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Soft tissue sarcoma at King ChulalongkornMemorial Hospital : A review of 105 cases

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Soft tissue sarcoma at King Chulalongkorn Memorial Hospital : A review of 105 cases

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Objective : *To collect data from all cases of malignant soft tissue tumors (sarcomas) and determine prevalence, percentage and relative frequency of each sarcoma, age, sex, sex ratio and site distribution during the period January 1995 to 1999.*

Setting : *Department of Pathology, King Chulalongkorn Memorial Hospital*

Subjects : *All cases of sarcoma from the surgical files of the Department of Pathology during January 1995 to December 1999*

Design : *Retrospective descriptive study*

Methods : *We collected data from all soft tissue sarcoma cases from requisite forms and pathological reports from January 1995 to December 1999. We determined the prevalence of malignant soft tissue tumor according to the 1993 WHO soft tissue classification. The relative frequency rate of each tumor, mean age at presentation, sex, sex ratio and anatomical site distribution were analysed.*

Results : *105 cases of sarcomas were collected. The most common soft tissue sarcoma was leiomyosarcoma (26.7 %). The other soft tissue sarcomas, presented decreasing frequency, accounted for by were malignant schwannoma (19.0 %), rhabdomyosarcoma (14.3 %), malignant fibrous*

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histiocytoma (10.5 %), fibrosarcoma (8.6 %), liposarcoma (7.6 %), angiosarcoma (4.8 %), synovial sarcoma (3.8 %), extraskeletal mesenchymal chondrosarcoma (1.9 %), epithelioid sarcoma (1.9 %) and malignant hemangiopericytoma (0.9 %). Nearly half of all sarcoma cases were leiomyosarcoma and malignant schwannoma. The major age group at presentation with soft tissue sarcoma ranged between 50 - 59 years. The majority of cases (69.5 %) involved patients older than 40 years. More of these cases affected males (male:female ratio = 1.39:1). The majority arose in the lower and upper extremities (46.6 %), except rhabdomyosarcoma and extraskeletal mesenchymal chondrosarcoma.

Discussion : *This study found 105 cases of soft tissue sarcoma at the King Chulalongkorn Memorial Hospital between January 1995 to December 1999. Diagnosis is complicated, due to the numerous subclassifications of soft tissue sarcoma, and the different clinical features. Most of our findings are in accordance with previous studies and we discuss those that differ. We emphasize the integration of clinical features with histopathological finding as a preliminary requirement to reach the correct diagnosis of soft tissue sarcoma.*

Key words : *Soft tissue sarcoma, Prevalence of soft tissue sarcoma, Clinical feature.*

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จุดประสงค์ : *เพื่อรวบรวมมะเร็งของเนื้อเยื่ออ่อน และหาค่าความชุกร้อยละของการเกิดโรคและความถี่สัมพันธ์ของมะเร็งเนื้อเยื่ออ่อนแต่ละชนิด อายุ เพศ สัดส่วนเปรียบเทียบระหว่างเพศชายและหญิง และตำแหน่งของการเกิดก้อนภายในโรงพยาบาลจุฬาลงกรณ์ตั้งแต่ มกราคม 2538 - ธันวาคม 2542*

สถานที่ที่ทำการศึกษา : *ภาควิชาพยาธิวิทยา โรงพยาบาลจุฬาลงกรณ์*

ผู้ป่วยที่ได้ทำการศึกษา : *ผู้ป่วยที่ได้รับการผ่าตัดและส่งชิ้นเนื้อตรวจที่ภาควิชาพยาธิวิทยา และได้รับการวินิจฉัยว่าเป็นมะเร็งเนื้อเยื่ออ่อน ตั้งแต่ มกราคม 2538 ถึง ธันวาคม 2542*

รูปแบบการวิจัย : *การศึกษาย้อนหลังเชิงพรรณนา*

วิธีการศึกษาวัดผล : *ได้ทำการค้นคว้าและรวบรวมข้อมูลจากใบส่งชิ้นเนื้อตรวจทางพยาธิวิทยาและใบรายงานผลทางพยาธิวิทยาของผู้ป่วยทั้งหมดที่ได้รับการวินิจฉัยว่าเป็นมะเร็งเนื้อเยื่ออ่อนตั้งแต่ มกราคม 2538 ถึง ธันวาคม 2542 โดยได้ตรวจหาความชุกและร้อยละของการเกิดมะเร็งเนื้อเยื่ออ่อนโดยจัดแบ่งตาม WHO ในปี 2536 นอกจากนั้นยังวิเคราะห์หาความสัมพันธ์ของความถี่ของการเกิดโรค อายุ เพศ และตำแหน่งของการเกิดโรค*

ผลการศึกษา : *จากการศึกษาและรวบรวมมะเร็งของเนื้อเยื่ออ่อนจำนวน 105 ราย พบ leiomyosarcoma มากที่สุด (26.7 %) ลำดับถัดมาได้แก่ malignant schwannoma (19.0 %), rhabdomyosarcoma (14.3 %), malignant fibrous histiocytoma(10.5 %), fibrosarcoma(8.6 %), liposarcoma (7.6 %), angiosarcoma (4.8 %), synovial sarcoma (3.8 %), extraskeletal mesenchymal chondrosarcoma (1.9 %), epithelioid sarcoma (1.9 %), malignant hemangiopericytoma (0.9 %). เกือบ 50 % ของมะเร็งเนื้อเยื่ออ่อนทั้งหมด ได้แก่ leiomyosarcoma และ malignant schwannoma มะเร็งที่พบน้อย ได้แก่ angiosarcoma,*

synovial sarcoma, extraskeletal mesenchymal chondrosarcoma, epithelioid sarcoma, malignant hemangiopericytoma ช่วงอายุที่เกิดมะเร็งเนื้อเยื่ออ่อนมากที่สุดคือ 50 - 59 ปี โดยกลุ่มอายุที่เกิดโรคมากที่สุดคือกลุ่มที่มีอายุเกิน 40 ปี โดยพบ 69.5 % ของผู้ป่วยทั้งหมด พบมะเร็งในเพศชายมากกว่าหญิงโดยอัตราส่วนเพศชายต่อหญิงเท่ากับ 1.39 : 1 ตำแหน่งที่พบก้อนมากที่สุดคือ แขนขาทั้งส่วนบน และล่าง (46.6 %) ยกเว้น rhabdomyosarcoma และ extraskeletal mesenchymal chondrosarcoma

สรุป : *ได้ทำการศึกษามะเร็งของเนื้อเยื่ออ่อน 105 รายในโรงพยาบาลจุฬาลงกรณ์ ระหว่างเดือนมกราคม 2538 ถึงธันวาคม 2542 สืบเนื่องจากมะเร็งเนื้อเยื่ออ่อนมีการแบ่งแยกออกไป หรือประกอบไปด้วยมะเร็งกลุ่มย่อยหลายชนิดและมีความแตกต่างในเรื่องลักษณะการแสดงออกทางคลินิก ดังนั้น คณะผู้วิจัยจึงได้พยายามเก็บรวบรวมข้อมูล และวิเคราะห์ลักษณะการแสดงออกทางคลินิกเปรียบเทียบกับรายงานในต่างประเทศก่อนหน้านี้ ส่วนใหญ่ของข้อมูลที่ทำการศึกษาจะสอดคล้องกับข้อมูลที่ได้กล่าวมาแล้ว เหตุผลที่อธิบายถึงความแตกต่างได้นำเสนอไว้แล้วในช่วงวิเคราะห์ อย่างไรก็ตามคณะผู้วิจัยใคร่จะนำเสนอ และเน้นย้ำถึงความสำคัญในการผสมผสานระหว่างลักษณะการแสดงออกทางคลินิก และการตรวจพบทางกล้องจุลทรรศน์ ซึ่งเป็นพื้นฐานที่สำคัญในการนำไปสู่การวินิจฉัยมะเร็งเนื้อเยื่ออ่อนให้ถูกต้อง*

Soft tissue is the nonepithelial extraskeletal tissue of the body that principally derives from mesoderm. It consists of muscle, fat, blood vessels, fibrous and other supporting tissue.[1] However, it also includes the peripheral nervous system and tumors can arise from nerve and present as a soft tissue mass. The malignant soft tissue tumors (sarcomas) are relatively rare tumors when compared with carcinoma. In the United States, the annual incidence accounts for approximately 1 % of all cancers.[2] One study in the Finnish population found the incidence rate was 1.35 per 100,000 per year.[3] Based on this data, only a small number of new cases appear per year. The incidence of this sarcoma is usually underestimated because it also arises in parenchymatous organs and is often attributed to tissues other than the connective tissue. The aim of this study is to analyze the true prevalence, percentage and relative frequency of each sarcoma in our hospital and assess the associated clinical features which include age, sex, sex ratio, and site distribution of these sarcomas.

Materials and Methods

Data from surgical files of the Pathological Department, King Chulalongkorn Memorial Hospital collected between January 1995 to December 1999 were searched. All cases of sarcoma were reviewed by both authors. The diagnosis was made according to the criteria of Enzinger and Weiss which follow the WHO histological classification of 1993. The relative frequency of each sarcoma was analyzed. The clinical features of age, sex, sex ratio and location were assessed.

Result

In all 105 cases of sarcomas were collected. The number and percentage of cases and relative frequency of each were calculated and are shown in Table 1. The soft tissue sarcomas presented in decreasing frequency were leiomyosarcoma (26.7 %), malignant schwannoma (19.0 %), rhabdomyosarcoma (14.3 %), malignant fibrous histiocytoma (10.5 %), fibrosarcoma (8.6 %), liposarcoma (7.6 %),

Table1. Relative frequency of each sarcoma in Chulalongkorn Memorial Hospital between 1995 to 1995.

Type	Number of cases	Frequency (%)
Fibrosarcoma	9	8.6
Malignant fibrous histiocytoma	11	10.5
Liposarcoma	8	7.6
Leiomyosarcoma	28	26.7
Rhabdomyosarcoma	15	14.3
Angiosarcoma	5	4.8
Malignant hemangiopericytoma	1	0.9
Synovial sarcoma	4	3.8
Malignant schwannoma	20	19.0
Extraskeletal mesenchymal chondrosarcoma	2	1.90
Epithelioid sarcoma	2	1.90
Total	105	100.0

angiosarcoma (4.8 %), synovial sarcoma (3.8%), extraskeletal mesenchymal chondrosarcoma (1.9 %), epithelioid sarcoma (1.9 %), and malignant hemangiopericytoma (0.9 %).

All clinical features are recorded in table 2 and 3. Fibrosarcoma presented at a mean age of 35.1 years. It occurred in males more than females. The ratio of male: female was 3.5:1. The majority arose in the lower extremities (44.5 %). Cases of Malignant fibrous histiocytoma showed a mean age of 49.9 years. Males were found more commonly than females (male:female = 1.7:1). The majority occurred in the lower extremities (45.4 %). Other sites, in decreasing frequency, were trunk (27.3 %), upper extremities (18.2 %), and retroperitoneum (9.1 %). Liposarcoma had a mean age of presentation at 53.6 years. There was no evidence of sex predilection. The site distribution was equally at retroperitoneum, head and neck, and upper extremities (each 25.0 %).

Leiomyosarcoma presented a mean age of 55.6 years and was predominantly found in males (male:female = 1.4:1). It commonly occurred in the lower extremities (28.6 %). The other presenting sites were intraabdominal (25.1 %), retroperitoneum (21.4 %). Rhabdomyosarcoma presented at a mean age of 30.6 years. There was no evidence of sex predilection. The most common site was head and neck (40.0 %). The second commonly affected site was the lower extremities (33.2 %). Cases of angiosarcoma showed a mean age of 42.3 years. Females were found more than males (4:1). The most common sites were equally lower extremities and intraabdomen (each 40 %). The other less common site was the upper extremities. Malignant hemangiopericytoma found in only one male patient. The age at presentation was 56 years. It arose in the upper extremity. Synovial sarcoma presented at a mean age of 23.7 years. The male to female ratio was 1:1. The most common site distribution was the lower extremities (75.0 %).

Table 2. The sex ratio and mean age presentation of various sarcomas.

Type	Ratio (M:F)	Age (mean age)
Fibrosarcoma	3.5:1	35.1
Malignant fibrous histiocytoma	1.7:1	49.9
Liposarcoma	1:1	53.6
Leiomyosarcoma	1.4:1	55.6
Rhabdomyosarcoma	1:1	30.6
Angiosarcoma	1:4	42.3
Malignant hemangiopericytoma	1:0	56.0
Synovial sarcoma	1:1	23.7
Malignant schwannoma	1:1.2	40.6
Extraskeletal mesenchymal chondrosarcoma	2:0	28.0
Epithelioid sarcoma	2:0	26.0

Table 3. The anatomical site distribution of various sarcomas.

Type	Head & Neck (%)	Trunk (%)	Upp. Ext. (%)	Low. Ext (%)	Intra Abd (%)	Retro (%)	NOS (%)
Fibrosarcoma	11.1	0	11.1	44.5	11,1	0	22.2
Malignant fibrous Histiocytoma	0	27.3	18.2	45.4	0	9.1	0
Liposarcoma	25.0	12.5	25.0	0	12.5	25.0	0
Leiomyosarcoma	7.1	7.1	3.6	28.6	25.1	21.4	7.1
Rhabdomyosarcoma	40.0	6.7	6.7	33.2	6.7	6.7	0
Angiosarcoma	0	0	20.0	40.0	40.0	0	0
Malignant hemangiopericytoma	0	0	100	0	0	0	0
Synovial sarcoma	0	0	25.0	75.0	0	0	0
Malignant schwannoma	5	30.0	30.0	15.0	10.0	0	10.0
Extraskeletal mesenchymal chondrosarcoma	0	50.0	50.0	0	0	0	0
Epithelioid sarcoma	0	0	50.0	50.0	0	0	0

Note : Upp. ext. = Upper extremities, Low. Ext = Lower extremities,
Int Abd = Intraabdomen, Retro = Retroperitoneum, NOS = Not specified site

Malignant schwannoma presented at a mean age of 40.6 years. The majority were found in females (male:female =1.2:1). The most common sites were the trunk and upper extremities (each 30 %). Extraskeletal mesenchymal chondrosarcoma had a mean age of presentation of 28 years. All of the patients were male. These arose in the trunk and upper extremities (50 %). Cases of epithelioid sarcoma showed a mean age of 26 years. All of the patients were male. All tumors occurred in the upper and lower extremities (each 50 %).

Discussion

We found 105 cases of soft tissue sarcomas in the surgical files of King Chulalongkorn Memorial Hospital between January 1995 to December 1999. The most common soft tissue sarcoma was leiomyosarcoma (26.7 %). More than 45 % of all sarcoma cases were leiomyosarcoma or malignant schwannoma. Fibrosarcoma was formerry reported as the most common soft tissue sarcoma (about 65 %).[4] At this time, due to the development of diagnostic antibodies, to specific cell type thus the diagnosis of fibrosarcoma has been reduced. A previous reviewed of the relative frequency of each sarcoma by Hashimoto et al. was as follows : malignant fibrous histiocytoma (25.1 %), liposarcoma (11. 6 %), rhabdomyosarcoma (9.7 %), leiomyosarcoma (9.1 %), synovial sarcoma (6.5 %), malignant schwannoma (5.9 %), and fibrosarcoma

(5.2 %).[5] Another series from Pritchard et al. found that fibrosarcoma ranked the third following liposarcoma (21 %) and rhabdomyosarcoma (19 %).[6] Leiomyosarcomas are usually found to far out- number malignant fibrous histiocytomas and liposarcomas. The incidence rate of leiomyosarcoma is about 5 to 10 % of soft tissue sarcomas.[7-9] However, our series discloses a different ranking of sarcoma. The ranking of malignant fibrous histiocytoma is changed from the first to the fourth in our series and we found only 10.5 %, compared with previous series. With the new development of antibodies at this time, more specific markers have been established. The consensus of the line of diffentiation of each tumor always plays a role in apprication of diagnostic immunohistochemistry study. Malignant fibrous histocytoma show a divergent line of differentiation and no definite marker.[10] This is why malignant tumor of smooth muscle is found to predominate over malignant fibrous histiocytoma. The second most common sarcoma in our series is malignant schwannoma (19.0 %). Usually, the second most common sarcoma has been found to be liposarcoma. A study from the Armed Forces Institute of Pathology found the incidence rate of liposarcoma ranged from 9.8 to 16 %.[11] Our findings are different, as the malignant schwannoma presented more frequently than liposarcoma. Both angiosarcoma and malignant hemangioperictyoma were definitely rare tumors and their incidence rate was less than 1%.[12] Our study found angiosarcoma and malignant hemangiopericytoma at 4.8 % and 0.9 %, respectively. Our finding is very interesting since the differing prevalence, percentage, and relative frequency among these soft tissue sarcomas may indicate the influence of different geographic and race distribution. Rhabdomyosarcoma represents 14.3 % of all sarcomas. According to the aforementioned data, a higher frequency of this sarcoma is found in our study. Synovial sarcoma is found less than in previous studies (5.6 to 10 %). Sporadic cases of extraskeletal mesenchymal chondrosarcoma and epithelioid sarcoma have been reported in the literature. Our series found each sarcoma at about 1.9 %.

Prior reports give an age at presentation for leiomyosarcoma, malignant schwannoma, malignant fibrous histiocytoma, fibrosarcoma, liposarcoma, angiosarcoma, and malignant hemangiopericytoma of 59, 34, 46, 45, 57, 58, and 45 years respectively.[13-16] Our study disclosed a mean age group presentation of leiomyosarcoma, malignant fibrous histiocytoma, and liposarcoma corresponding with the previous literature. The fibrosarcoma and angiosarcoma were present in a younger age group than in previous studies and predominantly occured in middle-aged patients. Malignant schwannoma and malignant hemangiopericytoma show a mean age at presentation older than the previous studies.

Our findings of mean age of presentation of adolescent and young adult soft tissue sarcoma were: rhabdomyosarcoma (mean age,30.6 years), synovial sarcoma (mean age, 23.7 years), extraskeletal mesenchymal chondrosacoma (mean age,28 years), and epithelioid sarcoma (mean age, 26 years). The rhabdomyosarcoma was divided into three major groups. The mean age for each subtype was as follows: embryonal (mean age, 8 years), alveolar (mean age,16 years), and pleomorphic (mean age, 50 to 56 years).[17] That our study showed an older affected group with rhabdomyosarcoma may be the result on the majority of the cases being pleomorphic

sarcoma (8/15 cases). Synovial sarcoma, extraskeletal mesenchymal chondrosarcoma, and epithelioid sarcoma present in patients with a mean age of 26.5 years, 23.5, and 30.1 years respectively.[18] Our report found a similar mean age presentation in these adolescent soft tissue sarcomas.

The major affected aged group in these soft tissue sarcomas ranges between 50 and 59 years. The majority of cases (69.5 %) present in patients older than 40 years. (Table 4)

A majority of these tumors affected male patients (male: female ratio = 1.39:1), Which is similar to prior reports, excepting leiomyosarcoma that usually occurrs in females and angiosarcoma which is more frequently found in male patients.[13,16] The most common adolescent and middle-aged soft tissue sarcoma presented equally often in both sex.[19]

Our study found the principal location of soft tissue sarcomas was the extremities (except rhabdomyosarcoma). The overall incidence at upper and lower extremities gave 46.6 %. The other affected sites were trunk (13.4 %), intraabdomen (12.4 %), head and neck (11.4 %) and retroperitoneum (10.5 %). (Table 5). The adult soft tissue sarcomas, which comprise liposarcoma, malignant schwannoma, malignant fibrous histiocytoma and angiosarcoma frequently involve the extremities.[13,14,16,20] However, adolescent and middle-aged sarcoma usually have different sites of presentation. Generallly, rhabdomyosarcoma presents in decreasing frequency as follows; head and neck, genitourinary tract, retroperitoneum, and upper and lower extremities (except pleomorphic rhabdomyosarcoma).[17,19] The most commonly affected site for rhabdomyosarcoma we found to correspond with the previous reports that is it usually affected the head and neck, followed by the extremities. Fibrosarcoma, synovial and epithelioid sarcoma mostly affected the lower extremities. Extraskeletal mesenchymal chondrosarcoma usually affects head and neck, followed by the lower extremity.[20] Our 2 cases arose in the trunk and upper extremity.

Conclusion

Our study found 105 cases of soft tissue sarcoma at the King Chulalongkorn Memorial Hospital between January 1995 to December 1999. According to numerous subclassifications of soft tissue sarcomas, combined with difference of clinical features we attempted to analyse prevalence, percentage

Table 4. The distribution of mean age presentation of soft tissue sarcomas.

Mean age at presentation	Number of cases	% of cases
10 – 19	0	0
20 – 29	8	7.6
30 – 39	24	22.9
40 – 49	25	23.8
50 – 59	48	45.7
	105	100.0

Table 5. The relative frequency of anatomical distribution of soft tissue sarcomas.

Site	Number of cases	% of cases
Head&Neck	12	11.4
Trunk	14	13.4
Upper extremities	18	17.1
Lower extremities	31	29.5
Intraabdomen	13	12.4
Retroperitoneum	11	10.5
Not specified site	6	5.7
Total	**105**	**100.0**

and relative frequency of each sarcoma, age, sex, and anatomical site distribution. A comparative presentation with previous studies is given. Nearlly all of our findings correspond with the literature. We would like to emphasize the correlation between clinical features and histopathological finding as the preliminary requirement to reach the correct diagnosis of soft tissue sarcoma.

References

1. Zahm SH, Fraumeni JF. The epidemiology of soft tissue sarcoma. Semin Oncol 1997 Oct; 24(5): 504 - 14
2. Parker SL, Tong T, Bolder W, Wingo PA. Cancer statistics, 1996. CA Cancer J Clin 1996 Jan-Feb; 46(1): 5 - 27
3. Rantakokko V, Ekfors TO. Sarcomas of the soft tissue in the extremities and limb girdles: analysis of 240 cases diagnosed in Finland in 1960-1969. Acta Chir Scand 1979; 145(6): 384 - 94
4. Meyerding HW, Broders AC, Hargrave RL. Clinical aspects of fibrosarcoma of the soft tissues of the extremities. Surg Gynecol Obstet 1936; 62: 1010
5. Hashimoto H, Daimaru Y, Takeshita S, Tsuneyoshi M, Erijoji M. Prognostic significance of histologic parameter of soft tissue sarcomas. Cancer 1992 Dec 15; 70(112): 2816 - 22
6. Pritchard DJ, Soule EH, Taylor WF, Ivine JC. Fibrosarcoma: a clinicopathologic and statistical study of 199 tumors of the soft tissues of the extremities and trunk. Cancer 1974 Mar; 33(3): 888 - 97
7. Cornog JL. Gastric leiomyoblastoma: a clinical and ultrastructural study. Cancer 1974 Sep; 34(3): 711 - 9
8. Langley JR. Gastric and extragastric leiomyoblastoma: report of six new cases with a review of the literature. Am Surg 1976 May; 42(5): 369 - 75
9. Saul SH, Rast ML, Brooks JJ. The immunohistochemistry of gastrointestinal stromal tumors: evidence supporting origin from smooth muscle. Am J Surg Pathol 1987 Jun; 11(6): 464 - 73
10. Taxy JB, Battifora H. Malignant fibrous histio-

cytoma. An electron micorscope study. Cancer 1977 Jul; 40(1): 254 - 67

11. Russell WO, Cohen J, Enzinger FM, Hajdu SL, Heise H, Martin RG, Meissnen W, Miller WT, Schmitz RL, Suit HD. A clinical and pathological staging system for soft tissue sarcomas. Cancer 1977 Oct; 40(4): 1562 - 70
12. Bardwil JM, Mocega EE, Butler JJ, Russin DJ. Angiosarcomas of the head and neck region. Am J Surg 1968 Oct; 116(4): 548 - 53
13. Fletcher CD. Pleomorphic malignant fibrous histiocytoma: fact or fiction?. A clinical reappraisal based on 159 tumors diagnosed as pleomorphic sarcoma. Am J Surg Pathol 1992 Mar; 16(3): 213 - 28
14. Fisher C, Carter RL, Ramachandra S, Thomas DM. Peripheral nerve sheath differentiation in malignant soft tissue tumours: an ultrastructural and immunohistochemical study. Histopathology 1992 Feb; 20(2): 115 - 25
15. Scott SM, Reiman HM, Pritchard DJ. Soft tissue fibrosarcoma: a clinicopathologic study of 132 cases. Cancer 1989 Aug 15; 64(4): 925 - 31
16. Meis-Kindblom JM, Kindblom LG. Angiosarcoma of soft tissue: a study of 80 cases. Am J Surg Pathol 1998 Jun; 22(6): 683 - 97
17. Gaffney EF, Dervan PA, Fletcher CD. Pleomorphic rhabdomyosarcoma in adulthood: analysis of 11 cases with definition of diagnostic criteria. Am J Surg Pathol 1993 Jun; 17(6): 601 - 9
18. Smith ME, Brown JI, Fisher C. Epithelioid sarcoma: presence of vascular - endothelial cadherin and lack of epithelial cadherin. Histopathology 1998 Nov; 33(5): 425 - 31
19. Carter RL, Mccarthy KP, Cachin LG, Jameson CF, Philp ER, Pinkerton CR. Expression of desmin and myoglobin in rhabdomyosarcomas and in developing skeletal muscle. Histopathology 1989 Dec; 15(6): 585 - 95
20. Guccion JG, Font RL, Enzinger FM. Extraskeletal mesenchymal chondrosarcoma. Arch Pathol 1969; 99: 1142