Sculpting Hope: Exploring Challenges, innovations and Future Horizons in treatment of Pelvic Bone Sarcomas

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Musculoskeletal tumors of the Pelvis can either be Primary Bone tumors or Metastatic Lesions. The most frequent are Osteosarcomas, Ewings Sarcoma, Chondrosarcoma, and Metastatic carcinoma. The field of Pelvic Oncological surgery has advanced in recent years due to the progress in Anesthesia, Peri-Operative care, and Improved Imaging capabilities, particularly the use of Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and the development of adjuvant chemo and radiotherapy. Pelvic sarcomas are typically a challenge when it comes to resection of these tumors, this is multifactorial, like proximity of the tumor to the Genitourinary structures, adjacent neurovascular bundles, size of the tumor, difficult anatomy of the Pelvis, high level of surgical skills required for resection and reconstruction and associated high morbidity and mortality with Pelvic Surgeries.

Keywords: Pelvic Bone Sarcomas, Challenges, Modern Advances

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The constitutional symptoms of pelvic sarcomas are like other sarcomas such as pain and a palpable mass, but in the case of Pelvic sarcomas due to the accommodating nature of the pelvic anatomy, tumors usually grow considerably in size before any clinical presentation and the symptoms like difficulty in mobilization, neurovascular deficit, and genitourinary problems appear late when the tumor mass has grown in such a size that it has started causing these related symptoms. Therefore, generally, the presentation of Pelvic bone sarcomas is late in the course of the disease. Another factor for late presentation is the lack of awareness among the masses to seek proper medical help regarding their ailment.

Multidisciplinary treatment is the pre-requisite of Sarcoma care involving Oncologists, radiologists, Pathologists, and surgeons, that too in a center experienced in treating Sarcomas. When it comes to Pelvic Sarcomas the surgical turf becomes multidisciplinary as well. Generally, a combined surgical approach by a Pelvic Sarcoma surgeon and a Colorectal Surgeon, Gynae-oncologist, Urologist, Spine Surgeon, Vascular Surgeon, and Plastic Surgeon is mandated.

Tissue biopsy remains the gold standard for the diagnosis of Sarcomas. CT and ultrasound-guided Needle biopsies are usually recommended to obtain a diagnosis. The most common challenge that Sarcoma Surgeons face in our part of the world is the wrong approaches to biopsy. The biopsy should ideally be performed by the surgeon who will be involved in the resection and reconstruction of the Pelvic sarcoma or it should be discussed with the Surgeon responsible for definitive resection as the tract is excised along with the tumor. So, a wrong open biopsy approach can increase the challenge of curative tumor resection with clear margins in the already difficult surgical territory of the Pelvis.

Hemipelvectomies are either External or Internal. Both are used for the local control of the disease, Internal Hemipelvectomy is the preferred surgical intervention where the limb is preserved along with the function. Nevertheless, a clear resection margin is always preferred as it is the most important prognostic factor in disease recurrence and metastasis. Life is preferred over limb so doing an External Hemipelvectomy is sometimes the only option for resection with curative intent.

In Internal Hemipelvectomies, specifically those involving the acetabulum, The Cost of reconstruction either with LUMiC Cup endoprosthesis or computer-assisted custom endoprosthesis is another hurdle in achieving a better functional outcome. Other reconstruction options like liquid nitrogen-treated bone, allograft, or extracorporeally irradiated

autografts together with prostheses are also reasonable options but require the establishment of a bone bank or the option to irradiate bone during the resection operation. In our country bone banks and a setup to irradiate bone in the operation theatres are scarce as well.

Among modern advances are Patient-specific instrumentation (PSI) and three-dimensional (3D) printing, gaining popularity in the resection of Pelvic Bone Sarcomas. Preoperative scanning for PSI necessitates the creation of a three-dimensional (3D) model of the tumor and surrounding bony structure, which is then used to construct an exact cutting jig. The surgeon can only insert the guide in a specific location due to the patient's unique anatomy and the PSI form. The surgical approach, bone exposure, and tumor extension must all be taken into account when defining these contact surfaces by the surgeon and engineer. The jig serves as a guide for the osteotome or bone saw and is fixed to the nearby bone. As a result, this approach replicates surgical planning more precisely than a free-hand method.

While navigation systems have been used in orthopedic surgery for more than three decades, Augmented reality (AR) is the vista of the future. AR assistance could help to achieve desired margins and help the surgeon navigate difficult Pelvic anatomy, while it has shown promising results in animal models, application for humans is yet to be finalized.

Keeping in view the challenges present, recent advances, and where we stand as a nation there is a need for the development of a nationwide referral system connecting with high-volume specialized centers for timely referral of pelvic sarcoma patients, development of more centers experienced in the treatment of Pelvic Sarcomas, education among peers, training programs in high-volume centers for young surgeons, development of the local industry to produce more cost-effective custom made endoprosthesis, last but not least, acquisition of latest armamentarium and technological advances to help improve outcomes in Pelvic Bone Sarcoma.

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REFERENCES

1. Laitinen MK, Parry MC, Morris GV, Jeys LM. Pelvic bone sarcomas, prognostic factors, and treatment: A narrative review of the literature. Scandinavian Journal of Surgery. 2023;112(3):206-215. doi:10.1177/14574969231181504
2. Jay S. Lee, Ciara M. Kelly, Edmund K. Bartlett, Management of pelvic sarcoma, European Journal of Surgical Oncology, Volume 48, Issue 11, 2022, Pages 2299-2307, ISSN 0748-7983, doi:10.1016/j.ejso.2022.09.011.
3. Soares do Brito J, Esperança-Martins M, Abrunhosa-Branquinho A, Melo-Alvim C, Lopes-Brás R, Janeiro J, Lopez-Presa D, Fernandes I, Portela J, Costa L. Management of Unresectable Localized Pelvic Bone Sarcomas: Current Practice and Future Perspectives. Cancers (Basel). 2022 May 22;14(10):2546. doi: 10.3390/cancers14102546. PMID: 35626150; PMCID: PMC9139258.
4. Binitie O, Tejiram S, Conway S, Cheong D, Temple HT, Letson GD. Adult soft tissue sarcoma local recurrence after adjuvant treatment without resection of core needle biopsy tract. Clin Orthop Relat Res. 2013 Mar;471(3):891-8. doi: 10.1007/s11999-012-2569-z. PMID: 22968531; PMCID: PMC3563812.
5. Berger-Richardson D, Swallow CJ. Needle tract seeding after percutaneous biopsy of sarcoma: Risk/benefit considerations. Cancer. 2017 Feb 15;123(4):560-567. doi: 10.1002/cncr.30370. Epub 2016 Nov 2. PMID: 27859013.
6. Fujiwara T, Lex JR, Stevenson JD, Tsuda Y, Clark R, Parry MC, Grimer RJ, Jeys LM. Surgical treatment for pelvic Ewing sarcoma: What is a safe and functional acetabular reconstruction when combined with modern multidisciplinary treatments? J Surg Oncol. 2019 Nov;120(6):985-993. doi: 10.1002/jso.25660. Epub 2019 Aug 5. PMID: 31381161.
7. Tsuda Y, Evans S, Stevenson JD, Parry M, Fujiwara T, Laitinen M, Outani H, Jeys L. Is the Width of a Surgical Margin Associated with the Outcome of Disease in Patients with Peripheral Chondrosarcoma of the Pelvis? A Multicenter Study. Clin Orthop Relat Res. 2019 Nov;477(11):2432-2440. doi: 10.1097/CORR.0000000000000926. PMID: 31453886; PMCID: PMC6903848.
8. Bus MP, Szafranski A, Sellevold S, Goryn T, Jutte PC, Bramer JA, Fiocco M, Streitbürger A, Kotrych D, van de Sande MA, Dijkstra PD. LUMiC® Endoprosthetic Reconstruction After Periacetabular Tumor Resection: Short-term Results. Clin Orthop Relat Res. 2017 Mar;475(3):686-695. doi: 10.1007/s11999-016-4805-4. PMID: 27020434; PMCID: PMC5289170.
9. Wafa H, Grimer RJ, Jeys L, Abudu AT, Carter SR, Tillman RM. The use of extracorporeally irradiated autografts in pelvic reconstruction following tumour resection. Bone Joint J. 2014 Oct;96-B(10):1404-10. doi: 10.1302/0301-620X.96B10.33470. PMID: 25274929.
10. Puri A, Pruthi M, Gulia A. Outcomes after limb sparing resection in primary malignant pelvic tumors. Eur J Surg Oncol. 2014 Jan;40(1):27-33. doi: 10.1016/j.ejso.2013.10.017. Epub 2013 Nov 5. PMID: 24239184.
11. Wong KC, Kumta SM. Joint-preserving tumor resection and reconstruction using image-guided computer navigation. Clin Orthop Relat Res. 2013 Mar;471(3):762-73. doi: 10.1007/s11999-012-2536-8. PMID: 22948524; PMCID: PMC3563823.
12. Gerbers JG, Stevens M, Ploegmakers JJ, Bulstra SK, Jutte PC. Computer-assisted surgery in orthopedic oncology. Acta Orthop. 2014 Dec;85(6):663-9. doi: 10.3109/17453674.2014.950800. Epub 2014 Aug 20. PMID: 25140984; PMCID: PMC4259032.
13. Benady A, Gortzak Y, Sofer S, Ran Y, Rumack N, Elias A, Efrima B, Golden E, Segal O, Merose O, Sternheim A, Dadia S. Internal Hemipelvectomy for primary bone sarcomas using intraoperative patient specific instruments- the next step in limb salvage concept. BMC Musculoskelet Disord. 2022 Nov 24;23(1):1012. doi: 10.1186/s12891-022-05918-1. PMID: 36424560; PMCID: PMC9685900.

14. Cartiaux O, Paul L, Francq BG, Banse X, Docquier PL. Improved accuracy with 3D planning and patient-specific instruments during simulated pelvic bone tumor surgery. Ann Biomed Eng. 2014 Jan;42(1):205-13. doi: 10.1007/s10439-013-0890-7. Epub 2013 Aug 21. PMID: 23963884.
15. Cho HS, Park MS, Gupta S, Han I, Kim HS, Choi H, Hong J. Can Augmented Reality Be Helpful in Pelvic Bone Cancer Surgery? An In Vitro Study. Clin Orthop Relat Res. 2018 Sep;476(9):1719-1725. doi: 10.1007/s11999.0000000000000233. PMID: 30794209; PMCID: PMC6259783.