

# Fine Needle Aspiration Cytology in Splenomegaly

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A prospective study of Splenic Fine Needle Aspiration Cytology on 31 splenomegalic patients was carried out. Quite cellular aspirates were obtained from all cases. The cases were divided into reactive hyperplasia, granulomatous inflammation, parasitic infestation, extramedullary erythropoiesis, lipid storage disease, haemophagocytic syndrome and neoplastic disorders. Splenic Fine Needle Aspiration Cytology was found quite useful in diagnosis of both neoplastic and non-neoplastic diseases. In 42 % cases, it provided the first and the specific diagnosis, in 35% cases it confirmed the splenic involvement in already diagnosed systemic disease and in the rest 23% cases it ruled out splenic involvement in the systemic diseases. The splenic Fine Needle Aspiration Cytology is a safe, simple, quick, inexpensive and highly valuable diagnostic procedure as a primary investigation in splenomegaly.

**Key words:** Fine Needle Aspiration Cytology (FNAC), Splenic Fine Needle Aspiration Cytology (sFNAC), Splenomegaly.

## Introduction

The Fine Needle Aspiration Cytology (FNAC) has become quiet popular diagnostic modality nowadays. Its great advantages of being easy, simple, inexpensive, rapid and amenable to repeat procedures without significant complications have made it a first and the foremost outpatient procedure in evaluation of masses worldwide. It has distinct advantages over open and true cut or core biopsy (CB), because it does not require any special instruments and gives rapid and reliable results without incurring any significant trauma and cost.<sup>1</sup> FNAC, when practiced in a multidisciplinary setting, with involvement of pathologist, radiologist and clinicians, is an extremely accurate test.<sup>2</sup>

In addition to masses, FNAC is of great benefit in some visceromegalies e.g., lymph nodes, liver and spleen. The spleen has been relatively rarely targeted for FNAC although in many cases of splenomegaly a tissue diagnosis is highly desirable. History and clinical examination along with laboratory and

radiological tests provide tentative diagnosis in most cases of splenomegaly. The useful laboratory tests include complete blood count (CBC), bone marrow examination and Polymerase Chain Reaction (PCR).<sup>3</sup> The helpful radiological examinations include ultrasound, CT scan,<sup>4,7</sup> scintigraphy,<sup>8</sup> and Magnetic Resonance Imaging (MRI).<sup>9, 10</sup> However, these modalities usually narrow down the differential diagnosis and rarely provide a definite diagnosis. Tissue sample in the form of an aspirate or a biopsy is required to clinch a specific diagnosis.<sup>4</sup> Material for splenic tissue diagnosis is obtained through splenectomy specimen, core biopsy (CB) or splenic FNAC (sFNAC). Although complete spleen specimen has a high diagnostic yield,<sup>11</sup> it is a poor way of obtaining diagnostic material as spleen is not a vestigial organ. Absence of spleen predisposes individuals to overwhelming postsplenectomy infection (OPSI), the risk being 35 times greater than the general population.<sup>12</sup> Splenectomy has therefore gone out of fashion over the years in order to preserve immunocompetence and other important functions of the spleen.<sup>13, 14</sup>

Tissue-core biopsy is another mean of obtaining material for diagnosis. Studies on ultrasound guided (UG)-CB, have found it effective and safe procedure in abdominal lymphomas.<sup>15</sup>

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However, the core biopsies as compared to FNAC, in richly vascular organs have understandably higher risk of pre and postoperative haemorrhage and other trauma related complications.

Interestingly the spleen had been punctured even in the ancient times for diagnosis of malaria. An enlarged spleen is an easy target for FNAC. Thus if we want to preserve spleen for all good reasons and avoid unnecessary trauma, sFNAC becomes the logical choice in almost all splenomegaly patients where a definite cause for splenomegaly needs to be established.

There are myriad causes of splenomegaly including various infections, metabolic disorders, circulatory derangements, immunological disarrays, haematopoietic cells abnormalities and neoplastic processes.<sup>16</sup> The infectious disorders include viral, bacterial, fungal and parasitic diseases. Tuberculosis, leishmaniasis and malaria are quiet frequent causes of splenomegaly in many developing countries. Gaucher's disease and Niemann-Pick are important storage causes. Variety of hemolytic anaemias also frequently cause splenomegaly. Cirrhosis and portal hypertension are responsible for congestive splenomegaly. Felty's syndrome and haemophagocytic syndrome (HPS) may also cause splenomegaly. Lymphomas, leukaemias and metastatic tumours are responsible for significant number of splenomegalies.

In this study we have evaluated the feasibility, diagnostic accuracy and pitfalls of FNAC as a primary investigation in splenomegaly.

## Patients and Methods

We performed and evaluated 32 sFNAC on 31 splenomegaly patients at Pakistan Institute of Medical Sciences, Islamabad from February 2001 to June 2002.

Before sFNAC, history was taken and physical examination of the patient was performed. The procedure was explained to the patient and a performa prepared for the study was filled out. Coagulation profile of the patient was checked. Our prerequisite for the patient selection was normal coagulation profile and the platelet count higher than  $50 \times 10^9/l$ . as opposed to Lishner et al who required the platelet count higher than  $100 \times 10^9/l$ .<sup>17</sup> When

platelet count was less than 50, platelets were transfused with platelets concentrates. In two pediatric cases, we performed sFNAC on platelet counts of  $27 \times 10^9/l$  &  $30 \times 10^9/l$ , under the supervision of a pediatrician and the patients were kept under close follow-up for few hours. No complications were seen in any of our cases.

The aspiration sites after palpation were marked and skin was cleansed with alcohol. Three separate samples were obtained from different sites. We inserted a 23 gauge fine needle perpendicularly in a quick stab like fashion in and out manner without moving needle laterally. The entire procedure for each prick did not exceed more than three seconds. The needle was then attached to 20 ml air filled syringe. The material was immediately smeared on clean glass slides. Wet fixation was done in 95% ethanol, for staining with haematoxyline and eosin.

The cytology slides were examined under microscope and diagnoses were correlated with other clinicopathological findings in these patients. The results were statistically analyzed.

## Results

The age and sex distribution of the patients is given in Table 1.

Age groups (years)	Number of cases	Males	Females
0-01	10	7	3
01-06	10	7	3
06-12	5	5	-
12-20	1	1	-
20-30	2	1	1
30-40	1	1	-
40-50	1	1	-
50-60	-	-	-

>60	1	-	1
Total:	31	23	8

The presenting signs and symptoms of the patients included abdominal distension, prolonged fever, pallor, generalized weakness, headache, breathing difficulty, constipation, ear discharge, pruritis, and loss of consciousness (Table 2). Median splenic size was 7 centimeters below costal margin. We grouped splenic enlargement into: slight (just palpable or about 5 cm.) - (7 cases), moderate (to umbilicus) - (12 cases), and marked (below umbilicus) - (12 cases).<sup>18</sup>

Signs	Number of cases	Percentage
Splenomegaly	31	100
◆ Slight enlargement	(7)	(22.6)
◆ Moderate enlargement	(12)	(38.7)
◆ Marked enlargement	(12)	(38.7)
Pallor	31	100
◆ Hemoglobin > 9 gm/dl	(10)	(32.2)
◆ Hemoglobin 6-9 gm/dl	(15)	(48.4)
◆ Hemoglobin < 6 gm/dl	(06)	(19.4)
Hepatomegaly	27	87.1
Fever	16	51.6
Lymphadenopathy	07	22.6
◆ Single group	(1)	(3.2)
◆ Generalized	(6)	(19.4)
Jaundice	04	12.9
Petechial rashes	03	9.7

**Diagnoses:** The break down of various diagnoses is given in Table 3.

The cytological findings of each case were analyzed and correlated with other clinicopathological

findings.

**Reactive Hyperplasia:** It constituted heterogeneous proliferation of lymphoid cells with variable maturation (Figure 1). There were scattered histiocytes, variable number of endothelial cells and neutrophils. Groups or sheets of mesothelial cells from splenic capsule were also occasionally present.

**Granulomatous Inflammation:** In this group, we observed granulomas formed by epithelioid cells along with lymphoid cells. The epithelioid cells were cigar-shaped containing faintly stained nuclei with even distribution of chromatin. The caseous material in the background when present was quite suggestive of tuberculosis (Figure 2).

Groups of disorder	Number of cases (percentage)
1 Reactive hyperplasia	7 (22.5)
2 Granulomatous inflammation	1 (3.2)
3 Parasitic Infestation	3 (9.7)
4 Extramedullary erythropoiesis	8 (25.8)
5 Lipid storage disease	3 (9.7)
6 Haemophagocytic syndrome	2 (6.4)
7 Neoplastic disorders	7 (22.5)
Total	31 (100)

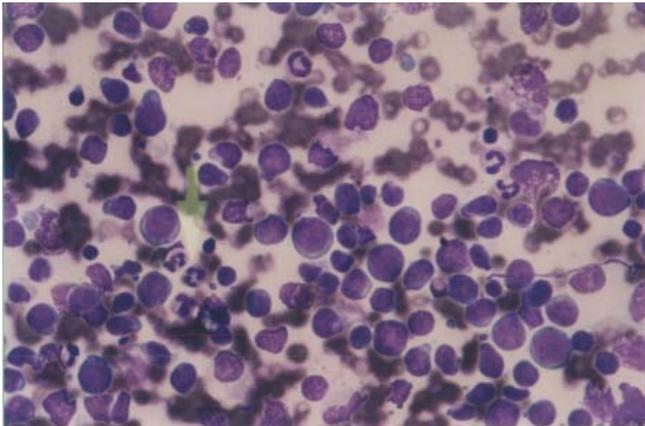
**Parasitic Splenomegaly:** Aspirates from liver and spleen in leishmaniasis showed macrophages loaded with *Leishmania donovani* (LD) bodies (Figure 3). Diagnosis of malaria was given on finding dark brown pigment compatible with malarial pigment and fragmented schizonts in the smears.

All the three patients were under 2 years of age with main clinical suspicion of storage disorder. Two of them revealed Visceral Leishmaniasis, and one case was compatible with malarial parasitic infection.

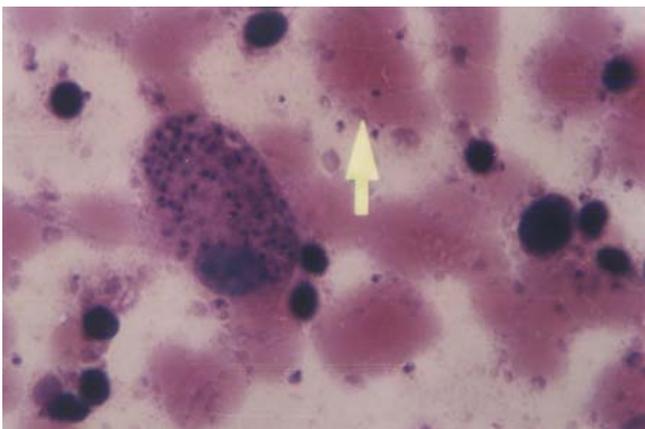
**Extramedullary Haematopoiesis:** The diagnosis of extramedullary haematopoiesis was made when haematopoietic cells with representation of all cell lines at different stages of maturation were seen

on smears. In most of the cases, the erythrocytic series was dominant. The background showed variable reactive lymphocytes (Figure 4). The possibility of haemolytic process was suspected in most cases.

In this group, seven children presented with main clinical suspicion of storage disorders. In 5 of them the bone marrow examination was also performed which suggested congenital dyserythropoietic anemia in 3 cases, pure red cell aplasia in one case, and hypersplenism in the fifth case, which also showed large sized macrophages mimicking storage cells both in bone

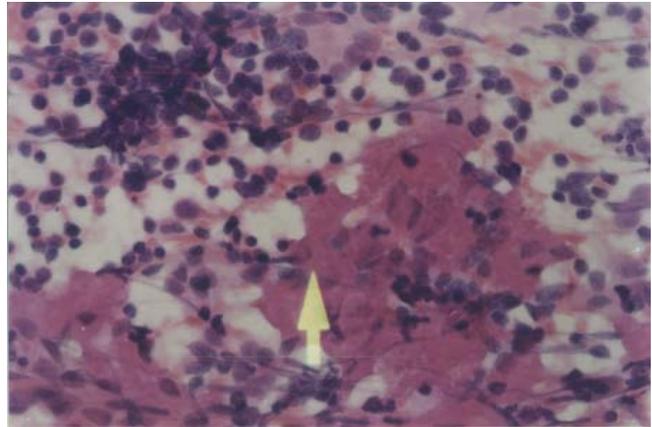


**Fig. 1: Reactive hyperplasia. Smear showing heterogeneous population of lymphoid cells and scattered neutrophils. Giemsa stain (x 400).**

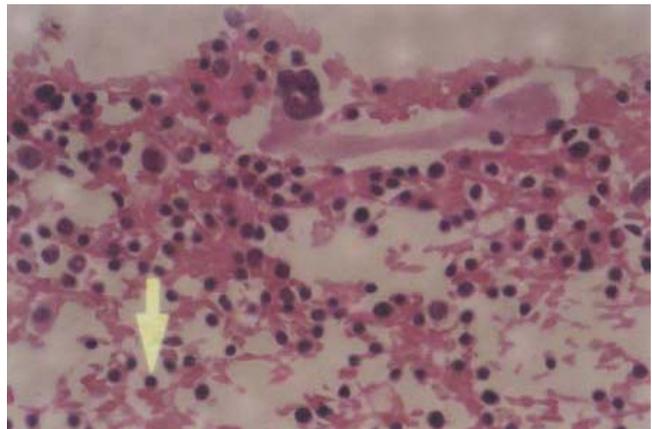


marrow and splenic aspirate. Thalassaemia major was the most likely diagnosis in one of the other two children.

**Fig. 3: Visceral leishmaniasis. Extracellular LD bodies (arrow) showing more degenerated changes than in intracellular ones. H&E (x 1000).**



**Fig. 2: Granulomatous inflammation. Smear showing granuloma (arrow). H&E (x 400).**



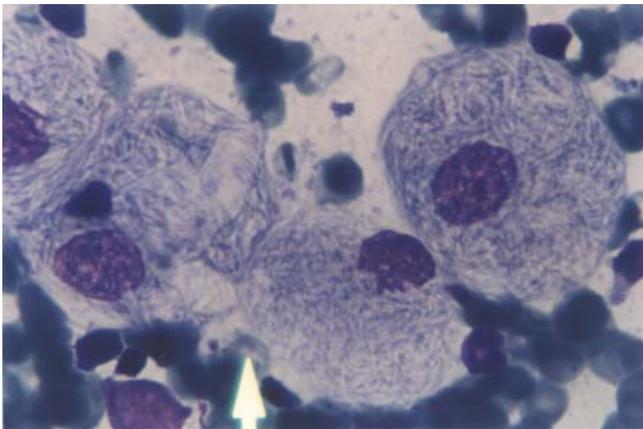
**Fig. 4: Extramedullary haematopoiesis. Cells are predominantly of erythroid series (arrow) with megakaryocyte at the top. H&E (x 400).**

An adult patient was consistent with a case of hypersplenism on bone marrow examination, perhaps secondary to autoimmune hemolytic anemia.

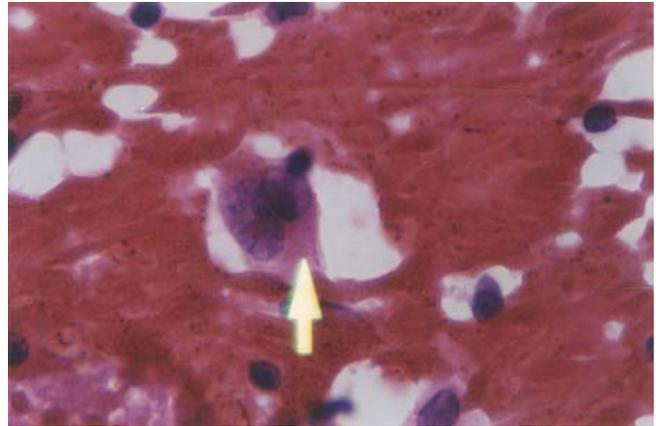
**Lipid Storage Disease:** In all three children the smears revealed numerous large storage cells having eccentric nucleus and 'crumpled tissue paper' cytoplasm (Figure 5). Similar cells were also seen on hepatic FNAC. Diagnosis of lipid storage disease, most likely Gaucher's disease was rendered. It must be stressed here that a definite diagnosis of Gaucher's disease versus Niemann-Pick disease can only be made through biochemical analysis of the tissue.

**Haemophagocytic Syndrome:** Diagnosis of haemophagocytic syndrome was made on finding scattered macrophages with engulfed haematopoietic cells (Figure 6). The macrophages own nucleus was pushed to one side while engulfed cells were contained within lysosomal vacuoles.

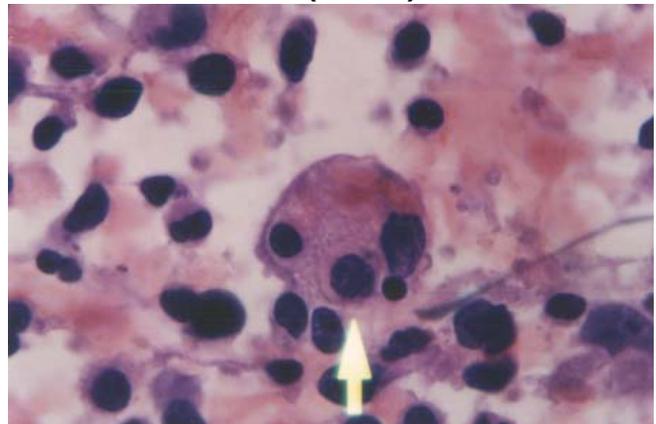
**Neoplastic Splenomegaly:** Among seven cases, there were three cases of leukaemias (of different types), two cases each of Hodgkin's and non-Hodgkin lymphomas (Figures 7 & 8). The neoplastic cells showed characteristic nuclear and cytological abnormalities of particular neoplasia. In Hodgkin's disease there were classical Reed-Sternberg cells in the background of plasma cells and eosinophils.



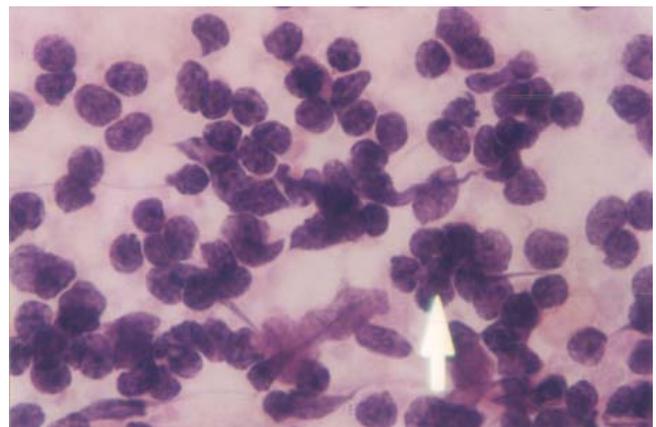
**Fig. 5: Lipid storage disease. 'Crumpled tissue paper' appearance more evident in lipid containing macrophages. Giemsa stain (x 1000).**



**Fig. 7: Hodgkin Lymphoma. RS cell (arrow). H&E (x 1000).**



**Fig. 6: Haemophagocytic syndrome. Phagocytosed blood cells. H&E (x 1000).**



**Fig. 8: NHL. Smear showing atypical monotonous lymphoid cells. H&E (x 1000).**

## Discussion

For diagnosis of splenic pathology, the tissue material can be obtained through splenectomy specimen, core biopsy or FNAC. As splenectomized patients have a life long risk of overwhelming postsplenectomy infection (OPSI),<sup>19, 20</sup> spleen must be preserved whenever possible.<sup>21</sup> Therefore splenectomy for achieving diagnosis is out of question. Tissue-Core biopsy is another mean of obtaining material for tissue diagnosis, and it is effective and safe procedure at most anatomic sites. In abdominal lymphomas, it was possible to assess the specific histo-type in 46/53 (87%) patients on UG-CB.<sup>15</sup> In another study of UG-CB quality of splenic sections was not good.<sup>22</sup> The core biopsies in richly vascular organs like spleen have understandably higher risk of postoperative haemorrhage making this procedure undesirable in most cases.

FNAC when practiced in a multidisciplinary setting, with involvement of pathologist, radiologist and clinicians, is found to be an extremely accurate test with high sensitivity, which approaches that of surgical pathology, and specificity very similar to that of frozen section.<sup>2</sup> In comparison with UG-FNAC of spleen, UG-CB had similar diagnostic yields. Except for the diagnosis of splenic lymphoma, in which CB, obtained better results than sFNAC.<sup>23</sup> However, in our cases we had no difficulty in diagnosing and classifying lymphomas on sFNACs. Although much less frequent than other techniques of obtaining tissue material, exceptionally hemorrhages may be encountered. These complications can be minimized by 'quick stabbing technique', which avoids needle movements thus minimizing the trauma. The splenic FNAC has been found equally feasible and safe in pediatric population.<sup>24</sup>

When the aspirate showed only benign splenic parenchyma, we have grouped 7 (22.6%) such smears as reactive hyperplasia.<sup>17</sup> In a study of 50 sFNAC showed 24 (48%) similar aspirates.<sup>25</sup> In another study out of 31 cases of pyrexia of unknown origin (PUO) 9 (29%) aspirates were reactive.<sup>26</sup>

We consider pure reactive hyperplasia as strong evidence against the clinical suspicion of storage disease, neoplastic disease and parasitic infections. In case of focal involvement of the spleen in malignancy there is however a chance to miss the diagnosis. One case, which first showed reactive hyperplasia revealed non-Hodgkin's lymphoma (NHL) on subsequent aspirate after about 2 months.

As it is observed that some times atypical hyperplasia preceded frank lymphoma, we cannot exclude the possibility of conversion of atypical hyperplasia to frank malignancy. Another case, which was labeled as reactive hyperplasia, turned out to be Hodgkin's disease on cervical lymph node biopsy raising the possibility of focal splenic involvement in this case, which might have not been targeted by the needle. On the other hand, spleen might have not been involved in malignancy. It is suggested that when there is a strong suspicion of malignancy multiple aspirates from different sites are performed which will reduce the chance of missing the diagnosis.

A diagnosis of granulomatous inflammation with necrosis on sFNAC is highly suggestive of tuberculosis in our settings. One should be however careful as sinusoidal cells and fibroblasts sometimes mimic epithelioid cells and give false impression of granulomatous inflammation.

In an Indian study about one third aspirates in patients with pyrexia of unknown origin (PUO), were compatible with tuberculosis, 63% of which showed Acid-fast bacillus (AFB) positivity as well, on Ziehl-Neelsen (ZN) stain in direct smear.<sup>26</sup> The percentage of the positivity for AFB seems to be rather quite high in this series. In another study of ultrasound guided (UG) FNAC in cases of abdominal tuberculosis, 7/8 cases had positive splenic aspirates with 87.5% sensitivity.<sup>27</sup>

Among the three cases of parasitic infections in our study, two cases of visceral leishmaniasis (VL) the aspirates were loaded with LD bodies. Extracellular LD bodies showed slight degenerated changes i.e., slight purplish colour as compare to blue dots seen in LD bodies present within the macrophages. Ghost nuclei of degenerated LD bodies, often make them difficult to differentiate from platelets, cellular debris and stain particles in the smears. The third case revealed ruptured schizont with scattered malarial pigment in the smear. The patient responded to anti malarial therapy.

Thakur et al studied 270 patients with febrile splenomegaly. The patients belonged to endemic Kala-azar areas. The author concluded that splenic aspirates gave positive results more often than bone marrow aspiration. Furthermore, intercostals route was preferable over abdominal route of aspiration.<sup>28</sup> In another study 3 out of 31 patients with PUO, were diagnosed as VL on splenic aspirates.<sup>26</sup>

We did not encounter cases of fungal or bacterial infections. However, the role of sFNAC, in fungal and bacterial infective splenomegaly is well documented.<sup>17</sup> In a study of cancer patients, one patient with AML had *Aspergillus* identified in splenic aspirate, while granulomatous inflammation with yeast consistent with *Candida* was seen in a patient with NHL. One aspirate demonstrated abscesses without recognizable organisms.<sup>29</sup> Montes et al reported a case of *Blastomyces dermatidis*, diagnosed on splenic FNAC.<sup>30</sup>

In our study, there were 8 cases of extramedullary haematopoiesis. Clinicopathological correlation was of great help in arriving correct diagnosis. Bone marrow (BM) examination suggested the diagnosis of congenital dyserythropoietic anaemia (CDA) in three cases, pure red cell aplasia in one case and hypersplenism in one adult and one pediatric case. In one of the cases with the diagnosis of CDA on BM aspiration, splenic aspirate also showed the atypical erythroid series cells, similar to those seen in the BM aspirate.

Two cases were compatible with clinical impression of haemolytic anaemia. One of them had the clinical suspicion of thalassaemia. Serum Iron, total iron binding capacity (TIBC), serum ferritin and Foetal Haemoglobin (HbF) percentage were consistent with the diagnosis.

One case of extramedullary haematopoiesis also contained a few large macrophages mimicking storage cells. These large macrophages were also present in BM aspirate. However, the cells were very few in number and the patient had hyperbilirubinaemia suggestive of haemolytic process.

Extramedullary haematopoiesis is seen in the various haemolytic anaemias as well as in myeloid metaplasia. Austin et al and Zeppa et al, in two separate studies also reported extramedullary erythropoiesis on sFNAC in cases of myeloid metaplasia.<sup>31, 32</sup> Extra-adrenal myelolipoma are rarely seen in spleen. Adipose tissue elements are seen with haematopoietic elements in the smear.<sup>33</sup> Extramedullary haematopoiesis was reported in spleen, in a case report of polycythaemia vera as well.<sup>9</sup>

In our three cases of lipid storage disease the splenic aspirates were quite cellular and contained numerous large lipid-containing macrophages. The storage cells had eccentric nucleus and 'crumpled tissue paper' cytoplasm was strongly suggestive of

Gaucher's disease. Zeppa et al and Kobayashi et al reported cases of lipid storage disease on sFNAC performed intraoperatively.<sup>32, 34</sup>

Immunophenotypical comparison of Gaucher's cells and pseudo-Gaucher cells can be made to some extent. Though Gaucher's cells and pseudo-Gaucher cells express a very similar immunophenotype, the expression of HLA-DR antigens is much stronger in Gaucher's than in pseudo-Gaucher cells.<sup>35</sup>

Both cases of haemophagocytic syndrome (HPS) in our study were children with history of fever, unexplained hepatosplenomegaly and pancytopenia. Familial form is generally seen in children. In adults, it is usually secondary to some other diseases.<sup>36</sup> HPS can easily be missed if phagocytosis of haematopoietic cells is less severe. Pathologist should have high suspicion when macrophages appear in index of large number, while interpreting the smear. We have found dry smears for Giemsa stain useful in these cases.

Out of 7 cases of neoplastic diseases in our study, 2 cases were of NHL. NHL is the most frequent diagnosis among neoplastic diseases diagnosed by sFNAC in some other studies. In two cancer centers, diagnoses of NHL by sFNAC were made in 10/50<sup>25</sup> and in 5/11<sup>29</sup> cancer patients respectively. In 4/31 cases of PUO diagnosis of NHL was made.<sup>26</sup> A primary lymphoma of spleen on UG sFNAC was reported with no evidence of involvement of lymph nodes, bone marrow or any other organs before the procedure.<sup>37</sup>

We had two cases Hodgkin's lymphoma (HL). Granulomatous tissue reaction is a frequent source of confusion. We had granulomas in one case besides atypical cells. The diagnosis was correctly made on FNAC of spleen. Both the cases were positive on cervical lymph node FNAC as well. The other case was grouped among the 'reactive hyperplasia' on FNAC spleen and lymph node, was later diagnosed as HL (lymphocytic depletion type) on cervical lymph node biopsy. Though the splenic involvement in that case was not confirmed, patchy involvement of spleen in HL can easily be missed by FNAC if the needle has not targeted the growth.

Silverman et al suggested the diagnosis of HL, on finding atypical lymphoid cells with granulomas in the smears. The diagnosis was confirmed on splenectomy specimen.<sup>29</sup>

In our study, in three cases of leukaemias, sFNAC was performed as part of initial work up. Diagnoses of AML, ALL and CLL were made

respectively. The diagnoses were correlated with bone marrow findings. In the case with AML initial bone marrow finding was negative, while leukaemic cells were present in the splenic aspirate. In subsequent bone marrow aspirate the diagnosis of AML-M<sub>2</sub> was made. Blast cells in acute leukaemias sometimes give false impression of immature haematopoietic cells in extramedullary haematopoiesis making it necessary to carefully differentiate between these two entities. Silverman et al and Zeppa et al had reported leukaemias on sFNAC.<sup>29, 32</sup>

Spleen is a rare site of metastases as opposed to lymph nodes. We did not encounter any case of metastatic disease excluding lymphomas and leukaemias. Kraus et al in a study of 122 splenectomies, showed 17 metastasis on histology.<sup>11</sup> Mastroianni et al reported splenic involvement in advanced ovarian carcinoma in 3 cases.<sup>38</sup> Hess et al reported splenic metastatic melanoma.<sup>39</sup> Cristallini et al reported splenic metastasis from a papillary serous ovarian adenocarcinoma, diagnosed on CT-guided sFNAC.<sup>40</sup>

We used 'quick stabbing technique' for aspiration with the aim to minimize haemorrhagic complications and blood dilution in the smears. We employed abdominal approach for aspiration, as our study was based on cases with palpably enlarged spleen. We found smears satisfactory in all cases. In a National Committee for Clinical Laboratory workers, recommended a 'modified technique' to avoid trauma.<sup>41</sup> Our study did not involve needle manipulation at all.

Ultrasound-guidance (UG) was used for aspiration in our study in only one case of NHL. Radiologist performed the aspiration. Imaging techniques, such as UG, CT-guidance, and fluoroscopy-guidance may be required for aspiration, especially in the cases where spleen is not palpably enlarged or when there were focal lesions in the spleen, which can be missed by needle, if introduced blindly.

There were no procedural complications in our study. As spleen is highly vascular organ, the procedural trauma is very much likely in invasive procedures, therefore coagulation profile of the patient is mandatory before the aspiration. Our pre requisite for the patient selection was normal coagulation profile and the platelet count higher than  $50 \times 10^9/l$ . In a study of 140 sFNACs splenic bleeding occurred in two cases, one of them required splenectomy.<sup>32</sup> One haemorrhagic complication out of 11 cases was

reported in one study.<sup>29</sup> Caraway and Fanning reported one out of 50 patients who developed pneumothorax on sFNAC that resolved spontaneously.<sup>25</sup>

Our study was confined to cytomorphological features of splenic aspirates. Apart from cytology, other utilities of material obtained by FNAC include Culture, Polymerase Chain Reaction (PCR) studies, Immunohistochemistry, and Flow Cytometry (FCM). Lishner et al reported enterococci on splenic aspirate culture.<sup>17</sup> Aranda et al had highlighted value of splenic aspirate for culture on autopsy.<sup>42</sup> Brown et al performed Ki-67 staining on splenic aspirate in cases of NHL.<sup>43</sup> Saddik et al had performed FNAC on seven surgically resected spleens (ex vivo). They utilized FCM and immunohistochemical surface marker analysis, techniques. The authors concluded that FNAC provides adequate material for FCM and Immunocytochemistry.<sup>44</sup> Two other studies on utility of FCM on FNAC material concluded that diagnostic precision was enhanced, by combining FCM with morphological and immunological evaluation of FNAC. Usefulness of FCM on patients with established or suspected NHL was demonstrated on splenic aspirate material.<sup>45</sup> FCM on sFNAC material in the diagnosis of malignancy was found useful in 4 out of 5 patients in one study. Normal lymphocytes were demonstrated by FCM on fifth case.<sup>46</sup> In a study of UG-sFNAC on chimpanzees.

## Summary & Conclusions

1. We found splenic FNAC very useful technique in diagnosis of variety of diseases affecting spleen primarily or secondarily.
2. In about 42% cases FNAC of spleen provided us the first and the specific diagnosis in different diseases including: Parasitic Splenomegaly, Granulomatous inflammation, Lipid storage disease, Haemophagocytic syndrome, and Lymphoma.
3. In 35.5% cases FNAC of spleen confirmed the splenic involvement in already diagnosed systemic disease. These cases included leukaemia and extramedullary haematopoiesis.
4. In 22.6% cases FNAC of spleen were useful in ruling out its involvement in the systemic diseases. Here FNAC revealed reactive hyperplasia only.
5. We used novel 'quick stabbing technique'. No procedural complications were seen in our cases. We recommend that attention must be

paid to the coagulation profile before the procedure.

6. Fine Needle Aspiration Cytology of spleen is a safe and highly useful diagnostic procedure as a primary investigation in splenomegaly.
7. Splenic FNAC without ultrasound guidance may not target the focal lesions. In such cases imaging techniques may be employed for the aspiration.

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