Management of subdural intracranial empyemas should not always require surgery

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SUMMARY Seven patients with subdural empyema were initially treated by antibiotics without surgery. Six have recovered without sequelae. One required delayed surgery and has recovered with epilepsy. The authors emphasise the use of CT for the diagnosis and follow-up of subdural empyema, the principles and modalities of non-surgical treatment, and the good results, especially for late morbidity.

From the medical literature, it is evident that, even when antibiotics became available, most authors have agreed there is need for surgery in all intracranial subdural empyemas.1–3 However, this treatment has not prevented serious mortality1 4 and sequelae.1 5 Since the use of CT for the diagnosis of various central nervous system suppurations,6 7 some authors have treated brain abscesses,6 8–10 extradural/intracranial abscesses11 and even spinal epidural abscesses7 without surgery. We report here the results obtained with 7 patients with subdural empyema treated without surgery.

Case reports

The first three patients have been the subject of a previous report in a review about clinical and radiological findings in subdural empyemas. The second patient’s history is reported in detail, and the six others are summarised in the table. Each patient’s CT scan, before and after treatment, is shown in the figs 1–5.

Patient 2
This 19-year-old woman had a 1 week history of fever and bifrontal headache and received each day amoxicillin (1 g orally) for 4 days. She was admitted to the neurological department on 13 April 1982 with fever (38°5), headache and vomiting. She was lethargic, with a left hemiplegia and a palsy of both external recti. Her neck was stiff. Generalized seizures occurred. CSF contained 900 white cells/mm3 (100% polymorphonuclear), protein 0·6 mg/l and glucose 0·6 g/l. ESR was 120 mm/h and WBC count was 15000 (80% polymorphonuclear). CT (fig 2a) revealed an interhemispheric area of low density with an enhanced thin margin after contrast and compression of cerebral and ventricular structures. No causative organism was isolated from CSF or blood cultures. Skull radiographs showed opacification of the right maxillary and frontal sinuses. The patient was treated with ampicillin (12 g IV), sisomicine (150 mg IM) and trimethoprim-sulfamethoxazole (320 mg=1600 mg IV) for 6 weeks, then by oral amoxicillin 6 g daily for 4 months. Clonazepam (3 mg IV) was added during the first 48 hours and mannitol during the first 5 days. When the treatment was stopped, she had no neurological deficit and CT scan (fig 2b) showed no abnormalities. Thirty months later, she had had no seizure, and did not receive anticonvulsant medication.

Discussion

The use of CT for diagnosis and follow-up
As in brain abscesses,6 a non-surgical treatment of subdural empyemas is possible only if CT can be performed. It reveals small empyemas which could not be diagnosed otherwise, as in the second case reported by Rosazza:13 this was a patient with purulent meningitis and without any focal deficit, in whom CT showed a small subdural empyema. CT also allows easy and atraumatic follow-up.2 14

The classical treatment of subdural empyemas
For most authors, surgery is always required in all subdural empyemas: they often prefer a large craniotomy1 3 15 16 to burr holes, so as to provide purulent material and allow an irrigation of the subdural space with antibiotics.16 For these authors, the surgical treatment must be performed in emergency, but Pimontel-Appel14 prefers to wait for an improvement of the neurological state, 24 to 48 hours after the onset of antibiotic therapy. In spite of the possibility of improvement with surgical treatment, the importance of antibiotics cannot be neglected.

The first successfully treated cases occurred only
Table  Cases of non-surgically treated subdural empyemas

<table>
<thead>
<tr>
<th>Authors</th>
<th>Sex and age (yr)</th>
<th>Clinical signs</th>
<th>CSF Cells</th>
<th>P</th>
<th>G</th>
<th>ESR mm/h</th>
<th>WBC/mm³</th>
<th>CT scan</th>
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<tbody>
<tr>
<td>Rasaza¹³</td>
<td>M 14</td>
<td>fever, headache, left hemiplegia</td>
<td>33</td>
<td>1200</td>
<td>720</td>
<td>?</td>
<td>17400</td>
<td>IH SDE</td>
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<td>Rasaza¹³</td>
<td>M 11</td>
<td>fever, meningism</td>
<td>316</td>
<td>1500</td>
<td>721</td>
<td>?</td>
<td>17300</td>
<td>IH SDE</td>
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<tr>
<td>Case 1 802284</td>
<td>M 29</td>
<td>fever, focal seizures, generalised status</td>
<td>830</td>
<td>800</td>
<td>500</td>
<td>26</td>
<td>11600</td>
<td>IH SDE, left PA SDE (fig 1)</td>
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<tr>
<td>Case 2 820869</td>
<td>F 19</td>
<td>fever, generalised seizures, left hemiplegia</td>
<td>900</td>
<td>600</td>
<td>600</td>
<td>120</td>
<td>15000</td>
<td>IH SDE (fig 2)</td>
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<tr>
<td>Case 3 821121</td>
<td>M 22</td>
<td>fever, focal seizures, coma, right hemiplegia</td>
<td>50</td>
<td>550</td>
<td>700</td>
<td>85</td>
<td>15100</td>
<td>FR SDE (fig 3)</td>
</tr>
<tr>
<td>Case 4 830286</td>
<td>M 40</td>
<td>fever, generalised seizures, right hemiplegia</td>
<td>5</td>
<td>400</td>
<td>800</td>
<td>60</td>
<td>13000</td>
<td>FR SDE (fig 4)</td>
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<tr>
<td>Case 5 831075</td>
<td>M 56</td>
<td>fever, generalised status, right hemiplegia, meningeism</td>
<td>50</td>
<td>400</td>
<td>500</td>
<td>100</td>
<td>22000</td>
<td>whole convexity SDE (fig 5)</td>
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<tr>
<td>Case 6 840544</td>
<td>M 15</td>
<td>fever, meningism</td>
<td>80</td>
<td>300</td>
<td>500</td>
<td>15</td>
<td>6000</td>
<td>FR SDE (fig 6)</td>
</tr>
<tr>
<td>Case 7 841050</td>
<td>F 24</td>
<td>fever, focal and generalised seizures, coma</td>
<td>100</td>
<td>1100</td>
<td>740</td>
<td>80</td>
<td>12000</td>
<td>IH SDE, TE SDE (fig 7)</td>
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</tbody>
</table>

M, male; F, female; P, proteins (mg/l); G, glucose (mg/l); SDE, subdural empyema; IH, interhemispheric; PA, parietal; FR, frontal; TE, temporal; TR, total recovery; Ampi, ampicillin; TMP-SMX, trimethoprim-sulfamethoxazole; Siso, sisomicine; Amox, amoxicillin; Metro, metronidazole; PRIS, pristinamycin.

Why have we tried a non-surgical treatment?
Surgery has usually been performed as an emergency because of two objections to a non-surgical treatment: firstly, antibiotics do not penetrate into loculated intracranial suppurations, and secondly, it is necessary to know the causative organism and its sensibility to antibiotics after the introduction of penicillin.¹⁷ More recently, ampicillin and especially chloramphenicol have been preferred, because of their good diffusion into the central nervous system¹³¹⁸ and their effectiveness on anaerobic organisms, which are frequently isolated from subdural empyemas.¹⁸

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Fig 1  (Patient 1) (a) On admission: interhemispheric and left parietal subdural empyema. (b) After a 30 day course of antibiotics: disappearance of the most part of the empyema, but increase of the posterior part. (c) A year later: no residual empyema.
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<table>
<thead>
<tr>
<th>Point of entry</th>
<th>Organism</th>
<th>Treatment</th>
<th>Associated medications</th>
<th>Clinical outcome</th>
</tr>
</thead>
<tbody>
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<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, Chloramphenicol (3 weeks IV, 5 weeks orally)</td>
<td>Dexamethazone</td>
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<td>sinusitis</td>
<td>staphylococcus</td>
<td>Ampi IV, 6 weeks</td>
<td>sinusitis drainage</td>
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<td>unknown</td>
<td>Ampi IV, 6 weeks</td>
<td>Tetracosactide</td>
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<tr>
<td>sinusitis</td>
<td>streptococcus</td>
<td>Ampi IV, TMP-SMX, Siso IM</td>
<td>Mannitol, Clonazepam</td>
<td>seizures</td>
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<td>unknown</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Mannitol, Clonazepam</td>
<td>TR</td>
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<tr>
<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Amox 4 months</td>
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</tr>
<tr>
<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, TMP-SMX, Metro</td>
<td>Mannitol, Clonazepam</td>
<td>TR</td>
</tr>
<tr>
<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Mannitol, Clonazepam</td>
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</tr>
<tr>
<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Mannitol, Clonazepam</td>
<td>TR</td>
</tr>
<tr>
<td>sinusitis</td>
<td>unknown</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Mannitol, Clonazepam</td>
<td>TR</td>
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<tr>
<td>sinusitis</td>
<td>post-traumatic</td>
<td>Ampi, TMP-SMX, PRIS 3 months</td>
<td>Mannitol, Clonazepam surgical treatment</td>
<td>TR</td>
</tr>
<tr>
<td>sinusitis</td>
<td>post-traumatic</td>
<td>Ampi, TMP-SMX, Siso</td>
<td>Mannitol, Clonazepam</td>
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</table>

antibiotics. To our knowledge, antibiotic has never been found in the pus of subdural empyemas, as it has in brain abscesses; nevertheless, in our cases 2 to 7, antibiotics were sufficient to improve the patients' state and to normalise the CT scan. In two of Rosazza's cases and in Rousseaux' case, antibiotics had also been able to cure such lesions. Our first patient was surgically treated one month after the onset of the antibiotherapy: his neurological condition had improved, but surgery was decided because the size of the most posterior part of the empyema had gradually increased; this patient was our first medically treated patient but now, with Rosazza and Rousseaux' experiences, and from our next six patients, we think that it would have been possible to treat him without surgery. In Kaufman and

Fig 2 (Patient 2) (a) On admission: interhemispheric subdural empyema. (b) During the 6th month: CT scan is normal.

Fig 3 (Patient 3) (a) On admission: frontal subdural empyema. (b) Eight months later: no residual empyema.
Holtzman\textsuperscript{1} 22 cases, the neurological condition deteriorated in spite of antibiotics. We are not sure whether the dosage was sufficient, but, in our cases, although the patients often showed a little deterioration during the first 24 or 48 hours, we always continued the same treatment. So, we think that antibiotics are probably able to penetrate into subdural empyemas. The pus has been free of organisms in our patient 1 and reported by Borzone \textit{et al.}\textsuperscript{23} This penetration is perhaps made possible by an unusual development of meningeal arteries, as in our third case, which brought large quantities of antibiotics in the margin of the empyema.\textsuperscript{24 25}

It is not always necessary to know the causative organism from the empyema itself. In our seven cases, the causative organism was found only in the first patient, from blood cultures. Surgery is not indicated for identification of the organism as in brain abscesses; this is possible in less than 50\% of the operated cases, and in 30\% of the non-surgically treated ones, from blood or CSF cultures, or from the point of entry; moreover, the organism is, in most cases, sensitive to large spectrum antibiotics used intravenously with high doses.

\textit{Modalities of the medical treatment}

We have used intravenous antibiotic therapy for 4 to 6 weeks and oral antibiotics until the CT scan was normal in all cases except the first in which the patient himself stopped the treatment in the sixth week. We think it is possible to stop earlier, as in Rosazza' cases,\textsuperscript{13} but care is required to ensure sterilisation of these lesions. Clonazepam was used when generalised seizures occurred. Corticosteroids have been avoided during the acute phase as they prevent antibiotics from penetrating into the abscesses.\textsuperscript{8} To prevent oedema, 10\% hypertonic mannitol was used during the first few days. Of course, surgical treatment might have been necessary for patients who were rapidly deteriorating neurologically with medical treatment. However, in our second and seventh cases, a little deterioration did not lead to surgery. In four cases, antibiotics alone were sufficient to treat the initial infection of paranasal sinuses; in one case, delayed surgery prevented relapse and in two cases, early surgery was necessary to treat the paranasal sinusitis.

\textbf{Results}

With classical treatment, associating emergency surgery and antibiotics, the mortality was high\textsuperscript{1 23 26 – 28} and sequelae (focal deficits or epileptic seizures) were frequent.\textsuperscript{1 5} In our cases, only one patient had sequelae, (generalised seizures) and he had
been operated upon. After 6 to 30 months, the other six have no focal deficit or seizure. The three other patients previously reported in the literature, also have had no sequelae.

For these 10 cases, summarised in the table, the morbidity and mortality obtained by medical treatment alone seem better than those by surgical treatment, as also shown in brain abscesses. Many studies have shown that the most important prognostic factor in intracranial infection is the level of consciousness when the treatment is commenced. Three patients (cases 2, 4, 6) were not in coma and they may therefore have been expected to have a better prognosis, no matter how they were treated. Nevertheless, the four others were in coma, and three had total recovery, and one little sequelae. In the literature, with surgery, the mortality and morbidity seem higher.

A long period of intravenous treatment may be a financial disadvantage as compared with perhaps a more rapid response to surgical drainage, leading to earlier discharge and cheaper overall treatment; nevertheless, shorter treatments are possible, as in our first patient, and it would be possible to discharge these patients earlier in the future, when our experience will be greater. Moreover, less sequelae is also a financial advantage.

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References

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