STUDY OF PAEDIATRIC SOLID TUMOURS FOR A PERIOD OF 5 YEARS

Basumitra Das[1], Rema Nair Sarkar[2], Bhagyalakshmi Atla[3]

[1]Professor, Department of Pathology, Andhra Medical College, Visakhapatnam, Andhra Pradesh.
[2]Assistant Professor, Department of Pathology, Andhra Medical College, Visakhapatnam, Andhra Pradesh.
[3]Professor and HOD, Department of Pathology, Andhra Medical College, Visakhapatnam, Andhra Pradesh.

ABSTRACT

BACKGROUND

Paediatric Solid Neoplasms (PSN) are a global problem. There is significant variation of incidence of paediatric solid neoplasms in various regions of the world. Benign tumours are more common than cancer. In an effort to better understand the prevalence of paediatric solid tumours in our region, a retrospective review of the tumours diagnosed histopathologically was carried out.

MATERIALS AND METHODS

This is a retrospective study undertaken in a tertiary care hospital for a period of five years. All the benign and malignant paediatric solid tumours of children below 14 years from January 2012 to December 2016 were retrieved and analysed according to age, sex and histopathological diagnosis. Leukaemias were excluded from our study. All tumours were diagnosed on conventional haematoxylin and eosin-stained sections.

RESULTS

A total of 109 cases of solid paediatric tumours were received during this period. Of these, maximum of 30 tumours were of soft tissue tumours followed by Central Nervous System (CNS) and bone tumours with 24 and 23 cases, respectively. 7 cases of blastomas were also observed.

CONCLUSION

This study showed benign and malignant tumours to be of near-equal prevalence. Soft tissue tumours were the most common. Ratio of benign tumours to malignant were almost equal below 4 years. Malignant tumours were higher in 5-9 years group.

KEYWORDS

Paediatric Solid Tumours, Neoplasms, Astrocytomas.

HOW TO CITE THIS ARTICLE: Das B, Sarkar RN, Bhagyalakshmi A. Study of paediatric solid tumours for a period of 5 years. J. Evid. Based Med. Healthc. 2017; 4(93), 5632-5637. DOI: 10.18410/jebmh/2017/1129

BACKGROUND

Paediatric cancers are rare comprising only 1% of all the cancers.[1] Cancer is emerging as a major killer of children in developing countries due to significant strides in treatment of infectious and nutritional diseases. There is significant geographical variation of incidence of Paediatric Solid Neoplasms (PSN).

In India, PSN are coming into greater focus because of preventive measures being taken for the infections and malnutrition, which were major factors contributing to morbidity and mortality earlier.[2,3]

Benign tumours are more common than malignant tumours. Benign tumours rarely cause serious complications unless by virtue of their size, location and site.[4] Unlike adults in whom cancers of lung, skin, breast and colon predominate, cancers of the haematopoietic system, nervous tissue, soft tissue, bone and kidney predominate in childhood.[4]

Financial or Other, Competing Interest: None.
Submission 18-11-2017, Peer Review 26-11-2017,
Acceptance 02-12-2017, Published 05-12-2017.
Corresponding Author:
Dr. Rema Nair Sarkar,
Assistant Professor, Department of Pathology,
Andhra Medical College, Visakhapatnam, Andhra Pradesh.
E-mail: rema_doc@yahoo.com
DOI: 10.18410/jebmh/2017/1129

Aim and Objectives

To evaluate the pattern and frequency of both benign and malignant paediatric solid tumours and to study their histological patterns and distribution in relation to age, sex and site.

MATERIALS AND METHODS

This retrospective study was undertaken in a tertiary care hospital for a period of five years in the Department of Pathology. All the benign and malignant paediatric solid tumours of children below 14 years from January 2012 to December 2016 were retrieved and analysed according to age, sex and site. Leukaemias were excluded from our study. All tumours were diagnosed on conventional haematoxylin and eosin-stained sections.

RESULTS

A total of 109 cases of solid paediatric tumours were received during this period. Of the 109 cases, 55 tumours were benign or of intermediate grade (50.45%) and 54 cases (49.54%) were malignant. Of these, a maximum of 30 tumours were of soft tissue tumours (27.52%) followed by

CNS tumours (23 cases, 21.10%), haematopoetic (13, 11.92%) and bone tumours (12 cases, 11%) (Table 1, 2).

Of the 30 soft tissue tumours, 24 tumours (80%) were benign or of intermediate grade. Peripheral sheath tumours were the commonest with 13 cases (43.33%) among the soft tissue tumours followed by fibrous and fibrohistiocytic tumours with 8 cases (26.6%) (Table 3). Among the malignant tumours, rhabdomyosarcoma (Figure 1) was seen in 6 out of the 30 cases (20%) of the soft tissue tumours and were all seen below 9 years with female preponderance with histological variants botryoid, embryonal and alveolar types were seen. Three cases of ganglioneuroma (Figure 2) were seen.

Among the 23 cases of CNS tumours (21.10%), astrocytoma (Figure 3) was commonest with 10 cases (43.47%) and were commonly seen in 5-9 yrs. age group. Medulloblastoma was seen in 9 cases (39.13%) with insignificant male preponderance having a ratio of M:F ratio being 1.3:1. Craniopharyngioma (Figure 4, 5) was seen in 2 cases (8.69%). Bone tumours 12 cases (11%) were mostly benign with a ratio of 5:1 with osteochondroma being the commonest - 6 cases (50%).

Among the malignant bone tumours, osteosarcoma and Ewing's sarcoma (Figure 6) were common. Out of 13 cases of haematopoetic tumours, 10 cases of Non-Hodgkin's Lymphoma (NHL) (76.92%) and three cases of Hodgkin's lymphoma were seen. All NHL tumours observed had affected the nodes and were of high grade. All tumours of Hodgkin's lymphoma occurred in 5-9 years group showing mostly the mixed variant. 7 cases of blastomas also were also observed.

Among the blastomas, nephroblastoma (Figure 7) constituted 57% of the cases, retinoblastoma (28.57%) and hepatoblastoma (14.2%). Miscellaneous tumours constituted 23%, which were varied affecting skin, thyroid, breast, etc. (Table 4).

Among the miscellaneous tumours, teratoma was seen in 10 cases (9.17%) of the total tumours. Germ cell tumours were seen in 11 cases (10.09%). Carcinomas were seen in 5 cases with a case each of squamous cell carcinoma, nasopharyngeal carcinoma, adenocarcinoma of colon, follicular carcinoma of thyroid and papillary carcinoma of thyroid. One case of pilomatricoma was seen (Figure 8). Brain (21 cases - 19.26%) was the commonest organ affected by childhood tumours followed by upper extremity and lymph node. Testis, bladder and nose showed the least incidence (0.91)% (Table 5).

	Type	Number of Cases	Subtotal	Percentage
1.	**Haematopoetic Solid Tumours**		13	11.93
	Hodgkin's	3		
	Non-Hodgkin's	10		
2.	**Blastomas**		7	6.42
	Nephroblastoma	4		
	Hepatoblastoma	1		
	Retinoblastoma	2		
3.	**Soft Tissue Tumour**		30	27.52
	Fibrous tumours			
	Fibroma	2		
	Fibromatosis	2		
	Infantile myofibromatosis	1		
	Fibrous histiocytic tumours			
	Benign fibrous histiocytoma	2		
	Dermatofibrosarcoma protuberans	1		
	Tumours of skeletal muscle			
	Rhabdomyosarcoma	6		
	Tumours of peripheral nerve sheath			
	Neurofibroma	12		
	Schwannoma	1		
	PNET			
	Ganglioneuroma	3		
4.	**Bone Tumours**		12	11.01
	Osteochondroma	6		
	Ossifying fibroma	2		
	Osteoma	2		
	Osteosarcoma	1		
	Ewing's sarcoma	1		
5.	**CNS Tumours**		23	21.10
	Ependymoma	2		
	Medulloblastoma	9		
	Astrocytoma	10		
	Craniopharyngioma	2		

6.	**Others**		24	22.02
	Mature teratoma	10		
	Angular dermoid	2		
	Fibroadenoma	3		
	Follicular carcinoma of thyroid	1		
	Papillary carcinoma of thyroid	1		
	Squamous cell carcinoma	1		
	Nasopharyngeal carcinoma	1		
	Pilomatricoma	1		
	Papillary hidradenoma	1		
	Adenocarcinoma colon	1		
	Mixed germ cell tumour	2		
	Total	**109**	**109**	**100%**

Table 1. Incidence of Paediatric Solid Tumours

	Age Distribution			**Total**	**Sex Distribution**	
	<4 Yrs.	**5-9 Yrs.**	**10-14 Yrs.**		**M**	**F**
Haematopoetic solid tumours	2	7	4	13	7	6
Blastomas	7	0	0	7	4	3
Soft tissue tumour	14	7	9	30	13	17
Bone tumours	1	3	8	12	9	3
CNS tumours	5	13	5	23	13	10
Others	6	3	15	24	11	13
Total	**35**	**33**	**41**	**109**	**57**	**52**

Table 2. Age and Sex Distribution of the Paediatric Solid Tumours

	Age				**Sex**	
	Birth - 4 Yrs.	**5-9 Yrs.**	**10-14 Yrs.**	**Total**	**M**	**F**
Fibrous tumours	5	0	0	5	0	5
Fibrohistiocytic tumours	0	2	1	3	2	3
Skeletal muscle tumours	3	3	0	6	0	6
Tumours of peripheral nerve sheath	5	0	8	13	10	3
Primitive neuroectodermal tumour	3	0	0	3	1	0
Total	**16**	**5**	**9**	**30**	**13**	**17**

Table 3. Age and Sex Distribution of Paediatric Soft Tissue Tumours

	Age				**Sex**	
	Birth - 4 Yrs.	**5-9 Yrs.**	**10-14 Yrs.**	**Total**	**M**	**F**
Mature teratoma	4	3	3	10	5	5
Angular dermoid	0	0	2	2	1	1
Squamous cell carcinoma	0	0	1	1	1	0
Fibroadenoma breast	0	0	3	3	0	3
Nasopharyngeal carcinoma	0	0	1	1	1	0
Pilomatricoma	0	0	1	1	0	1
Follicular CA of thyroid	0	0	1	1	0	1
Papillary CA of thyroid	0	0	1	1	0	1
Papillary hidradenoma	0	0	1	1	0	1
Mixed germ cell tumour	1	0	0	1	1	0
Adenocarcinoma colon	0	0	1	1	1	0
Metastatic tumour lymph node	1	0	0	1	1	0
Total	**6**	**3**	**15**	**24**	**11**	**13**

Table 4. Age and Sex Distribution of Miscellaneous Tumours

Site of Tumours	**Number**	**Percentage**
Upper and lower extremities	18	16.51
Scalp	4	3.67
Eye	8	7.34
Face	8	7.34
Neck	3	2.75
Nose	1	0.92
Abdomen	4	3.67
Retroperitoneum	8	7.34
Brain	21	19.27
Lymph nodes	14	12.84

Trunk and chest wall	8	7.34
Sacrococcyx	3	2.75
Breast	3	2.75
Vagina	2	1.83
Thyroid	2	1.83
Bladder	1	0.92
Testes	1	0.92
Total	**109**	**100**

Table 5. Site Wise Distribution of Various Solid Paediatric Tumours (n=109)

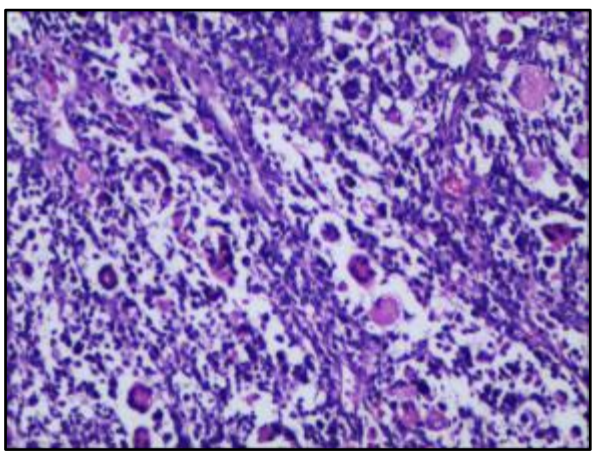

Figure 1. Photomicrograph of Rhabdomyosarcoma Showing Small Round Cells Arranged in Sheets and Tumour Giant Cells (100X H and E)

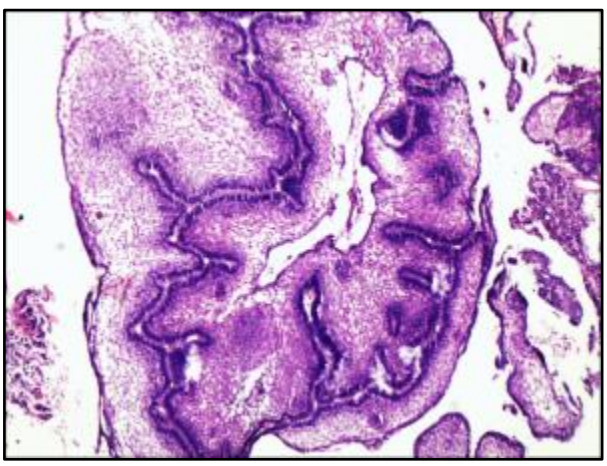

Figure 4. Photomicrograph of Craniopharyngioma Showing Papillary Forms and Sheets of Squamous Cells (40X H and E)

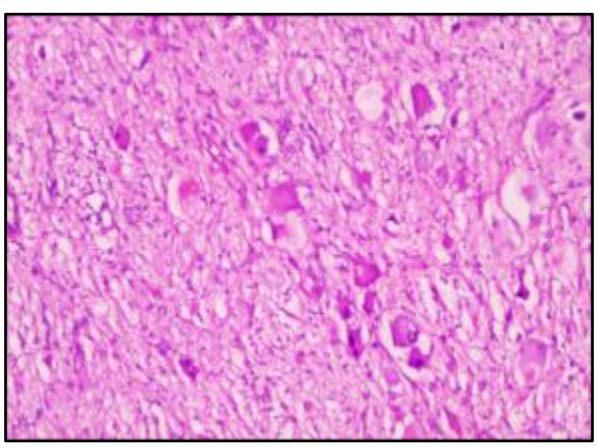

Figure 2. Photomicrograph of Ganglioneuroma Showing Fascicles of Nerve Bundles and Ganglion Cells (H and E 100X)

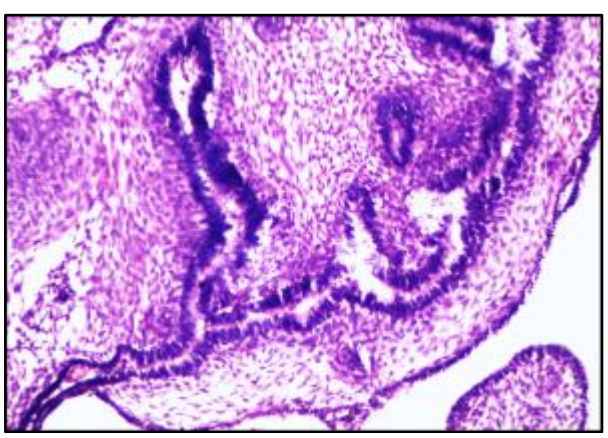

Figure 5. Photomicrograph Showing Craniopharyngioma Composed of Papillary Forms, Sheets of Squamous Cells (100X H and E)

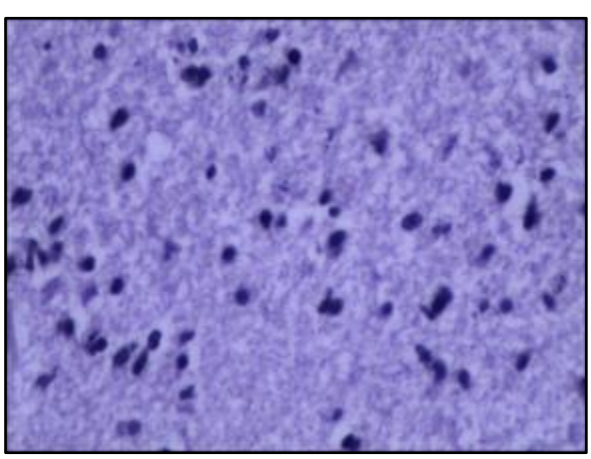

Figure 3. Astrocytoma Showing Pleomorphic Astrocytes Against a Fibrillary Background 100x H and E

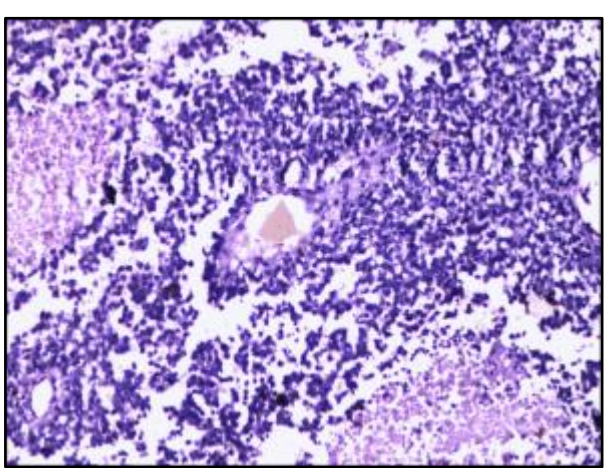

Figure 6. Ewing's Sarcoma Showing Rosettes and Foci of Necrosis 100x H and E

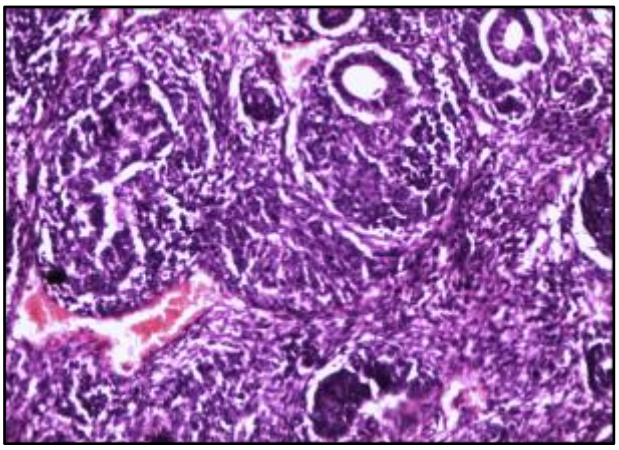

Figure 7. Photomicrograph Showing Wilms Tumour Showing Blastemal, Epithelial and Mesenchymal Components (100X H and E)

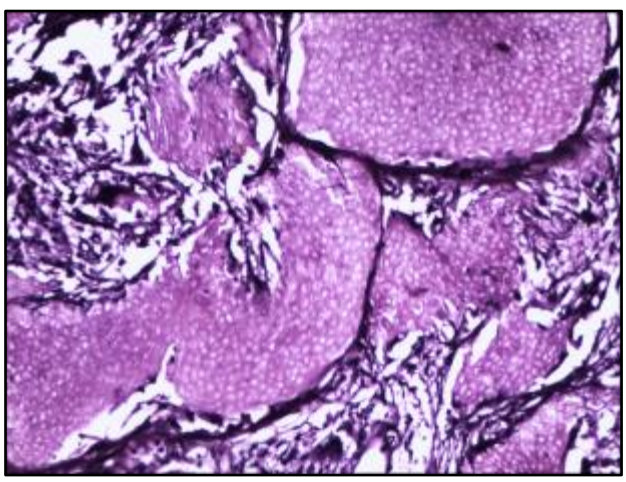

Figure 8. Photomicrograph Showing Ghost Cells in Pilomatricoma (100X H and E)

DISCUSSION

Variation in the incidence of paediatric solid tumours have been seen all across the world. Environmental, cultural, racial and genetic factors have attributed to the prevalence of malignant tumours.[5] Studying the patterns in various geographical areas and in different population may lead to the possible aetiological factors.

Benign tumours are more common than malignant tumours. In our study, malignant tumours accounted for 49% of the total cases differing from the findings that was seen in a study in Zaire where only 39% biopsies in children <15 years of age revealed malignancy.[6] In children, 80% of the tumours arise in haematopoetic elements, nervous tissue, lymph nodes, bones and soft tissue. Significant amount of tumours belong to the small round cell tumour, which include rhabdomyosarcoma, lymphoma, PNET, Ewing's sarcoma and neuroblastoma.

Among the paediatric cases received, soft tissue tumours were the commonest (30 cases, 27.52%). The tumours were commonly seen in females with male-to-female ratio being 1:1.30. The tumours were in higher incidence at five and above years (53.33%), while 46.66% were seen below 4 years.

Peripheral sheath tumours were the commonest with 13 cases (43.33%) among the soft tissue tumours followed by fibrous and fibrohistiocytic tumours with 8 cases (26.6%). A single case of ganglioneuroma was also encountered (Figure 2).

Rhabdomyosarcoma comprises the most common single soft tissue sarcoma among children and adolescents and frequently occurs in the head and neck region.[7] But, this site was not reflected in our study, though it was second commonest soft tissue tumour. The rhabdomyosarcoma in our study showed prevalence of 20% among the soft tissue tumours with 50% of them present in children below 5 years in concurrence with a study of Kachanov DY et al in which rhabdomyosarcoma represented 54.4% of cases.[8] All cases presented in females with sites involved being the vagina (botryoid type), bladder (embryonal type) and lower extremity (alveolar type) (Figure 1).

In the present study of total of 109 cases, 54 cases were malignant. Of these malignant paediatric cases, CNS tumours was the commonest followed by lymphoma unlike the study of Sajid Hussain Shah et al in which lymphoma constituted the largest group. CNS tumours showed a slight male preponderance with significant higher incidence in age group 5-9 years with astrocytoma being the commonest (10 cases, 34.7%) followed by medulloblastoma with 9 cases (30.43%), which was in correlation with Asirvartham JR et al[9] and slightly differed from Nasir S et al.[10] A single case of craniopharyngioma was seen in this study (Figure 4, 5). Astrocytoma and medulloblastoma were the most common CNS tumours (Figure 3). The analysis based on data collected by the Manchester Children's Tumour Registry during 45-years' time period (1954-1998) revealed astrocytoma being the most common among the paediatric CNS tumours.[11]

NHL cases presented with mainly nodal presentation with slightly-reduced male preponderance when compared with Sajid Hussain Shah, Suhail Musaffar et al,[12] which showed extranodal NHL (57%) with higher male preponderance (M:F, 5.8:1). All cases were of high grade similar to this study. Asians have been shown to have lesser incidence of Hodgkin's lymphoma. In our study, Hodgkin's lymphoma constituted 23.07% of the lymphomas and were all seen in girls in the 5-9 years of age in concurrence with Sajid et al.[13]

Among the bone tumours, osteochondroma is the most common benign tumour in children, which was observed in our study (50%) too with male preponderance (5:1), which correlated with this study.[14] Among the bone tumours, osteochondroma was the most common (6 cases) in coherence with Punia R S et al.[15] The others included 2 cases of osteoid osteoma, 2 cases of ossifying fibroma, 1 case each of osteosarcoma and Ewing's sarcoma (Figure 6). Diagnosis of bone tumours require correlation of clinical, radiographic and pathologic findings. The major malignant bone tumours diagnosed were ES/PNET and osteosarcoma, most common in 10-14 years age group, which coincides with Banerjee et al and Eyre et al studies.[16]

Blastomas unique to childhood arising from primitive immature tissue are usually malignant nephroblastoma, retinoblastoma and hepatoblastoma are the commonest.

Our study showed one case of nephroblastoma (57.10%) followed by 2 cases of retinoblastoma (28.57%) (Figure 7).

In our study, one case each of follicular carcinoma of thyroid and papillary carcinoma of thyroid was seen in >9 years age group with both cases occurring in females. The malignant epithelial tumours are uncommon in the paediatric age group among the carcinomas (4.58%). We observed single case of colorectal carcinoma diagnosed as Signet ring cell type, which is rarely seen in children and has very poor prognosis. Pilomatricoma, a neoplasm of hair germ matrix origin is one of the most common cutaneous appendage tumours in patients below 20 years[17] (Figure 8).

The miscellaneous category included mature cystic teratoma (10 cases), angular dermoid (3 cases), 3 case of fibroadenoma in a 13-year-old female, one case each of follicular and papillary carcinoma of thyroid, 1 case each of squamous cell carcinoma, nasopharyngeal carcinoma, adenocarcinoma of colon, mixed germ cell tumour and papillary hidradenoma.

Teratoma in sacrococcyx region is commonest with female ponderance. In the present study, mature teratoma constituted 9.17% of the total paediatric tumours and occurred in sacrococcygeal region. Germ cells tumours arise from cells that develop from within the embryo and are seen in the migratory midline path descending into testis or ovaries and maybe cancerous or noncancerous and make 3% of the childhood tumour. Rarely, extragonadal sites like lower back, chest and head maybe involved due to failure in migration. Among the thyroid cancers, the pattern corresponding to adult is seen.

CONCLUSION

Diagnosis of bone tumours require correlation of clinical, radiographic and pathologic findings. The major bone tumours diagnosed were ES/PNET and osteosarcoma, most common in 10-14 years age group, which coincides with other series.

Compared with other studies, our study has a higher incidence of soft tissue sarcomas. CNS tumours, this could probably be due to regional variation or because of selection bias, our study being a hospital-based study and the number of cases being less compared with other studies.

REFERENCES

[1] Lanier AP, Holck P, Day EG, et al. Childhood cancer among Alaska Natives. Pediatrics 2003;112(5):e396.

[2] Kusumakumary P, Jacob R, Jothirmayi R, et al. Profile of pediatric malignancies: a ten year study. Indian Pediatr 2000;37(11):1234-1238.

[3] Banerjee CK, Walia BNS, Pathak IC. Pattern of neoplasms in children. Indian J Pediatr 1986;53:93-97.

[4] Maitra A. Diseases of infancy and childhood. In: Kumar V, Abbas AK, Fausto N, et al. eds. Robbins and Cotran pathologic basis of disease. 8th edn. Pennsylvania: Saunders 2010:447-483.

[5] Mamatha HS, Kumari BA, Appaji L, et al. Profile of infantile malignancies at tertiary cancer center- a study from south India. J Clin Oncol 2007;25(Suppl 18):20026.

[6] Fischer PR, Ahuka LO, Wood PB, et al. Malignant tumours in children of Northeastern Zaire. A comparison of distribution patterns. Clin Pediatr (Phila) 1990;29(2):95-98.

[7] Parham DM, Ellison DA. Rhabdomyosarcomas in adults and children: an update. Arch Pathol Lab Med 2006;130(10):1454-1465.

[8] Kachanov DY, Dobrenkov KV, Abdullaev RT, et al. Incidence and survival of pediatric soft tissue sarcomas in Moscow region, Russian Federation, 2000-2009. Article ID 350806, Sarcoma 2012;2012: p. 6.

[9] Asirvartham JR, Deepthi AN, Chyne R, et al. Perdiatric tumours of the central nervous system: a retrospective study of 1,043 cases from a tertiary care centre in south India. Childs Nerv Syst 2011;27(8):1257-1263.

[10] Nasir S, Jamila B, Khaleeq S. A retrospective study of primary brain tumours in children under 14 years of age at PIMS, Islamabad. Asian Pac J Cancer Prev 2010;11(5):1225-1227.

[11] McNally RJ, Kelsey AM, Cairns DP, et al. Temporal increases in the incidence of childhood solid tumours seen in Northwest England (1954-1998) are likely to be real. Cancer 2001;92(7):1967-1976.

[12] Shah SH, Pervez S, Hassan SH. Frequency of malignant solid tumours in children. J Pak Med Assoc 2000;50(3):86-88.

[13] Shah SH, Muzzaffar S, Pervez S, et al. Childhood non-Hodgkin's lymphoma: an immunophenotypic analysis. JPMA 2000;50:89-91.

[14] Biermann JS. Common benign lesions of bone in children and adolescents. J Paediatr Orthop 2002;22(2):268-273.

[15] Punia RS, Mundi I, Kundu R, et al. Spectrum of nonhematological pediatric tumours: a clinicopathologic study of 385 cases. Indian Journal of Medical and Paediatric Oncology 2014;35(2):170-174.

[16] Eyre R, Feltbower RG, Mubwandarikwa E, et al. Incidence and survival of childhood bone cancer in northern England and the West Midlands, 1981-2002. Br J Cancer 2009;100(1):188-193.

[17] Demircan M, Balik E. Pilomatricoma in children: a prospective study. Pediatr Dermatol 1997;14(6):430-432.