Stacked Metaphyseal Cones for the Treatment of Extensive Bone Loss in Total Knee Arthroplasty: A Multicenter Analysis of 55 Patients

Nathanael D Heckmann, McKenzie Watts Culler, Jessica Leipman, Lucas Anderson, Yale Fillingham, Jesse Isaac Wolfstadt

INTRODUCTION: Stacked cones offer a modular solution for extensive metaphyseal bone loss during total knee arthroplasty (TKA). This multicenter study evaluates early outcomes and survivorship of stacked cone constructs.

METHODS: A retrospective observational study was conducted across four tertiary referral centers to identify patients who underwent TKA with stacked cones from 2010-2024. Demographic, operative, clinical, and radiographic data were collected and assessed. Kaplan-Meier survival analysis was performed with all-cause reoperation, all-cause revision, revision for aseptic loosening, and radiographic loosening as endpoints.

RESULTS:
In total, 57 patients received stacked cone constructs, with stacked cones used in the tibia in 36 (63.2%) patients, in the femur in 16 (28.1%) patients, and in both the femur and tibia in 5 (8.8%) patients. Of the 57 patients, 38 (66.7%) were men. The average age was 66.5 years (range, 42.8-87.8 years), with a mean body mass index of 33.9 kg/m2 (range, 20.4-55.4 kg/m2), median of 4 prior surgeries (range, 0-17), and average follow-up of 23.7 months (range, 6.4-82.2 months). The most common indications for stacked cones were periprosthetic joint infection (PJI) (n=27, 47.4%) and aseptic loosening (n=20, 35.1%). Fifteen (26.3%) patients underwent reoperation at a mean time of 2.9 months (range, 0.4-37.3 months); the most common reasons for reoperation were PJI (n=6) and extensor mechanism reconstruction (n=3). Five (8.8%) patients underwent revision of the stacked cone construct, with 4 revised for PJI and 1 for periprosthetic fracture. Survivorship free from all-cause reoperation was 83.9% at 1 year (95% confidence interval [CI], 69.8-92.4%) and 63.9% at 3 years (95% CI, 33.5-82.0%). Survivorship free from all-cause revision was 96.4% at 1 year (95% CI, 84.9-99.6%) and 82.3% at 3 years (95% CI, 48.1-94.8%) while survivorship free from revision for aseptic loosening was 100% at 3 years (95% CI, 69.2%-100%). Survivorship free from radiographic loosening was 98.2% at 1 year (95% CI, 87.4-100%) and 74.4% at 3 years (95% CI, 43.9-90.9%).

DISCUSSION AND CONCLUSION:
Stacked cone constructs are a viable option for managing extensive metaphyseal bone loss in TKA.

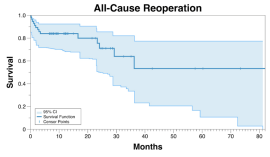

Figure 1. Kaplan-Meier survivorship curve with all-cause reoperation as the endpoint.

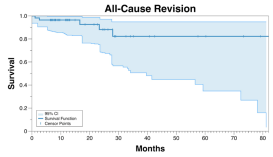

Figure 2. Kaplan-Meier survivorship curve with all-cause revision of the stacked cone construct as the endpoint.

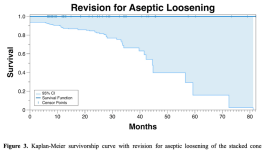

Figure 3. Kaplan-Meier survivorship curve with revision for aseptic loosening of the stacked cone construct as the endpoint.

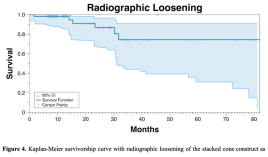

Figure 4. Kaplan-Meier survivorship curve with radiographic loosening of the stacked cone construct as the endpoint.