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Evaluation of Central Nervous System Tumors by Squash and Imprint Cytology with Histopathological Correlation

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Abstract

Introduction: Intraoperative diagnosis of space occupying lesions of the central nervous system is of utmost importance in order to plan the early treatment of patients. The study was designed to find correlation of imprint cytology, squash cytology with histopathological diagnosis of CNS Tumors in southeast region of Rajasthan.

Material and methods: The present cross-sectional study was conducted in a course of 6 months (April 2017 - September 2017) after approval by ethical committee of RNT Medical college, Udaipur. Tissue samples from 50 patients of CNS lesions were studied by imprint and squash cytology and results were compared with histopathological biopsy.

Results: Male predominance was seen in CNS tumors. Most common age group for was 21- 30 year. Astrocytoma and schwannoma were seen in almost each age group, only one case of medulloblastoma seen in older age group (61-70 year). meningiomas were present commonly in patients aged > 20 yrs. Overall sensitivity, specificity and Diagnostic accuracy was greater for squash Cytology. WHO Grade I included maximum number of cases.

Conclusion: Squash and imprint cytology aid in early intraoperative diagnosis and help surgeons to make prompt treatment plan. Both techniques are technically simple, have high diagnostic accuracy despite the small sample size, rapid, cost effective and do not require any special instrument and hence both techniques can be used as primary tools for diagnosing CNS tumors.

Keywords: imprint cytology, squash cytology, CNS tumors

Introduction

Intraoperative diagnosis of space occupying lesions of the central nervous system is of utmost importance in order to plan the early treatment of patients. Several previous studies regarding correlation of cytological diagnosis with histopathological diagnosis showed good results. Dudgeon and Patrick.[1] 1927 were the first to study smears prepared from cut surface of freshly removed surgical biopsies from various tissues including breast, thyroid, and lymph nodes. Due to lack of awareness, imprint cytology and squash cytology are not practiced currently at our institution southeast Rajasthan. Cytological

methods are ideal for speedy intraoperative diagnosis of stereotactic CNS biopsy samples because the tissue is minimally distorted, and none is wasted.[2] The study is designed to find correlation of imprint cytology, squash cytology with histopathological diagnosis of CNS Tumors in southeast region of Rajasthan. Vikram Narang and Sunita Jacob et al reported diagnostic accuracy of squash smears 89.2% and that of imprint cytology 78.4%. the low accuracy of touch imprint was attributed to poor cellular yield.[3] Both the techniques can be used as primary tool for diagnosis if correlation with histopathology is accurate.[4]

Material and methods

The present cross-sectional study was conducted in course of 6 months (April 2017 - September 2017) after approval by ethical committee of RNT Medical college, Udaipur. Tissue samples from 50 patients of CNS lesions were taken during intraoperative procedure in department of neurosurgery, Maharana Bhupal Singh Hospital, Udaipur, Rajasthan. Both positive and negative control were taken. Collected clinical data included Registration number, Age, sex, site and primary clinical diagnosis and radiological diagnosis. freshly resected samples were collected in normal saline and following method was used for cytosmear preparation. Touch imprint smears were prepared by gently pressing the slides on the sample and fixed in 95% ethanol. Squash smear smears were prepared by taking a small piece (<0.5 mm in diameter) on a slide, and subsequently smearing it with another slide. Smears were then fixed and stained with May Graunwald Geimsa stain. Histopathological sections were stained with H&E stain. Results of Imprint and Squash smears were then compared with Histopathological diagnosis. WHO grading was used for interpretation.

Observations

The present study was conducted on 50 patient of CNS lesions. All lesions were diagnosed by cytology and histopathology. Incidence of various CNS lesions and their variants were studied in reference to age, sex, site of occurrence, cytological and main histopathological features. Factors which were observed were as follows:

1. Sex ratio of CNS lesions.
2. Age and sex distribution of CNS lesions.
3. Variants of CNS lesions in relation to age and sex.
4. Localization of CNS lesions.
5. Incidence of individual CNS lesions
6. Correlation of cytology and histopathology diagnosis.

The cases where intraoperative cytological diagnosis was same as the histological diagnosis including the grade of tumor were considered complete correlation.

Out of 50 operated CNS lesions male patients were 29 and female 21 with M: F of 1.38.

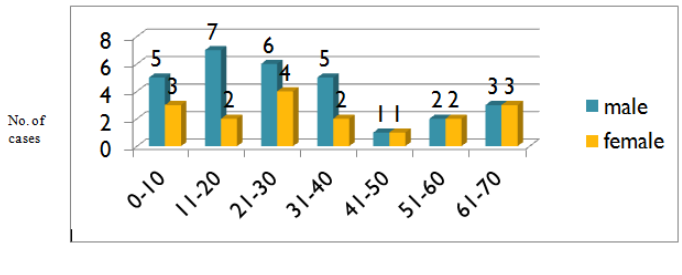
Maximum cases were in supratentorial location 26, 15 were infratentorial and 6 in spinal region.

In astrocytoma, meningioma, choroid plexus papilloma, papillary adenoma, neurocytoma, oligodendroglioma female preponderance was observed. Rest of the tumors were more common in males.

TUMORS	FEMALE	MALE	Total
AC	6	4	10
CGL		1	1
NC	2		2
CPC		1	1
CPP	1		1
EM		3	3
HB		2	2
MB	1	5	6
MG	7	5	12
ODG	2		2
PA	1		1
PNET		2	2
SN	1	4	5
TC		1	1
RG		1	1
Grand Total	21	29	50

Table 1: Sex Incidence Of Various Lesions

Figure 2: Age And Sex Incidence Of CNS Tumors



Type of lesion

Age	AC	CGL	CPP	EM	HB	MB	MG	NC	ODG	PA	PNET	SN	TC	CPC	RG	Grand Total
0-10	2	1				4								1		8
11-20	2				2	1	1				2	1				9
21-30	2		1				2	2		1		1	1			10
31-40	1				1		3					2				7
41-50						1			2							3
51-60	1						3					1				5
61-70	2					1	4							1		8
Grand Total	10		1	1	3	2	6	12	2	2	1	2	5	1	1	50

Table 2: Age Incidence Of Various CNS Lesions

Maximum male patients were observed in 2nd decade followed by 3rd decade. maximum female patients were observed in 3rd decade.

IMPRINT

HPE	TUMORS	AC	CGL	CPP	EM	EMB	HB	MB	MG	NC	ODG	PA	PNET	RCN	SN	VL	Grand Total
	AC		9		1												10
	CGL			1													1
	NC									2							2
	CPC					1											1
	CPP				1												1
	EM				3												3
	HB						1									1	2
	MB							6									6
	MG								12								12
	ODG										2						2
	PA											1					1
	PNET												1	1			2
	SN														5		5
	TC		1														1
	RG	1															1
	Grand total	10	2	1	4	1	1	6	12	2	2	1	1	1	5	1	50

Table 3: Correlation Between Squash And Histopathological Diagnosis

Meningioma (12) and astrocytic tumors (10) formed main proportion of lesions in our study.

One case of haemangioblastoma was diagnosed as vascular lesion and one case of tuberculoma was diagnosed as chronic granulomatous lesion on imprint smears. One case of choroid plexus carcinoma was misdiagnosed as ependomyoblastoma. One case of reactive gliosis was misdiagnosed as astrocytoma on imprint but was correctly diagnosed on squash smears.

HPF	Row Labels	AC	CGL	CPC	CPP	EM	HB	MB	MG	NC	ODG	PA	PNET	RCN	SN	TC	RG	VL	Grand Total
	AC	10																	10
	CGL		1																1
	CPC			1															1
	CPP				1														1
	EM					3													3
	HB						1											1	2
	MB							6											6
	MG								12										12
	NC									2									2
	ODG										2								2
	PA											1							1
	PNET												1	1					2
	SN														5				5
	TC		1																1
	RG																1		1
	Grand Total	10	1	1	1	3	1	6	12	2	2	1	1	1	5	1	1	1	50

Table 4 : Correlation Between Squash And Histopathological Diagnosis

One case of tuberculoma and one case of chronic granulomatous lesion was diagnosed as chronic inflammatory lesion on squash smears. And one case of hemangioblastoma was diagnosed as vascular lesion on squash smears.

IMPRINT AND SQUASH

HP	Row Labels	ANGIOMATOUS	ATYPICAL	FIBROUS	MENINGOTHELIAL	PSAMMOMATOUS	TRANSITIONAL	Grand Total
	ANGIOMATOUS	1						1
	ATYPICAL		2					2
	FIBROUS			3				3
	PSAMMOMATOUS					2		2
	TRANSITIONAL				1		3	4
	Grand Total	1	2	3	1	2	3	12

TABLE 5: VARIANTS OF MENINGIOMA: CORRELATION IMPRINT, SQUASH WITH HP (HP: histopathology)

Out of 12 cases 11 show same results on histopathology ,squash smears and imprint smears. One case of transitional meningioma was incorrectly diagnosed as meningothelial meningioma on imprint and squash smears.

WHO Grade[4]

TUMORS	I	II	III	IV	Grand Total
AC	5	2	2	2	11
CPC			1		1
CPP	1				1
EM		3			3
HB	2				2
MB				6	6
MG	10	2			12
NC		2			2
ODG		1	1		2
SN	5				5
Grand Total	23	10	4	8	45

Table 6: Who Grading Of CNS Tumors

Maximum cases were WHO grade I (23) followed by WHO grade II (10). The sensitivity and specificity of imprint smears was 97.8% and 66.7% respectively. And sensitivity and specificity of squash smears was 97.9% and 100% respectively. NPV of imprint smear was 66.7% and of squash smear was 100%. PPV of imprint smears was 97.8% and of squash smears was 97.9%.

	IMPRINT	SQUASH
SENSITIVITY	97.8%	97.9%
SPECIFICITY	66.7%	100%
PPV	97.8%	97.9%
NPV	66.7%	100%
DA	66.7%	100%

Table 7: Comparison of Both Techniques

Discussion

The current study was undertaken to assess the utility of intraoperative consultations for cytomorphological diagnosis by imprint and squash smear techniques and was correlated with histopathological diagnosis.

Mean diagnostic accuracy was 66.7% of imprint smear technique which was found to be bit lower than other studies conducted by Nishant et al[10] 92%, Charusheela et al 92.6%. Vikram Narang and Sunita Jacob et al[3] reported diagnostic accuracy of squash smears 89.2% and that of imprint cytology was 78.4% the low accuracy of touch imprint was attributed to poor cellular yield. Diagnostic accuracy was 100% for squash smear technique in the present study, the findings are consistent with previous studies conducted by Iqbal et al 95.36%[14] and Imtiaz et al[12] 93.6%.

STUDIES ON IMPRINT	DIAGNOSTIC ACCURACY	STUDIES ON SQUASH	Diagnostic accuracy
Suan et al (1990)	96.3%	Asha et al (1989)	87%
Lee (1990)	92.9%	Imtiaz et al (2006)	93.5%
Ferlik et al (1999)	92.6%	Shukla et al (2006)	87.76%
Pickren et al (2005)	**97%**	**Iqbal et al (2007)**	**95.36%**
Nishant sharma et al (2012)	92%	Jaiswal et al (2010)	83.7 %
Charusheela et al (2017)	92.6%	Patil et al (2016)	92%
OUR STUDY	66.7%	OUR STUDY	100%

Table 8: Various Studies: Imprint Cytology And Squash Cytology

Nishant etal[10] (2012) reported a sensitivity 92.9%, specificity 90.6%, diagnostic accuracy 92% on imprint smears and sensitivity 90.6%, specificity 87.5% and diagnostic accuracy 89.3% on squash smears.

IMPRINT	Sensitivity	specificity	Diagnostic accuracy
Nishant et al(2012)	92.9%	90.6%	92%
Our study	97.8%	66.7%	66.7%

SQUASH	sensitivity	specificity	Diagnostic accuracy
Nishant et al(2012)	90.6%	87.5%	89.3%
Our study	97.9%	100%	100%

TABLE 9: COMPARISON OF RESULTS OF OUR STUDY WITH OTHER STUDY

Conclusion

The study was able to bring up cytological techniques as accurate diagnostic tool for early intraoperative diagnoses. This procedure is safe, very rapid, simple, easily reproducible and low-cost effective tool to diagnose brain lesion where frozen sections are not available. Thus, in future all neurosurgery operation theatre should be equipped with a cytology facility.

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Abbreviations : AC:Astrocytoma; CGL: Chronic Granulomatous Lesion ; CPP: Choroid Plexus Papilloma ; EM: Ependymoma ; HB: Haemangioblastoma MB: Medulloblastoma ; MG: Meningioma ; NC: Neurocytoma ; ODG: Oligodendroglioma ; PA: Papillary Adenoma ; SN: Schwannoma PNET: Peripheral Neuroectodermal Tumor ; TC : Tuberculoma ; CPC: Choroid Plexus Malignancy; RG: Reactive Gliosis; EMB: Ependomyoblastoma)

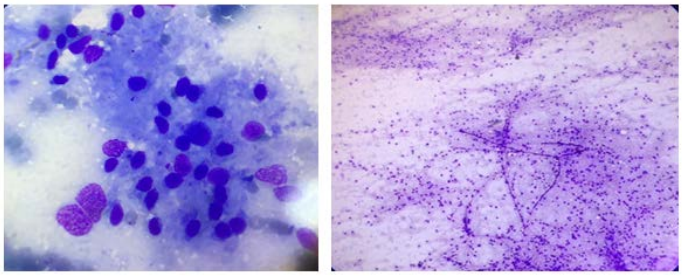

Figure 1: Imprint smear of Oligodendroglioma showing discohesive, relatively small tumor cells with scanty cytoplasm, uniform dark nuclei, no cell process (MGG 1000X). Squash smear of Oligodendroglioma showing chicken wire network of vessels. (MGG 100 X).

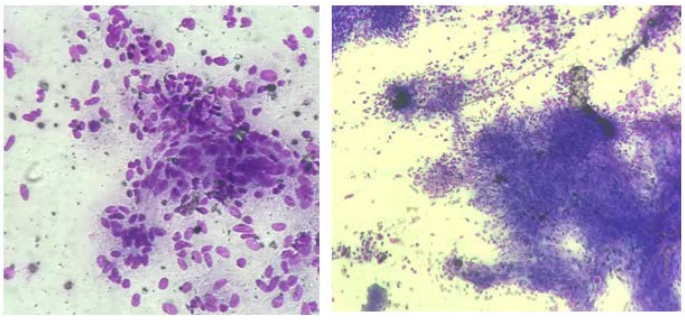

Figure 2: Imprint Smear of Fibrous Meningioma showing plump spindle cells (MGG,400 X View). Squash smear of Fibrous Meningioma showing Plump spindle nuclei in sheets. (MGG,400 X View)

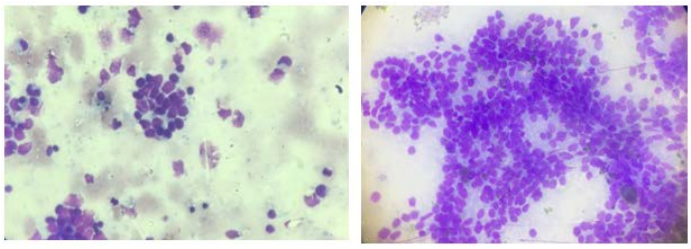

Figure 3: Imprint of Medulloblastoma showing poorly differentiated cells arranged in rosettes with high N/C ratio and densely staining nuclei (MGG ,400 X View) and Squash smear of Medulloblastoma (MGG,400 X View) high cellularity with poorly formed rosettes.

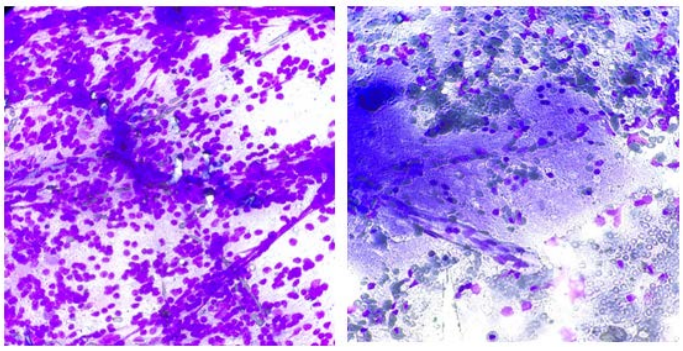

Figure 4: squash smear of Haemangioblastoma (MGG ,400 X view), Imprint smear (MGG, 400 X view)

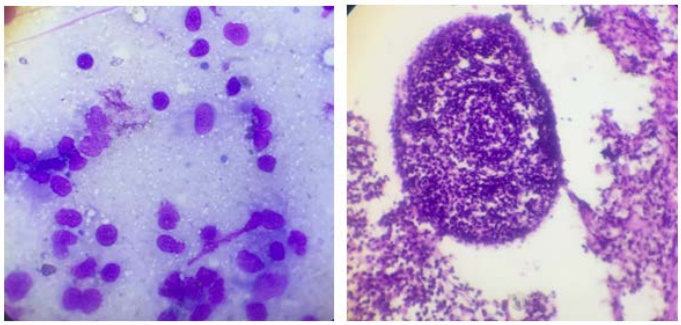

Figure 5: Imprint smear of Tuberculoma showing epithelioid cells, lymphocytes. (MGG 1000 X). Histopathological section of Tuberculoma (H & E ,400 X).

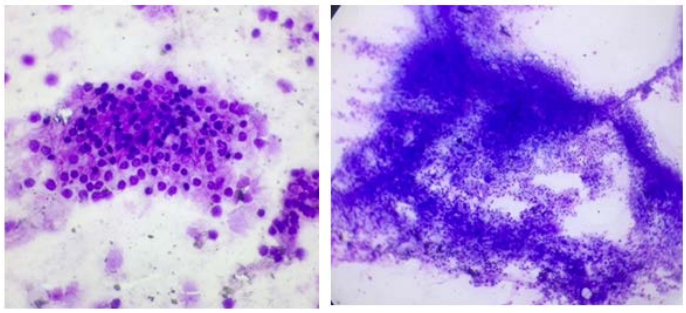

Figure 6: Imprint smear of pilocytic astrocytoma showing presence of uniform nuclei with delicate chromatin surrounded by hair like elongated glial cell processes. (MGG, 400 X). Squash smear of pilocytic astrocytoma showing clustering of tumor cells around blood vessels. (MGG 400 X)