Evaluation of stereotaxy in the management of brain abscess

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Background
Stereotaxic surgery began in 1908, when Sir Victor Horsley and Robert Clarke introduced their apparatus. Brain abscess (BA) is a life-threatening condition and has different modalities of treatment. One of these modalities is stereotactic aspiration.

Aim
The aim of the study was to evaluate and demonstrate the outcome of stereotactic-guided aspiration of BA.

Patients and methods
This is a prospective, descriptive study that included 20 patients with different intracranial abscesses aspirated by stereotaxy. Inclusion criteria: deep-seated abscesses that are located near or within eloquent structures. Multiple BAs differ in size with the largest one with mass effect. Compromised patients with poor general condition are considered to be poor candidates for open surgery. Exclusion criteria: all patients who will need surgical excision due to any cause such as posterior fossa abscess, large superficial BA close to the cortical surface. The authors did computerized tomography scan with contrast for all patients preoperatively, within the first 72 h postoperatively and after 6 months.

Results
The authors aspirated BAs from 20 patients of whom 14 were men. Most of these patients had single abscess (*n*=17). The most common presenting symptom is headache which is found in 16 patients. The most common sites for abscesses were brain stem and basal ganglia in half of the patients. The only complication found postoperatively was hemorrhage in only two patients. Only two (about 10%) cases showed residual abscess in 6 months follow-up.

Conclusion
The authors found that stereotaxy is very helpful in the cases with localization of the abscess, reducing morbidity and mortality of the cases, leading to save the resources.

Keywords:
abscess aspiration, brain abscesses, stereotaxy

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Introduction

Brain abscess (BA) is a universal health problem with a high morbidity and mortality rate; thus, the disease today presents a leading public health problem and a major burden on health-care facilities all around the world [1,2].

BA is a dynamic focal form of intracranial suppuration and a serious life-threatening emergency [3]. They begin as a localized area of cerebritis and develop into an encapsulated collection of pustular materials presenting as a mass-like lesion, similar to the abscess in other sites [4].

Treatment of BA may be through antibiotics only, stereotactic aspiration plus antibiotic therapy or open surgical excision plus antibiotics. Indications of stereotactic aspiration are deep-seated abscesses that located are near or within eloquent structures and multiple BAs which differ in size with the largest one with mass effect. Compromised patients with poor general condition are considered to be poor candidates for open surgery.

Aim

The aim of the study was to evaluate and demonstrate the outcome of stereotactic-guided aspiration of BA.

Patients and methods

This is a prospective, descriptive study that was done at the Neurosurgery Department at Assiut University Hospital, Egypt, to all patients presented to us during the period from January 2017 to

December 2018 and fulfilled the inclusion criteria included in this study.

Selection criteria

Inclusion criteria

Patients having BA with the following criteria:

(1) Deep-seated abscesses that are located near or within eloquent structures.
(2) Multiple BAs that differ in size with the largest one with mass effect.
(3) Compromised patients with poor general condition considered to be poor candidates for open surgery.

Exclusion criteria

(1) All patients who will need surgical excision due to any cause such as posterior fossa abscess.
(2) Large superficial BA close to the cortical surface.

Preoperative preparation

All patients underwent general and neurological assessment including a thorough history including start of complaint, associated comorbidities such as discharging ear in otitis media, chest infection, congenital heart disease or immunocompression and history of previous trauma or neurosurgical procedure. Physical examination to search for the cause of BA such as external ear examination to see if there is discharge or inflammation, chest examination to find any signs of chest infection, cardiac examination and examination of the site of previous surgery or trauma if present, neurological examination including Glasgow coma scale, cranial nerve examination including pupils reaction to light to see if there is compression and mass effect and motor examination to asses motor power.

Laboratory workup and imaging which was done preoperatively included a computerized tomography (CT) scan of the head with precontrast and postcontrast study and MRI brain pregadolinium and postgadolinium enhancement.

Empirical antibiotic therapy was given to all patients immediately after aspiration of abscess including vancomycin and metronidazole till the results of culture and sensitivity are obtained.

Operative management

Surgical technique

All patients were treated with stereotactic aspiration using a CRW [Radionics Cosman - Roberts - wells (CRW) integra company USA] stereotactic system and CT scanning using GE (GE bright speed elite 16 scanner Milwaukee USA) Bright Speed unit.

All patients were operated under general anesthesia in the operation room:

(1) First the patient is transferred to the operation theater, where we apply a stereotactic frame under local anesthesia with good sterilization before applying it.
(2) Then the patient is transferred to the CT unit where data acquisition was done. CT scanning was done using the thinnest possible CT scan slice for maximum accuracy. All of the nine carbon rods of the localizing ring must appear as nine points around the head in the axial CT scan. Then the collected data was processed using the programmed computer (Epson HX-20 computer) to get our target in the three planes (anteroposteior, lateral, and horizontal).
(3) After that, the patients were transferred to the operation theater where general anesthesia was applied.
(4) Then burr hole tapping of abscess was done after complete sterilization. The burr hole should be at the same side of the abscess and with definite landmark (2 cm posterior to coronal sutures and 2 cm lateral to sagittal suture).
(5) Aspiration must be slowly and gently to avoid sudden decompression with pressure gradient effect and to avoid hemorrhage. Washing with saline should be done for large abscesses.
(6) Sample was taken for culture and for sensitivity test of pus. Then wound closure requires multiple layers.

All patients continued to receive empirical antibiotic therapy until we got culture and sensitivity results and if positive the antibiotics were changed accordingly for 4–6 weeks postoperatively (Fig. 1).

Postoperative assessment

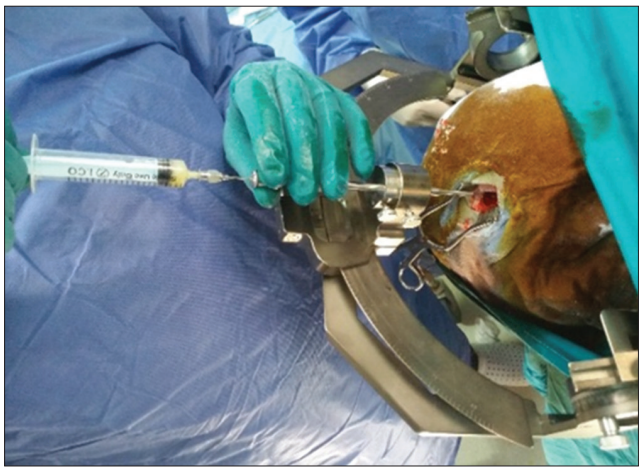
All patients were assessed clinically and radiologically in early postoperative period during hospital stay to detect any complications. Patients were transferred to intermediate care unit for the first 24 h postoperatively. Immediate postoperative CT scan was done to all patients within the first 72 h postoperatively.

CT scanning with contrast was done after 6 months for all patients.

Ethical consideration

The study was approved and monitored by the Medical Ethics Committee, Assiut Faculty of Medicine, IRB#17100924.

Figure 1



Pus drainage from the brain abscess by stereotaxy at Assiut University Hospital (Neurosurgery Department).

The investigators explained the steps and value of the research to all eligible participants who agreed to be included in the study and obtained signed fully informed consent.

Statistical analysis

All data were analyzed using SPSS software (version 21; SPSS Inc., Chicago, Illinois, USA).

Results

This study included 20 patients, who had BA, 14 (70%) patients were men and six (30%) patients were women (Table 1).

Clinical presentation

The presenting symptoms were headache in 16 (80%) patients, which was typical of increased intracranial pressure; six (30%) patients presented with vomiting; six (30%) patients presented with epileptic seizures; and 10 (50%) patients presented with weakness in the form of hemiparesis; and two patients presented with fever.

After examination of the patients it was observed that weakness was present in eight (40%) patients, papilledema in four (20%) cases, and 14 (70%) patients had disturbed conscious level.

The patients in this study had different lesion sites as shown in Table 2.

Glasgow coma score at presentation

Glasgow coma score (GCS) was assessed in all patients included in our study. We found that two patients presented with a GCS of less than 8, five patients presented with a GCS of between 8 and 12, and 13 patients with a GCS of more than 12.

Table 1 Number of brain abscesses found in our studied patients

Number of abscesses	*n* (%)
Solitary	17 (85)
Multiple	3 (15)

Table 2 Sites of brain abscesses included in this study

Sites	*n* (%)
Brain stem	5 (25)
Basal ganglia	5 (25)
Parietal	3 (15)
Frontal	2 (10)
Frontoparietal	2 (10)
Temporal	1 (5)
Occipital	1 (5)
Frontotemporoparietal	1 (5)

Postoperative complications

Successful aspiration was done to all patients. The only postoperative complication was hemorrhage in the abscess cavity. It occurred in only two (10%) cases and 18 patients had no postoperative complications.

Conscious level on discharge

Significant improvement in the conscious level of the patients occurred postoperatively. A total of 17 (85%) patients discharged were fully conscious within 7 days after aspiration and the remaining three patients discharged were fully conscious after 2 weeks.

Postoperative imaging

Postoperative imaging (CT brain with contrast) was done to all patients after 6 months and showed complete absence of any residual abscess in 18 (90%) patients, and only two patients had residual abscess which was less than 1 cm which is not large enough to be reaspirated (Figs. 2–4).

Discussion

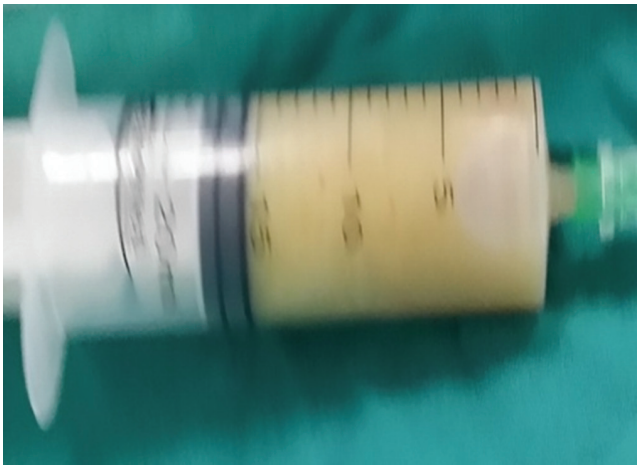
In the present study out of 20 patients with BA, 14 (70%) patients were men and six (30%) were women.

In 2008, Menon found that BA was two or three times more frequent in men than women[3]. Muzumdar in his 2011 study found that the male-to-female ratio varied from 1.3: 1 to 3: 1 [5]. In the Korfias study in 2003 brain abscess was aspirated for 12 patients of which seven patients were men and five patients were women). All of these previous studies agreed with our study results.

Figure 2

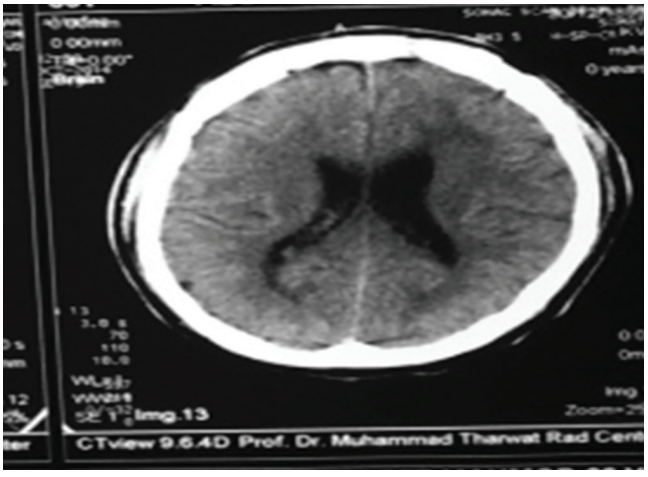
Preoperative computed tomography scan axial cut showing left frontal brain abscess in the studied patient.

Figure 3



Syringe containing pus from stereotactic aspiration of the abscess.

Figure 4



Postoperative follow-up computed tomography brain scan axial cut after 6 months from tapping of the studied patient.

Clinical presentation

As regards clinical presentation of our cases of BA which varies from one patient to the other, Muzumdar found that the most common clinical presentations were headache, changes in level of consciousness, nausea and/or vomiting, and high-grade fever. Seizures occurred in 25–34% of patients. In our study, headache was the most common presentation which was found in 16 (80%) patients, vomiting was found in six (30%) patients, and weakness as a complaint was in 10 patients but on examination only eight of them actually had weakness. Six patients presented with fits and fever was only in two patients [5].

Number of abscesses

In our study of 20 patients who had BA that was aspirated via stereotaxy, 3 out of 20 cases had multiple abscesses, and 17 had single abscess with a percentage of 15 vs 85%, respectively. This means that the majority of cases of BA were present with solitary abscess and that is in line with Hasdemir and Ebeling (1993) who aspirated BA from 24 patients via stereotaxy and only two cases had multiple abscesses with a percentage of 8%; this is approximately the same with our study[6].

Site of brain abscess

Site of BA is an important factor to determine the presenting symptom of the patients, so in our study we focused on the site of the abscess and we have found that half of our 20 patients had abscess in the brain stem and basal ganglia region and the others presented in the cerebral cortex (10% frontal, 15% parietal, 5% temporal, 5% occipital, 10% combined frontal and parietal, and 5% combined frontal and parietal and temporal).

In comparison, Efstathios (2003) in his study of 12 patients with BA who were treated by stereotactic aspiration, six (50%) patients had BA in the brain stem and basal ganglia which is the same percentage in our study and five patients had it in the cerebral cortex and one in the deep white matter [7].

In Murat Kutlay[8] study, 21 patients were treated with stereotactic aspiration, seven cases had cortical abscesses, nine cases were with deep cortical and five were within the thalamus or caudate nucleus.

Postoperative complications

In our study, only two patients had postoperative complications in the form of hemorrhage in the abscess cavity.

Regarding the Kutlay study in 2005, it included aspiration of BA es in 13 patients and no complications occurred after aspiration. Hegdi in his study found that 3 out of 22 patients had hemorrhage in the abscess cavity postoperatively [9].

In the Kouyialis study (2003) repeated CT scans in all patients exhibited gradual decreases in abscess size, reaching total disappearance of edema and abscess cavities [7].

Follow-up of patients after 6 months

In 2008, Kocherrye studied 22 patients with BA es which were operated with stereotactic aspiration. In CT follow-up after 6 months, five patients showed remarkable recurrence which need further aspiration. Only three patients underwent repeated aspiration with stereotaxy [9].

According to Efstathios the postoperative follow-up was between 3 months and 3.5 years. All patients had normal courses and returned to their previous activities, which means that no recurrence in follow-up of his patients [7].

In this study, we did CT brain after 6 months on 20 patients and only two of them had residual abscess which were small in size and were treated medically without requiring respiration.

Conscious level at admission and on discharge

Conscious level of the patients is a very important factor in the assessment of effectiveness of any modality of treatment. So, in our study we recorded the GCS of patients on admission and on discharge. We divided the GCS of our patients into three subgroups. The first group had a low GCS of less than 8, the second group had a GCS of between 8 and 12, and the third group had a score from 13 to 15.

We found that at admission, 13 (65%) patients out of 20 patients were within the third group, five (25%) patients within the second group, and only two (10%) patients within the first group.

On discharge, the recording of GCS score showed that 18 (90%) patients had GCS 15 and only two (10%) patients had GCS 14.

Kutlay (2005) found that out of his 13 studied patients only one patient discharged with GCS 14 and most of his patients (12) who treated with stereotactic aspiration discharged fully conscious with GCS 15 and this in agreement with our results [8].

Conclusion

Stereotactic surgery is a safe and effective method for the treatment of BA. Stereotactic aspiration is the modality of choice in abscesses in deep and/or eloquent structures, immunocompromised patients with BA, and in multiple BAs.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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