



08:103

Computer navigation assisted surgery for tumors resection and allograft reconstruction in the extremities

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Introduction: The use of image fusion for computer-assisted bone tumor surgery seems to facilitate not only tumor resection but also bone reconstruction. The purpose of this study is to report our experience in preoperative planning, tumor resection and bone reconstruction with allografts using intraoperative navigation assistance.

Methods: We analyzed sixty-nine patients with bone tumor of the extremities treated using intraoperative navigation assistance. We excluded pelvic tumors in this series. All patients were 3D reconstructed in a virtual platform and planned determining the osteotomy position according to oncology margins in a CT-MRI image fusion. Allografts were selected from our digital bone bank and the allograft osteotomies were also planned preoperatively. Tumor resections and allograft reconstructions were performed using a computer navigation system according to previously planned cuts. Forty-three tumors were localized in the femur, 21 in tibia, 3 in humerus, 1 in cubitus and 1 foot. Reconstructions included 47 intercalary allografts, 18 osteoarticular allografts and 4 APC.

Results: In three patients (4.3%) the navigation was not carried out due to technical problems. In one the crash was secondary to software problem, and in the remaining two cases the crash was secondary to hardware problems. Of the 66 cases where the navigation was performed, the mean registration error was 0.65 mm (range 0.3-1.2). The mean time for navigation procedures including bone resection and allograft reconstruction during surgery was 35 minutes (range 18-65). Histological examinations of all specimens showed a clear tumor margin in all patients.

Conclusion: Our findings suggest that preoperative planning and tumor resection guided by navigation is accurate and useful method for bone tumor resection and reconstruction. Although navigation procedures demands time during surgery, it allows the surgeon to performed accurate cuts in bone tumor resection and allograft reconstruction that reduces the total length of the whole procedure. In our study, the navigation in tumor of the extremities could not be performed in 4.3% of series.

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