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Original Article

Comparison of Surgical Outcomes between Endoscope-assisted Evacuation and Conventional Burr Hole Aspiration of Brain Abscess at a Tertiary Care Hospital

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Abstract:

Background: *Brain abscess is a major health problem with a reasonable morbidity and mortality rate.*

Objective: *The objective of this study was to compare the efficacy between endoscope-assisted evacuations of brain abscess with burr hole aspiration method in a tertiary health care center.*

Methodology: *This non-randomized clinical trial was conducted in the Department of Neurosurgery at Dhaka Medical College Hospital, Dhaka, Bangladesh during the period of July 2016 to December 2017. Patients with the age group of more than or equal to 18 years of both gender presented with brain abscess were enrolled in this study. The endoscope-assisted evacuation of abscess was done on group A patients and burr hole aspiration was done on group B patients. Outcome of the patients was assessed using GCS and MRC muscle power grading and by GOS. Patients were evaluated by contrast enhanced*

CT scan of head at pre-operative, 1st and 30th postoperative day. Both groups received best available medical treatment along with surgery.

Results: *The mean age of was 13.0 ± 6.3 years in burr hole group and is 13.1 ± 6.4 years in endoscope-assisted group. The patients presented with GCS was 66.7% in burr hole group and 93.3% in endoscope assisted group. The study showed e"75.0% evacuation of brain abscess at 1st post-operative day in 13(92.9%) patients in endoscope-assisted group and 5(33.3%) patients in burr hole group. The study showed mortality rate of 6.7% in both the groups. Mean residual volume at 30th post operative day was 0.75ml in endoscope-assisted group and 1.75ml in burr hole aspiration group.*

Conclusion: *In conclusion endoscope-assisted procedure has better rate of abscess evacuation, less chance of residual and repeated surgeries than conventional burr hole.*

Keywords: *Brain abscess; endoscope-assisted evacuation; conventional burr hole; aspiration; brain abscess*

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Introduction

Brian abscess is one of the most serious diseases of the central nervous system[1]. Central nervous system infections (CNS) and their sequelae constitute a major source of morbidity. This condition is two to three times more common among men and morbidity rate is highest in fourth decade of the life[2]. The incidence of brain abscesses is 8.0% of intracranial masses in

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developing countries, whereas the incidence is 1.0 to 2.0% in the West[1]. The incidence ofmultiple brain abscesses in non-immunocompromised patients is 13.0% of all intracranial abscesses[2].

It has been reviewed the management of brain abscesses among paediatric cases where repeated puncture, aspiration and excision are the surgical procedures performed in the study[3]. The recurrence has been observed in that series of repeated puncture and aspiration group. Follow-up of the cases treated by tapping-aspiration who were periodically reviewed elicited the following neuropsychiatric sequelae like mild hemiparesis, seizures, alterations in cognitive, emotional and gestural ability, major visual disturbances4. It was mentioned recurrence of an abscess can be regarded as a complication, as it is usually due to inadequate medical or surgical treatment following complete resection[5].

In another study Sharma et al6 have reviewed that there is no single best surgical techniques developed to treat brain abscess. Lavage with endoscopic stereotactic evacuation may cut down indications of excision of brain abscesses in future. It was expected in the study that a trend of adequate drainage of brain abscess via minimally invasive surgery had been emerging6. Yadav et al7 showed that the results of endoscopic treatment of brain abscesses were found to be safe and effective. A prospective study was conducted on 24 patients of brain abscesses treated and all the patients of brain abscesses except small abscesses of less than 1.0 cm and multiloculated abscesses, were included in the study[7].

However, Tan et al[8] compared the two surgical methods, burr hole and craniotomy and its outcome in a retrospective case review in terms of radiological clearance on brain CT, improvement of neurological status, the need for repeated surgery, and survival and morbidity at three months after surgery. The one group of patients had undergone craniotomy and excision of abscess, and the rest of the patients had undergone burr hole aspiration as their first surgical treatment. The study showed blind aspiration of the abscess made it difficult to estimate the adequacy of the evacuation; furthermore, the capsule might collapse partially and prevent further aspiration and leave a residual abscess after surgery[8]. The objective of this study was to compare the efficacy between endoscope-assisted evacuations of brain abscess with burr hole aspiration method in a tertiary health care center.

Methodology:

Study Settings & Population: This non-randomized clinical trial was conducted in the Department of Neurosurgery at Dhaka Medical College and Hospital, Dhaka, Bangladesh during the period of July 2016 to December 2017. Patients presented with solitary brain abscess diameter e”2.5 cm who were admitted into the Department of Neurosurgery at Dhaka Medical College and Hospital, Dhaka, Bangladesh and were underwent surgical treatment were included in the study. Patients with brain abscess who were treated conservatively, brain abscess diameter less than 2.5 cm, deep seated brain abscess were excluded from this study. The neurological status at admission was evaluated using the Glasgow Coma Scale (GCS). History of clinical presentation was taken from conscious patients and relevant attendants in case of altered conscious patients. In all cases, standard laboratory tests were conducted, including a complete blood count, ESR, CRP and serum electrolytes. The ABCs method was adopted to measure the abscess volume. All surgical procedures were performed under general anesthesia.

Surgical Procedure: All the surgeries were done by single surgeon of a neurosurgery unit of DMCH. The abscess evacuation rate was calculated and was presented by percentage. Abscess evacuation rate at 1st post-operative day was calculated on the basis of CT scan of head. Site of the burr hole was located according to location of abscess and the parameters considered important included the shortest trajectory to the abscess wall, a trajectory passing through non-eloquent regions of the cortex and alignment of the cavity along the long axis of the abscess. For endoscope-assisted evacuation 4-mm 0-degree/30-degree rod-lens endoscope was used and sheath was prepared from outer covering of 3-cc syringe having inner diameter of 10 mm and length 5.5 cm of which proximal end was bevelled to prevent brain injury. Bony bleeding was eliminated by bone wax. End-point of the abscess evacuation was determined when no more purulent material was found and when the brain was found sufficiently relaxed. In case of Burr hole aspiration patients received conventional surgery (burr hole with brain cannula aspiration) and available best medical management. The burr hole and drainage procedure was defined as making a small opening in the skull using a hudson brace up to a maximum diameter of 16 mm. At the end of pus aspiration, normal saline irrigation and aspiration was given slowly with 10/20 cc syringe. Irrigating and aspirating fluid was

observed till the color of aspirates become clear. Any bleeding from dural edge was stopped by the bipolar cautery. A piece of gel foam was given above the dural edges. Then the wound was closed in layers.

Follow up and Outcome Measures: The protocol of doing CT-scan (contrast enhanced) was on pre-operative, 1st and 30th post-operative day to assess the residual of abscess between two groups. In some patients, additional CT scans were required on the early post-operative days (7th or 14th POD) in case of repeated surgeries. Post-operative complications were observed up to 14th POD. The outcome of the patients was assessed using the Glasgow Outcome Score (GOS), GCS on 1st, 7th and 30th postoperative day. Patients were evaluated for motor deficit on pre-operative and 7th post-operative day using MRC grading. The study followed the antibiotic protocol of intravenous antibiotic for 6 weeks followed by oral antibiotics for another 6 weeks. In this study patients were discharged from hospital on 30th day with the advice of continuing intravenous antibiotics for 2 weeks at home.

Statistical Analysis: Appropriate data were collected using a preformed data sheet. Data were processed and analyzed using SPSS (Statistical Package for Social Science) software version 22.0. The level of significance was 5.0% and P value <0.05 was considered as significant. The summarized data were presented in the tables. Prior to commencement of this study, ethical clearance was taken from the Institutional Review Board (IRB).

Result:

The mean age is 13.0±6.3 years, ranging from 6 to 25 years in burr hole group and mean age in endoscope-assisted group is 13.1±6.4 years, ranging from 2 to 26 years. The findings are not statistically significant (Table I).

Pre-Operative GCS showed that the most of the patients (66.7% in burr hole group and 86.6% in endoscope assisted group) were found within GCS range 13 to 15. One (6.7%) patient from each group was within the GCS 3-8. The findings were not statistically significant. One (6.7%) patient from each group was within the GCS 9-12. One (6.7%) patient from burr hole group was within GCS 3-8. The finding was not statistically significant. One patient from endoscope group excluded due to death on 1st post-operative day. GCS at 30th POD shows 14 patients (100%) in both the groups are within GCS 13-15. This is not statistically significant (Table 2).

Fisher's Exact test was done to measure the level of significance.Abscess volume at different periods. On 30th post operative day mean abscess volume was found 1.75 mL in burr hole group and 0.75ml in endoscope-assisted group which was found statistically not significant (p<0.05) (Table III).

In this study 1 patient in burr hole group having MRC grade (0-2) showed improvement at 7th post operative period. While in endoscope assisted group 3 patients of grade (0-2) showed improvement at 7th post operative period. This is not statistically significant (p>0.05) (Table IV).

In this study 5(33.3%) patients of burr hole group were needed 1 attempt of repeat puncture whereas no patient in endoscope assisted group were needed repeated surgery. This finding was statistically significant (p<0.05) (Table V).

Death of 1(6.7%) patient was from each group during this study which was not statistically significant (Table VI).

Table-I

Demographic profile of the patients (n=30)

Variables	Group		P value
	Burr Hole	Endoscope assisted	
Age Group			
• 0 to 10 Years	7 (46.7%)	6 (40.0%)	
• 11 to 20Years	6 (40.0%)	7 (46.7%)	
• 21 to 30Years	2 (13.3%)	2 (13.3%)	
Mean ±SD	13.0 ± 6.3	13.1 ± 6.4	0.955*
Gender			
• Male	10 (66.7%)	8 (53.3%)	0.456**
• Female	5 (33.3%)	7 (46.7%)	

*Unpaired t test was done to measure the level of significance; **Chi-square test was done to measure the level of significance

Table-II

Pre-operative GCS of study population (N=30)

GCS	Group		P value
	Burr hole	Endoscopeassisted	
Pre-operative GCS			
13-15	10 (66.7%)	14 (93.3%)	0.334
9-12	4 (26.6%)	1 (6.7%)	
3-8	1 (6.7%)	0 (0.0%)	
GCS score at 1st POD			
13-15	13 (93.3%)	13 (93.3%)	1.00
9-12	1 (6.7%)	1 (6.7%)	
3-8	1 (6.7%)	0 (0.0%)	
GCS score at 30th POD			
13-15	14 (100.0%)	14 (100.0%)	1.00
9-12	0 (0.0%)	0 (0.0%)	
3-8	0 (0.0%)	0 (0.0%)	

Table-III

Abscess volume of study population at pre, 1st and 30th POD (Mean±SD mL)

Volume of abscess	Group		P value
	Burr hole	Endoscope-assisted	
Pre-operative	31.43 ± 21.63	33.89 ± 22.65	0.767
1st Post-operative	9.33 ± 9.42	4.57 ± 2.84	0.037
Residue at 30th POD	1.75 ± 2.00	0.75 ± 1.05	0.227

Table-IV

Pre and 7th Post-Operative MRC Muscle Power Grade in Study Population (n=28)

MRC grade	Group		P value
	Burr hole	Endoscope- assisted	
Pre-Operative			
0-2	3 (21.4%)	3 (21.4%)	1.000
3-5	11(78.6%)	11(78.6%)	
7th Post-Operative			
0-2	2 (14.3%)	0 (0.0%)	0.454
3-5	12(85.7%)	14 (100.0%)	

Fisher's Exact test was done to measure the level of significance

Table-V

Number of Repeated Surgery among Study Population (n=28)

Repeatedsurgery	Group		Pvalue
	Burr hole	Endoscope assisted	
Yes	5 (33.3%)	0 (0.0%)	0.042
No 9 (66.7%)	14 (100.0%)		
Total	14 (100.0%)	14 (100.0%)	

Fisher's Exact test was done to measure the level of significance

Table-VI

Mortality and survival rate of the study population (n=30)

Mortality	Group		P value
	Burr hole	Endoscopeassisted	
Death	1(6.7%)	1(6.7%)	1.00
Survive	14(93.3%)	14(93.3%)	
Total	15(100.0%)	15(100.0%)	

Fisher's Exact test was done to measure the level of significance

Discussion:

Bacterial brain abscesses can be diagnosed and treated with percutaneous aspiration under imaging modalities. Drainage of brain abscesses are carried out in most centers with contrast- enhanced CT-scan9-11. When the lesion cannot be demonstrated well with CT-scan, MR imaging is used. They have provided promising results in the management of this disease. One major advantage of modern imaging techniques is the use of stereotaxy. The definitive surgical methods of brain abscess are still not finalized and until now there has been no large prospective randomized controlled study to show the most effective surgical method. There were comparative studies between aspiration and excision of abscess12; however, no consensus has showed comparative study of endoscope-assisted versus burr hole aspiration of abscess yet. This prospective interventional study aimed to compare the efficacy between endoscope-assisted evacuation and burr hole aspiration of brain abscess.

Analysis of age distribution showed that the age of total 30 patients ranged from 2 to 26 years. The mean age was 13.0±6.3 years in burr hole group ranging from 6 to 25 years. The mean age was 13.1±6.4 years in endoscope-assisted group ranging from 2 to 26 years. No statistical significant (>0.05) difference was observed. Yadav et al7 showed age ranged between 6 and 58 years. Riaz et al9 showed the commonest age group was from 11 to 20 years.

Male sex was found predominant in both the groups. Male-female ratio was 2:1 in burr hole aspiration group and 1.14:1 in endoscope-assisted group. The distribution of male was 18 (60%) and female was 12(40%) in study population. However, it was not statistically significant (p>0.05) between the two groups. There were 46 (63.01%) male and 27 (36.99%) female patients in the study conducted by Riaz et al9. The study conducted by Tan et al8 showed 64.7% of patients were male and 35.5% were female which is very similar to this study. Male predominance in brain abscess complicating ear, nose and throat infections probably reflects the general predilection of boys for infectious diseases10-13.

The study showed most of the patients presented with GCS range 13 to 15 pre-operatively. It was 66.7% in burr hole group and 93.3% in endoscope assisted group. There was no statistical significant difference in this feature (p>0.05). Ahmad et al11 showed GCS was 13/15 in 57 (57%) patients, followed by 10/15 in 20 (20%) patients. In the study on 1st and 7th

post-operative day 13 (93.3%) patients from both the group are found within GCS range 13 to15 and one (6.7%) patient from each group is within the GCS 9 to 12. On 30th POD 14 (100%) patients in both the group are within GCS 13 to 15. This was not statistically significant (p>0.05).

Abscess volume at pre-operative period and 30th POD between individual group showed significant difference (p<0.05). Mean residual volume at 30th post operative day in endoscope-assisted group was 0.75ml and in burr hole group was 1.75ml which was not statistically significant (p>0.05). In the study in burr hole group 1 patient having MRC grade (0 to 2) showed improvement at 7th post-operative period. While in endoscope assisted group

3 patients of grade (0 to 2) showed improvement at 7th post-operative period. There was no statistical significant difference between two groups (p>0.05).

In terms of re-surgery, some patients in the burr hole group had to undergo another episode of operation in this study. This study showed necessity of repeated surgery in burr hole group than endoscope assisted group for clearance of residual abscess at post operative period. This is in consistent with other study14. Again, 5(33.3%) patients in burr hole group had to go for repeated puncture for once for clearance of residual, whereas no patient in endoscope assisted

group needed re-surgery for residual brain abscess. 47.8% patients in the burr hole group required a second surgery in the study done by Tan et al8. Riaz et al9 showed 13.70% patients needed second burr hole aspiration in their study. Ahmad et al11

showed that 17(17%) patients in their study had significant residual abscesses that were re-aspirated. There are several other studies showed statistically significant difference regarding number of repeated surgery for abscess residual11-13.

This study showed mortality rate of 6.7% which was not statistically significant. One patient from each group died. In endoscope assisted group one patient with TOF died on 1st post operative day due to sudden cardiac arrest. In burr hole group one patient died on 7th post operative day who was unconscious (GCS 5) with features of raised ICP on admission. In the study by Tan et al8 three patients died within one week after the first surgery (surgical mortality rate of 5.9%), which showed similarity to this study.

Conclusion:

In conclusion endoscope-assisted procedure has better rate of abscess evacuation and less chance of residual than conventional burr hole. In this study patients of burr hole group needed the attempt of repeat puncture whereas no patient in endoscope assisted group needed repeated surgery. Large scale multi-centre study should be performed.

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