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Can neoadjuvant radiotherapy facilitate a safer resection and limb sparing surgery in the treatment of osteosarcoma?

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Introduction: Although preoperative radiotherapy is not currently a part of osteosarcoma treatment algorithms. It might still help to enhance resectability and achieve limb salvage. We hereby report an osteosarcoma series where neoadjuvant radiotherapy was used in order to ease the operation so that vital organs and tissues can be protected.

Patients and Methods: In our orthopedic oncology database, we identified 15 patients with osteosarcoma who received radiotherapy before the operation between 1992 and 2015. The median age was 20,1 (14-52 years). The location of the disease was proximal humerus and scapula in 4 cases, proximal tibia in 3 cases, distal femur in 5 cases, proximal femur and pelvis in 2 cases, distal humerus in 1 case and thoracic wall in 1 case (one patient underwent two separate operations for distal femur and proximal femur). The cases were either primary osteosarcoma (10 cases) or recurrent disease (6 cases). The mean tumor volume was 485 cm³. Vital tissues such as femoral artery, radial and sciatic nerve were in danger in all cases. Two patients had presented with pathologic fracture. A dose of 35 Gy in 10 fractions or 50 Gy in 25 fractions was administered before the operation.

Results: Wide resection was performed in all cases, and reconstruction with tumor prosthesis was applied in 10 cases. Limb salvage was achieved in all patients with clean margins except two cases, where tumor cells were found inside the femoral vein margin although the vein was sacrificed. Among all cases, femoral/popliteal vein was sacrificed in 3 patients, femoral artery was sacrificed in one patient (who underwent femoropopliteal bypass afterwards) and unilateral T11-L1 nerve roots were sacrificed in one patient. All other vital tissues were preserved. The tumor necrosis rate was grade 1 in 5 cases, grade 2 in 6 cases and grade 3 in 5 cases according to Huvos classification. The mean follow-up period was 30,2 months (1-204 months). There were three (19%) local recurrences at a mean period of 7 months. Six patients (37,5%) had distant metastases (lung or vertebra) at a mean period of 7,3 months. One patient underwent amputation due to deep infection two years after the operation. Other complications included wound detachment in two cases (12,5%). Three patients (19%) died due to metastases at a mean period of 23 months (7-45 months).

Conclusion: Neoadjuvant radiotherapy may aid in the surgical treatment of selected osteosarcoma patients by enhancing the resectability of the tumor without damaging vital tissues. It is a safe method without any major complications given that the right dose is administered.