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Sinusitis-induced subdural empyema

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Abstract

Over a 17 year period, 1975–91, 10 children were managed who had sinusitis-induced subdural or extradural empyema. Their ages ranged from 6 to 14 years, with a mean of 11 years. All presented with worsening headaches, fever, vomiting, all had neurological abnormalities, and all had symptoms or signs suggestive of sinusitis. Initial computed tomography gave normal results in five cases and the empyema was diagnosed on the second or third scan. All patients had symptoms for at least one to two weeks before the diagnosis was made. *Streptococcus milleri* was the organism most frequently implicated. Medical treatment was started in all cases on admission, but all required surgical intervention before resolution.

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Subdural or extradural pyogenic collections most commonly arise by direct extension of infection from meningitis or the sinuses. Subdural empyema secondary to bacterial meningitis tends to occur in small infants,[1] and is usually recognised clinically, readily diagnosed by computed tomography, and managed relatively early. Subdural or extradural empyema secondary to sinusitis, so called 'sinusitis-induced' empyema,[2] occurs in older children and is responsible for 50–70% of all subdural empyemas.[1 3] The clinical presentation of sinusitis-induced empyema is less well recognised and the diagnosis often delayed. Recent series of subdural empyema associated with sinusitis describe it as an illness predominantly of adolescent and young men, characterised by the rapid development of stupor, nuchal rigidity, seizures, and hemiparesis.[2 4] However the onset may be much more variable and often masked by prior antibiotic treatment.[3]

We report a review of cases of subdural and extradural empyema associated with sinusitis seen at our hospital over a 17 year period 1975–91.

Methods

A search was made of the medical records of all children admitted to this hospital in the years 1975–91 inclusive, with a discharge diagnosis of subdural, extradural, or cranial empyema or abscess, sinusitis, or frontal osteomyelitis. A case was defined as having sinusitis-induced subdural or extradural empyema if there was radiological and/or operative evidence of a subdural or extradural purulent collection, and of sinusitis.

Results

Over the period 1975–91 a total of 10 children were found to have had sinusitis-induced subdural or extradural empyemas. Seven children had a subdural empyema, two had a extradural empyema, and one child had both.

PRESENTATION

The age range of the children with sinusitis-induced empyemas was 6 to 14 years (mean 11 years). Seven were over 9 years and seven were boys. Their symptoms, presentation, and findings are shown in tables 1 and 2. At admission, all 10 children complained of headache, nine had fever, eight had some neurological signs and the remaining two were lethargic. Two children were admitted 24 hours after sudden onset of fever, headache, seizures, and abnormal behaviour. Both also had periorbital swelling. They remained at a local hospital for a week, with an uncertain diagnosis. In both cases two weeks elapsed before the subdural empyema was diagnosed. Despite the initial speed of onset of symptoms, they did not progress over this time. One child had pustules that appeared over the forehead and another, with a bulging swelling of his forehead, had a true Pott's puffy tumour.

All 10 children had some symptoms or signs by admission, which could be attributed to acute bacterial sinusitis, but rarely recognised as such, that is tenderness or pain over the sinuses, purulent nasal discharge, or periorbital swelling. Only one child was diagnosed clinically as having sinusitis. She was admitted for treatment of this. In four children no mention of the sinuses was made on admission.

Table 1 Presenting characteristics of children with sinusitis induced subdural and extradural empyema

Patient No	*Age (years)*	*Sex*	*Duration of symptoms to presentation (days)**	*Total duration to diagnosis (days)†*	*No of scans to diagnosis*	*No of days from 1st to final scan*
1	10	M	10	17	3	3
2	12	M	5	8	1	
3	9	M	1	17	2	10
4	13	M	7	9	1‡	
5	7	M	6	25	2	21
6	12	F	14	14	1	
7	13	F	5	9	2	3
8	6	F	12	12	1‡	
9	14	M	1	12	1	
10	14	M	14	18	2	4

*Duration of symptoms up to presenatation at first hospital (local or teaching).
†Duration of symptoms from onset to diagnosis, that is *plus time in hospital before diagnosis made.
‡Brain scan (before the availability of computed tomography).

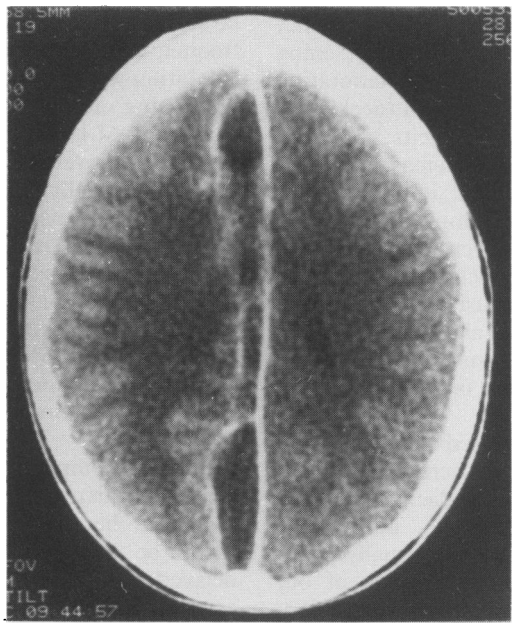
Table 2 Presenting clinical features of 10 children with sinusitis induced subdural or extradural empyema

Symptoms	*No of cases*
Headache	10
Fever	9
Vomiting	7
Seizures	6
Periorbital swelling	5
Lethargy	4
Irritability	3
Ptosis	3
Papilloedema	3
Hemiparesis	3
Neck stiffness	2
Tenderness over sinus	2
Rhinitis	2
VI nerve palsy	1

DIAGNOSIS

Plain radiographs or computed tomograms showed frontal, maxillary and/or ethmoid sinusitis in nine patients. In the last patient no radiography was performed but sinus infection was found at surgery. Three children had osteomyelitis, two of the frontal bones and one of the ethmoid. Seven of our 10 children had a lumbar puncture, including two with papilloedema. All had the typical picture associated with a subdural empyema,[3] of a mild pleocytosis, usually with $10–100 \times 10^9/l$ white cells and sterile culture (see table 3). No patient had any side effects from the lumbar puncture.

There was always some delay in the diagnosis of empyema, which was made from eight to 25 days after the onset of symptoms. Patients experienced symptoms for up to 14 days before admission, and a further one to 19 days after admission, before the empyema was diagnosed. This delay occurred whether or not antibiotics were given. Five of the children had computed tomograms which did not show the empyema, before a definitive abnormal scan was obtained between three to 21 days later (see Figure). A minimum of eight days of symptoms occurred before the collection was picked up radiologically. After diagnosis surgery was usually carried out within a few days, although one child was medically treated for two weeks before surgery.



Computed tomogram of brain with sinusitis-induced subdural empyema. This shows an extensive collection of pus in the frontal subdural space, extending posteriorly along the flax.

ORGANISMS

In eight of our 10 patients, an organism was grown from the blood and/or the abscess, although all but one of the children had been receiving antibiotics before culture. *Streptococcus milleri* was the most common causative organism, being the sole organism grown in four of our patients. *Streptococcus mitis*, a group C streptococcus, bacteroides, and *Staphylococcus aureus* were each grown from blood or abscess in one patient. These organisms are similar to other studies[1 2 4] with streptococci being the most common organism present. Blood cultures were positive in four patients.

TREATMENT

All children were started on intravenous antibiotics on admission, often continuing for periods of one to two weeks before the empyema was diagnosed, usually a combination of penicillin, chloramphenicol, or a cephalosporin. All children had some form of surgery (table 3), and three required repeated procedures. Four children received two to three weeks of antibiotics before surgery. However none of the children improved before surgical drainage. Only two of the four children who had burr holes recovered with one operation. Of the six with craniotomy, only one required further intervention. Those who required multiple procedures were the patients who grew bacteroides and *S aureus*.

Table 3 Infectious characteristics of children with sinusitis induced subdural and extradural empyema

Patient No	*Organism*	*Site of empyema*	*Initial lumbar puncture (WCC×10⁹/l*)*	*Treatment*	*Osteomyelitis site*	*Follow up*
1	Streptococcus C (blood culture)	Right subdural	0	Burr holes	—	Normal
2	No growth	Left frontal, subdural	25	Craniotomy	—	Normal
3	No growth	Left subdural	7	Craniotomy (multiple)	—	Hemiplegia, resolved three months; epilepsy, hydrocephalus
4	*S aureus* (abscess)	Left subdural/ extradural	9	Burr holes+ craniotomy	—	Normal
5	*S milleri* (sinus) *S mitis* (abscess)	Left extradural	63	Craniotomy	Ethmoid	Normal
6	*S milleri* (abscess)	Left subdural	—	Burr holes	—	Epilepsy
7	*S milleri* (blood culture, abscess)	Left extradural	—	Craniotomy	—	Hemiplegia and dysphasia, resolved six weeks
8	Bacteroides (abscess, blood culture)	Left subdural	28	Burr holes ×3	—	Normal
9	*S milleri* (abscess, blood culture)	Right subdural	9	Craniotomy	Frontal	Normal
10	*S milleri* (abscess)	Right subdural	—	Craniotomy	Frontal	Normal

*WCC = white cell count.

OUTCOME

There were no deaths. Seven children had no residual neurological sequelae on discharge from hospital. Two children had persistent epilepsy, one of whom had hydrocephalus. Two children had hemiparesis, which resolved in six to 12 weeks (table 3).

Discussion

The age and sex distribution of our patients was similar to previous studies, confirming sinusitis-induced subdural empyema to be a condition mainly of adolescent children, with boys predominating over girls by about 3:1.

The severity of the presenting symptoms in our children varied, but they were quite consistent in their nature. Wald *et al* described the characteristic signs and symptoms of sinusitis-induced empyema by dividing them into four groups: those due to pansinusitis (mild headache, pyrexia), raised intracranial pressure (worsening headache, intractable vomiting, deteriorating consciousness), meningeal irritation (neck stiffness), and focal neurological deficits.[5] She also suggested that extradural empyemas cause less cortical involvement and less impairment of consciousness than subdural empyemas.

The majority of our children had had symptoms for one to two weeks before presentation, initially those of simple sinusitis, that is fever, mild headache and malaise, although they were often not recognised as such, and usually treated non-specifically with oral antibiotics by the family doctor.

Symptoms usually progressed over the second week as signs of raised intracranial pressure developed, that is worsening headache, vomiting, seizures, and lethargy. Seizures, behavioural changes, and periorbital swelling usually precipitated hospital admission. Only two of our patients showed signs of meningeal irritation. Neurological signs were present in seven children. If lethargy and abnormal behaviour are also included, then all our patients had some clear neurological abnormality on admission. Indications of a more terminal illness, such as coma and cerebral herniation, were not seen in any of our children, although three had a hemiparesis, which Wald *et al* describe as a late sign.[5]

Diagnosis took between one and three weeks from the onset of symptoms in all children, due to a combination of a delay in presentation to hospital, and delay in recognition at this hospital or the referring one. Sinusitis was evident on initial scan or radiograph in all cases, but in five cases the initial computed tomogram did not show empyema. A collection took one to two weeks to show with repeated scanning. It is uncertain whether the empyema developed later or whether a small early collection was missed on the initial scan. Early or small collections may be missed for a variety of reasons. In previous years early abscesses were less often established with the poor scanning quality and slow scan times of the first computed tomography machines, without high quality resolution capabilities. Interpreter errors of more subtle findings may occur. Early suppuration is isodense, but other changes may help such as 'mass effect' from associated cerebral oedema.[5] Finer 3–5 mm slices may be necessary rather than the more routine 10 mm ones. It is, however, still well recognised that abnormal findings on computed tomography may develop within one to seven days of a normal scan, and repeated scans are necessary if the diagnosis is still suspected.[2] Luken and Whelan describe four cases who had a subdural empyema demonstrated by angiography or operatively, within 24 hours of a normal computed tomogram.[6] It is not known whether magnetic resonance imaging would be more sensitive than computed tomography in diagnosing subdural empyema in these cases. Resolution has been reported to follow medical treatment alone,[2] but this is rare and has also been linked to increased mortality.[7] Some form of surgical drainage is usually required. Burr holes and irrigation may be sufficient in some cases, but craniotomy will frequently be required to give the best chance of resolution with least chance of further intervention being necessary. For example, Johnson *et al* reported 13 children with sinusitis induced subdural empyema.[8] All of the 10 who were initially medically treated developed radiological evidence of disease progression and seven had persisting signs. All improved after surgical drainage. Our series supports these observations.

The outlook in our small series was good. There were no deaths compared with a reported mortality of 18–40%.[1 3 8] Residual neurological sequelae were uncommon, occurring in only three of our children, and resolving with time in two.

Subdural empyemas will usually present to general paediatricians. Because the initial symptoms can be non-specific, the diagnosis can easily be overlooked and correct treatment delayed. Clinical suspicion of subdural empyemas should be highest in young adolescent children with a pyrexia of unknown origin that is associated with any neurological abnormality and symptoms or signs suggestive of sinusitis. Evidence from radiography or computed tomography of sinusitis should prompt repeated scanning of the head over the next few weeks until symptoms resolve or a diagnosis is made. Early diagnosis, treatment, and awareness of this rare but important condition are the mainstay of successful outcome.

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