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Review Article

Effect of Obesity on Total Ankle Arthroplasty: A Systematic Review of Postoperative Complications Requiring Surgical Revision

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ABSTRACT

Total ankle arthroplasty has become an increasingly used alternative to ankle arthrodesis for the treatment of end-stage ankle arthritis. However, despite progressive technological advances and the advent of multiple commercial implant systems, some concern remains for the relatively high complication and failure rates. The objective of the present investigation was to perform a systematic review of the incidence of complications in obese patients undergoing total ankle arthroplasty. We performed a review of electronic databases with the inclusion criteria of retrospective case series, retrospective clinical cohort analyses, and prospective clinical trials with ≥15 total participants, a mean follow-up period of ≥12 months, ≥1 defined cohort with a body mass index of ≥30 kg/m^2, and a reported incidence rate of complications requiring revisional surgery at the final follow-up point. Four studies met our inclusion criteria, with a total of 400 implants analyzed. Of these, ≥71 (17.8%) developed a complication requiring a revisional surgical procedure. The most commonly reported surgeries were revision of the metallic components and ankle gutter debridement. It is our hope that our investigation will allow foot and ankle surgeons to more effectively communicate the perioperative risk to their patients during the education and consent process.

Total ankle arthroplasty (TAA) has become an increasingly used alternative to ankle arthrodesis for the treatment of end-stage ankle arthritis (1,2). However, despite progressive technological advances and the advent of multiple commercial implant systems, some concern remains for the relatively high complication and failure rates associated with the procedure (3–11). These rates have been attributed to both implant- and patient-specific factors. Several patient-specific relative contraindications to total joint implants include, but are not limited to, the presence of diabetes, peripheral arterial vascular disease, neurologic conditions, and tobacco use. Another potential important consideration might be patient body mass index (BMI), in particular, when considering its effect on the development of postoperative complications, the longevity of the implant, and functional outcomes.

The World Health Organization has identified obesity as a "global epidemic" and has defined a "normal" weight using the BMI as one <25 kg/m^2, "overweight" as 25 to 29.9 kg/m^2, and "obese" as ≥30 kg/m^2 (12). In general, obese patients are at a greater risk of the development of musculoskeletal lower extremity pathology (13–19) and are at a greater risk of the development of complications in the perioperative setting (20–35). Most of the contemporary orthopedic data related to prosthetic complications associated with elevated BMI have been focused on patients undergoing total hip and knee arthroplasty (36–38). These data provide evidence suggesting that the incidence of revision and infection, decreased implant survival, and decreased functional outcomes is greater in those patients with a BMI >30 kg/m^2.

However, it remains unclear whether these conclusions are universal to all joint arthroplasties of the lower extremity, because a relative paucity of data specific to the relationship between an elevated BMI and outcomes after TAA is available. Therefore, the objective of the present investigation was to perform a systematic review of the incidence of complications in obese patients undergoing TAA.

Materials and Methods

We performed a systematic review of the medical data including PubMed and Ovid through Medline® (available at: http://www.ncbi.nlm.nih.gov/pubmed and http://ovidsp.ovid.com/autologin.cgi), Embase (available at: https://www.embase.com/login), and the Cochrane Database of Systematic Reviews (available at: http://www.cochranelibrary.com/cochrane-database-of-systematic-reviews). Additionally, we performed a manual search of the references of any article we identified as meeting our inclusion criteria. The search was performed in July 2016 with no restriction on publication date and with the word query: ("total ankle arthroplasty" OR "total ankle replacement" OR "total ankle" OR "TAR" OR "TAA" OR "ankle replacement") AND

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("obesity" OR "obese" OR "body mass index"). The abstracts returned from these searches were initially reviewed by 1 author (A.J.M.) for potential relevance. Each potentially relevant report was then reviewed by all authors (L.E.S., J.C.V., A.J.M.) for specific inclusion and exclusion criteria. Complete agreement was necessary for final inclusion, with 1 author (A.J.M.) considered the final arbiter.

The inclusion criteria were retrospective case series, retrospective clinical cohort analyses, and prospective clinical trials with ≥15 total participants, a mean follow-up period of ≥12 months, ≥1 defined cohort with a BMI ≥30 kg/m^2, and a reported incidence of complications requiring revisional surgery at the final follow-up point. Only full text reports were considered, and studies not published in the English language were excluded.

Results

The searches for potentially relevant reports yielded 19 unique studies (7,9–11,29,39–52). Each of these were obtained and reviewed for our specific inclusion and exclusion criteria, which resulted in the final inclusion of 4 published reports (Table) (39–42). Of the 4 included studies, 3 were retrospective cohort analyses comparing a normal BMI population to an obese population (40–42) and 1 was a retrospective case series of obese patients (39).

These 4 studies included an analysis of 400 implants in 392 patients (Table). The available descriptive data of the subject cohorts is provided in the Table. Of these, ≥71 (17.8%) developed a complication requiring a revisional surgical procedure. This included a specific description of subsequent surgeries for revision of metallic components in 33, open or arthroscopic gutter debridement in 29, tendon lengthening, fascial release, and/or tenolysis procedures in 15, incisional wound debridement in 5, reconstructive realignment foot/ankle surgery in 5, excisional debridement for deep space infection in 5, conversion to ankle arthrodesis in 4, replacement of implant liners in 3, and periprosthetic osseous cyst debridement in 2, for a total of 101 revisional procedures performed.

Discussion

The objective of our systematic review was to evaluate the incidence of complications requiring revisional surgery in obese patients undergoing TAA. We observed an incidence rate of complications requiring revisional surgery of ≥17.8% (71 of 400). This included detailed documentation of the revisional surgery performed on ≥71 of the 409 implants and a detailed description of the total of 101 specific revisional procedures performed. We decided on a conservative interpretation of this finding to indicate that it was likely that at least several patients had undergone multiple procedures, although it is also possible that the observed incidence rate was somewhat >17.8% if this interpretation is incorrect. The most commonly reported revisional surgeries were revision of the metallic components (33 of 101 [32.7%]) and ankle gutter debridement (29 of 101 [28.7%;]).

Just as with any scientific investigation, critical readers are encouraged to review and assess the study design and specific results to reach their own independent conclusions, as the preceding only represents our conclusions from the data. We also realize that all investigations have limitations, and ours had several to consider inherent to systematic reviews. First, we did not search every available electronic database, only those that we have found most useful in our clinical practices. Additionally, this type of search process, in particular, the initial abstract screening for potentially relevant studies, is prone to human error. Because of this, it is possible that other investigations would have met our inclusion criteria but were not included in our report.

Second, we excluded several reports in accordance with our inclusion and exclusion criteria, which could be considered limited and/or restrictive. Another group of investigators undertaking a similar review with another group of more or less strict inclusion and

Table
Summary of included articles and results

Investigators	Study Design	Implants in Obese Subjects With Demographic Information	Reported Indication	Implant Type	Reported Complications Requiring Revisional Surgery
Schipper et al (42), 2016	Retrospective case series	49 Implants in 46 patients; age 54.7 ± 13.8 (37 to 82) y; follow-up 7.7 ± 2.0 (5.0 to 11.9) y; 55.1% male	Degenerative or posttraumatic arthritis: n = 35; inflammatory arthritis: n = 5*	Agility: n = 42; INBONE: n = 5; Salto Talaris: n = 1*	21 (42.9)
Barg et al (39), 2011	Retrospective comparative cohort analysis	123 Implants in 118 patients; age 59.8 ± 11.6 (25.4 to 79.4) y; follow-up 67.7 ± 27.0 (29 to 126) mo; 51.7% male	Degenerative or posttraumatic arthritis: n = 100; inflammatory arthritis: n = 20; other: n = 1*	HINTEGRA: n = 123	23 (18.7)
Gross et al (41), 2016	Retrospective comparative cohort analysis	189 Implants in 189 patients; age 61.7 ± 8.9 y (NR); follow-up: 43.9 ± 17.0 mo (NR); 48.7% male	Degenerative or posttraumatic arthritis: n = 171; inflammatory arthritis: n = 8; other: n = 10	INBONE: n = 99; S.T.A.R.: n = 57; Salto Talaris: n = 33	20 (10.6)
Bouchard et al (40), 2015	Retrospective comparative cohort analysis	39 Implants in 39 patients; age 62.4 ± 8.4 y (NR); follow-up 3.76 ± 1.73 y (NR); 46.2% male	Degenerative or posttraumatic arthritis: n = 32; inflammatory arthritis: n = 6; other: n = 1	Mobility: n = 11; HINTEGRA: n = 26; S.T.A.R.: n = 2	7 (17.9)
Total	NA	400 Implants in 392 patients	Degenerative or posttraumatic arthritis: n = 338; inflammatory arthritis: n = 39; other: n = 12*	HINTEGRA: n = 149; INBONE: n = 104; S.T.A.R.: n = 59; Agility: n = 42; Salto Talaris: n = 34; Mobility: n = 11*	71 (17.8)

Data presented as n, mean ± standard deviation (range), or n (%), unless noted otherwise.
Abbreviations: NA, not applicable; NR, not reported.
* These do not sum to the number of total implants described in the sample size but we have reported the data provided in the studies.