Case report

Successful treatment of multicompartmental cerebral ventriculitis caused by *Acinetobacter baumannii*

Dom Mahoney\textsuperscript{b}, David Porter\textsuperscript{a}, Mahableshwar Albur\textsuperscript{a,⁎}

\textsuperscript{a} North Bristol NHS Trust, Microbiology, Severn Infection sciences, Pathology Sciences Building, BS10 5ND, Bristol, United Kingdom

\textsuperscript{b} University of Bristol, United Kingdom

A B S T R A C T

We present a case report of a 58-year-old woman with subarachnoid haemorrhage complicated by non-communicating hydrocephalus. During the course of her neurosurgical management, she developed external-ventricular drain associated ventriculitis which in turn was complicated by lack of communication between third and fourth ventricles. The causative organism was a fully-sensitive *Acinetobacter baumannii*, a nosocomial pathogen often associated with complicated treatment regimens and poor outcomes. This patient was successfully managed by a multi-disciplinary team involving neurosurgeons, neuroradiologists and infection specialists. Patient made a full recovery following double CSF diversion and intravenous plus intrathecal antimicrobial therapy.

Case report

A 58-year-old woman presented to a local district general hospital with a history of sudden-onset headache, visual loss, projectile vomiting followed by collapse. Her Glasgow Coma Scale was 4 out 15 on the scene as recorded by paramedics, which improved to 7 by the time she had arrived at the local emergency department. CT scan on admission revealed a significant intracranial haemorrhage occupying all the ventricles arising from an arteriovenous malformation (AVM) in the left cerebellar hemisphere (Fig. 1). This AVM was noted in a CT scan of the head performed 4 years ago following an episode of dysesthesia. However, following a surgical consultation at the time, the option of treatment with gamma-knife was declined due to its high risk.

The patient was transferred to our regional neurosurgical centre, and immediately taken to theatre on arrival to undergo external ventricular drainage (EVD) of the right lateral ventricle. She was then managed in the Intensive Care Unit (ICU) for the ten days subsequently. During her ICU stay, patient had a tracheostomy, and was treated with a course of broad-spectrum antibiotics for an episode of ventilator associated pneumonia.

Following a stepped down to the neurosurgical high dependency unit, the patient’s EVD became blocked and was subsequently replaced. At this point samples of her cerebrospinal fluid (CSF) grew *Staphylococcus epidermidis* consistent with EVD associated ventriculitis. She was treated with a course of intrathecal vancomycin. Following further episodes of catheter failure in the ensuing weeks, the EVD was replaced on two occasions.

Almost one month after admission, the patient developed another episode of EVD associated ventriculitis and the CSF cultures grew a fully-sensitive *Acinetobacter baumannii*. This episode of ventriculitis was treated with a combination of intrathecal gentamicin and intravenous high dose meropenem 2gm TDS. During the course of her recovery, patient developed an acute decline in the cognitive function, and the third EVD drain in the right frontal horn had stopped working. An MRI scan showed periventricular oedema surrounding the fourth ventricle, implicative of an encysted ventricle (Fig. 2). Emergency drainage of the fourth ventricle was performed via a right transcerebellar approach using image guidance, leaving the patient with a second EVD catheter in situ. One week later, the patient returned to operating theatres for the insertion of a ventriculoperitoneal shunt. Following this, imaging implied that the left lateral ventricle had become isolated and thus a second proximal catheter was inserted in the left frontal horn and connected to the same valve. The patient subsequently underwent a successful surgical management of the cerebellar AVM the following month and made a full recovery with a vigorous input from therapists.

Discussion

*Acinetobacter* infections of the central nervous system are well recognised and of increasing prevalence [1]. Studies have been published that estimate their associated mortality to exceed 15%, and may reach as high as 71% [2,3]. Pathogens of this genus are also highly capable of developing extensive and multidrug resistances, rendering the infections they cause complicated [4]. Intracranial *Acinetobacter baumannii* infections may not always present overtly with stereotypical symptoms of fever and progressive consciousness deficits, but rather as a...
pseudomeningitis or pseudoventriculitis [5]. Many risk factors for the
development of Acinetobacter spp. infections have been suggested.
These include craniotomy, spinal anaesthesia, long ITU stays and im-
plantation of CSF drainage devices. In one study including cases with
multiple causative pathogens, the meningitis observed in 78 of 91 pa-
tients was EVD-associated [6]. The difficulty associated with their
management render reports of infections caused by Acinetobacter spp.
highly relevant to clinical practice.

Due to the poor transmission of many intravenous agents across the
blood-brain barrier, intrathecal administration has been adopted in
many cases. The use of intrathecal aminoglycosides is well reported as a
method of sterilising the CSF in cases of confirmed Acinetobacter ba-
mannii infection [4]. The intrathecal administration of gentamicin is
perhaps the most familiar to most physicians, although the use of
netilmicin has also been reported [7]. With extensive reports of re-
stance among Acinetobacter spp., colistin has been increasingly used.
Individual reports have found intrathecal colistin therapy to be a safe
and efficacious alternative [8]. However, clear-cut data of use of in-
trathecal antimicrobial therapy is very limited and guidelines are very
old [11]. The efficacy of other, less familiar antimicrobial agents (e.g.
sulbactam & polymyxin B) has been reported, as has the use of ri-
fampicin in the management of Acinetobacter spp. infections [9].

Although the use of newer drugs such as tigecycline is not advised
due to the lack of evidence and data [2,4], administration of carbape-
nems in the management of A. baumannii infections is well established
and familiar to many clinicians. Initially this class of antibiotics de-
monstrated relatively low rates of resistance development among Aci-
etobacter spp., although emerging strains are exhibiting resistance
rates of over 40% [1]. Interestingly, it appears that Acinetobacter may be
able to develop resistance to specific compounds within a class, whilst
other drugs of the same type remain effective [10].

In conclusion, this complex case of ventriculitis was made un-
predictable by the fact that the ventricles were communicating micro-
biologically but not sufficiently to allow CSF flow. The decision was
subsequently made to administer intrathecal aminoglycosides at both
sites in conjunction with an intraventricular carabapenem. This was a course
of conventional antibiotics, as opposed to those that are increasingly
resorted to in the management of such infections. This familiarity made
the management safer for the patient, and resulted in successful re-
solution of her infection. Due to lack of quality data on this rare in-
fection, large scale multicentre, prospective studies are urgently re-
quired to develop evidence-based comprehensive, organism-specific
guidelines for EVD associated ventriculitis.

References

[1] Karaiskos I, Galani L, Baziaka F, Giamereolou H. Intraventricular and intrathecal
colistin as the last therapeutic resort for the treatment of multidrug-resistant and
extensively drug-resistant Acinetobacter baumannii ventriculitis and meningitis: a
literature review. Int J Antimicrob Agents 2013;41.
[2] Karaiskos I, Galani L, Baziaka F, Katsouda E, Ioannidis I, Andreou A, et al. Successful
treatment of extensively drug-resistant Acinetobacter baumannii ventriculitis and
meningitis with intrathecal colistin after application of a loading dose: a case
series. Int J Antimicrob Agents 2013;41.
[3] Chen HP, Lai CH, Chan YJ, Chen TL, Liu CY, Fung CP, et al. Clinical significance of
Acinetobacter species isolated from cerebrospinal fluid. Scand J Infect Dis 2005;37.
[4] Rodriguez Guardado A, Blanco A, Asensi V, Perez F, Rial JC, Pintado V, et al.
Multidrug-resistant Acinetobacter meningitis in neurological patients with in-
traventricular catheters: assessment of different treatments. J Antimicrob Chemother
2008;61.
[5] Bayramoglu G, Kaya S, Besli Y, Cakir E, Can G, Akineden O, et al. Molecular epi-
demiology and the clinical significance of Acinetobacter baumannii complex iso-
lated from cerebrospinal fluid in neurosurgical intensive care unit patients.
Infection 2012;40.
[6] Kim HH, Kim SW, Park GY, Kwon EG, Kim HH, Jeong JY, et al. The causes and
treatment outcomes of 91 patients with adult nosocomial meningitis. Korean J
Intern Med 2012;27(2).
[7] Buke C, Sipahi OR, Yurtseven T, Zileli M. High dose of intrathecal netilmicin in the
treatment of nosocomial Acinetobacter baumannii meningitis. J Infect 2005;51(5).
[8] Ho YH, Wang LS, Chao HZ, Chang KC, Su CF. Successful treatment of meningitis
causd by multidrug-resistant Acinetobacter baumannii with intravenous and in-
trathecal colistin. J Microbiol, Immunol Infect 2007;40.
[9] Glessens T, Peterson K, Mascola J. Successful treatment of Acinetobacter meningitis
with meropenem and rifampicin. J Antimicrob Chemother 2005;56(3).
[10] Nunez ML, Martinez-Tolosa MC, Bru M, Simarro E, Segovia M, Ruiz J. Appearance
of resistance to meropenem during the treatment of a patient with meningitis by
Acinetobacter. Scand J Infect Dis 1998;30.
[11] British Society for Antimicrobial Chemotherapy guidelines. The management of
neurosurgical patients with postoperative bacterial or aseptic meningitis or external
ventricular drain-associated ventriculitis. Infection in Neurosurgery Working Party
of the British Society for Antimicrobial Chemotherapy. Br J Neurosurg
2000;14(February (1)):7–12.