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

- **Clinical efficacy of an inverted PHILOS plate for treating distal humeral shaft fractures**
- **Association between Chronic Obstructive Pulmonary Disease and Osteoporosis**
- **Robot-assisted percutaneous screw fixation combined with endoscopic bone graft Vs conventional open screw fixation with bone graft in the treatment of lumbar spondylolysis**
- **An Unique Case of Tendon-Sheath Fibroma in the Fourth Toe**

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Looking forward to your valuable feedback

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Clinical efficacy of an inverted PHILOS plate for treating distal humeral shaft fractures

INTRODUCTION

Distal humeral shaft fractures can be successfully treated with the anterior minimally invasive percutaneous technique using an inverted PHILOS plate.

Distal third humeral shaft fractures, commonly known as distal humeral shaft fractures, represent around 7% of all humeral shaft fractures, 16% of humeral fractures, and 3% of total fractures in the body. These fractures are often spiral or oblique in nature and may include a medial wedge-shaped fragment. Due to the complex anatomy of the distal humerus, choosing a standardized surgical approach can be challenging. However, surgical intervention significantly lowers the risk of nonunion, reducing its incidence from 17.6% with conservative management to 5.6%.[1] Open reduction and internal fixation (ORIF) is a widely used surgical technique, with multiple approaches described in the literature. However, the absence of a standardized anatomical plate makes achieving stable fixation challenging, particularly when using reconstruction plates. Additionally, the short length of the distal fragment often restricts the number of screws that can be securely inserted, which may compromise stability and raise the likelihood of fixation failure during rehabilitation.[2,3] Between January 2018 and May 2021, researchers treated distal humeral shaft fractures using an anterior minimally invasive approach with an inverted PHILOS plate. This method addresses the challenges associated with reconstruction plates by enabling adequate distal screw fixation while minimizing radial nerve exposure, thereby lowering the risk of iatrogenic nerve injury.

METHODS

This retrospective study included 32 patients diagnosed with distal humeral shaft fractures. The surgical approach utilized an anterior minimally invasive percutaneous technique with an inverted PHILOS plate. Key outcome measures comprised operative duration, intraoperative blood loss, incision length, and the time required for fracture healing. Patients underwent follow-up evaluations at 1-, 3-, and 6- months post-surgery, where functional outcomes were assessed using the Constant-Murley shoulder score, the Mayo Elbow Performance Score, and the Visual Analog Scale (VAS) for shoulder and elbow pain. Additionally, postoperative complications, such as nerve injury and nonunion, were recorded.

RESULTS

The average operative duration was 1.69 ± 0.66 hours, ranging from 1 to 3.5 hours. Median intraoperative blood loss was 50 ml, with an interquartile range (IQR) of 50–100 ml. The total incision length averaged 10.9 cm, varying between 7 and 16 cm. Patients were followed for an average of 14.19 months, with a range of 10 to 30 months. Fracture healing occurred on an average of 11.2 weeks, ranging from 6 to 18 weeks. Functional outcomes showed a mean Constant shoulder function score of 92.69 (range: 80–100) and a mean Mayo Elbow Performance Score (MEPS) of 91.4 (range: 75–100). The median VAS score for shoulder pain was 1 (IQR: 0–2), while for elbow pain, it was 1 (IQR: 0–1.75). The mean distal cortical length of the fracture measured 3.93 cm, ranging from 2.13 to 10.9 cm. On average, 5.72 screws (range: 3–9) were used for distal fragment fixation (Figure 1, 2).

Figure 1. The distance between the distal end of the fracture line and the upper edge of the olecranon is known as the distal cortical length, or DCL. Based on the PHILOS plate length measurement schematic design, this study found that a DCL of 2.5 cm is needed for six screws, 3 cm for seven screws, and 4 cm for nine screws for PHILOS plates. The PHILOS plate has the potential to hold more screws in the same DCL than other plate types, which improves fracture fixing strength and stability. Clinical benefits from this design advantage could include more dependable fracture stabilization.

Figure 2. PHILOS plate length measurement

DISCUSSION

This study utilized an anterior minimally invasive percutaneous technique with an inverted PHILOS plate to fix distal humeral shaft fractures. Recent research has explored the use of minimally invasive anterior single-plate fixation for treating midshaft humeral fractures.[4] This approach provides multiple benefits, including a smaller incision, minimal soft tissue disruption, and the preservation of radial nerve integrity. These factors help lower the risk of iatrogenic nerve injury and promote improved fracture healing.[5,6]

CONCLUSION

Treating distal humeral shaft fractures with an inverted PHILOS plate using an anterior minimally invasive percutaneous approach offers multiple advantages. These include minimal soft tissue disruption, reduced intraoperative

blood loss, and a decreased risk of iatrogenic radial nerve injury. This technique has shown to be an effective option for managing these fractures clinically.

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Association between Chronic Obstructive Pulmonary Disease and Osteoporosis

INTRODUCTION

Patients with COPD have a complicated, non-linear relationship between their BMD and lung function, which emphasizes how crucial it is to track changes in bone density while managing the condition.

Osteoporosis (OP) is a skeletal disorder marked by decreased bone density and a higher susceptibility to fractures, making it a major public health concern.[1] OP develops due to multiple factors, including age, sex, genetic influences, nutritional status, and lifestyle habits.[2] In recent years, research on the potential relationship between chronic obstructive pulmonary disease (COPD) and osteoporosis has increased. Studies indicate that osteoporosis is significantly more prevalent in individuals with COPD compared to the general population. While pulmonary function tests (PFTs) remain the gold standard for diagnosing COPD, they are insufficient to fully capture its complexity. Routine chest computed tomography (CT) is a key component of standard COPD assessments, allowing for early detection and precise localization of lung lesions. Additionally, Quantitative computed tomography (QCT) has emerged as a valuable diagnostic tool for COPD, offering the advantage of assessing bone mineral density (BMD) without exposing patients to additional radiation.[3] Research on the connection between lung function and BMD in COPD patients remains limited. This study examined the association between BMD and lung function, specifically the forced expiratory volume in one second (FEV1) to forced vital capacity (FVC%) ratio, using QCT in individuals with COPD.

METHODS

This prospective cross-sectional study involved 85 COPD patients, including both newly diagnosed individuals and those undergoing re-evaluation during hospitalization. The study considered several exposure variables, such as lung function (FEV1/FVC%), age, sex, body mass index, smoking history, tea consumption habits, and physical activity levels. BMD was assessed using QCT. To examine the relationship between these variables and BMD, linear regression and generalized additive models were utilized.

RESULTS

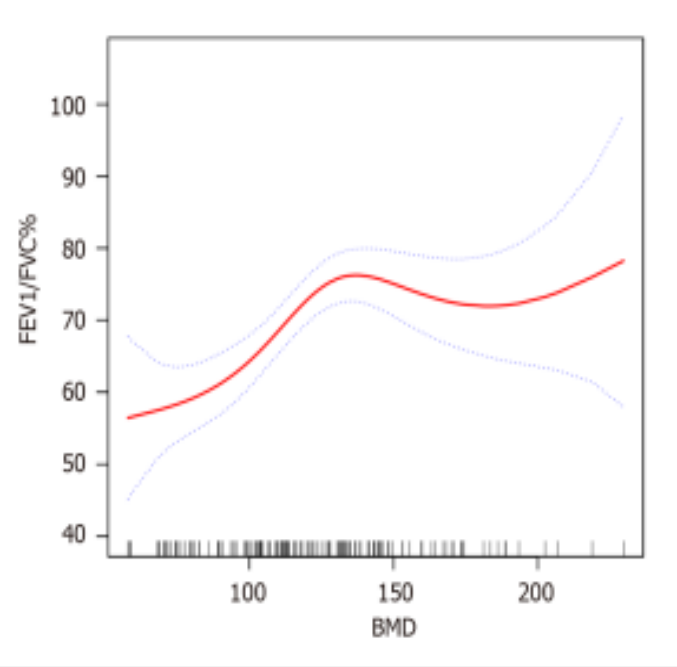

Figure 1. Relationship between bone mineral density and the percentage of forced vital capacity and forced expiratory volume in one second.

Linear regression analysis identified a significant positive correlation between BMD and FEV1/FVC% (β = 0.1, 95% confidence interval [CI]: 0.1-0.1; P < 0.0001), indicating that as BMD increased, FEV1/FVC% also rose (β = 9.0, 95% CI: 5.3-12.8; P <0.0001). Among participants aged 60 years or younger (n = 85), a non-linear relationship between FEV1/FVC% and BMD was observed (edf = 4.0045, F = 5.0685; P = 0.0003) (Figure 1). The non-linear model demonstrated a significant positive association between FEV1/FVC% and BMD when BMD was below 128.08 mg/cm³ (β = 0.245, 95% CI: 0.094 to 0.396; P = 0.0019), whereas a negative trend was noted beyond this threshold (β = -0.136, 95% CI: -0.284 to 0.013; P = 0.0753). The difference between these two slopes was statistically significant (β difference = -0.381, 95% CI: -0.633 to -0.128; P = 0.0037). These findings suggest a complex, non-linear association between BMD and FEV1/FVC%, with BMD ≤128.08 mg/cm³ potentially serving as a valuable biomarker for lung function assessment. Furthermore, an increase of 1 mg/cm³ in BMD corresponded to a 0.245 L rise in FEV1/FVC%, offering a novel biological perspective for evaluating lung function in COPD patients.

DISCUSSION

This study confirmed a positive association between BMD and FEV1/FVC% in COPD patients, aligning with prior research. Previous studies have demonstrated a significant correlation between BMD in the L2 vertebra and pulmonary function test (PFT) results in individuals with COPD, emphasizing a considerable decline in BMD in the hip and lumbar spine regions among these patients.[4] A prospective cohort study conducted by Campos-Obando et al. found a strong correlation between BMD and mortality associated with chronic lung disease, highlighting the connection between lower BMD and declining lung function.[5] An

extensive multicenter study revealed that individuals with COPD have a higher likelihood of developing fractures and osteoporosis, with the use of high-dose corticosteroids further amplifying this risk.[6]

CONCLUSION

This study enhanced understanding of the connection between BMD and lung function in COPD patients, aiding clinicians in more accurately evaluating osteoporosis risk. In addition, routine BMD assessments should be incorporated into clinical practice, with early interventions such as vitamin D and calcium supplementation recommended when necessary to mitigate osteoporosis risk.

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Robot-assisted percutaneous screw fixation combined with endoscopic bone graft Vs conventional open screw fixation with bone graft in the treatment of lumbar spondylolysis

INTRODUCTION

Spondylolysis refers to the degeneration and separation of a thin segment between the upper and lower articular processes, typically caused by repeated stress on the lumbar spine during extension and rotation, leading to a stress response and subsequent fracture. When

In comparison to traditional open surgery, robot-assisted screw fixation and endoscopic bone graft offer a safe and dependable minimally invasive treatment for lumbar spondylolysis with a higher degree of pedicle screw implantation accuracy, lower radiation exposure, less intraoperative trauma, and a faster recovery time.

lumbar spondylolysis is present, the upper vertebra may shift forward relative to the lower vertebra, a condition known as lumbar spondylolisthesis. As a result, spondylolysis and spondylolisthesis are considered part of continuous disease progression. While most cases improve with conservative treatment, surgical intervention is necessary for patients who experience persistent symptoms and do not respond to conservative therapy after six months.[1] In recent years, orthopedic surgical robots have demonstrated distinct advantages in stability and precision due to their features, including the absence of tremors, controlled movement, and accurate force application. Robot-assisted pedicle screw fixation enhances surgical safety and minimizes the risk of screws penetrating the bone cortex.[2-4] This retrospective study explored the use of robot-assisted percutaneous pedicle fixation combined with endoscopic bone grafting by evaluating its clinical effectiveness compared to traditional open surgery and presenting it as a promising alternative to conventional open procedures, offering potential advantages in precision and minimally invasive techniques.

METHODS

A cohort study was conducted on 43 patients with lumbar spondylolysis who underwent surgical treatment. Between January 2022 and June 2023, 20 patients received percutaneous screw fixation combined with endoscopic bone grafting, while 23 patients underwent conventional open screw fixation with bone grafting. Various factors, including demographic data, robotic surgery parameters, perioperative outcomes, visual analogue scale (VAS) and Oswestry Disability Index (ODI) scores, pedicle screw placement accuracy, radiographic fusion results, and follow-up findings, were systematically recorded, analyzed, and compared between the two groups. Categorical variables were assessed using chi-square tests, while continuous variables were analyzed using t-tests or Mann–Whitney U tests after normality evaluation. Statistical significance was set at $p<0.05$.

RESULTS

Compared to the conventional surgery group, the robot-assisted surgery group demonstrated significantly lower intraoperative blood loss, reduced postoperative drainage, shorter hospital stays, and fewer intraoperative fluoroscopy sessions, resulting in lower radiation exposure ($p<0.05$). However, the robotic procedure required a longer operative time. The

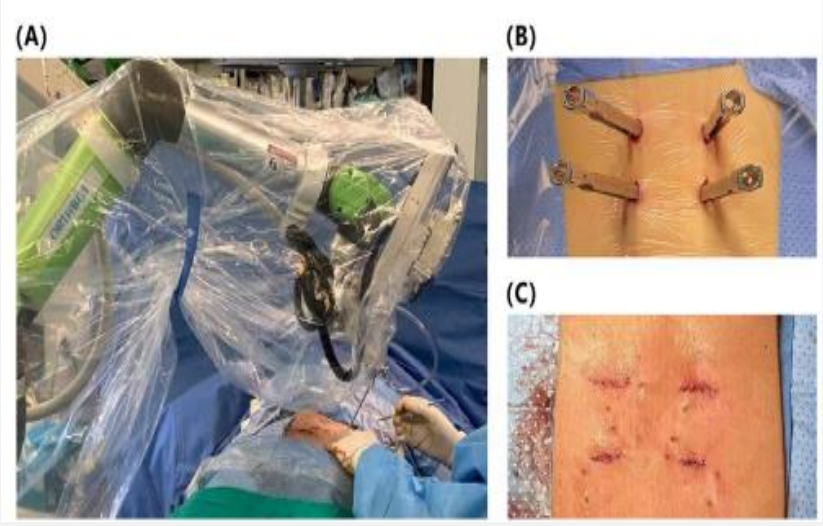

Figure 1. Robotically assisted surgery. (A) Robotic placement of pedicle screws. (B) Insertion of a percutaneous wire. (C) Only four incisions, each ranging in length from 1 to 1.5 cm, were visible on the patient's body surface after surgery.

reductions in blood loss, drainage, and recovery duration are likely attributed to the minimally invasive nature of robotic-assisted surgery (Figure 1). Postoperative imaging revealed high screw placement accuracy in both groups, with a grade A rate of 95% in the robot-assisted group versus 91.4% in the conventional surgery group, based on the Gertzbein–Robbins scale. Additionally, both groups showed comparable improvements in VAS and ODI scores over a one-year follow-up period, with successful bone graft fusion rates of 97.5% in the robot-assisted group and 93.5% in the conventional group.

DISCUSSION

This study demonstrated that robot-assisted percutaneous screw fixation combined with endoscopic bone grafting is a dependable minimally invasive approach for managing lumbar spondylolysis, providing clinical outcomes comparable to open surgery. Additionally, a recent study presented a minimally invasive technique that integrates endoscopic bone grafting with manual percutaneous screw fixation[2], suggesting that this combined technique has proven effective in repairing pars defects, offering benefits that patients find favorable. However, careful execution is essential to minimize the risk of nerve and tissue damage. The use of robotic systems in orthopedic surgery, including Renaissance, ROSA (Robotic Stereotactic Assistance) Spine, and MAKO, is becoming increasingly common. Robot-assisted procedures have been shown to improve implant placement accuracy and support minimally invasive surgical techniques.[5]

CONCLUSION

This clinical trial demonstrated that robot-assisted screw fixation combined with endoscopic bone grafting is not only comparable to but may also offer advantages over conventional open surgery. Both approaches yielded similar outcomes in terms of back pain relief, disability improvement, and bone fusion. However, robotic surgery was associated with reduced intraoperative blood loss, less postoperative drainage, and shorter hospital stays, indicating lower surgical trauma for patients. Additionally, it required fewer x-ray fluoroscopies and resulted in lower radiation exposure. These findings highlight robot-assisted screw fixation with endoscopic bone grafting as a promising minimally invasive option for treating lumbar spondylolysis.

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An Unique Case of Tendon-Sheath Fibroma in the Fourth Toe

INTRODUCTION

FTS can lead to misdiagnosis, often being confused with other soft tissue tumors such as giant cell tumor of the tendon sheath, nodular fasciitis, or fibrous histiocytoma.

Fibroma of the tendon sheath (FTS) is an uncommon, slow-growing benign fibrous tumor that typically appears as a small, painless mass, most often affecting the tendons of the upper extremities in young adult males.[1] FTS most commonly occurs between the third and fifth decades of life, with a male predominance ranging from 1.5 to 3 times higher than in females. It is a benign myofibroblastic tumor that originates from the synovial lining of the tendon sheath. Although it strongly adheres to the tendon sheath, marginal resection is usually performed to preserve function, which may contribute to its relatively high local recurrence rate of 24%. FTS is a distinct clinicopathologic condition that rarely affects the foot and is often misdiagnosed as a giant cell tumor of the tendon sheath during both clinical evaluation and gross pathological examination.[2]

CASE PRESENTATION

A 61-year-old man presented with a gradually enlarging subcutaneous mass on his left fourth toe, leading to progressive swelling and joint stiffness. He had no history of trauma. The mass encircled the entire toe, but clinical examination showed no signs of erythema, bruising, tenderness, skin adhesion, or fluctuance. The skin remained intact. However, the patient exhibited a reduced range of motion and stiffness at the fourth metatarsophalangeal (MTP) and proximal interphalangeal (PIP) joints. X-ray imaging revealed a soft tissue mass without calcifications or bony abnormalities, while MRI showed low signal intensity on T1-weighted images and increased intensity on T2-weighted images compared to normal muscle, with gadolinium enhancement (Figure 1). A core needle biopsy confirmed the diagnosis of fibroma of the tendon sheath (FTS). To relieve discomfort from the bulk of the mass, particularly with footwear, the patient underwent local excision, though digit amputation was discussed as an option. Due to the mass's circumferential involvement, potential neurovascular compromise was also considered a surgical risk. During surgery, the tumor appeared as a firm, multilobulated, pink-tan fibrous mass measuring 4.0 × 3.5 × 1.3 cm, adherent to the extensor digitorum longus (EDL) tendon. It was carefully dissected from the tendon sheath and surrounding neurovascular structures without complications. Postoperatively, the wound healed within three weeks without any loss of extensor function or sensation. At the latest follow-up, 23 months after surgery, there were no signs of recurrence. Histopathological

examination confirmed a dense, fibroblastic lesion with minimal cellularity, extensive stromal hyalinization, and proliferating synovial cells, consistent with FTS, without any signs of mitotic atypia.

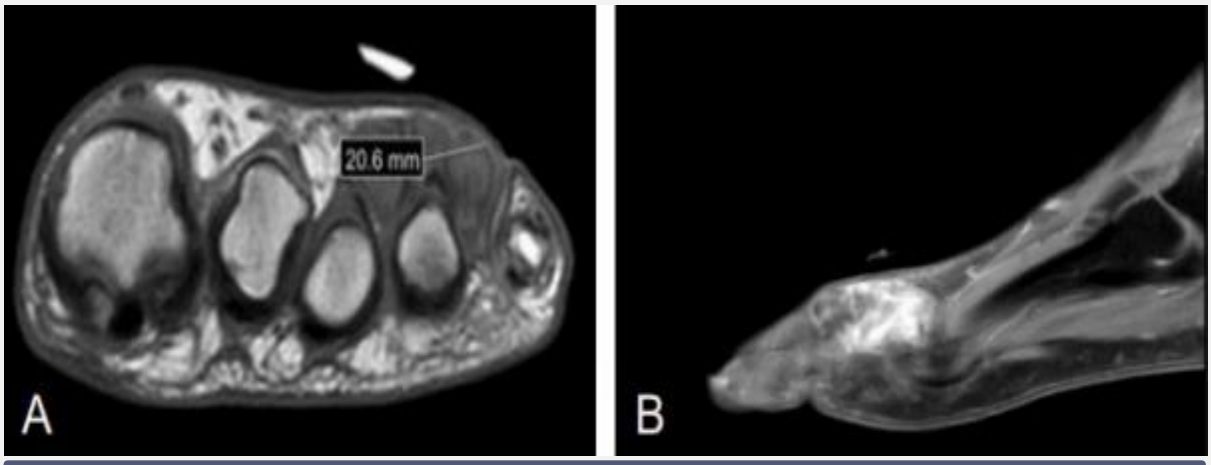

Figure 1. Soft tissue mass with several lobules at the left foot's PIPJ and distal fourth metatarsal. A) Images with T1 weighting show low intensity. B) Increased intensity and gadolinium enhancement on T2-weighted images in comparison to normal muscle.

DISCUSSION

Cases of FTS in the toe are relatively rare. Clinically, it typically appears as a slow-growing, painless mass, although tenderness may develop due to compression of adjacent structures or pressure from footwear. This can lead to misdiagnosis, as FTS is often mistaken for other soft tissue tumors such as giant cell tumor of the tendon sheath, nodular fasciitis, or fibrous histiocytoma. In this patient, MRI findings were characteristic of FTS, showing low signal intensity on T1-weighted images and high signal intensity on T2-weighted images, with gadolinium enhancement. The exact cause of FTS remains uncertain, making diagnosis challenging. Although some cytogenetic studies have attempted to clarify its pathogenesis, definitive conclusions have yet to be reached. Research has identified USP6 genetic rearrangements, t(2;11) (q31–32;q12), and chromosomal abnormalities involving the long arm of chromosome 11, but their clinical significance remains unclear.[3-6] Further molecular cytogenetic studies are needed to gain a deeper understanding of the underlying causes of FTS.

CONCLUSION

This case highlights the need to recognize FTS as a possible diagnosis for solitary toe masses. Due to its uncommon occurrence and risk of recurrence, it is crucial for clinicians and pathologists to be aware of FTS for accurate diagnosis and effective treatment.

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