Stereotacic Biopsy of Brain Stem Lesions, A Report of 65 Cases

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ABSTRACT

Introduction: *In adults, brain stem lesions are varied in pathology and pre-operative radiological diagnosis, though improving with time, is still incorrect in at least 15 to 20% of cases [1, 2, 3, 8. 9]. Appropriate therapeutic measures to treat brain stem lesions require histological diagnosis.* ***Patients and Methods:*** *This is a prospective study to evaluate safety; diagnostic yield of brain stem biopsy using a frame-based computed tomography guided stereotactic procedures done between June 2004 and February 2007 . It included 66 stereotactic procedures in 65 cases diagnosed of brain stem lesions. Patients were categorized into adult and pediatric groups. All adult patients were biopsied while the patient is awake and physiologically monitored for any unwanted morbidity with subsequent change of the entry point.* ***Results:*** *Among the study group there were 41 male (63%) and 24 female (37%). There were 9 (13.9%) pediatric patients and 56 (86.1%) adults. All cases but one had only single stereotactic procedure. We had only one procedure related mortality. Procedure related morbidity included 4 cases of hemifacial numbness required repositioning of the electrode, 2 cases of facial palsy, one recovered after few days and the other one improved in a month after steroid administration and one case of diplopia related to 6th nerve palsy improved after one week with steroid administration. Regarding the diagnostic yield we had positive pathological results in all cases but one (98.5%).* ***Conclusion:*** *Brain stem stereotactic procedures are safe and reliable technique in both adults and children. Performing this technique in awake adult patient reduces the morbidity of this technique and adds to the safety of the procedure.*

INTRODUCTION

In adults, brain stem lesions are varied in pathology and pre-operative radiological diagnosis, though improving with time, is still incorrect in at least 15 to 20% of cases[1,2,3,8,9]. Appropriate therapeutic measures to treat brain stem lesions require histological diagnosis. With the exception of certain circumstances, where an exophytic component of the lesion is present, open biopsy is associated with a low diagnostic yield and such an undertaking is often marred by prohibitive mortality and /or morbidity[1,11]. The same is usually the fate of attempts at resecting these lesions. However, more recent literature reports better outcome with the use of operative microsurgical techniques in lesions where a distinct plane separates the pathological from the normal tissue[4,5,10,12]; or where a non-neoplastic lesion is present[6,7,11,12,13]. In general, the vast majority of brain stem lesions are not amenable to surgical resection, making stereotactic biopsy an attractive method of obtaining pathological tissue. Some authors claim that magnetic resonance imaging (MRI) is prone to replace the role of the biopsy in the diagnosis of children as brainstem gliomas present as diffuse non-enhancing masses[7,14]. On the other hand, several publications have shown that stereotactic biopsy performed by an experienced staff and guided by modern imaging equipment [computed tomography (CT), MR,

PET] can be as effective and safe as biopsies in any other brain location.

PATIENTS & METHODS

This is a prospective study to evaluate safety; diagnostic yield of brain stem biopsy using a frame-based computed tomography guided stereotactic procedures done between June 2004 and February 2007. It included 66 stereotactic procedures in 65 cases diagnosed of brain stem lesions. Theses cases were done in two different hospitals, Ain Shams University Specialized Hospital (Cairo, Egypt) and Nozha International hospital (Cairo, Egypt).

All patients had preoperative plain and post-contrasted computed tomography, MRI brain and only those where accurate diagnosis can not be made or those with tissue sample needed or aspiration of cystic lesions required aspiration are offered brain stem stereotactic biopsy.

Routine preoperative investigations are done to all patients. Informed consent was obtained from each patient. All cases were done using Leibinger ZD stereotactic frame (Howmedica Leibinger GmgH, Freigurg, Germany). The base ring was applied by negative mounting under local anaesthesia using Xylocaine 2%. In pediatric cases mild sedation was achieved with intravenous Dormicum.

Stereotactic CT scan was done and the target co-ordinates and entry points were calculated using stereoplan software.

Our protocol involved two entry points: a trans-frontal coronal para-saggital approach for lesions located in the midbrain with or without extension, and a suboccipital transcerebellar lateral route for lesions located at or below the Pons.

The skin was prepared with Povidone iodine solution, and with local infiltration with 2% Xylocaine to the skin a twisted drill hole was made to gain cranial access. The patient was kept awake throughout the procedure to allow for continuous monitoring to limit the procedure morbidity. The disposable biopsy probe (Nashold biopsy Needle, Radionics, Berlington, MA, USA) was introduced slowly monitoring any signs of cortical or brain stem dysfunction which necessitated change of the entry point or the trajectory. At least three biopsy specimens where taken for every solid lesion. For every cystic lesion on the other hand, trial of total aspiration of cysts followed by wall biopsy. All patients had postoperative CT scan and were discharged on the second day unless complicated.

RESULTS

Between June 2004 and February 2007, 66 procedures were done to 65 patients with brain stem pathologies. Among the study group there were 41 male (63%) and 24 female (37%). There were 9 (13.9%) pediatric patients and 56 (86.1%) adults.

All cases were done using Leibinger ZD stereotactic frame which have the advantage of negative mounting (head ring placed upside down with pins below the ring, in this case the Z coordinates become negative). This provides enough space for image acquisition and comfortable patient positioning during surgery.

All cases but one had only single stereotactic procedure (the only case needed another procedure was a case of pilocytic cystic astrocytoma that needed re-aspiration after three months following definite treatment by Gamma Knife Radiosurgery).

We had only one procedure related mortality. This was 72 years old male patient who had a Ponto-Medullary abscess secondary to systemic Typhoid

infection. Following aspiration of 3.5 ml of pus, we had a bloody aspirate. The patient had a hematoma on postoperative CT scan. He died on the third postoperative day.

Procedure related morbidity included 4 cases of hemifacial numbness required repositioning of the electrode, 2 cases of facial palsy, one recovered after few days and the other one improved in a month after steroid administration and one case of diplopia related to 6th nerve palsy improved after one week with steroid administration.

Regarding the diagnostic yield we had positive pathological results in all cases but one (98.5%). That case was a case of multifocal lesions in the brain stem where pathology revealed normal tissue. The other pathologies included: 16 inflammatory cases (5 tuberclomata, and 7 intra-axial abscesses, 4 encphalitis), 19 cases of pilocytic astrocytomas, 18 cases of GII astrocytomas, 5 cases of high grade astrocytomas, 2 cases of multiple sclerosis, 2 cases of lymphomas, and 4 cases of metastatic lesions. Summary of the results for pediatric group will be listed in *table 1*.

Table 1 Summary of the results of pediatric group

Case no.	***Age & sex***	***Location***	***Pathology***	***Approach and complications***
1	7 male	Midbrain	Fibrillary astrocytoma	transfrontal
2	6 female	Midbrain and upper pons	Abscess	transfrontal
3	8 female	Midbrain cystic lesion	Piloctic astrocytoma	transfrontal
4	4 female	Pontine cystic lesion	Pilocytic astrocytoma	Suboccipital transcerebellar
5	10 female	Midbrain lesion	encaphalitis	transfrontal
6	7 male	Potine lesion	Fibrillary astrocytoma	Suboccipital transcerebellar
7	8 male	Midbrain and pons	abscess	transfrontal
8	11 male	Potine lesion	High grade astroctoma	Suboccipital transcerebellar
9	11 male	Poto-medullary lesion	Cystic astroctoma	Suboccipital transcerebellar

Complicated adult cases will be listed in *table 2*.

Age and Sex	**Location**	**Pathology**	**Approach and complications**
Male 72	Ponto-medullary	Abscess	Suboccipital transcerebellar. Hematoma ending in death
Male 55	Pontine lesion	Tubercloma	Contra-lateral facial numbness improved after repositioning of the electrode
Female 44	Pontine lesion	Cystic astrocytma	Diplopia related to 6th nerve palsy improved on steroid treatment
Male 48	Midbrain lesion	High grade astrocytoma	Contra-lateral facial palsy improved on medical treatment for few days
Female 65	Midbrain lesion	Encephalitis	Contra-lateral facial pain improved after repositioning of the electrode.
Male 57	Midbrain extending to the pons	Metastasis	Contra-lateral facial numbness improved after repositioning of the electrode.
Male 68	Midbrain extending to the pons	High grade astrocytoma	Contra-lateral facial palsy improved in a month after steroid administration and physical therapy
Female 33	Midbrain cystic lesion	Pilocytic astrocytoma	Contra-lateral facial pain improved on repositioning of the electrode

Few illustrated cases are shown in figures 1-5

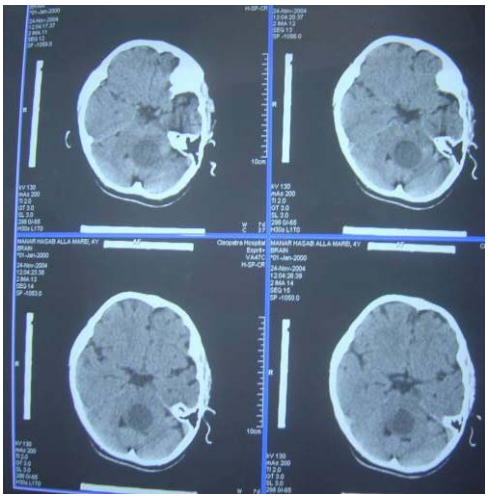

Figure 1: CT scan of the youngest patient of the group which was diagnosed as pilocytic astrocytoma

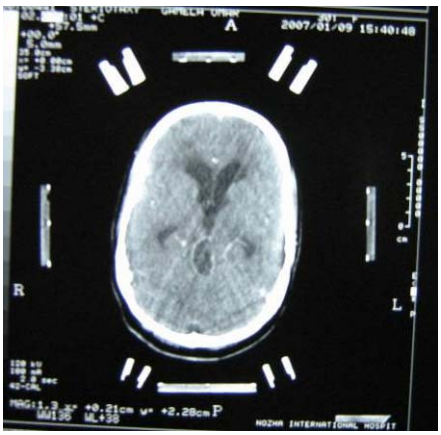

Figure 2: Pre-Aspiration CT scan of a 30 year old female patient

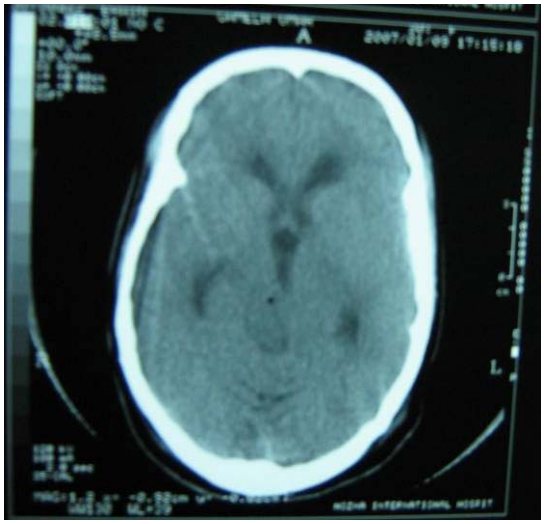

Figure 3: Post-Aspiration scan of the same patient.

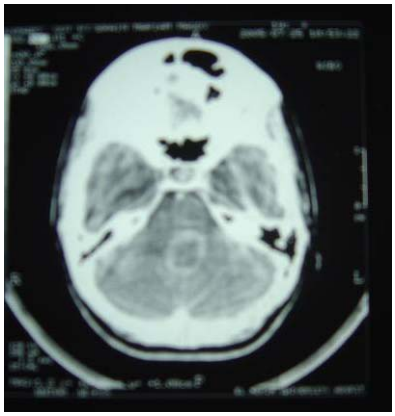

Figure 4: Pre-operative CT of adult patient proved to be an abscess.

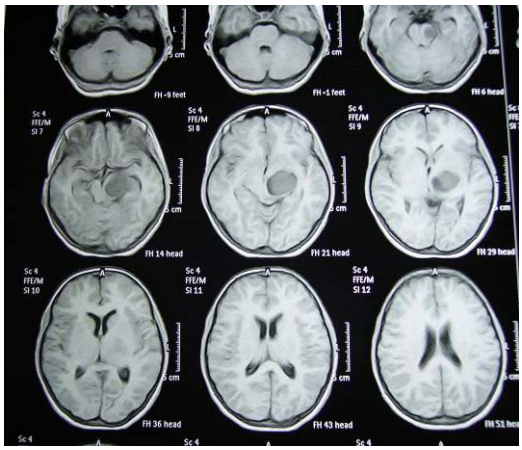

Figure 5: Pre-operative MRI of a case pathologically proved to be fibrillary Astrocytoma.

DISCUSSION

Between June 2004 and February 2007, 66 procedures in 65 patients with intrinsic brain stem lesions. The patient population was divided according to age into adult and pediatric patients. Biopsy was restricted in pediatric patients to those radiological diagnosis was insufficient.

Despite the increased sensitivity of modern neuro-imaging techniques, a considerable number (10–20%) of brain stem masses are misdiagnosed using radiology alone[1,2,3,8,9]. Exact tissue diagnosis can change management and prognosis of these cases.

All cases were done using Leibinger ZD stereotactic frame which have the advantage of negative mounting (head ring placed upside down with pins below the ring, in this case the Z coordinates become negative). This provides enough space for image acquisition and comfortable patient positioning during surgery.

In pediatric cases we performed stereotactic procedures in only two instances. The first was to do brain stem decompression in cases of large cystic lesions as cystic astrocytomas and abscesses. The second instance was when a sure diagnosis was impossible with radiology alone.

The morbidity following open biopsy or resection of intrinsic brain stem lesions had led to reluctance advocating any operative procedure. However, in our series and in other series that performed stereotactic biopsy in adult awake patient has proved to be safe, reliable and accurate. This technique is not new,

but all older series have been performed on small number of cases. Our series which included 56 procedures as compared to 13 procedures in the other series adds weight to the growing evidence that safety of the procedure can be increased and morbidity can be reduced by doing the technique in awake patients. It also showed that this technique can be reproducible with the same success.

Conclusion

Brain stem stereotactic procedures are safe and reliable technique in both adults and children. Performing this technique in awake adult patient reduces the morbidity of this technique and adds to the safety of the procedure.

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