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Purpose: To determine if there is a difference in oncologic outcome for patients 35 years or younger as compared to those over 35 years treated for chondrosarcoma.

Methods: Three hundred ten patients treated surgically for a chondrosarcoma between 1989 and 2012 were identified from our prospectively collected database. Patient and tumor characteristics, treatment details, local recurrence-free, metastasis-free and overall survival were compared for patients 35 years or younger to those over 35 years. Means were compared with the t-test, proportions with the chi-square test and survival with the log rank test. Cox regression was employed for multivariate analysis.

Results: Ninety-four patients (30%) were ≤ 35 (range 14-35) years, of whom 56 (60%) were male. Fifty-five (58%) were in the lower extremity, 91 (97%) were primary presentations, 60 (64%) were grade 2 or 3, 4 (4%) had pathologic fractures and none had metastases at diagnosis. Mean tumor size was 8.7 (1.7-26.7) cm. Three patients (3%) required an amputation, 7 had radiotherapy and 5 chemotherapy. There were 2 local recurrences (2%), 10 (10.6%) developed metastases and 86 (91%) are currently alive without disease. For those over 35 (range 36-94) years: 132 (61%) were male, 149 (69%) were in the lower extremity, 202 (94%) were primary presentations, 173 (80%) were high grade, mean tumor size was 10.5 (1.5-34.4) cm, 19 (9%) had pathologic fractures, 13 (6%) presented with metastases, 20 (9%) required an amputation, 16 had radiotherapy, 7 had chemotherapy, 29 (13%) had a local recurrence, 46 (21%) developed metastases and 147 (68%) are currently alive without disease. The tumors were higher grade in the older group ($p=0.004$), while mean size was not significantly different ($p=0.07$).

Data was parsed and analysed in 3 stages and at each stage ≤ 35 group was compared for outcomes with >35 group. First stage included all primary and secondary chondrosarcomas including low and high grades; second stage included all primary chondrosarcomas excluding the secondary chondrosarcoma group as they usually have good long term outcomes; stage 3 involved comparison of only primary high grade tumors to avoid bias created by higher proportion of high grade tumors in >35 group.

With no exclusions, five year local recurrence-free survival was 98% for those ≤ 35 and 86% for those over 35 years ($p=0.001$). Five year overall metastasis-free survival 90% and 80%, respectively ($p=0.038$). Five year overall survival was 93% and 83%, respectively ($p=0.000$).

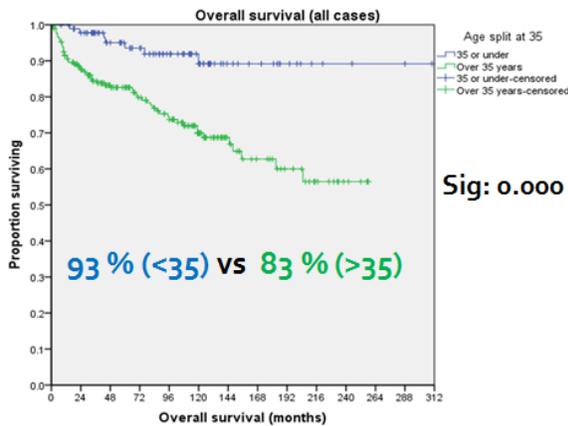
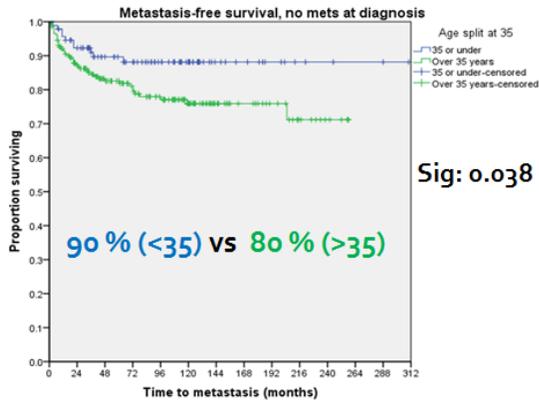
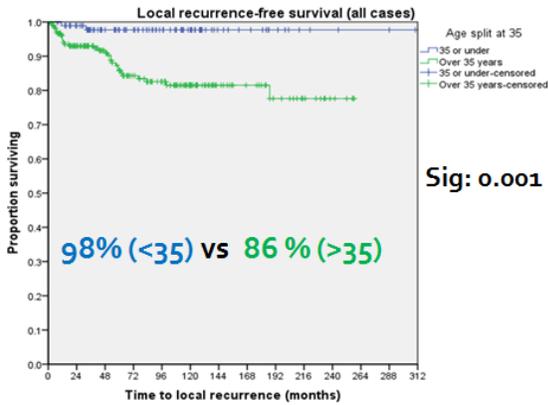
After excluding the secondary chondrosarcomas, five year local recurrence-free survival was 97% for those ≤ 35 and 82% for those over 35 years ($p=0.02$). Five year metastasis-free survival 90% and 80%, respectively ($p=0.02$). Five year overall survival was 93% and 82%, respectively ($p=0.02$).

After further excluding all low grade primary tumors five year local recurrence-free survival for primary high grade chondrosarcoma was 97% for those ≤ 35 and 85% for those over 35 years ($p=0.05$). Five year overall metastasis-free survival was 87% and 74%, respectively ($p=0.05$). Five year overall survival was 91% and 84%, respectively ($p=0.03$).

On multivariate Cox Regression analysis for high grade sarcomas, age ≤ 35 years and presence of pathologic fracture were statistically significant ($p=0.03$ and $p=0.0002$) for local recurrence while pathologic fracture and larger tumor diameter were significant for metastasis-free survival ($p=0.0002$ and $p=0.01$).

Conclusion: Patients with chondrosarcoma who were 35 years or younger had better local recurrence-free and metastasis free survival than those over 35 years.

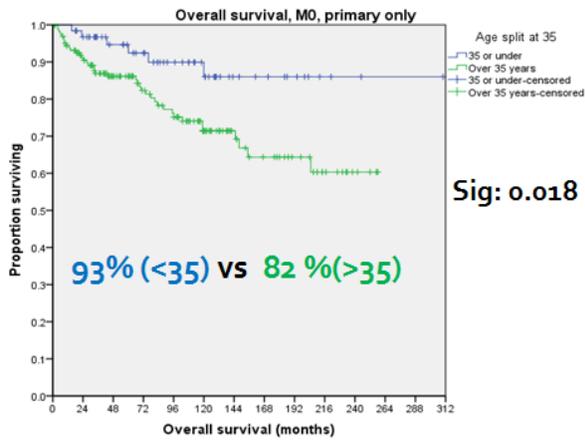
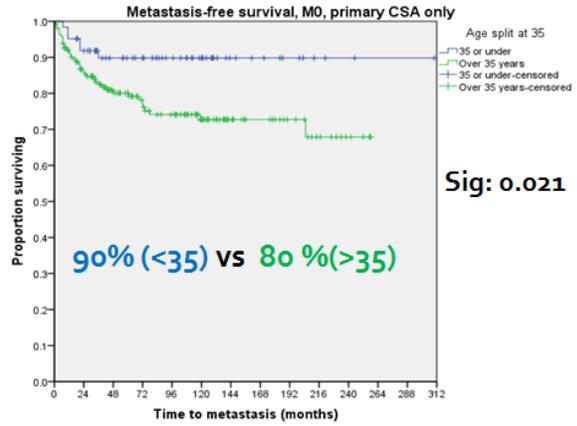
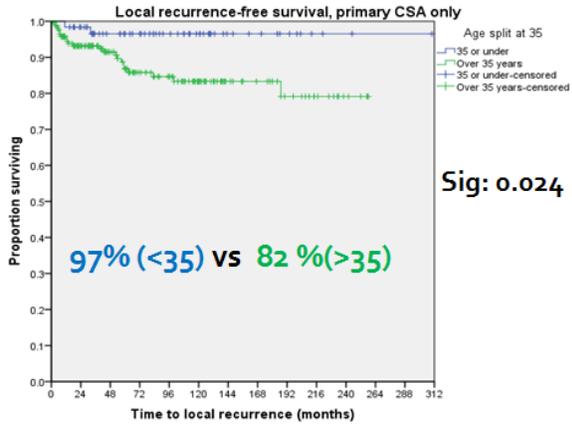
Survival Curves for All Chondrosarcomas



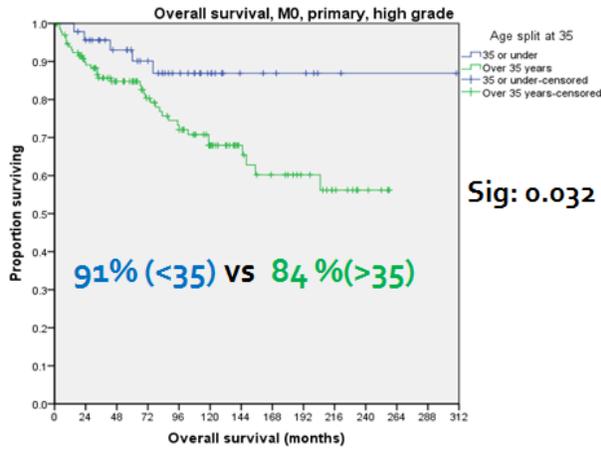
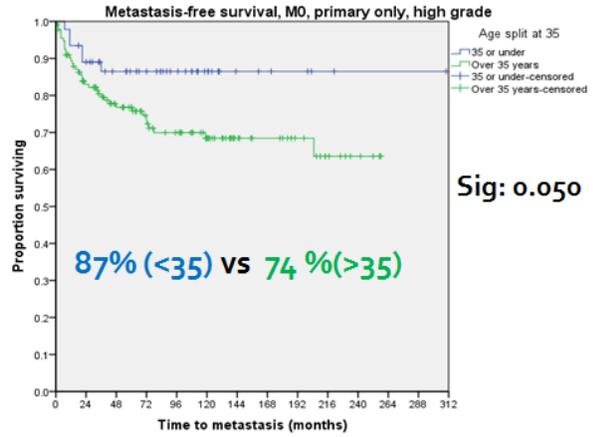
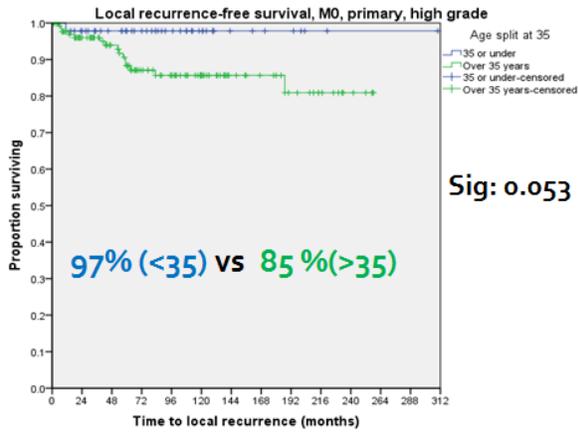
Exploratory Analysis

| | Less than 35 | more than 35 | p value |
|----------------------------|-----------------|------------------|---------|
| N | 94(30%) | 216(70%) | |
| extremity sarcomas | 55(58%) | 149(69%) | |
| primary presentations | 91(97%) | 202(94%) | |
| high grade | 60(64%) | 173(80%) | 0.004 |
| pathological fracture | 4(4%) | 19(9%) | |
| Metastasis at presentation | 0 | 13(6%) | |
| Mean Tumor size | 8.7cm(1.7-26.7) | 10.5cm(1.5-34.4) | 0.07 |
| Local Recurrence | 2(2%) | 29(13%) | |
| Metastasis | 10(10.6%) | 46(21%) | |
| ANED | 86(91%) | 147(68%) | |

Survival Curves for All Primary Chondrosarcomas



Survival Curves for Primary High Grade Chondrosarcomas



| Cox Regression | | | |
|----------------|------|---------------|------|
| Metastasis | | LR | |
| | Sig. | | Sig. |
| path fracture | .000 | path fracture | .000 |
| Margins | .187 | Margins | .261 |
| age <35 | .210 | age <35 | .028 |
| Size | .019 | Size | .056 |