

## Brain abscesses in Iraq during a 10 years period: Part 11. Diagnostic investigations, management and outcome.

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### Summary:

**Background:** This study comprises two parts, the first one dealt with epidemiology, etiology and clinical picture of brain abscess. This part describes diagnostic investigations, management and final outcome of brain abscess during a 10 years period.

**Methods:** The case records of patients with brain abscess admitted to the neurosurgical specialties hospital in Baghdad over a 10 years period extending from 1<sup>st</sup> Jan. 1993 to 31<sup>st</sup> Dec. 2002, inclusive were reviewed. Data obtained included demographic and clinical data.

**Results:** Results of peripheral leukocytes count, ESR and CSF were supportive in 16.7%, 67.9% and 78% of cases in which tests were applied, respectively. CT scan was suggestive in 100% of cases. Use of antibiotic therapy as a preliminary treatment line was adopted in 37.8% of cases, while surgery as a preliminary line of treatment was adopted in 62.3% of cases. Out of 68 cases, complete resolution was encountered in 70.6% of cases, sequelae in 11.8% and death in 17.9%. Bad neurological status on admission was the most encountered contributing factor for death. Metastasis from a remote infection process is a risky aetiology contributing to bad prognosis.

**Conclusion:** The use of CT scan represents an important change in the diagnostic regimen of brain abscess in the last 10-15 years.

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### Introduction:

Brain abscess remains a serious disease that leads to mortality and disability if misdiagnosed or managed improperly, and even successfully treated cases of brain abscess can result in long term neurological sequelae and disability<sup>1,3</sup>. Its epidemiology has changed little over the last 20 years, with increased incidence among immunocompromised individuals (transplant recipients, cytotoxic chemotherapy receivers and AIDS patients) and decreased incidence among patients with otitis media and sinusitis, related to earlier diagnosis and more effective antibiotic therapy<sup>4</sup>.

This study comprises two parts, the first part dealt with epidemiology, aetiology and clinical picture of brain abscess while this part is going to describe diagnostic investigations, management and final outcome of the brain abscess during a 10 years period extending from 1993 to 2002.

### Materials and methods:

This study included review of case records of patients with brain abscess admitted to the neurosurgical department of surgical specialties hospital in Baghdad over a 10 years period extending from 1<sup>st</sup> Jan. 1993 to 31<sup>st</sup> Dec. 2002, inclusive. The cases included in the study were those having a clinical picture suggestive of brain abscess supported by CT scanning appearance. They were 78 cases. In 70 cases of them, the diagnosis was confirmed either by surgical evidence with or without microbiological evidence or by clinical and radiological response to the treatment. The other eight cases were regarded as suspicious since no surgical or microbiological proof of diagnosis or response to treatment (clinical and radiological) was feasible. Data obtained from the case records included patient age, gender, date of admission, aetiology, sign and symptoms, duration of symptoms before seeking medical advice and onset and progression of disease process. Other data regarding diagnostic investigations used, management line, recurrence and final outcome were also collected. Data were, also, obtained from neurosurgical department registry book, which included total number of cases admitted to the department during the study period.

### Results:

Diagnostic investigations:

The diagnostic investigations used and frequency

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of supportive results encountered from them are shown in Table 1. Results of peripheral leukocytes count (PLC) were supportive of diagnosis (in term of elevated PLC above 11000/ ml as recommended by Loftus et al 4) in 16.9% of cases. Among those cases with supportive results, 90% of them had an infectious aetiology for brain abscess. Results of erythrocyte sedimentation rate (ESR) were supportive of diagnosis in term of elevated ESR above 40 mm/h in 67.9% of cases; 84.3% of them had an infectious aetiology of brain abscess. Analysis of the CSF was performed in 20.5% of the cases and was suggestive of the disease in 75% of cases. Skull X ray was performed in a small percentage of cases (11.5%) including all cases of post- traumatic abscess and it was suggestive of disease in 50% of them in term of encountering signs of raised ICP and foreign bodies as bullets and shells. CT scanning was performed in 78 cases of brain abscess and it was suggestive of the disease in 100% of them. The CT scan findings were studied regarding site of the lesion, side of the lesion, extension of the abscess, multiplicity of the lesion, multilocularity of the lesion and stage of the lesion as it is shown in Table 2.

The relationship between site of the lesion and aetiology of brain abscess is shown in Table 3. Most of frontal, parietal and occipital abscesses were associated with cyanotic heart disease aetiology (in 27.3%, 31.1% and 23.1 %, respectively), while most of temporal abscesses were secondary to otitis media (39.1%) which was the source of infection in the majority of cerebral abscesses (77.8%).

#### Microbiological investigations:

Specimens from brain abscess material, CSF, blood and specimen from remote infection sites were set on culture to find out the causative microorganism and to determine the appropriate antibiotic therapy.

Regarding histopathological examination, this was performed in only four (5.1 %) cases and it was suggestive of brain abscess in all cases. Management: Analysis was carried out on 77 cases only. Corticosteroids were added as adjunctive in the management of all cases. The management of brain abscess was as follow:

1. Use of antibiotic therapy alone as preliminary treatment line. This was adopted in 37.8% of cases and in 7 (9.1%) of them, it is needed to be followed by surgical treatment. Antibiotics were prescribed on culture basis in 20.7% of cases only, in the remaining 79.3% they were used on empirical basis. Clinical and CT follow - up of patients were provided in 75.9% of cases only.
2. Surgery as a preliminary line of treatment. This was adopted in 48 (62.3%) cases. Therefore, surgical treatment whether as a preliminary treatment line or as alternative option after a trial of antibiotic therapy alone was adopted in a total of 55 (71.4%) cases. Preliminary aspiration alone was performed in a total

of 38 (69.1%) cases, and was followed by excision in eight (14.5%) cases. Preliminary excision was adopted in nine (16.4%) cases only.

#### Final outcome:

Analysis was carried out on 68 cases. Complete resolution (as proved by clinical and radiological follow - up) was encountered in 70.6% of cases, sequelae in 11.8% of cases and death in 17.6%. Regarding sequelae as final outcome, permanent neurological deficit in the form of hemiplegia, blindness and dysphagia was encountered in 87.5% of cases. Epilepsy was registered in 50% of cases.

As for death as a final outcome, there were certain prognostic factors for death as described by Loftus et al 4, of which bad neurological status on admission (in term of disturbed consciousness) was encountered in 91.7% of cases, followed by risky aetiology of brain abscess in term of having remote infection or having cyanotic congenital heart disease or immuno - comprization (in 50% of cases). Non- surgical management was registered in 16.7% of cases.

Recurrences (not included in the final outcome in this study) were found to occur in 9 (11.5%) of cases. Certain specific factors were found to be contributing to recurrences which included failure to eliminate the source of infection (in 88.9% of cases), failed or delayed aspiration (in 44.4% of cases) and incorrect antibiotic therapy (in 33.3%) when related to culture reports.

Assessment of certain variables (including aetiology, clinical course of the disease, recurrence, management lines and sites of the abscess) with the final outcome revealed that there was no statistically significant association between these variables and final outcome (Tables).

#### **Discussion:**

##### Diagnostic investigations:

This study revealed that PLC was elevated (above 11000 cell/ml) in a minority of cases (16.9%). This finding is lower than that reported by other workers 5 who reported elevated PLC in 30% of cases. Moreover, the majority (90%) of those cases with supportive results had infectious aetiology. This figure is again slightly lower than that reported by Carey et al 6 where all cases of elevated PLC had an infectious aetiology. The ESR was elevated above 40 mm/ hour in the majority of cases. This is lower than the finding of the previous study, in which the supportive results were reported in up to 90% of cases 6. In the majority of cases (84.3%) with supportive results the aetiology was infectious. The high rate of infectious aetiology among cases with elevated PLC and ESR raise the suspicions that this elevation might be attributed partly to these infections rather than to the abscess itself. CSF analysis was the least frequently performed test (in one fifth of cases). This might be attributed to the

fact that lumbar puncture should be best avoided in the cases of presence of an intracranial mass <sup>4</sup>.

Skull x- ray was performed in a small percent of cases of brain abscess, because it is reported to be normal and seldom give a clue to the diagnosis <sup>9</sup>, and that is why it is replaced by CT scanning. This represents an important change in the diagnostic regimens of brain abscess that occurred in the last 10 - 15 years. In a previous study in Iraq in 1992, skull X- ray was used to be performed for all patients in Iraq <sup>10</sup>.

CT scanning in this study was performed for all cases of brain abscess and it was suggestive of disease in all of them. The three most commonly affected sites in a decreasing order of frequency were parietal, frontal and temporal lobes. This finding differs from that previously reported in Iraq in which the order was frontal, temporal and parietal lobes <sup>10</sup>. Cyanotic congenital heart disease was the most common aetiology in parietal and frontal lobe abscesses, while otitis media was the most common aetiology in temporal lobe abscess. Both findings are consistent with that of other workers <sup>4</sup>. Otitis media was also the aetiology associated with the majority (77.8%) of cerebellar abscess; this is slightly lower than the range of 85 - 90% reported in textbooks <sup>11</sup>. Regarding side of the lesion, brain abscess were ipsilateral to the side of the infection source in all cases which is in agreement with a previous study in Iraq <sup>10</sup>. Multiple lesions were encountered in about one third of cases, which is higher than 20% previously reported in Iraq <sup>10</sup>.

Despite the encouraging data regarding the utility of MRI in the diagnosis of brain abscess and despite the reported superiority over CT scanning in this respect <sup>11</sup>, MRI has been performed in only few cases of the study sample. This may be attributed to limits in the availability of this imaging technique.

In this study sterile cultures were encountered in slightly more than one fourth of cases. This is close to figure of 29.2% previously reported in Iraq <sup>10</sup> and agrees with western literature with an incidence of 25-30% <sup>5,12</sup>. Anaerobes (alone mixed with aerobes) were encountered in 12.5% of all culture results. This agree with a recent literature <sup>13</sup> and is considered as one of the important epidemiological changes of brain abscess that were attributed to better microbiological isolation techniques for anaerobes, which in turn have resulted in lowering the incidence of sterile cultures <sup>4</sup>.

#### Management:

Antibiotics were used alone as preliminary treatment line in 37.7% of cases and in 9.1 % of them; this option was needed to be followed by surgical intervention. This frequency of cases treated with antibiotic therapy alone is a big change in treatment of brain abscess when compared to zero frequency among cases studied

10 20 years ago in Iraq <sup>10</sup>. Clinical and CT follow- up of patients treated with antibiotics alone was provided in 75.9% of cases, as this is recommended as an integral part of management with antibiotics alone <sup>4</sup>. The frequency of performing surgical aspiration is higher, od that of surgical excision and it is lower than that previously reported in Iraq <sup>10</sup> (61.4% and 23.9%, respectively).

#### Final outcome:

This study showed that permanent neurological deficit was the most frequently registered sequelae (reported in 87.5% of cases), while epilepsy was reported in 50% of cases. The frequency of permanent neurological deficit is higher than the rate of 50% while that of epilepsy is within the range of 30-50% reported in literatures <sup>4</sup>.

The case fatality rate of 17.6% revealed by present study is lower than the rate of 25% previously reported in Iraq <sup>10</sup> and higher than the 9% reported in western countries <sup>5</sup>. Bad neurological status on admission was the most frequently encountered contributing factor for death in this study. This agrees with most of literatures <sup>5,10,12,14</sup>. Metastasis from a remote infection process is a risky aetiology contributed to bad prognosis revealed by this study, as the resultant abscesses are commonly multiple and deeply- seated and hence associated with bad prognosis <sup>7,8,15</sup>. The frequency of ~urrences of 11.5% reported in this study is slightly higher than the range of 5-10% reported in the other literature <sup>4</sup>.

Our finding that there was no statistically significant association between aetiology and the final outcome disagrees with literatures which reported that metastatic abscesses are usually associated with worse prognosis than those secondary to contiguous infections <sup>16,17</sup>. A non-statistically significant association between duration of symptoms and type of clinical course with final outcome was also revealed by this study. A finding, which differs from most literatures <sup>1</sup>. Disturbed consciousness has been reported as the most important factor influencing death occurrences as a final outcome <sup>5,10,12</sup>. This study, however, showed that there was no statistically significant association between it and final outcome. Regarding the preliminary management line, it was found again that there was no statistical significant association between it and final outcome. This finding differs from other literatures, which reported that permanent neurological deficits were more likely with excision than aspiration <sup>16,20</sup>. Abscess site has been reported also among the most influential factors on outcome <sup>6</sup>, but this study revealed no statistically significant association between it and final outcome.

**Table 1. Frequency of diagnostic investigations used and supportive results encountered from them.**

Type of Investigation	No. of investigated cases	Supportive results No.	%
Lab. Investigation			
PLC	59	10	16.9
ESR	56	38	67.9
CSF analysis	16	12	75.0
Radiological investigations	9	6	66.7
Skull X ray			
CT scanning	78	48	100.0
Microbiological investigation	40	29	72.5
Histopathological study	4	4	100.0

**Table 2 Distribution of the study sample by the CT scan findings**

CT finding	No.	%
Site of the lesion I		
Parietal lobe	45	57.7
Frontal lobe	33	42.3
Temporal lobe	23	29.5
Occipital lobe	13	16.7
Cerebellar lobe	9	11.5
Other sites (specific structures)	3	3.8
Side of the lesion 1,2		
Right	38	48.7
Left	32	41.0
Right and left	8	10.3
Extension of the lesion		
Rupture to the ventricular space	5	6.4
Multiplicity of the lesion		
Multiple lesions	22	28.2
Multilocularity		
Multilocular lesions	13	16.7
Stage of the lesion		
Cerebritis e is	20	25.6
Capsular stage	58	74.4
Thin capsular	4	5.1
Thick capsular	54	69.3
<b>Total</b>	<b>78</b>	<b>100</b>

*1 more than one site may be involved*

*2 the lesions were ipsilateral to the side of the source of infection in all cases*

**Table 3 Relationship between site of the lesion and the aetiology of brain abscess**

Aetiology	Site of infection					
	Parietal lobe	Frontal lobe	Temporal lobe	Occipital lobe	Cerebellum	Specific structures
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Cyanotic congenital heart Disease	14 (31.1)	9(27.3)	4(17.4)	3(23.1)	0(0.0)	1 (33.3)
Otitis media	3(6.7)	2(6.1)	9(39.1)	2(15.4)	7(77.8)	0(0.0)
Meningitis	5(11.1)	6(18.1)	2(8.7)	2(15.4)	0(0.0)	0(0.0)
Metastatic (from sites other than heart)	7(15.6)	3(9.1)	1(4.4)	1(7.7)	1 (11.1)	0(0.0)
Trauma	5(11.1)	4(12.1)	0(0.0)	1 (7.7)	0(0.0)	0(0.0)
Sinusitis	0(0.0)	1 (3.0)	1 (4.4)	0(0.0)	0 (0.0)	1 (33.3)
Immuno-compromization	1 (2.2)	1 (6.1)	0(0.0)	1 (7.7)	0(0.0)	0(0.0)
Infected cysts	2(4.5)	0(0.0)	1(4.4)	1(7.7)	0(0.0)	0(0.0)
Unspecified	8(17.8)	7(21.2)	5(21.7)	1(7.7)	1 (11.1)	1 (33.3)
<b>Total</b>	<b>45(100)</b>	<b>33(100)</b>	<b>23(100)</b>	<b>13(100)</b>	<b>9(100)</b>	<b>3(100)</b>

**Table 4 Frequency of culture findings in relation to the specimen tested in fort aients**

Type of the specimen tested	No. Tested	Culture results				
		Negative findings (sterile)	Positive findings			
			Aerobic bacteria only	Anaerobic bacteria only	Mixed aerobic and anaerobic bacteria	Fungal isolate
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Brain abscess material (pus)	32	8(25.0)	21 (65.6)	2(6.3)	0(0.0)	1(3.1)
Blood	2	0(0.0)	0(0.0)	0(0.0)	2(100.0)	0(0.0)
CSF	5	3(6.0)	1(20.0)	0(0.0)	1(20.0)	0(0.0)
Remote infection site material	1	0(0.0)	1(100.0)	0(0.0)	0(0.0)	0(0.0)
<b>Overall</b>	<b>40</b>	<b>11 (27.5)</b>	<b>23 (57.5)</b>	<b>2(5.0)</b>	<b>3(7.5)</b>	<b>1(2.5)</b>

**Table 5 Relationship between final outcome and certain variables**

Aetiology	Final outcome			
	Complete resolution	Sequele	Death	Total
	No. (%)	No. (%)	No. (%)	No. (%)
Cynotic congenital heart disease	14 (82.4)	1 (5.9)	2(11.8)	17(100)
Otitis media	9(56.3)	1 (6.3)	6(37.5)	16(100)
Meningitis	3(60)	2(40)	0(0.0)	5(100)
Metastasis from sites other than heart	6(85.7)	0(0.0)	1 (14.3)	7(100)
Duration of symptoms	14 (70.0)	2 (10.0)	4 (20.0)	20(100)
Less than 2 weeks				
More or equal to 2 weeks	34 (70.8)	6 (12.5)	8 (16.7)	48(100)

Onset and progression	24 (72.7)	5 (15.2)	4 (12.1)	33(100)
Insidious and slow				
Rapid and fulminat	24 (68.6)	3 (8.6)	8 (22.9)	35(100)
State of consciousness	18 (62.1)	3 (10.4)	6 (20.7)	29(100)
Disturbed				
Not disturbed	25 (80.6)	2(6.5)	4(12.9)	31 (100)
Preliminary management line	18 (81.8)	2(9.1)	2(9.1)	22(100)
Antibiotic therapy				
Surgery	30 (65.2)	6 (13.0)	12 (21.7)	46(100)
Type of surgical intervention	24 (68.6)	5 (14.3)	6 (17.1)	35(100)
Aspiration				
Excision	6(54.6)	3 (27.3)	2 (18.2)	11 (100)
Site of the lesion	30 (78.9)	4(10.5)	4(10.5)	38(100)
Parietal lobe				
Frontal lobe	20 (74.1)	4(14.8)	3(11.1)	27(100)
Temporal lobe	15 (71.4)	3(14.3)	3(14.3)	21 (100)
Occipital lobe	7(63.6)	2(18.2)	2(18.2)	11(100)
'Cerebellaum	3(37.5)	1 (12.5)	4(50.0)	8(100)
Other sites (deep structures)	1 (33.3)	1 (33.3)	1 (33.3)	3(100)
Recurrences	5(62.5)	2 (25.0)	1 (12.5)	8(100)
Present				
Absent	42 (85.7)	6 (12.3)	1 (2.1)	49(100)

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