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# Comparative study between Blair's procedure of ankle fusion and arthroscopic ankle arthrodesis

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## ABSTRACT

**Background:** Our objective was to perform a comparative study in terms of functional outcome of Blair's procedure of ankle fusion versus arthroscopic methods of ankle fusion.
**Methods**: 25 patients that underwent arthroscopic ankle arthrodesis versus Blair's procedure of ankle fusion were taken for study at government medical college, Srinagar (VCSGGIMS and R) from the duration 2015-2021. Clinical assessment was done foot and ankle disability index and visual analog scale score for pain. Radiological assessment was done by serial X-rays. Regular follow-ups were taken till one year.
**Results**: Both modalities proved to be equally effective in terms of patient's functional outcome. Our analysis showed that Blair's procedure ankle fusion was associated with a lower fusion rate (OR 0.26, 95% CI 0.13-0.52, p=0.0002), longer tourniquet time (MD 16.49, 95% CI 9.46-23.41, p<0.00001), and longer length of stay (MD 1.60,95% CI 1.10-2.10, p<0.00001) compared to arthroscopic ankle fusion; however, there was no significant difference between two groups in terms of infection rate (OR 2.41, 95% CI 0.76-7.64, p=0.14), overall complication rate (OR: 1.54, 95% CI 0.80-2.96, p=0.20), and operation time (MD 4.09, 95% CI 2.4910.66, p=0.22).
**Conclusions**: We found no significant difference between two groups in terms of infection rate, overall complication rate, and operation time. Further high quality randomized controlled trials that are adequately powered are required.

**Keywords**: Blair's procedure, Ankle, Arthrodesis, Arthroscopic, Ankle fusion

## INTRODUCTION

Ankle arthritis is associated with pain and gross derangement of function. Ankle arthritis is far less common than hip and knee arthritis, and >80% of ankle arthritis is after traumatic. Conservative treatment options include anti-inflammatory medications, orthotic devices, and operative debridement. Once conservative treatment options fail, ankle arthrodesis has traditionally been the treatment of choice. Arthrodesis has been shown to have good clinical results in terms of pain relief. Ankle fusion can lead to a change in gait, with an effect on cadence and stride length, leading to abnormal motion of the subtalar joint; however, reduction in pain and return to activities still make the procedure a good choice for properly selected patients. After the first arthrodesis performed in early 19$^{th}$ century, technological advancement and better understanding of bone fusion has made possible for less invasive ankle fusion.[1] Therefore, many different surgical procedures have been described of which Blair's procedure and arthroscopic fusion with internal fixation with screws have been widely practiced.[5]

Moreover, the use of the technique was limited to surgeons with a particular skill set in small joint arthroscopy, making Blair's procedure fusion more appealing for most surgeon. Despite ongoing research, the most effective technique for ankle fusion is still controversial. The outcomes of arthroscopic and Blair's procedure ankle arthrodesis have been compared by some studies making a

systematic review worthwhile. To our knowledge, there is no systematic review in literature comparing outcomes of Blair's procedure and arthroscopic methods of ankle fusion.[7] Our objective was to perform a systematic review of the literature and conduct a meta-analysis to investigate the outcomes of Blair's procedure (Figure 1 A to D) versus arthroscopic methods of ankle fusion (Figure 1 A to G).

## METHODS

### *Study details*

Retrospective comparative study, at government medical college, Srinagar (VCSGGIMS and R) from 2015-2021, ethical approval and patient consent taken.

### *Eligibility criteria*

*Age group*-18-85 years (skeletally mature) patients selected for the study.

*Sex*-Either sex.

*Inclusion criteria:* Patient's selected had End stage arthritis and post traumatic arthritis.

*Exclusion criteria:* Patients of Charcot joint/neuropathic joint excluded from the study.

### *Outcome measures*

Fusion rate was considered as primary outcome measure. The secondary outcome measures included infection rate, overall complication rate, length of hospital stay, operative time, and tourniquet time.

### *Literature search*

No similar study found.

### *Data synthesis and statistical analyses*

For dichotomous outcome variables (overall complication rate, fusion rate, infection rate), we calculated the odds ratio (OR). The OR is the odds of an event in the Blair's procedure fusion group compared to arthroscopic fusion group. For fusion rate, OR of more than one would favor Blair's procedure group and an OR of less than one would favor the arthroscopic group. For infection rate and overall complication rate, an OR of less than one would favor Blair's procedure group and an OR of more than one would favor the arthroscopic group. For continuous parameters (tourniquet time, operative time and length of stay) we used the mean difference (MD) between the two groups. We used the individual patient as the unit of analysis. Information about dropouts, withdrawals and other missing data were recorded and, if not reported, we contacted the study authors where possible. The final analysis was based on intention-to-treat data from the individual clinical studies.

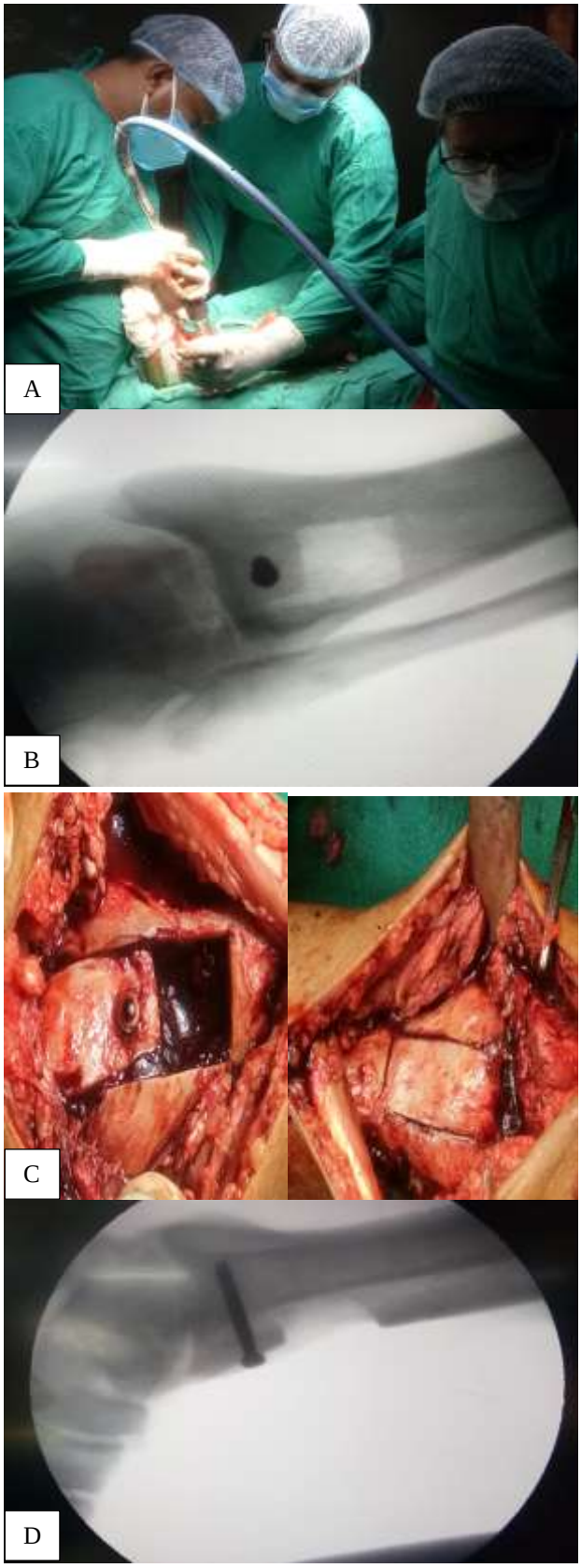


**Figure 1: (A): Operating surgeon with team, (B) intra-operative C arm image of Blair procedure of ankle fusion, (C) intraoperative Blair procedure. images, (D): x-ray images of ankle fused by Blair's procedure.**

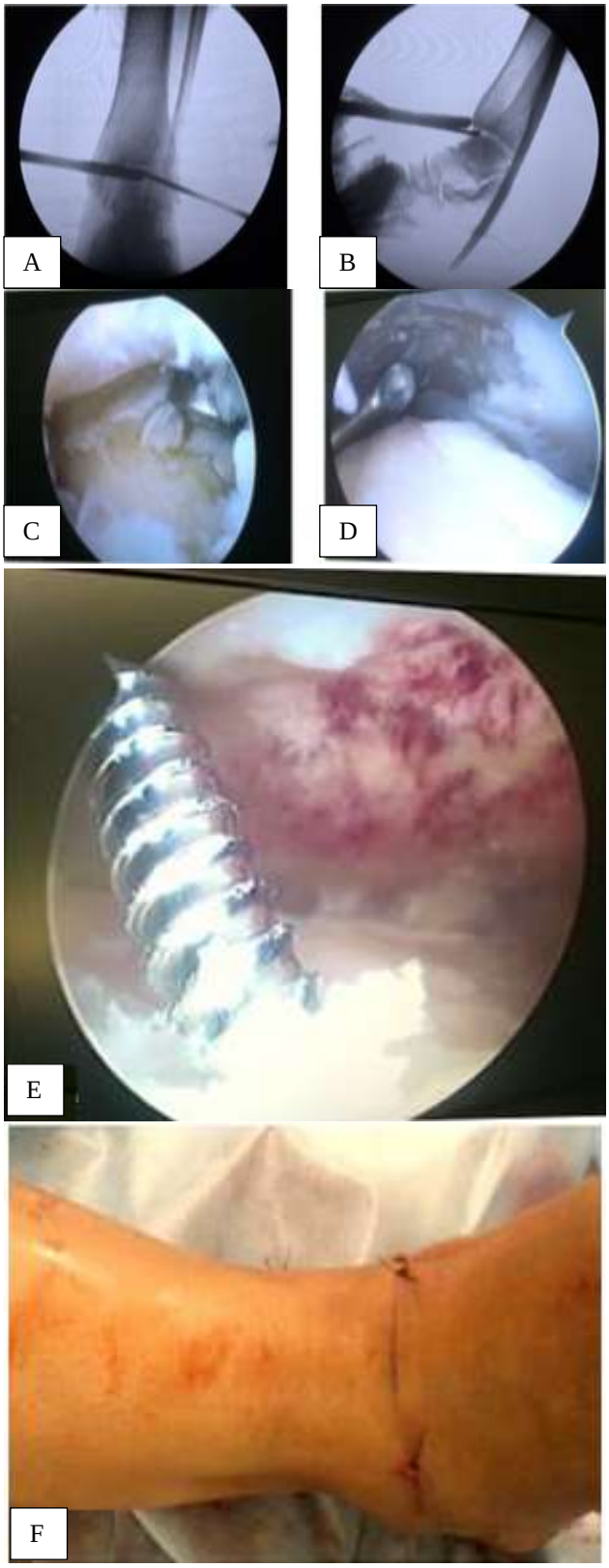


**Figure 2: (A-B): Arthroscopic portals made for ankle fusion, (C-D): Fusion of ankle joint after debridement, (E): Insertion of screw under arthroscopic, (F): Image shows suture site of arthroscopic portals.**

## RESULTS

### *Demographics data*

*Age group*-18-85 years (skeletally mature) patients selected for the study.

*Sex*-Either sex.

*Inclusion criteria:* In the Inclusion criteria patient's selected and included had end stage arthritis and post traumatic arthritis.

*Exclusion criteria:* In the exclusion criteria patients of the Charcot joint/neuropathic joint excluded from the study.

### *Fusion rate*

Fusion rate was reported in all 25 patients as shown in the Figure 2F. Fusion rate was significantly lower in Blair's procedure group (OR 0.26, 95% CI 0.13-0.52, p=0.0002). A low level of heterogeneity among the studies existed (I2=26%, p=0.25).

### *Infection rate*

Infection rate was reported as more in Blair's procedure. (OR 2.41, 95% CI 0.76-7.64, p=0.14). A low level of heterogeneity among the studies existed, (I2=0%, p value of=0.98).

### *Overall complication rate*

There was no difference in risk of overall complication between Blair's procedure and arthroscopic groups (OR: 1.54, 95% CI 0.80-2.96, p=0.20).

### *Tourniquet time*

Tourniquet time was significantly shorter in arthroscopic group (MD 16.49, 95% CI 9.46-23.41, p<0.00001). A high level of heterogeneity among studies existed (I2=93%, p=0.00001).

### *Length of stay*

The length of stay was significantly shorter in arthroscopic group (MD 1.60,95% CI 1.10-2.10, p<0.00001). A low level of heterogeneity among studies existed (I2=0%, p=0.41).

### *Operation time*

There was no significant difference in operation time between Blair's procedure and arthroscopic group (MD=4.09, 95% CI 2.49-10.66, p=0.22). A moderate level of heterogeneity among the studies existed (I2=35%, p=0.20).

**Table 1: Representation of final outcome and demographic data.**

| Variables | Group 1 | | P | Group 2 | | P |
|---|---|---|---|---|---|---|
| | AAF | OAF | | AAF | COO | |
| **Number of patients** | 11 | 14 | | 12 | 13 | |
| **Mean of age (Years) (95% CI)** | 54.76±14.11 | 55.35±12.52 | 0.891 | 54.76±14.11 | 53.33±14.82 | 0.782 |
| **Gender (Male/Female)** | 7 Oct | 16 Oct | 0.859 | 7 Oct | 4 Nov | 0.388 |
| **Smoker (No. and %)** | 3 (17.6) | 7 (26.9) | 0.481 | 3 (17.6) | 4 (26.7) | 0.538 |
| **Diabetes (No. and %)** | 4 (23.5) | 3 (11.5) | 0.298 | 4 (25.3) | 1 (6.7) | 0.19 |
| **Mean of BMI (kg/m$^2$)** | 26.55±5.23 | 28.93±5.95 | 0.188 | 26.55±5.23 | 29.21±5.22 | 0.162 |
| **Mean of AOFAS score (Pre-operative)** | 36.2±13.5 | 32.5±11.8 | 0.347 | 36.2±13.5 | 30.7±12.8 | 0.253 |
| **Mean of follow-up time (Months)** | 31.94±11.07 | 34.81±9.41 | 0.368 | 31.94±11.07 | 36.53±8.49 | 0.202 |

AAF=Arthroscopic ankle fusion group, OAF=Open ankle fusion group (demographic composition: OAF=COO+SOO), COO=Complex osseous operation; SOO=Simple osseous operation, BMI=body mass index, AOFAS=Score the American orthopedic foot and ankle society score. PP values: α=0.05, (Age, BMI, AOFAS score and follow-up time: independent-samples T test; gender, smoker and diabetes: Chi-squared test).

## DISCUSSION

We conducted a systematic review of the literature and meta-analysis of outcomes of arthroscopic versus Blair's procedure of ankle fusion. Our analysis showed that arthroscopic ankle fusion was associated with a higher fusion rate, shorter tourniquet time, and shorter length of stay compared to Blair's procedure ankle fusion; however, there was no significant difference between two groups in terms of infection rate, overall complication rate, and operation time. The between-study heterogeneity was high for tourniquet time but low or moderate for other outcomes. The direction of the effect sizes remains unchanged throughout sensitivity analyses. The available evidence is derived from a very small number of studies with generally small sample sizes; therefore, the best available evidence is not adequately robust to make definitive conclusions. We found higher fusion rate associated with arthroscopic ankle fusion. It has been shown by others that arthroscopic ankle arthrodesis achieves high union rates, facilitates short time to union, and permits rapid patient mobility. The minimum degree of soft-tissue envelope disruption associated with arthroscopic arthrodesis may reduce the degree of permanent functional impairment of the joints and soft tissues adjacent to the arthrodesis site. It also appears to allow more rapid activation of the bone healing cascade, leading to more rapid bone healing and earlier functional improvement. All of these may explain higher fusion rate associated with arthroscopic ankle fusion. We also found shorter length of hospital stay in patients undergoing arthroscopic ankle fusion. A better pain control during the postoperative period, less morbidity and a faster return to a normal life after rehabilitation associated with arthroscopic fusion rate main explain shorter length of stay in these group of patients. Despite these advantages of arthroscopic ankle fusion, there are still some concerns including the ability of correcting significant angular deformities or bone loss with the arthroscopic technique.

Moreover, it has been shown that both arthroscopic and Blair's procedure ankle arthrodesis lead to early osteoarthritic changes in adjacent joints, mainly the subtalar joint. Unfortunately, the limited available data did not allow us to compare long-term outcomes of either techniques; therefore, the results of this study do not provide an answer for the concerns mentioned above.

Nielsen et al and Peterson et al included ankle deformities of less than 10 for arthroscopic fusion.[11,12] A large coronal plane deformity has been considered as relative contraindication for arthroscopic ankle arthrosis by many authors.[20] Townshend et al however, achieved technical success in arthroscopic group including coronal plane deformities of as large as 30.[11] They argued that large coronal plane deformities are frequently the result of talar tilting within the ankle mortise, with little deformity in the actual tibia or talus. After arthroscopic debridement, the surgeon can reposition the talus to eliminate the coronal malalignment without the need for major bone resection or osteotomy.[10] Consistent with this argument, similar outcomes after arthroscopic ankle arthrodesis in patients with <15 deformity and >15 (up to 45 degree) of deformity have been reported by Gougoulias et al.[21]

## CONCLUSION

The best available evidence demonstrates that arthroscopic ankle fusion may be associated with a higher fusion rate, shorter tourniquet time, and shorter length of stay compared to Blair's procedure ankle fusion. We found no significant difference between two groups in terms of infection rate, overall complication rate, and operation time. The best available evidence is not adequately robust to make definitive conclusions. Long-term results of the comparative efficacy of arthroscopic ankle fusion over Blair's procedure ankle fusion are not currently available. Further high quality randomized controlled trials that are adequately powered are required.

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