Conversion of Pantalar fusion to total ankle replacement: A case Review

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Abstract: Patients with non-union or malunion of an ankle arthrodesis present as a management problem for foot and ankle surgeons. The treatment options include conservative treatment, resection and attempt at re-fusion, or even the need for additional joint fusion procedures (hindfoot fusions). Ankle arthrodesis with poor outcomes also may result in amputation. Conversion from arthrodesis to joint replacement has been present with good results in the orthopedic literature for quite some time, however the published literature of the success with failed ankle arthrodesis to ankle replacement is very limited. The purpose of this article is to present a case study of a 60-year-old male who underwent total ankle replacement using the INBONE® total ankle replacement system after an ankle arthrodesis non-union.

Key words: Pantalar fusion, non-union and total ankle replacement

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Arthrosis of the ankle and hindfoot can be a debilitating condition with a significant impact on a patient's quality of life. The condition results in pain, limited range of motion, impairment of ambulation, and deformity. Ankle arthrodesis is widely accepted as the gold standard for end stage ankle arthritis [1]. Ankle arthrodesis is a predictable operation that can be accomplished in most cases of ankle joint arthritis [1]. Like any other surgical procedure, ankle arthrodesis is not without its complications. Complications include non-union, malunion, deep infection, and continued pain. These complications can occur even with accurate and anatomic positioning of the arthrodesis. In addition, ankle arthrodesis may have detrimental effects to normal gait mechanics in speed, stride length, and symmetry [1]. It is also a well-known fact that adjacent joints may also develop arthritis due to the increased mechanical demand. The combination of hindfoot and ankle arthritis is even more challenging than ankle arthritis alone [2]. Selective fusion of one, two or three joints of the hindfoot have remained mainstays of treatment for orthopedists and podiatrists. However, when these fusions are combined with ankle fusion, it is known to be a more challenging procedure with less predictable outcomes [3]. Pantalar arthrodesis is common procedure for severe hindfoot degenerative joint disease. However, the procedure has varying amounts of success reported in the literature. Acosta et al. sighted a 37% complication rate with pantalar arthrodesis and also
noted that pantalar arthrodesis had a higher rate of non-union than a tibiocalcaneal arthrodesis [3]. When pantalar fusion or ankle arthrodesis fail, the surgical treatment options may be very limited. The current rate for ankle arthrodesis nonunion ranges from 0-40% [7]. The treatment options for a painful nonunion of ankle arthrodesis include bracing, resection and attempt at refusing and even below knee amputation. Major complication rates following revision arthrodesis range from 23-60%, and also have a high rate of nonunion and mixed clinical outcomes [7].

Ankle replacements have become a more acceptable treatment option for ankle arthritis over the last several decades. Ankle implants were originally designed in the 1970s as an alternative to ankle arthrodesis. Early designs often failed as a result of poor implant design, loosening and instability [4]. Despite the early problems, ankle implants have continued to improve and become a more reliable surgical option for the management of end stage ankle arthritis. In patients with failed ankle arthrodesis, conversion to a total ankle replacement is emerging as a salvage procedure. Conversion of fused or ankylosed hip and knee have been converted to total joint replacement with well documented success for years [5]. Several small studies have suggested that converting a failed ankle arthrodesis into a total ankle replacement is not only a salvage procedure but favorable [5,6]. The advantages include pain relief and restoration of motion of the ankle joint, which may help preserve other surrounding joints and improve quality of life [5]. However, literature that exist for conversion of failed ankle arthrodesis to total ankle replacement is limited. Most available studies are level IV evidence and include only a small number of patients [6]. Hinterman et al. in 2009, conducted a prospective study in 30 feet (29 patients) using the HINTERGRA® ankle replacement in patients that had previously failed ankle arthrodesis due to non-union. They saw VAS scores decrease from 7.5 to 2 and AOFAS scores increase from 34 to 71, while 25.5 degrees of total ankle range of motion was achieved. This study suggested that conversion from failed ankle arthrodesis to total ankle replacement is a viable treatment option that provides reliable intermediate results [8]. This case study describes a patient with a pantalar fusion who experienced an ankle non-union that was converted to a three-component total ankle replacement.

Case Study

60-year-old male with a significant past medical history of hypertension and atrial fibrillation presented for debilitating and chronic right ankle pain. His ankle pain had been present for the past five years. Six years prior, he had a triple arthrodesis to treat his painful flatfoot deformity. Over the years, he has tried many conservative treatment options and less invasive options for the painful ankle including: activity modification, ankle foot orthosis (AFO), ankle injections, physical therapy, and ankle arthroscopy.

Figure 1. Initial pre-operative radiographs demonstrating triple arthrodesis.

He was diagnosed with severe ankle arthritis and decided to proceed with ankle fusion in 2015. An anterior plate and two large compression screws were used to fuse the ankle. Patient was compliant with all of the post-operative instructions. However, after several months of weight-bearing, he began to experience significant pain in his right ankle. Post-operatively, he was prescribed Celebrex for the pain and an AFO to control the micro motion of the ankle. With little improvement in pain, he obtained radiographs and a CT scan that demonstrated a nonunion with pseudoarthrosis at the ankle joint. The CT scan also showed solid bony fusion of the subtalar joint, talonavicular joint and calcaneocuboid joint. The hardware was intact without any evidence of infection and the ankle and foot were maintained in good overall alignment.
Figure 2 & 3. Post-operative radiographs of the right ankle demonstrating non-union.

His surgical options were then discussed in detail. Options included attempt at re-fusion with resection and bone grafting. It was also discussed with the patient to have an ankle fusion takedown and conversion to a total ankle replacement, which the patient decided to proceed with. He was also in need of a total knee replacement; it was suggested by the attending surgeon that he have the knee replacement before having the ankle surgically corrected. The patient felt that the ankle was too painful to be able to rehab the knee so the ankle fusion takedown and conversion to total ankle replacement was done first.

Anterior ankle incision was placed in between the tibialis anterior and EHL tendons. The incision was carried down to the level of the periosteum and then the bone. The anterior ankle hardware and crossing screws were removed from the prior ankle arthrodesis site. The screw from the previous subtalar joint arthrodesis and hardware from the previous talonavicular joint arthrodesis were also removed to allow for the talar component of the total ankle replacement.

The INBONE® foot holding system was then correctly placed using fluoroscopy to target the center of the talus. A small stab incision was made on the plantar surface of the foot and the 6-mm drill for the intramedullary tibial reaming system was inserted. The resection guide was then aligned with the intramedullary drill. The bone cuts were then made using the jig, however the lateral aspect of the tibia and talus were unable to be cut through the jig. This side was cut using a freehand technique. The remaining bone was removed using a rongeur and curettes. The INBONE® foot holding jig was then realigned. The tibia was then prepared for the tibial stem and reaming. The tibial tray size was then verified. The tibial stem was then assembled and placed into the reamed portion of the tibia within the medullary canal. The tibial tray was then inserted and cemented into place. The trial spacer and talar component were then placed. The talus was then prepared through the talar trial component. The final talar component was inserted and press fit into the predrilled holes within the body of the talus. The poly was then inserted between the talar component and the tibial stem.

Figure 4. Anterior ankle incision placement.

Figure 5. Removed hardware from distal tibia and talus.

Figure 6 & 7. Intra-operative images of the tibial stem, talar component and poly in place

Intra-operatively, ankle joint range of motion measured 39 degrees. The ankle joint was then closed along the subcutaneous tissue and skin. The foot was
then placed in a posterior splint that could be removed for gentle active ROM. The patient was given three weeks of Lovenox for DVT prophylaxis. His wounds healed without complications. He was placed into CAM boot at three weeks and told to continue with ROM exercises. At three months, he was able to walk with the assistance of crutches but was limited in physical therapy and activity due to the chronic knee pain.

\[\text{Figure 8. Intra-operative images of the tibial stem, talar component and poly in place}\]

\section*{Discussion}

Few studies have addressed the complications of ankle arthrodesis, and even fewer have addressed painful non-union of pantalar arthrodesis [6]. Conversion of painful arthrodesis to total ankle replacement is a possible salvage procedure for these patients, however the amount of quality evidence on the effectiveness of this procedure is very limited. In a recent study by Barg and Hinterman, they found that while patients who underwent conversion from painful ankle arthrodesis to total ankle replacement did have an overall decrease in pain, only 18.2% were pain free at last follow up and also found that the rehab period was much longer for patients who underwent conversion compared to patients that underwent primary TAR [5]. The patient from our case study also was still having pain at his last follow up, however his overall pain was significantly improved compared to prior to conversion, which is similar to reported outcomes. In a case report by Atkinson et al. where a painful ankle arthrodesis nonunion was converted into a total ankle replacement, a significant improvement in gait was noted. They noted a normalization of gait mechanics, increased pace of gait, improved stride length and cadence, as well as increased ankle power throughout the gait cycle [9]. The patient in our study has subjectively reported similar improvement in his gait. Prior to his conversion he stated that he walked with a significant limp due to the constant ankle pain. At his 5 month follow up he stated that he was walking with a more normal gait. Ankle replacement combined with hindfoot arthrodesis is a fairly common practice. Even though some surgeons have performed hindfoot along with total ankle replacements, it is recommended that these procedures be performed in isolation. The large amount of preparation that is required of the talus for both an ankle replacement along with a hindfoot fusion(s) may place the talus at risk of osteonecrosis [8]. The patient in this case study had a well healed and well positioned hind foot fusion, essentially creating a large bone platform for the total ankle conversion. Ankle arthrodesis through a lateral approach with a fibular takedown is a common approach to ankle fusion. However, in the case of this patient, still having the fibula intact allowed for more stability in the conversion to total ankle replacement. Greisberg et al, in a study of 23 ankle fusion conversions to TAR had 5 ankles where the distal fibula had been resected during arthrodesis. This resection predisposed the total ankle replacement to have a symptomatic valgus tilt. Pelligrini et. al noted in their study that a patient that had the fibula intact still had valgus migration of the total ankle talar implant. They attributed this to foot malalignment and deltoid ligament insufficiency. Other studies have stated that lack of a distal fibula is contraindication to ankle arthrodesis conversion to total ankle replacement. The patient in this case study had his fibula intact and a well aligned foot, providing for more stability for the implant. The options for salvage after failed ankle arthrodesis are limited and challenging. This patient at the 5 month mark is doing relatively well. This case echoes the findings of previous small studies in that ankle arthrodesis conversion to total ankle replacement may be a viable option. This patient continues to be followed and intermediate and long-term results are needed in order to determine the success of the procedure.

\section*{References:}

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