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Unicameral Bone Cyst: Does surgical technique and type of graft affect clinical outcomes?

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Background: Unicameral Bone Cyst (UBC) is a common benign bone tumor, which may require surgical intervention. Multiple treatment options exist for UBC. While the trend is away from open diaphysectomy and bone grafting procedures and towards percutaneous interventions, recurrence rates remain high and no defined algorithm exists. Recently, the type of bone grafting or injectable material used has emerged as a topic of controversy.

Purpose: To determine which treatment option or injectable material after a single procedure offers the most favorable rates of recurrence, radiographic outcomes, and reoperation.

Methods: We searched the Medline, Cochrane and EMBASE databases to identify all published studies prior to February 2015 reporting on the clinical outcomes in the treatment of “solitary bone cyst,” “unicameral bone cyst,” or “simple bone cyst.” All study, subject, surgical technique (curettage & grafting, decompression, and percutaneous injection), graft or injection material, clinical outcomes and complications were analyzed. Study data was aggregated for studies of levels I to III based on each treatment method and type of injection, and weighted outcomes and complication rates were calculated. Analysis including level IV studies was reported using descriptive statistics. The systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.

Results: 50 therapeutic studies ranging between levels I to IV evidence (1 Level I, 20 Level III, 29 Level IV), including 2,378 cysts were eligible. Use of curettage & grafting (CG) compared to percutaneous injection (PI) had a lower risk of recurrence of 37% vs. 66% ($p < 0.0001$), need for reoperation of 26% vs. 59% ($p < 0.01$), and higher rates of clinical success according to the Modified Neer Outcome Rating System (MNORS) at 67% vs. 36% ($p < 0.00001$). Similarly, continuous decompression was superior to PI for recurrence rates of 49% vs. 65% ($p < 0.01$), better MNORS healing at 50% vs. 35% ($p < 0.01$). No difference existed between CG and decompression in relation to recurrence rate and MNORS. Both PI and CG had lower reoperation rates owing to the need for removal of the decompression hardware. Subgroup analysis of autogenous and allograft bone in CG shows no difference in the recurrence rates. Evaluation between PI of methylprednisolone (MP) and bone marrow aspirate (BMA) exhibits no difference in the recurrence rates, but MP provides cyst healing after an average of 1.6 injections compared to 1.9 injections for BMA ($p = 0.02$). Grouping of all cysts treated with PI had a recurrence rate after a single injection at 68%, but variation in the recurrence rate existed for MP (70%), BMA (53%), MP/BMA (43%), demineralized bone matrix (DBM) +/- BMA (32%), and bioceramic (12%).

Conclusions: Treatment of UBC has various modalities with no consensus on the ideal technique to achieve cyst healing and prevent pathologic fracture. Despite the large number of studies on the topic, the literature has primarily been limited to retrospective reports and incomplete comparisons of treatment options. Although CG carries a higher morbidity than decompression and PI, it provides lower rates of recurrence or reoperation compared to the historical percutaneous alternatives. We believe more recent attempts to use DBM/BMA or bioceramics through PI may provide a less invasive way to achieve the same osteoconductive scaffold as in CG.