

# *Streptococcus pyogenes* and invasive central nervous system infection

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## Abstract

*Streptococcus pyogenes* is a Gram-positive beta-hemolytic bacteria, also known as group A streptococci, that causes a range of infections. The most common presentation is acute pharyngitis; however, it is also implicated in skin and soft tissue infections, and less commonly bacteremia, osteomyelitis, pneumonia, otitis media and sinusitis. Group A streptococci infections of the central nervous system are exceedingly rare in the antibiotic era. The mechanism of infection is typically contiguous spread from existing infection or via direct inoculation. We present a case of an 81-year-old female with a past medical history of dementia, transient ischemic attacks, type 2 diabetes mellitus, hypertension, descending thoracic aortic aneurysm status post-stent placement in 2008, hepatitis C and hyperlipidemia who initially presented after being found unresponsive at home. Her initial symptoms were primarily of altered mentation and on evaluation was found to be in septic shock with suspicion of meningoenzephalitis. Her initial workup included a computed tomography of head which was remarkable for left and right mastoid effusions. A lumbar puncture was performed with cloudy purulent fluid, an elevated white blood cell count, low glucose and elevated protein. The patient was initially started on broad spectrum coverage and soon had 4/4 blood cultures and cerebrospinal fluid cultures growing *Streptococcus pyogenes*. Empiric vancomycin, ceftriaxone and ampicillin were administered but switched to penicillin G in the setting of elevated total bilirubin and septic shock with multi-organ failure and narrowed to ampicillin–sulbactam based on sensitivities. Unfortunately, the patient deteriorated further due to septic shock and multi-organ failure and later died in the medical intensive care unit.

## Keywords

*Streptococcus pyogenes*, multi-organ dysfunction, bacteremia, meningitis, encephalitis

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## Introduction

*Streptococcus pyogenes* is a Gram-positive beta-hemolytic bacteria, also known as group A streptococci (GAS), that causes a wide well known variety of diseases. The microbe is an infrequent but pathogenic part of the skin flora, with the most common infection being acute pharyngitis.<sup>1</sup> Although GAS has been known to cause infections throughout the body, central nervous system (CNS) infections such as meningitis are rarely caused by GAS.<sup>2</sup>

## Case presentation

We present a case of an 81-year-old female with a past medical history of dementia, transient ischemic attacks, type 2 diabetes mellitus, hypertension, descending thoracic aortic aneurysm status post-stent placement in 2008, hepatitis C and hyperlipidemia who initially presented with altered

mental status after she was found unresponsive at home. Per family accounts, the patient was in her bed, unresponsive, with mild shaking of the extremities and eyes open. In the Emergency Department, the patient was found to have left-sided neck deviation, shaking movements of right hand and

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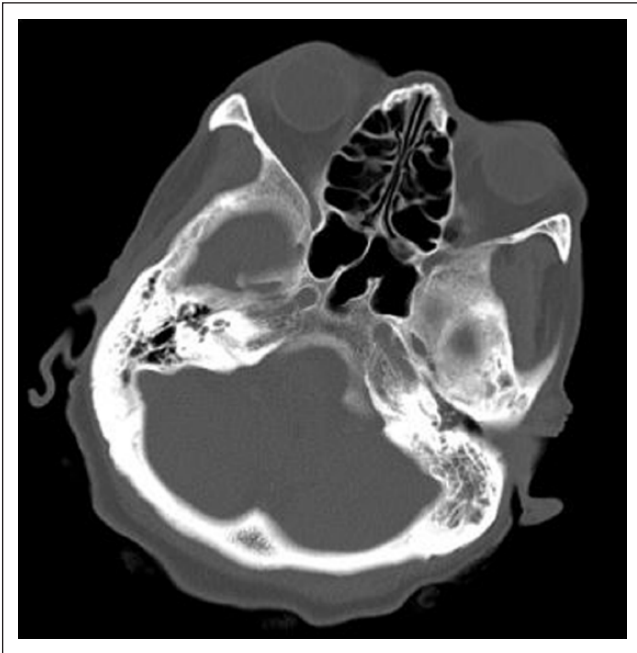
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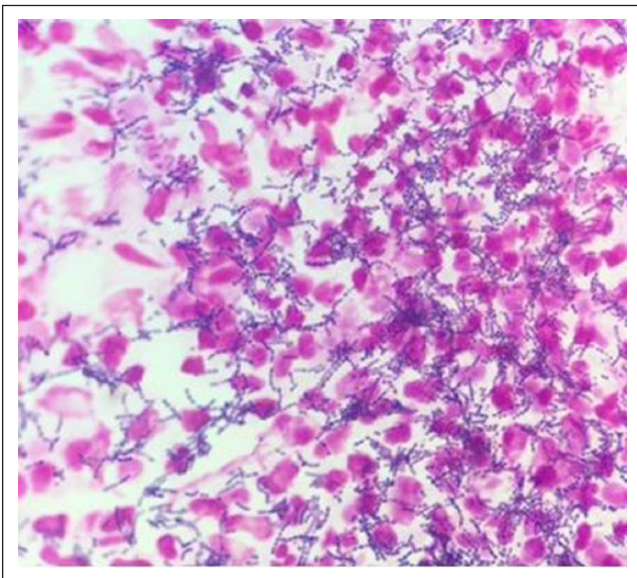
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**Figure 1.** CT head showing left and right mastoid air cell effusion.



**Figure 2.** Gram stain showing Gram-positive bacteria in chains.

foot, and a left gaze deviation and was subsequently treated as status epilepticus. On presentation, the patient had hypothermia, tachycardia and had a leukocytosis with significant bandemia of 35; a lumbar puncture was performed which was cloudy, yellow, red blood cells (RBC) 70, white blood cell (WBC) 3400, 12 neutrophils, 8 eosinophils, 28 lymphocytes and 52 monocytes, the cerebrospinal fluid (CSF) had a low glucose of <20, an elevated protein count of >600 and opening pressure of 22 cmH<sub>2</sub>O. Computed tomography (CT)

**Table 1.** Antibiotic susceptibility: results similar to blood and CSF cultures.

Drug	<i>Streptococcus pyogenes</i> (group A)	
	MICM inter	MICM dilut
Ampicillin	S	≤0.06
Ceftriaxone	S	≤0.25
Erythromycin	S	≤0.06
Levofloxacin	S	0.5
Penicillin	S	≤0.03
Tetracycline	S	≤0.5
Vancomycin	S	0.5

CSF: cerebrospinal fluid.

of head done in the Emergency Department for possible stroke revealed a left mastoid effusion and an interval development of right mastoid air cell effusion (Figure 1). The patient had 4/4 blood cultures with growth of Gram-positive cocci in chains which was later speciated to *S. pyogenes* and also had growth from the CSF culture of heavy growth with streptococcus group A (Figure 2). The patient was initially started on dexamethasone, ampicillin, ceftriaxone and vancomycin which was later de-escalated to ceftriaxone. Other pertinent events during the hospitalization including the patient being in septic shock requiring vasopressor therapy, she had renal injury and had an iatrogenic pneumothorax from a central line placement. Infectious disease was consulted and consequently to multi-organ failure recommended changing ceftriaxone to penicillin G. Given the mastoid effusion on the CT head, otitis was presumed the most probable primary source of the invasive CNS infection. Once final culture results came back as *S. pyogenes*, penicillin G was altered to ampicillin–sulbactam as the pathogen was pan-sensitive (Table 1). Unfortunately, the patient failed to recover from the infectious insult, her neurological status remained grave, the patient’s family eventually made her a DNR (do not resuscitate) and she eventually succumbed to multi-organ failure from septic shock.

## Discussion

Invasion of the CNS by microorganisms is a severe and often morbid event. The spectrum of potential infections in addition to pharyngitis caused by *S. pyogenes* or GAS includes integumentary infections, bacteremia, osteomyelitis, pneumonia, otitis media, sinusitis, toxic shock syndrome, in addition also causing non-suppurative infections as rheumatic fever and glomerulonephritis. Rarely, meningitis and brain abscesses as a direct extension from ear or sinus infections or hematogenous spread can occur.

A total of 1.2 million cases of bacterial meningitis occur annually worldwide.<sup>3</sup> The major causes of community-acquired bacterial meningitis are *S. pneumoniae*, *Neisseria meningitidis* and *Listeria monocytogenes* and healthcare

associated being *Staphylococci* and aerobic Gram-negative bacilli.<sup>3</sup> Group A streptococcus, or *S. pyogenes*, is a rare cause of meningitis. According to the Centers for Disease Control and Prevention (CDC),<sup>4</sup> in 2015, there were 15,540 cases of invasive GAS disease, with the most common etiology being cellulitis (39%), primary bacteremia (19.6%), pneumonia (14.1%), necrotizing fasciitis (7.5%) and streptococcal toxic shock syndrome (2.7%). GAS meningitis has a prevalence of 0.06 cases in 100,000 children per year with a case mortality rate of 43%;<sup>5</sup> GAS CNS infections remain rare and account for less than 0.2% of all bacterial meningitis.<sup>2,6</sup>

GAS meningitis is a community-acquired disease; in 2002, Van de Beek et al.<sup>7</sup> published that out of 41 patients with GAS meningitis, 60% had prior otitis or sinusitis; the fulminant disease had a mortality rate of 27%. Another case series by Sommer et al.<sup>6</sup> revealed that out of nine total cases, eight were community acquired, six had prior neurosurgical conditions and five had upper respiratory tract infections. Epidemiological data from our hospital showed that from 2013 to 2017, there were 41 cultures positive for GAS, of which 40 were blood cultures and 1 which was the case described above was a CSF culture. Resistance patterns showed that one culture was resistant to clindamycin, erythromycin and tetracyclines; four cultures were resistant to erythromycin and tetracyclines; and three cultures were resistant to just tetracyclines. From 2013 to 2017, there were no resistance to penicillins by GAS at our inner city hospital.<sup>8</sup>

## Conclusion

GAS, or *S. pyogenes*, is a rare cause of bacterial meningitis after the neonatal period but has to be considered as a potential pathogen. Early recognition and treatment are critical; diagnostic failure can result in sepsis and death.

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## Informed consent

Written consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

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