Computer navigation aided precision excision for sacrum chordoma

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Background: Low-grade malignant sacral chordoma have longer survival, the lung metastasis rate is low. Surgery is the main alternative treatments. Because special and complex anatomical sites, intracapsular resection recurrence rate is as high as 64.7% for the reserved sacral nerve. With the application of the musculoskeletal system tumor surgical staging, development of imaging techniques, we recognized that appropriate the surgical resection margin can reduce the local recurrence rate for the sacral chordoma. Advances in CT / MRI imaging have make better to distinguish the tumor boundary before operation. Preoperative surgical planning is becoming very important. Delicate surgical resection of the tumor will become the main trend. It is very difficult for to confirm the the surgical margin of the sacral tumor and the sacral nerve position in the sacrum for avoiding unnecessary damage in the surgical process. Computer-assisted navigation technology has applications in many areas of orthopedic surgery. It may be possible that to achieve the precise excision for sacral tumors under the computer navigation. Objective To assess the clinical significance of the application of computer assisted navigation technology in excision for sacrum tumor.

Methods: from December 2007 to December 2012, 19 patients with sacrum chordoma were treated with computer navigation. 11 cases were male and 8 females, aged 36 to 81 years, mean 53.5 years old, 18 cases are over the level of sacrum3 and 1 cases under the sacrum3. 4 cases were recurrence. CT and MRI with the preoperative data put into the computer navigation workstation. CT images determine the scope of the invasion of tumor in bone tissue. MRI determine the scope of the invasion of tumor in soft tissue. The CT and MRI image fusion identify the precise boundaries of the tumor in CT images and made markers for navigation guidance in the operative. 5 cases used CT-image navigation. The Iso-c scan had been made for another 14 cases that had not been found the markers for navigation guidance with soft tissue mass on the back of sacrum, then fused the Iso-c images with preoperation CT images for improving the images quality. Registration error is 1.49mm. According to preoperative planning, 17 cases had been resected the sacrum with the real time computer navigation and the aggressive curettage were completed for 2 cases. The precise surgical removal of the lesions boundary were verified by computer navigation and reserved the sacral never according to the preoperative planning. The operations were performed with average 300 minutes and 2821ml blood. After operation, 2 cases accepted radiotherapy.

Results: 19 patients all finished surgery according to preoperative planning. Wide resection in 3, marginal resection in 14 and intraleisional resection in 2 cases were verified by specimens. All patients were followed up for 7 months to 60 months, an average of 25.1 months. 14 primary cases with marginal resection and wide resection did not recur. In 4 recurrence cases, 2 cases with aggressive curettage recur in 1 case and 2 cases with marginal resection recur in 1 case.

Conclusions: Computer navigation technology helps to wide and marginal excision for the sacral chordoma, to reduce the recurrence rate.