

## **Extra-skeletal tumor invasion in Chondrosarcoma**

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### **Background**

Extra-skeletal tumor invasion is common in chondrosarcomas, but microscopic extra-skeletal tumor invasion has been not well recognized.

### **Purposes**

The purpose of this study is to investigate the effect of extra-skeletal tumor invasion on prognosis and the relationship between microscopic extra-skeletal tumor invasion and preoperative image on magnetic resonance imaging (MRI) in patients with chondrosarcoma.

### **Patients and Methods**

We reviewed 24 consecutive patients with chondrosarcoma who underwent surgery from 2004 to 2015 at Nagoya University Hospital. Secondary and periosteal chondrosarcoma and no resected specimen (i.e. treated by curettage or reconstructed by recycle bone) were excluded. We analyzed the relation between overall survival (OS)/ metastasis free survival (MFS) and each clinical factor (age  $\geq 60$ , gender, size  $> 8$ cm, tumor location, tumor grade, subtype, extra-skeletal tumor invasion). We also evaluated the relation between microscopic extra-skeletal tumor invasion and preoperative MRI. The statistical analysis was performed by Log-rank test and Fisher's exact test.

### **Results**

There were 13 males and 11 females with a median age of 61 years (range 32-85). The sites of surgery for primary tumors were femur (n=9), rib (n=6), pelvis (n=4), humerus (n=2), sternum (n=1), scapula (n=1), and spine (n=1). Histological subtypes were 18 conventional, 3 clear cell, and 3 dedifferentiated chondrosarcoma. According to the AJCC Staging System, there were 19 cases of Stage I, 3 of Stage II, and 2 of Stage IV. The surgical margins were microscopically negative in 23 of 24 cases (95.8%). Perioperative chemotherapy was performed in one case, but there was no case of perioperative radiotherapy. One case had a pathological fracture before surgery. There were 14 macroscopic (58.3%) and 8 microscopic (33.3%) extra-skeletal tumor invasion. The median length of microscopic extra-skeletal invasion was

2.5mm (range 0.5–10.0mm), and 6 of 8 microscopic extra-skeletal tumor invasion were observed at entheses. In evaluable patients without macroscopic extra-skeletal invasion, diffuse enhancement (P=0.036) and diffuse STIR high (P=0.048) on MRI can predict microscopic extra-skeletal invasion. With a median follow-up of 39.1 months, there were total 6 metastases and 5 deaths. On univariate analysis, high histologic grade (P<0.001), dedifferentiated chondrosarcoma (P<0.001), size  $\geq$  8cm (P=0.015), and bones of extremity (P=0.046) were found to be risk factors of OS. Dedifferentiated chondrosarcoma (P=0.001), high histologic grade (P=0.002), and microscopic extra-skeletal invasion (P=0.028) were found to be risk factors of MFS.

### **Conclusions**

The rates of extra-skeletal invasion were reported as 50-77% in patients with chondrosarcoma [1, 2], which is similar to the rate of macroscopic extra-skeletal tumor invasion in our study. Extra-skeletal invasion was reported to be associated with an increased risk of death after surgery of chondrosarcoma [1], but there was only correlation with MFS in our study. This may probably due to small number of the cases and short follow-up periods in our study. Relatively large number of microscopic extra-skeletal tumor invasion (n=8, 33.3%) was observed in our study. Most of microscopic extra-skeletal tumor invasions were observed at entheses. Preoperative MRI can predict many of these invasions, and it seems to be reasonable to make a surgical plan by enhanced MRI.

### **References**

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