

Original Article

Diagnostic Accuracy of Imprint Cytology and Frozen Section for CNS Tumor

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Abstract :

The present study was a cross-sectional type of descriptive one carried out with the objective of determining the diagnostic accuracy of imprint cytology and frozen section of central nervous system tumors. A purposively selected sample of 33 clinically diagnosed patients with CNS tumors has been included for the study. The relevant data on CNS tumors were collected by using imprint cytology, frozen section and paraffin section. The sensitivity of imprint cytology was 75.0% and specificity was 55.17% respectively. On the other hand positive predictive value of imprint cytology was 18.75% and negative predictive value was 94.11%. The sensitivity of frozen section was 100% and specificity was 86.21% respectively. Comparing the findings of the frozen section to histopathology, the positive predictive value was 50.0% and negative predictive value was 100%. The sensitivity and specificity of imprint cytology was lower in comparison to frozen section and paraffin section. Still then imprint cytology is preferred, because it can be carried out rapidly and easily. It will also be a very helpful aid especially when facilities for frozen section are limited but neurosurgical-procedure is available. A well designed research with adequate sample size should be carried out to get better diagnostic accuracy of imprint cytology in central nervous system tumors.

Key words : CNS Tumor, Frozen Section, Imprint Cytology.

Introduction :

Bangladesh with a country of about 150 million populations offers rather limited neurosurgical services to her people. On the other hand limited data are available on central nervous tumours in our country. Shamsuzzaman¹ carried out a study of histological pattern and frequency of intracranial tumours in the then IPGMR now Bangabandhu Sheikh Mujib Medical University (BSMMU). He included 100 cases in his study and reported that incidence of glial and meningeal tumours are higher than other tumours.

Bashar² studied role of cytologic smear in intraoperative diagnosis of CNS tumours. Nasrin³ carried out another study on intraoperative diagnosis of CNS tumours by crush preparation. Both these studies were carried out in BSMMU to assess the role of cytology in the intraoperative diagnosis of CNS tumours. Bashar² found that meningioma was the commonest followed by schwannoma, astrocytoma and others in his series while Nasreen³ showed the commonest tumour to be schwannoma followed by meningioma, astrocytoma craniopharyngioma and others. All of these provided little information on the types of CNS tumours in our country.

The advantages of intraoperative smear are many folds. The primary advantages are its technical simplicity, the ease with which several small pieces of needle biopsy can be screened, high diagnostic accuracy despite the small sample size, rapid evaluation and also cost effectiveness. It helps to define tumor margin during open surgery, as tumor margin in viable brain area cannot be investigated by removing large pieces of tissue as necessary for frozen sections².

Imprint cytology technique provides rapid interpretation of brain lesions without risks and artifacts involved in frozen section specimen. It is less expensive in comparison to frozen section. Several studies have demonstrated that the diagnostic accuracy of frozen sections and crush smear in neurosurgical specimen is almost equal when compared with permanent section.

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The study is aimed at assessing diagnostic accuracy of imprint cytology and frozen section of central nervous system tumour and to compare with paraffin section.

Materials and Methods:

It was a Cross-sectional type of descriptive study carried out with the aim of assessing the diagnostic accuracy of imprint cytology and frozen section of central nervous system tumors. This study was carried out in the department of Pathology, Rajshahi Medical College and Neurosurgery department of RMCH, Rajshahi from January 2009 to December 2010. All the patients diagnosed as CNS tumor and subsequently received operative treatment in RMCH. A total number of 33 patients were diagnosed as having central nervous system tumor and all of them received surgical treatment at Rajshahi Medical College Hospital during the whole period of data collection. Therefore, all these 33 patients constituted the sample size for the present study. All the patients were underwent operation for CNS tumor. Touch preparation for imprint cytology was taken during operation. Tissue was taken for frozen section during operation. Tissue was taken after operation for paraffin section. The collected data and the laboratory findings were entered into SPSS programme and analyzed by the same software. Sensitivity, specificity, positive and negative predictive value of imprint cytology and frozen section were calculated with the gold standard test of the biopsy materials. All the necessary and relevant data regarding patients were recorded methodically and meticulously as far as possible in a data sheet. All the cases were numbered chronologically and the same number was given to the cytology slides and tissue sections for cytopathological and histopathological examination.

All the data were evaluated by standard statistical methods. Various indices such as false positive, false negative, sensitivity, specificity, accuracy and predictive value of positive and predictive value of negative diagnosis were calculated. For calculation and statistical analysis cases with adequate material were included.

Results :

The present study has been carried out with the objective of assessing the diagnostic accuracy of imprint cytology and frozen section for central nervous system tumours. A total number of 33 patients with CNS tumor were included in the study. The results of the study has been presented and described in the following section.

Regarding frequency distribution of patients by imprint cytology findings, it was revealed that out of 33 patients, 11 (33.33%) patients were diagnosed as astrocytoma. It was also observed that 11 (33.33%) patients were meningioma and 5 (15.15%) patients were diagnosed as schwannoma (Table I).

Table I: Frequency distribution of patients by imprint cytology (N=33)

Imprint cytology	Frequency (%)
Astrocytoma	11 (33.33)
Schwannoma	5 (15.15)
Meningioma	11 (33.33)
Malignant fibrous histiocytoma	1 (3.03)
Craniopharyngioma	1 (3.03)
Ependymoma	3 (9.09)
Glioblastoma multiforme	1 (3.03)
Total	33 (100)

Regarding frequency distribution of patients by frozen section findings, the study showed that out of 33 patients 13 (39.39%) were diagnosed astrocytoma. It was further revealed that 12 (36.37%) were diagnosed meningioma and 4 (12.12%) were diagnosed schwannoma (Table II).

Table II: Frequency distribution of patients by frozen section (N=33)

Frozen section	Frequency (%)
Astrocytoma	13 (39.39)
Schwannoma	4 (12.12)
Meningioma	12 (36.37)
Metastatic carcinoma	1 (3.03)
Malignant fibrous histiocytoma	1 (3.03)
Craniopharyngioma	1 (3.03)
Haemangioblastoma	1 (3.03)
Total	33 (100)

About frequency distribution of patients by histopathology it was revealed that out of 33 patients, the findings of 14 (42.42%) patients were suggestive meningioma. It was also found that 11 (33.33%) were diagnosed astrocytoma and 2 (6.06%) patients were diagnosed schwannoma by histopathology (Table III).

Table III: Frequency distribution of patients by histopathology (N=33)

Histopathology	Frequency (%)
Astrocytoma	11 (33.33)
Schwannoma	2 (6.06)
Meningioma	14 (42.42)
Metastatic carcinoma	1 (3.03)
Malignant fibrous histiocytoma	1 (3.03)
Craniopharyngioma	1 (3.03)
Haemangioblastoma	1 (3.03)
Ependymoma	1 (3.03)
Glioblastoma multiforme	1 (3.03)
Total	33 (100)

The study showed that out of 33 patients, 16 (48.48%) patients were found to be positive by imprint cytology. Among them, 3 (18.75%) patients were positive and 13 (81.25%) were negative on the basis of findings of histopathology. It was revealed that 17 (51.52%) patients became negative by imprint cytology. Among them, 1 (5.88%) patients were positive and 16 (94.12%) patients were negative respectively by histopathology. It was further found that 4 (12.12%) patients became positive and 29 (87.88%) patients negative compared to clinical findings. The sensitivity of imprint cytology was 75.0% and specificity was 55.17% respectively. On the other hand positive predictive value of imprint cytology was 18.75% and negative predictive value was 94.11% (Table IV).

Table IV: Frequency distribution of patients by imprint cytology and histopathology.

Imprint cytology	Histopathology		Total N (%)
	Positive N (%)	Negative N (%)	
Positive	3 (18.75%)	13 (81.25%)	16 (48.48%)
Negative	1 (5.88%)	16 (94.12%)	17 (51.52%)
Total	4 (12.12%)	29 (87.88%)	33 (100.0%)

Sensitivity=75%, Specificity=55.17%, Positive predictive value=18.75%, Negative predictive value=94.11%

Regarding frequency distribution of patients by frozen section and histopathology findings it was revealed that out of 33 patients, 8 were found positive by frozen section. Among them, 4 (50.0%) patients became positive by histopathological test and similar percentages (50.0%) were negative histopathologically. The study showed that by frozen section examination, 25 (75.76%) patients were found negative and all of them 100% also became negative in histopathological examination. There were 4 (12.12%) patients positive and 29 (87.88%) patients showed negative features by histopathology (Table V). The sensitivity of frozen section was 100% and specificity was 86.21% respectively. Comparing the findings of the frozen section to histopathology it was revealed that positive predictive value was 50.0% and negative predictive value was 100%.

Table V: Frequency distribution of patients by frozen section and histopathology.

Frozen	Histopathology		Total N (%)
	Positive N (%)	Negative N (%)	
Positive	4(50.0%)	4(50.0%)	8(24.24%)
Negative	0	25(100.0%)	25(75.76%)
Total	4(12.12%)	29(87.88%)	33(100.0%)

Sensitivity=100%, Specificity=86.21%, Positive predictive value=50.0%, Negative predictive value=100.0%

Regarding comparison of sensitivity and specificity of imprint cytology and frozen section of CNS tumor it was found that, sensitivity of imprint cytology was 75%, specificity was 55.17%, positive predictive value was 18.75% and negative predictive value was 94.11%. It was also revealed that sensitivity of frozen section was 100%, specificity was 86.21%, positive predictive value was 50% and negative predictive value was 100% (Table VI).

Table IV: Frequency distribution of patients by imprint cytology and histopathology.

Points	Imprint cytology	Frozen section
Sensitivity	75.00%	100%
Specificity	55.17%	86.21%
Positive predictive value	18.75%	50.00%
Negative predictive value	94.11%	100%

Discussion :

The objective of present study was to evaluate diagnostic accuracy of imprint cytology and frozen section in central nervous system tumours. A total number of 33 patients with CNS tumor were included in the study. Study showed that out of 33 patients, 48.48% patients were found to be positive by imprint cytology. Among them, the percentage of positive cases was 18.75% and 81.25% were negative on the basis of findings of histopathology. It was revealed that 51.52% patients became negative by imprint cytology. Among them, 5.88% patients were positive and 94.12% patients were negative respectively by histopathology. It was further observed that 12.12% patients became positive and 87.88% patients negative compared to clinical findings. The sensitivity of imprint cytology was 75.0% and specificity was 55.17% respectively. On the other hand positive predictive value of imprint cytology was 18.75% and negative predictive value was 94.11%. The result indicates that both sensitivity and specificity were lower compared to histopathology. Sidawy and Jannota⁵ found that diagnostic accuracy of imprint cytology ranges from 83% to 94%. Cahill and Hidvegi⁶ showed that diagnostic accuracy of imprint cytology is 90.0%. Bashar² found that accuracy of imprint cytology is 91.7%. Compared to these findings, the diagnostic accuracy was found to be much lower for the present study (sensitivity 75.0% and specificity 55.17%). It was probably due to small sample size were taken purposively and nonrandomly and some tumors were misdiagnosed which were in consistent with histopathological diagnosis.

Regarding frozen section and histopathology findings it was revealed that, 24.24% were found positive by frozen section. Among them, 50.0% patients became positive by histopathological test and similar percentage 50.0% was negative histopathologically. The study revealed that by frozen section examination, 75.76% patients were found negative and all of them (100%) also became negative in histopathological examination. It was found that 12.12% patients became positive and 87.88% patients showed negative features by histopathology. The sensitivity of frozen section was 100% and specificity was 86.21% respectively. Comparing the findings of the frozen section to histopathology it was revealed that positive predictive value was 50.0% and negative predictive value was 100%. Shaha AB⁷ et al showed that the accuracy of frozen section diagnosis was 90.4%. The diagnostic accuracy of frozen section detected by Sidawy⁵ and others was lower (90%) than the present study. Cahill⁶ et al observed the sensitivity of frozen section was 93% which is also lower to present study findings. The discordance was probably due to some cases were misdiagnosed which were in consistent with histopathological diagnosis and also due to small sample size were included in the present study and sample was taken nonrandomly which would influence the result.

Conclusion :

The technique is fast, cost-effective and simple. So, intraoperative cytologic diagnosis may be useful as a primary diagnostic tool. Use of cytologic material for evaluation during intraoperative consultation will be a very helpful aid especially when facilities for frozen section are limited but neurosurgical-procedure is available. In future, further studies are needed to establish intraoperative cytology as an alternative to frozen section in our country and also to gain experience by the pathologists in interpreting intraoperative cytology in diagnosing central nervous system tumor.

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