CORR Insights

CORR Insights®: Reconstruction After Hemipelvectomy With the Ice-Cream Cone Prosthesis: What Are the Short-term Clinical Results?

Luis Aponte-Tinao MD

Where Are We Now?

Management of pelvic tumors continues to be a major challenge to orthopaedic oncology surgeons. Enneking and Dunham [2] developed a classification system for pelvic resection in internal hemipelvectomy based on the section of bone to be resected (Type I involves the iliac wing, Type II, the

periacetabular region, Type III, the pubic rami, and Type IV the sacrum) [2].

Type II resections (periacetabular region) are the most demanding resections. They also have the worst functional outcomes. When resection methods (with and without reconstruction) are compared to one another, previously published studies [1, 4–6] do not agree about which approach is most likely to result in best functional outcomes. One review article likewise suggested that there is no clearly superior reconstructive approach for

those patients who undergo internal hemipelvectomy for tumor [7].

Unfortunately, complications following reconstruction after internal hemipelvectomy in the periacetabular region is common. In 10 patients, there were seven complications (four infections and three local recurrences) after pelvic reconstruction with the Ice-Cream Cone prosthesis in the current study by Barrientos-Ruiz and colleagues. This remains consistent with previously published estimates for patients treated with internal hemipelvectomy in the periacetabular region [1, 7]. Despite these complications, the authors found that all of the implants were retained at short-term followup, with an average functional result of “Fair” on the MSTS scale (19 of 30) at 2 years. The Ice-Cream Cone implant, as Barrientos and colleagues noted in their study, is advantageous because it has a reproducible technique that does not need a perfect match between the patient and implant. Regarding functional outcomes, although the authors report a median

This CORR Insights® is a commentary on the article “Reconstruction After Hemipelvectomy With the Ice-Cream Cone Prosthesis: What Are the Short-term Clinical Results?” by Barrientos-Ruiz and colleagues available at: DOI: [10.1007/s11999-016-4747-x](https://doi.org/10.1007/s11999-016-4747-x)

The author certifies that he, or a member of his immediate family, has no funding or commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research*® editors and board members are on file with the publication and can be viewed on request.

The opinions expressed are those of the writers, and do not reflect the opinion or policy of *CORR*® or The Association of Bone and Joint Surgeons®.

This *CORR Insights*® comment refers to the article available at DOI: [10.1007/s11999-016-4747-x](https://doi.org/10.1007/s11999-016-4747-x)

L. Aponte-Tinao MD (✉)

Carlos E. Ottolenghi Institute of Orthopedics, Italian Hospital of Buenos Aires, Potosí 4247 (1199) Buenos Aires, Argentina
e-mail: luis.aponte@hospitalitaliano.org.ar

CORR Insights

MSTS score of 19 of 30 achieved at 2 years, approximately half of their patients could not return to work. Bus et al. [1] reported a mean MSTS score of 49% (13 to 87) in 10 patients reconstructed with a similar Ice-Cream Cone prosthesis who were alive at final followup, with worse scores in those patients who experienced complications.

Where Do We Need To Go?

Treating pelvic tumors with a multidisciplinary approach has decreased mortality; however, morbidity remains high. Complications occur in more than 50% of patients, including local recurrences, wound complications, infection, and prosthesis dislocations [7]. Reconstructive goals should be to decrease the risk of complications and improve functional outcomes. Given the high risk of failure among patients who develop complications, there is plenty of room for improvement. As these reconstructions invariably follow tumor resections, the primary goal remains oncologic: In order to reduce the risk of local recurrences, we need more-accurate bone and soft-tissue resections and we need to ensure clear margins. An added benefit of greater accuracy could be easier reconstructions, potentially diminishing infections and prosthesis dislocations.

How Do We Get There?

Preoperative three-dimensional (3-D) planning of the osteotomy may have implications not only for the adequacy of the resection margins, but also for the biomechanical stability and design of the prosthesis [3–6]. The difficulty remains in how we transfer insights of the preoperative 3-D planning process to the operating field. We have two options if we wish to reproduce this planning in the operative room and increase accuracy: (1) Computer-assisted navigation technologies [3, 6] or (2) Patient-specific templates that make a guided osteotomy feasible [4, 5].

Jeys and colleagues [6] noted that computer navigation-assisted surgery is safe and may have the potential for reducing the intralesional resection and local recurrence rate for primary tumors of the pelvis and sacrum. The aim of surgical navigation is to perform surgery according to previously planned margins. Previous studies [3, 6] have detailed the accuracy of 3-D planning and navigation in bone tumor resection [6]. Although 3-D planning and navigation could be ideal for complex anatomies, as well as help the surgeon focus on the position of the prosthesis, this technology is rarely used in pelvic tumor surgery.

Patient-specific instruments have been developed as an alternative to

navigation systems. These instruments are designed using computer-aided systems and can assist in fitting bone-specific contact surfaces into unique positions on the bony structure of the patient [4, 5]. There are two main issues with this technique: (1) The design, manufacturing, and delivery of patient-specific guides and implants can take approximately 3 weeks [5], and (2) mispositioning of the guide can cause inaccuracy during bone cutting [4].

Although we cannot yet know whether preoperative 3-D planning, in addition with computer-assisted navigation or patient-specific instruments, will help us to reduce morbidity, but I believe that these approaches may indeed help.

References

1. Bus MP, Boerhout EJ, Bramer JA, Dijkstra PD. Clinical outcome of pedestal cup endoprosthetic reconstruction after resection of a periacetabular tumour. *Bone Joint J.* 2014;96-B:1706–1712.
2. Enneking WF, Dunham WK. Resection and reconstruction for primary neoplasms involving the innominate bone. *J Bone Joint Surg Am.* 1978;60: 731–746.
3. Farfalli GL, Albergo JJ, Ritacco LE, Ayerza MA, Milano FE, Aponte-Tinao LA. What is the expected learning curve in computer-assisted

CORR Insights

- navigation for bone tumor resection? [Published online ahead of print Feb 25, 2016]. *Clin Orthop Relat Res*. DOI:[10.1007/s11999-016-4761-z](https://doi.org/10.1007/s11999-016-4761-z).
4. Gouin F, Paul L, Odri GA, Cartiaux O. Computer-assisted planning and patient-specific instruments for bone tumor resection within the pelvis: A series of 11 patients. *Sarcoma*. 2014;2014:842709.
  5. Holzapfel BM, Pilge H, Prodinger PM, Toepfer A, Mayer-Wagner S, Hutmacher DW, von Eisenhart-Rothe R, Rudert M, Gradingner R, Rechl H. Customised osteotomy guides and endoprosthetic reconstruction for periacetabular tumours. *Int Orthop*. 2014;38:1435–1442.
  6. Jeys L, Matharu GS, Nandra RS, Grimer RJ. Can computer navigation-assisted surgery reduce the risk of an intralesional margin and reduce the rate of local recurrence in patients with a tumour of the pelvis or sacrum? *J Bone Joint Surg Br*. 2013;95:1417–1424.
  7. Mayerson JL, Wooldridge AN, Scharschmidt TJ. Pelvic resection: Current concepts. *J Am Acad Orthop Surg*. 2014;22:214–222.