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ORIGINAL ARTICLE

Combination of needle aspiration and core needle biopsy: A new technique of stereotactic biopsy

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ABSTRACT

Aim: The study aims at describing the results of using a new technique to acquire the tissue sample in stereotactic biopsy of brain lesions.

Materials and Methods: The study was performed in 19 patients over a period of 5 years in which we used the new technique, i.e., Abrar and Afzal technique (AT) of obtaining tissue biopsy. It is a combination of core tissue biopsy and needle aspiration techniques. The technique was devised to acquire greater amount of tissue for pathologic study.

Results: While we could give pathologic diagnosis in 18 patients out of 19 (94.7%), in one patient, the tissue sample revealed only inflammatory cells and definitive diagnosis could not be reached. There was no significant morbidity or any mortality in the series.

Conclusion: Abrar and Afzal technique is a reasonably accurate technique of acquiring larger tissue sample in stereotactic brain biopsy without any additional risks. It can be done with little modification of the conventional equipment available with the stereotactic system.

Key words: Cerebral mass lesions, stereotaxy, technical modification

Introduction

Evolution of more sophisticated imaging techniques has initiated a renewed interest in stereotactic devices, methods, and application.[1] True stereotaxy means precise guidance of various instruments to a preselected discrete target with accuracy and precision,[2,3] and its major use remains in biopsies of cerebral mass lesions for the purpose of pathological diagnosis.

Stereotactic frames have gained acceptance and have become a safe and invaluable tool for deep tumor biopsies.[4,5] Computed tomography (CT) or Magnetic Resonance Imaging MRI-directed stereotactic brachytherapy,[4,6] cyst and abscess drainage,[4,7] intracranial hematoma evacuation,[4,8,9] intracranial tissue transplantation,[8] and linear accelerator treatments.[10,11]

More recently, complex frameless stereotactic systems, with various software algorithms and usually using fiducial scalp markers, which provide at least the same level of accuracy as the frame-based methods are used.[12,13] Sophisticated stereotactic instrumentation has been developed by Kelly *et al*.[5,14] In our center, we are using the Leksell frame for our stereotactic procedures. We describe our experience with this frame by using the technical modification in taking biopsy which is a combination of needle aspiration and core needle biopsy.

Materials and Methods

The patients included in the study were all adults. The patients with diagnosis of having lesions located in a deep location or multiple lesions or diffuse lesions whose diagnosis could not be made after all radiological investigations were included.

Stereotactic biopsy (STB) is performed under local anesthesia (2% xylocaine) in all of the admitted patients ($n = 19$) and in seven patients, we had to use propofol sedation as well. STB was performed using the standard frontal bur hole ($n = 16$) and

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bur holes were tailor-made in three patients who had relatively superficial lesions in posterior parietal and occipital lobes. In these cases, the entry point was chosen after taking into consideration the neurological functions of the area involved and vascular structures in the area.

The frame used in our study is the Leksell's frame which was fixed using a local anesthetic agent at the pin site. The patients were then shifted to the CT scan room. Imaging system used by us was 64 slice, Siemens Somatom Sensation (Siemen, Enlargen, Germany). Initially, a single slice of CT scan was taken at approximately midway of the frame to ensure proper alignment of the frame with the axis of the CT gantry. Once the position was verified, an ionic contrast (Iohexol) 50 mL was administered intravenously and then imaging was done. Once scanning was done, the coordinates were calculated along x, y, and z axis. [Figure 1] All the patients had undergone CT scan (contrast-enhanced) prior to intervention. Besides, 16 patients had MRI done as well. The patients had a small bur hole (10 mm) made and arc of the device was locked in the frame. The frame was set as per the co-ordinates along the three axis.

Using AT, we chose the target as most enhancing portion of lesion which is on the superficial aspect of tumor. The cannula we used is a modified cannula which is 0.9-mm cannula and was provided with the Leksell stereotactic equipment. On this we mount, a rubber conduit cut from the intravenous infusion drip set, a 5-mL syringe can be attached to the other side of rubber conduit [Figure 2]. We introduced the cannula with stylet inside to the target (T) as seen in Figure 3, then we removed the stylet and introduced the cannula within the lesion for further 2 cm (lesser for lesions <2 cm) with negative suction being applied by a 5-mL syringe at the base of the cannula. Then, negative suction was removed and the cannula was withdrawn without re-inserting the stylet. The cannula was flushed with saline and the contents collected into a vial. The sample was in form of a long strip of tissue unlike the small bits obtained by conventional cup forceps. Crush biopsy or frozen section biopsy was done and once diagnosis was confirmed, the frame was removed and scalp incision closed. In the cases of biopsy being negative in first pass we take another pass from a different target and do repeat crush biopsy (n = 3). However, in one case we could not reach the final conclusion despite 2 passes and hitting the target correctly (as revealed by post-procedure CT scan). A specimen is sent for definitive biopsy as well.

Results

We enrolled the adult patients with age ranging from 21 years to 65 years. Male female ratio was 2:1. The site of lesion was frontal in three, parietal and occipital in two, basal ganglia in four, corpus callosum in one, thalamic in six, pineal in one, and two in sellar an suprasellar region [Table 1].

The pathological diagnosis was confirmed in 18 cases and in one case no conclusion was drawn. The nature of the lesion included glioblastoma multiforme (GBM) in three, grade II, III astrocytomas in three, pineal tumor in one, ependymomas in two, melanoma in one, tuberculoma in two, inflammatory in one, craniophrangiomas in one, and lymphomas in five [Table 2]. In the case where biopsy

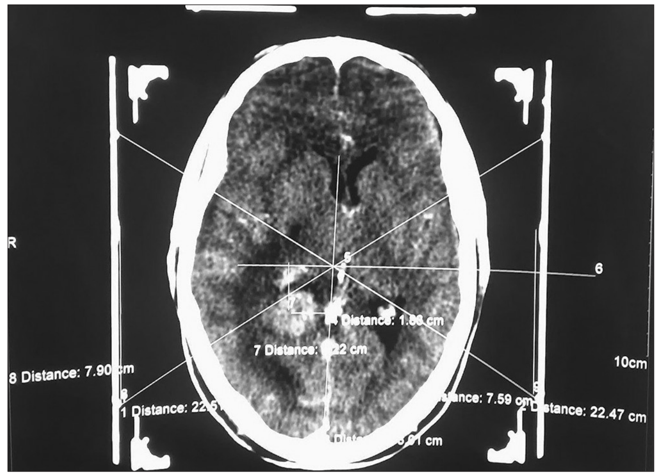

Figure 1: Computed tomography scan showing the target with fiducial markers and coordinates along x, y, z axis

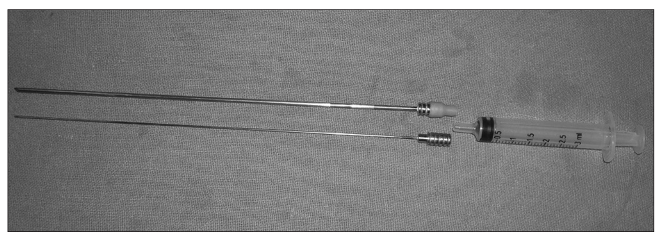

Figure 2: The cannula used for obtaining the tissue in stereotactic biopsy, rubber conduit is attached to the superficial part of cannula, to which we attach the syringe after removing of stylet once target is entered

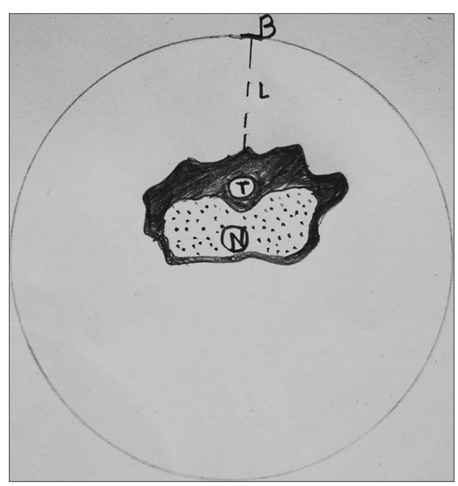

Figure 3: Schematic representation of contrast-enhancing target (t) inside the lesion. B represents the site of entry burr bole. N represents the necrotic portion of tumor and L is trajectory line

Table 1: Different sites of brain lesions and their number

Location	Number (*n*=19)
Frontal, fronto-parietal, fronto-temporal	3
Parietal, occipital, parieto-occipetal	2
Basal ganglia	4
Corpus callosum	1
Thalamus	6
Pineal	1
Supra sellar/parasellar	2

Table 2: Different pathological lesions and their number

Type of lesion	Number (*n*=19)
Glioblasoma multiforme	3
Astrocytoma grade II, III	3
Pineal tumor	1
Ependymoma	2
Melanoma	1
Tuberculoma	2
Inflammatory tissue	1
Craniopharyngioma	1
Lymphoma	5

was not confirmatory, we could only see an inflammatory infiltrate.

Discussion

The goal of any STB technique is obtaining tissue diagnosis with accuracy and least morbidity. During the past few decades, neurosurgery has seen the evolution of increasingly sophisticated imaging devices that allow unusual refinements in the radiological appreciation of normal and abnormal intracranial structures. Many stereotactic devices that allow a wedding of imaging techniques and stereotactic neurosurgical concepts have become available.[15,16] Krieger *et al*. had an accuracy of 95% in their study on brain tumors.[17] Dammers had accuracy of 89.4% in their study.[18] The extensive study by Apuzzo *et al*. analyzed 500 patients in whom they performed STB and they had an accuracy of 95.6% and they had a mortality of 1%.[4] Fugen *et al*. compared the results of STB and resected surgical specimens in brain lesions in a small study group and they could achieve 94% results.[19]

The sophisticated stereotactic instrumentation has been developed by Kelly *et al*.,[5,14] combining the microscope, laser, and computer stimulation for image-directed tumor excisions. Stereotactic and functional neurosurgeons have relied upon the consistent accuracy of probe and electrode placements affordable by skull-fixed coordinate frames since the development of stereoencephalotome in 1947.[20] Our technical modification is that of taking tissue sample using the Leksell stereotactic frame system.

The idea of taking core biopsy occurred while analyzing the literature comparing core breast biopsy with minimal biopsy and fine needle aspiration cytology which revealed far better results of the core biopsy.[21] Another factor was the incidence of negative biopsies with conventional techniques of taking tissue biopsy with cup forceps when the pathologist would often report inadequate sample. In our technique, we achieve a combined effect of aspiration due to negative suction of syringe with the cutting effect of passing core needle through the tumor.

Advance in technology and the development of computers and digital techniques in the recent years have led to increasing use of complex systems, with various software to process imaging data and facilitate accurate intra-operative localization of intracranial lesions without the use of stereotactic frame systems.[22,23] But in most of the undeveloped countries, the frameless stereotactic systems are not available in every neurosurgical center and the modifications with the frame-based systems can get comparable results.

Out of 19 patients in our study, we found that the precision of our system that has been described that allows the exact localization of lesions (18 out of 19) and the biopsies can be performed with a single pass of the aspiration needle. Obviously, such a method is superior to the conventional methods of STB and also "freehand" biopsies performed with the patients positioned in the CT scanner, which rely on serial scans for guidance as the biopsy needle is advanced. Moreover, the surgical procedure can be performed without loss of accuracy in a more convenient and sterile way by our system.

Most of our use of CT-stereotaxy is directed toward biopsy of brain lesions such as deep intrinsic masses 3.5 cm or less in diameter; small superficial lesions otherwise difficult to localize and lesions associated with motor, visual, or speech areas.

Advantages of AT over CT are that only single pass of biopsy needle is required through normal brain and the tissue yield is superior to CT. A single tissue specimen contains tissue from the enhancing and non-enhancing portion of the tissue which is not possible with the CT.

Conclusion

Abrar and Afzal technique is an acceptable method of stereotactic brain biopsy and can be done without additional risks with higher tissue yield. It can be done with little modification of the conventional equipment available with the stereotactic system.

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