

Supplemental table 1: QUADAS-2 results

Study	Risk of bias				Applicability concerns		
	Patient selection	Index test	Reference standard	Flow and timing	Patient selection	Index test	Reference standard
Ávila	+	-	-Positive culture and two SIRS criteria or -cytobiochemical suspicion (hypoglycorrachia less than 45 mg/dL and neutrophilic pleocytosis higher than 100 per mL) and SIRS-symptoms. The clinicians determines whether culture- or SIRS symptoms could be attributed to another cause.	-	+	+	+
Berger	+	-	Positive gram, antigen test or culture	+	+	-	-
Boer 2008	-	-	Positive gram or culture	-	-	-	-
Boer 2011	+	-	Two positive cultures	+	+	+	-
Bota	+	+	Criteria Lozier et al.	+	+	+	+
Coen	-	+	Positive culture \geq 24 hours after drain insertion, pleocytosis, fever and/or headache, meningeal signs and altered mental status	-	-	+	+

Gordon	+	-	Criteria Lozier et al.	+	+	+	+
Grille	+	+	Criteria Lozier et al.	-	+	+	+
Hader	+	-	Positive Gram stain or culture on consecutive days	+	+	-	-
Hariri	+	+	Criteria Lozier et al.	-	+	+	+
Hong	-	+	Pyogenic ventriculitis on MRI	-	-	+	-
Hopkins	-	-	Definite: positive culture with a clinical picture of infection or commencement of intrathecal AB Probable: raised CSF WCC: red cell count ratio (>1:7900) in the absence of positive culture or starting intrathecal AB with a clinical picture of infection.	?	+	+	+
Jost	-	?	CDC-criteria	-	+	-	+
Khalil	-	?	Positive CSF culture	-	+	+	-
Lackner	-	-	Positive CSF culture	-	+	-	-
Lenski 2017	+	+	Modified CDC criteria	+	+	+	+
Lenski 2018	+	-	Modified CDC criteria	+	+	+	+
Liu	+	?	Positive CSF culture	-	-	+	-

Lukaszewicz	-	?	positive for bacterial infection upon direct examination or in culture and contained > 100 leukocytes/mm3	+	+	+	+
Lunardi	-	+	CDC criteria	-	+	+	+
Martínez 1994	?	?	?	+	?	?	?
Martínez 2002	-	+	compatible clinical findings and either (1) a positive CSF culture or (2) negative culture but identification of bacteria on CSF Gram stain or (3) negative CSF culture accompanied by a CSF pleocytosis of less than 500 neutrophils/mm3 with a predominance of 50% or more of polymorphonuclear cells.	-	-	-	+
Mayhall	+	-	Positive culture	-	+	+	-
Mounier 2015 <i>Acta Neurochir.</i>	-	+	Positive culture and start antibiotics	+	+	+	-
Mounier 2015 <i>PLoS One</i>	+	+	Positive CSF culture obtained from the ventricular catheter except for commensals, where the same strain had to be isolated in two or more CSF samples.	+	+	+	-
Munoz-Gomez	?	-	marked CSF pleocytosis >50 WBC/mm3 in high lactic acid levels (>6mmol/L), positive Gram stain and positive CSF	-	?	-	+

			culture of a neuropathogen.				
Muttaiyah	+	?	Positive CSF culture, CSF leukocytosis $>5 \times 10^6/L$, clinical diagnosis of ventriculitis by an infectious diseases physician.	-	+	-	+
Omar	-	-	CDC criteria	+	-	+	+
Passer	+	-	IDSA guideline	+	+	+	+
Pfausler	+	+	?	+	+	+	?
Pfisterer	+	+	?	+	-	+	-
Ramírez	+	?	A positive CSF culture accompanied by abnormal CSF findings and appropriate clinical signs and symptoms.	?	+	+	+
Rath	-	-	Positive culture on two consecutive days	-	+	-	+
Ruiz-Mesa	-	?	?	?	-	?	?
Schoch	-	-	At least two of the following three criteria:	-	+	+	+
			1. One or more new clinical signs such as nuchal rigidity, headache, fever or neurological deterioration				
			2. CSF cell count increased by more than 100% over				

			the previous day					
			3. bacteria detected in CSF Gram staining and/or culture. Repeated evidence in two different samples was required to prove CSF infection in skin commensals.					
Schultz	+	?	1. No other detectable source of CNS infection.	?	+	?	+	
			2. Negative CSF cultures obtained at the time of ventriculostomy placement.					
			3. Ventricular catheterization ≥ 24 hours.					
			4. Two positive CSF-cultures with the same organism taken on different days.					
			5. CSF white blood cell count $\geq 11 \times 10^6/L$ and CSF polymorphnuclear leukocytes ≥ 50 .					
Shang	-	?	1. CSF cell count was $> 1000 \times 10^6/L$, and CSF sugar was < 1.9 mmol/l.	-	-	?	-	
			2. Bacteria were found on the CSF smear, or bacterial cultures were positive more than twice consecutively.					

3. Intracranial CT or MRI confirmed intraventricular debris and pus.							
Stubljär	?	-	Gold standard was constructed on the basis of clinical grounds, culture, and molecular results of bacterial identification from CSF and the results of response to antibiotic treatment	-	?	-	-
Walti	?	-	Modified CDC criteria	+	+	-	+
Wiegand	+	-	NHSN/CDC criteria	-	+	+	+
Wong	+	+	?	?	+	+	?
Wostrack	-	-	Positive microbial CSF culture with a clinical picture of infection or elevated CSF cell count, red cell/white cell ratio > 1: 700, increased lactate and/or decreased glucose.	-	-	+	+

Supplementary table 2: Direction of evidence in studies reporting on a parameter

	Studies reporting on parameter (n)	Total patients (n)	Direction of evidence in studies where patients with DAV were compared to patients without ventriculitis
Clinical parameters			
Fever	17	701	8 of 12 studies higher frequency of fever in DAV
Headache	2	58	-
Meningeal signs	4	82	
Increased heart rate	2	50	Symptom present in 52% of patients with DAV
Increased respiratory rate	2	50	Symptom present in 46% of patients with DAV
SIRS	2	248	86% (15/22) of patients with DAV met SIRS criteria

AUC 0.575 (95% CI 0.5-0.6)

CSF parameters

CSF cell count	21	1	13 of 17 studies found higher cell count in DAV, one article AUC 0.644
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%Polymorphnuclear cells	6	162	3 of 5 studies sign. increased proportion PMN in DAV
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Cell index	6	425	4 of 6 studies sign. Higher cell index in DAV
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Protein concentration	19	1705	6 of 11 studies sign. Higher protein conc. In DAV
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Glucose concentration	10	1054	6 of 10 studies sign. Lower glucose in CSF in DAV
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Glucose ratio CSF:plasma	8	468	5 of 8 studies sign. Lower ratio in DAV
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Lactate concentration	8	872	4 of 6 studies sign. Higher lactate conc. in DAV
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IL-1 β	3	97	2 studies sign. Higher IL-1 β in DAV
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IL-8	2	76	2 studies sign. higher IL-8 in DAV
TNF- α	2	53	1 of 2 studies higher TNF- α in DAV
Blood parameters			
Leukocyte count ($\times 10^9/L$)	14	1428	4 of 14 studies higher leukocyte count in DAV
CRP	11	656	2 of 6 studies sign. Higher CRP in DAV
Glucose	2	668	2 studies no sign. Difference in glucose concentration in DAV
Procalcitonin	6	203	2 of 6 studies sign. higher procalcitonin concentration in DAV
% Neutrophils	2	129	<p>Stubljär et al: no sign. difference</p> <p>Lenski et al: AUC=0.900, sensitivity 70%, spec. 100%</p> <p>Symptom present in 66% of patients with DAV and 61% of patients without DAV</p>

Microbiology results

Culture	6	246
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Gram stain	6	114
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PCR analysis on 16S rRNA	2	59	sensitivity of 100%, specificity of 78.6%
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DAV=Drain Associated Ventriculitis

Supplementary table 3: results of parameters researched in one study

	Studies	Total patients	Proportion infected	Symptom present or mean concentration in DAV	Symptom present in non-ventriculitis patients	Direction of evidence in studies where patients with DAV were compared to patients without DAV
Clinical parameters						
SIRS ^{1,2}	2	248	27%	86%, 15/22 patients		AUC 0.575 (95% CI 0.5-0.6)
Number of neurological pathological signs ^{a1}	1	226	20%			AUC 0.542 (0.5-0.6)
CSF parameters						
Visual inspection ³	1	7	100%	14% (1)		
WBC:RBC ratio ¹	1	226	20%			AUC 0.690 (95% CI 0.6-0.8)
Correction of protein conc. for blood admixture ⁴	1	187 samples	0%	-	139 (74%)	
Procalcitonin concentration ⁵	1	32	25% (8)			No significant difference

Radical oxygen species ⁶	1	30	23% (7)			Significant difference
TGF- β^5	1	32	25% (8)			No significant difference
sCD14-st ⁷	1	18	100%			Significant difference
CD62L ⁸	1	45	22% (10)			Significant difference
sCD62L ⁸	1	44	20% (9)			No significant difference
sCD62L/TP ratio ⁸	1	44	20% (9)			No significant difference
sTREM-1 ⁹	1	73	8% (6)			Significant difference
Blood parameters						
% Neutrophils ^{7,10}	2	129	57% (74)	66%	61%	Stubljär et al: no significant difference Lenski et al: AUC=0.900, sensitivity 70%, spec. 100%
Protein concentration ¹¹	1	638	9% (58)	71 mg/L	68 mg/L	No difference
α 1 antitrypsin ¹²	1	130	21 (16%)			No significant difference
fibronectin ¹²	1	130	21 (16%)			No significant difference

haptoglobin ¹²	1	130	21 (16%)			No significant difference
Band forms on WBC ¹³	1	39	39 (100%)			No significant difference
Microbiology results						
Biofilm formation ¹⁴	1	32	6 (19%)	100%	64%	75% (8/12) of colonized drains positive, 64% (9/14) of ventriculitis negative patients positive for biofilm formation
Sonication ¹⁵	1	14	5 (36%)	80%	56%	5 false positive results
<i>Other parameters</i>						
Metabonomics ¹⁶	1	15	5 (33%)			Good discriminatory effect
Radiological findings						
Changes in MRI DWI ¹⁷	1	4	4 (100%)			Strong correlation between ADC count and leukocytes and protein concentration in CSF ($r^2 = -0.84$, $r^2 = -0.62$)
Intraventricular debris	1	11	11 (100%)	100%		

on CT or MRI¹⁸

^aMeningeal irritation, altered consciousness, headache

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