Long term consequences of Total Ankle Replacement versus Ankle Fusion for end stage arthritis; A 25 year England national population based study of 41,000 patients

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INTRODUCTION:

Ankle arthritis affects 3-4% of the UK population and most commonly results from post traumatic arthritis, osteoarthritis and rheumatoid arthritis. The options for treating end stage arthritis are total ankle replacement (TAR) and ankle fusion (AF); open or arthroscopic.

Each of these definitive procedures irreversibly places patients on a long-term path and it is still not clear which is superior. TAR is reportedly associated with revision rates that are higher than total knee or total hip arthroplasty; ranging from 14-20% at 10 years based on data from four Registries. There is further concern that TAR patients may undergo multiple operations such as open/arthroscopic debridement, grafting of cystic bone defects and bearing exchange on their path to an ultimate revision procedure (either revision arthroplasty or revision to fusion).

In contrast, primary ankle arthrodesis has been reported to have a non-union rate of 5-13% in small studies. An additional major concern is the development of adjacent joint degeneration, requiring a talo-calcaneal or hindfoot fusion. This potentially moves a patient from a high functioning individual to someone with a rigid ankle-hindfoot complex. Recent analysis of a single centre cohort of 271 patients suggested this risk could be as high as 26% within 10 years.

While studies such as the TARVA trial demonstrate equivalent PROMS post TAR or AF at 3 years, the relative life-time risks of further surgery, adjacent joint disease progression and rare but serious peri-operative complications remain unclear. These are best studied using national population databases over a long period.

METHODS:

The Hospital Episode Statistics database (HES) for England, UK, was interrogated to identify all patients undergoing either a total ankle replacement (TAR) of ankle fusion (AF), between 1998 and 2023. Each record relates to one finished Consultant episode and contains detailed demographic data, co-morbidities, mortality-linked data, peri-operative complications and any further operative intervention.

The primary outcome was the rate of TAR revision (both revision arthroplasty and revision to fusion) versus AF revision; analysed by Kaplan-Meier revision free survival. Secondary outcome measures included the rates of postoperative complications at ninety days following TAR versus AF. The progression of adjacent joint disease was determined by the rate of hindfoot fusion (including triple fusion, subtalar, and/or talonavicular fusion), and reported as hindfoot fusion free survival. The rate, number and type of any subsequent re-operations following TAR or AF were compared and reported as 're-operation' free survival. Data was presented as rates of the outcome of interest with confidence intervals, and survival analysis was performed using R and StataSE.

RESULTS:

Following data cleaning, 10,335 TARs and 30,704 ankle fusions were eligible for analysis. The mean age for TAR was 63.8 years (median = 65 years) and 55.2 years (median = 60 years) for AF. Both TAR and AF were most commonly performed in male patients (60.06% and 63.36% respectively), and in the 60-79 age group (68.74% and 48.19% respectively).

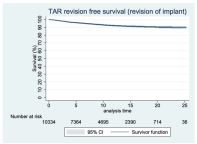
The observed revision rates of TAR were 6.7% at 5 years in 7,659 patients (95% CI 6.15% to 7.2%), 11.1% at 10 years in 4,975 patients (95% CI 10.2% to 12.0%), and 13.1% at 20 years in 753 patients (95% CI 10.8% to 15.8%). In comparison, the revision rate of a failed AF was 2.1% at 5 years in 24,108 (95% CI 1.9% to 2.3%), 2.9% at 10 years in 15,972 patients (95% CI 2.6% to 3.2%), and 3.1% at 20 years in 3,144 patients (95% CI 2.5% to 3.7%).

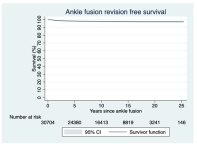
Both operations were associated with low 90-day mortality rates; 0.23% for TAR and 0.41% for AF (RR 0.23 95% CI 0.15 to 0.35). TAR was associated with higher risks of intra-operative fracture (0.42% vs 0.10%, RR = 4.35) and re-operation for wound infection (0.26% vs 0.15%, RR 1.74). Significantly fewer pulmonary emboli were observed within 90 days following TAR compared to AF (0.23% vs 0.58%, RR = 0.40).

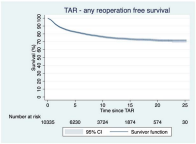
In terms of hindfoot disease progression, over a 20 year period, 5.94% of AF patients (95% CI 5.15 to 6.8%) and 4.80% of TAR patients (95% CI 3.4% to 6.6%) required a hindfoot fusion. The overall re-operation free survival over 25 years was 71.1% for TAR and 71.5% for AF. The majority of re-operations post AF occurred in the first year; 9.1% compared to 5.0% of TAR.

DISCUSSION AND CONCLUSION: Both total ankle replacement and ankle fusion for end-stage arthritis are safe operations. The observed revision rate of TAR in this national population study is 13% over 20 years and lower than reported previously. AF surgery was not associated with a high risk of subsequent hindfoot fusion surgery. Up to 30% of

patients underwent a further operation following either TAR or AF; significantly more of these occurred within the first year following AF compared to TAR.







	RR	l95	u95
mortality	0.5741992	0.3710978	0.8884577
Stroke	0.7026385	0.3398842	1.452556
MI	1.160881	0.6734977	2.000964
PE	0.4022638	0.2627901	0.6157621
LRTI	0.461486	0.2629076	0.810054
AKI	0.6707312	0.4968258	0.9055094
UTI	0.7568102	0.587897	0.9742551
Intraop fracture	4.351154	2.737146	6.916891
Prosthetic comp	0.4024839	0.334093	0.4848748
Prosthetic infection	0.7103356	0.5729749	0.8806262
Nerve injury	1.624619	0.9776062	2.699847
Reop for infection	1.741321	1.083287	2.799075
Fasciotomy	0.4944493	0.0595347	4.106514
Any reoperation	0.8900087	0.7092789	1.11679
BKA	0.2373357	0.0562258	1.001822
1 year reop	0.5529685	0.5037094	0.6070448
1 year bka	0.0639573	0.0157656	0.2594595
triple fus	0.7514988	0.3072812	1.837895
subt	0.6763489	0.4058215	1.127215
hffus	0.6011991	0.3979631	0.9082256
1 year revision -*	2.290282	1.846106	2.841327

Table 1. The above table shows un-adjusted RR for post op outcomes in TAR compared with ankle fusion.

*this mean revision of implant or revision to fusion in TAR, or revision of ankle fusion in ankle fusion