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Original Article

Diagnostic Utility of Crush Cytology in the Diagnosis of Large-Intestine Lesions: A Cyto-Histological Correlation Study

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Abstract

Background

Colonoscopy is a day to day procedure carried out in hospitals for lower gastrointestinal tract lesions. Lower gastrointestinal tract lesions can vary from mild inflammation to infection to malignant neoplasms. Histopathology of colonoscoy biopsy is considered as gold standard but it is a lengthy process taking multiple days to even weeks. Crush cytology is rapid and handy procedure which can be a good adjunct to histopathology. This study highlights the diagnostic role of crush cytology in colon lesions in correlation to histopathology.

Material and Methods

The study was conducted at Nobel Medical College Teaching Hospital,Biratnagar from August 2021 to September 2022 in the Department of Pathology and Gastroenterology among 62 colonoscopic biopsies. Crush cytology smears were prepared and stained with May-Grunwald-Giemsa and ultrapap. Histomorphological slides were prepared and stained with Haematoxylin and Eosin. Both the slides were assessed by 3 pathologists and results were recorded.

Results

This study was done among 62 cases in which the age range was 36-78 years with male to female ratio of 3.1:1. On histopathology, benign lesions were 67.7% and malignant were 32.3%. On crush cytology, benign pathology was seen in 42 cases, positive for malignancy in 17 and suspicious for malignancy in 3 cases. Sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of crush cytology when compared to the histopathology were found to be 90%, 95% , 90%, 95% and 93% respectively.

Conclusion

Crush cytology has high sensitivity, specificity, positive predictive value, and negative predictive value and is highly comparable to the histopathology reports.

Keywords: *Biopsy, Colonoscopy, Lower gastrointestinal tract, Malignant neoplasm*

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Introduction

Colonoscopy is a very common procedure done for the diagnosis of various lower gastrointestinal tract (GIT) lesions such as Crohn's disease, ulcerative colitis, tuberculosis, non-specific colitis, polyp and various malignancies. Biopsy is usually taken for the definite diagnosis [1].

Histopathological examination of the tissue has always been considered a gold standard for the diagnosis. However, it takes time (average of 5-7 days in a good set up). Therefore, several techniques have been practised for rapid cytological evaluation of biopsy specimens which includes imprint smear, crush cytology and brush cytology [2]. Crush cytology has been proven as a rapid and useful adjunct to histopathology. Several studies have proven an excellent diagnostic role of crush cytology in the diagnosis of lesions of central nervous system, stomach, ovary and lymph node and GIT [3-5]. Role of crush cytology in cases of large intestinal lesions have been studied less in Nepal.

This study was done to evaluate the diagnostic role of colonic biopsy crush smears cytology and correlate it with the histopathology.

Materials and Methods

This study was a hospital based prospective cross sectional study done in the Department of Pathology and Gastroenterology at Nobel Medical College and Teaching Hospital from August 2021 to September 2022. The study was approved by the institute review board of Nobel Medical College and Teaching Hospital (IRC-468/2021). Those patients requiring colonoscopy and biopsy for suspected colonic lesions as per clinical history or imaging were included for the study. Exclusion criteria were colonoscopy without biopsy, or inadequate sample on colonoscopy. All colonoscopic biopsy specimens during the above stated study period were included in this study.A convenience sampling method was used and sample size was calculated using the Cochran's formula ($n= Z^2 x p x q /e^2$). Prevalence of colorectal carcinoma is 11% [6]. Calculated sample size was 32. However, all samples during the study period were included in this study.

All colonoscopic specimens were received fresh in normal saline and process for crush cytology was done on same day to prevent any formalin induced cytological artifacts. Gross findings such as size and color were noted. Colonic tissue was gently held by forceps, transferred over two slides and crush smears were made. The air dried and alcohol fixed smears were then stained with May-Grunwald-Giemsa (MGG) and ultra PAP stains respectively using standard protocols.

The biopsy was then fixed with formalin and processed for routine histopathological analysis as per standard protocols. The smears were assessed by three pathologists, and then the diagnosis was made based on the cellularity, distribution and cell types. All lesions were categorized as negative for malignancy, suspicious for malignancy and positive for malignancy. Smears showing cytologically benign cells or reactive cells due to inflammatory conditions were considered negative for malignancy. If the smears show unequivocally malignant cells, it was considered positive for malignant cell. Suspicious category was labelled for those where smears show cellular atypia, but not compatible for malignancy. Histopathological report was considered as the gold standard. Demographic data and patient characteristics were also recorded.

All data were entered in microsoft excel and data analysis were done by SPSS 17 software. Cytological diagnosis given by crush smear was correlated with the histopathological diagnosis. For statistical analysis, suspicious category was considered positive for malignancy. Accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive values (NPV) were calculated. The agreement between cytological and histopathological diagnosis were determined by calculating Kappa score.

Results

This study was done on 62 cases of colon biopsy specimens received in the department of histopathology. The male female ratio was 3.1:1. The mean age of the patient was 52±7.2 years (range: 36-78years). Malignancies (32.3%) were found more common in the age group of 60-70 years. Benign lesions were more common (67.7%) in the study, and included ulcerative colitis in 27.4%, hyperplastic polyp in 11.2% cases, indefinite for inflammatory bowel disease (IBD) in 3.2% cases, and malignancies in 20 (32.3%) cases. Out of the total 20 malignant cases, adenocarcinoma accounted for 14 (22.5%) cases, while the remaining were signet ring carcinoma, non-Hodgkin lymphoma and neuroendocrine carcinoma as shown in Table 1.

On crush cytology, benign pathology was seen in 42 cases, positive for malignancy in 17 and suspicious for malignancy in three cases. The same tissue reporting on confirmation with final biopsy is shown in Table 2.

Sensitivity, specificity and overall accuracy of crush cytology when compared to the histopathology were found to be 90%, 95% and 93% respectively. Furthermore, positive predictive value was 90% and negative predictive value was 95%. Crush cytology was equally accurate in comparison to biopsy, with Kappa score of 0.72 (substantial aggrement) (Table 2).

Table 1: Histopathological spectrum of colonic biopsy specimen (n=62)

Diagnosis	Number of cases (%)
BENIGN LESIONS	42 (67.7)
IBD Favoring ulcerative colitis	17 (27.4)
Inflammatory polyp	10 (16.1)
Hyperplastic polyp	07 (11.2)
Tubular adenoma with Low grade dysplasia	04 (6.4)
Tubular adenoma with High grade dysplasia	02 (3.2)
Indefinite for IBD	02 (3.2)
MALIGNANT LESIONS	20 (32.3)
Adenocarcinoma	14 (22.5)
Signet Ring Cell Carcinoma	03 (4.8)
Non-Hodgkin Lymphoma	02 (3.2)
Neuroendocrine carcinoma	01 (1.6)

Table 2: Comparison of crush cytology with histopathology (n=62)

Cytological Diagnosis	Number	Histopathological Diagnosis	Number	Remark	Kappa Score
Negative for Malignancy	42	Benign	40	TN	
		Malignant	02	FN	0.72
Suspicious for Malignancy	03	Benign	01	FP	
		Malignant	02	TP	
Positive for Malignancy	17	Benign	01	FP	
		Malignant	16	TP	

TP: True positive;TN: True negative;FP: False Positive;FN: False Negative

Discussion

Colonoscopy is a very common procedure done for the evaluation of various lower gastrointestinal tract lesions like polyps, ulcer, inflammatory bowel disease (ulcerative colitis, Chrohn's disease), benign tumors, malignanttumors etc. It allows a very good gross inspection of lesions located in the colon. Biopsy is usually taken out from these lesions and sent for histopathological evaluation. Histopathological examination has been always a gold standard for the evaluation of colonic lesions which usually requires five to ten days for reporting. However, crush cytology of colonic tissue has emerged as a rapid and inexpensive diagnostic modality which can be done on same day within few hours.

In this study crush cytology was done on every colonic biopsy specimens and cytological diagnosis was based on cellularity, cell types, background and nuclear morphology.

Benign lesions were more common than malignant and that adenocarcinoma was found to be the most common malignant tumour in this study. Moreover, in the present study, it proved to be much useful with prompt diagnosis, and with sensitivity, specificity, PPV, NPP and overall accuracy rate of 90%, 95%, 90%, 95% and 93% respectively. This result matches with the other similar studies [7-9].

In a study by Desai P et al, among 451 patients who underwent crush smear, the sensitivity was found to be 97%, specificity was 90% and overall accuracy was 97%, and so was confirmed by other similar studies [3, 10-14]. However, for successful cytologic examination, a good and skilled endoscopists, and a good specimen preparation by the expert pathologists is prerequisite. Further, one should keep in mind that absence of positivity for cancer cells does not necessarily exclude malignancy. It has to be confirmed by biopsy. In a study done by Singh et al, from India, there were 14 cases out of 89 where crush cytological examination was negative for malignancy, but histopathological examination was positive for malignancy. These were generally signet-ring cell carcinomas, non-Hodgkin lymphoma or poorly differentiated carcinoma which is usually pauci-cellular in crush smears [8].

There are several advantages of crush smear. The important benefits of crush smear are following in our settings; 1. In absence of frozen section facility, on-table crush smear can be used to confirm the disease at operation. 2. It hastens the process of government scheme benefit of Rupee one lakh for cancer patients. 3. The “Cancer treatment chain” which has to be initiated within a week of out patient visit is not delayed. 4. As rapid one time procedure, it does not require a second procedure to confirm, in case of inadequate specimen like during endoscopic retrograde cholangiopancreatography (ERCP), colonoscopic biopsy, endoscopicbio psy, CT-guided core biopsy at difficult locations [2, 3, 8].

Furthermore, where available, Narrow-band imaging (NBI) is a potential adjunct to increase the diagnostic yield, by reducing the number of samples required and decreasing the risk of complications of colonoscopic biopsy for benign and malignant colonic diseases [14].

Limitations: The study is limited by small sample

size. Paucicellular malignancies like signet ring cell cancer, poorly differentiated cancers, neuro-endocrine tumors and non-Hodgkins lymphoma may be missed on crush smear. Furthermore, this technique cannot provide information about depth of invasion, type of malignancy for which further confirmation by histopathology is required.

Conclusion

Diagnosis of colonic lesion can be done on same day by making crush smears of colonoscopy biopsy specimens. It has a very high sensitivity, specificity, positive predictive value and negative predictive value. When compared to the histopathological diagnosis which is gold standard, it was found that crush smears of colonoscopy biopsy was comparable and has a very good diagnostic accuracy.

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