

Unique Application of K-Y Jelly in Cryotherapy for Giant Cell Tumors of the Distal Femur – A Case Report

Stephen D. Daniels, MD1, Steven Jones, MD1, Bennie Lindeque, MD, PhD1

Department of Orthopedic Surgery, University of Colorado Denver, 12631 E 17th Ave, Aurora, CO 80045, USA

ABSTRACT

- GCT's locally aggressive tumors causing pain and dysfunction through bony and soft tissue disruption
- Generally benign with 1-9% chance of metastasis
- Despite treatment may have up to 65% recurrence emphasizing the importance of appropriately eradicating primary lesions^{4,5,6}
- Several treatment strategies exist and have been a long standing topic of debate. Amongst these, cryosurgery has gained popularity and has reportedly been amongst the most successful in reducing recurrence rates and side effects.⁹
- Many methods of cryosurgery have been reported, but herein we describe a unique application of K-Y jelly as a semi-solid medium in cryotherapy for the treatment of GCT within the distal femur of a 30 y.o female patient

INTRODUCTION

- Giant Cell Tumors comprise 5% of primary bone tumors with an incidence of 1.7 per million persons/year. Appropriate treatment is essential to reduce risk of metastasis and local destruction of bony and soft tissues¹
- Many treatments have been reported: Curettage with bone grafting, curettage and cementing with PMMA, wide resection with endoprosthesis implantation, adjuvant systemic therapy, and cryosurgery
- Goals of treatment: eradication of tumor, reduction of iatrogenic complications, while simultaneously reducing risk of local recurrence (0-65% across the spectrum of techniques)
- Cryosurgery reportedly been once of the most successful for eradication and reduction of recurrence.
- Original technique described by Marcove: direct liquid nitrogen pour. Variations have been developed over the years to optimize this technique.
- Herein described case focuses on the medium (KY jelly) through which cryotherapy is applied primarily advantaged through control over the biologic area of exposure through use of a common operating room material

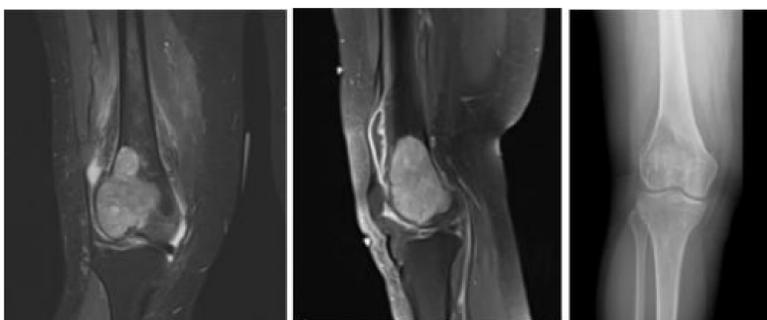


Figure 1: Pre-operative radiographic imaging and MRI scans demonstrating GCT comprising nearly the entire lateral femoral condyle

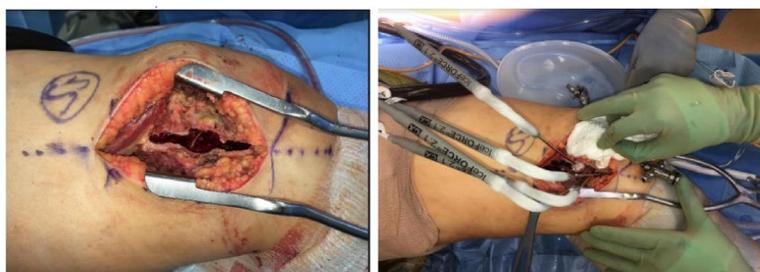


Figure 2: The bony cavity that remains after extensive curettage of the GCT



Figure 3: Positioning of the ice probes into the KY filled bony cavity for induction of cryotherapy



Figure 4: Antibiotic impregnated PMMA was placed into the residual cavity



Figure 5: Prophylactic fixation of the distal femur was performed with a laterally placed locking plate

DISCUSSION

- Successful treatment of GCT can be defined by several parameters: eradication of tumor, prevention of local recurrence, and reduction of iatrogenic injury and complications. Focus of our case was on the application of KY jelly for these purposes
- Recurrence rates of other described techniques: Curettage (65%), Cementation (14%), Bone grafting (30%).⁸
- One of the largest case series to date (n=102) describing cryotherapy with direct application of liquid N2 (pour technique) described recurrence of 8% (mean f/u 6.5 years), noting the following complications: Fracture (6%), partial skin necrosis (3%), 0.2% with degenerative changes of the knee.¹²
- Although demonstrated success, there are some notable disadvantages to liquid Nitrogen: exposure to extreme temperatures can decrease strength of bone by 40% increasing risk of fracture, low viscosity contributes to difficulty controlling zone of exposure.¹⁴
- KY jelly as a potential answer to these complications
 - Reaches threshold temp for inducing cellular apoptosis (-60°C) and inhibiting neovascularization at 46° warmer than traditional liquid N2¹⁰
 - Semi-solid medium with targeted biologic zone of exposure
 - Similar study using gel-medium demonstrated 3.4% fracture and 3.4% recurrence rate¹⁵
- Limitations of this study include a case report with N=1 at short term follow-up. We hope this paves the way for future comparative studies and believe KY jelly can be a viable option when considering treatment of GCTs

CONCLUSIONS

- Management of GCT bone is a highly debated topic with a myriad of strategies described in the literature
- Main goals elimination of tumor, prevention of recurrence, and reduction in complication rates
- KY Jelly should be strongly considered as a method for cytoablative strategies due to its several noted advantages: induction of apoptosis at less extreme temperatures, theoretically reducing the risk of decreasing bone strength and subsequent fracture, semi-solid properties allowing for a more targeted biologic zone of exposure, and abundant availability at low costs.

References

1. Verschuur AJ, Boveris J, Mink, Mastboom MJL, Sander Dijkstra PD, Van De Sande MAJ, Gelderblom H. Incidence and demographics of giant cell tumor of bone in The Netherlands: First nationwide Pathology Registry Study. *Acta Orthop*. 2018;88(5):570-574. doi:10.1080/17453674.2018.1490987
2. Raskin KA, Schwab JR, Mariani H, Springfield DS, Horvick PA. Giant cell tumor of bone. *J Am Acad Orthop Surg*. 2013;21(2):118-126. doi:10.5435/JAAOS-21-02-118
3. Erreni C, Tsubamoto S, Chen C, Donati DM. Present day controversies and consensus in curettage for giant cell tumor of bone. *J Clin Orthop Trauma*. 2013;19(6):1015-1020. doi:10.1016/j.jcot.2013.09.017
4. Rigolino AV, Fernando TS, Tanaka MH, Souza MM. Giant cell tumor locally advanced around the knee: treatment and literature review. *Rev Bras Ortop (English Ed)*. 2017;52(4):473-478. doi:10.1016/j.rboe.2017.06.009
5. Balke M, Schrempfer L, Gebert C, et al. Giant cell tumor of bone: Treatment and outcome of 214 cases. *J Cancer Res Clin Oncol*. 2008;134(9):969-978. doi:10.1007/s00432-008-0370-x
6. Kito M, Matsumoto S, Ae K, et al. Giant cell tumor of the distal femur: Outcome beyond 20 years of follow-up after curettage with polymethylmethacrylate. *J Orthop Sci*. 2018;23(6):1051-1055. doi:10.1016/j.jos.2018.06.013
7. Jamshidi K, Zandehmi F, Haji Algha Boozorg M, et al. Extended curettage versus en bloc resection for the treatment of grade 3 giant cell tumour of the knee with pathologic fracture: a retrospective study. *Int Orthop*. 2020. doi:10.1007/s00084-020-04848-9
8. Gaston CL, Bhambra R, Watanuki M, et al. Does the addition of cement improve the rate of local recurrence after curettage of giant cell tumours in bone? *J Bone Jt Surg - Ser B*. 2013;95(12):1660-1669. doi:10.1302/0301-620X.95B12.27663
9. Meiler J, Weinbroum A, Bickels J, et al. Fifteen years of bone tumor cryosurgery: A single-center experience of 440 procedures and long-term follow-up. *Eur J Surg Oncol*. 2008;34(8):921-927. doi:10.1016/j.ejso.2007.11.001
10. Wu PK, Chen CF, Wang FY, et al. Freezing Nitrogen Ethanol Composite May be a Viable Approach for Cryotherapy of Human Giant Cell Tumor of Bone. *Clin Orthop Relat Res*. 2017;475(6):1650-1663. doi:10.1007/s11999-017-5239-3
11. Heijden L, Dijkstra PDS, Sande MAJ, et al. The Clinical Approach Toward Giant Cell Tumor of Bone. *Oncologist*. 2014;19(5):550-561. doi:10.1634/theoncologist.2013-0432
12. Maltsev MA, Bickels J, Meiler J, Buch RG, Henshaw RM, Kollerier Y. Cryosurgery in the treatment of giant cell tumor: A long-term follow-up study. *Clin Orthop Relat Res*. 1999;359:176-188. doi:10.1097/00003086-199902000-00019
13. Abdelrahman M, Bassiony AA, Shalaby H, Assal MK. Cryosurgery and impacted subchondral bone graft for the treatment of giant cell tumor around the knee. *HSS J*. 2009;3(2):123-128. doi:10.1007/s11420-009-9125-8
14. Fisher AD, Williams DF, Bradley PF. The effect of cryosurgery on the strength of bone. *Br J Oral Surg*. 1978;15(3):215-222. doi:10.1016/0007-1226(78)90003-3

CLINICAL COURSE/SURGICAL TECHNIQUE

- The patient is a 30 year old African American female who originally presented to her primary care provider after a ground level fall with subsequent knee pain.
- Original radiographs demonstrated a well defined, lucent lesion with the femoral condyle, referred for advanced imaging (MRI) which demonstrates a metaphyseal lesion of the distal femur occupying >80% of the lateral condyle
- Patient taken to surgery where fresh frozen specimen confirmed GCT without malignant transformation
- Gross excision of the tumor was performed as meticulously as possible, leaving a large cavity that was subsequently washed with saline, peroxide, and then filled with K-Y jelly
- Four Galil ice FORCE probes inserted into the jelly and the cryotherapy session initiated: 5 min freeze-thaw cycle to -150°C with constant arthroscopic irrigation of warm saline through the knee joint. Probes were adjusted and a second cycle performed, KY jelly removed and the remaining cavity filled with PMMA. A six hole locking plate was then applied to the lateral distal femur for prophylactic fixation.
- At 8 month follow-up there was no radiographic evidence of tumor recurrence, clinically patient endorsed mild knee pain but able to successfully ambulate without limp, able to perform knee flexion to 120°, neurovascularly intact.



Figure 6: Radiograph obtained at 8 month post-op visit

