INTRAOPERATIVE DIAGNOSIS OF CNS TUMOR BY CRUSH CYTOLOGIC TECHNIQUE & ITS HISTOPATHOLOGICAL CORRELATION

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Summary

Central Nervous System (CNS) tumor comprises about 2-5% of all tumors. Quite a large number of patients with CNS tumor undergo surgical treatment in Bangladesh. Surgical treatment is greatly facilitated by the use of intraoperative diagnosis. The techniques for intraoperative diagnosis of neurosurgical biopsy specimen are frozen section & crush smear cytology. In our study, a total of 64 cases of CNS tumor was evaluated by crush smear. Among them, 54 (84.38%) cases were brain tumor & 10 (15.62%) cases were spinal tumor, with a slight male predominance (M:F = 1.2:1). The mean age of the patients was 31 years. Cerebrum was the commonest site of brain tumor & astrocytoma was the commonest malignant tumor. Among 64 cases, 61 cases were correctly diagnosed by crush cytologic technique. The accuracy of intraoperative cytologic diagnosis was determined in comparison to histologic diagnosis was 95.3%. It is concluded that crush cytologic technique may be considered as a reliable primary diagnostic tool for intraoperative evaluation of CNS tumor.

Key words: CNS tumor; Crush cytology; Frozen section.

Introduction

Surgical treatment of CNS tumor is greatly facilitated by the use of intra-operative morphological diagnosis. The techniques are frozen section & crush smear cytology. For the purpose of intraoperative consultations, crush preparations are indispensable adjuncts & expedient alternatives to frozen section [1].

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It supplements & in many instances replaces frozen section of brain tumor biopsy since the amount of material obtained during neurosurgical procedure is often small [2].

As most parenchymal brain tumors are soft & gelatinous in consistency, smear preparation can easily be made. Besides many of them are often accompanied by edema, which makes cryostat sections prone to ice-crystal artifact [3]. In addition, freezing, distorts the nuclei of astrocytes & introduces artifacts in paraffin section [4].

For the purpose of planning of treatment, or extent of surgical treatment, intraoperative morphological diagnosis is necessary [5 ,6].

The use of minimally invasive operative technique in neurosurgery continues to increase, as for example, in burr- hole biopsy & stereotaxy, cytology can provide diagnosis during the procedure, thereby many unnecessary major surgery can be avoided [7]. Besides, small size of stereotactic biopsy specimen is unsuitable for histologic study. On the otherhand,, smear preparation of such small biopsies is quite suitable & yields detailed features for proper intraoperative evaluation [8]. If a burr-hole biopsy reveals a surgically treatable condition, it may be vital to proceed to craniotomy without delay. Even among malignant tumors, distinction is important [9,4].

The advantages of intraoperative smear are many folds. The primary advantages are its technical simplicity, high diagnostic accuracy despite the small sample size, cost effectiveness, rapid evaluation & in defining tumor margin during open surgery [6].

In many developed countries, intraoperative diagnosis by smear cytology of CNS tumor is performed routinely as a means of primary diagnosis. The use of intraoperative cytodiagnosis of CNS tumor has not been established on a regular basis in our country. This study has been undertaken to study the cytomorphological features of CNS tumors, to evaluate the usefulness & accuracy of intraoperative cytology.

To practice crush smear cytology as a routine investigation during neurosurgical procedure for primary diagnosis.

Materials and methods

The study was carried out in the department of Pathology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka during the period from August 2004 to June 2005.

A total of 67 patients with different age & sex from Neurosurgery Department, BSMMU, Dhaka who were clinically & radiologically suspected having CNS space occupying lesion, underwent surgery and biopsies taken for histopathological evaluation were selected for study. Relevant clinical informations along with radiological impression were taken before proceeding to intraoperative diagnosis. The exact technique of obtaining cytologic material dependent on the size, shape & consistency of the specimen [10]. After obtaining cytologic material on slides crush preparation & immediate alcohol fixation (95 % ethanol) for two minutes were done. At least two slides were used for cytologic evaluation .Staining was done by haematoxylin & eosin stain as it is considered as a stain of choice in evaluating neurosurgical samples [11, 3, 4]. Intraoperative cyto diagnosis was given from biopsies obtained from open intracranial & spinal surgery. The remaining tissues immediately kept in 10% formalin for routine histologic preparation.

Results

A total of 67 cases were collected of which 3 cases were inadequate in cytologic smear. So the study was based on data obtained from 64 patients.

Of 64 cases, 36 (56.25 %) patients were male & 28(43.75 %) patients were female (M: F= 1.2:1).

Patient age ranged from 2.5 months to 70 years, with an average age of 31 years. Maximum number of patient was found in the age group of 31-40 years, n=14 (21.87%) irrespective of sex.

In 64 CNS lesions, brain was affected in 54 (84.38%) & spinal cord was affected in 10 (15.62%) cases. Among the brain tumors, cerebrum was the commonest site which was affected in 19 (35.1%) cases. Table II showing site distribution of 54 brain lesion. In 10 cases of spinal tumors, 5 cases were from cervical region, 4 cases were from thoracic region & these were extramedullary in location & one from lumbo sacral area which was intramedullary in location.

In this study of 64 cases, 40 cases were benign lesions of which schwannoma was the commonest, n= 16 (25%) & 24 cases were malignant tumor among which astrocytoma was the commonest, n=10 (15.62%). Among 16 cases of schwannomas, nine cases of schwannomas originated in the cerebellopontine angle of brain, the most common location within cranial vault and among 10 cases of astrocytomas, six cases originated in the cerebrum, the usual location in brain for astrocytomas [12].

All benign lesions were diagnosed correctly by crush cytology. Among 24 cases of malignant tumors, three cases were incorrect in cytology (False negative). So out of 64 cases of CNS lesions, sixty one cases were diagnosed correctly by cytology of crush preparation. Among the 3 false negative cases, two cases were metastatic adenocarcinoma in histopathology. One of which was diagnosed as reactive gliosis & the other one was diagnosed as meningioma in crush cytology. The remaining false negative case was atypical meningioma which was diagnosed as benign meningioma in crush cytology. The other discrepancy was observed in a case of Non-Hodgkin Lymphoma (NHL) which was confirmed by immunohistochemistry (IHC). This was misdiagnosed as anaplastic astrocytoma in crush smear though in classifying of benign & malignant lesion, it was not wrong. Table III(a) shows cytopathological diagnosis & its correlation with histopathology.

Table III(b) shows statistical analysis of cytopathological diagnosis with histopathology. In this study, there were 21 true positive & 40 true negative diagnoses. False negative cases were 03 & no false positive cases.

Regarding brain tumor, cerebrum was the commonest location & meningioma was the commonest tumor, 12 (22.22%), which was very close to that described by Morris J.H.1989 who stated that 20 % of intracranial tumors are meningiomas [13].

In spinal tumor, Schwannoma was the commonest intradural extramedullary tumor. The only intramedullary tumor was myxopapillary ependymoma.

Table I : Shows distribution of age & sex of 64 patients with CNS lesion

Sex	Age (years)							
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	Total
Mae	5	8	8	6	5	2	2	36
Female	4	3	5	8	5	2	1	28
Total	9	11	13	14	10	4	3	64

Table II : Showing site distribution of 54 brain lesion

1) Cerebrum	2) Sella/ Suprasellar Region	3) Cerebellum & posterior fossa	4) Cerebellopontine angle	5) others	6) total
19 (35%)	11 (21%)	11 (21%)	9 (16%)	4 (7%)	54 (100%)

Table III(a) : Shows correlation of cytopathological diagnosis with histopathology in 64 CNS lesions.

Histopathological diagnosis	No.of Cases	Cytopathological diagnosis	
A) Benign	40	Correctly classified	Other diagnosis
1) Schwannoma	16	16	
2) Meningioma	12	12	
3) Craniopharyngioma	05	05	
4) Pituitary adenoma	03	03	
5) Lipoma	01	01	
6) Other benign lesion.	03	03	
B) Malignant	24		
1) Astrocytoma	10	10	
2) Ependymoma	03	03	
3) Medulloblastoma	05	05	
4) Germinoma	01	01	
5) Adenoid cysic Ca	01	01	
6) NHL	01	-	AA
7) Atypical meningioma	01	-	Benign meningioma
8) Metastatic adeno Ca	02	-	i) Reactive gliosis ii) Meningioma

AA= Anaplastic Astrocytoma, NHL= Non Hodgkin Lymphoma

Table III(b) : Shows statistical analysis of cytopathological diagnosis

Histopathological Diagnosis		Cytopathological Diagnosis	
	Number	Malignant	Benign
Malignant	24	TP 21	FN 03
Benign	40	FP 00	TN 40
Total	64	21	43

TP= Denotes True Positive, TN= Denotes True Negative
FP= Denotes False Positive, FN= Denotes False Negative

Table IV : The statistical evaluation of cytological diagnosis in 64 cases of CNS lesion

Sensitivity %	Specificity %	PPV %	NPV %	Accuracy %
87.5	100	100	93	95.3

PPV = Predictive value for positive diagnosis
NPV =Predictive value for negative diagnosis

Discussion

The value of crush cytologic technique during intraoperative diagnosis of CNS tumor has been widely accepted in many developed countries of the world, though it is not widely adopted in our country.

In this study, crush smear cytology of CNS tumor yielded high diagnostic accuracy which may be comparable with large number of studies as shown in Berkeley et al 93% accuracy rate in their study on 216 cases of CNS lesions [14]. Cahill EM & Hidvegi DF showed 90.6% accuracy rate in their study on 32 cases of CNS tumor & in the study done by Bashar F the accuracy rate was 91.7% [15, 16].

Use of cytologic material for evaluation of CNS lesion during intraoperative consultation will be very helpful aid especially when facilities for frozen section is limited. The technique is fast, cost effective & simple especially defining tumor margin during operative procedure [6].

So crush cytologic technique may be used as a reliable primary diagnostic tool for intraoperative evaluation of CNS lesion.

Conclusion

Crush cytology yields high diagnostic accuracy for interpreting CNS tumor during operative procedure. It is useful as a reliable technique & primary diagnostic tool for planning treatment. Therefore crush smear cytology demands wide spread & routine practice during neurosurgical procedure.

Disclosure

All the authors declared no competing interest.

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