

Endoscopically Assisted Reduction and Screw Fixation of Acute Fracture of the Posteromedial Talar Process (Cedell Fracture)



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Abstract: Fracture of the posteromedial talar process (Cedell fracture) is a rare injury and is usually associated with other injuries such as medial subtalar dislocation. Diagnosis of the fracture necessitates a heightened clinical suspicion, and computed tomography should be performed in any suspicious cases. Timely treatment is important for restoration of proper anatomy and function of the subtalar joint. Significant morbidity is associated with an undiagnosed or non-operatively treated fracture of the posteromedial talar process, especially in a larger fracture that is intra-articular at both the ankle and subtalar joints. In this Technical Note, the technical details of endoscopically assisted reduction and screw fixation of acute posteromedial talar fracture is described. This can allow fracture reduction and fracture fixation under endoscopic visualization.

Fracture of the posteromedial talar process (Cedell fracture) is a rare injury. It can be caused by a high-energy trauma, which is usually associated with other injuries of the foot, such as subtalar dislocation and talar neck fractures.^{1,2} It can also occur as an avulsion injury secondary to a pronation–dorsiexion force (low-energy injury), which causes tension at the insertion of the posterior talotibial component of the deltoid ligament.¹⁻³ The fracture may present with posteromedial ankle pain and irritation of the flexor hallucis longus (FHL) tendon (pseudo hallux rigidus).⁴ Occasionally, tarsal tunnel syndrome may occur because of fracture

displacement and hematoma formation compressing the tarsal tunnel.¹

Delayed diagnosis of posteromedial talus fracture is not uncommon because of its rarity and similarity to an ankle sprain on standard ankle radiographs.⁵ Despite somewhat-improved visualization of the posteromedial talar process with oblique views, nondisplaced fractures remain difficult to see.³ When undetected, this fracture may become displaced, resulting in nonunion, malunion, or additional injuries such as to the FHL tendon, which may become interposed between the fracture fragments.³

Conservative management is reserved for completely nondisplaced fractures that can be managed with non-weight-bearing cast immobilization for 4 to 6 weeks.^{1,5} The posteromedial talar process fracture can involve both the posterior ankle and posterior subtalar joints and even minimal displacement of a sizable fracture fragment may lead to subtalar subluxation and arthrosis.^{4,6,7} Therefore, anatomical reduction and screw fixation with or without plating is recommended for any displaced fracture with articular involvement.^{1,5,7} Fracture excision is indicated for highly comminuted fractures, painful nonunion, or malunion of displaced fractures that cause posteromedial ankle impingement.^{2,5} Classically, this is performed through a long posteromedial incision with extensive soft-tissue

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The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received February 29, 2020; accepted April 25, 2020.

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2212-6287/20324

<https://doi.org/10.1016/j.eats.2020.04.014>

Table 1. Indications and Contraindications of Endoscopically Assisted Reduction and Screw Fixation of Acute Fracture of the Posteromedial Talar Process (Cedell fracture).

Indications	Contraindications
1. Displaced fractures of the posteromedial talar process that compromise articular congruity	1. The fracture fragment is small without articular involvement 2. The fracture is highly comminuted 3. It is relatively contraindicated in completely nondisplaced fractures

dissection.^{1,8,9} Endoscopic approaches for excision of the fragment^{5,10} or screw fixation of the fracture^{11,12} have been described.

The purpose of this Technical Note is to describe the details of endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process. It is indicated for displaced fractures of the posteromedial talar process that compromise articular congruity because unreduced large, displaced, articular fragments have a high propensity for

nonunion, and the subsequent articular malunion may progress to arthrosis of the ankle and posterior subtalar joint.^{2,4} It is contraindicated if the fracture fragment is small without articular involvement or the fracture is highly comminuted, in which excision of the fragment is preferred. Moreover, it is relatively contraindicated in completely nondisplaced fractures, which can be treated by cast immobilization (Table 1).

Technique

Preoperative Planning and Patient Positioning

Fractures of the posteromedial talar process are particularly difficult to detect on standard radiographs, although a 30° external rotation view may be helpful.^{2,13} Posteromedial tubercle fractures often demonstrate significant posterior subtalar facet involvement with joint subluxation that cannot be appreciated on plain radiographs.¹ Accurate assessment of fragment size and comminution is necessary to determine whether open reduction and internal

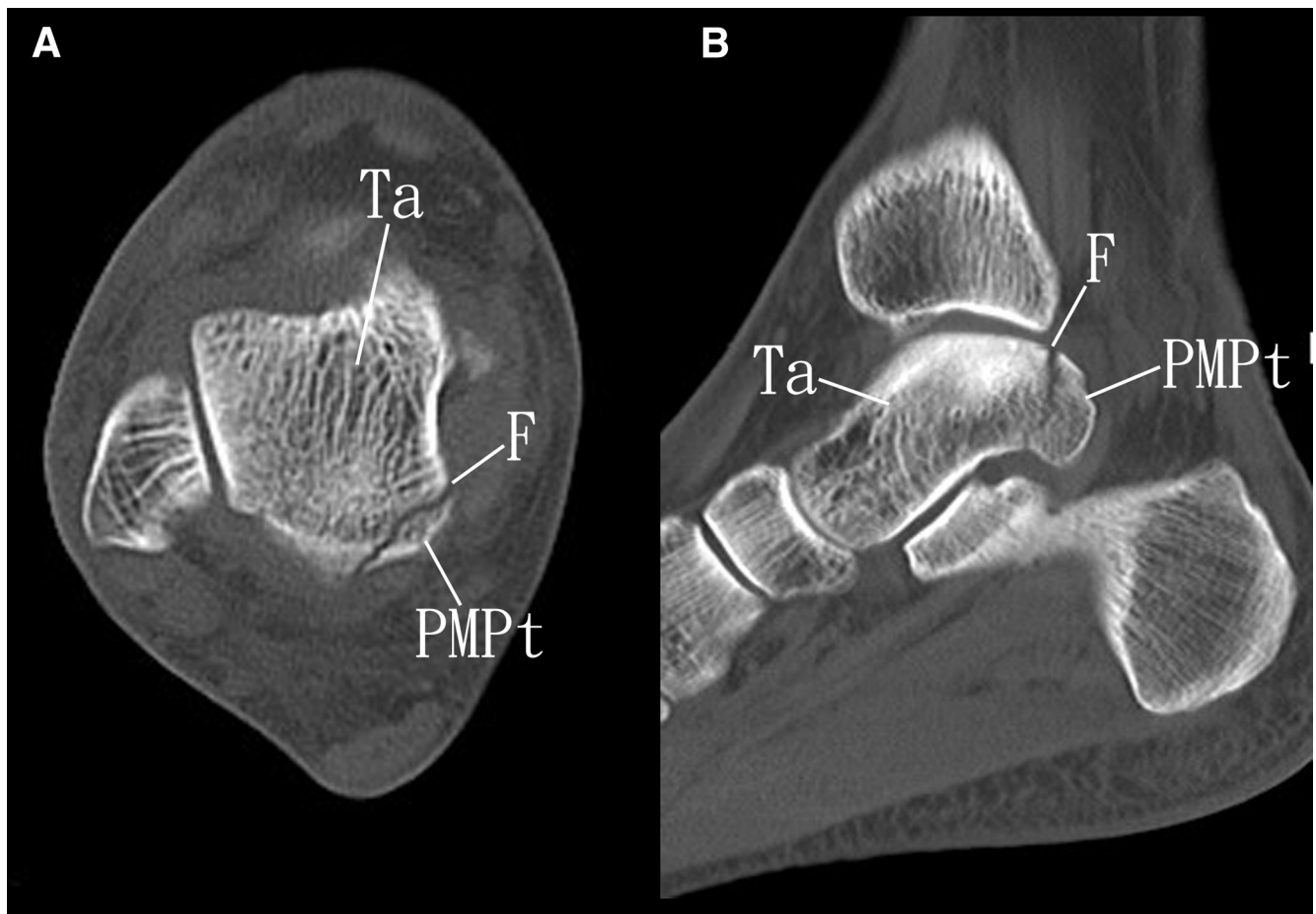


Fig 1. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. Preoperative computed tomography precisely localizes the fracture. (A) Transverse view; (B) sagittal view. (F, fracture line; PMPt, posteromedial process of the talus; Ta, talus.)

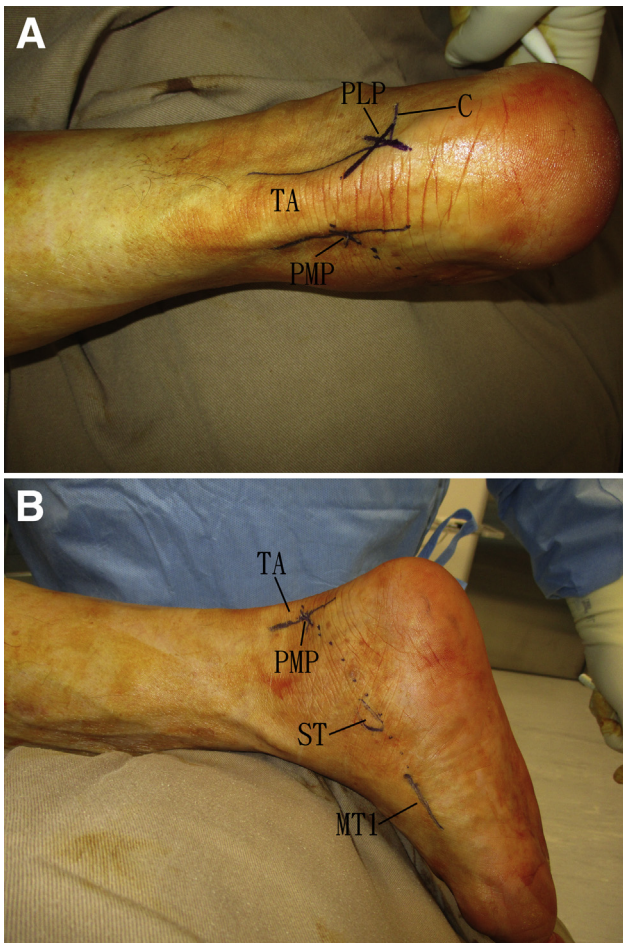


Fig 2. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The procedure is performed via the posteromedial and posterolateral portals. (A) The posterolateral portal is at the lateral side of the Achilles tendon, just above the poster-superior calcaneal tubercle. (B) The posteromedial portal is at the intersection point between the medial border of the Achilles tendon and the line joining the undersurface of the first metatarsal and sustentaculum tali. (C, superior border of the posterior calcaneal tubercle; MT1, first metatarsal; PLP, posterolateral portal; PMP, posteromedial portal; ST, sustentaculum tali; TA, tendo Achilles.)

fixation is appropriate and feasible. Computed tomography is frequently required to make this determination and also precisely localizes the fracture and helps determine the most appropriate surgical approach (Fig 1).²

The patient is placed in the prone position and an ipsilateral thigh tourniquet is used to provide a bloodless surgical field. Fluid inflow is driven by gravity, an arthro-pump is not used, and a 4.0-mm, 30° arthroscope (DYONICS; Smith & Nephew, Andover, MA) is used.

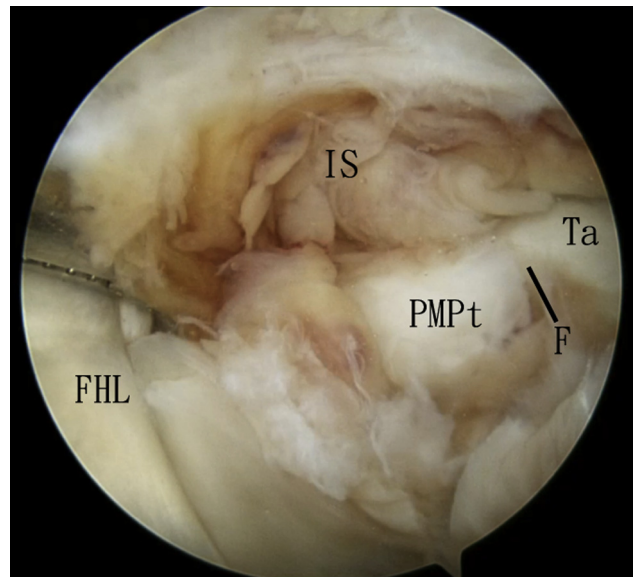


Fig 3. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The FHL tendon is retracted medially and posterior ankle capsulotomy is performed. The posteromedial talar fracture is exposed. (F, fracture line; FHL, flexor hallucis longus; IS, inflamed synovium; PMPt, posteromedial process of the talus; Ta, talus.)

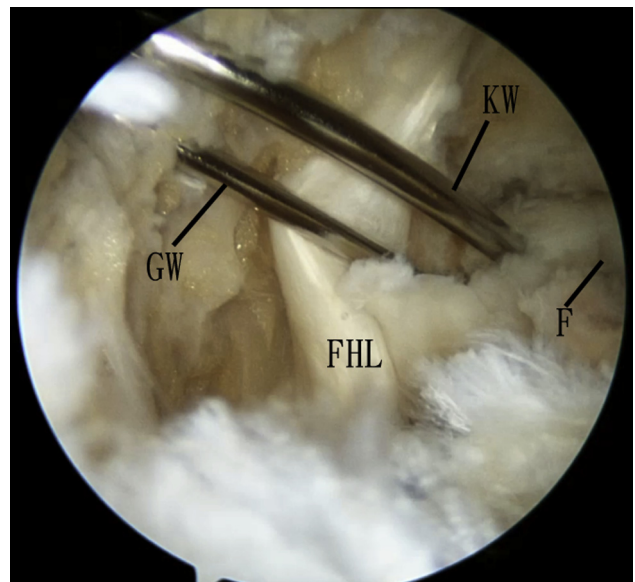


Fig 4. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The FHL tendon is retracted medially and the instrumentation is lateral to the tendon. The fracture is reduced and temporarily fixed with a 1.6-mm K-wire and a guidewire. (F, fracture line; FHL, flexor hallucis longus tendon; GW, guidewire; KW, Kirschner wire.)

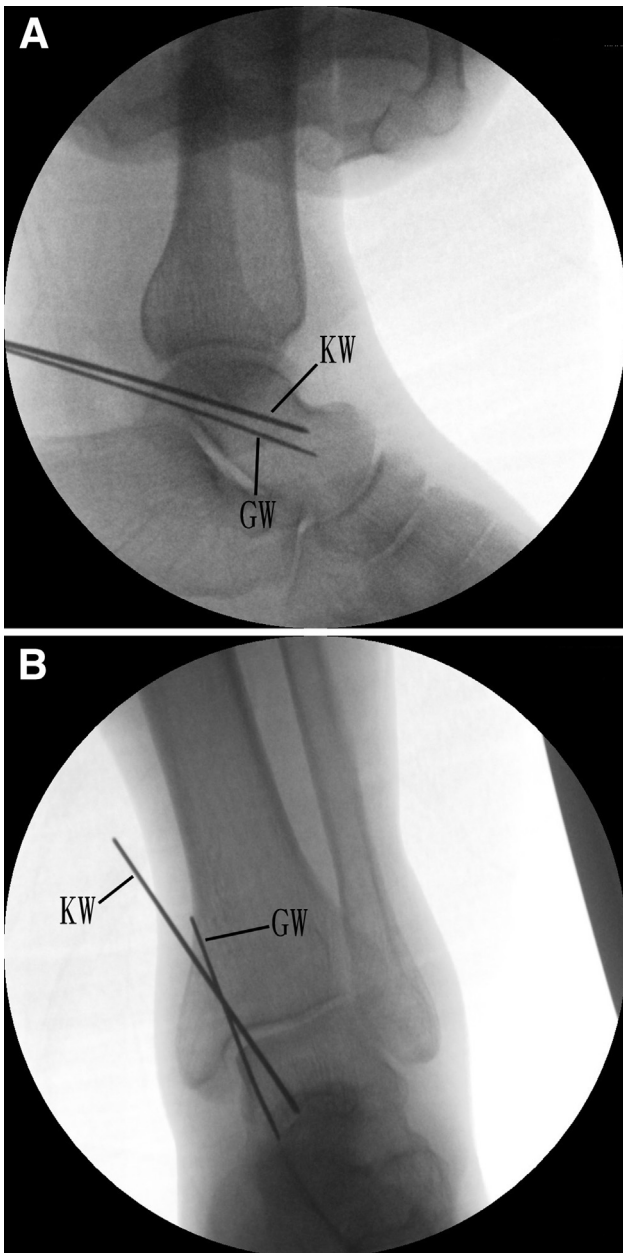


Fig 5. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The position of the K-wire and guidewire is checked with fluoroscopy. (A) Lateral view; (B) anteroposterior view. (GW, guidewire; KW, Kirschner wire.)

Portal Placement

The procedure is performed via the posteromedial and posterolateral portals. The posterolateral portal is at the lateral side of the Achilles tendon, just above the posterosuperior calcaneal tubercle. The posteromedial portal is at the intersection point between the medial border of the Achilles tendon and the line joining the undersurface of the first metatarsal and sustentaculum tali (Fig 2).^{14,15}

Exposure of the Fracture

The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The fibroosseous tunnel between the medial and lateral tubercles of the posterior talar process is released with a SuperCut scissors (STILLE, Lombard, IL) to improve the mobility of the FHL tendon. The tendon is retracted medially can expose the posterior ankle capsule and the posteromedial talar process. Posterior ankle capsulotomy is performed with an arthroscopic shaver (DYONICS) and the fracture is exposed (Fig 3). The surrounding inflamed synovium is resected with the shaver.

Fracture Reduction, Insertion of K-Wire, and Guidewire

The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The FHL tendon is retracted medially and the instrumentation is lateral to the tendon. The fracture is reduced and temporarily fixed with a 1.6-mm K-wire (Zimmer, Warsaw, IN). The size of the fracture fragment is assessed and the appropriate screw size is determined. In this illustrated case, the fracture is planned to be fixed with a 4.0-mm cannulated screws (Synthes, West Chester, PA). The corresponding guide wire (Synthes) is then inserted (Fig 4). The use of drill sleeve can maintain the fracture reduction and protect the FHL

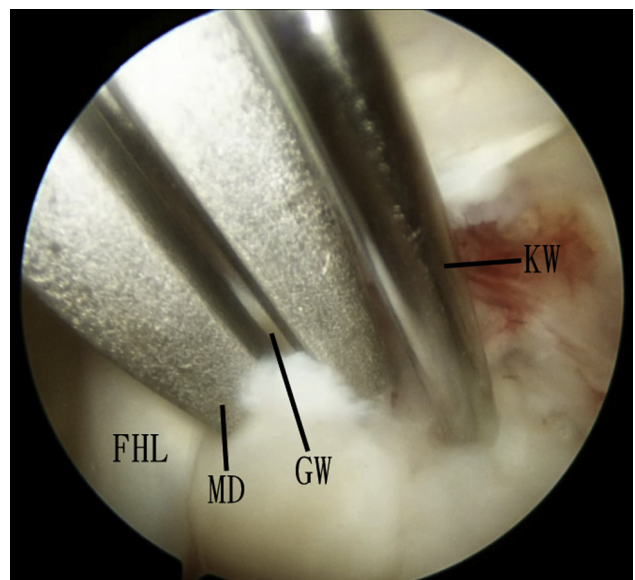


Fig 6. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the screw length is measured with a cannulated measuring device via the posteromedial portal. (FHL, flexor hallucis longus tendon; GW, guidewire; KW, Kirschner wire; MD, cannulated measuring device.)

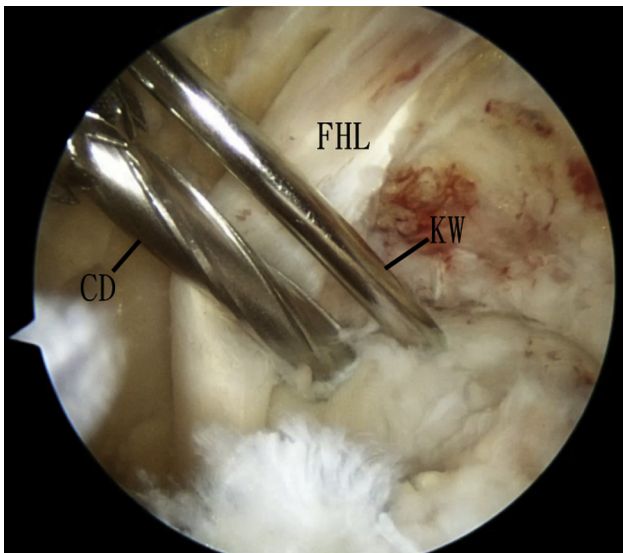


Fig 7. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the screw tract is drilled with a cannulated drill via the posteromedial portal. (CD, cannulated drill; FHL, flexor hallucis longus tendon; KW, Kirschner wire.)

tendon during K-wire and guidewire insertion. The position of the K-wire and guidewire is checked with fluoroscopy (Fig 5).

Measurement of Screw Length

The posterolateral portal is the viewing portal and the screw length is measured with a cannulated measuring device (Synthes) via the posteromedial portal (Fig 6).

Drilling the Screw Tract

The posterolateral portal is the viewing portal and the screw tract is drilled with a cannulated drill via the posteromedial portal (Fig 7). The FHL tendon is protected by the drill sleeve.

Insertion of the Cannulated Screw

The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. A 4.0-mm cannulated screws (Synthes) of appropriate length is inserted. To protect the FHL tendon, the tendon is further retracted medially by an arthroscopic probe (ACUFEX; Smith & Nephew) via the posteromedial portal and the screw is turned anticlockwise before it hits the bone (Fig 8).

Assessment of the Fracture Reduction and Fixation (With Video Illustration)

The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The fracture reduction at the ankle and posterior subtalar joints is assessed (Fig 9). The ankle is plantarflexed and the

great toe is dorsiflexed to confirm that the ankle motion and FHL gliding is not impinged by the screw head. The position of the screw is checked with fluoroscopy (Fig 10, Video 1, Table 2). Postoperatively, the foot is immobilized in a short leg cast, and the patient is advised on non-weight-bearing activity for 6 weeks.

Discussion

Diagnosis of fracture of the posteromedial talar process necessitates a heightened clinical suspicion, and

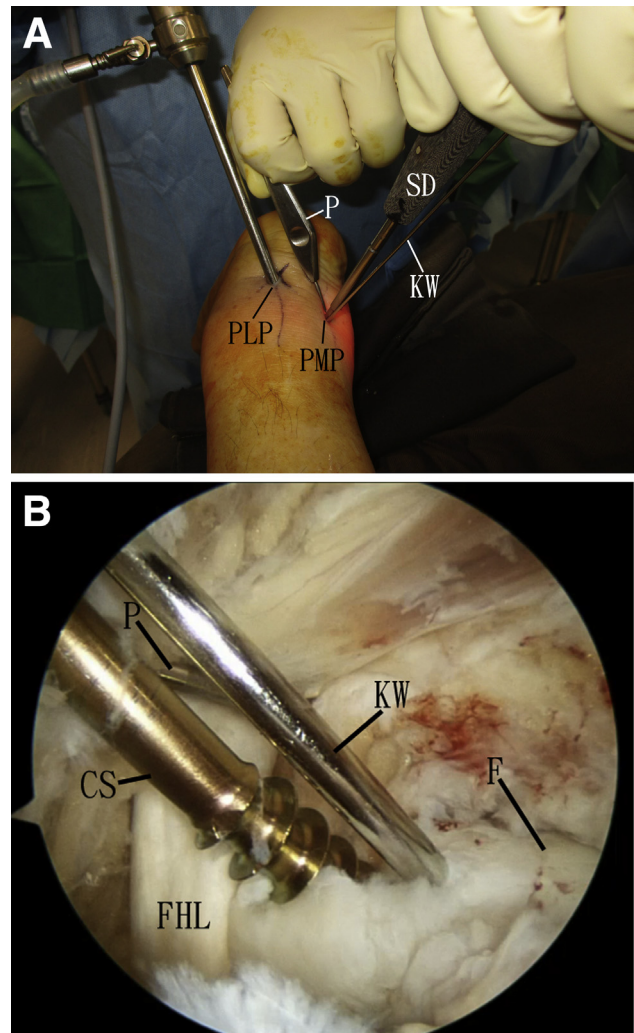


Fig 8. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. (A) A cannulated screw is inserted. To protect the FHL tendon, the tendon is further retracted medially by an arthroscopic probe (ACUFEX; Smith & Nephew, Andover, MA) via the posteromedial portal. (B) Endoscopic view of screw insertion. (CS, cannulated screw; F, fracture line; FHL, flexor hallucis longus; KW, Kirschner wire; P, arthroscopic probe; PLP, posterolateral portal; PMP, posteromedial portal; SD, screwdriver.)

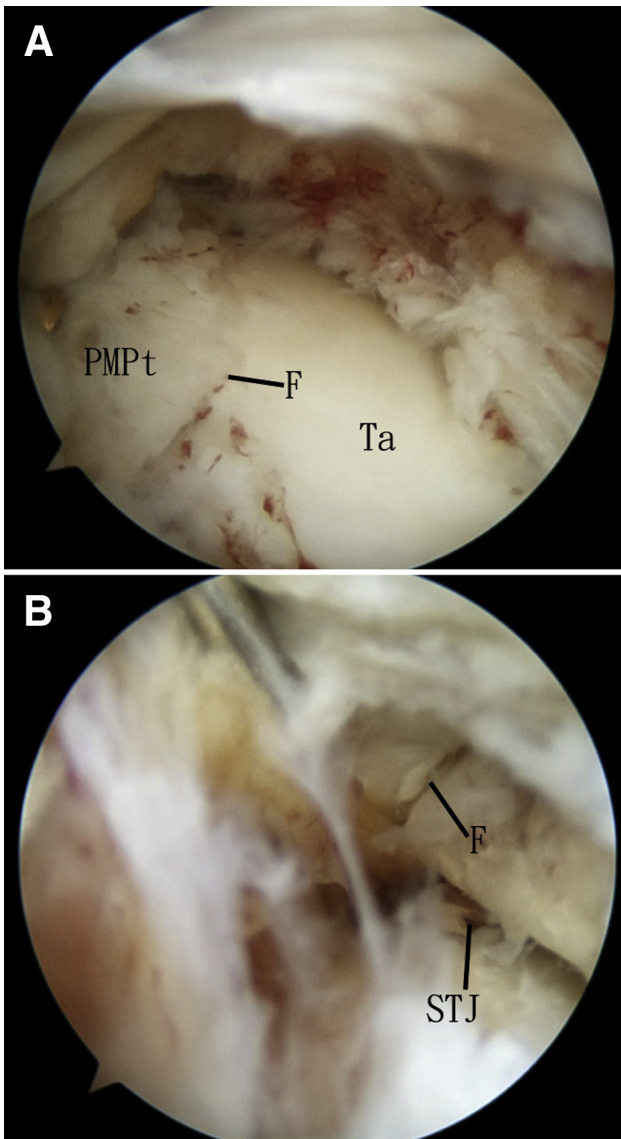


Fig 9. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in the prone position. The posterolateral portal is the viewing portal and the posteromedial portal is the working portal. The fracture reduction at the ankle (A) and posterior subtalar (B) joints is assessed. (F, fracture line; PMPt, posteromedial process of the talus; STJ, posterior subtalar joint; Ta, talus.)

computed tomography should be performed in any suspicious cases. Timely treatment is important for restoration of proper anatomy and function of the subtalar joint. Significant morbidity is associated with an undiagnosed or nonoperatively treated fracture of the posteromedial talar process, especially in a larger fracture that is intra-articular at both the ankle and subtalar joints.^{8,16}

To reduce surgical trauma, minimally invasive approaches of fracture fixation have been developed. Percutaneous screw fixation as a minimally invasive surgical approach can be difficult for posteromedial

talar fracture, as the safe zone is narrow.⁴ The posterior screw may violate the FHL tendon, the tibial neurovascular bundle, the ankle, and posterior subtalar joint.

In our technique, the fracture can be reduced under endoscopic visualization, and mobilization of the FHL tendon facilitates safe insertion of screw. However, the posteromedial talar fracture requires exposure of the medial corner of the posterior ankle and places the tibial neurovascular bundle at risk. The ankle should be kept in a plantar-flexed position to relax the

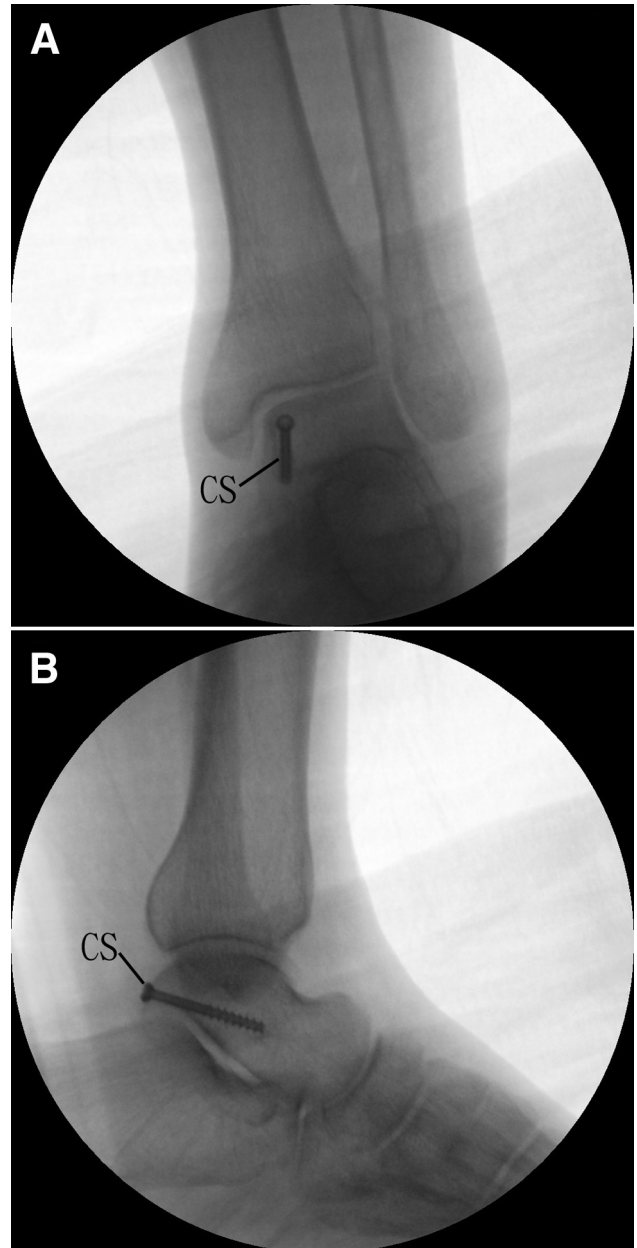


Fig 10. Endoscopically assisted reduction and screw fixation of acute fracture of the posteromedial talar process (Cedell fracture) of right ankle. The patient is in prone position. The position of the screw is checked with fluoroscopy. (A) Anteroposterior view; (B) lateral view. (CS, cannulated screw.)

Table 2. Pearls and Pitfalls of Endoscopically Assisted Reduction and Screw Fixation of Acute Fracture of the Posteromedial Talar Process (Cedell Fracture)

Pearls	Pitfalls
1) The posteromedial portal is established more proximal than the posterolateral portal.	1) Underappreciation of articular involvement.
2) The K-wire and guidewire are placed a bit more lateral.	2) Subtle radiographic findings.
3) The direction of wires and screw insertion is close to the sagittal plane.	3) Too much ankle dorsiflexion during instrumentation at the posteromedial portal may cause impingement of the tibial neurovascular bundle.
4) The flexor hallucis longus tendon is protected by the drill sleeve during insertion of K-wire, guidewire, and cannulated drill.	
5) The flexor hallucis longus tendon is further retracted medially with an arthroscopic probe during insertion of the cannulated screw.	

neurovascular bundle, especially during insertion of guidewire and screw.^{5,17} The more proximally placed posteromedial portal as in our technique may reduce the risk of impingement to the neurovascular bundle by the medially displaced FHL tendon, guidewire, or cannulated screw.^{14,15} However, the ankle still needs to be dorsiflexed during fracture fixation to monitor the fracture reduction. Therefore, it is important to keep the K-wire and guidewire insertion points a bit more lateral and the direction of wires and screw insertion close to the sagittal plane rather than from posteromedial to anterolateral direction to avoid impingement of the tibial neurovascular bundle by the instruments of the posteromedial portal.

This minimally invasive technique has the advantage of less soft-tissue trauma, better cosmetic results, fewer wound complications, and fracture reduction and screw fixation under endoscopic visualization. The potential risks of this technique include non-union, avascular necrosis, implant failure, chronic pain, stiffness, post-traumatic arthrosis, and neurovascular injury (Table 3).⁶ It is not technically demanding and can be attempted by the average foot and ankle arthroscopist.

Table 3. Advantages and Risks of Endoscopically Assisted Reduction and Screw Fixation of Acute Fracture of the Posteromedial Talar Process (Cedell Fracture)

Advantages	Risks
1) Less soft-tissue trauma	1) Non-union
2) Better cosmetic result	2) Avascular necrosis
3) Fewer wound complications	3) Implant failure
4) Fracture reduction and screw fixation under endoscopic visualization	4) Chronic pain
	5) Stiffness
	6) Post-traumatic arthrosis
	7) Neurovascular injury

References

- Kou JX, Fortin PT. Commonly missed peritalar injuries. *J Am Acad Orthop Surg* 2009;17:775-786.
- Berkowitz MJ, Kim DH. Process and tubercle fractures of the hindfoot. *J Am Acad Orthop Surg* 2005;13:492-502.
- O'Loughlin P, Sofka CM, Kennedy JG. Fracture of the medial tubercle of the posterior process of the talus: Magnetic resonance imaging appearance with clinical follow-up. *HSS J* 2009;5:161-164.
- Mao H, Wang H, Wang L, Yao L. Definition of a safe zone for screw fixation of posterior talar process fracture by 3-dimensional technology. *Medicine (Baltimore)* 2018;97:e13331.
- Más Martínez J, Verdú Román C, Martínez Giménez E, Sanz-Reig J, Bustamante Suárez de Puga D, Morales Santías M. Arthroscopic treatment of a malunion of a posteromedial tubercle fracture of the talus. *Arthrosc Tech* 2017;6:e2107-e2110.
- Wijers O, Engelmann EWM, Posthuma JJ, Halm JA, Schepers T. Functional outcome and quality of life after nonoperative treatment of posterior process fractures of the talus. *Foot Ankle Int* 2019;40:1403-1407.
- Kanbe K, Kubota H, Hasegawa A, Udagawa E. Fracture of the posterior medial tubercle of the talus treated by internal fixation: A report of two cases. *Foot Ankle Int* 1995;16:164-166.
- Swords M, Shank J, Benirschke S. Surgical treatment of posteromedial talar fractures: Technique description and results of 10 cases. *Indian J Orthop* 2018;52:269-275.
- Shi Z, Zou J, Yi X. Posteromedial approach in treatment of talar posterior process fractures. *J Invest Surg* 2013;26:204-209.
- Zwiers R, de Leeuw PAJ, Wiegerinck EMA, van Dijk CN. Surgical treatment for posteromedial talar process fractures [published online December 27, 2019]. *Foot Ankle Surg* doi:10.1016/j.fas.2019.12.003.
- Kubo M, Yasui Y, Miki S, Kawano H, Miyamoto W. Stress fracture of the posterior talar process in a female long-distance runner treated by osteosynthesis with screw fixation via two-portal hindfoot endoscopy: A case report. *BMC Musculoskelet Disord* 2019;20:401.
- Ogut T, Seyahi A, Aydingoz O, Bilsel N. A two-portal posterior endoscopic approach in the treatment of a complex talus fracture: A case report. *J Am Podiatr Med Assoc* 2009;99:443-446.
- Ebraheim NA, Karkare N, Gehling DJ, Liu J, Ervin D, Werner CM. Use of a 30-degree external rotation view for posteromedial tubercle fractures of the talus. *J Orthop Trauma* 2007;21:579-582.
- Lui TH. Flexor hallucis longus tendoscopy: A Technical Note. *Knee Surg Sports Traumatol Arthrosc* 2009;17:107-110.
- Lui TH, Chan LK. Posterior ankle and hindfoot endoscopy: A cadaveric study. *Foot Ankle Surg* 2016;22:186-190.
- Giuffrida AY, Lin SS, Abidi N, Berberian W, Berkman A, Behrens FF. Pseudo os trigonum sign: Missed posteromedial talar facet fracture. *Foot Ankle Int* 2003;24:642-649.
- Lui TH. Lateral plantar nerve neuropraxia after FHL tendoscopy: Case report and anatomic evaluation. *Foot Ankle Int* 2010;31:828-831.