

PAPER 5

Should larger stem diameter be prioritized over cement mantle thickness? An analysis of risks for failure in cemented endoprostheses with minimum five-year follow-up.

Ippolito J, Kadkoy Y, Schneider G, Thomson J, Park C, Beebe K, Patterson F, Benevenia J

Background:

With continued advances in treatment options, patients with endoprosthetic reconstruction are living longer and consequently relying upon their devices for a longer duration. Major causes of endoprosthesis failure include aseptic loosening and mechanical failure. In the setting of tumor resection, loss of bone stock and use of radiation therapy increase the risk for these complications. Advances in the availability of modular devices have increased stem options during the reconstructive period. As such, considerations of remaining native bone and stem length and diameter may be increasingly important.

Questions:

We asked the following questions related to failure rates of endoprostheses: (1) Does the ratio of bone to stem diameter impact failure? (2) Does increased resection length and decreased length of remaining bone increase risk for failure?

Methods:

We retrospectively analyzed patient outcomes at a single institution between the years of 1999-2022 who underwent cemented endoprosthetic reconstruction at the hip or knee and identified 150 patients. Of these 150, fifty-five had a follow-up of greater than five years and were used for analysis. Radiographs of these patients at time of surgery were assessed and measured for resection length, bone diameter, stem diameter, and remaining bone length. Resection percentage, and stem to bone diameter ratios were then calculated and their relationship to endoprosthesis failure were analyzed.

Results:

Patients in this cohort had a mean age of 46, and mean follow-up of 126.4 months. There were 33 distal femoral replacements (60%), 16 proximal femoral replacements (29%), and 6 proximal tibial replacements (11%). There were 5 patients who experienced aseptic loosening and 5 patients who experienced mechanical failure, with 1 patient experiencing both for an overall device failure rate of 18%. Patients with implant failure had a smaller mean stem to bone diameter (36% versus 44%; $p=0.004$). A stem to bone diameter of 40% appeared to be a breaking point between success and failure in this series, with 90% of patients with implant failure having a stem:bone ratio less than 40%. Stem to bone ratio less than 40% increased risk for failure versus stems that were at least 40% the diameter of bone [9/10 (90%) versus 7/45 (16%); odds ratio 48.8; $p<0.0001$]. Resection length did not appear to have an impact on the rates of aseptic loosening and mechanical failure in this series.

Conclusion:

Data from this series suggests a benefit to using larger stems when implanting cemented endoprostheses at the hip or knee. Stems which were less than 40% the diameter of bone were substantially more likely to undergo implant failure.