

A Comparison of Acetabular Augmentation and Photodynamic Nail Stabilization for Complex Oncologic Total Hip Arthroplasty

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INTRODUCTION: Total hip arthroplasty (THA) is well-established for managing primary sarcoma or skeletal metastases in the hip; however, periacetabular disease complicates fixation due to poor bony substrate. Traditional strategies for overcoming acetabular bone loss include tantalum augments or protrusion cups. More recently, photodynamic nails (PDN) have emerged as a promising method for periacetabular disease because of their radiolucency and ability to accommodate screw fixation after polymerization. This study compared patients undergoing complex THA with acetabular augments versus photodynamic nails (PDNs), with Simple THAs included as a reference group.

METHODS: A retrospective comparative study of patients undergoing THA for oncologic indications was conducted. Simple THA utilized only conventional implants; complex THA was defined as THA with additional pelvic fixation with PDNs (PDN+THA) or acetabular augments (Augment+THA). Demographic, surgical, and outcome data were collected. Primary outcomes were the cumulative incidence of reoperation or revision with death as a competing risk.

RESULTS: Final analysis included 15 PDN+THA, 36 Augment+THA, and 80 simple THA. Acetabular cementation was more common for Augment+THA (89%) and Simple THA (40%) than PDN+THA (7%, $p < 0.001$). PDN+THA used dual mobility (DM) heads in all cases, whereas Augment+THA (42 % DM) and simple THA (32% DM) more often used conventional heads ($p < 0.001$). While PDN+THA required longer operative time, blood loss and length of stay were decreased compared to Augment+THA ($p < 0.001$). Simple THA showed significantly lower rates of reoperation at 12 months (9%) and 24 months (13.2%) follow-up ($p < 0.05$); 12- and 24-month reoperation rates in PDN+THA (29.4% and 40.6%) and Augment+THA (24.3% and 34.1%) were comparable ($p = 0.682$). Revision rates for Simple THA, PDN+THA, and Augment+THA were similar at 12 months (7.5% vs. 15.7% vs. 19.7%, $p > 0.05$) and 24 months (12% vs. 24.4% vs. 30.1%, $p > 0.05$).

DISCUSSION AND CONCLUSION: PDN+THA showed comparable reoperation and revision rates compared to Augment+THA. However, despite increased operative time, PDN+THA revealed overall lower perioperative morbidity, as demonstrated by lower intraoperative blood loss and shorter length of stay. As expected, PDN+THA and Augment+THA displayed worse outcomes compared to Simple THA, highlighting the challenge of THA in patients with poor periacetabular quality. Regardless, PDN+THA is a viable strategy for mitigating periacetabular bone destruction and improving durability of THA constructs.

Figure 1. (A) Cumulative incidence of reoperation and (B) cumulative incidence of revision surgery for each cohort.

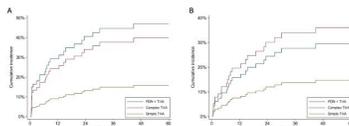


Figure 1. Overall survival of all included patients (A) and by cohort (B).

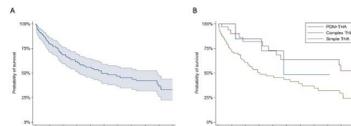


Table 1. Baseline demographic, perioperative, and treatment information for included patients.

| Factor | PDN+THA | Augment+THA | Simple THA | p-value |
|---------------------------------|----------------------|-----------------------|----------------------|---------|
| N | 15 | 36 | 80 | |
| Age ± | 75.0 (72.0, 82.0) | 60.0 (55.0, 68.8) | 64.0 (57.0, 73.2) | 0.001 |
| Female sex | 0 (0%) | 19 (53%) | 39 (49%) | 0.71 |
| BMi (kg/m²) ± | 27.4 (23.1, 31.0) | 27.0 (24.9, 30.0) | 26.1 (22.7, 29.1) | 0.87 |
| CCI ± | 6.0 (6.0, 6.0) | 6.0 (5.5, 8.0) | 6.0 (6.0, 7.0) | 0.61 |
| ASA class | | | | 0.20 |
| 1 | 1 (7%) | 11 (31%) | 16 (20%) | |
| 2 | 13 (87%) | 23 (64%) | 50 (63%) | |
| 3 | 1 (7%) | 0 (0%) | 5 (7%) | |
| Histology | | | | 0.21 |
| Breast | 2 (13%) | 3 (8%) | 18 (22%) | |
| Lung | 1 (7%) | 7 (19%) | 17 (21%) | |
| Prostate | 4 (27%) | 1 (3%) | 11 (14%) | |
| Renal cell carcinoma | 2 (13%) | 3 (8%) | 6 (8%) | |
| Multiple myeloma | 2 (13%) | 4 (11%) | 8 (10%) | |
| Osteosarcoma | 0 (0%) | 0 (0%) | 1 (1%) | |
| Chondrosarcoma | 0 (0%) | 2 (6%) | 3 (4%) | |
| Spindle cell sarcoma | 0 (0%) | 0 (0%) | 2 (2%) | |
| Other | 4 (27%) | 16 (44%) | 14 (18%) | |
| Pathologic fracture | | | | 0.40 |
| No | 5 (33%) | 13 (37%) | 25 (31%) | |
| Impending | 6 (40%) | 8 (22%) | 17 (21%) | |
| Complete | 4 (27%) | 16 (44%) | 38 (48%) | |
| THA-PDN timing | | | | <0.001 |
| 1-stage PDN-THA | 13 (87%) | 36 (100%) | 80 (100%) | |
| 2-stage (OTN) | 2 (13%) | 0 (0%) | 0 (0%) | |
| THA type | | | | <0.001 |
| Standard | 0 (0%) | 21 (58%) | 54 (68%) | |
| Dual-mobility | 15 (100%) | 15 (42%) | 26 (32%) | |
| Additional procedure | | | | <0.001 |
| Use of cement in cup | 1 (7%) | 32 (89%) | 32 (40%) | |
| Use of screws in cup | 0 (0%) | 26 (72%) | 67 (84%) | 0.011 |
| Operative time (min) ± | 315.0 (292.0, 431.0) | 243.0 (185.0, 305.0) | 132.5 (115.0, 179.0) | <0.001 |
| EBL (mL) ± | 100.0 (30.0, 300.0) | 950.0 (600.0, 1700.0) | 400.0 (240.0, 750.0) | <0.001 |
| LOS (days) ± | 5.0 (2.0, 14.0) | 8.0 (5.0, 14.0) | 5.0 (4.0, 8.0) | <0.001 |
| Preoperative RT | 1 (7%) | 0 (0%) | 28 (35%) | 0.07 |
| Postoperative RT | 3 (20%) | 13 (36%) | 27 (34%) | 0.52 |
| Preoperative QT | 10 (67%) | 11 (31%) | 53 (66%) | 0.003 |
| Postoperative QT | 12 (80%) | 17 (47%) | 51 (64%) | 0.07 |

PDN: photodynamic nail; THA: total hip arthroplasty; BMi: body-mass index; CCI: Charlson Comorbidity Index; ASA: American Society of Anesthesiologists; EBL: estimated blood loss; LOS: length of stay; RT: radiation therapy; QT: chemotherapy
 * Values represent median and interquartile range