

Accuracy and limitation of computer-guided curettage in benign bone tumor

SEO SW, KOH KR

Department of Orthopaedic Surgery, Samsung Medical Center, Sungkyunkwan University, Seoul, South Korea

sungwseo@gmail.com

Introduction: Intralesional curettage is one of the effective surgical options for patients with benign bone tumor, which minimizes functional damage. An accessory cavity of the tumor, major neurovascular structures, or joint cartilage can be located over the sclerotic wall of the cavity and it cannot be visualized in spite of a large cortical window. In such areas, aggressive curettage or burring is often avoided for safety reasons. In addition, creation of a large window is impossible in some anatomical location such as femoral head, talus, and center of the epiphysis of other bones without making an extensive joint dislocation. Recently, several authors reported that computer-assisted surgery was successfully applied to benign bone tumor such as osteoid osteoma in the spine and fibrous dysplasia of jaw. However, there is no report of computer-assisted surgery applied in the lower limb, especially near the joint. The purpose of this study is to evaluate the adequacy of tumor removal in computer-assisted curettage of benign bone tumor.

Methods: We prospectively designed a protocol for computer-assisted surgery which was approved by the institutional review board of Samsung Medical Center (SMC IRB No.71 200808058). The eligibility of computer-assisted surgery was judged by analyzing preoperative CT or MR images. We collected study patients consecutively according to our inclusion criteria and all of the patients provided written informed consent. Eight patients with benign bone tumors located near an articular joint or major neurovascular tissue were finally included.

The Stryker Navigation System (Mahwah, NJ) was used for all procedures. Image-to patient registration of navigation system was performed using paired-points methods with CT images. The cortical window was created to visualize the tumor cavity. A specially designed burr attached to a navigation probe was used to monitor the location of the burr tip in a real-time manner. We assessed the accuracy of curettage and articular involvement by comparing pre-operative and post-operative CT images.

Results: An adequate resection margin was determined based on a comparison of pre- and post-operative CT images. When the two images were fused, the outer resection margin in the postoperative CT scan covered the tumor cavity in the preoperative CT scan in three planes of all eight cases. A deeply-seated or multi-cystic tumor was sufficiently removed in all cases according to the pre- and post-operative fusion CT images.

The subchondral bone was punctured when the initial thickness of subchondral bone was less than 2.5 mm. However, computer-guided burr was safe if the thickness of the subchondral bone was more than 3mm. The mean value of the final MSTS score was 26 (86%, range 57%~97%), while that of the TESS score was 84 (range 64~93). There was no local recurrence observed in MRI or CT scan in any of the cases through the final outpatient follow-up (13.5 months, range 7~28). No other significant complications were observed during the follow-up period.

Conclusion: We found that computer-assisted curettage was beneficial in deeply seated epiphyseal benign tumors and relatively safe when we beware of paper-thin cortex. With the development of software and surgical tools for computer-assisted curettage, improved oncologic and functional outcomes of patients with benign epiphyseal bone tumors are expected.