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DIAGNOSTIC ACCURACY OF STEREOTACTIC BRAIN BIOPSY OF 32 BRAIN TUMOR CASES

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Abstract

The aim of our study is to evaluate the accuracy and reliability of brain lesion using computed tomography-guided stereotactic brain biopsy(CT-SBB) technique.

CT-SBB was performed in 32 patients between the year 2004 and 2008 in Neurosurgery Department of Dhaka Medical College Hospital. Only those patients were considered for stereotactic brain biopsy procedure who had visible lesions on CT. Clinical and radiological information of the patients were given to the pathologist for overall histopathological examination and diagnosis. The initial diagnosis (diagnostic yield) was defined as definitive percentage of histopathological diagnosis in the initial stereotactic biopsy and diagnostic accuracy was defined as percentage of same histopathological diagnosis through craniotomy as were in initial stereotactic biopsies.

A total of 32 stereotactic diagnostic procedures were done. The site of lesions were, 5frontal(15.62%), 7 temporal (21.87%), 11 parietal (34.37%), 2occipital(6.25%), 2 deepseated thalamic and basalganglionic (6.25%), 4 multiple (12.5%), 1supraseller (3.12%) and the histopathological diagnosis were, 18 neuroepithelial (56.25%), 2 metastatic (6.25%), 4 inflammatory (12.5%), 2 nacrotic (6.25%) and 1 craniopharyngioma (3.12%). Three of the total results (9.37%) were reported as "brain tissue" and two (6.25%) were reported as "gliosis".so,initially the histopathological diagnosis in ct-sbb were 27 out of 32(84.37%). Craniotomy was done in 9 patients after the initial ct guided sbb. Of these patients, the final diagnosis was changed from normal "brain tissue" to low-grade astrocytoma in one patient. The rest of these diagnoses were same as the initial diagnosis. The diagnostic accuracy was 88.88%(8 out of 9 cases) in our study. There was no mortality; only two patients developed initially mild monoperesis, which was resolved subsequently.

CT-guided stereotactic brain biopsy is a reliable,safe and effective procedure whose diagnostic yield and accuracy is very high with minimum mortality and morbidity.

Key wards: brain biopsy; frame-based biopsy; stereotactic

Introduction

Despite advances in imaging of brain, an accurate diagnosis of brain lesion requires, tissue sampling and histological verification[1]. The methods of sampling brain and tumor tissue for diagnosis have evolved from craniotomy for exploration based on symptoms and signs, to stereotactic approaches using computed tomographic scan, magnetic resonance imaging or metabolic imaging etc[2]. The introduction of computed tomography into clinical practice had resulted in the unexpected expantion of stereotaxy. CT has made possible the precise localization of intracranial targets together with targeted structures and this has contributed to the further expansion of stereotaxy[3]. Stereotactic biopsy is safe, reliable and gold standard method for tissue diagnosis in cases of surgically inaccessible gliomas, tumors and cystic lesions[4,5]. A preoperative diagnosis exclusively based on clinical and radiological findings may be incorrect in more than one-third of patients with discrete intra-axial lesions. By using this CT guided stereotactic technique in the neurosurgical armamentarium, imperic therapy without histopathological verification is rarely indicated[6]. To-day, stereotactic biopsy refers to as an optimal management of intracranial space-occupying lesions and it is current being used in oncological neurosurgery [7,8].

The aim of our study is to evaluate the histopathological accuracy and reliability of brain

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lesion using the computed tomography-guided stereotactic brain biopsy(CT-SBB) technique.

Materials and methods

CT-guided stereotactic brain biopsy was done in 32 patients between the year 2004 and 2008 in our Neurosurgery department of Dhaka Medical College Hospital. Only those patients were considered for stereotactic brain biopsy procedure who had visible lesions on CT. The gender distribution was 37.50%(n-12) female and 62.5%(n-20) male and mean age was 43.86 years. We used an Mizuho frame system for all stereotactic biopsy procedure.

Haematoxylin and eosin (HE) stains were applied on paraffin section for histopathological examination the cases. No immunohistochemical studies were done. We did not use intra-opreative frozen-section or smear cytology for pathological examination. Clinical and radiological information of the patients were given to Pathologist for overall histopathological examination and diagnosis.

The initial diagnosis (Diagnostic yield) was defined as definitive percentage of histopathological diagnosis in the initial stereotactic biopsy and diagnostic accuracy was defined as percentage of same histopathological diagnosis through craniotomy as were in initial stereotactic biopsies.

Techniques and procedure

Bleeding time and cloting time was done in all patients. Stereotactic frame is fixed along the tentorial plane- anteriorly the frame is fixed with two screws at two frontal eminence and posteriorly with two bilateral points are along the superior nauchal line. Before inserting screw, xylocaine& adrenaline is infiltered at these four points. Patients are sedated adequately with Midazolam and sufficient analgesia is ensuerd.

Patients are now taken to CT room and after establishment of a 3-dimentional target point by CT-guided image, patients are again taken to operation theatre and biopsy are taken through a small burrhole after infiltration of local anaesthetic agents at targeted scalp area or under G/A.

Results

A total of 32 stereotactic surgeries were done. The site of lesions were, frontal 5 (15.62%), temporal 7 (21.87%), parietal 11 (34.37%), occipital 2 (6.25%), deep-seated thalamic and basal ganglionic 2 (6.25%), multiple 4 (12.5%), supraseller 1 (3.12%) table-I and the histopathological diagnosis were neuroepithelial 18 (56.25%), metastatic 2 (6.25%), inflammatory 4 (12.5%), nacrotic 2 (6.25%), craniopharyngioma 1 (3.12%) (Table II). Three of the total results (9.37%) were reported as "brain tissue" and two (6.25%) were reported as "gliosis". So, initially the histopathological diagnosis in CT-SBB were 27 out of 32(84.37%). Craniotomy was done in 9 patients after the initial CT guided SBB (Table III). Of these patients, the final diagnosis was changed from normal "brain tissue" to low grade astrocytoma in one patient. The rest of these diagnosis were same as the initial diagnosis. The diagnostic accuracy was 88.88%(8 out of 9 cases) in our study. There was no mortality, only two patients developed initially mild monoperesis which was resolved subsequently.

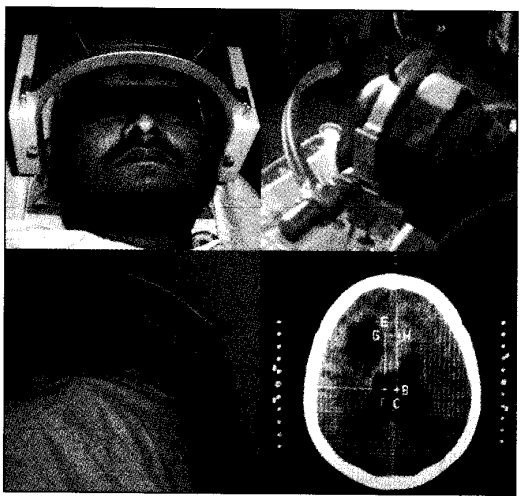

Fig 1 : Stereotactic biopsy technique of a corpus callosal glioma

Table I : Anatomical location of the brain lesions (n = 32)

Location	Number of Patients(%)
Lobar	
Frontal	5(15.62%)
Temporal	7(21.87%)
Parietal	11(34.37%)
Deep-Seated	
Occipital	2(6.25%)
Thalamic & Basal G	2(6.25%)
Multiple	4(12.5%)
Suprasellar	1(3.12%)
Total	32(100%)

Discussion

Although advances in the modern techniques provide early detection of brain lesions, they fail to give an accurate hitopathological diagnosis which is necessary

in the planning of a rational treatment strategy. Tumors suggesting a benign pathology in radiological examination might end-up with a malignant histopathological diagnosis or vice-versa(9). Because of the importance of an accurate diagnosis in order to avoid inappropriate therapy,together with the relative safety of the technique, CT- directed stereotactic biopsy sould be considered in all patients harbouring deep seated, multiple, diffuse, small,or inflammatory brain lesions[1]. Vaious data suggest that stereotactic biopsy of brain masses is a

Table II : Histopathological diagnosis of the brain lesions (n = 32)

Diagnosis	Number of Patients(%)
Neuro-epithelial tumors	
Low-grade astrocytoma	6 (18.75%)
High-grade astrocytoma	5 (15.62%)
Glioblastoma	5 (15.62%)
Oligodendroglioma	2 (6.25%)
Metastasis	2 (6.25%)
Inflammatory	4 (12.5%)
Others	
Necrosis	2 (6.25%)
Craniopharyngioma	1 (3.12%)
Non-diagnostic	
Brain tissue	3 (9.37%)
Gliosis	2 (6.25%)
Total	32 (100%)

Table III : Comparison of the histopathological diagnosis in the patients undergone stereotactic biopsy vs craniotomy

Stereotactic biopsy (n=9)	Craniotomy (n=9)
Brain tissue	Low-grade astrocytoma
Low-grade astrocytoma	Low-grade astrocytoma
Oligodendroglioma	Oligodendroglioma
High-grade astrocytoma	High-grade astrocytoma
High-grade astrocytoma	High-grade astrocytoma
High-grade astrocytoma	High-grade astrocytoma
High-grade astrocytoma	High-grade astrocytoma
Low-grade astrocytoma	Low-grade astrocytoma
Glioblastoma	Glioblastoma

safe and accurate technique that can obtain adequate tissue for histopathological diagnosis, thus providing the safe and accurate methods for obtaining intracranial tissue and the best available treatment for patients[10,11]. To patients with potentially inoperable lesion or lesions which might be best treated by chemotherapy or irradiation, modern techniques of neurosurgery now offer the options of precise stereotactic biopsy through small burr-holes as opposed to open biopsy[12].

There is very little post-procedure complications noted in different literatures regarding stereotactic biopsy amongst which haemorrhage is the main complication[13]. Though Jarus-Dziedzic et al. suggested that there was no mortality and no operative morbidity in their study, they noted that the most common post-strerotactic complication, cerebrovascular insult rarely poses diagnostic problems, even though, a serial stereotactic biopsy can safely clearify the situation[14]. But Thomas DG et al. showed in their study that there were complications in 14 cases (4.7%) including one (0.3%) death [1]. In a review of large stereotactic brain biopsy series, the morbidity rate was reported as 3.5% (range 0% to 13%) and the mortality rate was reported as 0.7% (range 0% to 2.6%). Reported morbidity related to SBB includes hemorrhage, seizure, stroke, infection, cerebrospinal fluid leakage and tumor seeding. Pre-operative anti-platelet drug use, corticosteroid use, deep or eloquent location, high-grade glioma, multiple trocer-canulla insertion and taking large numbers of specimen have been stated as the risk factor SBB [9,15]

In our study we did not do any frozen section biopsy but HJ Colbasani et al. in their study showed that comparison between the frozen section diagnosis and the final diagnosis based on the permanent sections revealed that they matches in 89(92%) cases and the exact grade or malignancy was determined by frozen section to make a final diognosis revealed that even if the specimen volume was less than 2 cubic millimeter, the bipsy was generally successful[16].

In AIDS patients stereotactic biopsy is very useful in terms of achieving a prompt and accurate diognosis and to guide the therapeutic scheme with focal brain lesions as most frequent diagnosis was progressive multifocal leucoencephalopathy (PML), followedby Primary Central Nervous System Lymphoma (PCNSL), and Toxoplasmosis in one series[17].

Regarding the histopathological results, CT-guided stereotactic brain biopsy provided a diagnostic yield of 84.37% in our series. This result is in accordance with other studies reported in literature ranges from 80% to 92% [2,4,11,14,15,18,19,20].

The diagnostic accuracy of SBB procedure has some limitations. The diagnostic accuracy is defined as

determining the correct pathology and, in the case of a tumor, correct tumor typing and grading. As the stereotactic biopsy material may not be representative of the whole lesion the diagnostic accuracy of SBB ranges from 80% to 96.7% in literatures [18,21,22]. SBB has a higher diagnostic rate in homogenous lesions but the accuracy is poorer heterogeneously contrast enhanced lesions [9].

Muragaki Y et al. suggested that the histopathological diagnosis of low grade glioma established after stereotactic bipsy is associated with a substantial risk of inaccuracy[23]. In our series, 9 patients underwent a craniotomy after the SBB procedure. Of these patients, the final diagnosis was changed from brain tissue to low grade astrocytoma in our patients and the rest of those diagnosis were identical to the initial diagnosis. The diagnostic accuracy was 88.88% (8 out of 9 patients) in our series; however, the small number of patients undergoing craniotomy limited the value of this conclusion.

A number of methods have been advocated to increase the accuracy of the SBB such as transecting multiple regions of lesions, using intraoperative frozen section, utilizing modern histopathological techniques (e.g. immunohistochemistry) and using positron emission tomography or magnetic resonance spectroscopy [9].

Conclusion

CT-Guided stereotactic brain biopsy is a reliable and safe procedure. Its diagnostic yield and accuracy is very high, though sometimes the accuracy is limited due to insufficient material and heterogeneity of the target lesions which can be minimized by an experienced team and using modern technologies.

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