DIAGNOSTIC ACCURACY OF SQUASH CYTOLOGY IN CENTRAL NERVOUS SYSTEM TUMOURS

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ABSTRACT

BACKGROUND

Intraoperative squash smear cytology is an important diagnostic tool; it guides the neurosurgeon during surgical resection; it also helps the surgeon to monitor and modify the approach to surgery. Hence prompt and correct diagnosis is essential for early intervention. In the era of stereotactic biopsies where the amount of tissue is very small, accurate diagnosis is imperative and it can be achieved with squash cytology which is a simple, cost effective and rapid technique. In this study, we have assessed the diagnostic accuracy of squash cytology by comparing with histopathological examination.

MATERIALS AND METHODS

This was a prospective study conducted in department of Pathology in S.C.B Medical College Hospital for a period of two years from June 2016 to May 2018. The study subjects were 73 consecutive patients operated for tumours of nervous system in department of neurosurgery. Complete clinical and radiological findings were recorded. During surgery, small bits of tissue measuring 1-2 mm^2 were removed and sent in a gauge moistened with saline for squash cytology. The squash smears were correlated with histopathological examination.

RESULTS

Astrocytoma (31.51%) was the most frequently encountered tumour followed by meningioma (28.77%) and schwannoma (13.70%). Peak incidence of brain tumor was observed in 41-50 years age group. The overall diagnostic accuracy of squash cytology in the present study was 84.93%.

CONCLUSION

Squash smear cytology proved to be simple, inexpensive, rapid technique for intraoperative consultation of CNS tumours and also aids the neurosurgeon for further proper management.

KEYWORDS

Squash Cytology, Tumours of Nervous System, Intra Operative Diagnosis.

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BACKGROUND

Tumours of the nervous system constitute less than 2% of the cancers globally.[1] They constitute the second most common form of cancer in children[2] and seventeenth most common in adults. However, the symptoms associated with the tumours range from headache to paresis culminating in death.[3] The time gap between the point of detection of nervous tumours to the point at which it becomes incurable is very narrow. It is important to classify these tumours according to the biological behaviour and prognosis. Equally important is to recognise certain primary brain tumours which respond to aggressive radiotherapy or chemotherapy. Rapid pre-operative diagnosis is of immense value to select treatment option.

Advances in neuroimaging permit early and exact localisation of tumours.[4] The stereotactic brain biopsies permit accurate sampling of multiple areas.[5,6] Hence exact diagnosis and accurate grading is possible in nervous system tumours.[7] The methods for intra operative diagnosis of nervous tumours are squash cytology, cryostat sections and imprint cytology.[8,9] Among the methods, squash cytology is the most effective, rapid and reliable method for rapid intraoperative diagnosis.[10,11] The main advantages of squash cytology are that it is quick, easy to prepare the slides and no need of specialised equipment like cryostat used for frozen sections. The cellular and nuclear details are well preserved. The background of smear may contribute valuable information about the nature of a tumour.

Despite the advantages, squash cytology has limitations. It cannot be performed on calcified tissues. The amount of pressure exerted when making the smear is crucial as too much pressure can cause crush artefacts which can pose difficulties in diagnosis and grading tumours especially astrocytoma.[12] The purpose of the present study was to assess the diagnostic accuracy of Squash cytology in

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detecting nervous tumours by correlating with histopathology which is the golden standard.

Aim

The aim of the study was to assess the diagnostic accuracy of Squash cytology for rapid Intraoperative diagnosis in tumours of nervous system by comparing histopathological examination.

Objectives

- To assess the diagnostic accuracy of squash cytology in tumours of nervous system by correlating with histopathology.
- To determine the diagnostic limitations of squash cytology

MATERIALS AND METHODS

This was a prospective study conducted in department of Pathology in a S.C.B Medical College Hospital for a period of two years from June 2016 to May 2017. The study was done with approval of the institutional review board. The study subjects were 73 consecutive patients operated for tumours of nervous system in department of neurosurgery. During surgery, upon opening the lesion, small bits of tissue measuring 1-2mm^2 were removed and sent in a gauge moistened with saline for squash cytology. The tissue was placed at the end of a clean glass slide and smeared by compressing the tissue with another slide. Care was taken to ensure uniform thickness of the smear. The smear obtained was fixed in absolute alcohol for 2 minutes, washed in water for one minute and stained with Haematoxylin for 5 minutes. Smears were kept in 0.5% aqueous hydrochloride for 10-20 seconds and rinsed in water for two minutes. Finally, smears were stained with eosin and washed with absolute alcohol, dried and then mounted in DPX. The whole procedure of fixation and staining took around 12-14minutes. The smears were reported and graded by the pathologist. After surgery, the remaining tissue was sent for histopathology in 10% formalin. The squash cytology diagnosis obtained was compared with the histopathology diagnosis which was the final and gold standard. The grading of the tumours by squash cytology was also compared with histopathology grading.

RESULTS

In the present study, 73 cases of tumours of nervous system were included. The most common tumor was astrocytoma followed by meningioma. The age group in our study ranged from 6 to 70 years with the mean age of 40 years (Figure-1). The maximum incidence of tumours occurred between 41 to 50 years. Paediatric tumours in the study included 3 cases of hemangioblastoma, 4 cases of medulloblastoma, 1 case of pleomorphic xanthoastrocytoma and 1 case of small cell variant of glioblastoma multiforme. In astrocytomas, grade 2 tumours occurred in all age groups, grade 3 tumours were common in 4th decade and grade 4 tumours were common in 5th decade. Among meningiomas, the most common in 5th decade followed by 3rd decade. In the present study, astrocytomas were more common in men and meningiomas were more common in women.

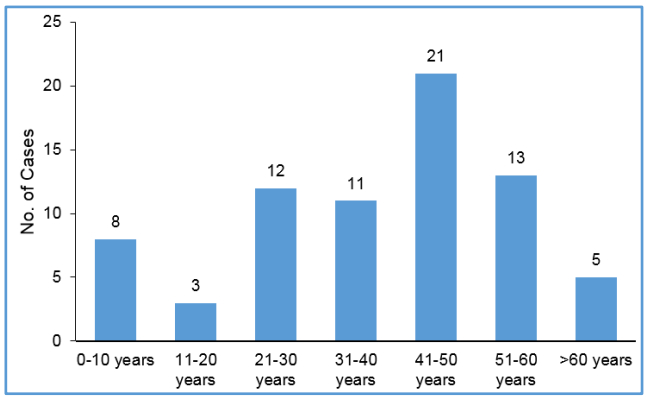

Figure 1. Age Distribution of the Tumours of the Nervous System

Tumours of the Nervous System	No. of Cases	Percentage
Astrocytoma	23	31.51
Meningioma	21	28.77
Schwannoma	10	13.70
Oligodendroglioma	05	6.85
Medulloblastoma	04	5.48
Ependymoma	02	2.74
Hemangioblastoma	03	4.11
CNS lymphoma	02	2.74
Metastatic	03	4.11
Total	73	100.00

Table 1. Clinical Diagnosis

Among 73 tumours of the nervous system, 63 were Central nervous system tumours and 10 were in the peripheral nervous system. The most common site in the central nervous system was the middle cranial fossa. The overall diagnostic accuracy of squash cytology in the present study was 84.93% (Figure-2). 11 cases were misinterpreted in squash cytology (Table-2).

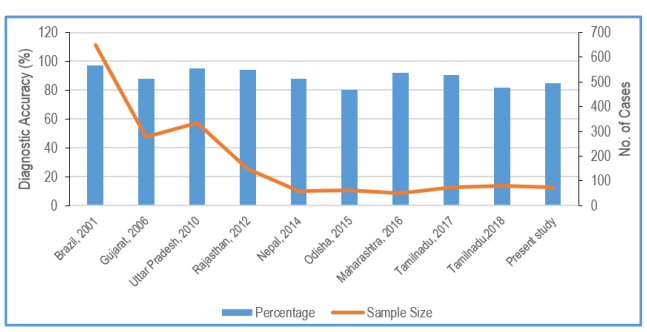

Figure 2. Comparison of Diagnostic Accuracy of Squash Cytology with Published Studies

Sl. No.	Tumours of the Nervous System	Total no. of Cases	Correlation	No. Correlation	Diagnostic Accuracy
1	Astrocytoma	23	20	03	86.96%
2	Meningioma	21	19	02	90.48%
3	Neurofibroma/Schwannoma	10	08	02	80.00%
4	Oligodendroglioma	05	04	01	80.00%
5	Medulloblastoma	04	03	01	75.00%
6	Ependymoma	02	02	00	100.0%
7	Hemangioblastoma	03	02	01	66.00%
8	CNS lymphoma	02	02	00	100.0%
9	Metastatic deposits	03	02	01	66.66%
	Total number of cases	73	62	11	84.93%

Table 2. Correlation of Squash Cytology with Histopathology in Tumours of the Nervous System

There were a total of 23 cases of astrocytoma. The most common was grade 4 astrocytoma (n=13) followed by diffuse astrocytoma grade 2 (n=7). The remaining were grade 3 astrocytoma (n=3). Among 23 cases, 3 cases were misdiagnosed. Out of 20 cases of astrocytoma diagnosed with squash cytology, exact grading was possible only in 16 cases. 4 cases were incorrectly graded. Hence when predicting the grade of astrocytoma, the diagnostic accuracy dropped from 86.96% to 69.5%. 100% diagnostic accuracy was achieved in ependymoma and CNS lymphoma.

DISCUSSION

Squash cytology is one of the methods employed for rapid intraoperative diagnosis in neuropathology. The main aim of stereotactic biopsy is to obtain enough tissue so that further diagnosis is established with histopathology. Similarly, when an unexpected lesion is expected during neurosurgery, squash cytology helps the surgeon to modify the plan of management.

The most common tumor in our study was astrocytoma followed by meningioma.[13,14] The most common tumor in astrocytoma was glioblastoma (grade 4) which reflects the Indian and global statistics. The diagnostic accuracy of squash cytology was 84.93% in our study. Other studies have shown diagnostic accuracy ranging from 80 to 97% (Figure 2). This highlights the diagnostic accuracy of squash cytology in detecting tumours of the nervous system.

Among Astrocytomas, the most common tumor was glioblastoma. Glioblastoma revealed extensive nuclear pleomorphism and atypia. Patchy areas of necrosis and endovascular proliferation were evident. 3 cases had diagnostic difficulties. One case was a small cell variant of glioblastoma in a 6 years old male child. This case was misinterpreted as medulloblastoma as the tumor cells were closely packed, monotonous with scanty cytoplasm. However, in histopathology, the tumor revealed necrosis and endovascular proliferation characteristic of glioblastoma. In one study, CNS lymphoma in histology was misdiagnosed as anaplastic oligodendroglioma in squash cytology. Similarly, 2 cases of grade 3 astrocytoma were misinterpreted as metastatic deposits as the representative area was not sampled during squash cytology. Grading of astrocytoma posed diagnostic difficulty. The diagnostic accuracy dropped from 86.96% (n=20/23) to 69.5% (n=16/23). In fact, it was accepted by other studies that it is inappropriate to grade astrocytomas by squash cytology as astrocytomas vary in grade from one area to another within a single tumor.[11]

Two cases of Schwannoma was misinterpreted as meningioma. Similarly, 2 cases of meningioma was misdiagnosed as schwannoma as the fibrous areas were mimicking as cellular areas of schwannoma.[15] Many studies reported diagnostic difficulties in squash cytology of oligodendroglioma as the classic perinuclear halo seen in histopathology was absent in squash cytology. One case of medulloblastoma was misinterpreted as hemangioblastoma. One case of metastatic adenocarcinoma was reported as grade 3 astrocytoma in histology due to high cellularity which is a common misinterpretation. One case of medulloblastoma in histology misinterpreted as haemangioma in squash, as the tumor tissue was difficult to make smear.[16]

Sl. No.	Squash Cytology	Histopathology
1.	Grade 3 astrocytoma	Metastatic carcinoma
2.	Meningioma	Schwannoma
3.	Schwannoma	Meningioma
4.	Oligodendroglioma	CNS lymphoma
5.	Hemangioblastoma	Medulloblastoma
6.	Metastatic carcinoma	Grade 3 astrocytoma
7.	Medulloblastoma	Glioblastoma multiforme (small cell variants)

Table 3. Cases Misinterpreted in Squash Cytology

CONCLUSION

The overall diagnostic accuracy of squash cytology in the present study was 84.93%. The method is easy, rapid and inexpensive. Details of the cellular morphology are well preserved with squash cytology. Hence squash cytology in tumours of the nervous system provides an efficient means of pathological assessment which in experienced hands of a pathologist will provide high degree of diagnostic accuracy.

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