

Original Article

Diagnostic Efficacy of CT and MRI with Biopsy in case of Brain Tumours

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ABSTRACT:

Background: Magnetic resonance imaging (MRI) has emerged as the primary diagnostic modality for the diagnosis of brain tumours. Brainstem lesions are sometimes treated on clinical and radiological grounds and it had even been argued that biopsy is not warranted in many of these lesions. Hence; we planned the present study to assess 50 brain biopsies and compare their diagnostic yield of different biopsy procures. **Materials & methods:** The present study included assessment of 50 brain biopsies for comparing their diagnostic yield of different biopsy procures. A total of 50 cases of intra-axial brain mass lesions, with the help of CT and/ or MRI, underwent brain biopsy procedure. Out of all the 50 biopsies included, 30 were frame based CT guided stereotactic, 12 were ultrasound guided and remaining 8 were frameless image guided stereotactic brain biopsies. All the results obtained were compiled on SPSS software. **Results:** Out of total 50 biopsies received, 30 were frame based biopsy, 12 were ultrasound guided and 8 were frameless image guided biopsy. Diagnostic accuracy of frame based biopsy was 83.3 % while diagnostic accuracy of Ultrasound guided biopsy and Frameless image guided biopsy were 83.3% and 87.5% respectively. **Conclusion:** Frameless image-guided stereotactic biopsy yielded highest diagnostic accuracy among all other diagnostic biopsy modalities

Key words: Brain tumours, Computed tomography, Magnetic resonance imaging.

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INTRODUCTION
Approximately 15 % of the intracranial space tumours among paediatric patients are of brainstem while among adults, the brainstem comprises of 2% of the lesions. Whereas on one hand, brainstem gliomas are the most common lesions among children, among adults, there exist a wide diversity among the occurrence of these lesions.^{1, 2} Brainstem lesions are sometimes treated on clinical and radiological grounds and it had even been argued that biopsy is not warranted in many of these lesions. This is based on the fact that surgery for brainstem lesions was historically associated with an unacceptably high mortality and morbidity.³ For the diagnosis of brainstem lesions, Magnetic resonance imaging (MRI) has emerged as the primary diagnostic modality. In regard to tumor grade classification, it was noted that the accuracy of MRI brain assessment was correct in 35% of low grade glioma and 27% of high grade glioma. Different entry points and trajectories are described for reaching the brainstem.^{4, 5} The technique used differs based on location of the lesion and surgeon's preference. Similar outcomes are reported with different approaches.^{6- 8}Hence; we planned the present study to

assess 50 brain biopsies and compare their diagnostic yield of different biopsy procures.

MATERIALS & METHODS

The present study was conducted in the department of radiology of the medical institute and included assessment of 50 brain biopsies for comparing their diagnostic yield of different biopsy procures. Ethical approval was taken from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total of 50 cases of intra-axial brain mass lesions, with the help of CT and/ or MRI, underwent brain biopsy procedure. Out of all the 50 biopsies included, 30 were frame based CT guided stereotactic, 12 were ultrasound guided and remaining 8 were frameless image guided stereotactic brain biopsies. Deep-seated, multiple lesions and the lesions of eloquent areas were used for taking the biopsies. Local anaesthesia was used for taking CT-guided and ultrasound (US) guided biopsies while for performing image-guided biopsies, general anaesthesia was used. All the results were compiled on SPSS software. SPSS software version 17.0 was used for assessment of results. Chi- square test

and univariate regression curves were used for evaluation of level of significance.

RESULTS

Out of total 50 biopsies received, 30 were frame based biopsy, 12 were ultrasound guided and 8 were frameless image guided biopsy. **Table 1** shows the diagnostic yield of various types of biopsy procedures. Diagnostic

accuracy of frame based biopsy was 83.3 % while diagnostic accuracy of Ultrasound guided biopsy and Frameless image guided biopsy were 83.3% and 87.5% respectively. Out of total 8 cases with inconclusive diagnosis, 4 cases were of normal brain while 3 cases and one case were of inconclusive diagnosis because of inadequate opinion and necrotic tissue (**Table 2**).

Table 1: Diagnostic yield of various types of biopsy procedures

Parameter	Frame based biopsy	Ultrasound guided biopsy	Frameless image guided biopsy
Biopsy number	30	12	8
Final diagnosis conclusive	25	10	7
Diagnostic efficacy (%)	83.3	83.3	87.5

Graph 1: Descriptive results of diagnostic yield of various types of biopsy procedures

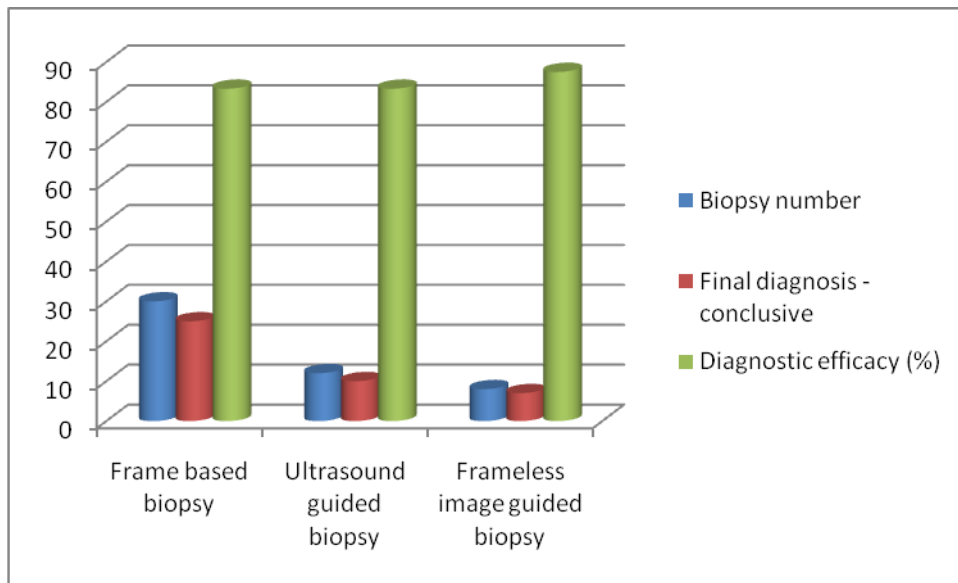
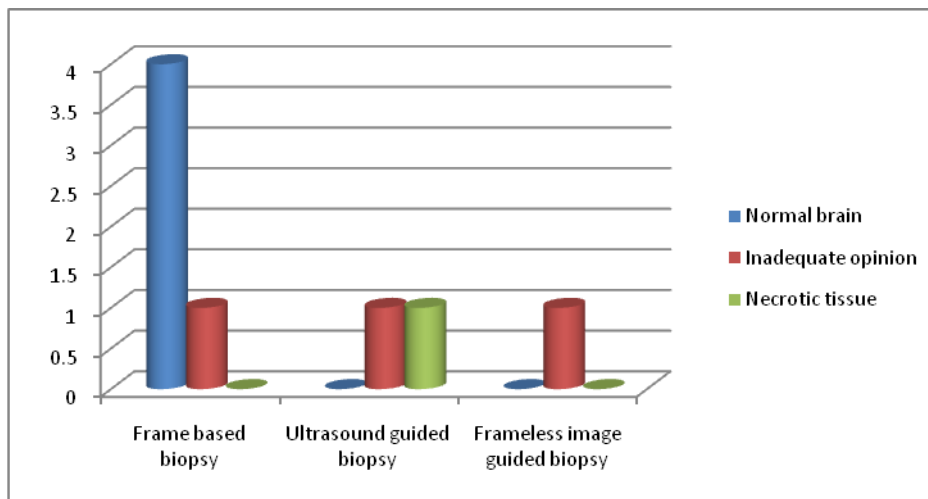


Table 2: Inconclusive diagnosis cases (N= 8)

Diagnosis	Frame based biopsy	Ultrasound guided biopsy	Frameless image guided biopsy
Normal brain	4	0	0
Inadequate opinion	1	1	1
Necrotic tissue	0	1	0

Graph 2: Descriptive results of Inconclusive diagnosis cases (N= 8)



DISCUSSION

Brain tumors share some features and challenges for diagnosis and therapy with tumors elsewhere in the body, but they also pose specific issues that are related to the unique properties of the organ they sit in. Stereotactic biopsy is currently being used in oncological neurosurgery despite its limitations.⁹⁻¹¹ Hence; we planned the present study to assess 50 brain biopsies and compare their diagnostic yield of different biopsy procedures. In the present study, we observed that frameless image guided biopsy exhibited highest diagnostic accuracy in comparison to frame based biopsy and ultrasound guided biopsy (**Table 1**). Manoj N et al analyzed all cases that underwent stereotactic biopsy for brainstem lesion in both adult and pediatric population between 1994 and 2009 in a single tertiary neurosurgical center. The clinical and radiological features, technique of the procedure, morbidity, diagnostic accuracy, spectrum of diagnosis, and variations in adult and pediatric population were analyzed. Eighty-two patients were included in the study. Computed tomography (CT) was used as guidance in 73 (38 children and 35 adults) patients and magnetic resonance imaging (MRI) in 9 (3 children and 6 adults). The biopsy was performed in a procedure room under local anesthesia in most adults, while children required sedation. Glioblastoma comprised 29.3% of all pathologies in children, compared with only 4.9% of the pathologies in adult population ($P = 0.007$). Tuberculosis was the next major diagnosis (9.8%). In 12 patients, initial biopsy was inconclusive. Following a repeat biopsy in 5 of these patients, a diagnosis was possible for 75/82 (91.5%) patients by STB. The location of the target, the choice of entry, the radiological characteristic of the lesion, enhancement pattern, and age group did not significantly correlate with the occurrence of inconclusive biopsy. Permanent complications occurred in two patients (2.4%). There was no mortality in this series. Stereotactic biopsy has an important role in brainstem lesions, more significantly in adults, due to wider pathological spectrum.¹² Massager N et al compared the results of magnetic resonance (MR) imaging, positron emission tomography (PET) scanning, and histological studies obtained in 30 patients who underwent MR imaging- and PET-guided stereotactic biopsy procedures for a brainstem mass lesion. Between July 1991 and December 1998, 30 patients harboring brainstem mass lesions underwent a stereotactic procedure in which combined MR imaging and PET scanning guidance were used. Positron emission tomography scanning was performed using [¹⁸F]fluorodeoxyglucose in 16 patients, methionine in two patients, and both tracers in 12 patients. Definite diagnosis was established on histological examination of the biopsy samples. Interpretation of MR imaging findings only or PET findings only was in agreement with the histological diagnosis in 63% and 73% of cases, respectively. Magnetic resonance imaging and PET findings were concordant in 19 of the 30 cases; in those cases, imaging data correlated with histological findings in 79%. Treatment based on information derived from MR

imaging was concordant with therapy based on histological findings in only 17 patients (57%). Combining MR imaging and PET scanning data, the concordance between the neuroimaging-based treatment and treatments based on histological findings increased to 19 patients (63%). In seven patients who underwent biopsy procedures with one PET-defined and one MR imaging-defined trajectory, at histological examination the PET-guided samples were more representative of the tumor's nature and grade than the MR imaging-guided samples in four cases (57%). In 18 patients PET scanning was used to define a biopsy target and provided a diagnostic yield in 100% of the cases. Although the use of combined PET and MR imaging improves radiological interpretation of a mass lesion in the brainstem, it does not accurately replace histological diagnosis that is provided by a stereotactically obtained biopsy sample.¹³ Quick-Weller J et al focussed on results, approaches, modalities of anesthesia, and complications. We performed a retrospective analysis of our prospective database, including 26 patients who underwent stereotactic biopsy of the brainstem between April 1994 and June 2015. All of the patients underwent preoperative MRI. Riechert-Mundinger-frame was used before 2000, thereafter the Leksell stereotactic frame was used. After 2000 entry and target points were calculated by using BrainLab stereotactic system. We evaluated histopathological results as well as further treatment; additionally we compared complications of local versus general anesthesia and complications of a frontal versus a trans-cerebellar approach. Median age of all patients was 33 years, and median number of tissue samples taken was 12. In all patients a final histopathological diagnosis could be established. 5 patients underwent the procedure under local anesthesia, 21 patients in general anesthesia. In 19 patients a frontal approach was performed, while in 7 patients a trans-cerebellar approach was used. Complications occurred in five patients. Thereby no significant difference was found with regard to approach (frontal versus trans-cerebellar) or anesthesia (local versus general). Stereotactic biopsies even of lesions in the brainstem are a save way to obtain tumor tissue for final diagnosis, resulting in adequate treatment.¹⁴

CONCLUSION

From the above results, the authors concluded that frameless image-guided stereotactic biopsy yielded highest diagnostic accuracy among all other diagnostic biopsy modalities. However; future studies are recommended larger samples size for better exploration of results.

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