

COMPARATIVE STUDY OF OUTCOME OF BRAIN ABSCESS TREATED BY ASPIRATION VERSUS EXCISION WITH CAPSULE

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Abstract

Background: There are two common surgical options i.e. Burr hole aspiration and Excision with capsule with craniotomy in the treatment of brain abscess. The purpose of the study is to compare the two surgical methods (Burr hole and craniotomy) used as treatment for cerebral abscess and its outcome in terms of radiological clearance on brain CT, improvement of neurological status, the need for repeated surgery, and mortality and morbidity at six months after surgery. **Materials and methods:** The study was conducted in the Neurosurgery ward of Chittagong Medical College Hospital in a period (July 2012 to June 2014) of 24 months period. A total of 34 patients were taken as study subjects where two groups were made. Group A (n=20) patients were treated by burr hole aspiration under general anesthesia and Group B (n=14) patients were treated by craniotomy and excision with capsule under general anesthesia. Perioperative and postoperative outcome was evaluated and compared. The clinical success of the both procedures, length of hospital stay, surgery

related complications and neurological outcome were analyzed. **Results:** Among the 34 patients in both groups postoperative clinical data showed in group B there are more incidence of headache, vomiting, neurological deficit and seizure in three postoperative days than Group A patients. Few cases of fever was found in both groups. Two cases of wound infection was found in Group B at 7 postoperative days. Post operative GCS where Glasgow Coma Scale (GCS) was found to be gradually improving in Group A patients whereas in Group B 2 cases had GCS within 8-12 after 7 postoperative days. Regarding outcome during discharge improved GCS(>12) were found all in group A patients but it was less in Group B patients. Vomiting also found nil in Group A patients whereas in group B it was present in 2 cases during discharge. Seizure and neurological deficit was found nil in Group A patients but 4 cases in Group B had seizure and neurological deficit. There was one case in Group B who had wound infection. Evaluation of post operative hospital stay among the 34 patients in both groups were statistically significant less time was needed in Group A patients than Group B ($p < 0.05$). **Conclusion:** In our study we found regarding surgical management of brain abscess, burr hole aspiration was found better than craniotomy with excision with capsule.

Keywords

Burr hole; Craniotomy; Cerebral abscess.

Introduction

Brain abscesses occur commonly in developing countries, with an incidence of up to 8%. In the developed world, its incidence is of up to 2% of all space occupying lesions¹. Two common surgical methods are used to manage brain abscesses, burr hole aspiration and open craniotomy

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excision with capsule. Aspiration is the surgical procedure of choice over open craniotomy and excision because it is less invasive, thus reducing the likelihood of neurological sequelae². Despite the advent of modern neurosurgical techniques, including stereotactic brain biopsy and aspiration, better culturing techniques to identify the infectious agent, new antibiotics, and modern non-invasive neuroimaging procedures, brain abscess still poses a public health challenge, especially in developing countries³.

A brain abscess can form when fungi or bacteria reach the brain through a wound to the head or infection elsewhere in the body⁴. According to the Children's Hospital of Wisconsin, infections from other parts of the body account for between 20 and 50 percent of all brain abscess cases. Both heart and lung infections are among the most common causes of brain abscesses, but brain infections can also begin as an ear infection or even an abscessed tooth⁵.

Nearly anyone can get a brain abscess, but there are certain groups of people are at higher risk than most. Some diseases, disorders, and conditions that raise the risk include, a compromised immune system due to Human Immunodeficiency Virus (HIV) or Acquired Immunodeficiency Syndrome (AIDS) cancer and other chronic illnesses, congenital heart disease, meningitis, immunosuppressant drugs, such as those used in chemotherapy, chronic sinus or middle ear infections, certain birth defects, such as tetralogy of Fallot allow infections to reach the brain from the teeth and intestines also^{6,7}.

Many of these symptoms closely resemble a number of other illnesses and health problems. Methods of diagnosing a brain abscess include a head CT (Computed Tomography) scan with contrast or Magnetic Resonance Imaging (MRI) with contrast^{8,9}.

Surgery is often the inevitable step. Surgery for the removal of an abscess most commonly involves aspiration by burr hole or craniotomy and excision with capsule¹⁰. Both the technique are widely used in present time but there are scarcity of studies to compare the outcome of both techniques in our setting. So it is an opportunity to conduct a study in this context.

Materials and methods

It was a cross sectional comparative study, done in the Department of Neurosurgery of Chittagong Medical College Hospital, Chittagong during periods of two years from July 2012 to June 2014. Patients of brain abscess undergone surgery was selected by purposive sampling. Due to time and patient factors, 34 subjects were taken for the study.

Inclusion criterias

- i) All ages of patients of brain abscess
- ii) Cerebral and cerebellar abscess
- iii) All patients of brain abscess admitted in Neurosurgery ward of CMCH undergone surgery
- iv) Some patients from private hospitals with brain abscess undergone surgery.

Exclusion criterias

- i) Multiple small abscess
- ii) Deep seated abscess (Pons)
- iii) Unwilling to be include in the study
- iv) Poor physical condition and unfit for the surgery.

A hypothesis was built after extensive literature review on surgical treatment of brain abscess by surgical excision by craniotomy versus burr hole and aspiration. Then a protocol of a cross sectional comparative study is designed. Inclusion and exclusion criteria are set up and sample size is calculated accordingly. Patients of brain abscess were included in this study after fulfilment of selection criteria. The 34 samples were included by purposive sampling technique. All samples were evaluated clinically by detail history and physical examination. Patients were explained about the procedure and a written consent was taken to be included in the study. Surgery was done by the competent surgeons of the Department of Neurosurgery. Type of surgery were selected after consulting with neurosurgeon and no intervention were done by the researcher. Group A patients (n=20) were those in whom burr hole aspiration was done and Group B (n=14) patients were those who undergone surgical excision with capsule. Postoperative period of each patient group was monitored closely to record the outcome of the surgery and followed up for next six month. Then the data were entered into computer statistical

analysis of the results being obtained by using windows based computer software devised with Statistical Packages for Social Sciences-15 (SPSS Inc, Chicago, IL, USA). Statistical significance was set at $p < 0.05$ and confidence interval set at 95% level.

Results

Present study was a cross sectional comparative study conducted in the Department of Neurosurgery, Chittagong Medical College Hospital from July 2012 to June 2014.

Table I : Postoperative clinical data

Events	Day -1		Day- 3		Day-5		Day -7	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Headache	7	8	5	7	4	6	2	5
Fever	0	1	1	1	0	1	0	1
Neurological deficit	3	6	2	6	1	5	1	4
Vomiting	6	7	5	6	3	5	0	3
Seizure	3	5	2	5	1	4	1	4
Wound infection	0	0	0	0	0	0	0	2

Group A: Burr hole aspiration

Group B: Excision with capsule by craniotomy

Table II : Outcome of the patients at discharge

Events	Group A (n=20)		Group B (n=14)		p value
	n	%	n	%	
GCS >12	20	100%	12	85%	0.023
Fever	0	0%	0	0%	
Vomiting	0	0%	2	14%	
Seizure	0	0%	4	28%	
Neurological deficit	0	0%	4	28%	
Wound infection	0	0%	1	7%	

Group A: Burr hole aspiration

Group B: Excision with capsule by craniotomy

Table III : Postoperative hospital stay

	Group		p value
	Group A	Group B	
Hospital stay in days (Mean \pm SD)	7 \pm 1.9	11 \pm 4.4	0.013

Group A: Burr hole aspiration

Group B: Excision with capsule by craniotomy

Table IV : Followup of the patient at 1st month

Complications	Group A(n=19)		Group B(n=13)		p value
	n	%	n	%	
GCS15/15	19	100%	13	100%	
Nausea/Vomiting	2	5.2%	4	30.7%	0.45
Wound infection	0	0%	2	15.5%	
Recurrence	5	26%	1	7.6%	0.04
Headache	3	15.7%	6	46.1%	0.03
Fever	3	15.7%	2	15.3%	0.12
Neurological deficit	1	5.2%	4	30.7%	0.65
Seizure	1	5.2%	4	30.7%	0.65

*1 patient died in group A and another 1 died in Group B, Group A: Burr hole aspiration, Group B: Excision with capsule by craniotomy

Table V : Followup of the patients at 6th month

Complications	Group A(n=19)		Group B(n=13)	
	n	%	n	%
GCS >12	19	100%	13	100%
Nausea/Vomiting	0	0%	1	7.6%
Wound infection	0	0%	0	0%
Recurrence	0	0%	0	0%
Headache	0	0%	2	15.2%
Fever	0	0%	0	0%
Neurological deficit	0	0%	4	30.7%
Seizure	0	0%	4	30.7%

Group A: Burr hole aspiration

Group B: Excision with capsule by craniotomy

Table VI : Post operative Glasgow Outcome Scale (GOS)

Follow up	Group	Good recovery (5)	Moderate disability (2)	Severe disability (0)	Persistent vegetative form	Death (1)
1 st month	A	19	0	0	0	1
	B	12	2	0	0	1
3 rd month	A	19	0	0	0	0
	B	12	0	0	0	0
6 th month	A	19	0	0	0	0
	B	12	0	0	0	0

Group A: Burr hole aspiration

Group B: Excision with capsule by craniotomy

Table I showing postoperative clinical data where in group B there are more incidence of headache, vomiting, neurological deficit and seizure in three postoperative days than Group A patients. Less cases of fever was found in both groups. There was two cases of wound infection was found in Group B at 7 postoperative days.

Table II showing outcome during discharge improved GCS (>12) were found all in group A patients but it was less in Group B patients. Vomiting also found nil in Group A patients whereas in group B it was present in 2 cases during discharge. Seizure and neurological deficit was found nil in Group A patients but 4 cases in Group B had seizure and neurological deficit. There was one case in Group B who had wound infection.

Table III showing evaluation of post operative hospital stay among the 34 patients in both groups were statistically significant less time was needed in Group A patients than Group B ($p < 0.05$).

There was more recurrence that is 5 in Group A who undergone reaspiration again and 1 in Group B who was undergone reexploration. Neurological deficit, seizure, headache and vomiting was found more in Group B than Group A.

Table VI showing post operative clinical data where GOS evaluated in both groups at different followup was noted.

Discussion

The present study was conducted in the Department of Neurosurgery and other Private Hospitals among 34 cases of brain abscess. Prognosis of brain abscess depends on the anatomic location of abscesses, stage of abscess

formation, age of the patient, and neurological status (GCS) of the patient. The prognosis is worse for patients with intraventricular rupture, associated meningitis, ependymitis or empyema, an unknown primary source, sterile pus or culture, large abscess, presence of hydrocephalus, metastatic abscess, neonates and infants, multiple deep-seated abscesses, inaccurate diagnosis, and/or congenital cyanotic heart disease¹¹⁻¹³. In the present study multiple small abscess and brain stem abscess were excluded from the study.

Regarding postoperative clinical data in Group B there are more incidence of headache, vomiting, neurological deficit and seizure in four post operative followup than Group A patients. More cases of fever was found in Group B. Two cases of wound infection was found in Group B at 7 postoperative days. In day 1 headache was present 7 in Group A and 8 in Group B. Fever was nil in Group A and fever 1 in Group B, neurological deficit was 3 in Group A and 6 in Group B, vomiting was found 6 in Group A and Group B 7, seizure was found 3 in Group A and Group B 5, wound infection was absent.

Among the 34 patients in both groups postoperative mortality (At 1st month In Group A n-1(5%) and in Group B n-1(7%), At 3rd month Group A n-0, Group B, n-0, at 6th month Group A n-0, Group B, n=0) were similar in burr hole aspiration and the excision with capsule. It was statistically insignificant ($p > 0.05$). Aspiration alone can be sufficient for good outcome at any stage of the abscess formation^{13,14}. A large abscess can be aspirated via a burr hole and completely decompressed, with an immediate reduction of mass effect and intracranial pressure. The limitation for aspiration is a multiloculated abscess, and recurrent abscess formation after surgery is significantly higher than in patients with uniloculated abscess.

At 1st month postoperative followup >12 GCS was found 100% in Group A, Group B it was 100%, vomiting was found 5.2% in Group A and 30.7% in Group B ($p = 0.45$) wound infection was found nil in Group A, 15.5% in Group B, recurrence was found 26% in group A, Group B 7.6% ($p = 0.04$) headache was found 15.7% and in Group B 46.1% ($p = 0.03$) fever was found 15.7% in Group A and 15.3% in group B ($p = 0.12$) neurological deficit was found 5.2% in Group A, 30.7% in group B, seizure was 5.2% in Group A and in Group B 30.7% ($p = 0.65$).

At 3rd month postoperative followup 15/15 GCS was found 100% in Group A, Group B it was 100%, vomiting was found 0% in Group A and 7.6% in Group B, wound infection was found nil in Group A, nil in Group B, recurrence was found 5.2% in group A, Group B 7.6%, headache was found 5.2% and in Group B 30.7% (p-0.13) fever was found 0% in Group A and 0% in Group B, neurological deficit was found nil in Group A, 30.7% in group B, seizure was 5.2% in Group A and in Group B 30.7% (p-0.65).

According to Wilkings aspiration alone is the best treatment option for brain abscess¹⁵. Analysis of different postoperative data discussed above also proved this.

Regarding hospital stay Group A it was 7 ± 1.9 days and Group B it was 11 ± 4.4 days. Distribution was found statistically significant (p-0.013).

Regarding GOS analysis revealed one patient in Group A (5.0%) and one patient in group B (7.2%) died. There was one death in each group (5% vs 7.1%) at postoperatively within one month. Overall mortality was 24% in the study done by Kao et². But in the present study it was only 1 in number in each group. It signified better surgical and hospital care in our setting. According to Grossman et al¹⁶. Aspiration of the brain abscess has low surgery related mortality and morbidity rate. This findings are consistent with the present study. In a study done by Su et al where 11 patients of brain abscess were treated with aspiration (5 cases) and excision (6 cases). They found aspiration was better in terms of outcome¹⁷.

Brain abscesses that have proved resistant to multiple aspirations and have not showed volume reduction, have adhesions to the dura, or a large brain surface area, should be excised to achieve a cure. Complete excision of the abscess and the surrounding capsule appears to be required only in patients with multi-loculated abscesses (For whom closed-needle aspiration procedures have failed) or in cases due to more resistant pathogens¹⁸. Abscesses containing gas are resistant to antibiotics and are better treated with excision⁶. Post-traumatic abscesses containing foreign bodies or contaminated retained bone fragments require excision to prevent recurrence¹⁹. Abscesses resulting from fistulous communication,

such as trauma or congenital dermal sinus, require excision of the infected granulation tissue and closure of the fistula. Abscesses localized to one lobe and contiguous to the primary source are better treated with excision along with the primary focus. The abscess may be excised during the late capsular stage or after aspiration. However, excision is inappropriate for abscesses in the cerebritis stage, for brain stem abscesses in eloquent areas, and for cases of multiple small abscesses.

In this study the postoperative complications, hospital stay, and mortality neurological deficit, seizure, headache and vomiting were found less except recurrence in the Group A that is who were done burr hole and aspiration than the Group B that is craniotomy with excision with capsule. So we can say that burr hole with aspiration might be the better option for the management of brain abscess.

Conclusion

In this study difference was found between burr hole aspiration and by excision with capsule by craniotomy. Postoperative complication, hospital stay, headache, vomiting, neurological deficit, seizure, mortality and cost were found less in burr hole and aspiration group. So we can conclude that burr hole with aspiration is a better option in the surgical treatment of brain abscess than craniotomy and excision.

Disclosure

All authors declare no competing interest.

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