

Table S1 AJCC-Stage made a high degree of collinearity with AJCC-T, AJCC-N, AJCC-M, and grade

| | AJCC-Stage I (n=278) | AJCC-Stage II (n=600) | AJCC-Stage III (n=14) | AJCC-Stage IV (n=165) | χ^2 value | P |
|---------------|----------------------|-----------------------|-----------------------|-----------------------|----------------|--------|
| AJCC-T1 | 144 (51.8%) | 255 (42.5%) | 0 (0.0%) | 34 (20.6%) | 545.48 | <0.001 |
| AJCC-T2 | 131 (47.1%) | 344 (57.3%) | 0 (0.0%) | 119 (72.1%) | | |
| AJCC-T3 | 3 (1.1%) | 1 (0.2%) | 14 (100.0%) | 12 (7.3%) | | |
| AJCC-N0 | 278 (100.0%) | 600 (100.0%) | 14 (100.0%) | 149 (90.3%) | 87.83 | <0.001 |
| AJCC-N1 | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 16 (9.7%) | | |
| AJCC-M0 | 278 (100.0%) | 600 (100.0%) | 14 (100.0%) | 9 (5.5%) | 989.36 | <0.001 |
| AJCC-M1 | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 156 (94.5%) | | |
| Grade unknown | 78 (28.1%) | 0 (0.0%) | 0 (0.0%) | 25 (15.2%) | 966.79 | <0.001 |
| Grade I | 129 (46.4%) | 0 (0.0%) | 0 (0.0%) | 2 (1.2%) | | |
| Grade II | 71 (25.5%) | 0 (0.0%) | 0 (0.0%) | 6 (3.6%) | | |
| Grade III | 0 (0.0%) | 212 (35.3%) | 5 (35.7%) | 60 (36.4%) | | |
| Grade IV | 0 (0.0%) | 388 (64.7%) | 9 (64.3%) | 72 (43.6%) | | |

The result of chi-squared test revealed that AJCC-Stage was linearly correlated with AJCC-T, AJCC-N, AJCC-M, and grade (all P<0.05). AJCC, the American Joint Committee on Cancer.

Table S2 The relationship between radiotherapy/chemotherapy and clinicopathological characteristics

| Characteristics | Radiotherapy | | χ^2 value ^a /T ^a | P ^a | Chemotherapy | | χ^2 value ^b /T ^b | P ^b |
|------------------------------|----------------------|-------------|---|----------------|--------------------|-------------|---|----------------|
| | None/unknown (n=986) | Yes (n=71) | | | No/unknown (n=159) | Yes (n=898) | | |
| Age (years) | 24.50±17.32 | 34.54±18.19 | -4.701 | *<0.001 | 39.05±20.81 | 22.72±15.69 | 9.433 | *<0.001 |
| Sex | | | 1.241 | 0.265 | | | 2.142 | 0.143 |
| Male | 544 (55.2%) | 44 (62.0%) | | | 80 (50.3%) | 508 (56.6%) | | |
| Female | 442 (44.8%) | 27 (38.0%) | | | 79 (49.7%) | 390 (43.4%) | | |
| Race | | | 1.946 | 0.584 | | | 5.969 | 0.113 |
| White | 758 (76.9%) | 51 (71.8%) | | | 120 (75.5%) | 689 (76.7%) | | |
| Black | 138 (14.0%) | 13 (18.3%) | | | 30 (18.9%) | 121 (13.5%) | | |
| Asian or Pacific Islander | 81 (8.2%) | 7 (9.9%) | | | 9 (5.7%) | 79 (8.8%) | | |
| American Indian | 9 (0.9%) | 0 (0%) | | | 0 (0%) | 9 (1.0%) | | |
| Marital status | | | 14.775 | *0.001 | | | 81.745 | *<0.001 |
| Single | 753 (76.4%) | 40 (56.3%) | | | 74 (46.5%) | 719 (80.1%) | | |
| Married | 193 (19.6%) | 27 (38.0%) | | | 69 (43.4%) | 151 (16.8%) | | |
| Divorced/widowed/separated | 40 (4.1%) | 4 (5.6%) | | | 16 (10.1%) | 28 (3.1%) | | |
| ICD-O-3/pathological subtype | | | 21.741 | *0.016 | | | 266.681 | *<0.001 |
| 9180/3 | 595 (60.3%) | 39 (54.9%) | | | 61 (38.4%) | 573 (63.8%) | | |
| 9181/3 | 155 (15.7%) | 20 (28.2%) | | | 10 (6.3%) | 165 (18.4%) | | |
| 9182/3 | 54 (5.5%) | 8 (11.3%) | | | 16 (10.1%) | 46 (5.1%) | | |
| 9183/3 | 43 (4.4%) | 1 (1.4%) | | | 2 (1.3%) | 42 (4.7%) | | |
| 9184/3 | 4 (0.4%) | 1 (1.4%) | | | 4 (2.5%) | 1 (0.1%) | | |
| 9185/3 | 9 (0.9%) | 0 (0.0%) | | | 1 (0.6%) | 8 (0.9%) | | |
| 9186/3 | 39 (4.0%) | 1 (1.4%) | | | 5 (3.1%) | 35 (3.9%) | | |
| 9187/3 | 2 (0.2%) | 0 (0.0%) | | | 2 (1.3%) | 0 (0.0%) | | |
| 9192/3 | 62 (6.3%) | 0 (0.0%) | | | 47 (29.6%) | 15 (1.7%) | | |
| 9193/3 | 18 (1.8%) | 0 (0.0%) | | | 10 (6.3%) | 8 (0.9%) | | |
| 9194/3 | 5 (0.5%) | 1 (1.4%) | | | 1 (0.6%) | 5 (0.6%) | | |
| Primary site | | | 144.171 | *<0.001 | | | 58.552 | *<0.001 |
| Extremities | 858 (87.0%) | 23 (32.4%) | | | 103 (64.8%) | 778 (86.6%) | | |
| Pelvis/spine | 45 (4.6%) | 14 (19.7%) | | | 11 (6.9%) | 48 (5.3%) | | |
| Skull/mandible and others | 83 (8.4%) | 34 (47.9%) | | | 45 (28.3%) | 72 (8.0%) | | |

Table S2 (continued)

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| Characteristics | Radiotherapy | | χ^2 value ^a /T ^a | P ^a | Chemotherapy | | χ^2 value ^b /T ^b | P ^b |
|--|----------------------|-------------|---|----------------|--------------------|--------------|---|----------------|
| | None/unknown (n=986) | Yes (n=71) | | | No/unknown (n=159) | Yes (n=898) | | |
| Grade | | | 1.853 | 0.396 | | | 203.284 | *<0.001 |
| Grade I/II | 198 (20.1%) | 10 (14.1%) | | | 97 (61.0%) | 111 (12.4%) | | |
| Grade III/IV | 691 (70.1%) | 55 (77.5%) | | | 51 (32.1%) | 695 (77.4%) | | |
| Unknown | 97 (9.8%) | 6 (8.5%) | | | 11 (6.9%) | 92 (10.2%) | | |
| Laterality | | | 125.327 | *<0.001 | | | 39.873 | *<0.001 |
| Not a paired site (axial) | 65 (6.6%) | 33 (46.5%) | | | 36 (22.6%) | 62 (6.9%) | | |
| Left-origin of primary | 484 (49.1%) | 21 (29.6%) | | | 63 (39.6%) | 442 (49.2%) | | |
| Right-origin of primary | 437 (44.3%) | 17 (23.9%) | | | 60 (37.7%) | 394 (43.9%) | | |
| Bilateral, single primary | 0 (0.0%) | 0 (0.0%) | | | 0 (0.0%) | 0 (0.0%) | | |
| AJCC-Stage | | | 2.981 | 0.395 | | | 163.777 | *<0.001 |
| I | 264 (26.8%) | 14 (19.7%) | | | 107 (67.3%) | 171 (19.0%) | | |
| II | 556 (56.4%) | 44 (62.0%) | | | 45 (28.3%) | 555 (61.8%) | | |
| III | 14 (1.4%) | 0 (0.0%) | | | 1 (0.6%) | 13 (1.4%) | | |
| IV | 152 (15.4%) | 13 (18.3%) | | | 6 (3.8%) | 159 (17.7%) | | |
| AJCC-T | | | 16.128 | *<0.001 | | | 35.322 | *<0.001 |
| T1 | 388 (39.4%) | 45 (63.4%) | | | 99 (62.3%) | 334 (37.2%) | | |
| T2 | 570 (57.8%) | 24 (33.8%) | | | 58 (36.5%) | 536 (59.7%) | | |
| T3 | 28 (2.8%) | 2 (2.8%) | | | 2 (1.3%) | 28 (3.1%) | | |
| AJCC-N | | | 3.754 | 0.053 | | | 2.877 | 0.090 |
| N0 | 973 (98.7%) | 68 (95.8%) | | | 159 (100%) | 882 (98.2%) | | |
| N1 | 13 (1.3%) | 3 (4.2%) | | | 0 (0.0%) | 16 (1.8%) | | |
| AJCC-M | | | 0.278 | 0.598 | | | 17.952 | *<0.001 |
| M0 | 842 (85.4%) | 59 (83.1%) | | | 153 (96.2%) | 748 (83.3%) | | |
| M1 | 144 (14.6%) | 12 (16.9%) | | | 6 (3.8%) | 150 (16.7%) | | |
| Surgery code | | | 27.021 | *<0.001 | | | 31.155 | *<0.001 |
| Local or partial resection | 127 (12.9%) | 22 (31.0%) | | | 44 (27.7%) | 105 (11.7%) | | |
| Radical resection with limb salvage | 611 (62.0%) | 36 (50.7%) | | | 83 (52.2%) | 564 (62.8%) | | |
| Amputation | 206 (20.9%) | 6 (8.5%) | | | 25 (15.7%) | 187 (20.8%) | | |
| Forequarter/hindquarter/hemipelvectomy | 34 (3.4%) | 5 (7.0%) | | | 4 (2.5%) | 35 (3.9%) | | |
| Surgery, NOS | 8 (0.8%) | 2 (2.8%) | | | 3 (1.9%) | 7 (0.8%) | | |
| Tumor size (mm) | 102.18±67.51 | 83.21±65.51 | 2.292 | 0.022 | 83.77±89.79 | 103.94±62.33 | -3.491 | *0.001 |
| Extension (mm) | 35.42±14.62 | 42.20±16.60 | -3.739 | *<0.001 | 33.01±16.77 | 36.38±14.43 | -2.387 | *0.018 |

The result of Chi-squared test or Student's t-test revealed that radiotherapy was significantly related to more T1, more local or partial resection and longer extension and so on (all P^a<0.05); chemotherapy was significantly related to Grade III/IV, less AJCC-I, more AJCC-IV, less AJCC-T1, more AJCC-M1, larger tumor size, longer extension and so on (all P^b<0.05). *, P<0.05. 9180/3 osteosarcoma NOS, 9181/3 chondroblastic osteosarcoma, 9182/3 fibroblastic osteosarcoma, 9183/3 telangiectatic osteosarcoma, 9184/3 osteosarcoma in Paget disease of bone, 9185/3 small cell osteosarcoma, 9186/3 central osteosarcoma, 9187/3 intraosseous well-differentiated osteosarcoma, 9192/3 parosteal osteosarcoma, 9193/3 periosteal osteosarcoma, 9194/3 high-grade surface osteosarcoma; AJCC, the American Joint Committee on Cancer; NOS, not otherwise specified.

Table S3 Multivariate analysis excluding radiotherapy and chemotherapy for cancer-specific survival in the training set

| Characteristics | Multivariate analyses for CSS | |
|--|-------------------------------|---------|
| | HR (95% CI) | P value |
| Age (years) | 1.025 (1.019-1.031) | *<0.001 |
| Sex | | 0.092 |
| Male | 1.000 | |
| Female | 0.821 (0.653-1.033) | |
| ICD-O-3/pathological subtype | | *0.021 |
| 9180/3 osteosarcoma (NOS) | 1.000 | |
| 9181/3 chondroblastic osteosarcoma | 0.953 (0.711-1.279) | |
| 9182/3 fibroblastic osteosarcoma | 0.731 (0.458-1.165) | |
| 9183/3 telangiectatic osteosarcoma | 0.744 (0.429-1.290) | |
| 9184/3 osteosarcoma in Paget disease of bone | 1.511 (0.459-4.974) | |
| 9185/3 small cell osteosarcoma | 0.244 (0.034-1.764) | |
| 9186/3 central osteosarcoma | 0.547 (0.269-1.111) | |
| 9187/3 intraosseous well-differentiated osteosarcoma | <0.001 (<0.001-1.276E+114) | |
| 9192/3 parosteal osteosarcoma | 0.200 (0.072-0.554) | |
| 9193/3 periosteal osteosarcoma | 0.152 (0.021-1.089) | |
| 9194/3 high-grade surface osteosarcoma | 1.873 (0.595-5.900) | |
| Primary site | | 0.122 |
| Extremities | 1.000 | |
| Pelvis/Spine | 1.379 (0.854-2.228) | |
| Skull/Mandible and others | 0.746 (0.478-1.165) | |
| Grade | | 0.124 |
| Well/moderately differentiated; Grade I/II | 1.000 | |
| Poorly/undifferentiated/anaplastic; Grade III/IV | 1.449 (0.999-2.102) | |
| Unknown | 1.246 (0.750-2.071) | |
| AJCC-T | | 0.627 |
| T1 | 1.000 | |
| T2 | 1.133 (0.861-1.491) | |
| T3 | 0.993 (0.529-1.864) | |
| AJCC-N | | *0.001 |
| N0 | 1.000 | |
| N1 | 2.806 (1.507-5.226) | |
| AJCC-M | | *<0.001 |
| M0 | 1.000 | |
| M1 | 2.921 (2.239-3.811) | |
| Surgery code | | 0.178 |
| Local or partial resection | 1.000 | |
| Radical resection with limb salvage | 0.768 (0.544-1.084) | |
| Amputation | 0.919 (0.621-1.360) | |
| Forequarter/hindquarter/hemipelvectomy | 1.262 (0.715-2.229) | |
| Surgery, NOS | 1.290 (0.457-3.641) | |
| Tumor size (mm) | 1.002 (1.001-1.003) | *0.001 |
| Extension (mm) | 1.019 (1.011-1.028) | *<0.001 |

*, P<0.05. We re-conducted a COX multivariate analysis excluding radiotherapy and chemotherapy, and obtained same results of predictive factors. CSS, cancer-specific survival; HR, hazard ratio; CI, confidence interval; AJCC, the American Joint Committee on Cancer; NOS, not otherwise specified.

Table S4 Multivariate analysis excluding radiotherapy and chemotherapy for overall survival in the training set

| Characteristics | Multivariate analyses for OS | |
|--|------------------------------|---------|
| | HR (95% CI) | P value |
| Age (years) | 1.032 (1.024-1.041) | *<0.001 |
| Sex | | 0.154 |
| Male | 1.000 | |
| Female | 0.853 (0.685-1.061) | |
| Marital status | | 0.061 |
| Single | 1.000 | |
| Married | 0.870 (0.622-1.216) | |
| Divorced/Widowed/Separated | 0.490 (0.275-0.892) | |
| ICD-O-3/pathological subtype | | *0.019 |
| 9180/3 osteosarcoma (NOS) | 1.000 | |
| 9181/3 chondroblastic osteosarcoma | 0.904 (0.680-1.202) | |
| 9182/3 fibroblastic osteosarcoma | 0.850 (0.553-1.308) | |
| 9183/3 telangiectatic osteosarcoma | 0.777 (0.469-1.289) | |
| 9184/3 osteosarcoma in Paget disease of bone | 1.522 (0.538-4.304) | |
| 9185/3 small cell osteosarcoma | 0.233 (0.032-1.685) | |
| 9186/3 central osteosarcoma | 0.566 (0.289-1.105) | |
| 9187/3 intraosseous well-differentiated osteosarcoma | <0.001 (<0.001-5.386E+107) | |
| 9192/3 parosteal osteosarcoma | 0.194 (0.070-0.535) | |
| 9193/3 periosteal osteosarcoma | 0.130 (0.018-0.926) | |
| 9194/3 high-grade surface osteosarcoma | 1.754 (0.557-5.523) | |
| Primary site | | 0.056 |
| Extremities | 1.000 | |
| Pelvis/Spine | 1.640 (1.053-2.553) | |
| Skull/Mandible and others | 0.903 (0.603-1.350) | |
| Grade | | 0.065 |
| Well/Moderately differentiated; Grade I/II | 1.000 | |
| Poorly/undifferentiated/Anaplastic; Grade III/IV | 1.513 (1.021-2.292) | |
| Unknown | 1.530 (0.853-2.456) | |
| AJCC-T | | 0.864 |
| T1 | 1.000 | |
| T2 | 1.054 (0.812-1.367) | |
| T3 | 0.936 (0.503-1.740) | |
| AJCC-N | | *0.001 |
| N0 | 1.000 | |
| N1 | 2.946 (1.598-5.431) | |
| AJCC-M | | *<0.001 |
| M0 | 1.000 | |
| M1 | 2.878 (2.221-3.727) | |
| Surgery code | | 0.153 |
| Local or partial resection | 1.000 | |
| Radical resection with limb salvage | 0.741 (0.538-1.020) | |
| Amputation | 0.946 (0.657-1.362) | |
| Forequarter/hindquarter/hemipelvectomy | 1.076 (0.625-1.851) | |
| Surgery, NOS | 0.918 (0.327-2.580) | |
| Tumor size (mm) | 1.002 (1.001-1.003) | *<0.001 |
| Extension (mm) | 1.020 (1.012-1.028) | *<0.001 |

*, P<0.05. We re-conducted a COX multivariate analysis excluding radiotherapy and chemotherapy, and obtained same results of predictive factors. OS, overall survival; HR, hazard ratio; CI, confidence interval; AJCC, the American Joint Committee on Cancer; NOS, not otherwise specified.