



Original Article

# A comparative study of cell block and cytological smears in FNAC of intra-abdominal lesions

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## Keywords:

Cellblock;  
Hepatocellular carcinoma;  
Metastatic  
adenocarcinoma;

## ABSTRACT

**Background:** Cell blocks are micro biopsies and are complimentary to cytology smears and give a more accurate diagnosis. This study aimed to study cell block as an adjunct for FNAC smears in intra-abdominal lesions, and to compare the sensitivity and specificity of the cell block with FNACs of intra-abdominal lesions.

**Materials and Methods:** This study was done for three years. FNAC of the intra- abdominal lesions were done and smears were prepared for routine staining (HE, PAP, and MGG), the rest of the material was submitted in 60% ethanol for cell block preparation.

**Results:** FNACs were done in 102 cases, cell blocks were obtained in 95 cases, and histopathological correlation in 87 cases. The maximum number of cases was between 51-60 years age group. The liver was the most common organ involved with 22 cases(21.56%). Nonneoplastic cases were 17, neoplastic was 85. Statistical analysis was done for benign and malignant cases. Histopathological correlations were available in 71 neoplastic cases. The sensitivity, specificity PPV, NPV, and diagnostic accuracy of combined FNACs and Cell blocks were 98.27%, 100%, 100%, 92.85%, and 98.59% respectively.

**Conclusions:** FNAC of intra-abdominal lesions is a safe, simple, cost-effective procedure and along with cell blocks gives a precise diagnosis. They can also be used for histochemical stains, immunocytochemistry, and in-situ-hybridization.

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Received : November 25<sup>th</sup> 2020 ; Accepted : July 26<sup>th</sup> 2021

**Citation:** Anita A M, Mali MD HA, Patil AG, Meenakshi M. comparative study of cell block and cytological smears in FNAC of intra-abdominal lesions. J Pathol Nep 2022;12(1):1900-6. DOI: 10.3126/jpn.v12i1.33054

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DOI: 10.3126/jpn.v12i1.33054



## INTRODUCTION

Intra-abdominal lesions possess significant diagnostic difficulties. Fine needle aspiration cytology (FNAC) plays an important role as it is rapid, less hazardous, and easy to perform diagnostic modality.<sup>1</sup> Imaging techniques such as ultrasonography, CT/MRI scan can be used as a guide for FNAC of intra-abdominal lesions by adding to the yield of the aspirate and providing important diagnostic clues.<sup>2</sup> However, FNAC sometimes does not yield information for precise diagnosis and there is always the risk of false-negative/indeterminate diagnosis. In these cases, cell block preparations can be helpful. Cell blocks are micro biopsies

embedded in paraffin that broaden the diagnostic value of cytology specimens and compliments cytology smears. It employs retrieval of small tissue fragments from Fine needle aspiration specimens which are processed to form a paraffin block.<sup>3</sup> Cell block is a cost-effective procedure and useful adjunct to smears to establish a more definitive diagnosis. It preserves architectural patterns like cell balls, papillae, and three-dimensional clusters with better nuclear and cytoplasmic preservation, intact cell membrane, crisp chromatin details.<sup>4</sup> Cell blocks can be used for histochemical stains, immunocytochemistry, and in insitu-hybridization. Blocks can be stored for the long term and multiple sections can be performed unlike cytological smears.<sup>5</sup>

This study was carried out to study cell block as an adjunct for FNAC smears in intra-abdominal lesions and to compare sensitivity and specificity of the cell block with FNAC smears of intra-abdominal lesions.

## MATERIALS AND METHODS

The present study was carried out in the department of pathology, Mahadevappa Rampure medical college, Kalaburagi, India for a period of three years including a one-year retrospective (July 2016- June 2017) and two years prospective study (from July 2017 to June 2019). A total of 102 cases were studied. Intra-abdominal organs included in the study were liver, spleen, pancreas, stomach, gallbladder, small and large intestine, omentum, mesentery, retroperitoneum, kidney, adrenals, lymph nodes, soft tissues, uterus, and ovary.

After taking informed consent from the patient, Direct FNAC for superficial and palpable masses were done with a 22-25G needle attached to a 10ml syringe. For deeper lesions, ultrasonographic evaluations were done to assess the origin of the lesions and their relationship with the adjacent organs. Aspiration was done under radiological guidance using a 9 cm long, 22-24G spinal needle. Smears were prepared for routine staining - May Grunwald Giemsa (MGG), Hematoxylin and Eosin (H and E), and Papanicolaou (Pap) stains. The rest of the material was submitted in 60% ethanol for cell block preparation. The entire material was then centrifuged at 1500 rotations per minute for 20 minutes. The supernatant fluid was discarded and the cell button formed was sent for routine histopathological processing. The fixed tissue was sectioned and put on slides and stained with H and E. Whenever necessary special stains and immunohistochemical stains were done.

Data analysis:- Study design was an observational type of descriptive study. Sample size estimation was done by using G Power software (version 3.0). Statistical analysis was done by using SPSS software(version 20.0). Data were spread on an excel sheet, calculated statistical parameters like mean and standard deviation. For Qualitative data analysis, the Chi-square test and Fischer's exact test were applied for statistical significance. For Quantitative data analysis, a t-test was applied for statistical significance. If the p-value was <0.05, it was considered significant. Accuracy, sensitivity, specificity, positive predictive value(PPV), negative predictive value(NPV) of cytological and cell block correlation were calculated.

## RESULTS

FNACs were done in 102 cases, cell blocks were obtained in 95 cases and histopathological correlation in 87 cases respectively. The maximum number of cases was between 51-60 years age group. 54 cases (52.95%) were male and 48 cases (47.05%) were female (M: F- 1.12:1) with slightly male predominance. The most common clinical manifestation was pain abdomen/discomfort in 49(87.50%) cases followed by distension of abdomen (46.42%) and loss of appetite (42.85%), respectively.

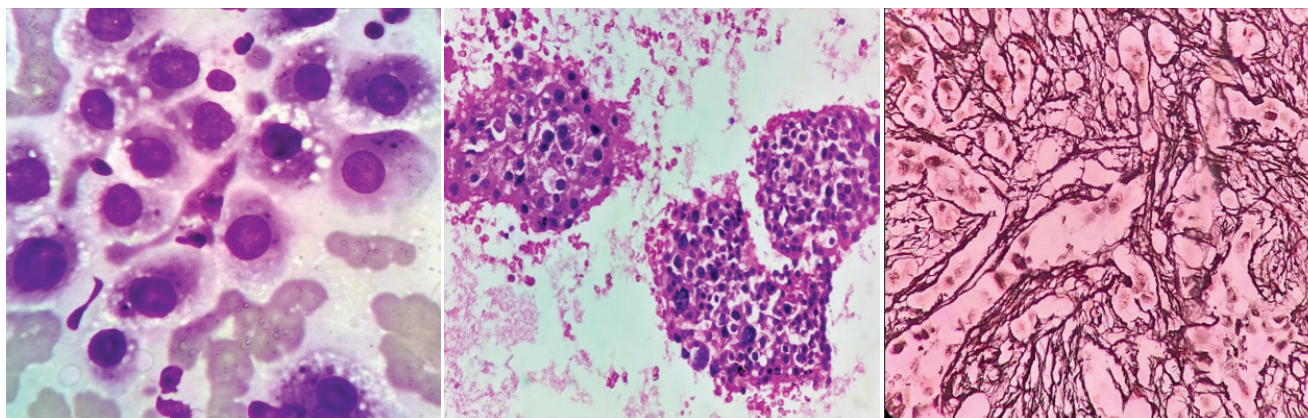
Out of the total of 102 cases, USG guided FNAC was done in 95 cases (93.14%) and direct FNAC in 7 cases (6.86%) respectively. On FNA, haemorrhagic cellular aspirate were obtained in 81 cases (79.42%), purulent in 9 cases(08.82%),clear fluid like in 7 cases(06.86%) hemorrhagic in 5 cases(04.90%) respectively.

Liver was the most common organ involved with 22 cases(21.56%) followed by retroperitoneum/pelvis-18(17.65%), ovary-15(14.70%), lymph node -15(14.70%), kidney-9(8.83%), intestine-8(7.84%), epigastrium -7(6.86%), uterus- 4(3.94%), and each case(0.98%) of pancreas, spleen, stomach, and gall bladder respectively. Out of the total of 102 cases (100%), the majority were malignant primaries with 40 cases (39.21%) followed by metastatic with 29 cases (28.43%). 16 cases (15.68%) were benign and 16 cases (15.68%) were inflammatory respectively. One case of myeloid metaplasia was also reported. Table-1 shows category wise distribution of all intra-abdominal cases. The study shows that there was no statistically significant difference among cytological diagnoses with cell block and/or histopathological diagnosis ( $p>0.05$ ).

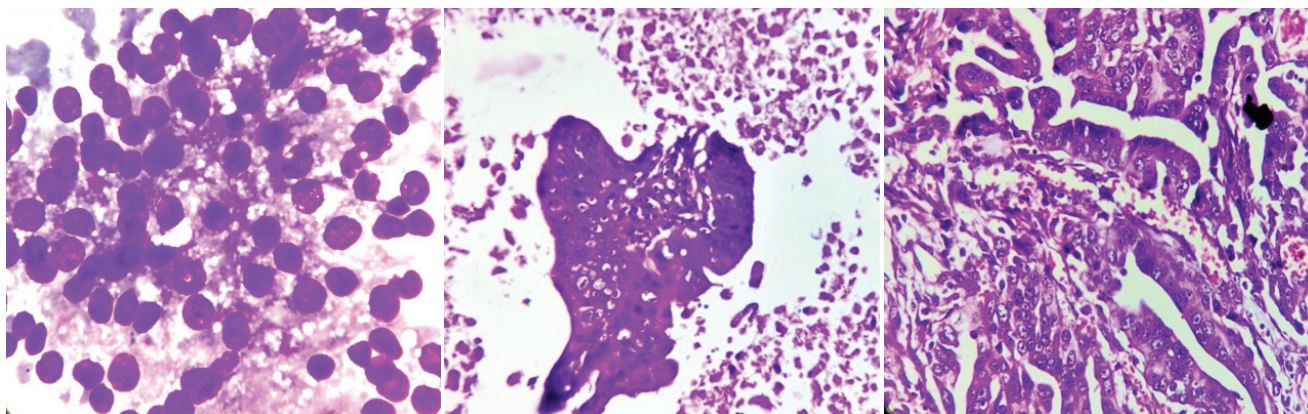
**Table 1: Category Wise Distribution Of All Intra-Abdominal Cases**

Categories	Cytological Diagnosis/ cases (%)	Cell block Diagnosis / cases (%)	Histopathological Diagnosis/cases (%)
Non neoplastic lesions	18(17.64%)	17(16.67%)	16(15.69%)
Neoplastic lesions	84 (82.36%)	78(76.46%)	71(69.60%)
<b>Total</b>	<b>102(100.0%)</b>	<b>95(93.13%)</b>	<b>87(85.29%)</b>

Chi-square test  $c_2yates = 0.018$ ,  $p\text{-value} = 0.99$   $1df$ ,  $p > 0.05$ , Not significant



**Figure 1: Moderately Differentiated Hepatocellular Carcinoma. A. FNAC- polygonal cells with increased N: C ratio and prominent nucleoli. B. Cell block. C. Reticulin stain on cell block showing partial loss of reticulin fibers.**



**Figure 2: Papillary Renal Cell Carcinoma. A. FNAC showing Highly cellular smear showing papillary fragments with fibrovascular core, cells with increased N: C ratio. B. Cell Block - areas of haemorrhage and necrosis with cells cuboidal to low columnar with vesicular chromatin and prominent nucleoli. C. Biopsy - stratification of epithelium with prominent nucleoli.**

Organ/site-wise diagnosis of all intra-abdominal lesions is depicted in table 2. The study observed that inflammatory lesions were more common in lymph nodes (cases=5), whereas benign lesions were more common in the ovary with 8 cases. Primary malignant lesions were most common in the ovary, lymph node, colon, and kidney with 6 cases each, and metastatic lesions were most common in the liver with 10 cases respectively.

### STATISTICAL ANALYSIS

Statistical analysis was done for neoplastic lesions. Out of 85 neoplastic lesions in this study, histopathological correlations were available in 71 cases. Sensitivity, specificity, positive predictive value (PPV), Negative predictive value (NPV), and Diagnostic accuracy were done for neoplastic lesions on FNAC, cell block, and both combined FNAC and cell block with histopathology as the gold standard. Fisher's exact test was used where applicable.

Out of 71 neoplastic lesions diagnosed and confirmed on histopathology, FNAC showed 14 benign lesions, 50 malignant lesions. Two benign lesions (metanephric adenoma and lymphatic cyst) were reported as malignant (false positive). Similarly, five malignant cases

were reported as benign lesions (false negative) due to scant material. (Table 3). The sensitivity, specificity, PPV,

NPV and diagnostic accuracy of combined FNACs and Cell blocks were 98.27%, 100%, 100%, 92.85% and 98.59% respectively.

Out of 71 neoplastic cases diagnosed on histopathology, cell block showed 54 as malignant and 15 as benign lesions. One case of mucinous cystadenocarcinoma of ovary showed only mucin (false negative) and one case of uterine lipoleiomyoma showed few spindle cells suspicious to be pleomorphic (false positive) on cell block respectively. P-value = 0.356, at 1df,  $p > 0.05$ , Not significant. sensitivity, specificity, PPV, NPV and Accuracy on cell blocks were 98.18%, 93.75%, 98.18%, 93.75% and 97.18% respectively. The study also shows increased diagnostic accuracy of cell blocks in comparison to FNAC.

Out of 71 neoplastic lesions confirmed on histopathology, combined FNAC and cell block showed 57 cases as malignant, 13 cases as benign. One case of mucinous cystadenocarcinoma of the ovary showed only mucin on FNAC and cell block (false negative). None of the cases showed false positives when FNAC and cell blocks were

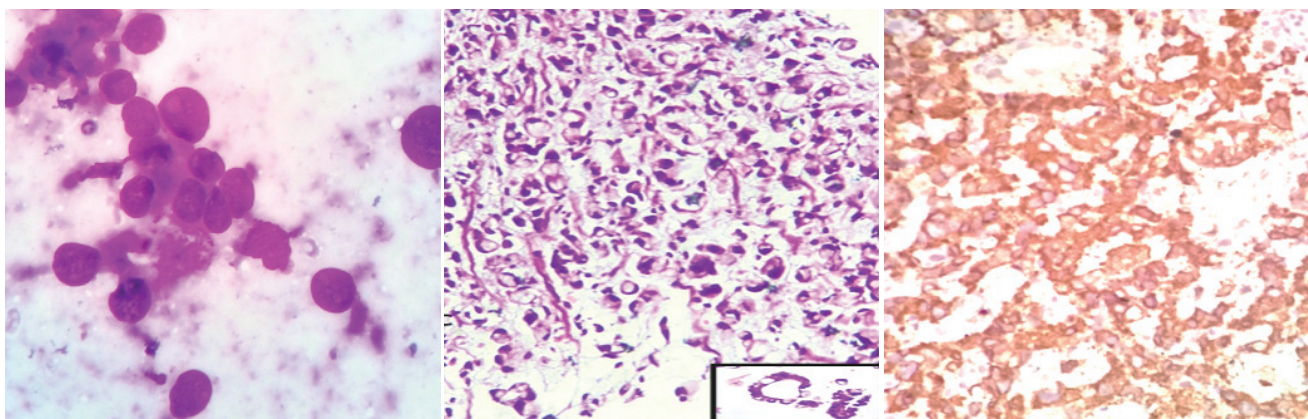
**Table 2: Haematological parameters in COVID groups**

	NON-NEOPLASTIC LESIONS		NEOPLASTIC LESIONS	
	Inflammatory/ others	Benign	Malignant Primary	Metastatic
Liver(n=22)	Cyst-1 Abscess-2	Regenerative nodule-3 Hepatic adenoma-1	HCC-Well differentiated-3 Moderately differentiated-1 (fig. 1) Poorly Differentiated-1	Adenocarcinoma (Colon)-5 (Breast)-1, (GIT)-1 (Pancreas)-1,(Unknown)-1 Poorly Differentiated Carcinoma (Lung)-1
Retroperitoneum (n=18)	Granulomatous Lesion-1 Non Specific Inflammatory Lesion-2 Others- ectopic spleen-1	Lymphangioma-2	Small Round Cell Tumour-1 Neuroblastoma-2 Liposarcoma-1 Leiomyosarcoma-1	Adenocarcinoma (Unknown)-4 Squamous Cell Carcinoma(Unknown) -1 Poorly Differentiated Carcinoma(Genitourinary Tract)-2
Ovary (n=15)		Serous Cystadenoma-2 Mucinous Cystadenoma-2 Mature Teratoma--3 Fibroma-1	Mucinous Cystadenocarcinoma-1 Serous Cystadenocarcinoma -2 Brenner Tumour With Serous Cystadenocarcinoma -1 Dysgerminoma-1 Granulosa Cell Tumour-1	Krukenberg Tumour-1
Lymph Node (n=15)	Granulomatous Lymphadenitis-3 Reactive Lymphadenitis-2	-	Hodgkins Lymphoma-2 Non Hodgkins Lymphoma-3 Neuroblastoma-1	Adenocarcinoma (Upper-GIT )-2 Adenocarcinoma (Colon)- 1 Poorly Differentiated Carcinoma(Genitourinary Tract)-1
Kidney (n=9)	Chronic Pyelonephritis-1 Xanthogranulomatous Pyelonephritis-1	Metanephric Adenoma-1	Clear Cellcarcinoma-2 Papillary Renal Cell Carcinoma-2 (fig-2) Transitional Cell Carcinoma-1 Wilms Tumour-1	-
Colon (n=8)	Tuberculosis Of Intestine-1 Non Specific Enteritis-1	-	Adenocarcinoma Of Colon -6(fig-3)	-
Epigastrium / Paraumbilical region ( n=7)	-	-	-	Adenocarcinoma (Unknown) -1 Adenocarcinoma (Git)-1 Poorly Differentiated Carcinoma (Unknown) – 3 Squamous Cell Carcinoma (Upper Git) -2
Uterus (n=4)	-	Lipoleiomyoma -1	Leiomyosarcoma-3 (fig-4)	-
Spleen (n=1)	Perispleenic Abscess-1	-	-	-
Pancreas (n=1), Stomach (n=1), Gall bladder (n=1)	-	-	Adenocarcinoma-3 (1 each)	-

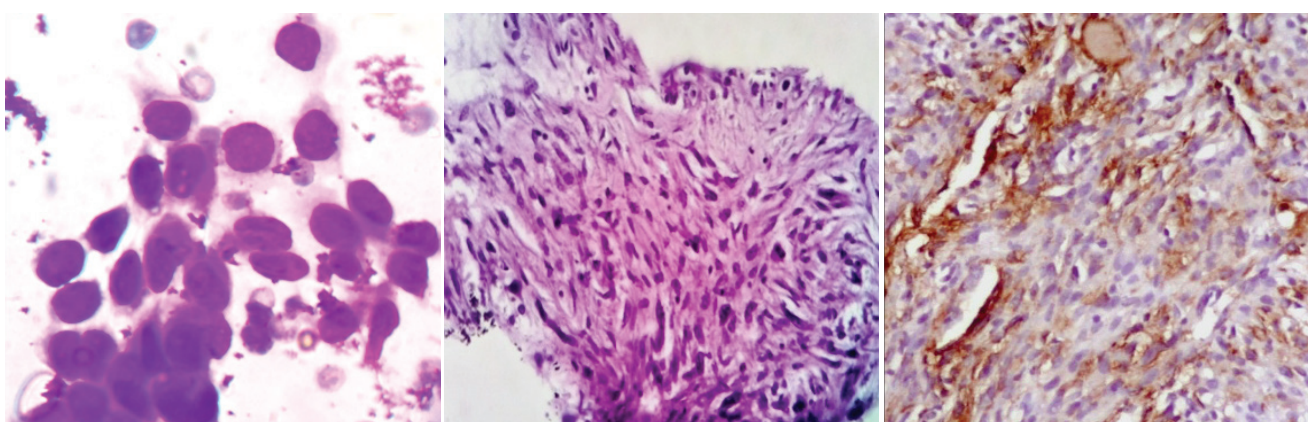
combined. The study showed sensitivity, specificity, PPV, NPV, and accuracy of 98.27%, 100%, 100%, 92.85%, and 98.59% respectively of combined FNAC and cell blocks. The study observed sensitivity, specificity, PPV, NPV, and diagnostic accuracy of combined FNAC and cell blocks were higher in comparison to FNAC or cell blocks alone respectively(Table-4).

## DISCUSSION

FNAC of intra-abdominal malignant lesions is the first choice of diagnostic modality with almost 100% specificity.<sup>1</sup> The intra-abdominal lesions particularly located deep are difficult to assess and more importantly to diagnose. Though imaging technologies (USG/CT/MRI scan) help in evaluating the lesions, sometimes it becomes difficult to diagnose and differentiate between borderline and malignant lesions.<sup>2</sup> Also many intra-abdominal inflammatory conditions like tuberculosis give misleading



**Figure 3: Moderately Differentiated Adenocarcinoma Of Colon** A. FNAC-loosely cohesive clusters of cells, pleomorphic nuclei, coarse chromatin, and prominent 1-2 macronucleoli .B. Cell Block showing pleomorphic signet ring .C. Cell block- cyokeratin positive.



**Figure 4: Leiomyosarcoma** - A. FNAC- high-grade malignant spindle cell tumour. B. Cell Block- spindle cells and areas of haemorrhage. C. Cell Block - tumour cells showing SMA positive

**Table 3: Statistical analysis and diagnostic value of neoplastic lesions on FNAC**

Statistical values of FNAC	Number of cases	Diagnostic values	Percentage
True positives	50	Sensitivity	90.90%
True negatives	14	Specificity	87.50%
False positives	02	PPV	96.15%
False negatives	05	NPV	73.68%
<b>Total</b>	<b>71</b>	<b>Accuracy</b>	<b>90.14%</b>

$p$ -value =0.061,  $p > 0.05$ , Not significant

**Table 4: Statistical analysis and diagnostic value of neoplastic lesions on combined FNAC and cell block**

Statistical Analysis Of Combined Fnac and Cell Block	Number of cases	Diagnostic value of Combined Fnac and Cell Block	Percentage
True Positives	57	Sensitivity	98.27%
True Negatives	13	Specificity	100%
False Positives	--	PPV	100%
False Negatives	01	NPP	92.85%
<b>Total</b>	<b>71</b>	<b>Accuracy</b>	<b>98.59%</b>

**Table 5: Statistical results and comparative analysis of FNAC**

Study	No. of FNACs	Sensitivity %	Specificity %	Diagnostic Accuracy %
Shamshad et al (2006) <sup>14</sup>	200	94.11%	100%	95.7%
Hemalatha et al (2013) <sup>15</sup>	90	94.1%	100%	96.3%
B S Sumana et al(2015) <sup>8</sup>	62	95.35%	100%	96.43%
Shashikala Vinayakamurthy (2016) <sup>9</sup>	66	91.6%	88.8%	62%
Aparna Amogh et al (2016) <sup>11</sup>	660	83%	88%	85%
Elizabeth P Mathew (2018) <sup>12</sup>	46	62.22%	100%	63.04%
Sourav Bhowmik et al (2018) <sup>13</sup>	167	100%	90.09%	---
B Ranjitha et al (2019) <sup>10</sup>	82	84%	100%	85.7%
Present study (2019)	102	90.90%	87.50%	90.14 %

**Table 6: Analysis of combined FNAC and cell block sensitivity in various studies**

STUDY	FNAC%	CELL BLOCK%	COMBINED FNAC AND CELL BLOCK %
Richardson et al(1955) <sup>16</sup>	28%	68%	82%
Keyhani Rofaga et al, (1984) <sup>18</sup>	55%	60%	86%
Wojcik and Selvaggi (1991) <sup>19</sup>	83.5%	85.5%	84.5%
Khan N et al(2006) <sup>17</sup>	56%	72%	85.3%
Sharma R et al (2015) <sup>20</sup>	89.23%	95.38%	96.92%
Shashikala Vinayakamurthy (2016) <sup>9</sup>	96.96%	68.18%	100%
Sourav Bhowmik et al (2018) <sup>13</sup>	89.9%	95.9%	96.39%
Present study	90.90%	98.18%	98.27%

results on radiology. In such situations, FNACs play a very vital role. Guided FNACs under USG /CT scan increases the sensitivity and specificity.<sup>3,4</sup>

Sometimes sufficient material is not obtained on FNAC or a lot of material gets entrapped in the needle hub and gets clotted which cannot be used for making FNACs smear. In such situations making a cell block of excess or clotted material present in the needle hub can be useful.<sup>5,6</sup> Cellblock has many advantages like it is cost-effective and multiple sections of it can be given. It gives an accurate and precise diagnosis. It preserves architectural patterns, three-dimensional clusters and gives better nuclear and cytoplasmic details. The biggest advantage is cell blocks can be used for a variety of histochemical stains, immunocytochemistry, and insitu-hybridization.<sup>7,8</sup>

In this study, a total of 102 cases of intra-abdominal lesions, referred to the Department of Pathology, for FNAC of intra-abdominal lesions were studied during a period of three years from July 2016 to June 2019 respectively. FNACs were done in all 102 cases(100%). Cell blocks were obtained in 95 cases (93.13%) and histopathological correlation was available in 87 cases (85.29%) respectively<sup>9,10</sup>. The study was done compared with various studies done on cell blocks in intra-abdominal lesions. The mean age range for a maximum number of cases i.e; 25 cases (24.50%) was between 51-60 years in our study which correlates well with the studies done by Suva Cheta M with 34 cases (34%) (2016) and Aparna Amogh with 153 cases (23.18%) (2016) respectively.<sup>11</sup>

The diagnostic yield of 95.09% in our study was well correlated with other studies done by Bilquis A Soleman et al<sup>7</sup> (2004) With 97.4%, BS Sumana et al<sup>8</sup> (2015) with 95.7%, Shashikal Vinayakamurthy et al<sup>9</sup> (2016) with 96.6% and B Ranjitha et al<sup>10</sup> (2019) with 95.5% of diagnostic yield respectively. Coming to gender, there was a male preponderance with the maximum number of cases being males in comparison to females in 102 cases with M: F ratio of 1.12 : 1. Other studies also depicted male preponderance.<sup>8,9,11,12</sup>

The most common organ/site was the liver with 21.56% of all cases. The liver was also the most common organ involved in the studies done by B S Sumana et al (2015)<sup>8</sup> with 40%, Aparna Amogh (2016)<sup>11</sup> with 46.81%, Shashikala Vinayakamurthy (2016)<sup>9</sup> with 57.8%, and Elizabeth P Mathew (2018)<sup>12</sup> with 44% respectively. The next most common site was retroperitoneum with 17.65% which was also noted in the study done by Shashikala Vinayakamurthy (2016)<sup>9</sup> with 15.15% respectively.

Concerning the classification of lesions, the study observed that the most common lesions were malignant (including metastatic lesions) with 67.64%. Malignant lesions were also the most common lesions in the study done by B S Sumana et al (2015)<sup>8</sup> with 67.74%, Shashikala Vinayakamurthy (2016) <sup>9</sup> with 77.28%, and B Ranjitha (2019)<sup>10</sup> with 69.5% respectively. This study also showed 29 cases (28.43%) of metastatic lesions out of 102 cases(100%) which correlates well with the study done by S Bhowmik et al(2018)<sup>13</sup> with 55 cases (34.16%) out of 161 cases(100%) and B Ranjitha

(2019)<sup>10</sup> with 21 cases(25.60%) out of 82 cases (100%). Table-5 shows statistical results and comparative analysis of FNAC. The sensitivity and specificity of FNACs were 90.90% and 87.50% respectively. Similar findings were seen in the study done by Shashikala Vinayakamurthy (2016)<sup>9</sup> with 91.6% and 88.8% respectively. The diagnostic accuracy in our study was 90.14%. Similar findings were seen in the studies done by Shamshad et al (2006)<sup>14</sup> with 95.7%.

Table-6 shows an analysis of combined FNAC and cell block sensitivity in comparison with various studies. The combined FNAC and cell block sensitivity was 98.27% in the present study, this correlated well with the study done by Sharma R et al (2015)<sup>20</sup> with 96.92%, Shashikala Vinayakamurthy (2016)<sup>9</sup> with 100%, and Sourav Bhowmik et al (2018)<sup>13</sup> with 96.39% sensitivity respectively. The combined specificity in the present study was 100%. Similar findings were seen in the study done by Sourav Bhowmik et al (2018)<sup>13</sup> with 95.9% and Sharma R et al (2015)<sup>20</sup> with 95.38% specificity respectively. The combined diagnostic accuracy was 98.59% which correlated with studies were done by Sourav Bhowmik et al (2018)<sup>13</sup> with 96.39%, Sharma R et al (2015)<sup>20</sup> with 96.92%, and Shashikala Vinayakamurthy (2016)<sup>9</sup> with 100% diagnostic accuracy respectively.

## CONCLUSIONS

Fine Needle Aspiration of intra-abdominal lesions is a safe, simple, efficient, cost-effective procedure and gives an accurate diagnosis. Radiologically guided FNACs can be utilized as a standard technique for pre-operative evaluation of deep-seated intra-abdominal lesions. Cellblock in addition to FNACs helps in diagnosing more accurately which is evident by its high rates of Sensitivity, Specificity, Diagnostic Accuracy, and Positive Predictive Value. Cell blocks are cost-effective and act as useful adjuncts to FNAC smears in giving an accurate diagnosis. Cell blocks are particularly useful to categorize tumors that may not be possible from smears themselves. They can also be used for a variety of histochemical stains and immuno-cytochemistry and provides good material for in-situ-hybridization.

**Conflict of interest:** None

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