



UvA-DARE (Digital Academic Repository)

Bacterial meningitis in adults: clinical characteristics, risk factors and adjunctive treatment

Brouwer, M.C.

Publication date
2010

[Link to publication](#)

Citation for published version (APA):

Brouwer, M. C. (2010). *Bacterial meningitis in adults: clinical characteristics, risk factors and adjunctive treatment*. [Thesis, fully internal, Universiteit van Amsterdam].

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

Chapter 5

Community-acquired *Staphylococcus aureus* meningitis in adults

Matthijs C Brouwer, Gabrielle D Keizerweerd, Jan de Gans,
Lodewijk Spanjaard, Diederik van de Beek

Scandinavian Journal of Infectious Diseases 2009; 41: 375-377

Abstract

We present 9 patients with community-acquired *Staphylococcus aureus* meningitis. Foci of infection outside the central nervous system were present in 8 (89%) patients, mostly endocarditis and pneumonia. Cardiorespiratory complications occurred frequently and 6 patients died (67%). Identification and treatment of the primary focus of infection should be a priority in these patients.

Introduction

Staphylococcus aureus is an uncommon cause of community-acquired meningitis, and has been associated with endocarditis.¹⁻³ Here we describe 9 cases with community-acquired staphylococcal meningitis from a nationwide prospective cohort study. This observational study with anonymous patient data was carried out in accordance with Dutch privacy legislation. Written informed consent to use data made anonymous was obtained from the patient or from the patient's legal representative.

Case reports

Nine of 696 patients (1%) in the cohort had cerebrospinal (CSF) cultures positive for *S. aureus*, providing an incidence rate of only 3 per 10,000,000 adults. Predisposing factors were present in 8 patients (89%); 5 patients were considered to be immunocompromized (Table). On admission, distant foci of infection outside the central nervous system were found in 8 patients (89%): pneumonia in 3, endocarditis in 5, sinusitis with cavernous sinus thrombosis, thrombophlebitis, and urinary tract infection each in 1. Two patients presented with petechial rash. One patient presented with hemiparesis and aphasia due to cerebral infarction.

Table. Clinical and laboratory findings in 9 adults with community- acquired *S. aureus* meningitis^a

Characteristic	frequency (%)	Characteristic	frequency (%)
Mean age, years (range)	57 (18-78)	Rash	2/9 (22%)
Male gender	4/9 (44%)	Neck stiffness	6/9 (67%)
Predisposing factors		Aphasia	2/7 (29%)
Recent head injury	1/8 (13%)	Focal neurologic deficits	2/9 (22%)
Immunocompromised state ^b	5/9 (56%)	Cerebrospinal fluid values ^d	
Injection drug use	1/9 (11%)	White cell count per mm ³	740 (1-1813)
Cerebrospinal fluid leak	1/9 (11%)	<100/mm ³	2/9 (22%)
Malignancy ^c	2/9 (22%)	100-999/mm ³	4/9 (44%)
History of heart valve disease	3/9 (33%)	>999/mm ³	3/9 (33%)
Other focus of infection		Protein (g/L)	2.7 (0.26-6.77)
Sinusitis	1/9 (11%)	CSF/serum glucose ratio	0.37 (0.02-0.6)
Thrombophlebitis	1/9 (11%)	Gram positive cocci in CSF	4/9 (44%)
Pneumonia	3/9 (33%)	Blood culture positive	7/7 (100%)
Endocarditis	5/9 (56%)	Complications	
Urinary tract infection	1/9 (11%)	Impaired consciousness	5/9 (56%)
Symptoms and Signs on admission		Cardiorespiratory failure	6/9 (67%)
Coma (GCS < 8)	2/9 (22%)	Sepsis	4/9 (44%)
Temperature ≥38°C	8/9 (89%)	Mortality	6/9 (67%)

GCS denotes Glasgow Coma Scale, CSF denotes cerebrospinal fluid; ^a Continuous variables are noted as mean value (range) unless otherwise specified; ^b Patients receiving immunosuppressive drugs and patients with diabetes mellitus, alcoholism, asplenia, liver cirrhosis, end-stage renal disease, or HIV infection were considered immunocompromised. ^c Lung carcinoma, colon carcinoma; ^d CSF white cell count, protein concentration, glucose and CSF/serum glucose ration were determined in all patients.

CSF findings were often atypical for bacterial meningitis. One patient had completely normal CSF and only 4 patients (44%) had 1 or more individual CSF predictors of bacterial meningitis (glucose level <1.9 mmol/l, CSF-blood glucose ratio <0.23 , CSF protein level >2.2 g/l, CSF leucocytes $>2000 \times 10^6/l$)⁴. Two patients had very low CSF leucocyte counts ($<100 \times 10^6/l$). Blood cultures were performed in 7 patients and all were positive. Initial antimicrobial therapy consisted of combination therapy including flucloxacillin in 8 patients and a third generation cephalosporin with amoxicillin in 1.

Computed tomography (CT) was performed in all patients on admission and showed hypodense lesions suspect for cerebral infarction in 4 (44%). Chest X-ray was performed in 8 revealing pulmonary abnormalities in 6 patients: pneumonia in 2, lung oedema in 2, and pleural effusion and lung cancer each in 1. Transoesophageal echocardiography was performed in 3 patients and showed vegetations in 2 and a thrombus in 1. Transthoracic echocardiogram was performed in 1 additional patient and showed no abnormalities. As echocardiography was not performed in all patients, endocarditis could have been missed. An electrocardiogram was performed in 6 patients showing abnormalities in 1 (atrial fibrillation).

Neurological complications occurred in 5 patients (56%) and systematic complications occurred in 6 (67%). All of these 6 patients with systemic complications had cardiorespiratory failure. Two patients additionally developed acute kidney failure requiring haemodialysis. Six patients died, resulting in a mortality rate of 67%. Death was due to septic shock, respiratory failure, cardiac ischaemia or multiorgan dysfunction. Two of 3 (67%) surviving patients had neurological sequelae. One patient had a hemiparesis due to cerebral infarction and 1 had severe visual impairment after cavernous sinus thrombosis. Only 1 out of 5 patients with endocarditis survived, with severe heart failure due to valve insufficiency. The patients died between 2 and 27 days after admission (median 5) and all received appropriate antimicrobial therapy until death.

Discussion

Community-acquired meningitis due to *S. aureus* is a rare but severe disease in patients with underlying conditions. Almost all of our patients had pneumonia or endocarditis, which is concordant with previous reports.^{2,3,5-7} Therefore, the search for a primary infection focus is a priority in patients presenting with community-acquired *S. aureus* meningitis. Identification of such focus of infection may lead to a change in duration of antimicrobial therapy or even surgical intervention. Such evaluation should include a thorough physical examination, cardiac ultrasound, chest X-ray, and urine culture. A cardiologist should be consulted and, if results are negative, the patient should be evaluated by an otolaryngologist to rule out sinusitis.

CSF findings were atypical for bacterial meningitis in the majority of patients. 56% had no individual CSF findings indicative of bacterial meningitis. Patients with clinical suspicion of *S. aureus* meningitis, i.e. those patients with endocarditis and a decreased level of

consciousness, should receive antimicrobial treatment including vancomycin pending CSF culture results, also if CSF findings are atypical for bacterial meningitis.

The mortality rate among our patients was high (67%) and substantially higher than previously reported.^{2,3} The high mortality rate is probably associated with the proportion of patients with endocarditis who were at risk for fatal cardiorespiratory complications. Mortality rates in patients with *S. aureus* endocarditis complicated by meningitis have been reported up to 86%.^{8,9}

References

1. van de Beek D, de Gans J, Tunkel AR, Wijdicks EFM. Community-acquired bacterial meningitis in adults. *N Engl J Med* 2006; 354: 44-53.
2. Lerche A, Rasmussen N, Wandall JH, Bohr VA. *Staphylococcus aureus* meningitis: a review of 28 consecutive community-acquired cases. *Scand J Infect Dis* 1995; 27: 569-73.
3. Gordon JJ, Harter DH, Phair JP. Meningitis due to *Staphylococcus aureus*. *Am J Med* 1985; 78: 965-70.
4. Spanos A, Harrell FE Jr, Durack DT. Differential diagnosis of acute meningitis. An analysis of the predictive value of initial observations. *JAMA* 1989; 262: 2700-7.
5. Fong IW, Ranalli P. *Staphylococcus aureus* meningitis. *Q J Med* 1984;53:289-99.
6. Pedersen M, Benfield TL, Skinhoej P, Jensen AG. Haematogenous *Staphylococcus aureus* meningitis. A 10-year nationwide study of 96 consecutive cases. *BMC Infect Dis* 2006; 6: 49.
7. Pintado V, Meseguer MA, Fortun J, Cobo J, Navas E, Quereda C. Clinical study of 44 cases of *Staphylococcus aureus* meningitis. *Eur J Clin Microbiol Infect Dis* 2002;21:864-8.
8. Angstwurm K, Halle E, Wetzel K, Schultze J, Schielke E, Weber JR. Isolated bacterial meningitis as the key syndrome of infective endocarditis. *Infection* 2004;32:47-50.
9. Jones HR Jr, Siekert RG, Geraci JE. Neurological manifestations of bacterial endocarditis. *Ann Intern Med* 1969; 71: 21-8.