
Brain abscess in childhood

A 25-year experience

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Abstract The presentation, treatment and outcome of 98 children with brain abscesses at Red Cross War Memorial Children's Hospital, Cape Town, is reviewed. Middle ear disease and trauma were the commonest sources of infection in 60% of patients. The usual presentation was that of meningitis and it is recommended that computed tomography be performed before lumbar puncture in those patients with associated middle ear disease, trauma or sinusitis. With early treatment of both the abscess and the underlying source of infection, the mortality rate was 16%.

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Despite improvements in primary health care facilities and socio-economic circumstances, brain abscess remains a common paediatric disease in South Africa, and is associated with a high mortality rate if not diagnosed early.

Despite the fact that computed tomography has allowed brain abscess to be diagnosed with relative ease, it is still unfortunately only the larger centres in South Africa that have this facility. Practitioners must always

maintain a high index of clinical suspicion if brain abscesses are to be diagnosed early and the unnecessary danger of lumbar puncture avoided.

We present our 25-year experience of paediatric brain abscesses in the hope that this will contribute to a heightened awareness of this potentially lethal condition.

Methods

Case material

The clinical presentation, diagnosis and treatment of children presenting to the Department of Paediatric Neurosurgery at Red Cross War Memorial Children's Hospital were retrospectively analysed.

Incidence, age and gender

Of the 98 patients treated during the 25-year period 1966 - 1991, 61 were boys and 37 girls. The mean age of presentation was 8 years (range 3 months to 14 years). Children with post-meningitic and idiopathic brain abscesses presented at an earlier age (8 months and 6 years respectively).

Aetiology

The underlying aetiology of the abscesses is listed in Table I. Of importance is the large number of implantation abscesses secondary to trauma. Of the 26 abscesses in this group, 12 followed compound depressed fractures of the skull and 14 developed after penetrating skull trauma. A knife was responsible for this in only 3

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patients. Other instruments included wire (5 cases), metal spikes (3), nails (2), a fork and a pellet.

TABLE I.
Aetiological factors

Aetiology	No.
Otogenic	33
Implantation	26
Idiopathic	17
Rhinogenic	9
Iatrogenic	4
Haematogenous	4
Post-meningitic	3
Cardiac	1
Dermal sinus	1
Total	98

Clinical presentation

The commonest presentation (43/98) resembled that of meningitis with headache, neck stiffness and pyrexia. Only 25 patients had a focal neurological deficit and 22 patients presented with seizures. Fifty-three patients had a depressed level of consciousness with a mean Glasgow coma score (GCS) of 13/15 (i.e. drowsy and disoriented).

Diagnosis

Before CT the diagnosis was made by means of arteriography and isotope scanning. These modalities of investigation have been completely replaced by CT. The typical CT scan of an abscess shows a low-density ring-enhancing lesion with considerable mass effect and mid-line shift (Fig. 1). The site of the abscess is dependent on the underlying aetiology (Table II).

TABLE II.
Site of abscess according to aetiology

Aetiology	Site	%
Otogenic	Temporal	52
	Cerebellar	48
Implantation	Frontal	54
	Parietal	35
	Temporal	8
	Cerebellar	3
Cryptic	Parietal	36
	Frontal	25
	Temporal	19
	Brainstem	13
	Occipital	7
Rhinogenic	Frontal	100

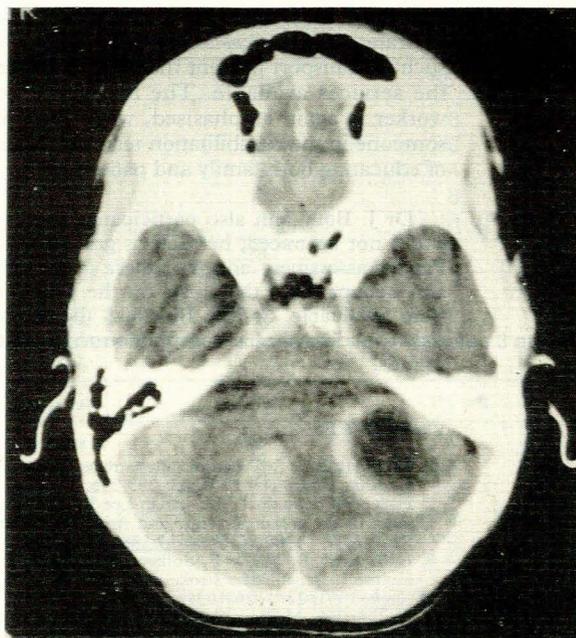


FIG. 1.
 CT scan showing the typical appearance of a brain abscess with enhancement of the capsule on contrast administration.

Treatment

Ninety-eight per cent of the patients were treated surgically. Ninety-two per cent of these underwent burr-hole aspiration of the abscess. Eight patients with cerebellar abscesses had the abscess excised as the primary form of surgical treatment. The majority of patients needed repeated aspirations of the abscess. The aim of surgical treatment is not only decompression, but also to obtain a specimen of pus for culture. It is imperative to treat the underlying septic focus at the same time.

All patients were placed on a triple antibiotic regimen consisting of intravenous penicillin, chloramphenicol and metronidazole until positive culture and sensitivity were obtained. The response to treatment was monitored by means of serial CT scans; the erythrocyte sedimentation rate (ESR) was also monitored. Patients were placed on oral antibiotics once features of resolution were apparent on CT and a fall in the ESR took place. These were continued for approximately 6 weeks until complete resolution of the abscess occurred (Fig. 2). Most staphylococcal infections were resistant to penicillin and this necessitated a change to cloxacillin.

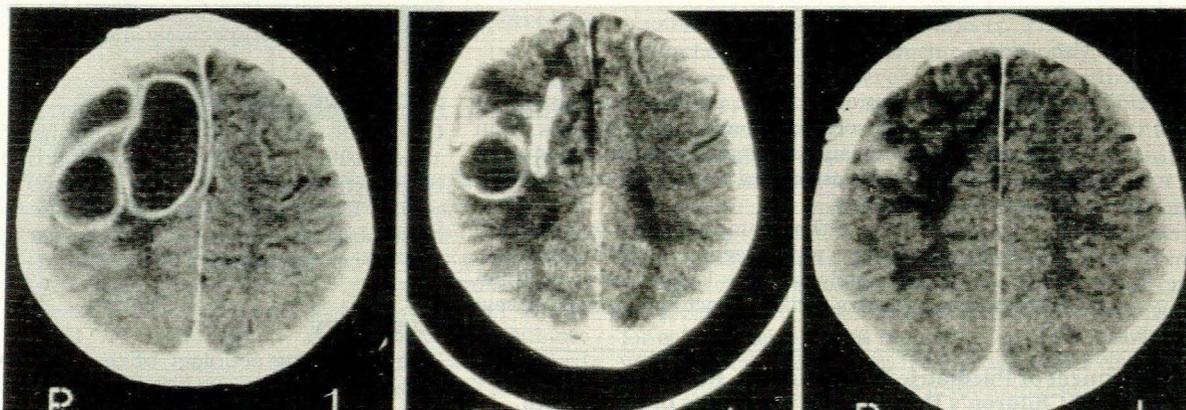


FIG. 2.
 Resolution of a brain abscess on CT at 3 weeks and 6 weeks following repeated burr-hole aspirations and triple antibiotics.

Bacteriology

A positive culture was obtained in 44% of patients. In 15%, multiple organisms were found. The organisms cultured are shown in Table III.

Surgical results

Sixteen patients died. The mean GCS of this group was 10/15 at the time of surgery. In patients with a GCS < 8/15 pre-operatively the mortality rate was 70%. The lowest mortality rate of 7,5% occurred in patients with implantation abscesses.

The incidence of postoperative epilepsy varied with the aetiology and by inference the site (Tables III and IV). Fifty per cent of children with frontal rhinogenic abscesses, 27% with frontoparietal implantations and 15% with temporal otogenic abscesses developed seizures.

TABLE III.
Bacteriology

Organism	No.
<i>S. aureus</i>	17
<i>Proteus</i> spp.	12
β-haemolytic streptococcus	9
<i>Bacteroides</i> spp.	6
Gram-negative bacilli	4
Anaerobic streptococcus	3
<i>S. milleri</i>	3
<i>Haemophilus influenzae</i>	2
Miscellaneous	3

TABLE IV.
Morbidity/mortality

	Mortality (%)	Epilepsy (%)
Otogenic	18	15
Implantation	7	27
Unknown	17	17
Rhinogenic	33	50

Discussion

Improved diagnostic methods, better anaesthetic and surgical techniques and the use of appropriate antibiotics, particularly metronidazole, have all contributed to improved results in the management of intracranial abscesses.¹⁻³ Despite this, cerebral abscesses remain a serious condition with mortality rates which reportedly range from 7,5% to over 40%.³⁻⁷ The morbidity is also significant with a high incidence of epilepsy (20 - 55%) as well as behavioural and intellectual impairment.^{2-4,8} In order to improve the results further, the emphasis must be on earlier diagnosis and treatment.

Brain abscesses are always secondary to infection elsewhere, the relative incidence of the source depending on the community in which the surgeon practises. In keeping with most other reports, abscesses secondary to chronic ear diseases were the commonest in this study, accounting for 34%.²⁻⁷ Implantation abscesses, however, accounted for 27%, a finding different from most other published series. This is because of the high incidence of penetrating trauma in our paediatric population as well as the susceptibility of children, unlike adults, to the development of implantation abscesses following penetrating trauma.⁹ Abscesses associated with congenital heart conditions are extremely rare in our practice and accounted for only 1% of cases. This low incidence may be due to the aggressive corrective surgery undertaken at an early age for congenital heart disease at Red Cross War Memorial Children's Hospital.

Brain abscesses can only be diagnosed early if a high index of suspicion is maintained in patients with sus-

pected intracranial sepsis. In our patients the commonest symptoms on presentation were headache, neck stiffness and pyrexia. Twenty-two per cent had seizures and only 25% of patients had a focal neurological deficit. Ideally all patients with suspected intracranial sepsis should have a CT scan to exclude the likelihood of a brain abscess before lumbar puncture; this would prevent the precipitation of transtentorial herniation and death. In South Africa, however, CT facilities are not readily available and failure to perform a lumbar puncture in patients with suspected meningitis could result in an increased mortality rate if this diagnosis is missed or delayed. Our findings would support the need for CT in that group of patients who present with symptoms and signs of meningitis and evidence of middle ear disease, sinusitis or trauma. If CT facilities are not available, empirical triple antibiotic therapy may be the best alternative in this high-risk group.

With a conservative policy of burr-hole aspiration in 92% of patients, we experienced an acceptable overall mortality rate of 16%. The mortality rate in the group of patients with a GCS < 8/15 on presentation was 70%; this supports the importance of early diagnosis. Primary excision of the brain abscess was carried out in 8% of patients; these had cerebellar abscesses. A further 12% had a secondary excision of the abscess because of failure to respond to burr-hole aspiration and the development of a thick-walled capsule.

An important aspect of the surgery is the obtaining of a specimen of pus for bacteriological analysis. In this series a positive culture was obtained in only 44% of patients. This low yield could be related to the use of antibiotics before a specimen was obtained or to delays in transporting the specimen to the laboratory. In centres where the specimen is cultured both aerobically and anaerobically almost immediately, it has been possible to obtain a 100% positive yield.¹⁰ Our antibiotic choice depended on the organism cultured and its sensitivity. In the absence of a positive culture patients were placed empirically on intravenous penicillin and chloramphenicol as well as rectal metronidazole. It is important to treat the intracranial sepsis as well as the underlying source. Where this is established pre-operatively a combined surgical procedure is undertaken with the relevant surgical discipline.

Although the overall mortality rate was 16%, the mortality and morbidity varied depending on the aetiology of the brain abscess. Implantation abscesses were associated with a lower mortality rate of 7,5%, but seizures occurred in 27% of survivors. This is probably due to their earlier presentation and superficial site. Rhinogenic abscesses had the worst prognosis, with a 33% mortality rate and a 50% incidence of epilepsy in survivors.

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