

Predicting Failure in Total Ankle Arthroplasty. A COFAS study

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Introduction/Purpose: Total ankle arthroplasty (TAA) and ankle arthrodesis (AA) are standard treatment modalities for end-stage ankle osteoarthritis. The total ankle arthroplasty (TAA) anatomical alignment is critical for the longevity of total ankle components. Coronal and sagittal malalignment results in altered joint mechanics and reactive forces that result in implant failure. Also, to our knowledge, tibial component sizing in the sagittal plane has been addressed in knee arthroplasty literature, but not in ankle arthroplasty literature. Based on these parameters, we developed a novel radiographic predictive score for failure in TAA (RPSFT).

Methods: A retrospective review performed on the COFAS database, selecting for all total ankle replacements done at a single institution between September 2004 and June 2015. Those with complete series of anteroposterior and lateral standing ankle radiographs, both preoperative and postoperative and a minimum of 1 year of follow-up, were included. We performed a multivariate logistic regression, using the medial distal tibial component angle, lateral talar station, talar tilt angle, and the absence of posterior under= or overhang of the tibial component in the first post-operative radiographs. These parameters were used to develop a RPSFT. Binomial regression was used to determine each variable's weight in the RPSFT and assigned a corresponding score value. A univariate logistic regression was estimated, using the RPSFT as the independent variable and mechanical failure as the dependent variable. Then a Receiver-Operating Characteristic curve was constructed and the probability of failure for each possible score was estimated.

Results: Of a total of 296 TAAs, 146 were included, and 8 TAAs required revision (5%). TAA revision was defined as a reoperation to remove one or both metal components, or amputation. According to our predictive score, if all the parameters are within established normal ranges (17 points) the TAA failure probability (TFP) is 2% [0-0.1] $p < 0.01$. If none of them are obtained (0 points) the TFP rise to 42% $p < 0.01$ (see attached table). Time to TAA failure averaged 4.4 years and ranged from 1.4 to 9.6 years.

Conclusion: Our model suggests that a coronal and sagittal alignment and absence of tibial implant under/overhang are of vital importance to prevent TAA failure. To our knowledge, this is the first study that presents a predictive score for failure in TAA using postoperative ALSAR. Further data analyses are ongoing and may expand our predictive model to include other radiographic parameters.

Score	Failure Probability	Non-Failure Probability
0	0.42 [0.06-0.79]	0.58 [0.21-0.94]
4	0.23 [0.06-0.40]	0.77 [0.60-0.94]
5	0.19 [0.06-0.34]	0.81 [0.67-0.94]
8	0.11 [0.03-0.19]	0.89 [0.81-0.97]
9	0.09 [0.02-0.16]	0.91 [0.84-0.98]
12	0.05 [0-0.10]	0.95 [0.90-1]
13	0.04 [0-0.09]	0.96 [0.91-1]
17	0.02 [0-0.05]	0.98 [0.95-1]