

Original Article

Prognosis of minimally invasive subtalar arthrodesis for traumatic subtalar arthritis and assess trauma degree

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Abstract: Objective: To investigate the clinical prognosis of minimally invasive subtalar arthrodesis for traumatic subtalar arthritis, and to analyze the correlation between trauma severity and postoperative outcomes. Methods: A total of 98 patients with traumatic subtalar arthritis were enrolled and divided into an observation group (minimally invasive surgery, 56 cases) and a control group (open surgery, 42 cases). Surgical indicators, American Orthopedic Foot and Ankle Society (AOFAS) score, imaging parameters, complications, Visual Analogue Scale (VAS) score, ankle range of motion, Foot and Ankle Ability Measure (FAAM) score, and full weight-bearing time were compared between the two groups. Spearman correlation analysis was used to analyze the relationship between trauma severity and postoperative prognosis. Results: The observation group had significantly shorter operation time and wound healing time, less intraoperative blood loss, and smaller surgical incision (all $P < 0.05$). Meanwhile, the observation group had higher postoperative AOFAS scores, FAAM scores and imaging parameters, and lower complication rates and VAS scores (all $P < 0.05$). Trauma severity was negatively correlated with postoperative function and imaging indicators, and positively correlated with pain degree and recovery time (all $P < 0.05$). Conclusions: Minimally invasive subtalar arthrodesis is a safe and effective surgical method for traumatic subtalar arthritis. It can effectively improve foot and ankle function, relieve postoperative pain and accelerate patient recovery. Trauma severity is closely associated with postoperative prognosis, which can provide a reliable reference for individualized clinical treatment.

Keywords: Traumatic subtalar arthritis, old calcaneal fractures, complications, ankle function recovery, minimally invasive subtalar arthrodesis

Introduction

Traumatic subtalar arthritis is a common lower extremity osteoarthropathy, mainly caused by foot trauma or severe ankle sprains. The primary pathological manifestations include articular cartilage damage and bony structural abnormalities. This disease not only causes severe pain and limb dysfunction in patients, but also leads to long-term subtalar joint instability and progressive joint degeneration [1-3]. With the continuous change of people's lifestyles and the increasing popularity of sports activities, the incidence of traumatic subtalar arthritis has increased significantly in recent years [4]. Relevant epidemiological data show that subtalar joint injuries are highly prevalent in the general population engaged in strenuous physical labor, which seriously impairs athletic

ability and reduces patients' quality of life (QoL) [5].

At present, conservative treatments, such as physical rehabilitation training and oral analgesic and anti-inflammatory drugs can only temporarily relieve clinical symptoms, but cannot fundamentally repair joint damage or reverse functional impairment [6]. Therefore, improving postoperative joint function and optimizing patients' postoperative QoL have always been the core research focus in the treatment of traumatic subtalar arthritis.

In recent years, minimally invasive orthopedic surgery has been widely applied and achieved promising clinical effects. Minimally invasive subtalar arthrodesis is performed through small surgical incisions. It can restore the nor-

mal anatomical alignment of subtalar joint surfaces and effectively relieve joint pain [7, 8]. Compared with traditional open surgery, minimally invasive surgery has obvious advantages. First, it features small incisions and mild soft tissue damage, which contribute to faster postoperative recovery. Patients can get out of bed for early ambulation within a few days after surgery, which reduces the incidence of postoperative complications such as incision infection and subcutaneous hematoma [9]. Second, minimally invasive surgery has high operational precision, which avoids accidental damage to peripheral nerves and blood vessels and creates favorable conditions for postoperative functional recovery [10].

Common minimally invasive surgical approaches include arthroscopic surgery, endoscope-assisted surgery and small-incision surgery. Arthroscopic surgery enables real-time observation of the internal joint structure through a miniature camera, allowing accurate debridement, repair and fusion under direct vision [11]. Endoscope-assisted surgery further optimizes the surgical visual field and improves operational accuracy. Small-incision surgery minimizes the resection of normal soft tissues and maximizes the retention of physiological foot and ankle functions [12]. The continuous innovation and development of minimally invasive technologies have improved the safety and efficacy of subtalar joint surgery, and significantly increased patient satisfaction.

This study retrospectively analyzed the clinical data of patients with traumatic subtalar arthritis treated by minimally invasive and open subtalar arthrodesis. The purpose was to evaluate the prognostic effect of minimally invasive surgery and clarify the correlation between trauma severity and postoperative outcomes. The research results can reveal the pathological characteristics of traumatic subtalar arthritis, provide a scientific basis for the selection of surgical indications for minimally invasive arthrodesis, and support the formulation of personalized treatment and rehabilitation plans. In addition, this study further explores the prognostic influencing factors of minimally invasive surgery, aiming to provide valuable references for clinical practice and related research, and promote the overall improvement of the diagnosis and treatment level of traumatic subtalar arthritis.

Materials and methods

Study subjects

A retrospective study was conducted on 98 patients with traumatic subtalar arthritis due to old calcaneal fractures who received treatment at Fengdu General Hospital from August 2022 to November 2023. All patients were divided into two groups according to surgical methods: 56 patients undergoing minimally invasive subtalar arthrodesis were included in the observation group (OG), and 42 patients undergoing traditional open subtalar arthrodesis were included in the control group (CG).

There was no significant difference in baseline data such as gender, age and lesion side between the two groups (all $P > 0.05$). This study was approved by the Ethics Committee of Fengdu General Hospital.

Inclusion criteria: (1) Age ≥ 18 years, with full capacity for civil conduct; (2) Complete clinical data and follow-up information; (3) Definite diagnosis of traumatic subtalar arthritis confirmed by X-ray, CT or MRI examination; (4) Tolerance to surgical treatment.

Exclusion criteria: (1) Combined with other recent joint or fracture injuries; (2) Severe systemic diseases such as cardiac, hepatic or renal insufficiency; (3) Infectious lesions or malignant tumors in the lower extremities; (4) Combined with calcaneal collapse deformity.

Surgical methods

Minimally invasive subtalar arthrodesis (OG): According to the patient's physical condition, general anesthesia, epidural anesthesia or local anesthesia was selected. After routine disinfection and sterile draping of the operative area, Siemens C-arm fluoroscopy was used intraoperatively to clarify the lesion scope and determine the optimal incision position. A 2-3 cm longitudinal small incision was made below the lateral malleolus of the affected limb.

The skin, subcutaneous tissue and superficial fascia were incised layer by layer under sterile conditions. Careful dissection was performed to avoid damaging the peroneal tendons, peripheral blood vessels and nerves. Electrocautery or ultrasonic bone scalpel was used to debride necrotic articular cartilage,

osteophytes and other abnormal tissues in the joint cavity to fully expose the subtalar joint. The joint surface was carefully examined to eliminate infectious foci that might affect bone healing. After debridement, C-arm fluoroscopy was repeated to confirm no residual debris and satisfactory joint exposure.

Two 6.5 mm diameter cannulated compression screws (45-55 mm in length) were implanted from the calcaneal tuberosity toward the talar body at an angle of 15°-20° to achieve rigid fixation of the subtalar joint. Auxiliary plates or special internal fixators were applied if necessary to enhance fixation stability. After fixation, C-arm fluoroscopy was performed again to verify good arthrodesis alignment, accurate screw position, and no articular cartilage penetration or internal fixation loosening.

The deep fascia and skin were sutured layer by layer meticulously to ensure tight tissue apposition and reduce the risk of postoperative infection and skin necrosis. Routine postoperative antibiotics were administered for 24 hours to prevent infection, along with analgesics as needed. Regular dressing changes and wound care were performed, and the affected limb was elevated. The drainage tube was removed 48 hours postoperatively. Early non-weight-bearing functional exercises were initiated under guidance, and regular follow-up visits were scheduled to assess recovery.

Open subtalar arthrodesis (CG): All patients underwent surgery under general anesthesia in the supine position. After routine disinfection and draping, the affected limb was exsanguinated, and a tourniquet was used for hemostasis. A 6-8 cm curved lateral incision was made along the malleolar connection line, with intraoperative position adjustment according to actual conditions.

The skin, subcutaneous tissue, superficial fascia and muscle layers were incised sequentially. Electrocautery or ultrasonic scalpel was used for dissection to fully expose the subtalar joint. Under C-arm fluoroscopy guidance, damaged articular cartilage and osteophytes were thoroughly debrided. Curettes and osteotomes were used to polish and trim the articular surface to form a flat and rough bone graft bed. Fluoroscopy was repeated to confirm no residual cartilage or osseous tissue in the joint cavity.

Appropriate internal fixation was selected according to intraoperative conditions. The conventional fixation scheme was one locking plate combined with three 3.5 mm diameter cortical bone screws (50-60 mm in length). If necessary, larger screws or plates were used for enhanced fixation. After fixation, C-arm fluoroscopy and computer-assisted image analysis were performed to verify satisfactory arthrodesis alignment, normal mechanical axis and accurate internal fixation position.

The incision was sutured layer by layer, and sterile dressings were applied. Postoperatively, patients received oral or intravenous antibiotics for 48 hours to prevent infection. Dressing changes were performed regularly, and sutures were removed 2 weeks post-surgery. Standard postoperative observation and nursing were implemented, and patients received gradual guided rehabilitation training.

Observational indicators

Intraoperative indicators: Operation time, wound healing time, intraoperative blood loss (IOB) and incision length were recorded and compared between the two groups.

AOFAS score: The AOFAS score was evaluated before and after surgery. The scoring system includes pain (0-40 points), joint function (0-50 points) and limb alignment (0-10 points), with a total score of 100 points. A higher score indicates better function.

Functional recovery grade [13, 14]: Postoperative foot and ankle functional recovery was divided into four grades. Excellent: normal foot and ankle function, no pain in daily activities, nearly normal joint range of motion, stable foot and no obvious deformity. Good: most daily activities can be completed independently, occasional mild pain without functional impact, slightly limited joint motion and good overall function. Moderate: obvious pain in daily activities, partial activity limitation, possible walking assistive devices, mild foot deformity and incomplete functional recovery. Poor: severely limited limb function, inability to complete basic daily activities, persistent pain, obvious foot deformity and joint instability, seriously affecting QoL. The excellent and good recovery rates were calculated for statistical analysis.

Table 1. Comparison of baseline general information between the two groups of patients

Indicator	Observation group (n=56)	Control group (n=42)	χ^2/t value	P value
Gender (Example)			0.126	> 0.05
Male	31	22		
Female	25	20		
Age (years)	46.38±7.25	45.71±6.93	0.463	> 0.05
Affected side			0.089	> 0.05
Left side	24	19		
Right side	32	23		

Imaging parameters: Preoperative and postoperative calcaneal height, calcaneal angle, calcaneal inclination angle and calcaneal compensation angle were measured and compared between the two groups.

Trauma severity grading: According to preoperative imaging findings and intraoperative observations, trauma severity was graded based on the degree of articular surface damage, talocalcaneal joint collapse and soft tissue injury, including grade 1 (mild), grade 2 (moderate) and grade 3 (severe).

Postoperative complications: The incidence of postoperative complications including limb claudication, joint stiffness, incision infection and subcutaneous hematoma was counted in both groups.

VAS score: The VAS score (0-10 points) was used to evaluate postoperative pain at 1 day, 7 days, 1 month and 3 months after surgery. Higher scores represent more severe pain.

Ankle range of motion: Postoperative ankle plantarflexion, dorsiflexion, inversion and eversion angles were measured in degrees (°) and compared between the two groups.

FAAM score: The postoperative FAAM score was used to evaluate patients' daily living ability and motor function of the affected foot. Higher scores indicate better functional recovery.

Full weight-bearing time: The postoperative time required for the affected limb to achieve full weight-bearing walking was recorded and compared between the two groups.

Statistical analysis

SPSS 22.0 statistical software was used for data analysis. Measurement data conforming to normal distribution were presented as mean $\pm$ sd ($\bar{x} \pm s$), and count data were expressed as frequency and percentage (%). Normality test and homogeneity of variance test were performed before inter-group comparison. Independent samples t-test was used for normally distributed and homogeneous measurement data;

Mann-Whitney U test was used for data with non-normal distribution. Chi-square test was used for count data. Bonferroni correction was applied for multiple comparisons. Spearman rank correlation analysis was used to analyze the correlation between ordinal data (trauma severity grade) and prognostic indicators. $P < 0.05$ was considered statistically significant.

Results

There were no significant differences between the two groups in baseline characteristics, including sex, age, and affected side (all $P > 0.05$; **Table 1**).

Comparison of intraoperative and recovery indicators

In the OG, the surgical time was 51.73±10.04 min, wound healing time was 24.48±6.01 d, IOB was 23.81±4.66 mL, and incision length was 2.37±0.41 cm. In the CG, the surgical time was 72.67±9.33 min, wound healing time was 37.04±5.22 d, IOB was 59.02±5.08 mL, and incision length was 4.58±1.17 cm. All intraoperative and recovery indicators of the OG were significantly superior to those of the CG (**Figure 1**, all $P < 0.05$).

Comparison of AOFAS scores

There was no significant difference in preoperative pain score, function score, alignment score and total AOFAS score between the two groups (all $P > 0.05$). Postoperatively, all AOFAS scoring indexes of both groups were significantly increased. The OG had significantly higher postoperative pain score, function score, alignment score and total AOFAS score than the CG (all $P < 0.05$, **Figure 2**).

Adoption of minimally invasive subtalar arthrodesis

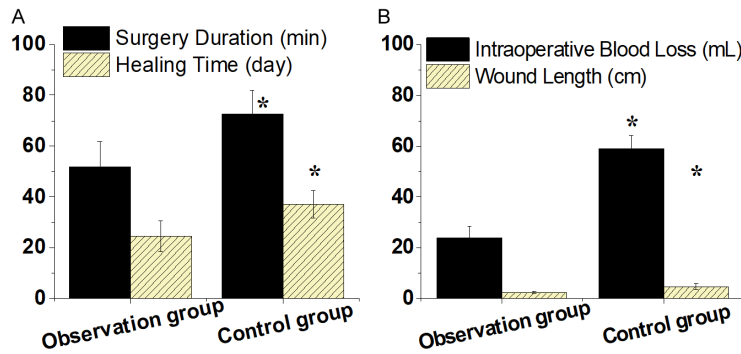


Figure 1. Comparison of surgical conditions of subjects. Note: (A) Surgery duration and healing time; (B) Intraoperative blood loss (IOB) and wound length; * $P < 0.05$ vs. control group.

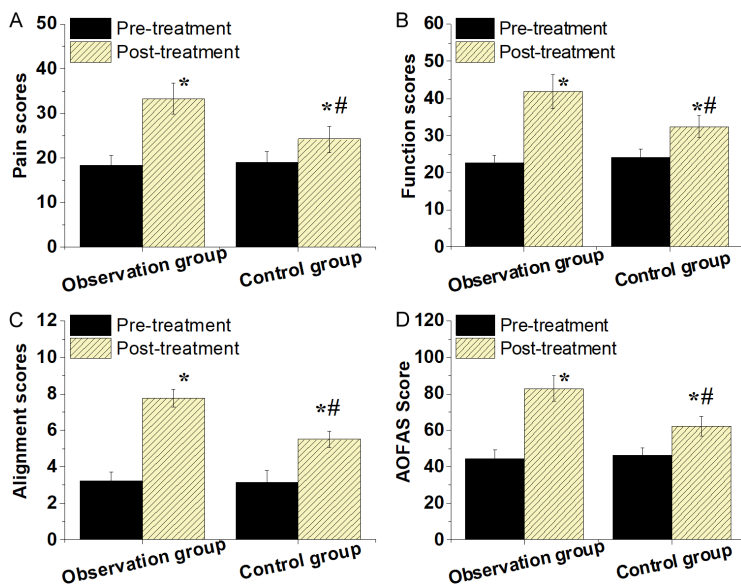


Figure 2. Comparison of AOFAS scores of subjects. Note: (A) Pain score; (B) Function score; (C) Alignment score; (D) American Orthopedic Foot and Ankle Society (AOFAS) total score. * $P < 0.05$ vs. control group; # $P < 0.05$ vs. pre-treatment.

Comparison of foot and ankle functional excellent and good recovery rates

In the OG, 21 cases achieved excellent functional recovery, 28 cases had good recovery, 6 cases had moderate recovery, and 1 case had poor recovery, with an excellent and good recovery rate of 87.5%. In the CG, there were 13 excellent recovery cases, 18 good cases, 9 moderate cases and 2 poor recovery cases, with an excellent and good recovery rate of 73.81%. The excellent and good recovery rate

of the OG was significantly higher than that of the CG ($P < 0.05$, **Figure 3**).

Comparison of postoperative imaging parameters

Preoperatively, there was no significant difference in calcaneal height, talocalcaneal angle, talocalcaneal inclination angle and calcaneal compensation angle between the two groups (all $P > 0.05$). Postoperatively, all imaging parameters of both groups were improved. The OG had significantly higher calcaneal height, calcaneal angle, calcaneal inclination angle and calcaneal compensation angle than the CG (all $P < 0.05$, **Figures 4, 5**).

Comparison of postoperative complication rates

In the OG, there was 1 case of claudication, 0 cases of joint stiffness, 1 case of incision infection and 1 case of hematoma, with a total complication rate of 5.36%. In the CG, there were 2 cases of limping, 1 case of joint stiffness, 2 cases of infection and 1 case of hematoma, with a total complication rate of 14.29%. The postoperative complication rate of the OG was significantly lower than that of the CG ($P < 0.05$, **Figure 6**).

Comparison of postoperative VAS pain scores

At 1 day, 7 days, 1 month and 3 months after surgery, the VAS pain scores of the OG were consistently lower than those of the CG, and the differences were statistically significant (all $P < 0.05$, **Table 2**).

Comparison of postoperative ankle range of motion

Postoperative ankle plantarflexion, dorsiflexion, inversion and eversion angles in the OG

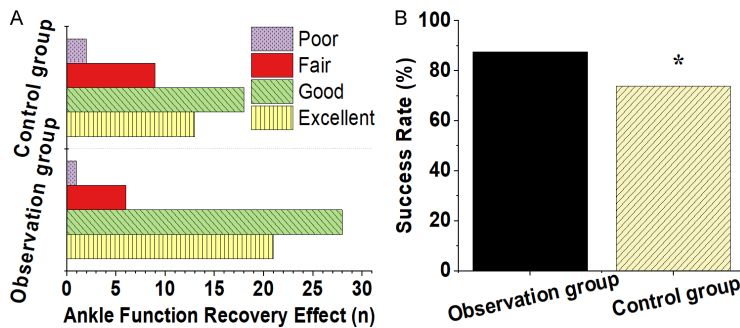


Figure 3. Comparison of the excellent and good rates of foot and ankle function recovery in the subjects. Note: (A) Number of patients with excellent, good, moderate, and poor ankle function recovery; (B) Excellent and good rate of ankle function recovery. * $P < 0.05$ vs. control group.

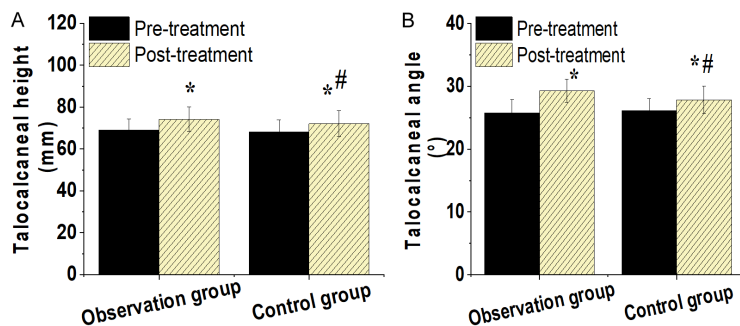


Figure 4. Comparison of talocalcaneal height and talocalcaneal angle. Note: (A) Calcaneal height; (B) Talocalcaneal angle. * $P < 0.05$ vs. control group; # $P < 0.05$ vs. pre-treatment.

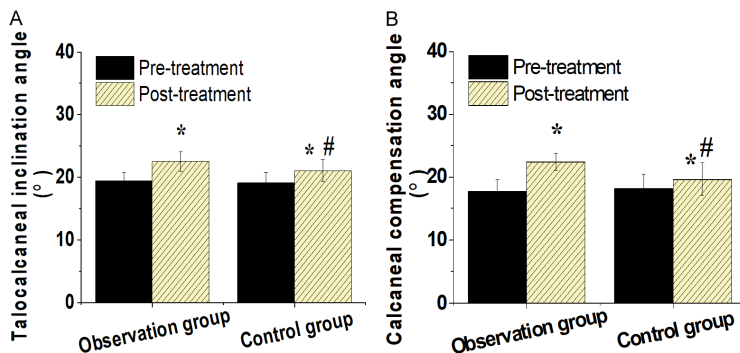


Figure 5. Comparison of talocalcaneal inclination angle and calcaneal compensation angle. (A) represents calcaneal inclination angle; (B) represents calcaneal compensation angle. Note: * $P < 0.05$ vs. control group; # $P < 0.05$ vs. pre-treatment.

were all significantly larger than those in the CG (all $P < 0.05$, Table 3).

Comparison of postoperative FAAM scores

The postoperative daily living activity score and sports function score of FAAM in the OG were

significantly higher than those in the CG (all $P < 0.05$, Table 4).

Comparison of postoperative full weight-bearing time

The postoperative full weight-bearing time of the OG was significantly shorter than that of the CG ($P < 0.05$, Table 5).

Spearman correlation analysis of trauma severity and postoperative prognosis

Spearman correlation analysis showed (Table 6) that trauma severity was significantly negatively correlated with postoperative total AOFAS score, pain score, function score and alignment score ($r = -0.72, -0.69, -0.70, -0.65$, all $P < 0.05$). Trauma severity was also negatively correlated with talocalcaneal height, talocalcaneal angle, talocalcaneal inclination angle and calcaneal compensation angle ($r = -0.65, -0.61, -0.58, -0.56$, all $P < 0.05$). In addition, trauma severity was significantly positively correlated with 3-month postoperative VAS score, fracture healing time and full weight-bearing time ($r = 0.68, 0.70, 0.66$, all $P < 0.05$).

Discussion

Traumatic subtalar arthritis is mostly secondary to calcaneal fractures and ankle injuries, with core clinical manifestations including joint pain, stiffness, and dysfunction. The disease not only severely affects patients' daily activities and QoL but also easily induces progressive joint degeneration and irre-

versible foot deformity if not treated timely and effectively [15, 16]. Delayed and improper treatment often leads to aggravated lesions, which requires more complex surgical intervention in the later stage. Therefore, early diagnosis and standardized treatment of subtalar joint trauma are crucial to restore foot and ankle

Adoption of minimally invasive subtalar arthrodesis

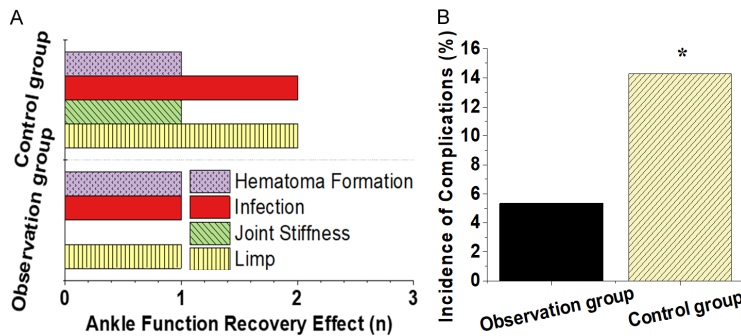


Figure 6. Comparison of postoperative complications. (A) is the number of cases of limping, joint stiffness, infection, hematoma formation; (B) is the incidence of complications. Note: * $P < 0.05$ vs. control group.

Table 2. Comparison of VAS pain scores between the two groups at different postoperative time points

Time point	Observation group (n=56)	Control group (n=42)	t value	P value
1 day postop	4.25±1.12	6.83±1.35	4.12	0.006
7 days postop	2.16±0.84	4.37±1.06	4.35	0.002
1 month postop	0.73±0.41	2.25±0.78	5.68	0.003
3 months postop	0.25±0.18	0.86±0.39	3.89	0.011

Note: VAS, visual analogue scale.

Table 3. Comparison of postoperative ankle range of motion between the two groups

Parameter	Observation group (n=56)	Control group (n=42)	t value	P value
Plantarflexion	38.64±3.27	29.53±3.16	4.79	0.004
Dorsiflexion	15.72±2.08	10.36±1.94	4.52	0.005
Inversion	22.45±2.31	16.83±2.17	3.88	0.012
Eversion	18.36±1.85	12.74±1.76	4.91	0.003

Table 4. Comparison of postoperative FAAM scores between the two groups

Item	Observation group (n=56)	Control group (n=42)	t value	P value
Activities of daily living score	86.42±5.13	72.35±6.24	5.31	0.002
Sports function score	80.16±4.72	65.73±5.81	4.57	0.004

Note: FAAM, Foot and Ankle Ability Measure.

function, reduce long-term pain burden and improve patients' QoL [17].

This study retrospectively analyzed 98 patients with traumatic subtalar arthritis caused by old calcaneal fractures, including 56 cases treated with minimally invasive subtalar arthrodesis and 42 cases treated with traditional open sur-

gery. Intraoperative indicator analysis showed that the OG had shorter operation time and wound healing time, less IOB and smaller incision length than the CG. This conclusion is consistent with the research results of Li et al. [18], which fully confirms that minimally invasive surgery has the advantages of mild trauma and rapid intraoperative and postoperative recovery. It is a safe and efficient surgical method for traumatic subtalar arthritis, which can effectively improve the overall rehabilitation efficiency of patients.

Foot and ankle functional recovery is the core evaluation index of surgical efficacy. AOFAS score is a classic scoring system for evaluating foot and ankle disease treatment and postoperative recovery, which can comprehensively reflect pain degree, joint function and limb alignment [19]. In this study, postoperative AOFAS scores of the OG were significantly higher than those of the CG, indicating that minimally invasive subtalar arthrodesis is superior to open surgery in improving postoperative foot and ankle function, relieving pain and correcting limb alignment, and can better optimize patients' postoperative QoL [20]. Further analysis of functional recovery grades showed that the excellent and good recovery rate of the OG reached 87.5%, which was significantly higher than the 73.81% of the CG. This result further verifies the significant clinical efficacy of minimally

invasive surgery in promoting functional recovery.

Imaging parameter recovery is the anatomical basis of functional improvement. Postoperative calcaneal height and angular parameters of the OG were significantly better than those of the CG. Normal calcaneal morphology and talocal-

Table 5. Comparison of postoperative full weight-bearing time between the two groups

Group	Number of cases	Full weight-bearing time	t value	P value
Observation group	56	28.64±5.32	6.26	0.001
Control group	42	42.37±6.15	-	-

Table 6. Correlation analysis between trauma severity and postoperative prognostic indicators

Postoperative prognostic indicator	r value	95% CI	t value	P value
AOFAS total score	-0.72	-0.81 - -0.61	4.26	< 0.001
Pain score	-0.69	-0.78 - -0.57	3.12	< 0.001
Function score	-0.7	-0.79 - -0.59	3.18	< 0.001
Alignment score	-0.65	-0.75 - -0.52	4.94	0.001
Talocalcaneal height	-0.65	-0.75 - -0.52	5.94	0.001
Talocalcaneal angle	-0.61	-0.72 - -0.47	2.76	0.002
Talocalcaneal inclination angle	-0.58	-0.69 - -0.43	3.61	0.004
Calcaneal compensation angle	-0.56	-0.68 - -0.41	2.53	0.005
VAS at 3 months postoperatively	0.68	0.56 - 0.77	5.05	< 0.001
Fracture healing time	0.7	0.59 - 0.79	3.18	< 0.001
Time to full Weight-Bearing	0.66	0.54 - 0.76	5.99	0.001

Note: AOFAS, American Orthopedic Foot and Ankle Society; VAS, visual analogue scale.

caneal biomechanical structure are the key to maintaining foot stability and normal joint motion [21]. Minimally invasive surgery can accurately restore the anatomical structure of the subtalar joint with less damage to peripheral soft tissues, thus achieving better anatomical reduction and laying a foundation for postoperative functional recovery.

Postoperative complication prevention is an important guarantee for safe rehabilitation. The complication rate of the OG was only 5.36%, which was significantly lower than 14.29% of the CG. The small incision and minimal soft tissue damage of minimally invasive surgery effectively reduce the risk of infection, hematoma and joint stiffness, improving the safety of surgical treatment.

In terms of pain control and rehabilitation progress, the OG had lower VAS pain scores at all postoperative time points, larger ankle range of motion, higher FAAM scores and shorter full weight-bearing time. This is because minimally invasive surgery avoids extensive stripping of soft tissues and damage to normal joint structures, reduces postoperative inflammatory pain and tissue adhesion, enables patients to carry

out early functional exercises, and shortens the overall rehabilitation cycle.

Spearman correlation analysis in this study confirmed that trauma severity is an important independent prognostic factor of traumatic subtalar arthritis. More severe preoperative joint damage and soft tissue injury correspond to worse postoperative anatomical recovery, lower functional scores, more significant pain and longer rehabilitation time [22]. This indicates that clinicians can formulate personalized surgical schemes and targeted rehabilitation plans according to patients' preoperative trauma severity. Strengthened perioperative management and early intervention for patients with severe trauma can effectively improve postoperative prognosis.

Conclusion

Minimally invasive subtalar arthrodesis has significant clinical advantages in the treatment of minimally invasive subtalar arthritis. Compared with traditional open surgery, it can effectively shorten operation time, reduce intraoperative blood loss and surgical incision trauma, lower postoperative complication rates, and accelerate wound healing and functional rehabilitation. It can significantly improve postoperative AOFAS scores, FAAM scores, ankle range of motion and imaging anatomical parameters, reduce postoperative pain, and shorten full weight-bearing time, thus effectively improving patients' QoL.

Trauma severity is closely correlated with postoperative prognosis of patients with traumatic subtalar arthritis. Severe trauma is associated with poor anatomical and functional recovery, more severe pain and longer rehabilitation cycle, which can provide accurate guidance for clinical stratified treatment and rehabilitation intervention.

This study has certain limitations. As a single-center retrospective study, there may be inherent selection bias. The sample size is limited, and the follow-up time is short, which cannot

evaluate the long-term efficacy of minimally invasive surgery. Therefore, large-sample, multi-center, prospective long-term follow-up studies are needed in the future to further verify the research conclusions and explore the long-term prognostic effect of minimally invasive subtalar arthrodesis.

Disclosure of conflict of interest

None.

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