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Case Report

Ankle Arthroscopy Medial Malleolar Osteotomy followed by Distraction Arthroplasty in Treating PVNS: A 5-Year Follow Up

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Abstract

Pigmented Villonodular Synovitis (PVNS) is a rare condition that causes swelling in certain joints, mostly affecting the knee and foot. The cause of PVNS is unknown, but it is thought to be caused by an overgrowth of cells in the lining of the joints. Symptoms of PVNS include pain, swelling, stiffness, and redness in the affected joint. Treatment for PVNS typically involves surgery to remove the excess tissue.

A 37-year-old woman with PVNS in her left ankle would undergo an ankle arthroscopy medial malleolar osteotomy and talar grafting followed by distraction arthroplasty. This surgery was successful in relieving the woman's pain and symptoms, and she was able to return to restricted work six months after surgery and able to make a full return to police activities 2 years post operation.

This case study suggests that medial malleolar osteotomy followed by distraction arthroplasty may be a viable treatment option for people with PVNS who do not want to undergo traditional surgery. However, more research is needed to confirm these findings.

Keywords: Pigmented villonodular synovitis; Medial malleolar osteotomy; Distraction arthroplasty; Ankle arthroscopy; Synovitis.

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Introduction

Pigmented Villonodular Synovitis (PVNS) is a rare condition which causes swelling in certain joints mostly affecting the knee and foot [1]. This disease has an estimated incidence rate of roughly 1.8 cases per million people in a population [2]. PVNS is usually found in adults aged 20–50 years, with a mean onset age of 35 years with the knee being the most common location [3]. Other possible locations of the disease consist of the hip, ankle, shoulder, foot, or facet joints of the spine. The cause of PVNS is unknown, however potential causes include genetic factors, trauma, and rheumatoid arthritis [4-

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6]. When observing the synovial fluid in PVNS, they generally have a dark brown or hemorrhagic color [7]. When observing the tissues affected by PVNS you can observe a variety of mononuclear cells, macrophages with extensive hemosiderin stores, and multinucleated osteoclast-type giant cells [8]. As the disease is benign it stays localized to the affected area, but it can affect the quality of life in those specific areas [9]. Clinical symptoms with patients that have PVNS include pain and swelling in the affected joint, localized tenderness, palpable soft tissue mass, and stiffness in the in the joint [10].

Case study

A 37-year-old female had escalating pain in the left ankle from a previous diagnosis of PVNS. Prior to the primary author, the patient had a previous orthopedic opinion to undergo an ankle fusion which was sought to avoid as the patient was concerned. Ankle fusion is an alternative for any end stage arthritis once other options have been exhausted [11,12]. The potential drawback with this surgical procedure is side effects and complications that can occur including infection, non-union, inadequate surgical alignment or early loss of position, malunion, delayed union, and stiffness in the joint [13]. An ankle fusion results in certain functional impairments that impacts the patient, as the patient wants to have a better quality of life for the patient's children and return to duties as a police officer. The patient reported worsening pain, particularly when getting up at night for the children. Acute pain and catching was felt when ambulating. The patient wanted to return to the occupation in the police force, requiring to have range of motion at the ankle joint in the location of assessment.

Investigation of PVNS

An MRI was requested for the patient to assess the extent of the PVNS. The MRI can be seen in Figure 1. Observed signs including a large amount of synovitis with a nodular synovium which encroached into anterior soft ankle tissues. The nodular synovium measured at 17 × 18 × 22mm showing internal foci of low signal change consistent with PVNS. The anterior ankle joint demonstrated synovial hypertrophy with early osteoarthritic changes. Post contrasts show intense synovium enhancement, subchondral cysts, and geodes. A moderate enhancement of the nodular synovitis was noted. In the medial talar dome, there is a large subchondral cyst change and subchondral geode formation. There was an overlying medial talar dome osteochondritis dissecans (OCD) measuring at 19mm, with the subtalar joint demonstrating synovitis as well.

Ankle arthroscopy medial malleolar osteotomy, structural graft of talar dome followed by distraction arthroplasty

To allow access to the large medial talar dome OCD a medial malleolar osteotomy was used. An oblique osteotomy directed perpendicularly to the articular surface of the tibia at the intersection between the tibial plafond and medial malleolus was performed [14]. A diagram of how this treatment is completed can be seen in Figure 2. Adequate intra-articular exposure for autologous bone cartilage transplantation or other transplantation procedures is a result of this. This process is a feasible solution for

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osteochondral lesions of the talus as seen within studies which aim to evaluate the feasibility of the technique [15].

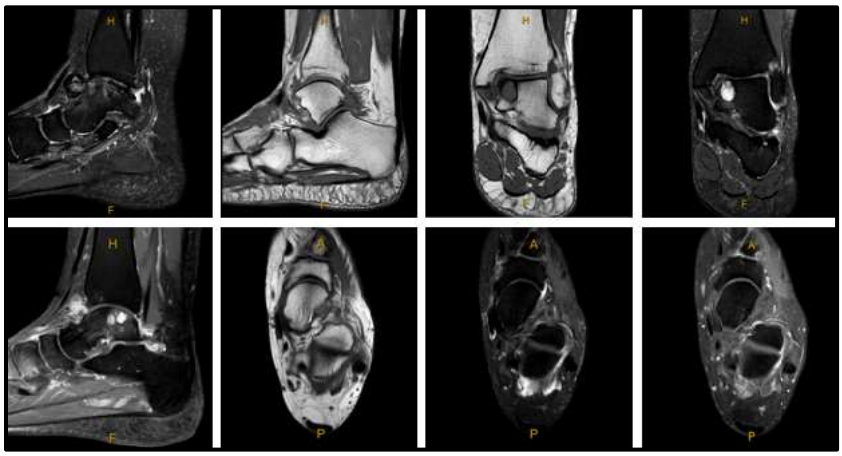

Figure 1: Initial MRI scans of patients left ankle.

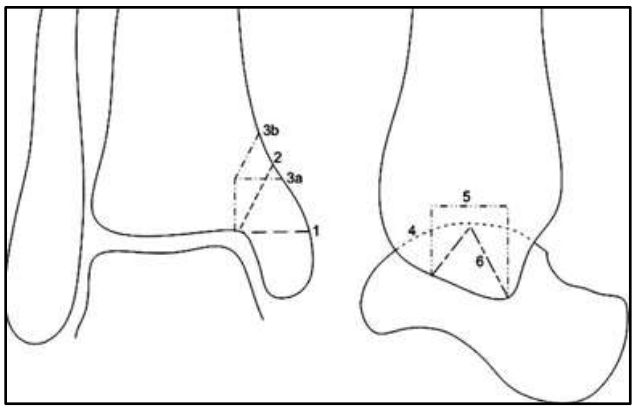

Figure 2: Anteroposterior (left) and lateral (right) drawings of an ankle, showing the different medial malleolar osteotomy techniques. (1) Transverse osteotomy; (2) oblique osteotomy; (3a) step-cut osteotomy; (3b) modified step-cut osteotomy; (4) crescentic osteotomy; (5) inverted U-osteotomy; (6) inverted V-osteotomy [14].

Figure 3: Integrant's Frame It External Fixator used to complete distraction arthroplasty.

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The second technique used in conjunction with the medial malleolar osteotomy was distraction arthroplasty. The distraction arthroplasty is the use of a frame to mechanically unload a joint to restore its function [16]. Figure 3 shows the external fixator (Integrant's Frame It) that was used to mechanically unload the joint. This technique can be used for ankle arthritis, to alleviate the inflammation and promoting the repair of the cartilage [17]. Debridement of the tissue affected by synovitis is highly recommended [18] and when the distraction arthroplasty is supplemented with debridement it gives superior outcomes [19].

Ankle arthroscopy was performed first via anterior portals. PVNS was noted and advanced cartilage loss at the medial ankle joint. Synovectomy was performed with a full radius shaver. Microfracture at the joint performed.

To initiate the surgery, the patient was in a supine position with a tourniquet around the leg as the leg was exsanguinated. Standard draping and prepping applied with IV antibiotics given with induction and a regional block administered.

A minimally invasive distractor was applied with a 2.7mm three chip arthroscope introduced through a medial portal. The frame had an insertion of 7x hard wires for the tibial wire portals. Wire safe points employed with 2x static circular proximal frames 150mm.6x telescopic arms to base plate. This frame can be seen connected to the patient in Figure 4.

The synovitis was encountered in the anterior, lateral, and medial gutters and this was resected using a 4.5mm full radius chondrotome. In the medial gutter of the talus, a large cartilage flap was elevated.

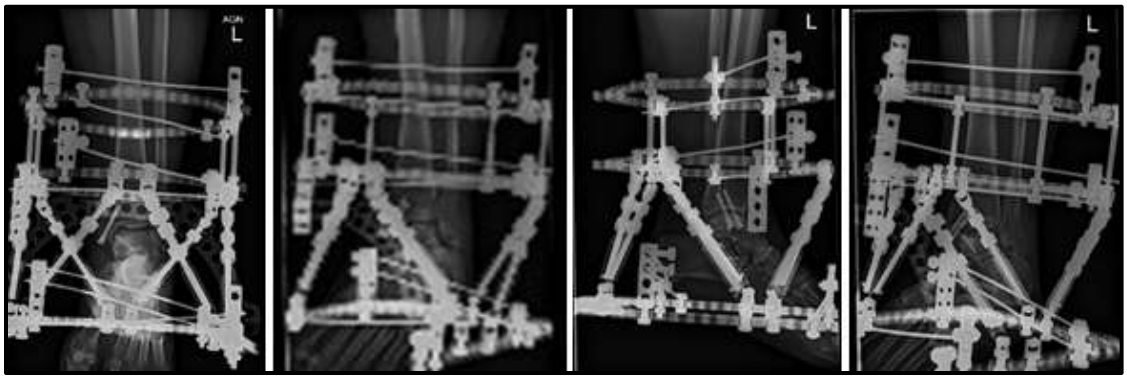

Figure 4: X-Rays of patient after Medial Malleolar Osteotomy followed by Distraction Arthroplasty.

A scanton grade 2 bone spur was identified and resected by a 4.5mm full radius burr. The medial malleolar osteotomy was then completed, where a 2cm cartilage flap was seen. Where the spur was resected, the synthetic bone was packed into position. The cartilage was then glued into position, with 1 × .3mm screw fixated into position. The talus cyst was resected and synthetic bone Graft It was impacted.

Subsequent course

Proceeding 1 day post operation, lengthening of the distraction was required and a script of

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panadeine forte and Keflex was made for the pain and prophylactic bacteria protection of pin sites. Keflex was changed to flucloxacillin to treat redness at pin sites. Frame was distracted 1mm per day for the first 3/52 to distract the joint, with frame removal at 8 weeks. The removal of the frame had no complications with debridement completed on the portals. 2 weeks following frame removal, all other sutures were removed where the wound was redressed with antiseptic and the wound dressing where all the wounds were clean and dry. 3 months post op, the patient's ankle had progressed well where increased weight bearing was suggested along with using a stationary bike for exercise. This allowed the patient to return to work for restricted desk activities. 9 months post op, the left ankle shown good consolidation of the defect in a CT scan, but the patient was getting pain outside of the foot. An ultrasound guided injection was performed to the calcaneocuboid joint. Following 1 year and 6 months of the initial operation, the patient would undergo a second operation consisting of an ankle arthroscopy, screw removal, and injection of growth factor (PRP). 6 months following the second op the patient was able to fully return to work with full duties.

The patient was able to make a full return to the occupation with full activity after 2 years from the initial operation. A check-up was completed after 2 years and 6 months post op which was accompanied with an X-Ray in Figure 5. As can be seen in the X-Ray, the joint is in a good height and the graft is in position. The patient has minimal pain and able to perform general duties as a police officer.

Figure 5: X-Rays of patient 2 years and 6 months post-surgery.

Five years after surgery the ankle has improved further. The patient is attending gym with minor pain and walking barefoot post exercise. Patient can perform restricted weight exercises at the gym. Patient can run on the ankle; however, pain follows with some stiffness. The patient is also free of any painkillers while working as a police force prosecutor, cleared as operational by the NSW Police Force.

Discussion

The purpose of this paper was to present an alternative technique to treating PVNS with

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the presence of advanced talotibial arthritis with a structural talar cyst. This case study shows the journey of the patient's medical experience to returning as a fully operational NSW Police Force member. The initial surgery of the medial malleolar osteotomy then distraction arthroplasty served the purpose to heal the osteochondral lesions and regenerate the ankle joint. Usage of distraction arthroplasty to regenerate over 50 joints in the last 8 years. Its application can be in many unique circumstances and seen as an alternative to ankle fusion. This case also demonstrates a follow up of a large non contained talar cyst with early structural collapse treated with a synthetic graft, Integrant's GraftIt. An alternative is ankle fusion, but it can overload the subtalar and chopart joints, which can be detrimental to the patient's line of work [20]. Surgical excision has a 50% chance of PVNS recurrences, hence avoiding it [21]. However, with the techniques used there are no side effects, the patient has no recurrence, but will continue to be monitored. Further evaluation is required to understand the extent.

Contribution

Contribution	Author
Application of technique to treat PVNS	Dr Gordon Slater
Treated patient with technique	Dr Gordon Slater
Analysed the results of the study	Dr Gordon Slater/ Mr Zadane Bachmid
Writing of the paper	Mr Zadane Bachmid
Proofreading/Editing of the paper	Dr Gordon Slater

Disclaimer

Dr. Gordon Slater has a pecuniary interest in Integrant a biotechnology company and Regen U clinics where he actively advises on treatment protocols and implant design.

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