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Original Research Article

Clinical, cytological and histopathological spectrum of pediatric lesions with emphasis on pediatric tumors

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ABSTRACT

Introduction: To study the clinical, cyto morphological features of all pediatric lesions and categorize them as inflammatory, benign and malignant lesions and to correlate with histopathological diagnosis, wherever possible.
Materials and Methods: All lesions in pediatric age group (0-14years) during a period of three years (2016-18) and total of 369 cases are detected clinically or under radiological guidance were included.
Results: Out of 2911 fine needle aspirations during the study period, 369 were aspirations in children of pediatric age group, constituting 12.67% of all aspirations. Repeat aspirations were done in 4 cases, of which 3 cases were from different organs at same time and in one case 2 aspirations were done in 2 month follow up period. Majority of lesions were inflammatory lesions comprising 74.52% (275) of all lesions, followed by neoplastic lesions (12.19%). Nonspecific inflammatory lesions were more common (63.63%) than specific inflammatory lesions (36.36%). Neoplasms comprised 12.19% (45) cases, and about two third of them were benign lesions (60%). Overall, benign lesions constituted 7.31% of all lesions and malignant lneoplasms 4.87%. Highest incidence was seen in 12th year comprising 15.71% (58 lesions).
Conclusion: FNAC is a rapid, easy, simple, minimally invasive technique well accepted in the adult population and also in pediatric age group. However with diagnostic accuracy of 91.30% in the present study as well as in previous studies, FNAC can be a reliable first line investigation in children. From this study it was clear that there is more widespread utilization of FNAC in children especially in enlarged cervical lymph nodes.

1. Introduction

Although fine needle aspiration cytology (FNAC) is well accepted as a useful technique in the management of adult patients, it is relatively a new technique to pediatric lesions. Until recently the application of FNAC to pediatric population was largely ignored by Indian and American pediatric literature.[1] Previous reports have studied its utility mainly in head and neck lesions,[1] lymphadenopathy,[2] malignant neoplasm[3] or neoplasm of particular organ.[4,5]

There is still reluctance to use FNAC as a diagnostic tool in children due to lack of experience as well as the uncommon nature of most mass lesions encountered in pediatric patients. But FNAC have shown excellent results with sensitivity and specificity approaching up to 93% to 100%.[6] FNAC can be recommended as a first line of investigation in diagnosis of pediatric lesions[1] and also an effective method for evaluation of pediatric patients.[7]

In India FNA in children was started in 1980s. In 1988 Verma K et al[11] studied 1632 FNA material aspirated from children and concluded that accuracy of tumor diagnosis is very high. Except for occasional false negative cases, there were no false positive cases giving 100% specificity.

Fine needle aspiration biopsy has an increasingly important role in expeditious diagnosis of childhood malignancies, similar to its value in work up of mass lesions in adult population. It is also extremely beneficial in work up and diagnosis of benign and malignant abdominal and

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thoracic lesions in pediatric group. Majority of these are small round cell tumors of childhood (SRCT).[5]

Initially FNAC was mainly used by pediatric oncologists in the evaluation of cancer recurrences in patients with already diagnosed malignancy. Now there has been a more widespread shift towards diagnostic modality in general pediatric population and FNAC as first diagnostic modality in work up of mass lesions in children for providing a rapid diagnostic result, thereby aiding in proper triage and management of patients.[12] The advantage attributed to this procedure includes rapid diagnosis,[13] minimal morbidity and mortality, low cost[14] and high accuracy.[15]

2. Objectives of the Study

1. To study the clinical and cytomorphological features of all pediatric lesions and categorize them as inflammatory, benign and malignant lesions.
2. To correlate with histopathological diagnosis, wherever possible.

3. Materials and Methods

All lesions in pediatric age group (0-14years)[16] which are detected clinically or under radiological guidance, over a period of 3 years were studied.

3.1 Methods of collection of data

After thorough clinical examination consent was obtained either from the parents or guardians after explaining the procedure in their vernacular language. Cases were divided clinically into palpable and non palpable masses. Palpable lesions were subjected for direct aspiration and USG guidance in non palpable and deep seated lesions. Puncture site was marked. With aseptic precaution 22-23G needle for superficial lesions and lumbar puncture needle of same thickness for deep seated lesions fitted with 10ml syringe, is introduced immediately under radiological guidance and aspiration was done under negative pressure. Sedation is used whenever necessary. Sample was expelled on slides, air dried and stained with Giemsa or fixed in 95% ethanol and stained with Papanicaloau's stain. Special stains were used wherever required.

3.2 Inclusion criteria

All lesions in pediatric age group i.e. 0-14 years, who presented clinically or found out radiologically and FNACs done are included.

3.3 Exclusion criteria

Age more than 14 years, ulcerated open lesions and leukemia.

3.4 Statistical analysis

Descriptive data was given in the form of range, mean. Appropriate methods were used wherever necessary.

4. Results

The present study comprised of 369 fine needle aspiration cytology smears aspirated from 365 children of age group 1-14years during the period January 2016 to December 2018(3 years). Two aspirations were done in 4 cases, of which 3 cases were from different organs at same time and in one case 2 aspirations were done in 2 month follow up period. Out of 2911 fine needle aspirations during the study period, 369 were aspirations in children of pediatric age group, constituting 12.67% of all aspirations. (Table 1)

All these 369 lesions were identified either by clinically or by imaging method and referred for fine needle aspiration. The data were gathered clinically, radiological findings and cytological interpretation were reviewed from all cases and histological correlation done wherever available and possible.

4.1 Categorizations of Lesions based on FNAC

All the Pediatric lesions were broadly classified as shown in Table 2. The aspirates which could not be interpreted because of less material and any other obscuring factor were classified as unsatisfactory for evaluation.

Majority of lesions were inflammatory lesions comprising 74.52% (275) of all lesions, followed by neoplastic lesions (12.19%). The specific inflammatory lesions include tuberculosis, filarial inflammation, or any fungal infections, Hashimoto's and lymphocytic thyroiditis and sialadenitis. All other lesions were categorized as nonspecific inflammatory lesions which includes various reactive lymph nodes and abscesses. Nonspecific inflammatory lesions were more common (63.63%) than specific inflammatory lesions (36.36%).

Neoplasms comprised 12.19% (45) cases, and about two third of them were benign lesions (60%). Overall, benign lesions constituted 7.31% of all lesions and malignant lesions 4.87%. 'Other' lesions constituted 8.94% (33) cases, which include thyroglossal cyst, colloid cyst, lymphatic cyst including a case of cystic hygroma, hamartoma, epidermal inclusion cyst, adenosis of breast, gynaecomastia etc. which were noninflammatory, nonneoplastic and represents some developmental aberrations or lesions due to hormonal changes. About 4.33% (16) smears were unsatisfactory for evaluation most of which were because of scant or absent material in fine needle aspiration.

4.2 Age

In the present study pediatric age is considered up to 14 years according to Indian standard[16]. The youngest child presented for FNAC was a newborn child (2 Days) with a soft nasal mass, which was an infected lymphatic cyst. Overall, age distribution of pediatric lesions were uniform with a slight increase in number of lesions in school going age (>6years). Highest incidence was seen in 12th year comprising 15.71% (58 lesions). (Table 3)

4.3 Sex

Incidence among male and female were almost equal with a proportion of 52.84% lesions in males and 47.15% lesions in females. Male, female incidence ratio is 1.12:1. (Table 4).

4.4 Location

Most common location of FNAC was head and neck area (Table 5), comprising 77.23% (285) and most common lesion aspirated was lymph node with an incidence of 63.41%(234). Abdominal and pelvic lesions constituted only 3.52% and similarly thorax and chest wall lesions were about 4.87% of all lesions. Most of the lesions in extremities, especially lower limb, yielded scant or absent aspirate making unsatisfactory for evaluation (7 smears out of 18).

Most common organ aspirated was lymph node comprising 72.89% (269) cases followed by bone and soft tissue lesions comprising 11.65% (43) cases. Most of the lesions in lymph node were nonspecific inflammatory lesions (169 cases) followed by specific inflammatory lesions (88 cases).

4.5 Pediatric tumors

A total of 45 neoplastic lesions were seen in the present study group with 27 benign tumors and 18 malignant tumors (Table 6). Most of these tumors were soft tissue origin. Majority of tumors were seen in 10-14years age group comprising 51.11% (23). There was a female preponderance with a Male: Female ratio of 1:1.6.

Benign tumors were fibroadenoma (10 cases), hemangioma (7 cases), benign spindle cell tumors (4 cases) which can not be categorized further on FNAC. A single case of fibromatosis, sacrococcygeal teratoma and pleomorphic adenoma was seen.

A total of 18 malignant tumors were encountered in the study, most of which were intraabdominal (8 cases) and SRCT (10 cases). Majority of the tumors were from renal and adrenal area followed by liver. Only one case of retroperitoneal immature teratoma was seen, which was clinically and radiologically thought as malignant SRCT arising from adrenal. Overall there were 10 cases of malignant SRCT.

4.6 Cyto-Histopathological correlation

Cytological and histological correlation was available in 15 benign lesions and 8 malignant lesions. Out of 23 cases positive correlation was available in 21 cases and 2 cases of false negative cases were seen. (Table 7)

The statistical analysis showed a sensitivity of 80%, specificity of 100%, positive predictive value of 100% and negative predictive value of 86.67%. Overall diagnostic accuracy of FNAC in pediatric age group in the present study comes up to 91.30%.

Table 1: Distribution of pediatric FNAC out of all FNAC

	2016	**2017**	**2018**	**Total**
Total FNACs	738	1092	1081	2911
Pediatric FNACs	83	143	143	369
Percentage	11.25	13.10	13.22	12.67

Table 2: Distribution of lesions

		2016	**2017**	**2018**	**Total**	**%**
	Specific	27	40	33	100(36.36)	27.10
Inflammatory	Nonspecific	30	65	80	175(63.63)	47.42
	Total	**57**	**105**	**113**	**275**	74.52
	Benign	7	11	9	27(60)	7.31
Neoplastic	Malignant	3	8	7	18(40)	4.87
	Total	**10**	**19**	**16**	**45**	12.19
Others		11	13	9	33	8.94
Unsatisfactory		5	6	5	16	4.33
Total		**83**	**143**	**143**	**369**	100

Table 3: Age distribution of pediatric lesions

Age (Years)	Inflammatory		Neoplastic		Others	US*	Total	%
	Specific	Non-Specific	Benign	Malignant				
1	3	10	2	2	2	1	20	5.42
2	5	10	2	1	-	2	20	5.42
3	3	14	2	-	-	2	21	5.69
4	4	9	-	2	2	-	17	4.60
5	10	16	-	3	1	1	31	8.40
6	3	11	1	-	1	1	17	4.60
7	4	16	2	-	-	-	22	5.96
8	5	13	2	-	3	1	24	6.50
9	3	6	2	-	3	1	15	4.06
10	11	19	1	-	4	-	35	9.48
11	7	9	-	-	1	3	20	5.42
12	14	20	5	7	10	2	58	15.71
13	14	9	4	2	5	2	35	9.48
14	15	13	4	1	1	-	34	9.21
Total	101	174	27	18	33	16	369	100
	275		45		33	16		

*Unsatisfactory

Table 4: Sex distribution of lesions

	Inflammatory		Neoplastic		Other	US*	Total	%
	Specific	Non-Specific	Benign	Malignant				
Male	48	103	10	11	13	10	195	52.84
Female	53	71	17	7	20	6	174	47.15
Total	101	174	27	18	33	16	369	100

*Unsatisfactory

Table 5: Site distribution of lesions

Location		Inflammatory		Neoplastic		Other	US*	Total	%
		Specific	Non-Specific	Benign	Malignant				
Head and Neck	Lymph Node	75	148	-	5	4	2	234	63.41
	Salivary Glands	9	-	1	-	1	-	11	2.98
	Thyroid	4	-	3	-	13	-	20	5.42
	Bone & Soft tissue	-	2	7	1	7	3	20	5.42
	Total	**88**	**150**	**11**	**6**	**25**	**5**	**285**	**77.23**
Axilla	Axillary LN	7	12	-	-	1	-	20	5.42
Thorax & Chest wall	Lung	-	-	-	-	-	1	1	0.27
	Chest Wall	-	1	1	-	-	2	4	1.08
	Breast	-	-	10	-	3	-	13	3.52
	Total	**-**	**1**	**11**	**-**	**3**	**3**	**18**	**4.87**
Abdomen and Pelvis	Liver	-	-	-	3	-	-	3	0.81
	Kidney	-	1	-	2	-	-	3	0.81

	Adrenal	-	-	-	2	-	-	2	0.54
	Spleen	-	-	-	-	-	1	1	0.27
	Bone & Soft tissue	-	-	2	2	-	-	4	1.08
	Total	**-**	**1**	**2**	**9**	**-**	**1**	**13**	**3.52**
Inguinal	Inguinal LN	6	9	-	-	-	-	15	4.06
Extremities	Upper Limb	-	1	3	1	1	1	7	1.89
	Lower Limb	-	-	-	2	3	6	11	2.98
Total		**101**	**174**	**27**	**18**	**33**	**16**	**369**	**100**

*Unsatisfactory

Table 6: Distribution of Pediatric tumors

Location		**Tumor**	**Infants & Toddlers**		**Pre-School age**		**School going age**				**Total**	
			0-3 yrs		4-6 yrs		7-10 yrs		11-14 yrs			
			♂	♀	♂	♀	♂	♀	♂	♀		
Benign	Soft Tissue	Hemangioma	1	1	-	-	1	-	1	3	7	24
		Spindle Cell Tumor	1	1	-	-	1	-	1	-	4	
		Fibromatosis	-	-	-	-	-	-	-	1	1	
		Teratoma	-	-	-	1	-	-	-	-	1	
	Parotid Gland	Pleomorphic adenoma	-	-	-	-	-	1	-	-	1	
	Breast	Fibroadenoma	-	-	-	-	-	3	-	7	10	
Malig-nant	Adrenal	Neuroblastoma*	-	-	-	-	-	-	1	-	1	18
		Ganglioneuroblastoma	-	-	-	1	-	-	-	-	1	
	Kidney	Nephroblastoma*	-	1	-	1	-	-	-	-	2	
	Liver	Hepatoblastoma*	-	-	1	-	-	-	1	-	2	
		Hepatocellular carcinoma	-	-	-	-	-	-	1	-	1	
	Lymph Node	Lymphoblastic Lymphoma* (HL, NHL)	-	-	1	-	-	-	3	1	5	
	Bone And Soft Tissue	Osteosarcoma	-	-	-	-	-	-	1	-	1	
		Ewings sarcoma*	-	-	-	-	-	-	-	1	1	
		Embryonal RMS*	-	1	-	1	-	-	-	-	2	
		Pleomorphic sarcoma	-	-	-	-	-	-	1	-	1	
		Immature teratoma	1	-	-	-	-	-	-	-	1	
Total			3	4	2	4	2	4	10	13	42	

*Small round cell tumors of childhood

Table 7: Cyto-Histopathological Correlation (N=21)

Organ	FNAC	HP	Correlation*	Type of Correlation
	Reactive lymph node	Reactive Hyperplasia	Y	True Negative
	LN-TB3	Tubercular LN	Y	True Negative
	LN-TB3	Tubercular LN	Y	True Negative
	LN-TB3	Tubercular LN	Y	True Negative
Lymph node	LN-TB2	Tubercular LN	Y	True Negative
	Lymphatic cyst	Cystic Hygroma	Y	True Negative
	Acute lymphadenitis	Filarial Lymphadenitis	Y	True Negative
	Abscess	Tubercular LN	Y	True Negative
	Acute Lymphadenitis	Tubercular LN	Y	True Negative
Breast	Fibroadenoma	Fibroadenoma	Y	True Negative
	Malignant SRCT	Immature Teratoma (Grade I)	Y	True Positive
Retroperitoneum	Ganglioneuroblastoma	Ganglioneuroblastoma	Y	True Positive
	Neuroblastoma	Neuroblastoma	Y	True Positive
	Nephroblastoma	Nephroblastoma	Y	True Positive
Kidney	Abscess	Pyonephrosis	Y	True Negative
	Nephroblastoma	Nephroblastoma	Y	True Positive
	Ganglion	Embryonal RMS	N	False negative
	Benign spindle cell tumor	Embryonal RMS	N	False negative
Soft Tissue	Acellular	Hamartoma	Y	True Negative
	Acellular	Nonspecific Fibrosis	Y	True Negative
	Abscess	Necrotic Debris	Y	True Negative

*Y-Yes, N-No

Table 8: Comparative analysis of organ distribution*

	Suzzane et al[8] 1984	Wakely et al[17] 1988	Gamba et al[4] 1995	Friere et al[75] 2008	Maheshwari et al[7]** 2008	Bhat B[26] 2008	Hasan et al 2013[24]	Mittra et al 2013[23]	Komal et al[25]2018	Present study 2018
Total cases	64	112	111	50	558	297	1337	100	312	369
Lymph nodes	9 (14.06)	44 (39.29)	54 (48.65)	25 (50)	52 (9.32)	204 (68.69)	594 (44.42)	81 (81)	312 (100)	269 (72.89)
Salivary Glands	-	5 (4.46)	2 (1.80)		11 (1.97)	10 (3.37)	-	1 (1)	-	11 (2.98)
Thyroid	-	12 (10.71)	3 (2.70)		-	17 (5.72)	8 (0.59)	4 (4)	-	20 (5.42)
Other head and neck	-	2 (1.79)	21 (18.92)		-	-	12 (0.89)	2 (2)	-	-
Breast	3 (4.69)	2 (1.79)	2 (1.80)	-	23 (4.12)	13 (4.38)	3 (0.22)	-	-	13 (3.52)
Intra thoracic organs	16 (25.00)	8 (7.14)	-	-	-	1 (0.34)	-	-	-	1 (0.27)
Chest wall		-	3 (2.70)	-	-	-	-	-	-	-
Liver	20 (31.25)	5 (4.46)	7 (6.31)	14 (28)	41 (7.35)	3 (1.01)	-	-	-	3 (0.81)
Kidney						3 (1.01)	10 (0.74)	-	-	3 (0.81)
Adrenal						2 (0.67)	17 (1.27)	-	-	2 (0.54)
Spleen						1 (0.34)	-	-	-	1 (0.27)
Bone and Soft Tissue	8 (12.50)	34 (30.36)	-	-	350 (62.72)	40 (13.46)	148 (11.06)	5 (5)	-	43 (11.65)
Miscellaneous	10 (15.63)	-	19 (17.12)	11 (22)	81 (14.52)	3 (1.01)	545 (40.76)	7 (7)	-	3 (0.81)

*Number in the bracket indicates percentage. **Study included only pediatric tumors.

Table 9: Comparative analysis of benign pediatric tumors

		Suzzane et al[8] 1984	Wakely et al[17] 1988	Maheshwari et al[7] 2008	Bhat B[26] 2008	Mittra et al[23] 2013	Hasan et al[24] 2013	Present study 2018
Total cases		57	112	342	297	100	1337	369
Benign cases		4	16	171	24	3	61	27
Breast	Fibroadenoma	1	1	20	10	-	-	10
Salivary gland	Pleomorphic adenoma	-	2	9	1	1	-	1
Soft Tissue	Vascular	1	2	36	7	2	31	8
	Fibrous	-	4	20	1	-	-	1
	Muscle	-	-	2	-	-	-	-
	Adipose tissue	-	1	35	-	-	30	-
	Nerve sheath	-	1	25	-	-	-	-
	Other	1	2	-	4	-	-	6
Bone	Giant cell tumor	-	1	10	-	-	-	-
	Chondroma	-	1	4	-	-	-	-
	Osteochondroma	-	-	10	-	-	-	-
Miscellaneous	Craniopharyngioma	-	1	-	-	-	-	-
	Ganglioneuroma	1	-	-	-	-	-	-
	Sacrococcygeal Teratoma	-	-	-	1	-	-	1
	Other	-	-	25	-	-	-	3

Table 10: Comparative analysis of malignant tumors

		Suzzane et al[8] 1984	Wakely et al[17] 1988	Gamba P.G et al[4] 1995	Maheshwari et al[7] 2008	Bhat B[26] 2008	Mittra et al[23] 2013	Hasan et al[24] 2013	Komal et al[25] 2018	Present study 2018
Total cases		57	112	111	342	297	100	1337	312	369
Malignant cases		19	39	8	146	15	10	199	06	18
Hematolymphoid	NHL	4	6	3	22	2	2	69	02	3
	HL		4		30	-	3	64	04	2
	Leukemic infiltrates	0	5	-	-	-	1	-	-	-
Kidney	Nephroblastoma	3	1	-	26	2	-	10	-	2
Adrenal	Neuroblastoma	4	3	-	9	1	-	17	-	1
	Ganglio neuroblastoma	-	-	-	-	1	-	-	-	1
Retro-peritoneal		-	-	-	1	-	-	-	-	-
Liver	Hepatoblastoma	-	-	-	-	2	-	-	-	2
	Hepatocellular carcinoma	-	-	-	-	1	-	-	-	1
Soft tissue	Vascular	-	-	-	4	-	-	-	-	-
	Fibrous	-	-	-		-	-	-	-	-
	RMS	2	-	4	3	2	1	12	-	2
	Adipose tissue	-	-	-	2	-	-	-	-	-
	Nerve sheath	-	-	-	-	-	-	-	-	-
	Sarcoma	1	3	-	3	1	-	-	-	1
Bone	Osteosarcoma	0	4	-	22	1	-	-	-	1
	Ewings Sarcoma	1	1	-	9	1	-	-	-	1
SRCT Unclassified		1	4	-	12	-	1	25	-	-
Other	Germ cell tumor	-	12	1	1	1	-	2	-	1
	LCH	-	-	-	02	-	1	-	-	-
Papillarythyroid ca		-	-	-	-	-	1	-	-	-

5. Discussion

Fine Needle Aspiration is a relatively cheap, easy, rapid, OPD based, diagnostic method with minimal intervention in the assessment of mass lesion including lesions in pediatric age group.[4]

Mass lesion in children can be of inflammatory cause like tubercular or reactive hyperplasia of lymph nodes, developmental errors like lymphatic cyst, hamartoma or neoplasia, both benign and malignant.[17]

Malignancy or any tumor in pediatric age is a great concern as well as a financial burden for parents. To the child it is a great physical injury, or it can be a cause of death. Although malignancies are more common in adults, it is one of the killers in children. In developed countries cancer is next only to trauma as a cause of mortality in children under 15 year of age. However in developing countries like India, infectious and nutritional causes are major cause of morbidity and mortality.[16]

So FNAC can act as first line investigation in children to triage the mass lesions into inflammatory, neoplastic or any other lesions. Based on cytomorphological features patients can be treated or further investigations can be sought.

In the present study most common location was head and neck area comprising 77.23%, this is in accordance with previous studies like Wakely P.E. et al,[18] Gamba P.G. et al,[4] Bhatt B[26] and Freire et al.[19] The most common organ aspirated in the present study is lymph nodes constituting 72.89% of all cases. This is in accordance with previous studies done by Wakely et al[18] (39.29%) and Gamba P.G. et al[4] (48.65). (Table 8)

There are discrepancies in the study done by Suzzane et al[4] and Maheshwari et al[7] as Suzzane et al[4] reports most common location as intraabdominal lesions (31%) followed by intrathoracic lesions (25%). This is because in olden days FNAC was specifically used for tumorous lesions and in pneumonia rather than use of FNAC in all mass lesions. Maheshwari V et al[7] reports, most common organ involved in pediatric age as bone and soft tissue lesions (62.72%). This is because study included only tumor lesions and not inflammatory lesions.

Hence mass lesions in head and neck area especially of cervical lymph nodes, are most common presentations in pediatric age group which are the area of concern for parents. In this regard, FNAC is a valuable tool to segregate inflammatory lesions from rare neoplastic lesions which are common in soft tissues.

In the present study the proportion of benign tumors is 7.31% (27) of all cases and 60% of all neoplastic pediatric tumors. Majority of the cases are soft tissue tumors (12) followed by fibroadenoma (10) and a case of pleomorphic adenoma of parotid. It was similar to other studies conducted by Maheshwari et al[7], Wakely P. E et al[18], Bhatt B[26] and Suzzane et al[8]. (Table 9)

Even though cytological similarities are present in various malignant childhood tumors, the therapy and prognosis markedly differ and some of them can be cured completely.[20] This necessitates the need to diagnose accurately on FNAC. One can take the help of clinical, radiological data like age, site, radiographic appearance and laboratory data to arrive at correct diagnosis.[21] Also if facilities are available, electron microscopy, immunohistochemistry, cytogenetic and molecular analysis are useful in the diagnosis of childhood tumors especially different types of "blastomas".

In this study proportion of malignant tumor is 4.87% of all cases and 40% of all pediatric tumors. This is similar to the results of Gamba P.G[4], Bhat B[26] and Komal S et al.[25] However Suzzane et al,[8] Wakely et al[18] and Maheshwari V et al[7] reports a higher incidence of malignant tumors in their studies. (Table 10)

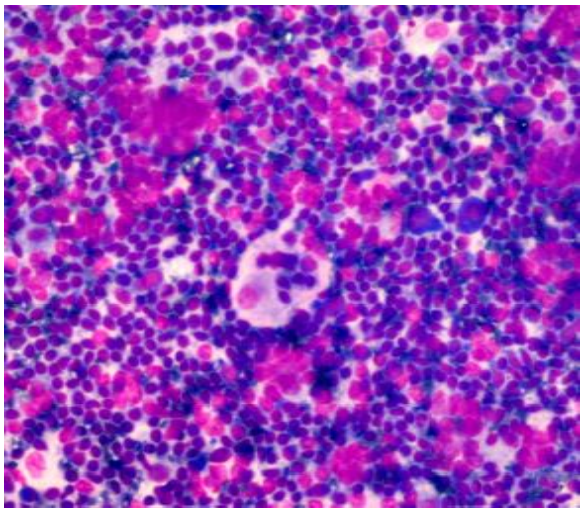

Fig. 1: Reactive Lymph node Mixed Population of small lymphocytes, large lymphocytes, immunoblasts and tingible body macrophage. (Giemsa x LP)

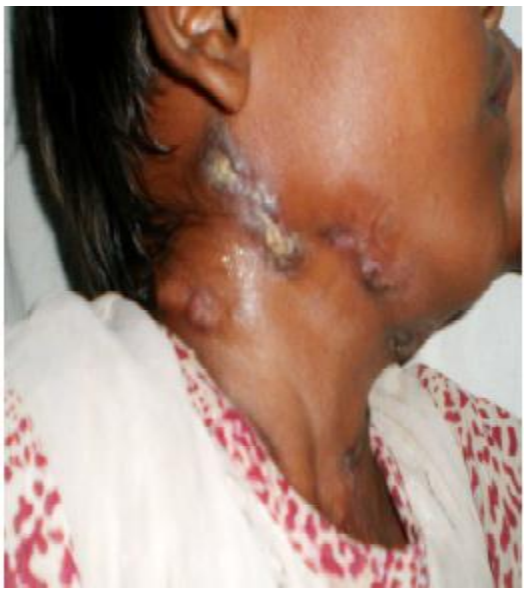

Fig. 2: Tubercular Lymphadenitis Cold abscess involving lymph nodes around the neck. (ZN stain: AFB Positive)

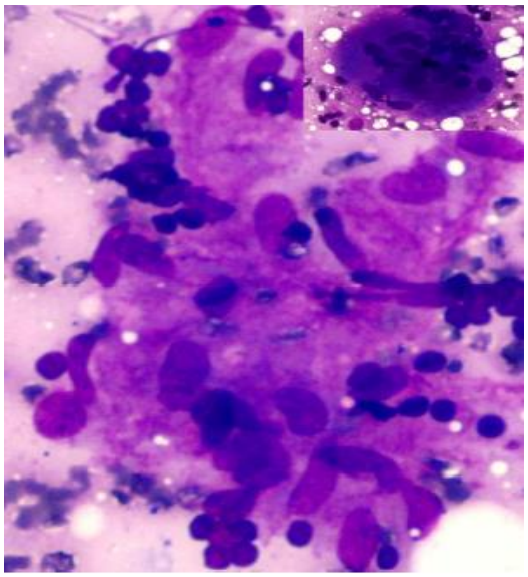

Fig. 3: FNAC: Tubercular Lymphadenitis. Epithelioid Granuloma. Inset. Langhan's type of Giant cell (Giemsa x HP)

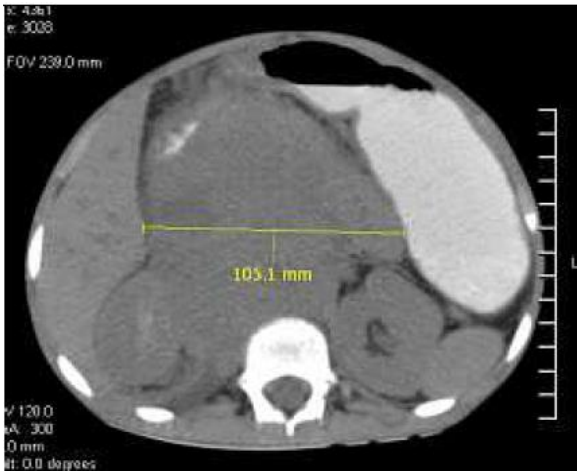

Fig. 4: Hepatoblastoma. CT image show large mass in liver

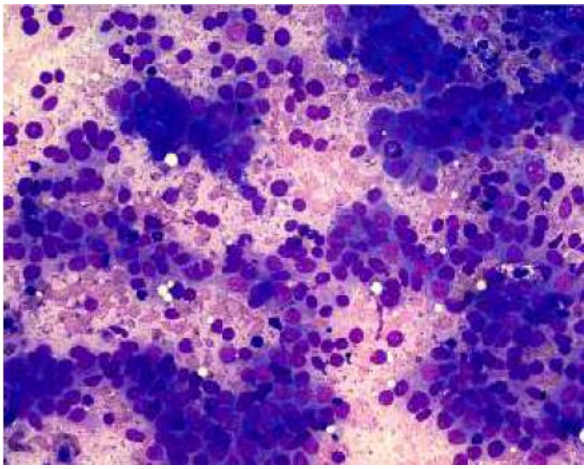

Fig. 5: Hepatoblastoma: Sheets, cords and trabeculae of round cells with embryonal and fetal type hepatocytes. (Geimsa x HP)

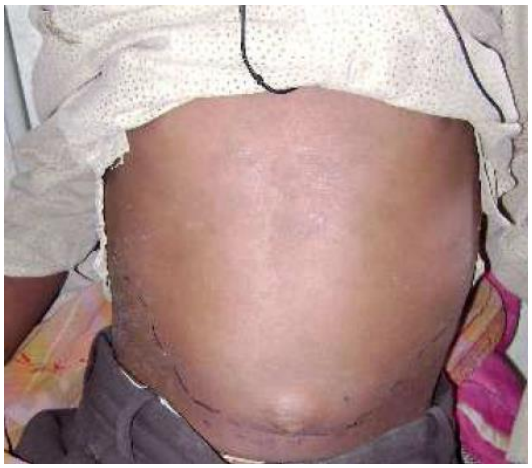

Fig. 6: Hepatocellular carcinoma. Massively enlarged liver with protuberant abdomen

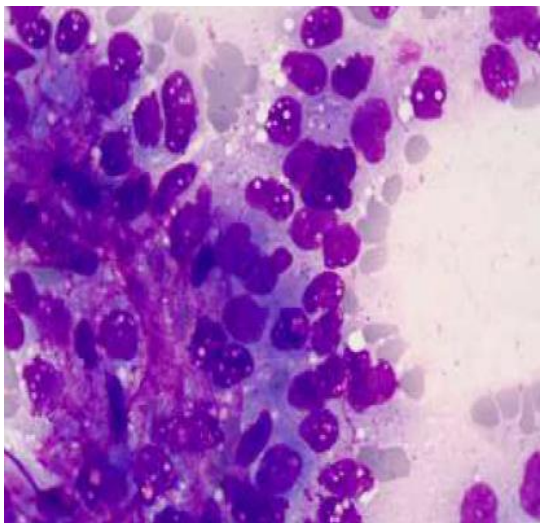

Fig. 7: Hepatocellular carcinoma: Malignant Hepatocytes with prominent nuclear pleomorphism and intranuclear inclusions. (Giemsa x HP)

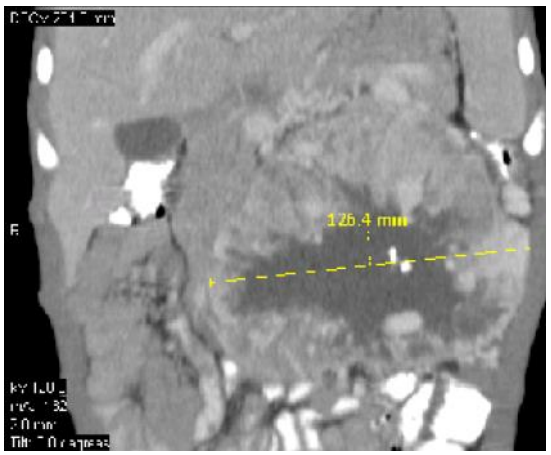

Fig. 8: Neuroblastoma: CT image showing large retroperitoneal mass with focal calcification at the centre.

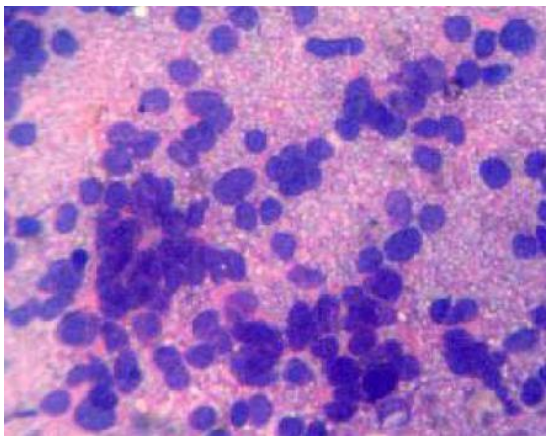

Fig. 9: Neuroblastoma Highly cellular smear showing singly scattered round cells with high N/C ratio, fine granular chromatin and inconspicuous nucleoli with occasional rosette formation (Pap x HP)

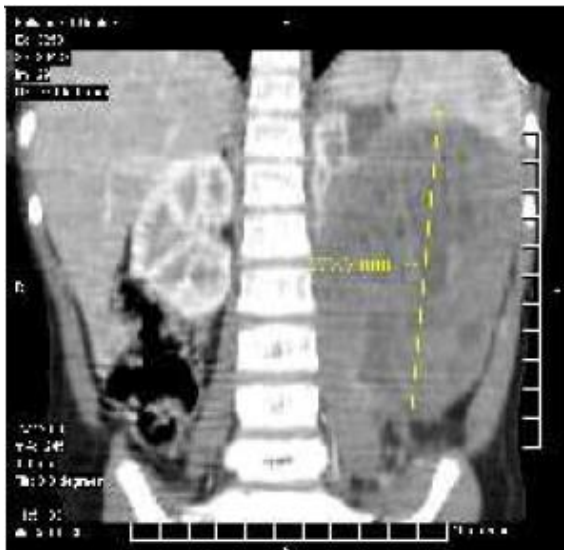

Fig 10: Nephroblastoma. CT Scan: Large homogenous left sided renal mass with right side normal kidney

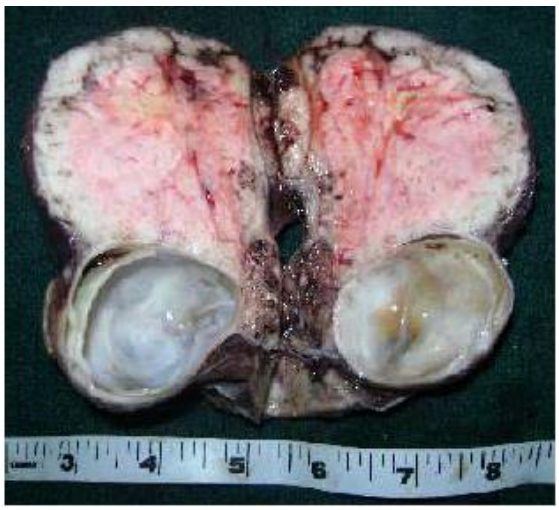

Fig. 11: Gross: Nephroblastoma. C/s: Large homogenous fleshy mass with a cystic change

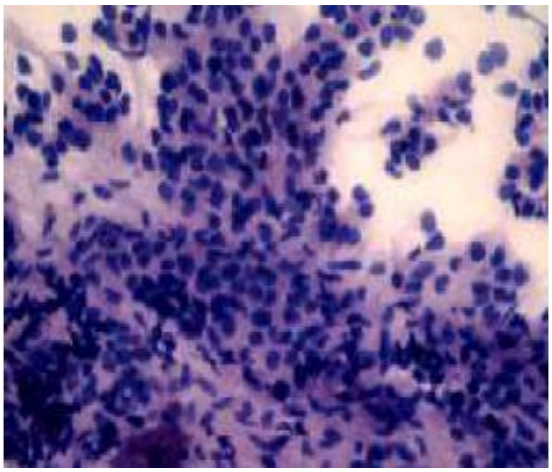

Fig. 12: Nephroblastoma closely embedded plump spindle shaped mesenchymal cells and blastemal small round cells. (Pap x HP)

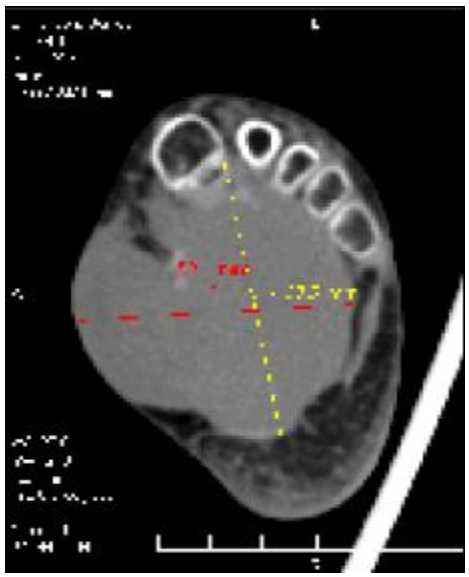

Fig. 13: Embryonal RMS. CT image show large homogeneous soft tissue mass involving whole plantar area

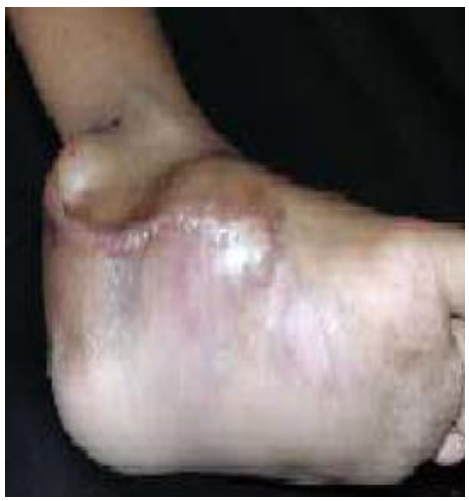

Fig. 14: Embryonal RMS Diffuse mass over medial and plantar aspect of foot with previous biopsy surgical scar over the skin

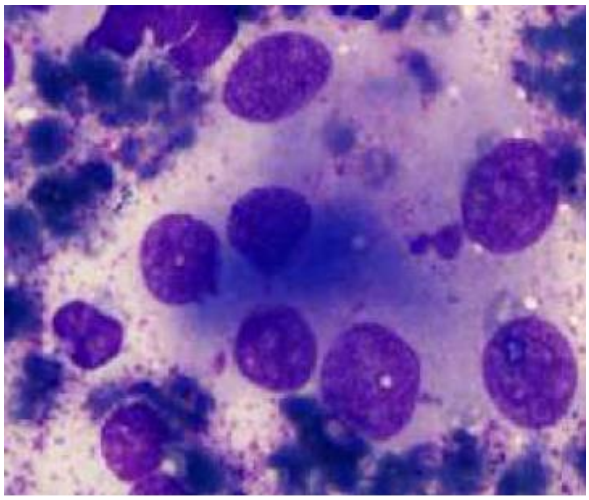

Fig. 15: Embryonal RMS Malignant Small round cells with a rhabdomyoblast showing gray blue cytoplasm and eccentric nucleus(Giemsa x HP)

5.1 Intra-abdominal tumors

Majority of the malignant tumors were from intra abdominal location. Only one case of pyonephrosis was nonneoplastic lesion. The intra abdominal tumors comprise 19.35% of all pediatric tumors and 57% of all malignant tumors. Vishwanathan et al[22] studied specifically intra abdominal tumors and malignant small round cell tumors were most common in his study. Similar result was seen in the present study with 5 out of 8 cases were SRCTs.

Pediatric Intra abdominal lesions pose a specific challenge especially in developing country where patients present with advanced disease stage. With the treatment protocols being available for each pediatric tumor entity, it is imperative for pathologist to give a rapid, accurate and specific diagnosis. FNAC is ideal and increasingly being used for abdominal lesions. If interpreted with key clinical features and radiology, its utility can be remarkably enhanced to give a clinically meaningful diagnosis.[22]

FNAC can provide a rapid diagnosis with easy access and minimum discomfort to patient, which obviates the need for more time consuming biopsy procedure. Even though FNA has its own limitations, like many a times, it is possible to diagnose as at least small round cell tumor. However differential diagnosis can be narrowed with clinical and radiological correlations. Also FNAC avoids biopsy in nephroblastomas with stage II or less, where biopsy is contraindicated.[21]

5.2 Renal and Adrenal Tumors

This is the most commonly seen pediatric abdominal tumor entity on FNAC. The close differential diagnosis is neuroblastoma and nephroblastoma, diagnosis is important as chemotherapy protocols are different. FNAC is done either to confirm radiologically diagnosed cases or when there is a radiological dilemma especially when the lesion is in upper pole of kidney.[20]

There were 2 false negative cases; both of them were embryonal rhabdomyosarcoma. In case of immature teratoma, even though on FNAC it was reported as malignant small round cell tumor, it was considered true positive as immature teratoma is a potentially malignant lesion. The reason for high rate of false negative cases on FNAC in embryonal rhabdomyosarcoma could be because, FNAC showed mainly myxoid matrix with loose cells and spindle cells with bland chromatin without any evidence of mitosis.

However overall diagnostic accuracy in the present study was 91.30% which indicates FNAC can be used as a first line investigation for mass lesions in pediatric age and high rate of specificity makes clinicians to rely on FANC diagnosis and subsequent treatment.

6. Conclusion

FNAC is a rapid, easy, simple, minimally invasive technique well accepted in the adult population and also in pediatric age group. However with diagnostic accuracy of 91.30% in the present study as well as in some few previous studies, FNAC can be a reliable first line investigation in children. From this study it was clear that there is more widespread utilization of FNAC in children especially in enlarged cervical lymph nodes. Most of them were reactive lymph nodes which does not need further investigation. It is also useful and best screening method in the diagnosis of tubercular lymph nodes. Even though common childhood tumors share common cytological features, with the help of clinical and radiological features, the diagnosis can be narrowed down to particular type. Overall FNAC in pediatric age group is as useful as in general population and greatest utility is seen in enlarged cervical lymph nodes.

7. Source of funding

None.

8. Conflict of interest

None.

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