroscopy.	1. The soft tissue of the incision for the screw insertion should be bluntly dissected down to the bone to avoid soft tissue entrapment by the screw head.
2. The position of the needle marking the nonunion site should be confirmed under fluoroscopy.	2. The biggest size screw that can be accommodated by the medullary cavity of the fifth metatarsal is used to minimize the risk of screw breakage and refracture.
3. The entrance point of the guidewire of the cannulated screw should be slightly plantar at the tip of the tuberosity.	

Table 3. Advantages and Risks of Endoscopic Management of Nonunion of the Tuberosity of the Fifth Metatarsal

Advantages	Risks
1. Better cosmetic result	1. Screw breakage
2. Less pain	2. Refracture
3. Less surgical trauma	3. Nonunion
	4. Injury to the branches of the sural nerve
	5. Periarticular fibrosis and stiffness of the fifth tarsometatarsal joint

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