

Role of Liquid Based Cytology in Ultrasonography Guided Fine Needle Aspiration Cytology of Intra-Abdominal Masses - A Cross-Sectional Study

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ABSTRACT

Background: Fine needle aspiration cytology (FNAC) is a minimally invasive method used in the evaluation of intra-abdominal masses. Liquid-based cytology (LBC) is one method of processing aspirated material. The present study describes the cytomorphological findings, adequacy, cellularity, cytoplasmic and nuclear detail, and background characteristics of LBC preparations from ultrasound-guided FNAC of intra-abdominal masses.

Methods: This cross-sectional descriptive study included 50 ultrasound-guided FNAC cases of intra-abdominal masses evaluated at the Department of Pathology, Government Medical College and Rajindra Hospital, Patiala, over 18 months. Aspirated material was rinsed into 12 mL BD CytoRich™ Red preservative and processed for LBC. No conventional-smear comparator was evaluated or reported in the present study.

Results: Patients ranged from 7 to 85 years (mean age 54.98 ± 14.56 years), and 35 (70%) were female. The liver was the most frequent FNAC site (24/50, 48%). LBC preparations were categorized as malignant in 33/50 cases (66%), suspicious for malignancy in 4/50 (8%), benign in 3/50 (6%), and unsatisfactory in 10/50 (20%). Overall sample adequacy was 40/50 (80%). Moderate cellularity was present in 33/50 (66%); good cytoplasmic detail in 40/50 (80%); good nuclear detail in 40/50 (80%); and a clean background in 44/50 (88%).

Conclusion: In this 50-case descriptive study, LBC preparations showed the reported levels of adequacy, cellularity, cytoplasmic and nuclear detail, and background cleanliness. Because no conventional-smear comparator or independent reference-standard correlation was reported, the present study does not establish superiority, improved diagnostic accuracy, or improved diagnostic performance of LBC. Larger comparative studies with predefined criteria and appropriate statistical analysis are required to determine the relative performance of LBC and conventional smears.

Keywords: Fine needle aspiration cytology, Liquid based cytology, Conventional smear, Intra-abdominal mass, background, cellularity.

INTRODUCTION

The management of abdominal masses may require clinical, radiological, cytological, surgical, and histopathological assessment [1]. FNAC is a minimally invasive technique that can provide cytological information from deep-seated lesions. Aspirated material may be processed as conventional smears or by liquid-based cytology (LBC) [2].

LBC was initially developed for gynecological cytology and has subsequently been used in non-gynecological cytology, including fine-needle aspiration samples [2,3,4]. Published studies have evaluated features such as cellularity, background, cell distribution, and cytomorphological preservation using comparative designs; however, those findings cannot be assumed to apply as comparative results to the present single-arm study.

The present study was undertaken to describe the cytomorphological and specimen-quality characteristics observed in LBC preparations from ultrasound-guided FNAC of intra-abdominal masses.

The objective was to describe the cytomorphological findings and specimen-quality characteristics of LBC preparations obtained from ultrasound-guided FNAC of intra-abdominal masses, including adequacy, cellularity, cytoplasmic detail, nuclear detail, background, and cytological diagnostic categories.

The study was aimed to discuss the role of liquid based cytology in guided fine needle aspiration of intra- abdominal masses.

MATERIALS & METHODS

Study design and setting

This cross-sectional descriptive study was conducted on ultrasound-guided FNAC cases of intra-abdominal masses at the Department of Pathology, Government Medical College and Rajindra Hospital, Patiala, Punjab. The study was conducted over a period of one and a half years (18 months). All USG guided FNAC of intra-abdominal masses that came to our institute

during this period were taken in the study (inclusion criteria). Already diagnosed cases of intra-abdominal masses and those with deranged coagulation profile were excluded from the study.

The study protocol was explained to the patients whose samples were included, and written informed consent was obtained for use of their samples. A structured proforma was used to record clinical and radiological information. FNAC of abdominal lesions was performed under ultrasound guidance as per the surgeon's specifications. The needle containing the aspirated material was rinsed into a tube containing 12 mL of BD CytoRich™ Red preservative. After fixation, washing, and processing, slides were mounted using DPX and examined microscopically.

Statistical Analysis

Data were collected using a pre-structured proforma, entered into an Excel spreadsheet, and analyzed using descriptive statistics. Frequencies and percentages were used for categorical variables; mean $\pm$ standard deviation (SD) and range were used for age. No inferential statistical test, sensitivity/specificity analysis, diagnostic-accuracy analysis, or reference-standard comparison was performed. Accordingly, the study is reported as descriptive and no comparative or diagnostic-performance inference is made.

RESULT

Age Distribution

The age of the patients ranged from 7 to 85 years, with a mean age of 54.98 ± 14.56 years. The majority of patients belonged to the 41–60 years age group (44%), followed by 61–80 years (34%), 21–40 years (18%), ≤ 20 years (2%), and > 80 years (2%) (Table 1).

Table-1 Distribution of patients according to age

Age	Frequency	Percentage
≤20 years	1	2%
21-40 years	9	18%
41-60 years	22	44%
61-80 years	17	34%
>80 years	1	2%
Total	50	100%
Range	7-85 years	
Mean Age± SD	54.98±14.56	

Gender Distribution

Out of the total 50 cases, 35 (70%) were females and 15 (30%) were males, indicating a female predominance (Table 2).

Table-2 Distribution of patients according to gender

Gender	Number	Percentage
Male	15	30%
Female	35	70%
Total	50	100

Site of FNAC

The most common site for FNAC was the liver (48%), followed by the gall bladder (14%), abdominal lymph nodes (12%), ovary (8%), omentum (4%), renal (4%), and periampullary region (4%). Less frequently involved sites included right iliac fossa mass (2%), retroperitoneal region (2%), and pancreas (2%) (Table 3).

Table-3 Distribution of patients according to site of FNAC

Site of FNAC	Number	Percentage
Liver	24	48%
Gall bladder	7	14%
Abdominal lymph node	6	12%
Ovary	4	8%
Omentum	2	4%
Renal	2	4%
Periampullary region	2	4%
Right iliac fossa mass	1	2%
Retroperitoneal region	1	2%
Pancreas	1	2%
Total	50	100%

Organ-wise Diagnosis on LBC

On organ-wise analysis of the LBC cytological categories, 33 of 50 cases (66%) were classified as malignant. Four cases (8%) were suspicious for malignancy, three (6%) were benign, and 10 (20%) were unsatisfactory. The liver accounted for 17 malignant cases (34% of all cases), followed by the gall bladder (5, 10%) and ovary (4, 8%). The complete organ-wise distribution is shown in Table 4.

A suspicion of malignancy was noted in 4 cases (8%), whereas benign lesions were seen in 3 cases (6%). Unsatisfactory samples were found in 10 cases (20%), with abdominal lymph nodes being the most frequent site for such cases (Table 4).

Table-4 Organ-wise diagnosis of cases on LBC

Organ	Malignant cases	Suspicion of malignancy	Benign cases	Unsatisfactory cases
Liver	17 (34%)	2 (4%)	3 (6%)	2 (4%)
Gall bladder	5 (10%)	1 (2%)	0 (0%)	1 (2%)
Abdominal lymph node	2 (4%)	0 (0%)	0 (0%)	4 (8%)
Ovary	4 (8%)	0 (0%)	0 (0%)	0 (0%)
Omentum	1 (2%)	1 (2%)	0 (0%)	0 (0%)
Renal	1 (2%)	0 (0%)	0 (0%)	1 (2%)
Periampullary region	2 (4%)	0 (0%)	0 (0%)	0 (0%)
Right iliac fossa mass	1 (2%)	0 (0%)	0 (0%)	0 (0%)
Retroperitoneal region	0 (0%)	0 (0%)	0 (0%)	1 (2%)
Pancreas	0 (0%)	0 (0%)	0 (0%)	1 (2%)
Total	33 (66%)	4 (8%)	3 (6%)	10 (20%)

Adequacy of LBC Samples

Out of 50 samples, 40 (80%) were considered adequate for cytological interpretation, while 10 (20%) were inadequate/unsatisfactory (Table 5).

Table-5 Adequacy on LBC

Adequacy	LBC findings	
	Number	Percentage
Adequate	40	80%
Inadequate	10	20%
Total	50	100%

Cellularity of LBC Samples

In terms of cellularity, moderate cellularity was observed in 33 cases (66%), mild cellularity in 7 cases (14%), and scanty cellularity in 10 cases (20%). No sample showed high cellularity (Table 6).

Table- 6 Cellularity on LBC

Cellularity	LBC findings	
	Number	Percentage
High	0	0%
Moderate	33	66%
Mild	7	14%
Scanty	10	20%
Total	50	100%

Cytoplasmic and Nuclear Details

Cytoplasmic details were graded as good in 40/50 cases (80%) and not good in 10/50 (20%). Nuclear details were graded as good in 40/50 cases (80%) and not good in 10/50 (20%) (Tables 7 and 8).

Table-7 Cytoplasmic details on LBC

Cytoplasmic details	LBC findings	
	Number	Percentage
Good	40	80%
Not good	10	20%
Total	50	100%

Table-8 Nuclear details on LBC

Nuclear details	LBC findings	
	Number	Percentage
Good	40	80%
Not good	10	20%
Total	50	100%

Background of LBC Smears

A clean background was observed in 44/50 cases (88%), while a bloody background was seen in 6/50 cases (12%) (Table 9).

Table-9 Background on LBC

Background	LBC findings	
	Number	Percentage
Clean	44	88%
Blood	6	12%
Total	50	100%

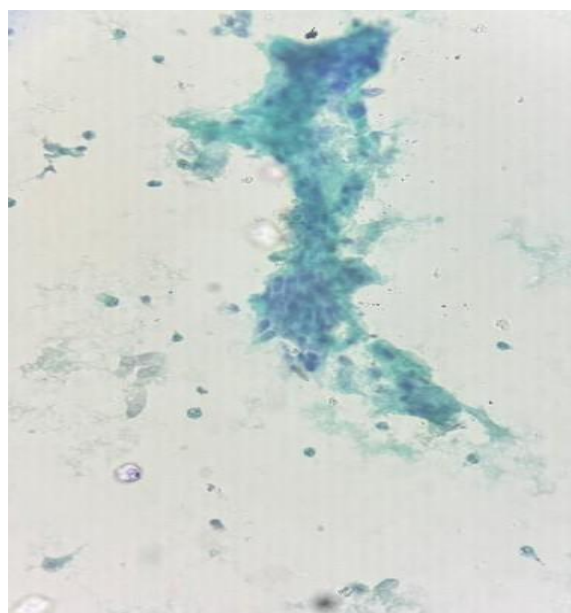


Figure 1 Low power view of Serous cystadenocarcinoma ovary-malignant epithelial cells arranged in papillary cluster and clean background (LBC, PAP x 100)

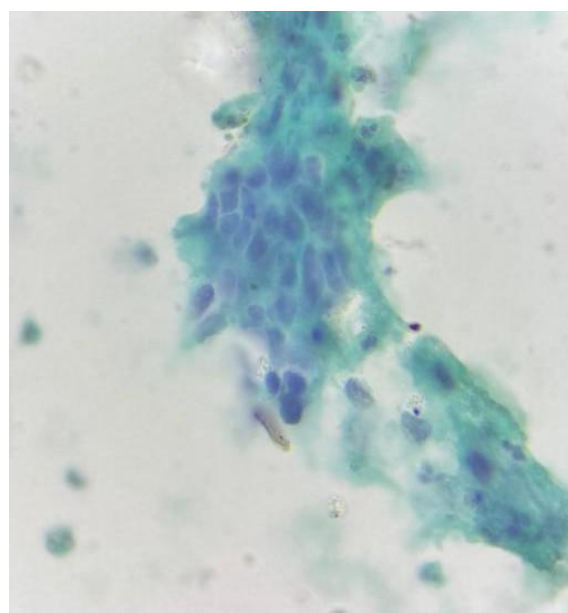


Figure 2 High power view of Serous cystadenocarcinoma ovary-malignant epithelial cells exhibiting moderate cellular and nuclear pleomorphism (LBC, PAP x 400)

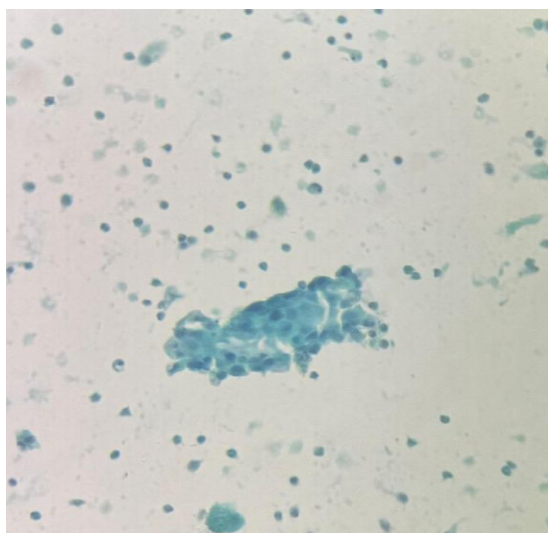


Figure 3 Low power view showing metastatic deposits of adenocarcinoma in liver (LBC, PAP x 100)

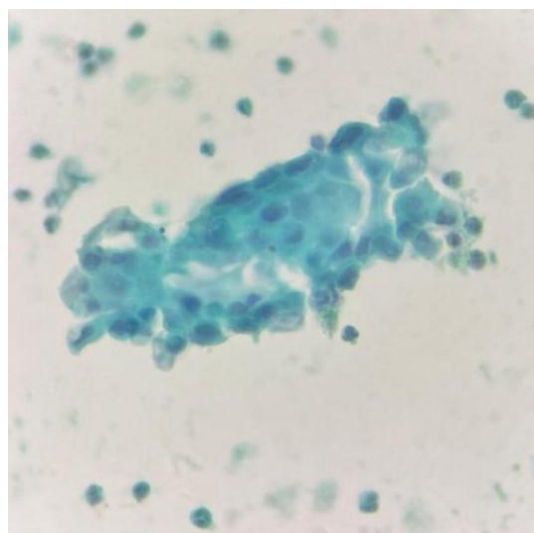


Figure 4 High power view showing metastatic deposits of adenocarcinoma in liver with preserved cytoplasmic and nuclear details (LBC, PAP x 400)



Figure 5 Low power view showing unsatisfactory sample due to lack of cellularity (LBC, PAP x 100)

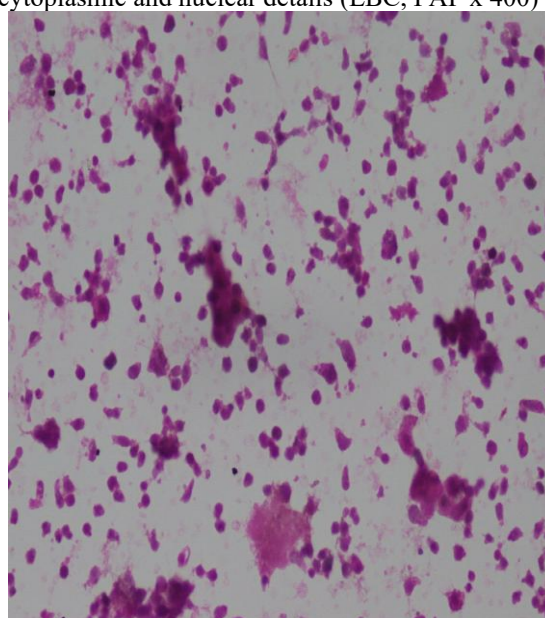


Figure 6 Low power view showing malignant round cell tumor of gall bladder (LBC, PAP x 100)

DISCUSSION

The present study was undertaken to describe the findings obtained from LBC preparations of ultrasound-guided FNAC specimens from intra-abdominal masses. As this was a single-arm descriptive study, the results describe the observed cytological and specimen-quality characteristics and should not be interpreted as evidence that LBC is superior to conventional smears.

Age Distribution

The mean age of patients in this study was 54.98 ± 14.56 years, with an age range of 7

to 85 years. The majority of cases were in the 41–60 years age group (44%), followed by those aged 61–80 years (34%), 21–40 years (18%), ≤ 20 years (2%), and > 80 years (2%). These findings are comparable to those reported in previous studies. Poddar et al. (2024) observed a predominance of cases in the 51–60 years age group, while Jun et al. (2023) found a mean age of 60.7 ± 12.8 years (range: 24–85 years) [6,7,8]. Similarly, Agrahari et al. (2022) reported a mean age of 47.73 ± 12.67 years, with ages ranging from 4 to 75 years [7,8]. The age distribution in the present study aligns with

these prior findings, confirming a middle-aged to elderly population as most commonly affected by abdominal masses.

Gender Distribution

Out of the 50 patients included in this study, 15 (30%) were male and 35 (70%) were female, indicating a female predominance. This gender distribution is in concordance with the studies by Jun et al. (2023), who reported 46.7% males and 53.3% females, and Agrahari et al. (2022), who found 38.1% male and 61.9% female patients [7,8]. However, other studies such as Poddar et al. (2024) and Sumana et al. (2015) reported a male predominance [6,9]. Thus, while some variation exists, the current findings support a female-dominant trend, consistent with recent studies.

Distribution of FNAC Sites

In the present study, the liver was the most common site for FNAC (48%), followed by the gall bladder (14%), abdominal lymph nodes (12%), ovary (8%), and omentum, renal region, and periaampullary region (each 4%). Less commonly involved sites included the right iliac fossa mass (2%), retroperitoneal region (2%), and pancreas (2%). This distribution is similar to that reported by Agrahari et al. (2022), where the liver (45.1%) and gall bladder mass (37.2%) were the predominant sites [7]. Sumana et al. (2015) also noted the liver (40%) and retroperitoneum (10%) as common sites for FNAC [9]. In contrast, Tripathy et al. (2015) included a broader spectrum of cases involving extra-abdominal sites such as breast and salivary glands [10]. These comparisons reinforce the liver as the most frequent site for abdominal mass evaluation using FNAC.

Organ-Wise Diagnosis

A detailed analysis of the cytological diagnosis by organ revealed the following:

Liver: Out of 24 liver cases, 17 (34%) were malignant, 2 (4%) were suspicious of malignancy, 3 (6%) were benign, and 2 (4%) were unsatisfactory.

Gall Bladder: Among 7 cases, 5 (10%) were malignant, 1 (2%) was suspicious, and 1 (2%) was unsatisfactory.

Abdominal Lymph Nodes: Of 6 cases, 2 (4%) were malignant and 4 (8%) were unsatisfactory.

Ovary: All 4 cases (8%) were diagnosed as malignant.

Omentum: One case (2%) was malignant and one (2%) was suspicious.

Kidneys: One malignant (2%) and one unsatisfactory (2%) case were reported.

Periaampullary Region: Both cases (4%) were malignant.

Right Iliac Fossa: One case (2%) was malignant.

Retroperitoneal Region and Pancreas: One case (2%) each showed unsatisfactory cytology.

Jun et al. (2023) reported similar results, with 38.3% malignant, 13.3% suspicious, 25% atypical, and 23.3% benign cases using LBC. Agrahari et al. (2022) found 67.3% malignant, 21.2% benign, and 11.5% inconclusive samples. The organ-wise distribution in the present study describes the cytological categories observed on LBC: 33 (66%) malignant, 4 (8%) suspicious for malignancy, 3 (6%) benign, and 10 (20%) unsatisfactory. These frequencies are descriptive and were not validated against histopathology or another independent reference standard. Published comparative studies have reported differing findings because they used different populations, preparation methods, and study designs [7,8,10].

CONCLUSION

The present 50-case cross-sectional descriptive study describes the cytological findings and specimen-quality characteristics of LBC preparations from ultrasound-guided FNAC of intra-abdominal masses. Among the 50 cases, 40 (80%) were adequate, 33 (66%) were classified as malignant, 4 (8%) as suspicious for malignancy, 3 (6%) as benign, and 10 (20%) as unsatisfactory; good cytoplasmic detail was observed in 40 (80%), good

nuclear detail in 40 (80%), and a clean background in 44 (88%). These findings describe the experience in this study population but do not establish superiority or greater diagnostic accuracy of LBC over conventional smears. The absence of a conventional-smear comparator and independent reference-standard correlation, together with the small sample size and single-center design, limits generalizability and prevents diagnostic-performance conclusions. Future comparative studies should include predefined specimen-quality criteria, an appropriate reference standard where applicable, and inferential statistical analysis.

Declaration

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

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