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Otogenic intradural complications:
(A review of 37 patients)

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Introduction

The potential for intracranial spread of infection from cholesteatomatous ears is well documented but in many parts of the world this potential may be underestimated. Early appropriate surgical intervention and aggressive antibiotic therapy have rendered this complication less common and less lethal. There is, however, no room for complacency and modern-day otolaryngologists must be well versed in its management.

The recent experience of the Departments of Otolaryngology and Neurosurgery at Groote Schuur Hospital in patients with otogenic intradural infective complications is presented and emphasis placed on close co-operation between these two specialities.

Clinical Material

Between 1980 and 1984 inclusive, 130 patients with acute and acute on chronic (cholesteatoma) mastoiditis were surgically treated at Groote Schuur Hospital. The clinical features of these patients were retrospectively analysed to determine the incidence and mortality of intradural septic complications. Of these 130 patients, 74 had cholesteatomas of which 33 had intradural extension of the infection. There were 14 patients with temporal lobe abscesses, 13 with cerebellar abscesses and 6 patients with subdural empyemas. Thus 44.6 per cent (33/74) patients with cholesteatomas presenting in the acute phase had intradural spread of the infection. The mortality for this group was 12.1 per cent (4/33).

In contrast to this group, 56 patients without cholesteatomas presented with acute mastoiditis, but only 4 (7.1 per cent) patients showed intradural extension of infection, (3 temporal lobe abscesses and 1 meningitis). In this group there was one death (Case 4) due to a temporal lobe abscess (Table I).

The age distribution is demonstrated in Fig 1 and shows a peak incidence in the 6 to 20 year age group (23/37). This is in accordance with other reports. As expected, there was a higher incidence of complicated cholesteatomas in the lower socio-economic groups and there were approximately twice as many males as females.

The 5 deaths are discussed individually.

Case 1

A 26-year-old male was seen in August 1980 with a four-day history of severe headaches followed by a generalized seizure. On examination he had a depressed level of consciousness, neck stiffness, cyanosis and a left hemiparesis. He required urgent intubation. A lumber puncture revealed purulent cerebrospinal fluid (CSF) and intravenous antibiotics were started. A computerized tomographic (CT) scan showed a right temporal abscess and urgent burr hole yielded 20 ml. of pus. Four days later a right radical mastoidectomy was performed and a large cholesteatoma in continuity with the temporal lobe access *via* an eroded tegmen was found. Post-operatively he deteriorated and died two days later.

Case 2

In November 1981, a 3-year-old female was treated at a peripheral hospital for meningitis, but because of gradual deterioration, an ENT opinion was sought and a radical mastoidectomy was performed. This revealed a large cholesteatoma with lateral sinus thrombosis and after a stormy post-operative course, she was referred to Groote Schuur Hospital. A CT scan showed a right temporal lobe abscess which was drained. Post-operatively she developed multiple pulmonary abscesses and after one week the radical mastoidectomy was revised and a lateral sinus empyema was drained. The internal jugular vein was ligated and noted to be thrombosed to its junction with the subclavian vein. She died soon after surgery.

Case 3

In 1981, a 15-year-old male was referred to Groote Schuur Hospital from a peripheral hospital after four days of treatment for meningitis. He became progressively more toxic and drowsy. A CT scan revealed a posterior fossa abscess which was drained *via* a burr hole

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TABLE I

	Acute-on-chronic mastoiditis cholesteatoma	%	Acute mastoiditis	%
Number of patients	74		56	
Temporal lobe abscess	14	36.5	3 (+ 1 Meningitis)*	7.1
Cerebellar abscess	13		—	
Post fossa subdural empyema	2	8.1	—	
Supratentorial subdural empyema	4		—	
Deaths	4	5.4	1	

* Meningitis only
Total Number: 130
Intradural Extension: 37 = 28,5%
Intradural Extension: 5/130 = 3.8 per cent
Mortality (with intradural extension): 5/37 = 13.5 per cent

and this was followed by a radical mastoidectomy. There was a large cholesteatoma, a perisinus abscess and a thrombosed lateral sinus which was opened. Post-operatively the patient deteriorated and died the next day.

Case 4

In 1981, a postauricular abscess was incised and drained in a 23-year-old male who had a history of chronic suppurative otitis media. The following day he was noted to be drowsy, pyrexial and to have neck stiffness. On arrival at Groote Schuur Hospital a CT scan demonstrated a large temporal lobe abscess (Fig. 2) which was drained. A cortical mastoidectomy exposed infected granulation tissue and a posterior fossa extradual abscess. There was no cholesteatoma. He deteriorated post-operatively and died the next day.

Case 5

A 13-year-old female was seen in 1982 with progressive drowsiness and a respiratory arrest in the Casualty Department. She was intubated and ventilated but both pupils were fixed and dilated. A CT scan showed a left temporal lobe abscess which yielded 60 ml. of pus on drainage. A radical mastoidectomy was performed for a large cholesteatoma which had eroded the tegmen. She died the next day.

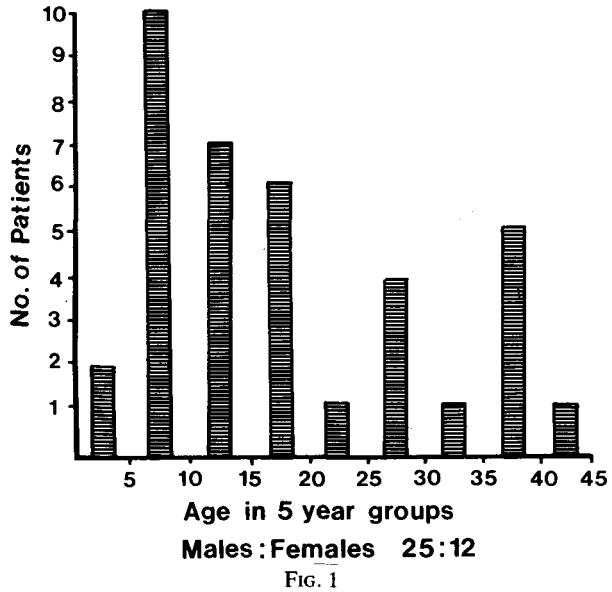


FIG. 1

Discussion

Although the potential of cholesteatomas for local destruction and intracranial spread of infection is well described; antibiotics and early mastoid surgery have dramatically reduced these complications. The lethal potential of this condition needs to be re-emphasised, as 44.6 per cent (33/74) of patients with cholesteatomas who presented with local and constitutional effects of acute aural sepsis at Groote Schuur Hospital already had intradural extension of the infection. This contrasted with only 7.1 per cent (4/56) of patients with acute non-cholesteatomatous mastoiditis who had concomitant intradural sepsis. It was interesting to note that there were similar numbers of temporal lobe and cerebellar abscesses in the cholesteatomatous group (Table I).

The mortality of these patients was 13.5 per cent (5/37). All patients dying either presented late, or definitive surgical management was delayed because of initial mis-diagnosis and the severity of the condition only appreciated once there was deterioration in the patient's condition.

Keet and De Villiers (1985), from the Department of Neurosurgery at Groote Schuur Hospital, reported on 557 cases of brain and subdural abscesses treated between 1952 and 1981. 39 per cent were secondary to ear infections. Overall there was a mortality of 38 per cent for otogenic intracerebral abscesses but these figures include terminal patients who died before any mastoid surgery could be performed and patients who had had mastoidectomies at other hospitals.

The outcome of intracranial abscesses was shown in vary directly with the level of consciousness on admission. A good result could be expected in a good grade patient as assessed using the Glasgow Coma Scale and who was treated promptly, while a high mortality was found in patients presenting with a depressed level of consciousness and features of incipient or established transtentorial herniation.

In Pennybacker's (1961) series of over 200 patients with otogenic intracranial complications treated by the Department of Neurological Surgery at the Radcliffe Infirmary, Oxford, 55 patients had abscesses in the temporal lobe and 30 in the cerebellum. He showed a dramatic improvement in mortality from 35 per cent

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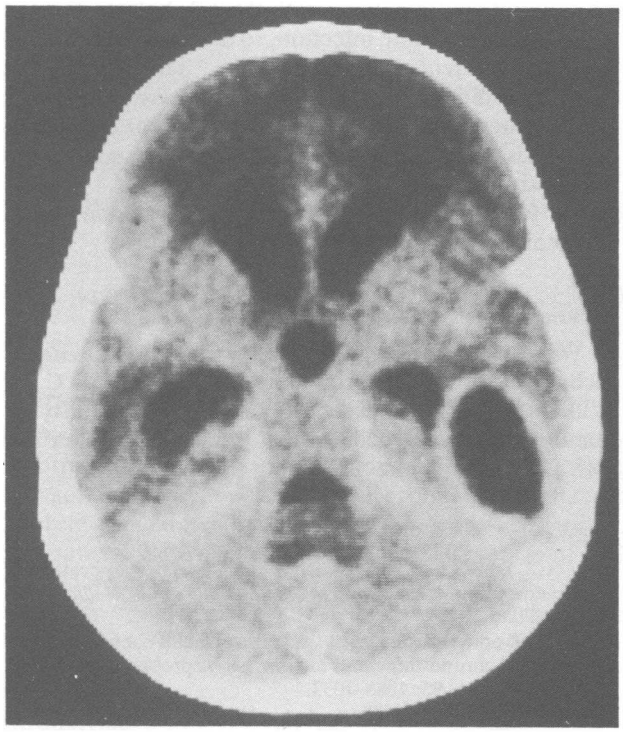


FIG. 2

CT Scan (enhanced) of Case 4. A large right temporal lobe abscess is present which is abutting on the temporal horn of the cerebral ventricle. There is ventricular dilatation denoting concomitant hydrocephalus.

between 1938 and 1950 to 5.7 per cent between 1950 and 1960. Wright and Grimaldi (1973) in the same hospital treated 36 patients with otogenic intracranial complications between 1961 and 1971. Of the 18 patients with brain abscesses, 14 had temporal lobe and 4 had cerebellar abscesses, reflecting the same proportions as found during the previous two decades (Pennybacker, 1948, 1961). There were no deaths but they did report a considerable morbidity, consisting of hemiplegia, ataxia and epilepsy.

Wolfowitz (1972) reported on 28 cases of otogenic intracranial complications treated at Baragwanath Hospital, Johannesburg, between 1965 and 1971 with an overall mortality rate of 25 per cent.

Dawes (1961) reported on 199 patients with otogenic intracranial complications treated at the Royal Victoria Infirmary, Newcastle-upon-Tyne, between 1944 and 1960. Thirty had temporal lobe abscesses and 10 cerebellar abscesses with a mortality of 50 per cent and 30 per cent respectively. Dividing the study into approximately 5-year periods, he demonstrated a progressive fall in the mortality from 37.3 per cent to 23.2 per cent to 6.5 per cent and emphasized the increased mortality associated with multiple intracranial lesions.

Proctor (1966) compared patients with otogenic intracranial sepsis in the pre-antibiotic and post-antibiotic eras treated at the University Hospital in Ann Arbor, Michigan. In the 10 years before antibiotics, 9 patients with temporal lobe abscesses, 6 with cerebellar abscesses and 3 with subdural abscesses were treated. In all there were 129 cases with 192 complications and 39 deaths (mortality 30.22 per cent). In the 10-year period up to 1963, 5 patients with temporal lobe abscesses, 3 with cerebellar abscesses and no subdural empyemas were seen. In all, there were 27 patients with 43 complications and there was only one death.

This dramatic improvement in management was further illustrated by Gower and McGuirt (1983) who reported 100 patients with otogenic intracranial sepsis and only 6 had brain abscesses. The overall mortality was 10 per cent.

Management Policy

These patients are jointly managed by the Neurosurgical and Otolaryngology Departments from the onset with aggressive medical and surgical approaches. CT scanning has proved the most effective diagnostic investigation for intradural complications and lumbar puncture is contra-indicated. The diagnosis of a cholesteatoma is made clinically and radiology may be misleading.

In general, the neurosurgical management takes precedence and is directed at:

(i) *Lowering the raised intracranial pressure.* This is directed at three broad causes:

(a) *The mass effect of the abscess.* The pus is aspirated *via* a burr hole with a blunt brain cannula. The injection of antibiotics into the abscess cavity is controversial and its value has never been proven. Injection of radio-opaque material such as sterile barium or Thorotrast is no longer practised at Groote Schuur Hospital, as serial CT scans have replaced these serial pyograms. Repeated aspirations of temporal lobe abscesses are performed until resolution and formal excision reserved for resistant cases. This policy is even more conservative when the dominant temporal lobe is involved. With cerebellar abscesses, however, routine formal excision is undertaken after an initial tap because of potential rapid fatal consequences. Subdural empyemas are drained *via* multiple burr holes or craniotomy depending on the extent of the pathology.

(b) *Surrounding oedema.* Steroids (dexamethasone) are used routinely with good effect even with the theoretical disadvantages of decreasing the inflammatory response and limiting antibiotic penetration. This takes 6–12 hours to be effective so in case of suspected cerebral herniation, osmotic diuretics (Mannitol) are used.

(c) *Hydrocephalus.* This is exceptionally rare with temporal lobe abscesses, but a common complication of cerebellar abscesses. In these cases a ventricular drain is inserted. This is left in until normal cerebrospinal fluid circulation is re-established—usually about 1 week. Rarely, however, there is irreversible CSF pathway obstruction and a ventriculo-peritoneal shunt is inserted after all the infection is controlled.

(ii) *Treating abnormal neurological function.* Anticonvulsants (phenytoin sodium) are used routinely in supratentorial abscesses. If no seizures occur by the time the abscess is considered cured, medication is stopped. In the event of seizures occurring, anticonvulsants are retained until a two-year seizure-free period has elapsed. Neurological deficits must be managed by rehabilitation using physiotherapy, occupational therapy and speech therapy services.

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(iii) *Treating infection.* Control is obtained from aggressive surgical and medical approaches. Intravenous ampicillin, chloramphenicol and metronidazole are used initially until the bacterial culture and sensitivity are obtained.

Mastoid surgery

Following the neurosurgical drainage, definitive mastoid surgery is undertaken under the same anaesthetic. With mastoiditis in the absence of a cholesteatoma, a full cortical mastoidectomy with exposure of the middle and posterior fossa dura is performed. Any extradural collection of pus is removed and the sigmoid sinus examined for patency. When a cholesteatoma is present, a radical mastoidectomy is performed, again with exposure of the middle and posterior fossa dura. There is no place for canal-up technique in these patients. However, an initial drainage procedure in very ill patients may be followed by a definitive radical mastoidectomy once the patient is well enough to withstand a longer operation.

Post operative management

Essential in the management is the close monitoring of these patients following surgery using clinical, haematological and radiological (CT Scan) parameters. Regular full neurological examination are imperative, as intracranial pathology may manifest up to three weeks after the mastoid infection has been controlled. Repeated CT scanning may be indicated and a persistently raised ESR or white cell count may alert the clinician to residual pathology. Antibiotics are maintained for a further two weeks after all signs of infection have been controlled, often 4 to 6 weeks depending on the case.

Conclusions

Mastoiditis associated with cholesteatoma still remains a dangerous disease and, in the Groote Schuur Hospital experience, 44.6 per cent of these patients had intradural sepsis. CT scanning should be used routinely pre-operatively in patients with clinical cholesteatoma in the presence of acute infection, so that early neurosurgical management can be effective. The deaths that occurred, did so when there was a delay in effective management, either by late presentation or initial misdiagnosis. With greater awareness, early diagnosis and aggressive medical and surgical management, the prognosis for patients even with intradural extension of otogenic sepsis should be excellent.

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