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Original Article

Value of Numerical Criteria in the Management of Brain Abscess

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Abstract

Background. **To study the value of a numerical criteria in the management of brain abscess.**

Methods. **All Patients with brain abscess were included prospectively in this study. Decision regarding management was made on the basis of a quantified numerical criteria , based on Glasgow Coma Scale, focal neurological deficit, radiological findings and Co morbidities . According to the criteria management was divided into three groups ,i.e., urgent intervention (Burr hole and aspiration), elective surgery on next available list (total excision) and conservative treatment (empirically)**

Results: **Thirty eight patients were studied during 16 months. According to the criteria , 8 patients were treated by burr hole in emergency, 10 patients were treated by total excision, 18 patients were treated by burr hole plus total excision and 2 patients did not undergo surgical intervention. Thirty (78.94%) cases out of 38 improved , 4 patients with hemiparesis did not improve (10.52%).Complications developed in 7 (18.42%). Four cases died (10.52%). There was no difference in the decision regarding mode of surgery based on criteria between the resident and senior consultants.**

Conclusion. **Numerical criteria provide a reasonably useful and uniform guideline for management of brain abscesses.**

Key Words: **Brain abscesses, Burr hole aspiration, Total excision, Numerical Criteria**

Introduction

Brain abscess is a focal, intracerebral infection that begins as a localized area of cerebritis and develops into a collection of pus surrounded by a well-vascularized capsule. Brain abscesses are uncommon but are life-threatening There is an enormous discussion about the management of brain abscesses regarding medical or surgical, type of surgery and time of surgical intervention.[1-12] In today's era assessment, decision making, communication and outcome in patients is preferably made by in a quantifiable manner as far as possible. Every patient is assessed and managed according to a numerical criterion e.g. Glasgow coma scale for head injury patients, MRC grading for power assessment, Frankle grading and white and Punjabi criteria for spinal injury patients.[13, 14] Introduction of these criteria has helped in the comparative research and selection of the best approach in each objective. These criteria also have helped to standardize overall care of the patient and have made discussion simple and straight forward.[15-20] There is no criteria so far reported for brain abscesses. It is imperative to design a quantitative criteria for brain abscess, like other entitites.Authors have attempted to introduce similar criteria for management of brain abscesses,i.e., Pakistan Institute of Medical sciences (PIMS) criteria for decision regarding assessment and management for brain abscess (Table 1) .Due weightage was given to individual component of the criteria. The sum total of the numbers determined the final decision making. The criteria for the management of brain abscess were applied in all cases. Criteria can be considered simple to follow and can help in the overall management specially in the emergency situation and if applied there is no difference between surgeons of variable experience.

Advances in the diagnosis and treatment modalities of brain abscess during the last 20 years have led to continuous reduction in the mortality associated with brain abscess. The advent of CT Scanning in 1974, MRI, the introduction of stereotactic biopsy and aspiration technique, and the availability of newer antimicrobials have all contributed to this improved outcome but the controversy regarding initial decision making still exist.[21-30]

Patients and Methods

All patients that presented with brain abscess from January 2014 to April 2015 were studied prospectively. Total 38 patients were studied. All patients had CT Scan brain with contrast. All patients were started on empirical antibiotic therapy, patients who had history of paranasal sinus infection and otogenic infection were started on third generation cephalosporin plus metronidazole and Amikacin.

Table 1: Assessment and management of brain abscess-Numerical criteria

GCS*	Points	Neurodeficit (Hemi paresis ,Aphasia) or superficial or deep)	Points	CT SCAN finding	Points	Co-morbidity/ Hydrocephalus/ Valvular heart disease	Points
3--8/15	3	Neurodeficit (Hemi paresis, Aphasia): 0.5 point Superficial and non eloquent area : 0 point Deep and eloquent area : 0.5 point	1	Size :More than 4 cm : 2 points Capsule : Thin: 0.5 point Thick : 1 point	3	HTN/DM/Chest infection	1
9--12/15	2	Absent	0	Size :2 to 3 cm : 1 point Capsule:thin:0.5point; Thick: 1point	2	Infratentorial Abscess (Hydrocephalus)	1
12--15/15	1			Size :Less than 2 cm: 1 pint Capsule: no importance	1	Heart disease (TOF,VSD)	1

*GCS-Glasgow Coma Scale

Patients who had history of trauma or surgery were started on Vancomycin, third generation cephalosporin and Metronidazole. Patients with history of congenital heart disease were started on third generation cephalosporin. Patients with history of dental sepsis were started on Mentronidazole and third generation cephalosporin. Appropriate antibiotics were started after culture sensitivity of pus. Improvement was checked in form of GCS, any neurodeficit in form of hemiparesis or aphasia improves or not. Patient discharged on antibiotics for 4 to 6 weeks. Fellow up in OPD after 4 weeks, 8 weeks and 6 months with serial CT brain with contrast.New criteria (PIMS criteria) for the management of brain abscess was introduced in which due importance was given to neurodeficit, CT scan findings, comorbidities, hydrocephalus and valvular heart disease(Table-1). When the points were more than 5 out of 10 then urgent Burr hole aspiration plus antibiotic cover was needed, if the points were more than 3 but less than 5 then total excision electively was needed and if the Points were more than 1 but less than 3 it needed medical treatment, observation and serial CT scans were needed. (Table- 2).It is pertinent that every patient presents with different variety and needs individualized treatment. More than 5 points were taken as a need for urgent intervention (Burr hole or total excision), for points between 3 to 5 total excision and for less than 3 points conservative management were employed (Table 2).

Table 2. Decision making regarding management of brain abscesses

	Points (Total points : 10)	Management
A	More than 5 points	Urgent intervention needed, either Bur hole or total excision depend on the availability of expertise and facilities in emergency.
B	Points between 3 and 5	Total excision electively as soon as possible except eloquent area.
C	Points less than 3	Medical treatment

Results

Majority (26) were adult, while 12 were children, less than 12 years of age. Thirty were male. Chronic suppurative otitis media (CSOM) was the commonest cause (Table 3).Posterior fossa was the commonest site (47.36%) (Table 4; Figure 1-10). Thirty eight cases were studied in which the resident on call was given the authority to make the decision regarding the choice of the treatment in the individual case. Patients mostly presented with loss of consciousness, headache, vomiting, epilepsy and focal neuro deficit. (Table 5). The PIMS criteria were applied in all cases. Eight patients were treated by burr hole only, eighteen patients were treated by burr hole plus total excision, ten patients were treated by total excision only and two patients did not need surgical intervention and they were treated with empirical antibiotic (Table 6).In all but two cases the resident confidently came to the same conclusion as the senior most member of the team. In two cases, treated

Table 3: Brain abscess- etiology

Cause	No(%)
Chronic suppurative otitis media	20
Fallot's tetralogy	8
Post traumatic	7
Iatrogenic	3

non-surgically the resident was indecisive because of the previous surgeries for frontal depressed skull fracture elevation but was fairly confident that the patient does not need surgical intervention for abscess at that moment

Table 4: Sites of Brain Abscess

Site	No(%)
Posterior Fossa	18(47.36)
Temporo parietal region	12 (31.57)
Frontal region	8(21.05)

Table 5: Common presentation of brain abscess

Common presentation of brain abscess	
Loss of consciousness	90%
Headache	90%
Vomiting	70 to 80%
Epilepsy.	60 to 70 %
Hemi paresis , aphasia	20 to 30%
Ear discharge	50%

Table 6: Comparison between residents and faculty decision regarding management of brain abscesses after applying the numerical criteria

Category	Resident	Percentage	Faculty	Percentage	Differences
A	8/38	21.05%	9/38	23.68%	2.63%
B	10/38	26.31%	11/38	28.94%	2.63%
C	2/38	5.26%	2/38	5.26%	-
D (A+B)	18/38	47.36%	16/38 s	42.10%	5.25%

. . Hydrocephalus developed in three patients (7.89%) which were later on VP Shunted, surgical site infection occurred in two patients (5.26%), CSF leak occurred in two patients (5.26%), and recurrence in three patients (7.89%). total excision was done in these seven patients (Group C). Thirty patients out of thirty eight patients improved (78.94%) (Table 7), four patients died (10.52%), mortality and causes; First two had Surgical site infection which lead to Meningitis, One had CSF leak in post fossa then Meningitis. one had associated co morbid (DM type 2). All who died were in GCS 5 or less on presentation four patients had hemi paresis that did not improve (10.52%).Group D. 47% patients according to the criteria, they needed urgent intervention (Burr hole aspiration and started on antibiotics) due to lack of facilities and expertise in emergency., CT brain with contrast was repeated there was residual abscesses so total excision was done on elective list

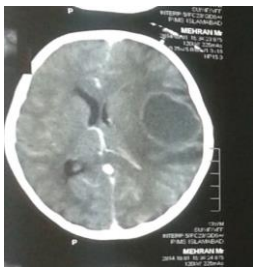

Fig1. Contrast enhancing CT brain showing a temporo parietal abscess

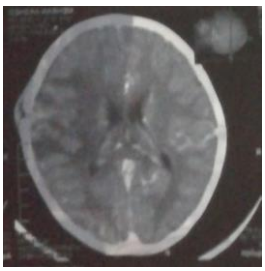

Fig2. CT scan brain of temporal parietal abscess - after burr hole aspiration

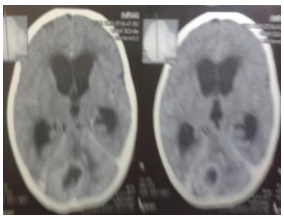

Fig.3 Contrast enhancing CT brain showing a posterior fossa abscess

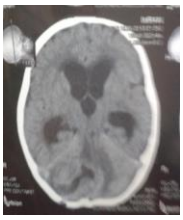

Fig. 4 CT scan brain of posterior fossa abscess - after burr hole aspiration

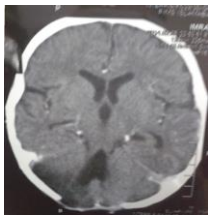

Fig 5: CT scan brain of posterior fossa abscess - after total excision

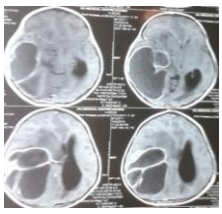

Fig.6 Pre op MRI brain with contrast of Temporo Parietal abscess

Discussion

Before the late 1800s, brain abscess was an almost uniformly fatal condition that was rarely diagnosed before autopsy. The pioneering work of an English surgeon William McEwen led to remarkable breakthroughs in the treatment of this condition.

Table No 7: Pre-Operative and Post-Operative status of the patients

Numbers of patients	Neurological status	Pre-Operatively	Post-Operatively
1 Group :20 patients 2 Group : 10 patients 3 Group: 8 patients	1 Group GCS: 2 Group GCS: 3 Group GCS:	1 Group GCS: 8.0 2 Group GCS: 10.0 3 Group GCS : 13.0	1 Group GCS: 15.0 2 Group GCS: 15.0 3 Group GCS : 15.0
1 Group : 4 patients 2 Group: 2 patients 3 Group: 4 patients	1 Group: Hemiparesis 2 Group: Hemiparesis 3 Group: Hemiparesis	1 Group : 2/5 MRC Grading 2 Group: 4/5 MRC Grading 3 Group:0/5 MRC Grading	1 Group : 3-4/5 MRC Grading 2 Group: 4-5/5 MRC Grading 3 Group:0/5 MRC Grading
6 Patients	Aphasia	Present	Normal speak(improved)
30 Patients	Headache and vomiting	Present	Absent (improved)

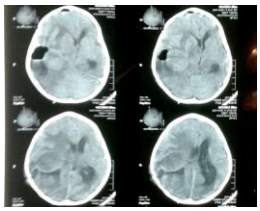

Fig.7 Post op CT scan brain of temporo parietal abscess

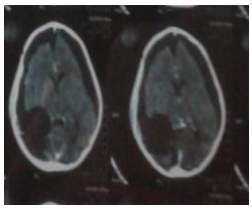

FIG.8 Post op CT scan brain of a patient with temporo parietal abscess

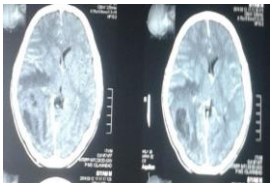

Fig.9 Pre op CT SCAN brain with contrast of Parietal abscess

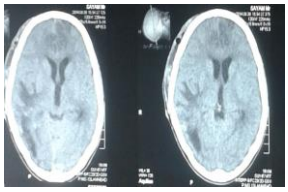

Fig.10 Post op CT scan brain of parietal abscess.

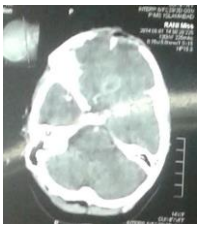

Fig.11 Contrast enhancing CT brain showing a frontal abscess

Fig.12: Contrast enhancing CT brain showing a frontal abscess, treated with antibiotic

With an improved knowledge of surgical anatomy and the development of new surgical techniques' he showed that selected cases could be cured with drainage of abscess[31- 33] Despite the improved treatment of underlying systemic infections and development of more effective antibiotics, the overall incidence of bacterial cerebral abscess has remained relatively constant. [34,35] Advances in the diagnosis and treatment modalities of brain abscess during the last 20 years have led to decrease in the mortality associated with brain abscess.[36] The advent of CT Scanning,MRI, stereotactic biopsy and aspiration technique, and the availability of newer antimicrobials have all contributed to this improved outcome.[37]

In underdeveloped countries, cerebral abscess accounts for 8% or more of all intracranial space occupying lesions.[38,39] Most cases occur during the first four decades, the median age being around 20 –40 years. Otitic source generally occurs in younger than 20 or older than 40 years in children between 4 and 7 years of age, mostly a result of cyanotic congenital heart disease or Otitis media ..Below 2 years often occur as a complication of bacterial meningitis caused by selected gram negative organisms.[40]

Microorganisms may reach the brain and cause focal suppuration by direct spread from a contiguous site of infections, by haematogenous spread from a remote reservoir of infection,by inoculation during a neurosurgical procedure or from penetrating craniocerebral trauma.[41] Immuno-compromised states such as AIDS, malignancy, organ transplantation and chronic corticosteroid therapy, may place individuals at high risk for development of brain abscess.[42]

Brain abscess is a focal, intracerebral infection that begins as a localized area of cerebritis and develops into a collection of pus surrounded by a well-vascularized capsule. The development of brain abscess is divided in four stages, Stage 1) Early cerebritis, time course 0 to 3 days. Stage 2) late cerebritis, time course 4 to 9 days. Stage 3) Early capsule formation, time course 10 to 14 days. Stage 4) Late capsule formation time course more than 14 days[43].

The comparison between residents and faculty regarding decision making for management of brain abscesses were almost similar and the PIMS criteria for the management of abscess is helpful.In our study 20

patients out of 38 had cerebral abscess due to chronic suppurative otitis media. After management these patients need proper treatment for otitis media to prevent recurrence.

Conclusion

Numerical PIMS criteria provide a reasonably useful guideline in the management of brain abscess.

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