Supplementary Table 1: Clinicopathologic features of 24 cases of 13q14-deleted neoplasm with atypical morphological features.

| Case No. | Age (years) | Sex | Location     | Size (cm) | Depth                | Treatment                                      | Follow-up (months) |
|----------|-------------|-----|--------------|-----------|----------------------|-----------------------------------------------|-------------------|
| 1        | 50          | M   | Shoulder     | 7.0       | Subcutaneous fat      | Complete excision and radiotherapy            | NED, 33           |
| 2        | 61          | M   | Right thigh  | 12.0      | Subcutaneous fat      | Complete excision and radiotherapy            | NED, 28           |
| 3        | 52          | M   | Head         | 4.5       | Subcutaneous fat      | Complete excision and radiotherapy            | NED, 17           |
| 4        | 68          | M   | Back         | 3.7       | Subcutaneous fat      | Complete excision                             | NED, 44           |
| 5        | 44          | M   | Back         | 2.0       | Subcutaneous fat      | Complete excision                             | NED, 22           |
| 6        | 56          | M   | Scrotum      | 2.3       | Subcutaneous fat      | Complete excision                             | NED, 23           |
| 7        | 41          | M   | Head         | 2.8       | Subcutaneous fat      | Complete excision                             | NED, 20           |
| 8        | 41          | M   | Shoulder     | 5.0       | Subcutaneous fat      | Complete excision                             | NED, 22           |
| 9        | 57          | M   | Left thigh   | 18.0      | Intramuscular         | Complete excision and radiotherapy            | NED, 64           |
| 10       | 69          | M   | Right knee   | 6.0       | Subcutaneous fat      | Complete excision                             | NA                |
| 11       | 50          | M   | Head         | 2.8       | Subcutaneous fat      | Complete excision                             | NA                |
| 12       | 27          | F   | Upper arm    | 7.0       | Subcutaneous fat      | Complete excision                             | NED, 36           |
| 13       | 56          | M   | Back         | 15.0      | Subcutaneous fat      | Complete excision                             | NED, 20           |
| 14       | 44          | M   | Mediastinum  | 17.5      | Deep                 | Complete excision                             | NA                |
| 15       | 48          | F   | Breast       | 0.8       | Deep                 | Complete excision                             | NED, 16           |
| 16       | 28          | M   | Scrotum      | 2.4       | Subcutaneous fat      | Complete excision                             | NED, 12           |
| 17       | 22          | M   | Left calf    | 6.0       | Subcutaneous fat      | Complete excision                             | NED, 10           |
| 18       | 60          | M   | Retroperitoneum | 7.7   | Deep                 | Complete excision                             | NED, 8            |
|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 19 | 44 | M  | Head | 3.0 | Subcutaneous fat | Complete excision | NED, 8 |
| 20 | 45 | F  | Pelvis | 12.3 | Deep | Complete excision | NED, 15 |
| 21 | 68 | M  | Scrotum | 10.0 | Subcutaneous fat | Complete excision | NED, 9 |
| 22 | 33 | F  | Right Parotid | 1.8 | Oral and maxillofacial | Complete excision | NED, 20 |
| 23 | 32 | F  | Left Breast | 1.5 | Deep | Complete excision | NED, 19 |
| 24 | 49 | F  | Right Palatine | 5.5 | Oral and maxillofacial | Complete excision | NED, 36 |
| Average | 47.7 | — | — | 6.5 | — | — | 22.9 |

F: Female; M: Male; NA: Not available; NED: No evidence of disease.

**Supplementary Table 2: Morphologic characteristics of ASLT.**

| Items                          | Positive ratio | Percentage (%) |
|-------------------------------|----------------|----------------|
| Tumor margin                  |                |                |
| Boundaries clear              | 15/23          | 65.2           |
| Infiltration of adjacent tissue | 8/23          | 34.8           |
| Varying sizes of lipomatous cells | 17/24       | 70.8           |
| Vacuolated lipoblasts         | 10/24          | 41.7           |
| Atypical spindle cell         | 22/24          | 91.7           |
| Atypical pleomorphic cell     | 2/24           | 8.3            |
| Myxoid background             | 18/24          | 75.0           |
| Part                          | 13/24          | 54.2           |
| Abundant                      | 5/24           | 20.8           |
| Fat-free/low-fat              | 9/24           | 37.5           |
| Ropy-like collagen bundles    | 3/24           | 12.5           |
| Floret like multinucleated cell | 4/24          | 16.7           |
| Mitotic activity              | 0              | 9/24           | 37.5 |

Average
|                           | Positive ratio | Percentage (%) |
|---------------------------|----------------|----------------|
| **Immunohistochemistry**  |                |                |
| CD34                      | 20/24          | 83.3           |
| MDM2                      | 3/20           | 15.0           |
| CDK4                      | 5/19           | 26.3           |
| p16                       | 6/13           | 46.2           |
| Rb expression loss        | 19/23          | 82.6           |
| **FISH**                  |                |                |
| RB1 deletion (13q14)      | 21/21          | 100.0          |
| FOXO1 deletion (13q14)    | 19/21          | 90.5           |
| RB1 and FOXO1 cohybridization deletion | 12/14          | 85.7           |

ASLT: Atypical spindle cell lipomatous tumor; HPF: High power field.

Supplementary Table 3: Immunohistochemistry and molecular characteristics.

FISH: Fluorescence *in situ* hybridization; FOXO1: Forkhead Box O1.