COMPUTERIZED STEREOTACTIC BRAIN BIOPSIES: AN EXPERIENCE OF 15 PATIENTS AT AYUB TEACHING HOSPITAL

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Background: Deep seated lesions of the brain cannot be approached by conventional neurosurgical approach stereotactic system offers minimally invasive and accurate approach to such lesions. This study was carried out with an objective to determine the safety, efficacy and diagnostic yield of stereotactic biopsies of brain lesions using Brown-Roberts-Wells (BRW) system. **Methods:** This study was carried out in patients with intracranial lesions at Ayub teaching hospital Abbottabad from September 1999 to October 2003. Suitable patients with intra cranial lesions underwent computerized stereo tactic biopsy with BRW system. Tissue specimens were analyzed in histopathology department of the Ayub Medical College and results were obtained. Data was analyzed via computer software SPSS 8.0 version for windows. **Results:** Fifteen patients were selected for stereotactic brain biopsy. Age ranged from 15 years to 54 years. Among them 09 (60%) were male and 06 (40%) were female patients. Out come of the procedure was highly promising in terms of safety and positive diagnostic yield in 14 patients (93.3%), and histopathalogical validity of results (93.3%). Only one patient suffered mild neurological deficit (6.7%), one patient had inconclusive tissue diagnosis and invalid result (6.7%). biopsy proven lesion was astrocytoma in 04 patients (26.7%), anaplastic astrocytoma in 04 (26.7%), gliomatosis in 02 (13.3%), tuberculomas in 03 (20.0%), metastatic adenocarcinomas in 01 (6.7%) and lymphoma in 01(6.7%). **Conclusions:** We conclude that computerized stereotactic brain biopsy is safe and effective procedure with a high diagnostic yield at our center.

Key words: Computerized stereotactic biopsy, brain, Brown-Roberts-Wells (BRW) system,

INTRODUCTION

Traditionally operations on the brain are performed by open craniotomy and subsequent manipulations and interventions are obliviously hazardous to such a delicate structure. Damage to vessels and other important motor and sensory areas result in considerable morbidity and mortality. To avoid these hazards the concept of stereaotaxy was born. The technique uses an external apparatus, which helps in directing an instrument to the main target lesion with very minimal tissue disruptions. Various procedures can be performed safely like tissue biopsies, drainage of abscess and cysts, placement of tissue grafts, functional stereaotaxy for movement disorders, brachytherapy, stereotactic radiosurgry and laser surgery for deep intracranial lesions.

Horsly and Clark performed first stereotactic brain biopsy on the cerebellum of the rat.[1] It was Descartes who gave the idea of a point in space by relating it to the three planes (x, y, z) intersecting at right angles to each other.[2] Spiegel-Wycis in 1947 their first human stereotactic technique using three dimensional coordinate system related to intracranial land mark defined by pneumoencephalography.[3] They first published human stereotactic brain atlas in 1952 which consisted of various sequential brain sections orientated along planes between pineal gland and foramen of monoro.[4]

This study was conducted to evaluate the safety and efficacy of stereotactic brain biopsies under local anaesthesia by Brown-Robert-Wells (BRW) frame at our center.

MATERIAL AND METHODS

This study was conducted at neurosurgical unit of Ayub teaching hospital, Abbottabad from September 1999 to October 2003. Suitable patients with suspected intra cranial lesions underwent computerized stereotactic biopsy with BRW system.

Both male and female patients who consented for the procedure, deep and superficial brain lesions and the tumors either primary or metastatic lesions were included in the study. All selected patients had both clinical and radiological evidence of brain lesions.

Patients below 15 years of age who were not cooperative during procedure, patients on anti coagulant therapy that may have bleeding

tendency pregnant patients and suspected vascular or peri vascular lesion on CT scan were excluded in the study.

Prior to computerized stereotactic biopsy all patients were clinically evaluated and available record such as CT scan, chest x-ray and all baseline investigations were reviewed. Head of the patient was shaved and base ring of BRW system was positioned and secured in to the outer table of the skull with small scalp incisions after infiltrating the required points with 2% lignocane. Patients were shifted to CT scanner. Localizing ring was attached to base ring before CT scanning. Region of interest was indicated to the CT technician and target was selected on CT console and pixel coordinates of nine localizer rods were derived and recorded. After removing the localizing unit patients were shifted to operation room.

Entry point was selected according to target location. Arc system was fixed to base ring and entry points marked and a probe fixed to the arc. The arc is detached and fitted to phantom base where x, y and z coordinates are derived from three scales (AP, Lateral, Vertical) and recorded.

The two dimensional coordinates (x, y) determined on the scanner console from nine localizer rods, the target values and their dimensional entry point coordinates were entered into EPSON Hx-20 micro computer and appropriate angle settings (alpha, beta, gamma and delta) and target setting were calculated. In the mean time coordinates for the setting of phantom targets were also calculated. Setting of arc and phantom rehearsal was done.

Entry point was infiltrated with 2% lignocane, incised, and small burr hole made with Hudson perforator. A minor cruciate incision made over the dura and a 14-gauge canula was advanced to the target site along the trajectory of the drill hole in rigid arc fixation. Stylet was removed, biopsy forecep advanced up to the stopping marker, opened and closed to obtain tissues at various orientations. Wound closed with one or two stitches and base ring removed and patients sent back to intensive care unit for monitoring. All the patients were followed for any complications.

The tissue was sent to the laboratory in 10 % formalin. The specimen was processed for paraffin embedding and slides were prepared. They were stained with H & E stain. Special stains were used if required. The histopathological diagnosis was recorded.

RESULTS

Fifteen patients were selected for stereotactic brain biopsy. Age ranged from 15 years to 54 years. Among them 09 (60%) were male and 06 (40%) female. In 14 patients (93.3%) there was smooth and uneventful recovery while one (6.7%) patient suffered mild neurological deficit. Fourteen of the tissue specimens removed and sent for histological examination were diagnostic (93.3%) while one report was inconclusive 1(6.7%). 14 patients (93.3%) had valid tissue diagnosis.

Biopsy proven lesions were astrocytoma in 04 patients (26.7%), ana- plastic astrocytoma in 04 (26.7%), gliomatosis in 02 (13.3%), tuberculomas in 03 (20.0%), metastatic adenocarcinomas in 01 (6.7%) and lymphoma in 01 (6.7%).

DISCUSSION

An accurate diagnosis of intracranial lesion is must for an appropriate treatment. Non-neoplastic lesions should be differentiated from neoplastic lesions with histological documented diagnosis for future management plan. MRI and CT scan images help in defining lesions of less than 4mm in diameter and computerized stereotactic biopsy is an accurate method to reach these lesions. Deep-seated brain lesions are also approached by this method, which is clearly having significant advantage over open craniotomy and brain biopsy. Winkler et al[6] studied 37 consecutive patients with an accurate diagnostic result in 36 cases (97%) with minimal intraoperative bleeding in 3 patients (8.1%) but none of our patients suffered such a complication. Past series in a large numbers in the western literature also showed computerized stereotactic biopsy as relatively safe procedure.[7]

Mortality and morbidity following stereotactic biopsy was reported to be in the range of 3.1% in 4000 reported cases. Another study conducted by Regis et al[8] in France on 3730 patients with pineal region tumors revealed mortality rate of 1.3% (5 patients of 3730) and 3 patients suffered neurological complications. it suggests that this procedure carries low mortality with a diagnostic yield of 94%, supporting our observations that is 93.3%. Avoidance of procedural complications like intra cerebral hemorrhage is largely dependent upon case selection, pre operative evaluation of patients and surgical expertise. Infections and convulsions following stereotactic biopsy are low.

A Chinese study carried out on 605 cases with deep intra cranial lesions that were biopsied streotacticaly yielded 96.69% positive rate, complications with biopsy occurred in 18 patients (2.9%) and 2 patients (0.33%) died following procedure.[9] These observations are higher than that of ours where no major complication or death occurred, reason may be their large study population. These results also indicate that stereaotaxy is a safe and reliable method of brain biopsy.

Chico-Ponce et al[10] studied 50 patients with tumors of brain stem in posterior cranial fossa and proved that streotacticaly guided biopsies provide an accurate and safe method of diagnosis in the lesions of brain stem.

Diagnostic yield in CT-directed stereotactic brain biopsy was stated to be more than 95% in a large series of 740 cases in a study by Apuzzo et al.[11] This study clearly resembles our study that shows 93.3% tissue diagnosis. In our series non-neoplastic lesions were in the range of 3 (20%) while neoplastic tumors like astrocytoma, glioma, anaplastic astrocytoma, lymphoma and metastatic tumors constituting remaining 12 (80%). Infected lesions, non-diagnostic procedure accounted 1 (6.7%). These lesions were repotted to be non-specific inflammatory response and necrosis was grouped in non neoplastic lesions.

Streotacticaly taken biopsy diagnosis was correlated with the tissue diagnosis after excision of the tumor, repeat biopsy or on autopsy reports.[12] In more than 90% of the patients and results were found to be validated in their large series. We in this part of the world don't perform routine post mortem examinations of patients dyeing in the hospitals for many different reasons. Our tools for the confirmation of previous biopsy result of the lesion was at times by repeat CT scans, repeat stereotactic biopsy, open surgery for large tumors, or through response to pharmacotherapy and radiotherapy. Our study revealed 93.3% diagnostic validity.

This technique being safe has also been advocated therapeutically for control of functional disorders like parkinsonisim in one of our country studies[13] in a smaller patient population.

Computerized stereotactic biopsy is performed under local anesthesia and thus a patient remains all the time awake. Results of brain lesion biopsy are excellent in terms of safety and tissue diagnostic yield, in the hands of experienced neurosurgeon and histopathologist who are trained in miniature specimen histopathalogy. This method provides a representative sample of the lesion but some times inconclusive reports are also obtained. These reports are also very significant because they exclude neoplasias. A constant liaison between neurosurgeon and surgical pathologist before and after stereotactic biopsy is highly demanding; so as to get optimum understanding of pathology and future management plans.

We conclude that stereotactic brain surgery is very accurate and safe procedure that gives an excellent diagnostic yield.

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