

Computer-assisted spinopelvic tumor resection using ultrasonic osteotome integrated stereotactic navigation

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Background. Multiplanar osteotomies are complex surgical procedures often performed for en bloc resection of spinopelvic tumors. Conventional osteotomies are performed utilizing surface anatomy as a guide and can result in large variations between the planned and actual osteotomies performed. Computer-assisted navigation may serve as a helpful adjunct to complex osteotomy by registering an osteotome or drill to the navigation system. Recently, ultrasonic cutting devices have been introduced to spine surgery that are designed to perform osteotomies more safely than the conventional osteotome or drill. However, the feasibility of integrating the ultrasonic osteotome with 3D navigation and its usefulness in spinopelvic tumor resections remain unknown.

Purpose. To determine the feasibility and safety of using ultrasonic osteotome integrated stereotactic navigation for spinopelvic tumor resections.

Patients and Methods. A retrospective review was performed on all surgical cases in which the resection technique employed the use of an ultrasonic osteotome integrated into a stereotactic navigation platform. The primary outcome measures were 1) ability to perform the desired osteotomy 2) technique-related operative complications and 3) margin status.

Results. 14 cases of en bloc tumor resection involving the spine and/or sacrum were identified for review. Osteotomies were performed in the following locations: 11 sacrum, 2 thoracic spine, and 1 cervical spine. In all cases the ultrasonic osteotome was successfully registered to the navigation system and integration with the stereotactic CT-guided navigation system provided real-time visualization of the trajectory and location of the ultrasonic osteotome tip. Osteotomies were performed safely in all cases without complication. Osteotomies were limited to 20mm cutting depth, the working length of the osteotome tip. In 4 cases, osteotomies greater than 20mm were required. In these cases the osteotomies were initiated with the navigated ultrasonic osteotome and completed with a traditional osteotome. Surgical complications unrelated to the use of the described technique were noted in 5 cases: durotomy (2), wound complication (3), postoperative hemorrhage (1), partial nerve root laceration (1). Microscopic margins were positive in 2/14 cases (1 bone margin, 1 soft tissue).

Conclusions. Integration of the ultrasonic osteotome with the stereotactic CT-guided navigation system appears safe and technically feasible for performing complex spine and pelvic osteotomies for en bloc tumor resection.

Level of Evidence: IV

