MICRO LABS LIMITED

ORTHO NEWSCAST

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Dear Doctor,

Greetings from Micro Labs. We are happy to bring you "**Ortho Newscast"** which contains latest and interesting news in the field of Orthopaedics.

This issue contains

- **Impact of total ankle arthroplasty on gait stability**
- **Oblique sliding ulna osteotomy for the management of neglected pediatric Monteggia fracture dislocation**
- **Diagnostic value of miR-32-3p in osteoporotic fractures patients**
- **Case Report on Surgical Approach for Extracting an Older Universal Slotted AO Femoral Nail**

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Impact of total ankle arthroplasty on gait stability

INTRODUCTION

ANKLE ARTHRITIS

TAA enhances gait stability in patients with end-stage ankle arthritis.

Arthritis is the leading cause of disability, often causing muscle atrophy and decreased physical activity. It can also have neurological and psychological effects, significantly impacting gait mechanics, range of motion, and balance, all of which play a critical role in maintaining stable walking patterns.[1] Ankle arthritis affects about 1% of the world's population, with approximately 50,000 new cases diagnosed each year.[2] Ankle arthritis often occurs alongside joint pain, reported foot dysfunctions, elevated midfoot peak plantar pressures, vascular issues, and deformities in the foot and ankle. These conditions contribute to greater instability and a higher likelihood of falls. Total ankle arthroplasty (TAA) is one surgical approach for managing painful, advanced ankle arthritis. Margin of Stability (MoS), a metric used to evaluate gait stability, has been linked to fall risk. Previous studies have indicated that advanced ankle arthritis reduces the anteroposterior Margin of Stability (MoS_{AP}) at heel strike on the non-arthritic leg while increasing the mediolateral Margin of Stability (MoS_{ML}) at midstance on the arthritic leg.[3] A reduced MoS_{AP} at heel strike on the non-arthritic limb, when compared to both the arthritic limb and those of asymptomatic control participants, may suggest a compensatory strategy to alleviate pain during walking. The influence of TAA on gait stability is not yet fully understood. So, this study investigates how TAA affects gait stability, as measured by the MoS, in individuals with end-stage ankle arthritis.

METHODS

This retrospective cohort study utilizes data from a prospective database and provides level III evidence. A total of 148 patients with ankle arthritis met the inclusion criteria for the study. To participate in this study, individuals had to be scheduled for primary, unilateral TAA to treat end-stage arthritis, either osteoarthritis or posttraumatic arthritis being the primary diagnosis and must have had complete gait data from pre-operative, 1-year post-operative, and 2-year post-operative walking trials. The study examines the effect of TAA on gait stability, measured by MoS, in these 148 patients. Kinematic data were collected pre-operatively, 1-year post-op, and 2 years post-op, with MoS measured at heel strike and midstance in both the MoS_{AP} and MoS_{ML} directions. A linear mixed effects model, accounting for gait speed, was used to evaluate the impact of limb, session, and their interaction on the outcome measures.

RESULTS

Gait speed showed a significant increase over time ($p < 0.001$), rising from 0.89 ± 0.27 m/s pre-operatively, to 1.16 ± 0.22 m/s at 1 year post-op, and 1.20 ± 0.23 m/s at 2 years post-op. A notable interaction ($p < 0.002$) between limb (surgical vs. nonsurgical) and session (pre-op, 1-year post-op, 2-years post-op) was found for each MoS variable. Overall, the study findings indicate that the nonsurgical limb's MoS_{AP} at heel strike (Figure 1A) and MoS_{ML} at midstance improved (increased) as time after surgery progressed (Figure 1B). These results suggest that patients developed compensatory movement patterns to manage the surgical limb during single-leg support. TAA helps reduce this compensation, improving symmetry between sides, although full symmetry was not achieved by 2 years post-op.

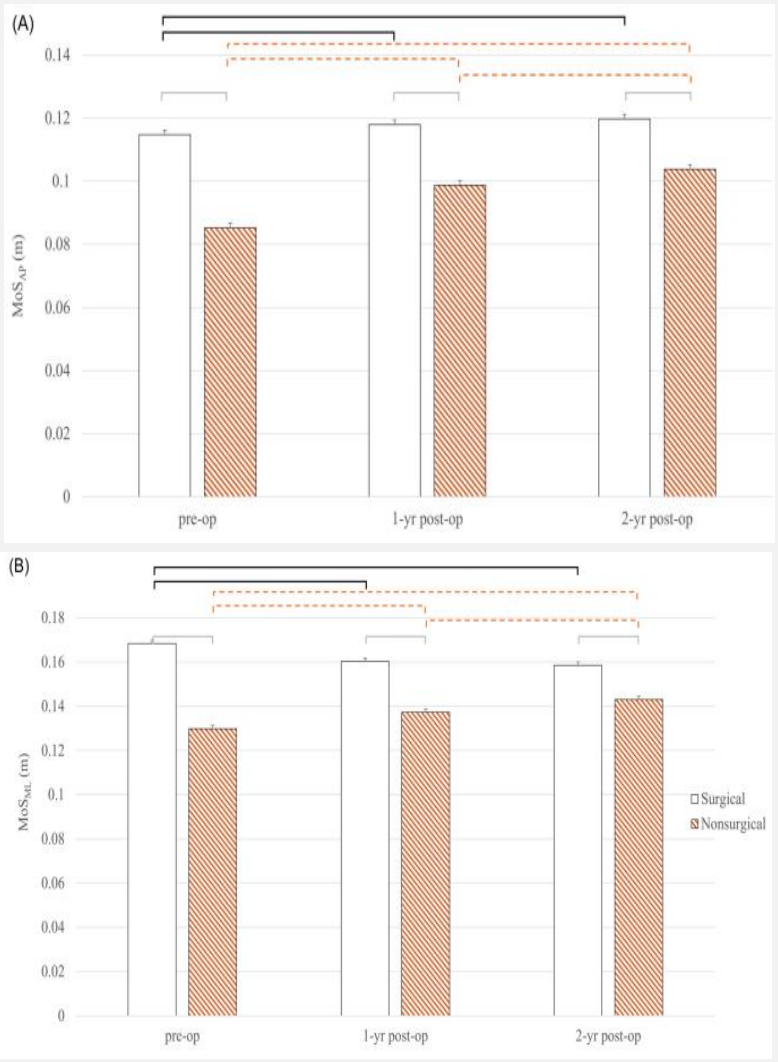

Figure 1. a) Margin of stability at heel strike in the anterior-posterior direction b) Margin of stability at midstance in the mediolateral direction for the surgical and nonsurgical limbs (LS means and SE).

Black lines indicate surgical limb session differences, dashed lines indicate nonsurgical limb session differences and grey lines indicate surgical to nonsurgical limb differences ($p < 0.05$). LS, least square; SE, standard errors

DISCUSSION

The current study demonstrated that TAA enhanced gait stability in individuals with end-stage ankle arthritis. Similarly, Barylak M et al. also found that TAA could improve gait stability in these patients. The non-arthritic limb exhibited a significantly smaller anteroposterior (AP) MoS at heel strike compared to the arthritic limb, while the arthritic limb showed a significantly larger mediolateral (ML) MoS during midstance compared to the non-arthritic limb.[3]

CONCLUSION

TAA enhances gait stability in patients with end-stage ankle arthritis. The improvement in MoS on the nonsurgical limb by 2 years post-operation indicates a transition from pre-surgery

compensatory patterns, which improves but does not eliminate difficulties with managing single-leg support on the surgical limb. This highlights the clinical importance of TAA as a comprehensive treatment for alleviating pain and improving function in ankle arthritis patients. TAA provides a multifaceted approach to enhance the quality of life by reducing pain and improving gait stability.

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Oblique sliding ulna osteotomy for the management of neglected pediatric Monteggia fracture dislocation

INTRODUCTION

Oblique ulna sliding osteotomy is a safe method to assist in the open reduction of neglected Monteggia fracture dislocation.

A delayed or missed Monteggia injury refers to an ulnar fracture accompanied by radial head dislocation, presenting more than four weeks after the original trauma.[1] Monteggia fracture-dislocation is rare and often overlooked, particularly when the initial elbow radiograph is misinterpreted. The delayed diagnosis is typically due to an incomplete fracture or plastic deformation of the proximal ulna.[2] Many researchers agree that open reduction of the radial head and correction or overcorrection of ulnar angular deformities are necessary to achieve a stable reduction of the radial head. However, the use of annular ligament reconstruction remains a subject of debate.[1] This study examined neglected Monteggia fracture cases and treated them with open reduction of the radio-capitellar joint and oblique sliding ulna osteotomy, which involved acute lengthening and correction, or overcorrection, of the deformity.

METHODS

The case series included two boys and two girls, aged 3 to 12 years, who had neglected Monteggia fractures with a duration ranging from 4 weeks to 3 years. Two cases were classified as Bado type I injuries (Figure 1(a) and (d)), while the other two were Bado type III (Figure 1(b) and (c)). Patients with Bado type I (patients 1 and 4) primarily experienced limited elbow flexion, restricted to 90°. These patients were treated with oblique sliding ulna osteotomy, a procedure that involved acute lengthening and correction of the deformity, or both, to facilitate

the open reduction of the radiocapitellar joint in cases of neglected Monteggia fracture-dislocation.

RESULTS

There were no instances of peripheral nerve palsy, dislocation, or subluxation following surgery, except for patient 1, who experienced early dislocation due to immobilization with less than 90° of elbow flexion. This patient required revision surgery and was treated with a temporary transfixing Kirschner wire for 3 weeks. One year after surgery, all patients regained nearly full range of motion (Figure 1).

Figure 1. The plain radiological view of each patients, including patients No. 1 (a), No. 2 (b), No. 3 (c), and No. 4 (d). The radiograph at the time of presentation (i), the post-operative radiograph in POP (ii), and the radiograph at the most recent follow-up (iii). The radio-capitellar Kirschner wire is visible in radiograph a(ii), which is the first post-operative radiograph.

DISCUSSION

In this study, temporary radiocapitellar transfixation was used before securing the ulna osteotomy to ensure proper lengthening and deformity correction, while preventing excessive overcorrection. This approach is consistent with the recommendation by Soni et al. that an external fixator may serve as an alternative to the transfixing Kirschner wire for stabilizing the radial head reduction.[3] In this study, the proximal oblique sliding ulna osteotomy technique provides immediate lengthening and angulation to stabilize the radial head reduction without the need for a bone graft. The direction of the osteotomy in either the coronal or sagittal plane depends on the specific type of deformity in the proximal ulna. Some researchers choose to overcorrect the ulna to ensure the reduction remains stable, though overcorrection has been associated with posterior dislocation of the radial head.[4]

CONCLUSION

This case series demonstrated that the oblique ulna sliding osteotomy can effectively achieve immediate ulnar angular correction and lengthening without the need for a bone graft, offering a safe method to assist in the open reduction of neglected Monteggia fracture dislocation and prevent recurrence.

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Diagnostic value of miR-32-3p in osteoporotic fractures patients

INTRODUCTION

miR-32-3p shows considerable diagnostic potential for OPF patients, suggesting that it could be a novel biomarker for diagnosing OPF

Osteoporosis (OP) is a widespread skeletal condition characterized by reduced bone mass, damage to bone tissue, and disruption of bone microstructure, leading to increased bone fragility and a higher risk of fractures.[1] Current treatments for osteoporotic fractures (OPF) include surgery and preventive pharmacological therapies. Advances in molecular biology have led to the identification of relevant genes and small molecules that aid in the treatment of OPF, as well as the development of several biomarkers for this purpose. However, due to low public awareness, many patients remain undiagnosed. Therefore, early detection and molecular-level risk assessment of OPF are crucial. MicroRNAs (miRNAs) are small non-coding molecules, typically 20–25 nucleotides long, that regulate disease onset by degrading or interfering with the function of target mRNAs.[2] In a study on bone marrow stromal cell-derived exosomes, miR-32 was shown to function by modulating DAB2IP.[3] While Molecular biology studies have identified differential expression of miR-32-3p in relation to osteoporosis and osteoarthritis[4], its role in OPF has yet to be thoroughly investigated or documented. This study aimed to evaluate the diagnostic potential of miR-32-3p in OPF patients and identify new biomarkers for clinical use.

METHODS

This study included 239 osteoporosis patients aged 55–75 years who were selected and categorized based on the presence of fragility fractures. In that, there were 108 patients with osteoporotic fractures and 131 patients with simple osteoporosis, forming the OPF group and OP group, respectively. Inclusion criteria included a T-score of ≤ -2.5 at any site, primary osteoporosis without prior antiosteoporosis treatment, and fractures defined as recent brittle fractures of the hip, vertebrae, distal radius, or proximal humerus caused by low-energy trauma. miR-32-3p expression levels in patients were measured using quantitative reverse transcription polymerase chain reaction (RT-qPCR), and the diagnostic accuracy of miR-32-3p was assessed using ROC curve analysis. Additionally, logistic regression was used to identify risk factors

associated with OPF occurrence. The impact of miR-32-3p on bone marrow stromal cells (BMSCs) was further examined through in vitro transfection experiments.

RESULTS

The average levels of lumbar bone mineral density (LBMD), total hip bone mineral density (TBMD), N-terminal mid-fragment of osteocalcin (N-MID), calcium (Ca), and Estradiol (E2) in the OPF group were lower than those in the OP group, with significant differences observed in LBMD, TBMD, Ca, and E2 ($P<0.001$). Additionally, the OPF group showed higher average levels of β-C-telopeptides of type I collagen (β-CTX), peptide of type I collagen (PINP), and total bilirubin (TB) compared to the OP group, with significant differences in β-CTX and PINP ($P<0.001$). RT-qPCR analysis revealed that miR-32-3p expression was significantly lower in the OPF group compared to the OP group ($P<0.001$). Logistic regression analysis indicated that β-CTX and Ca levels were also linked to the development of OPF ($P_{\beta-CTX}=0.008$, $P_{Ca}=0.038$). The ROC curve analysis demonstrated that miR- 32-3p had high accuracy in distinguishing between OP and OPF patients (AUC=0.905, $P<0.001$), with sensitivity and specificity of 88.9% and 75.6%, respectively (Figure 1). LBMD, TBMD, β-CTX, PINP, Ca, and E2 were significantly correlated with miR-32-3p expression ($P<0.05$), suggesting a relationship between these factors and the occurrence of OPF. RT-qPCR results showed that miR-32-3p expression increased in BMSCs after transfection with the miR-32-3p mimic, while it decreased after transfection with the miR-32-3p inhibitor, with all differences being statistically significant. Cell proliferation assays revealed that bone mesenchymal stem cells (BMSCs) numbers increased over time, with miR-32-3p mimic transfection accelerating proliferation and miR-32-3p inhibitor transfection inhibiting it. Apoptosis assays indicated that overexpression of miR-32-3p reduced apoptosis, while knockdown of miR-32-3p had the opposite effect.

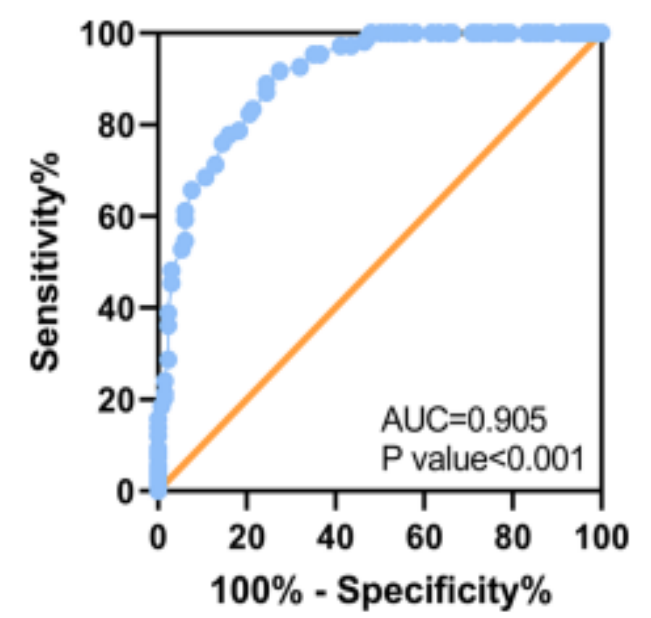

Figure 1. ROC curve analysis of the accuracy of miR-32-3p in differentiating OP from OPF patients

DISCUSSION

The findings of this study revealed that miR-32-3p levels in the serum of OPF patients were reduced, suggesting that miR-32-3p could serve as an important biomarker for diagnosing OPF. Furthermore, the ROC curve analysis showed an AUC greater than 0.9, with miR-32-3p effectively differentiating between OP and OPF patients with high sensitivity (88.9%) and specificity (75.6%). This indicates that miR-32-3p expression could be used in clinical settings

to diagnose OPF, which aligns with similar expression changes observed in osteoporotic fractures associated with type 2 diabetes.[5]

CONCLUSION

miR-32-3p shows considerable diagnostic potential for OPF patients, suggesting that it could be a novel biomarker for diagnosing OPF. Additionally, it presents promising opportunities for therapeutic approaches through targeted treatments.

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Case Report on Surgical Approach for Extracting an Older Universal Slotted AO Femoral Nail

INTRODUCTION

This case report demonstrates a customized surgical strategy for removing an old femoral nail in a patient with hip OA before total hip arthroplasty. Even though the nail's configuration presented difficulties, removal was eventually accomplished successfully.

The number of hip arthroplasties performed each year is rising, driven by the global aging population.[1,2] In patients who have had femoral nails implanted, removing the nail is often considered essential before proceeding with total hip arthroplasty (THA), especially as these individuals age and develop hip osteoarthritis. The AO (Arbeitsgemeinschaft für Osteosynthesefragen)/ ASIF (the Association of the Study of Internal Fixation) universal nail system, introduced in 1986, is no longer in use today. This type of nail features a thin wall design for flexibility and a fully slotted open-section cloverleaf shape, which makes its removal more challenging.[3] This study examines a rare case, highlighting the surgical method employed to remove an obsolete universal femoral nail system. Since the AO/ASIF universal nail system is no longer used in contemporary orthopedic practices, this case offers a valuable chance to document the removal process.

CASE PRESENTATION

A 50-year-old male with a left femur fracture, treated 35 years ago with femoral nail insertion, presented with symptomatic left hip osteoarthritis (Figure 1). As the patient sought THA, removal of the femoral nail was required before proceeding with the surgery. The patient was positioned laterally on a Jackson table using a half bean bag under general anesthesia. This choice of anesthesia was made to allow for muscle paralysis if necessary and to manage the potentially extended length of the surgery. A 5-cm incision was made over the greater trochanter, and subcutaneous tissue was dissected to expose the nail. The bone growth inside the nail was removed using a large curette. A ball-tip guide wire was placed through the center of the nail, and attempts to remove the nail were made with a conical bolt and backslap hammer. These initial attempts failed, likely due to insufficient removal of bone overgrowth and growth in the interlock screw holes. To improve engagement, a hook wire and multiple guide wires were inserted. Despite these efforts, the nail could not be removed, prompting the need for additional interventions. Anterior incisions were made on the distal thigh to access the interlock holes, which were drilled. Dissection around the nail's entry point and full removal of the osseous overgrowth was completed using a 1/2-inch osteotome. Ultimately, with the conical bolt and backslap hammer, the nail was successfully removed, although the nail's design continued to present challenges.

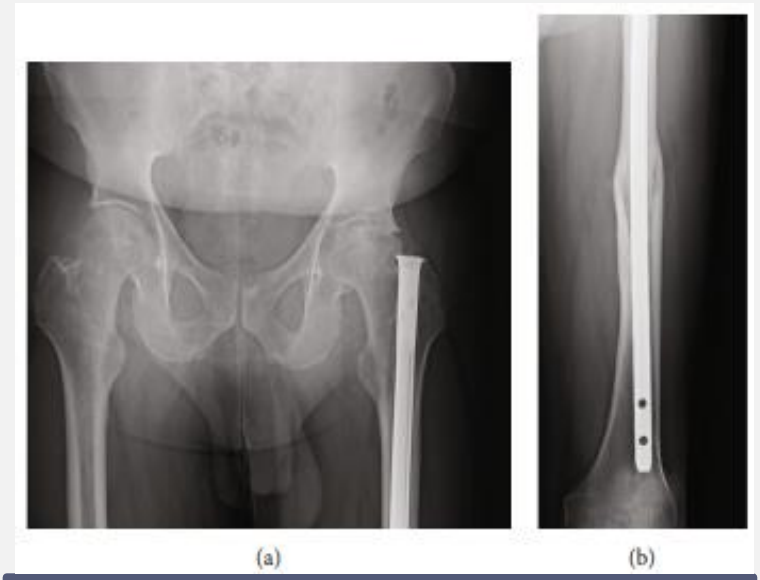

Figure 1. Anteroposterior radiograph showing a universal femoral nail and left hip osteoarthritis (a, b)

DISCUSSION

This case highlights the critical importance of careful preoperative planning and flexibility during surgery when dealing with the removal of old femoral nails. In this case, the patient received a femoral nail insertion about 35 years ago, requiring the development of a customized surgical approach to address the specific difficulties posed by the outdated nail design. The universal femoral nail, characterized by a fully slotted open-section cloverleaf design, made it challenging to engage the conical bolt for removal. Several issues can arise when removing old femoral nails, including the failure of the conical bolt to properly engage, complete entrapment of the nail, or the risk of causing an iatrogenic fracture or injury. Issues such as failure to attach the extractor can be caused by bone overgrowth, stripping of the proximal threads, or, less frequently, by impacted pieces of broken metal. To address these challenges, Georgiadis, Heck, and Ebraheim described a method using a high-speed drill with a carbide cutting bit to create a slot in the proximal end of the nail, allowing for the attachment of a hook and facilitating

removal.[4] Recently, Pathrot, Mannual, and Shettar demonstrated the effectiveness of using a stainless-steel wire technique.[5]

CONCLUSION

This case study illustrated a specialized surgical method for removing an old femoral nail before performing total hip arthroplasty in a patient with hip osteoarthritis. Despite the difficulties associated with the nail's design, the removal was ultimately successful. These cases underscore the importance of developing personalized surgical strategies to overcome the unique challenges posed by outdated orthopedic implants.

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