REVIEW

β Haemolytic streptococci and musculoskeletal sepsis in adults

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Abstract

Lancefield group A streptococci (GAS) account for 3–17% cases of septic arthritis, but other β haemolytic streptococci (BHS) (groups B, C, and G) are being increasingly implicated. Epidemiological evidence suggests that the increase of BHS sepsis in adults is a true increase and not simply a reflection of better reporting. While underlying predisposing disease and old age are common concomitants of BHS sepsis, some subjects with devastating disease have been young and healthy. This is particularly the case for highly virulent M1 serotypes of GAS, where a toxic shock-like syndrome has led to a number of deaths in young adults in the United Kingdom and elsewhere. Musculoskeletal features, such as myalgias, painful swollen limbs, myositis, and fasciitis, are important features of this condition, so that rheumatologists may be involved in management. Group C and G musculoskeletal sepsis remains uncommon, with a high prevalence of underlying predisposing disease, or pre-existing arthritis in the septic joint. Group B BHS septic disease appears to be increasing in incidence. Musculoskeletal sepsis with these organisms usually takes place in subjects with other diseases, but healthy subjects have not been spared. Multiple septic foci and a rapidly destructive arthritis are not uncommon, and a recently described extra-articular feature is potentially blinding metastatic endophthalmitis. Clinicians need to be aware of an apparently increasing incidence of BHS musculoskeletal sepsis in adults so that early identification can lead to aggressive management in these potentially fatal infections.

(*Ann Rheum Dis* 1993; 52: 483–487)

In reviews of septic arthritis β haemolytic streptococci (BHS) only account for 3–17% of all cases of septic arthritis.^{1–4} Group A streptococci (GAS) are the most common of the BHS to cause septic arthritis.^{1–5} Septic arthritis due to GAS is probably relatively benign in comparison with similar infections caused by other organisms. A review comparing outcomes of GAS septic arthritis with staphylococcal and Gram negative disease

found that there was less mortality, more frequent complete recovery of joint function, and fewer poor results.⁶ Possibly, septic arthritis consequent on groups B, C, and G streptococci (referred to as GBS, GCS and GGS respectively hereafter) is more complex and less benign than that due to GAS,^{7–11} though this may be owing to a higher prevalence of underlying predisposing disease in patients in the last three groups. Publications on streptococcal septic arthritis abound with anecdotal case reports of other unusual streptococci affecting peculiar joints with strange outcomes. Although the intensive study of individual cases can be instructive, it is probably more useful for the practising rheumatologist to be made aware of recent trends in the epidemiology of sepsis consequent on BHS, and to have highlighted some of the important clinical manifestations and management.

Bacteraemia due to BHS accounts for only about 5% of bacteraemias in the United Kingdom, though this proportion is increasing.^{12–13} This can be explained in part by improved reporting, more rigorous investigation of patients, increasing popularity of blood cultures as a diagnostic test, and changes in the epidemiology and aetiology of bacteraemia in an increasingly elderly population.^{12–15} There are, however, worrying trends to suggest that minor and serious infections from all BHS are truly increasing in frequency.^{6–16–22} In the era following the introduction of antibiotics most serious infections have been considered to take place in patients with underlying predisposing conditions, such as malignancy, diabetes, alcoholism, drug abuse, and in neonates and the elderly.^{16–23–27} Although these groups of patients remain at high risk, recent outbreaks of BHS have sometimes afflicted healthy subjects with serious life threatening infections. This is probably owing to changes in the virulence of organisms (particularly the increase in GAS M1 serotype^{22–28}). As was considered in a previous paper on rheumatic fever in adults, recent outbreaks have been associated with highly mucoid virulent GAS, so that in some of the military rheumatic fever epidemics there was a marked rise in significant suppurative disease, such as axillary lymphadenitis and tonsillar abscesses.^{29–30} Reactive and septic phenomena may therefore present concomitantly as they may be triggered by the same organism in different hosts.

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Accepted for publication
27 January 1993

Table 1 Important clinical features of group C streptococcal septic arthritis

- 1 Very rare: only 12 fully documented cases in English publications
- 2 3/12 significant predisposing disease and 6/12 significant pre-existing arthritis
- 3 Skin most common primary focus; usual presentation related to the joint with concomitant fever; knee most common joint, polyarticular in 5/12
- 4 All isolates sensitive to penicillin, but 6/12 needed more extensive drainage than a needle, and two patients developed persistent sterile synovitis
- 5 3/11 radiographic deterioration of joint, 2/11 decreased joint movement, but extra-articular features of sepsis more important determinants of outcome than articular
- 6 Some reports of associated or isolated osteomyelitis

See references 11, 31, and 33.

Serious infection due to GAS and GBS is more common in most series than that due to GCS and GGS.^{5 12 16 26} Septic arthritis due to GCS and GGS has been reviewed recently,^{11 31 32} and the important clinical features of infection with these organisms, together with lessons from recent case reports,³³⁻³⁵ are considered in tables 1 and 2. This section will concentrate on recently described severe GAS suppurative disease manifestations that might present to a rheumatologist, and septic arthritis and extra-articular manifestations that have recently been associated with GBS.

Severe septic syndromes and group A β haemolytic streptococci

There is evidence to show that incidence of the highly virulent M1 serotype of GAS is increasing in the United Kingdom,^{23 28} the USA,³⁶ and Scandinavia.³⁷ In England, for example, the proportion of M type 1 strains increased from about 1% in 1980 to 30% in 1987.²⁸ These series have been associated with high fatality.³⁸ One alarming manifestation has been the recognition of a dramatic and devastating toxic shock syndrome, which bears some resemblance to staphylococcal toxic shock syndrome but differs in certain clinical respects. Streptococcal toxic shock syndrome was first described in 1987 in two cases,³⁹ and this account was followed by a number of similar case reports from the United States, Eastern Europe, and Australia.⁴⁰ A British report in 1988 highlighted a progressively increasing incidence of fatal GAS infections between 1980 and 1987, with a concomitantly increasing proportion of these isolates accounted for by type M1.²⁸ In the same year three healthy young adults from the south of

Table 2 Important clinical features of group G streptococcal septic arthritis

- 1 Rare: only 47 fully documented cases in English publications, 13 of whom had infection of prosthetic joints
- 2 33/47 significant predisposing disease and 11/34 significant pre-existing arthritis
- 3 Cellulitis and endocarditis most common primary foci; knee most common joint, polyarticular in 17/47
- 4 All isolates sensitive to penicillin, but 13/47 needed more extensive drainage than a needle. 12/13 prosthetic joints settled without removal
- 5 No reported radiographic deterioration of joint or decreased joint movement
- 6 Some reports of associated and isolated osteomyelitis. Some reports of isolated pyomyositis

See references 32, 34, and 35.

England were reported with cellulitis due to GAS M1 type, and a rash typical of scarlet fever.⁴¹ All three presented with a swollen painful leg. They subsequently developed multisystem organ failure, and despite prompt treatment with high doses of benzylpenicillin, two died. More recently a number of case reports have highlighted tragic deaths in similar circumstances in young puerperal women.⁴⁰

The number of reports of GAS infections was increased in 1989 by 20 patients with a similar syndrome from the Rocky Mountain states, USA.⁴² Rheumatologists should be aware of this syndrome, as an impressive primary focus of soft tissue or skin was rapidly followed by the development of myositis or fasciitis, or both, with multiorgan system failure. Severe pain in an arm or leg and myalgias were common early symptoms. What bears testimony to the virulence of the triggering organism is that 13 of the 20 patients in the 1989 series were healthy young to middle aged adults (with a further two intravenous drug abusers, two alcoholics, one diabetic, and two with other underlying conditions). The characteristic features on admission were those of cutaneous swelling, redness or bullae, or both (with subsequent desquamation in some cases), fever, confusion, and hypotension. Ninety five per cent developed shock, 55% adult respiratory distress syndrome requiring assisted ventilation, 85% renal impairment, and two patients were left with irreversible damage requiring dialysis. Nine patients required fasciotomy, two of whom went on to amputation. The mortality was 30%. Three out of 10 typed GAS were M1 and three were M3, which has also been reported in association with invasive disease and rheumatic fever.^{36 43 44} Eight of 10 isolates produced streptococcal pyrogenic toxin A, which was previously described in scarlet fever epidemics before 1940⁴⁵ and has begun to re-emerge in invasive infective epidemics in the USA.^{39 46} It seems to act as a superantigen, binding to the V β region of the T cell receptor,⁴⁷ thus leading to polyclonal activation of T cells, and accounting in part for its diverse biological activities as a pyrogen, enhancer of endotoxic shock, and cause of multiorgan damage.⁴⁰ Interestingly, a British report of isolates from fatal GAS infections failed to find any production of streptococcal pyrogenic toxin A, but identified a high prevalence of the related streptococcal pyrogenic toxin B.⁴⁸ The multiorgan toxicity related to these microbes probably resides in a number of different bacterial products.

Musculoskeletal sepsis and group B β haemolytic streptococci

Data from the Communicable Diseases Surveillance Centre at Colindale, London, show that the number of adults with GBS bacteraemia has steadily increased since 1975, though this still only constitutes 1% of all bacterial isolates from blood samples.⁴⁹ A survey of England and Wales from July 1990 had after nine months identified 18 patients

Table 3 Important clinical features of group B streptococcal septic arthritis

- 1 Rare: only 33 fully documented cases in English publications, three of whom had infection of prosthetic joints
- 2 23/33 significant predisposing disease
- 3 Primary focus usually not identified; knee most commonly affected joint, polyarticular in 10/30
- 4 All isolates sensitive to penicillin, but 5/29 needed more extensive drainage than a needle. 2/3 prosthetic joints required revision
- 5 Radiographic deterioration of joint in 5/5, diminished function or persistent pain in 7/22, extra-articular manifestations of sepsis important determinants of outcome: death in 5/29
- 6 Some reports of associated and isolated osteomyelitis. Some reports of isolated pyomyositis

See references 52–56.

with GBS septicaemia, as compared with three in the whole of 1981 and 1982 in a survey by the Medical Services Study Group of the Royal College of Physicians.^{49 50} These combined observations suggest that better surveillance is unlikely to be the sole explanation for the increase, and some as yet unknown change in host or bacteria has taken place, with a true increase in the incidence of serious GBS infections in the United Kingdom.

Most epidemiological surveys of serious GBS infections have been hospital based for convenience, with all the inherent bias in such surveys. One recent study in Atlanta, USA, however, was a retrospective, population based survey linking laboratory records with patient case records.⁵¹ From an available population of 1.9 million people, 56 adults with invasive GBS were identified, with an annual incidence of 2.4 cases per 100 000 population. Five patients (9%) presented with septic arthritis, one with osteomyelitis, nine with cellulitis, and 11 with another soft tissue infection. If these figures are roughly appropriate for the United Kingdom it is possible that within an average sized district of 250 000 people one patient per year may present to the rheumatological or orthopaedic services with GBS musculo-skeletal sepsis. As was noted above, this figure may be rising.

Table 3 indicates the important clinical details from two reviews of GBS septic arthritis and recent case reports.^{52–56} There are several important features of GBS septicaemia and septic arthritis. Firstly, while subjects with pre-disposing disease are at high risk of such sepsis, healthy subjects are not immune. Secondly, once GBS is established within a patient it may lead to multiple septic foci and destructive arthropathy. These points are illustrated in a previously unreported patient presenting recently to a hospital in the north of England (table 4).

An important extra-articular manifestation has recently been described which should be monitored closely. We recently encountered a previously healthy 72 year old woman who presented with GBS septic arthritis of the left wrist and right subachromial bursa, who while undergoing intensive antibiotic treatment developed a metastatic endophthalmitis, with a profound loss of visual acuity, eventually responding to local and systemic steroids (Deighton C M, Galloway A, Deady J P, *et al*, unpublished data). Five other similar cases have been recorded, in which a concomitant septic arthritis was a common presenting feature.^{57 58} Clinicians need to be aware of this potential septic manifestation as early and aggressive intervention may save sight.

Overview and clinical implications

Resurgence of BHS in bacteraemia and septic musculoskeletal disease means a high level of vigilance is required by clinicians in considering these organisms in a wide variety of presentations. Isolation of a GBS or GGS from a joint should suggest the possibility of an underlying predisposing disease. It goes without saying that all septic arthritides should be treated aggressively, but of the BHS, GBS may have the most destructive potential if allowed to remain viable within a joint. Perhaps the isolation of GBS in synovial fluid should lower the threshold for early surgical drainage if the joint or joints are not responding to more conservative forms of management. Despite the universal susceptibility to penicillin and a wide variety of other β lactam antibiotics of the streptococci isolated in the series reported in this review, mortality of patients has been high. For GBS, GCS, and GGS this is usually a manifestation of extra-articular sepsis and underlying diseases or extremes of age. For recent manifestations of GAS M1 type sepsis these rules have often been disregarded, and the virulence of the organisms and their toxic products has been responsible for the deaths of an increasing number of healthy young adults. In all young patients with multisystem failure the possibility of GAS M1 type sepsis must be considered, as presumably the more rapidly this organism is identified and treated appropriately, the better the immediate chances for the patient.

If we are on the verge of an epidemic of BHS sepsis it is vital that as much information as possible is collected on each BHS isolate from blood and synovial fluid. This not only

Table 4 Case report of group B streptococcal septic arthritis

Patient:	56 year old male boiler engineer. Previously healthy. Smokes 40 cigarettes/day
Presentation:	One week light-headed, right temporal headache. Nausea, vomiting. Sudden onset of severe pain in the thoracolumbar spine radiating to right knee with paraesthesiae. Left shoulder and wrist pain. Unable to stand
Examination:	Pyrexia 38.5°C. Pulse 96 beats/min. Blood pressure 160/90 mmHg. No heart murmurs. Chest widespread rhonchi. Abdomen normal. Pain and limited movement over left ACJ with limited shoulder movement. Marked tenderness lumbar and mid-thoracic spine. Tenderness and limited movement left wrist. Central nervous system no neck stiffness or focal signs
Investigations:	Haemoglobin 122 g/l, white cell count 19.3×10 ⁹ /l with neutrophilia. Erythrocyte sedimentation rate 89 mm/h Group B streptococcus grown in blood and left wrist aspirate Liver function test results abnormal: ALP* 394 IU/l (NR* 30–110) liver type only ALT* 220 IU/l (NR 4–40) AST* 92 IU/l (NR 6–38) Albumin 27 g/l Normal: urea and electrolytes, urate, autoantibodies, serum proteins Bone scan increased uptake left wrist and shoulder, T7 and L5 Serial radiographs of lumbar spine and thoracic spine showed no change. Radiograph of left wrist and shoulder normal Normal abdominal ultrasound and echocardiogram
Treatment:	Intravenous ampicillin with improvement of left wrist and shoulder over one week. Gradual improvement of axial pain. Discharged after 21 days, walking with a Zimmer frame
Outcome:	Continues to have axial pain. No further sepsis. No evidence of evolving predisposing disease

*ALP=alkaline phosphatase; ALT=alanine transaminase; AST=aspartate transaminase; NR=normal range.

includes the Lancefield group characterisation but also subtyping of M and T types for GAS and some GGS, and identification of species and subtyping of GBS and GCS. Identification of bacterial toxins should also be determined on bacterial and serum samples. Samples should be sent to local microbiological services, who in the United Kingdom should also coordinate typing with the Streptococcus Reference Laboratory, Division of Hospital Infection, Central Public Health Laboratory, Colindale, London, United Kingdom.

Conclusions and recommendations

1 All streptococcal septic arthritides must have full characterisation of the responsible organism as there may be prognostic differences for the affected joints and variable prevalences of underlying (possibly occult) predisposing disease.

2 Group B streptococcal septic arthritis must be treated aggressively, and the possibility of septic polyarthritis and metastatic endophthalmitis monitored closely.

3 In the management of any previously healthy adult with acute multisystem failure the possibility of GAS toxic shock-like syndrome must be considered from the outset. In substantiated cases the organism must be fully typed, and the nature of its toxins determined.

4 If we are at the start of a BHS septic epidemic, and musculoskeletal manifestations may be prominent expressions of disease in adults, rheumatologists must remain vigilant and report any streptococcal septic arthritis to their national public health laboratories.

I would like to thank Dr Angela Galloway for her microbiological advice, and Dr Alexis Chuck, Dr Paul Crook, Dr David Walker, and Donna Deighton for their helpful comments. I would like to thank Dr Crook also for allowing me to report on his patient.

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