

Streptococcus milleri as a cause of pleural empyema

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ABSTRACT Review of an annual series of cases of empyema seen at a regional cardiothoracic unit showed that six out of 25 were due to *Streptococcus milleri*. The details of the cases are summarised. This organism is now an important cause of empyema, occurring much more commonly in men than in women; but since it is highly sensitive to penicillins permanent resolution can be achieved with antibiotic treatment combined with open or closed drainage.

Pleural empyema, or pus in the pleural cavity, has been recognised since the time of Hippocrates.¹ *Streptococcus pneumoniae* was once the predominant pathogen but antibiotics and chemotherapy changed the pattern and by the late 1950s it had been replaced by *Staphylococcus aureus*.² The next decade showed an increase in enteric and other Gram negative organisms, particularly *Pseudomonas*,³ while recently the importance of anaerobes has been re-emphasised,⁴ confirming the work of Guillemot⁵ and others at the turn of the century. The failure to identify anaerobes with any frequency was probably due to failure to obtain adequate specimens, failure to optimise their transport and culture, and possibly the prior administration of antibiotics. In the series we discuss here one microaerophilic organism predominated—namely, *Streptococcus milleri*.

Patients and methods

Twenty five patients in an annual series of non-chronic, non-tuberculous empyema were included. These patients were seen at a regional cardiothoracic unit from August 1981 to August 1982. They were under the care of four surgeons. Many had been referred from other centres, and some had received antibiotics before admission. Specimens were obtained by thoracocentesis, thoracoscopy, and thoracotomy and appropriate management was instituted.

The specimens were cultured anaerobically and aerobically on selective blood agar and in Robertson's medium, which was subcultured at 48 hours

for both anaerobic and aerobic culture. In all cases acid fast bacilli and fungi were looked for. Shortly after case 9, the laboratory introduced the API 20 Strep (No 2060) system (API System, SA) for speciating streptococci encountered in medical practice, which incorporates 20 biochemical tests.

Results

The patients' sex and age, aetiology, causative organism or organisms, and management are indicated in the table.

In this series nine out of 25 infections (36%) were due to anaerobic organisms. Specimens from five of the 25 patients were sterile on culture. Fifteen different organisms were represented; the most common (6/25 cases) was *Strep milleri* (24%). Empyema due to *Strep milleri* was successfully treated by conventional methods, including closed intercostal drainage, rib resection, and decortication. In addition, appropriate antibiotics were prescribed. Penicillin was used alone in four cases, though in case 22 ampicillin was used initially for 24 hours. Patient 15 was treated with cephmandole followed by cephalexin and patient 19 with ampicillin and metronidazole together with noxythiolin irrigation. There were no deaths. Five out of six of the cultures grew *Strep milleri* in pure culture. The sex ratio was 5:1 (M:F) with an age range of 24–66 years. For the series as a whole the sex ratio was close to 2:1 and the age range 19–73. Attention should be drawn to case 9, in which the organism was identified as a microaerophilic streptococcus before speciation became available and empyema was associated with a pyogenic liver abscess and subphrenic collection of pus. This association has previously been reported for group F streptococci⁶ and is important in the light of the observation by Bartlett and Finegold

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Details of the patients, organisms isolated from the empyema, and the treatment given

No	Sex	Age	Causal factors*	Organisms	Treatment†
1	M	39	Pneumonia	<i>E coli</i>	Thoracocentesis
2	F	45	Pneumonia in diabetic alcoholic	<i>H influenzae</i> <i>H parainfluenzae</i>	Closed drainage
3	M	44	Pneumonia with lung abscesses	<i>E coli</i>	Decortication and lingulectomy
4	F	59	Dilatation of benign oesophageal stricture	<i>Strep faecalis</i> <i>Klebsiella</i> sp	Closed drainage
5	M	41	Thoracotomy and deep x-ray treatment for inoperable cancer	Anaerobic streptococci (not speciated)	Closed drainage
6	M	67	Pneumonia	<i>Strep viridans</i> (not speciated)	Thoracoscopy, irrigation, and closed drainage
7	M	23	Pneumonia	<i>Strep viridans</i> <i>Bacteroides</i> sp	Rib resection
8	M	73	Pneumonia	<i>Staph aureus</i> <i>Strep faecalis</i>	Rib resection
9	M	34	Pyogenic liver abscess and subphrenic abscess	Microaerophilic streptococci	Closed drainage of both cavities
10	M	40	Pneumonia	No growth	Closed drainage
11	F	43	Trauma	<i>Staph epidermidis</i>	Closed drainage
12	M	59	Pneumonia	<i>Strep milleri</i>	Rib resection
13	F	61	Drainage of malignant pleural effusion	No growth	Decortication
14	M	66	Pneumonia	<i>Strep milleri</i>	Closed drainage
15	F	43	Laparotomy (endometriosis) in alcoholic	<i>Strep milleri</i> <i>Bacteroides</i> sp	Rib resection
16	F	63	Pneumonia	<i>Strep pneumoniae</i>	Closed drainage
17	M	66	Pneumonia	No growth	Closed drainage
18	F	19	Pneumonia	No growth	Thoracoscopy and aspiration
19	M	28	Pneumonia (Werdnig Hoffman muscular dystrophy)	<i>Strep milleri</i>	Closed drainage
20	M	60	Talc pleurodesis for pleural effusion of unknown cause	<i>Staph aureus</i>	Closed drainage
21	M	17	Pneumonia (mentally subnormal)	No growth	Thoracoscopy and closed drainage
22	M	40	Spontaneous haemo-pneumothorax, intercostal drainage, and thoracoscopy	<i>Staph epidermidis</i>	Decortication
23	M	55	Pneumonia	<i>Strep milleri</i>	Rib resection
24	M	24	Pneumonia	<i>Strep milleri</i>	Decortication
25	M	37	Lobectomy for cancer	<i>Klebsiella</i> sp <i>Staph aureus</i>	Rib resection

*"Pneumonia" indicates preceding pneumonia.

†Not including appropriate antibiotics.

that abdominal anaerobic infections accounted for over 17% of cases of anaerobic empyema.⁴

Discussion

Streptococcus milleri is a species of viridans (that is, α haemolytic) streptococci, which differs from the others in being particularly associated with visceral abscesses⁷ and infected fluid cavities and also with infective endocarditis.⁸ On blood agar *Strep milleri* normally appears as small, often minute, non-haemolytic colonies, though occasional strains may produce haemolysis. They are usually considered as microaerophilic, but some strains require anaerobic conditions and the growth of all of them is enhanced by the presence of carbon dioxide.⁹ *Strep milleri* is distinguished from other viridans streptococci by a battery of tests described by Colman and Williams.¹⁰

It is serologically heterogeneous, 14% in one series⁹ having the group F antigen.

Strep milleri is part of the normal flora of the mouth and pharynx and in addition is part of the human intestinal flora.^{11 12} It seems likely that in common with other bacteria *Strep milleri* may arrive in the lung in several ways:¹³ (1) aspiration of oral secretions; (2) direct implantation—for example, by trauma or surgery; (3) by extension from a contiguous focus such as a subphrenic abscess; and (4) via the bloodstream from a distant focus.

There have been no previous reports specifically discussing the role of *Streptococcus milleri* in the aetiology of empyema; but in a recent report of infections caused by Lancefield group F and related streptococci¹⁴ two out of 28 infections were empyemas caused by *Strep milleri*, and in a report of serious infections notified to the Central Public

Health Laboratory in London during 1972 and 1974 *Streptococcus milleri* was recognised as a cause of empyema.¹⁵

Streptococcus milleri is exquisitely sensitive to penicillin, ampicillin, and the β lactamase stable penicillins, but is variably sensitive to other antibiotics often used to treat hospital acquired infection.^{14 16} It is often isolated in pure culture—in the series of Shalae *et al*¹⁴ in eight out of nine isolates and in our series in five out of six. This contrasts with the anaerobic organisms found in empyemas, which are often part of a polymicrobial process with an average of three different organisms per infection.¹³ The sex distribution in empyema caused by *Strep milleri* shows a striking male preponderance (5:1). This male preponderance is seen in all infections caused by *Strep milleri*.¹⁴

The cases in this series show that *Streptococcus milleri* was the causative organism in at least 24% (6/25) of consecutive patients with pleural empyema admitted to a regional unit and together with cases from published reports on *Strep milleri* indicate that this is an important aetiological agent in pleural empyema.

The tendency to form empyemas correlates well with the organism's predilection for abscess formation and infected fluid cavities elsewhere in the body.^{15 8} Its great sensitivity to penicillin, however, means that with a combination of antibiotic treatment and either open or closed drainage permanent resolution of the empyemas can be achieved.

Streptococcus milleri is often isolated in pure culture, much more commonly from males than females. The organism is likely to be reported with increasing frequency as more laboratories begin to speciate streptococci, and we wish to draw attention to its prevalence.

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