

Liquid based cytology-is it effective in body fluids and fine needle aspiration cytology?

Sonti Sulochana¹, Vithya Priya², P.S Muthusubramanian³, Bhuvaneshwari⁴
¹Professor of pathology, ³PG student of pathology, ³Tutor.

Abstract:

Objective: Comparison of Conventional cytology Smears and Liquid Based thin layer preparation in: 1) FNAC
2) Body fluids.

Materials and Methods: A total number of 50 samples (25 cases are fnac and body fluids 25) are collected. The fnac samples and body fluids are taken from the patients who are attended out patient and in patient from various departments in saveetha medical college and hospital. The fnac was performed under aseptic precautions and smears are fixed and stained by hematoxyline and eosin, papanicoulo stain for conventional smears and_ezi Prep LBC procedure was followed for non gynaecological specimens.

Results and conclusions : Among 25 FNAC samples, Females> males, Thyroid cases 9,Soft tissues 7 cases, Breast 5 cases Lymph nodes 2, parotid 1 and liver 1case . Among 25 body fluid samples Male>female, Ascitic 7,and pleural 7 synovial 2,bronchial wash 2,pancreatic fluid 2, urine 1, CSF1, peritoneal,hydrocele 1and pus 1

In our study LBC and CS smears in both FNAC and body fluids are equal diagnostic accuracy.

Keywords: Liquid based cytology, Conventional smears, fixative, FNAC, Ascitic fluid, pleural fluid

INTRODUCTION

Fine-needle aspiration (FNA) is a safe and cost-effective technique for diagnosis. Liquid based cytology (LBC) was initially used on gynaecological pap smears. However it can be performed on non-gynaecological fine needle aspiration(FNA) samples(like breast [1-2],thyroid [3-4],,lymph nodes, salivary gland,bone,soft tissue)and body fluids like pleural[5],urine[6-12],and CSF [13] etc.

Exfoliative cytology is the study of spontaneously shed cells which line a cavity or an organ, from where these cells are removed by non-abrasive means. It comprises of study of cells from anatomic locations like pleural effusions ,pericardial, peritoneal, urine, CSF and synovial fluids as well as cells which are shed from respiratory and female genital tract. The cells in body fluids and washes can be concentrated by centrifugation or direct smear. Exfoliative cytology aids in the diagnosis of cancer, inflammatory conditions like parasitic infestations and infections like bacteria, fungi or viruses. The diagnosis of cancer in pleural, pericardial or peritoneal fluids is of much importance for the patient as well as the attending physician or surgeon.

Conventional smears are prepared by directly smearing collected cells onto a glass slide; in order to preserve the sample, it must be transferred to the slide quickly in 95% isopropyl alcohol fixative and kept for 20-30 minutes and smears are stained by hematoxylin and eosin(H&E). In conventional smears the cells are more clumping or cells overlapping on the slide, abnormal cells may also be obscured by blood, mucus, and other debris, which potentially leads to an increase in false-negative and equivocal results. To overcome this problem today Liquid-based cytology (LBC) have been developed to in an attempt to overcome these limitations by avoiding limiting factors such as obscuring material, air-drying and smearing artifacts.LBC enhances the diagnostic accuracy and gives better quality slides,with clear background maximising the cellular yield and presents the cells in a

single focus.It filters the mucus and unwanted bloody materials from the sample,improving the quality and clarity of the slides..LBC has increased sensitivity and specificity since cell fixation is better with well preservation of nuclear details;thus lowering the rate of unsatisfactory cytology samples[3]. The present study was undertaken to study the differences between conventional and LBC methods in various samples and body fluids[6] and to see how far the LBC is more effective than CS.

Inclusion criteria: All age groups, both male and female patients

Exclusion criteria: Pap Smears

Data analysis: statistical analysis was done. Sensitivity and specificity for two different methods were calculated.

Metaanalysis Data:

Investigations of the specimen and effusions by cytologic examination are of much importance in the diagnosis of diseases as well as for exclusion of neoplasia. A cytologic examination of the specimen and fluid performed on the smears of centrifuged specimen helps in differentiating benign from malignant effusions. It also aids in establishing the nature of malignancy in many cases and helps in the planning of treatment .It eliminates the need for invasive procedures and unnecessary surgical intervention, thus making the pathologist contribute positively to the clinical diagnosis and management of patients. There are many techniques used in the processing of the fluid specimens.

In recent years liquid-based is becoming an alternative to conventional cytopreparatory methods

LBC was favored over CS for evaluating gynecological specimens, which was approved by the FDA in 1996. Thereafter, LBC has been found to be useful in non-gynecological cytologic specimens like FNAC and body fluids, both small and large volume, which have drawn variable conclusions.In conventional FNAC smears, cells are admixed with debris, blood and exudates, which make

the interpretation difficult. There is suboptimal preservation of cells and cellular obscuring by unwanted material, leading to a high proportion of cases reported as inadequate or unsatisfactory for assessment. To overcome this problem, the LBC technique was introduced, which preserves cells in a liquid medium and removes all debris, blood and exudates, either by filtration or density gradient interpretation. Here, there is even distribution of cell material, lack of obscuring factors, no drying artifact and monolayering.

A study comparing liquid-based cytology with conventional cytology for detection of cervical cancer precursors by Siebers AG1 et al(18),stated that liquid-based cytology does not perform better than conventional Pap tests in terms of relative sensitivity and PPV for detection of cervical cancer precursors.

In a study of uterine cervical lesions by Nishio H1, Iwata T1,et a(19),There was no significant difference in the diagnostic performances of LBC and CS in patients with ASC-US or worse.

In a direct comparison study by Taylor *et al.*(18) of 5652 cases, CPS and LBC performance and accuracy were statistically similar.

Another Japanese study with 1551 split samples, showed that the sensitivity of lesions histologically diagnosed as CIN1 or above was not significantly different between the two methods.Large meta-analyses by Arbyn *et al.*(19) included 109 studies where positivity and/or adequacy rate was studied. In their analyses, there was no statistically difference in sensitivity and specificity between the two different methods for detection of CIN2+.

In a study comparing lbc and conventional smears of pancreaticobiliary disease by

Yeon MH1, Et al(20), showed that CP (LBC) has a lower diagnostic accuracy for pancreatic EUS-FNA based and biliary brush cytology based analyses compared with CS.

de Luna R et al(21). compared LBP with CS in pancreatic FNABs; they found the diagnostic accuracy of TP to be inferior to that of CS

in a recent study of thyroid FNAB by Cochand-Priollet B et al.(22) the diagnostic accuracy of CS was better than that of LBP

According to the study by kalpalata tripathy et al(23) on thyroid lesions,LBC was not useful in goiter and infectious lesions. It gave better results in anaplastic and medullary carcinoma

In the study of Bédard YC et al(24),The diagnostic yield of CS appears to be greater than that of LBP in the diagnosis of pleomorphic adenoma of salivary gland.

In the salivary glands, study by Parfitt *et al and kalpalata tripathy et al*(23), stated that LBC was not useful in cystic neoplasms like Warthin's tumor, mucoepidermoid and adenoid cystic carcinoma

The diagnostic accuracy,sensitivity and specificity of MLBC was similar to CS in the studies conducted by authors like Pawar PS et al(25),Leung CS et al.(26) and Dr. Karan Mahinderu et a(27)l.

According to study by kalpalata tripathy,In fibroadenoma breasts, although stromal fragments were lost, LBC proved to be useful in the diagnosis based on visualization of

ductal aggregates and bipolar cells. For duct carcinomas, the same criteria were useful.

In the comparison of conventional smear and lbc in lung and mediastinal masses by Garima Singh,inadequacy rates were significantly lower for conventional smears as compared to LBC .assessment cyto-morphological features of forty-one cases were predominantly equal as compared to conventional smear. However better preservation of nucleoli, chromatin texture, and cellular pleomorphism was found in LBC as comparison to conventional smear(28).

Overall accuracy of LBC with histological diagnosis was significantly higher than conventional . The study suggested that LBC is no doubt a better method of smear preparation from cytological material obtained from lung aspirates

Authors have studied the application of Thin Layer Cytology in exfoliative and aspiration cytology of pulmonary, urinary, gastrointestinal, endocrine, breast and salivary gland specimen and in the diagnosis of serous effusion. They found that ThinPrep was better than conventional in samples from all the above sites they analysed.overall diagnostic accuracy is also significantly higher as compared to conventional smearing;

In a study conducted by Seung et al(29) using 713 urine samples, LBC showed better cellularity than CS in 63.2% of cases whereas same cellularity in 36.8%.

Another study conducted by Babloyan et al(30) using 110 peritoneal fluids demonstrated that LBC (52%) showed better cellularity as compared to CS (9%) and same cellularity in 39% of cases.

Another study conducted by Alwahaibi et al(31) using 17 pleural and 24 peritoneal fluids demonstrated that CS were cellular in 78% of cases and LBC showed high cellularity in only 2% of cases.

A study conducted on urine samples by Seung et al(29), demonstrated that cytomorphologic features are better preserved in LBC than CS in 47.4% of cases and same by both methods in 52.6% of cases in urine samples.

Another study conducted by Babloyan et al(30) using 110 peritoneal fluids demonstrated that LBC showed excellent cytomorphology in 46% of cases whereas CS in 6% of cases.

Bong et al(32) conducted a study of 120 urine samples and found that CS was superior to LBC in terms of cell distribution. (p<0.05).

A study conducted by Seung et al(29) using urine samples,showed LBC demonstrated more uniform distribution than CS in 73.7% of cases.

Another study conducted by Alwahaibi et al(31) using pleural and peritoneal fluids, LBC showed uniform cell distribution in 98% of cases and CS showed only in 27% of cases .

In the Comparison study of liquid-based preparation and conventional smear of fine-needle aspiration cytology of lymph node by Singh, et al, no statistically significant difference was seen between LBP and CP regarding informative background, monolayer sheets, and cellularity.

There was absence of blood in the background and better nuclear and cytological details was seen in LBPs .

In study by kalpalata tripathy(23),In all lesions of the lymph node, LBC proved to be a better option.

According to study conducted by Babloyan et al 63 with peritoneal fluids, LBC showed obscuring background in 12% of cases and CS in 69% of cases and they concluded that LBC produced more cleaner background compared to CS.

In the study done by Seung et al (29) using urine samples , CS showed obscuring background in 3.8% of cases and LBC in none of the cases.

A study conducted by Alwahaibi et al (31) using pleural and peritoneal fluids observed that LBC produced clean background in 78% of cases and CS in 17% of cases.

Aim and Objective:

Comparison of Conventional cytology Smears and Liquid Based thin layer preparation in:

- 1) FNAC
- 2) Body fluids.

We aimed to evaluate and compare the diagnostic utility and accuracy of LBC and conventional cytology on the basis of adequacy, cell types, background (inflammatory or Haemorrhagic background), changes in cell morphology (normal, reactive and atypical changes) in FNAC samples and body fluid.

MATERIAL AND METHODS:

In this prospective study, a total of 25 FNA samples from various anatomical sites and 25 body fluids were evaluated. This study will be conducted on patients attending Cytopathology department for FNAC and body fluids collected from various department at our institution. Two passes were made in each case using a 23-gauge needle attached to a 10ml syringe.

First pass was made for conventional smear (CS) and the second pass was made for MLBC preparation. CS was made by directly placing the sample on the smear and immediately fixing it in 85% isopropyl alcohol for Papanicolaou or hematoxylin and eosin (H&E) stain.

Procedure: Ezi Prep LBC

Manufacture and Marketed by LBC INDIA

LIQUID BASED CYTOLOGY NON GYNAE PROCEDURE:

Contents:

1. LYSER SOLUTION – Used as a Non gynae preservative, to remove blood and mucus from the sample.
2. FIXATIVE (50ml) - A drop is enough for effective fixation of cells on the slide.
3. SEPERATOR SOLUTION – used for the effective separation of unwanted materials.
4. CENTRIFUGE TUBES
5. PASTEUR PIPETTE
6. OPTICOAT ADHESIVE SLIDES.

Principle of Liquid based cytology : Surface Adsorption by RCF (Relative centrifugal Force)

SAMPLE PREPARATION : If the sample volume is more than 2ml, it will be precentrifuged. The supernatant will be discarded and the pellet would be used for further procedure.

If the sample volume is less than 2ml, the sample can be used directly.

Step 1 : The precentrifuged sample will be loaded into the sample container, which has 12ml of lyser solution; mixed well and the sample is preserved for 30mins to one hour.

If the sample volume is less than 2ml, then the sample is directly added into the lyser solution.

After the desired time of preservation, a clean centrifuge tube will be taken and 4ml of separator solution will be loaded in it. To this layer, 7ml of preserved sample would be added and centrifuged at 1500 rpm for 5- 10 minutes. The supernatant is discarded and the pellet is used for slide preparation.

Step 2 : After discarding the supernatant, the pellet should be vortexed and homogenated. To this, one or two drops of normal saline will be added and mixed well.

Step 3 : Before loading the sample, the opticoat slides should be inserted in the slide carrier and both the funnels are locked. 4 to 5 drops of normal saline or distilled water are to be added on the funnels to wet the slides. Around 50 to 75ul of homogenised pellet sample will be added on both the funnels. To this, 50ul of fixative should be added.

The slide carrier would be loaded on the autoprocessor. The machine is switched on and centrifuged at 1200 rpm for 5mins. After the procedure, the excess fluid will be discarded, the slides from the chamber taken out, washed well and fixed in alcohol. Now the smear would be stained directly from Hematoxylin and eosin and two pathologists are examined the conventional and LBPs separately without knowing the diagnosis. The LBPs and CSs were compared for cellularity (Adequacy), Background (inflammatory or Haemorrhagic background, cell debris)

Informative back ground (colloid, mucus, proteinaceous material, stromal fragments), Cell architecture [Changes in cell morphology (normal, reactive and atypical changes)], presence of cells in monolayer and nuclear cytoplasmic details by a semiquantative scoring system (Table 1)

Procedure for conventional smears in body fluids

Centrifuge name: REMI 8C

Equipment:

Graduate Centrifuge tube, Glass slide, Micro pipette, Coplin jar, 95% isopropyl alcohol

Procedure:

Take sample graduate, centrifuge tube.

Load the tube REMI 8C centrifuge.

Swing 2000 RPM for 5 minutes.

Discard the supernatant fluid.

Mix the deposit.

Use micropipette .take 25 microLitre of this deposit or pellet.

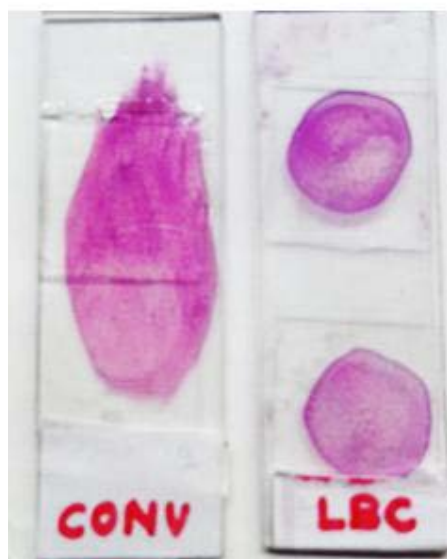
Place the drop glass slide. Streak the smear oval shape or spread the smear.

Immediately fix the smear in alcohol fixative in coplin jar for 5 to 10 minutes.

Start the staining (haematoxylin and eosin)

Staining Procedure

- 1) Hematoxylin- 5 – 7 minutes
- 2) Tap water wash
- 3) 1% Acid alcohol – 1 dip
- 4) Blueing
- 5) Eosin-15 -30secs
- 6) Blot dried and mounted with DPX.



The slides were reviewed by pathologists. The representative CS and LBC were compared for cellularity, background blood and cell debris, cell architecture, informative background (such as colloid, mucoid and stromal fragments), presence of cells in monolayer and clumps, and nuclear and cytoplasmic details by semiquantitative scoring system (Table 1).

Statistical analysis was made by graph pad method. Each cytological diagnosis was recorded and tabulated. The study protocol was approved by institutional Ethics (IEC) committee (Reg No SMC/IEC/2018/05/104) and oral

informed consent was obtained from all patients participating in the study.

RESULTS

The total number of FNAC and body fluid samples for cytological examination are 50(25+25). Among 25 FNAC samples [Female(21) > Male (4)], Thyroid cases 9(36%), Soft tissues 7 cases (28%), Breast 5 cases(20%), Lymphnodes 2(8%), parotid 1(4%) and liver 1 case(4%). Among 25 body fluid samples [Male(15) > female(10)], Ascitic 7(28%) and pleural 7(28%) synovial 2(8%), bronchial wash 2(8%), pancreatic fluid 2(8%), urine 1(4%), CSF 1(4%), peritoneal 1(4%), hydrocele 1(4%) and pus 1(4%)

Distribution of cases are shown in pie chart (Fig 1 and 2). There is no difference in sensitivity of LBCs and CSs of FNAC and Body fluids. The more important cytomorphological change seen in informative background which was lacking, so the sensitivity was reduced in both FNAC and body fluids (32% and 10%) (table 4,5).

The diagnostic accuracy was equal in LBC and CS of FNAC and body fluids (Fig 3-8)

In lipoma and sebaceous cyst the informative background is lacking in both LBC and CS (Fig 9,11)

In ganglion the mucoid material is lacking in LBC (Fig 10)

The cytomorphological changes compared in LBC and CS of thyroid showed lack of colloid, more uniform distribution of cells and small cohesive clusters and cellular alteration difficult to differentiate lymphocytes from follicular cells (Fig-12).

In bronchial was candida infection present seen in both LBC and CS and fore arm swelling also showed fungal organisms of phaeophomycosis (13,14)

In body fluids the diagnostic accuracy is equal in both LBC and CS of body fluids. But in suppurative, inflammatory and benign lesions cellular alterations in the nucleus and cytoplasm in the form of fibrous strands (Fig 16).

Table-1 Scoring system

Cytological features	Score			
	0	1	2	3
cellularity	Absent	Scanty/few	Adequate	Abundant
Background blood/cell debris	Absent	Occasional/few	Adequate	Abundant
Informative back ground	Absent	present		
Monolayer sheets/clusters	Absent	Occasional/few	Adequate	
Cell architecture	Not recognized	Partially recognized	Well recognized	
Nuclear detail	Poor	Fair	Good	excellent
Cytoplasmic detail	Poor	Fair	Good	excellent

The different sites of FNAC and Body fluids and their diagnosis,specificity and sensitivity are shown in Table 2, 3, 4,and 5

Diagnosis	Thyroid(9)	Soft tissues(7)	Breast(5)	Lymphnodes(2)	Parotid(1)	Liver (1)
Cystic colloid nodule	3					
Nodular goitre	3					
Hashimoto thyroiditis	2					
Undiagnostic	1					
Lipoma		1				
Inflammation with fungal organisms		2				
Epidermal cyst		2				
Ganglion		1				
Hemorrhagic		1				
Benign cystic lesion			2			
Firocystic disease			1			
Ductal carcinoma			1			
Undiagnostic			1			
Squamous cell carcinoma deposit				1		
TB Node				1		
Simple cyst					1	
Benign cyst						1

Table 3: Body fluids

Diagnosis	Ascitic fluid(7)	Pleural fluid(7)	Peritoneal fluid(1)	Synovial fluid(2)	Bronchial wash(2)	Pancreatic fluid(2)	Urine(1)	CSF(1)	Hydrocele fluid(1)	Pus(1)
Reactive effusion	2									
Inflammatory effusion(Acute/ Chronic)	4	4			1					
Suppurative effusion		2		2		1		1		1
Malignancy	1						1			
Eosinophilic effusion		1								
Spermatocele									1	
Benign			1		1					
unsatisfactory						1				

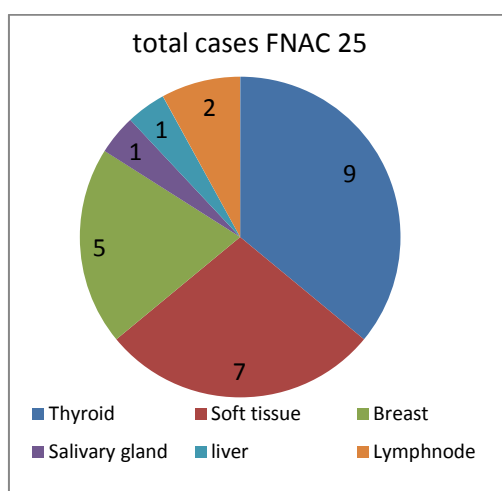


Fig-1

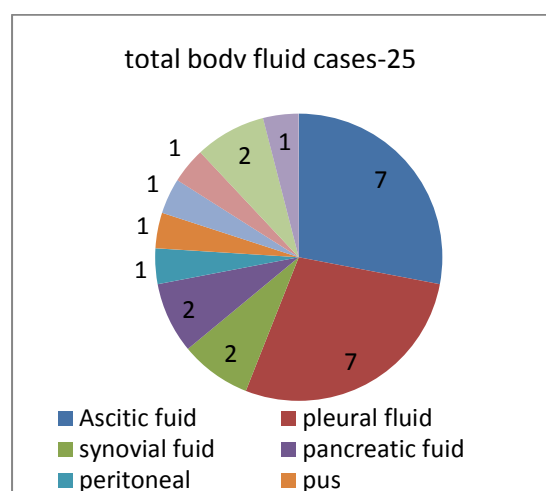


Fig-2

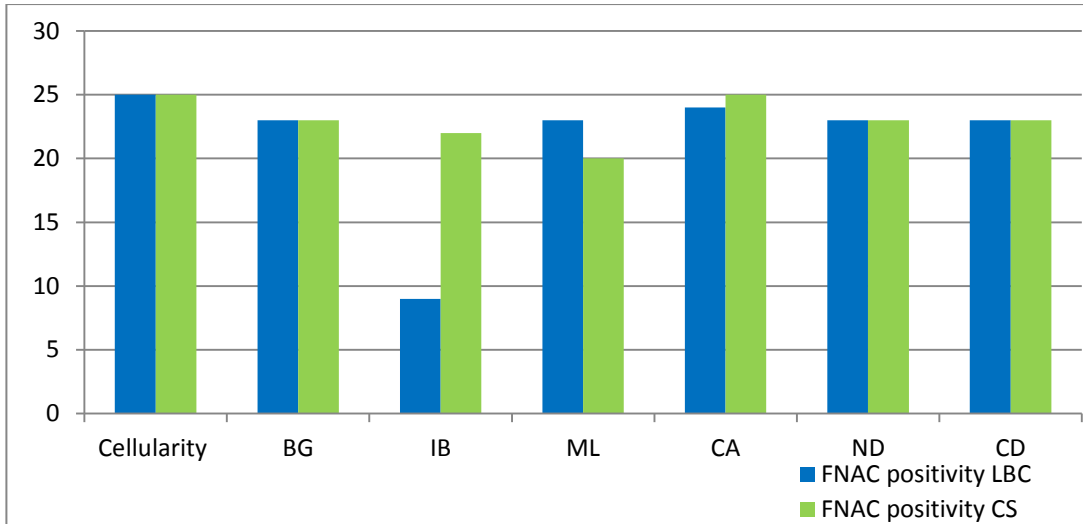


Fig-3

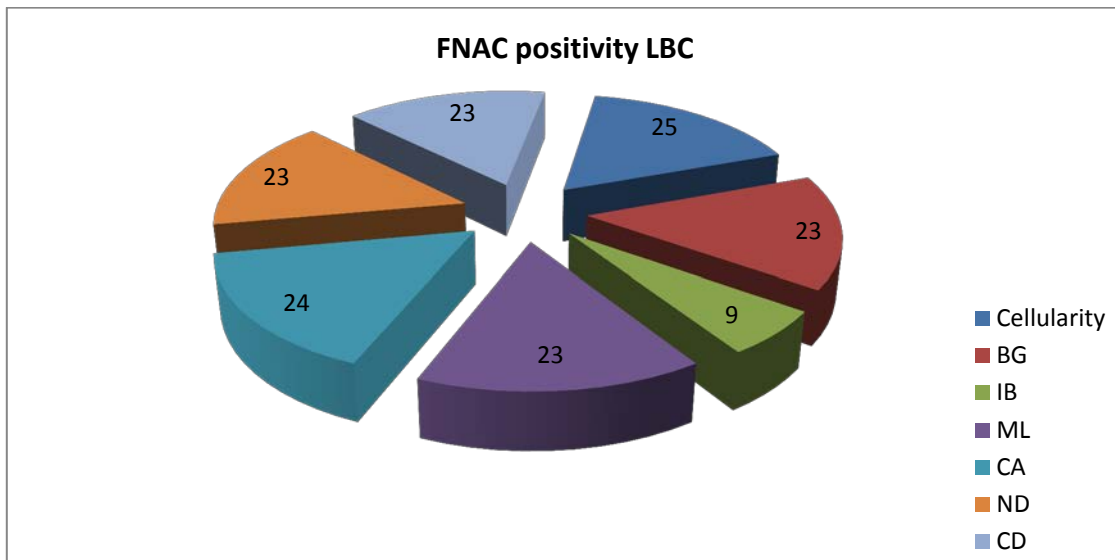


Fig-4

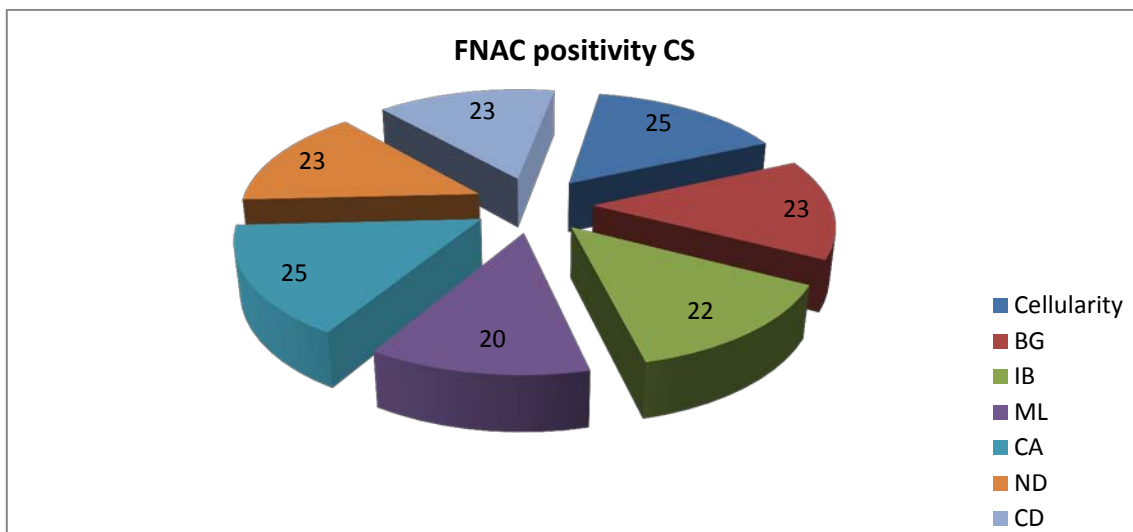


Fig-5

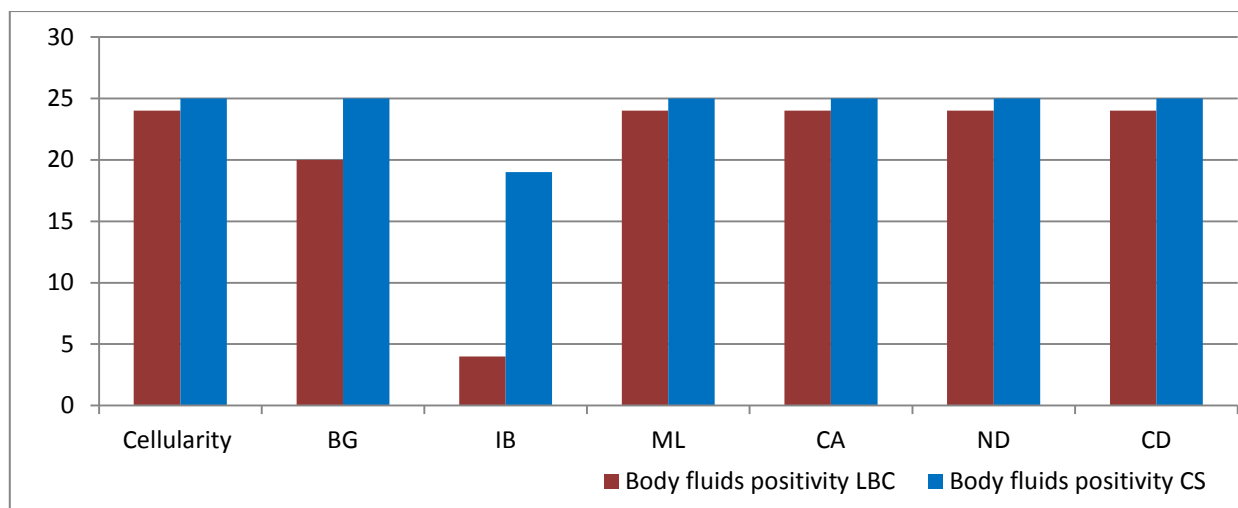


Fig-6

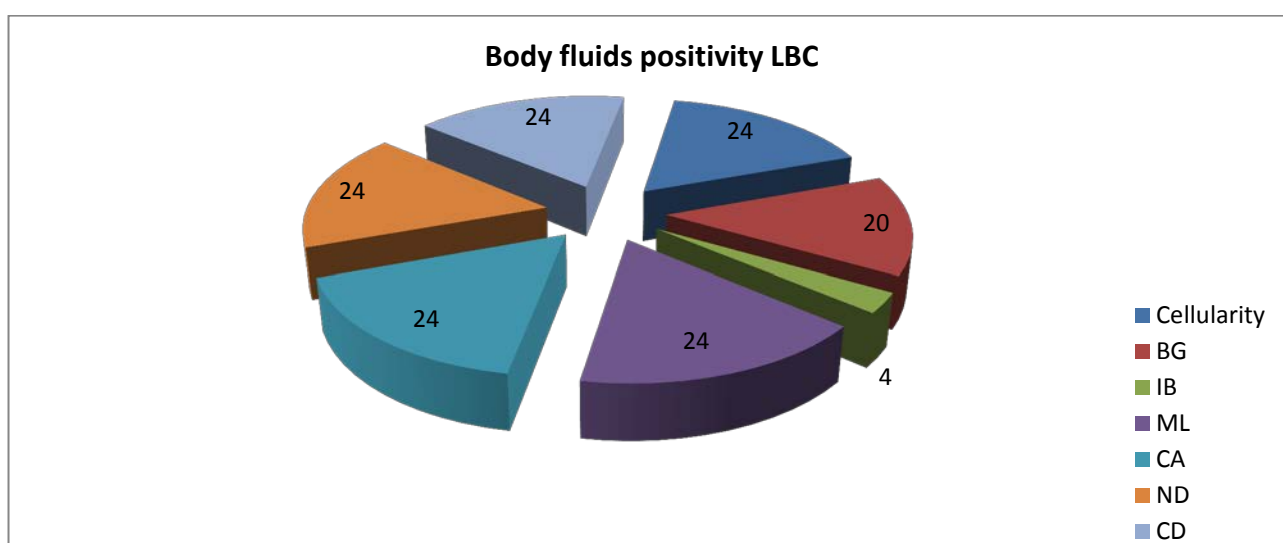


Fig-7

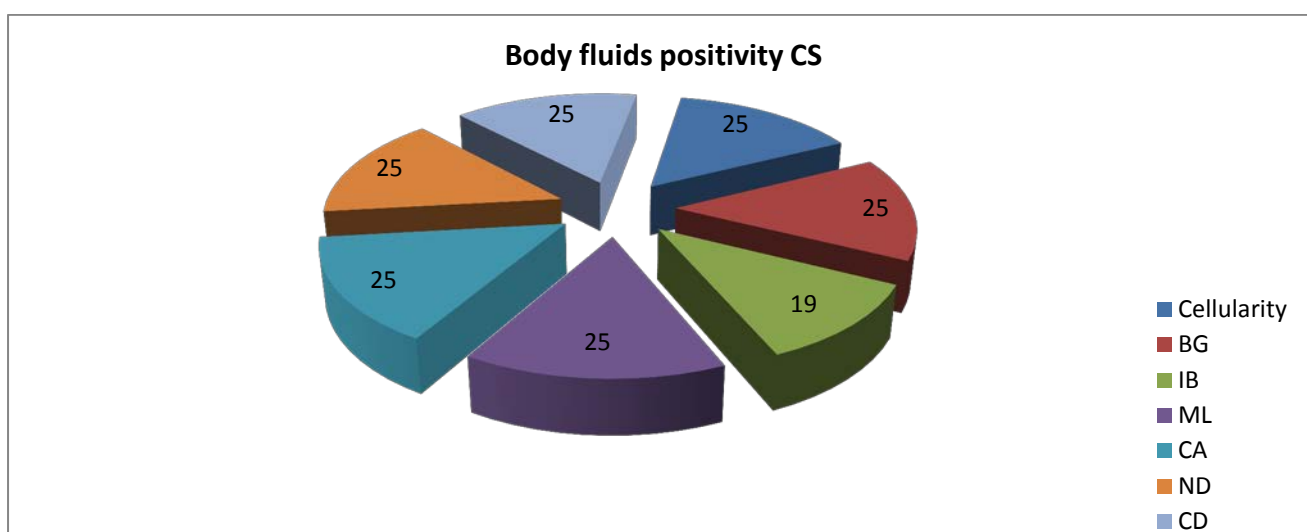


Fig-8

Table-4: FNAC Samples: Sample size: 25

Parameter	Comparison between LBC and CS				Total	Statistics
Cellularity	LBC	CS		Total		
		Positive	Negative			
Cellularity	LBC	Positive	25	0	25	Sensitivity = 100% Specificity = 0%
		Negative	0	0	0	
	Total	25	0	25		
BG	LBC	Positive	23	0	23	Sensitivity = 100% Specificity = 100%
		Negative	0	2	2	
	Total	23	2	25		
IB	LBC	Positive	7	2	9	Sensitivity = 32% Specificity = 33%
		Negative	15	1	16	
	Total	22	3	25		
ML	LBC	Positive	19	4	23	Sensitivity = 95% Specificity = 20%
		Negative	1	1	2	
	Total	20	5	25		
CA	LBC	Positive	24	0	24	Sensitivity = 96% Specificity = 0%
		Negative	1	0	1	
	Total	25	0	25		
ND	LBC	Positive	23	0	23	Sensitivity = 100% Specificity = 100%
		Negative	0	2	2	
	Total	23	2	25		
CD	LBC	Positive	23	0	23	Sensitivity = 100% Specificity = 100%
		Negative	0	2	2	
	Total	23	2	25		

Table 5: Body fluids: Sample size = 25

Parameter	Comparison between LBC and CS				Total	Statistics
Cellularity	LBC	CS		Total		
		Positive	Negative			
Cellularity	LBC	Positive	24	0	25	Sensitivity = 96% Specificity = 0%
		Negative	1	0	0	
	Total	25	0	25		
BG	LBC	Positive	20	0	20	Sensitivity = 80% Specificity = 0%
		Negative	5	0	5	
	Total	23	2	25		
IB	LBC	Positive	2	2	4	Sensitivity = 10% Specificity = 67%
		Negative	17	4	21	
	Total	19	6	25		

ML			CS		Total	Sensitivity = 96% Specificity = 0%
			Positive	Negative		
	LBC	Positive	24	0	24	
	Negative	1	0	1		
	Total		20	0	25	
CA			CS		Total	Sensitivity = 96% Specificity = 0%
			Positive	Negative		
	LBC	Positive	24	0	24	
	Negative	1	0	1		
	Total		20	0	25	
ND			CS		Total	Sensitivity = 96% Specificity = 0%
			Positive	Negative		
	LBC	Positive	24	0	24	
	Negative	1	0	1		
	Total		20	0	25	
CD			CS		Total	Sensitivity = 96% Specificity = 0%
			Positive	Negative		
	LBC	Positive	24	0	24	
	Negative	1	0	1		
	Total		20	0	25	

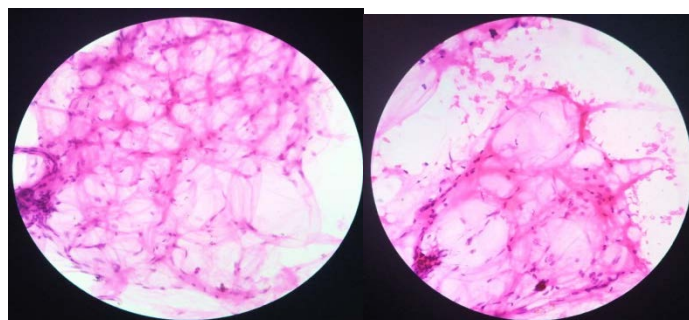


Fig-9,40X(H&E): Lipoma :Clean back ground in LBC smears

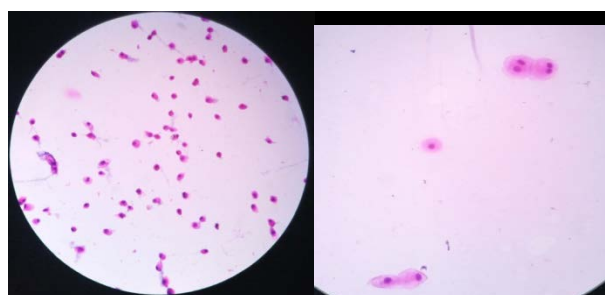


Fig-10,40X(H&E): Uniform cell distribution and lack mucoid material in LBC

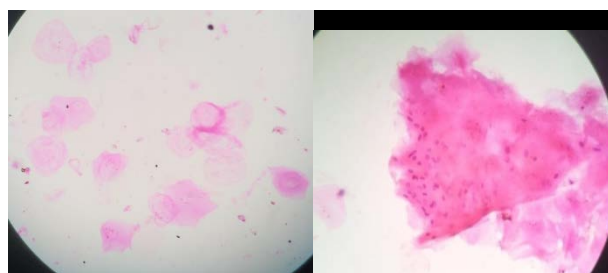


Fig 11, 40X, LBC and CS smears showing clean back ground

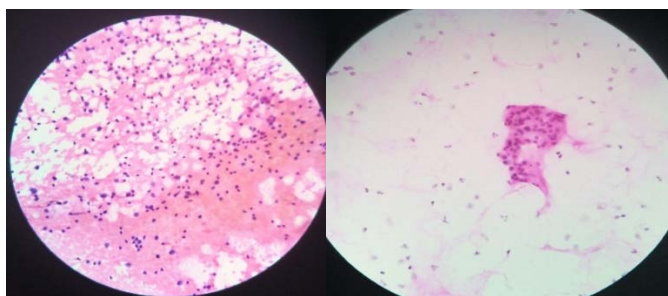


Fig 12,40X CS in thyroid shows well distribution and morphology of cells compared to LBC

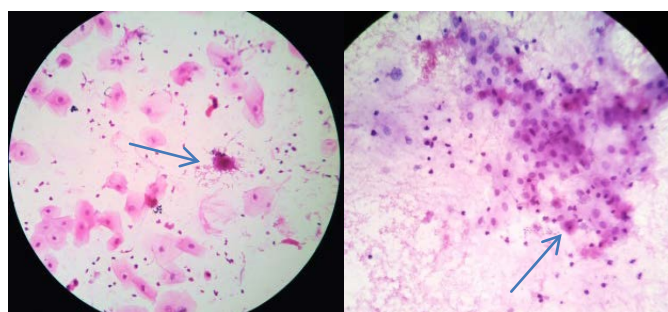


Fig 13 ,40X LBC and CS in bronchial wash arrow shows Candida as a budding yeast forms

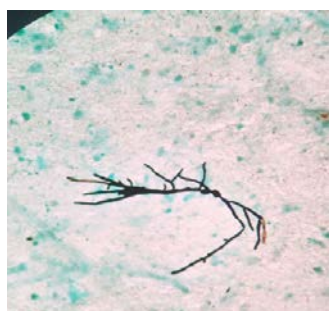


Fig-14,40X,CS GMS staining shows branching thin septate hyphae-Phaeohyphomycotic fungus

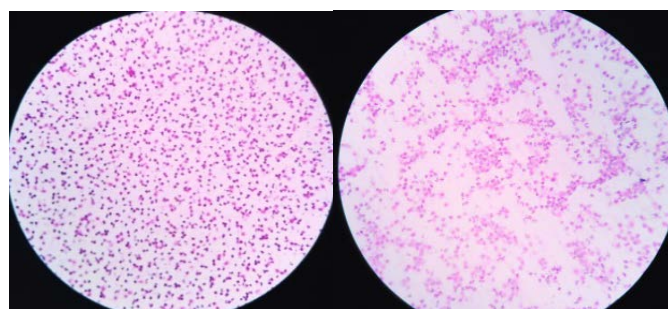


Fig 15,40X, LBC & CS smears of pleural fluid show adequate cellularity

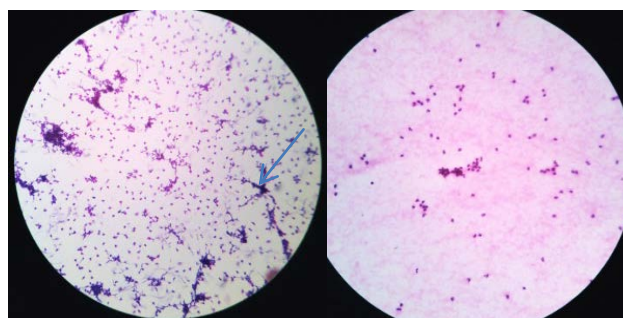


Fig 16, 40X LBC in pleural fluid shows more cellular alterations (strands of nucleus & cytoplasm) than CS

DISCUSSION:

In gynecological cytological specimens evaluation by LBC was favored over CS. Many studies are done in non gynaecological specimens like FNAC and body fluids cytological evaluation by LBC and CS have come to variable conclusion.

Liquid based cytology improves the quality of smears by means of an improved way of slide preparation following collection of samples in standard way and provides more representative sample of specimen with reduced obscuring background material which allows faster screening, diagnostic accuracy and uniform distribution of cells.

In thyroid lesions conventional smears have good cytomorphology than liquid based cytology. IN LBCs lack of colloid seen, and follicular cells are distributed in singly scattered and difficult to differentiate between lymphocytes in hashimoto thyroiditis. Even if follicular cells are seen more in cohesive clusters the nuclear cytoplasmic features are not cleared. Our study was correlating with Cochand-Priollet B et al.the diagnostic accuracy of CS was better than that of LBC(22). A study conducted in Lymphocytic thyroiditis and oncocytic tumors presented diagnostic problems, the lack of background colloid with LBC preparation (33,34).

More recent studies shows that LBCs and CS have more diagnostic accuracy in evaluation of breast FNABs. Dey P et al . were able to diagnose infiltrating ductal carcinomas and benign lesions of fibroadenoma (35). In their study LBC had adequate cellularity, good cell architecture and informative background of stromal fragments. In our study benign cystic lesions and ductal carcinoma of breast the cellularity was abundant,preserved cell architecture but the macrophages size was altered I,e mild shrunken.

Bedard YC et al analyzed 7464breast FNAC in 4 year period , comparing conventional with LBP, there was no significant difference in diagnostic accuracy (21).

Rana DN et al. done a large study in respiratory cytology specimens found no difference in diagnostic accuracy LBC and CS , but only differentiating point to favour LBC is clean back ground due to diminished mucoid or bloody material and more even distribution of cells(36). Our study was also correlating with this study. In our study the bronchial wash specimens showed lack of mucoid material and even distribution of columnar and squamous cells and less clumps over CS.

In our study, among the two the pancreatic fluid specimen ,one sample was undiagnostic due to inadequate material in both LBC and CS and other sample was showed suppurative inflammation. Recently de Luna et al.found the diagnostic accuracy of CS superior to that of LBC thin prep (21).And also found lack of mucin with LBC ,so it is difficult to diagnose mucinous tumors of pancreas.

In soft tissue lesions like lipoma, sebaceous cyst the informative background was very less or absent in both LBC and CS. In ganglion cyst , lack of mucoid material or pachy fragment of eosinophilic material seen in LBC. The CS more diagnostic accurate than LBC

In a study conducted by Alwahaibi et al(31) 17 pleural and 24 peritoneal fluids, CS were cellular in 78% of cases and LBC showed high cellularity in only 2% of cases. In our

study the smears are cellular in both pleural and peritoneal fluids of LBC and CS.

A study conducted by Seung et al (29) using urine samples showed LBC demonstrated more uniform distribution than in CS 73.3% of cases. Our study also shows more uniform distribution of cells and small clusters (96%) in both LBC and CS

Finally before implementing LBC in cytology lab the technician should be trained properly and also the faculty should be familiar or experience with the cytological features produced on LBC when compared to CSs on a wide range of lesions. Lee KR et al outlined several differences between the two preparation techniques and emphasized the importance of experience with LBP for a correct interpretation (37)

CONCLUSION :

In our study LBC and CS smears in both FNAC and body fluids are equal diagnostic accuracy. Many studies and including our study also showed informative back ground was lacking in LBC in both FNAC and body fluids. The screening time was reduced due to small area of smear, uniform distribution of cells and clean back ground . So LBC was more superior to CS in these features.

Especially when LBC is the first line and only method applied, careful interpretation of the slides must be applied before a definitive diagnosis is reached or when cytopathologist performing the FNAC has no adequate experience with LBC

Thin prep LBC is safe and acceptable for the diagnosis of thyroid, breast, soft tissue , lymphnode lesions when used in combination with conventional method.

SUMMARY

- The present study was undertaken to study the differences between conventional and LBC methods in various FNAC samples and body fluids and to see how far the LBC is more effective than CS.
- To evaluate and compare the diagnostic utility and accuracy of LBC and conventional cytology on the basis of adequacy,cell types,background(inflammatory or Haemorrhagic background),changes in cell morphology(normal,reactive and atypical changes)in FNAC samples and body fluid
- The total number of samples were 50 cases, out of them 25 cases are FNAC and body fluids 25 cases.
- Majority of the samples are benign and inflammatory in FNAC and body fluid specimens
- Among 25 FNAC samples ,Females> males, Thyroid cases 9(36%), Soft tissues 7 cases (28%), Breast 5 cases(20%), Lymphnodes 2(8%), parotid 1(4%) and liver 1case(4%)
- Among 25 body fluid samples(Male>female), Ascitic 7(28%) and pleural 7(28%) synovial 2(8%), bronchial wash 2(8%), pancreatic fluid 2(8%), urine 1(4%), CSF 1(4%), peritoneal 1(4%), hydrocele 1(4%) and pus 1(4%)
- The diagnostic accuracy was equal in both LBC and CS of FNAC and body fluids

- The cellularity are little more in LBC than CS, but in few cases it was equal.
- The cytological features in LBC and CS are almost all equal except the informative back ground of mucoid, colloid, proteinaceous fluid material and fragmented stromal fragments are lacking in LBC of FNAC and body fluids

Conflict of interest: No

Acknowledgement: Am thankful to our HOD and technicians for their support. Actually this is a **ICMR accepted STS project**, the number is **2018 03531**, due to delay submission we didn't get the fund

REFERENCE:

- [1] Komatsu k, Nakanishi Y, Seki T, Yoshino A, Fuchinoue F, Amano S et al., "Application of Liquid-Based Preparation Fine Needle Aspiration Cytology in Breast Cancer", *Acta Cytologica*, 2008, 52: 591-96.
- [2] Sartelet H, Lagonotte E., Lorenzato M, Duval I, Lechki C., Rigaud G et al., "Comparison of Liquid Based Cytology and Histology for the Evaluation of HER-2 Status Using Immunostaining and CISH in Breast Carcinoma" ,*Journal of Clinical Pathology*, 2005,58: 864-71.
- [3] Fadda G and Rossi ED. "Liquid-Based Cytology in Fine-Needle Aspiration Biopsies of the Thyroid Gland," *Acta Cytologica* ,2011,55: 389-400.
- [4] Hashimoto K, Morimoto A, Kato M, Tominaga Y, Maeda N, Tsuzuki T et al. "Immunocytochemical Analysis for Differential Diagnosis of Thyroid Lesions Using Liquid-Based Cytology", *Nagoya Journal of Medical Science* 2011,73:15-24.
- [5] Gabriel C, Achten R and Drijkoningen M, "Use of Liquid Based Cytology in Serous Fluids: A Comparison with Conventional Cytopreparatory Techniques" ,*Acta Cytologica* 200,48: 825-35.
- [6] Laucirica R, Bentz JS, Souers RJ, Wasserman PG, Crothers BA, Clayton AC et al. "Do Liquid-Based Preparations of Urinary Cytology Perform Differently than Classically Prepared Cases? Observations from the College of American Pathologists Interlaboratory Comparison Program in Nongynecologic Cytology", *Archives of Pathology & Laboratory Medicine* 2010; 134:19-22.
- [7] Norimatsu Y, Kawanishi N, Shigematsu Y, Kawabe T, Ohsaki H and Kobayashi TH. "Use of Liquid-Based Preparations in Urine Cytology: An Evaluation of Liqui PREP and BD SurePath" .*Diagnostic Cytopathology* 2010; 38: 702-04.
- [8] Piatone, Hutin K, Faynel J, Ranchin MC and Cottier M. "Cost Efficiency Analysis of Modern Cyto centrifugation Methods versus Liquid Based (Cytoc Thin prep) Processing of Urinary Samples". *Journal of Clinical Pathology* 2004; 57:1208-12.
- [9] Deshpande V and Mckee GT. "Analysis of Atypical Urine Cytology in a Tertiary Care Centre." .*Cancer* 2005; 105:468-75
- [10] Hwang EC, Park SH, Jung SI, Kwon DD, Park K, Ryu SB et al. "Usefulness of Liquid-Based Preparation in Urine Cytology". *International Journal of Urology* 2007; 14: 626-29.
- [11] Piaton E, Faynel J, Ruffion A, Lopez JG, Perrin P and Devonec M. "p53 Immunodetection of Liquid -Based Processed Urinary Samples Helps to Identify Bladder Tumours with a Higher Risk of Progression". *British Journal of Cancer* 2005; 93:242-47.
- [12] Voss JS, Kipp BR, Krueger AK, Clayton AC, Halling KC, Karnes RJ et al. "Changes in Specimen Preparation Method May Impact Urine Cytologic Evaluation". *American Journal of Clinical Pathology* 2008; 130: 428-33
- [13] Sioutopoulou DO, Kampas LI, Gerasimidou D, Valeri RM, Boukovinas I, Tsavdaridis D et al. "Diagnosis of Metastatic Tumors in Cerebrospinal Fluid Samples Using Thin-Layer Cytology". *Acta Cytologica* 2008;52 : 304 -08.
- [14] Koss LG and Melamed MR (Eds). *Koss' Diagnostic cytology and its histopathologic bases*.5th edition, Philadelphia: JB Lippincott Company; 2006.pp11 (a);
- [15] Koss LG and Melamed MR (Eds). *Koss' Diagnostic cytology and its histopathologic bases*.5th edition, Philadelphia: JB Lippincott Company; 2006.pp11 950(c)
- [16] Prathima S, Shivarudrappa A.S., Anil.N.S. Diagnostic efficacy of Manual Liquid Based Cytology in Fine needle Aspiration samples, *Indian Journal of Pathology*, 2017, 6(2):427-430.
- [17] Singh VB, Gupta N, Nijhawan R, Srinivasan R, Suri V, Rajwanshi A. Liquid-based cytology versus conventional cytology for evaluation of cervical Pap smears: Experience from the first 1000 split samples, *Indian J Pathol Microbiol*, 2015; 58:17-21
- [18] Albertus G.Siebers., Paul.J.J. M .Klinkhamer, Johanna.M.M.Grefte., Leon.F.A.G.judith.e.M., Angeliq Beijers-Broos., Johan Bulten., Marc Arbyn., Comparison of Liquid based cytology with conventional cytology for detection of cervical cancer precursors: A randomized controlled trial, *JAMA* 2009,302(16):1757-1764.
- [19] Nishio H.et al., *Jpn J Clin Oncol*, 2018, 48(6):522-528.
- [20] Yeon MH., Jeong HS., Lee HS., jang JS.,Lee S.,Yoon SM.,Chae HB.,Park SM.,Youn SJ.,Han JH.,Han HS.,L HC.,Comparison of liquid-based cytology(cell Prep Plus) and conventional smears in pancreaticobiliary disease.,*Korean J Intern Med*. 2018 ;33(5):883-892.
- [21] De Luna R., Eloubeidi M.A.,Sheffield M.V.,Eltoum I, Jhala N., Jhala D.,Chen V.K.,Chheng D.C., Comparison of Thin Prep and conventional preparations in pancreatic fine needle aspiration biopsy, *Diagn Cytopathol*,2004,30(2):71-76.
- [22] Cochand-Prillett B.,Prat J.J.,Polivka M.,Thienpont L.,Dahan H.,Wassef M.,Guillaudeau P.J., Thyroid fine needle aspiration: the morphological features on Thin Prep slide preparations. Eighty cases with histological control,*Cyto pathology*,2003,14(6):343-349.
- [23] Tripathy K., Misra A., Ghosh JK., Efficacy of liquid-based cytology versus conventional smears in FNA samples. *J Cytol* 2015; 32:17-20.
- [24] Bedard Y.C., Pollett A.F.,Breast fine needle aspiration. A comparison of ThinPrep and conventional smears,*Am J Clin Pathol*,1999,111(4):523-527.
- [25] Pawar PS, Gadkari RU, Swami SY, Josh I AR. Comparative study of manual liquid based cytology (MLBC) technique and direct smear technique (conventional) on fine needle cytology/fine needle aspiration cytology samples. *J Cytol* 2014 Apr-Jun; 31(2): 83-6.
- [26] Leung CS, Chiu B, Bell V. Comparison of ThinPrep and conventional preparations: nongynecologic cytology evaluation. *Diagn Cytopathol* 1997 Apr; 16(4): 368-71.
- [27] DR. Karan Mahinder.,DR.Nandini .N.M.,Arnav Kishore.,DR.Anil Kumar Singh., Manual Liquid Based Cytology in Breast Fine Needle Aspiration- Comparison with the conventional smear., *IOSR-JDMS* 2016,15(7):17-24.
- [28] Singh G, Agarwal P, Goel MM, Kumar M, Singh DP (2017) Conventional vs. Liquid Based Cytology in Fine Needle Aspirates of Lung and Mediastinal Masses. *J Pulm Respir Med* 7: 400. doi: 10.4172/2161-105X.1000400
- [29] Seung -myoung Son et al. Evaluation of Urine Cytology in Urothelial Carcinoma Patients: A Comparison of CellprepPlus® Liquid-Based Cytology and Conventional Smear.*Korean Journal of Pathology* 2012; 46(1): 68–74.
- [30] Babloyan S, Voulgaris Z, Papaefthimiou M, Beglaryan G, Kyroudi A, Karakitsos P. Comparison of quality between conventional and thinprep cytology in investigation of patients with epithelial ovarian cancer. *The New Armenian Medical Journal* 2009;3 (3):22 – 28.
- [31] Nasaryousufalwahaibi, Nasra Said Alnoumani, Usha Rani Bai. Comparison of Thin Prep and Conventional. Preparations for Peritoneal and Pleural Cytology Smears. *Annual Research & Review in Biology* 2014; 4(20): 3139-49.
- [32] Bong Kyung Shin, Young Suk Lee, Hoiseenjoeng, Sang Holee, Hyunhulkimaree Kim and Han Kyoem Kim. Detecting malignant urothelial cells by morphometric analysis of Thin Prep Liquid based Urine Cytology Specimens. *Korean Journal of Cytopathology* 2008; 19(2); 136-43.
- [33] Saleh H.A., Hammoud J., Zakaria R., Khan A.Z., Comparison of ThinPrep and cell block preparation for evaluation of thyroid epithelial lesions on fine needle aspiration biopsy.*Cytojournal*,2008.5:3.

- [34] Stamataki M., Anninos D., Brountzos E, Georgoulakis J., Panayiotides J., Christoni Z., Peros G., Karakitsos P., The role of liquid- based cytology in the investigation of thyroid lesions, *Cytopathology*, 2008, 19(1):11-18.
- [35] Dey P., Luthra U.K., George J., Zuhairy F., George S.S., Haji B I., Comparison of Thin Prep and conventional preparations on fine needle aspiration cytology material, *Acta Cytol* ,2000, 44(1):46-50.
- [36] Rana D.N., O'Donnell M., Malkin A., Griffin M., A comparative study: Conventional preparation and Thin Prep 2000 in respiration cytology, *Cytopathology*, 2001, 12(6):390-398.
- [37] Lee K.R., Papillo.J.L, ST.John. Eyerer G.J.A., Evaluation of the Thin Prep processor for fine needle aspiration specimens, *Acta Cytol*, 1996, 40(5):895-899.

Author's contribution:

Dr. Sonti sulochana, guide to STS project (data collection, screening and reporting of slides, results, discussion and conclusion)

Dr vithya priya : Data collection and typing of manuscript

Dr Muthusubramaniyam: photos

Dr Bhuvaneshwari: Statistical analysis of data