

unibh Meningitis after Ventricular Shunt Operations: Multicenter Study to Identify Etiology, Incidence and Risk Factors

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Background

- A Ventriculoperitoneal shunt is the main treatment for communicating hydrocephalus. Surgical site infection associated with the shunt device is the most common complication and an expressive cause of morbidity and mortality of the treatment.
- The objective of our study is to answer three questions:
 - What is the risk of meningitis after ventricular shunt operations?
 - What are the risk factors for meningitis?
 - What are the main microorganisms causing meningitis?

Methods

- A retrospective cohort study assessed meningitis and risk factors in patients undergoing ventricular shunt operations between 2015/Jul and 2018/Jun from 12 hospitals at Belo Horizonte, Brazil.
- Data were gathered by standardized methods defined by the National Healthcare Safety Network (NHSN)/CDC procedure-associated protocols for routine SSI surveillance.
- Sample size = 926.
- 26 preoperative and operative categorical and continuous variables were evaluated by univariate and multivariate analysis (logistic regression).
- Outcome variables:
 - ✓ Meningitis, hospital death, hospital length of stay.

Results

- 71 patients were diagnosed with meningitis which represent a risk of 7.7% (C.I.95%= 6.1%; 9.6%).
- Mortality rate in patients without infection was 10% while hospital death of infected patients was 13% (p=0.544).
- From the 26 variables analyzed, three were selected as risk factors by logistic regression model:
 - ✓ age beneath two years old (OR = 3.20; p < 0.001),
 - ✓ preoperative hospital length of stay greater than four days (OR = 2.02 ; p = 0.007) and
 - ✓ more than one surgical procedure, besides ventricular shunt (OR = 3.23 ; p = 0.043).
- Patients two or more years old, who had surgery four days after hospital admission, had increased risk of meningitis from 4% to 6% (p = 0.140). If a patient < two years had surgery four days post hospital admission, the risk of meningitis is increased from 9% to 18% (p = 0.026).
- From 71 meningitis, in 45 (63%) the etiologic agent was identified: *Staphylococcus aureus* (33%), *Staphylococcus epidermidis* (22%), *Acinetobacter sp* (7%), *Enterococcus sp* (7%), *Escherichia coli* (7%), *Pseudomonas sp* (7%), and other (18%).
- Hospital length of stay in non-infected patients (days): mean = 21 (sd = 28), median = 9; hospital stay in infected patients: mean = 34 (sd = 37), median = 27 (p=0.025).

Conclusions

- Two intrinsic risk factors for meningitis post ventricular shunt, age under two years old and multiple surgeries, and one extrinsic risk factor, preoperative length of hospital stay, were identified. Incidence of meningitis post VP shunt decreases with urgent surgical treatment.

Table 1: Incidence of nosocomial infection, surgical site infection, meningitis, and hospital mortality.

Outcome	n	Risk	95% C.I.
Nosocomial infection	97	10.5%	[8.7%; 12.6%]
Surgical site infection	83	9.0%	[7.3%; 11.0%]
Meningitis	71	7.7%	[6.1%; 9.6%]
Hospital death	97	10.5%	[8.7%; 12.6%]

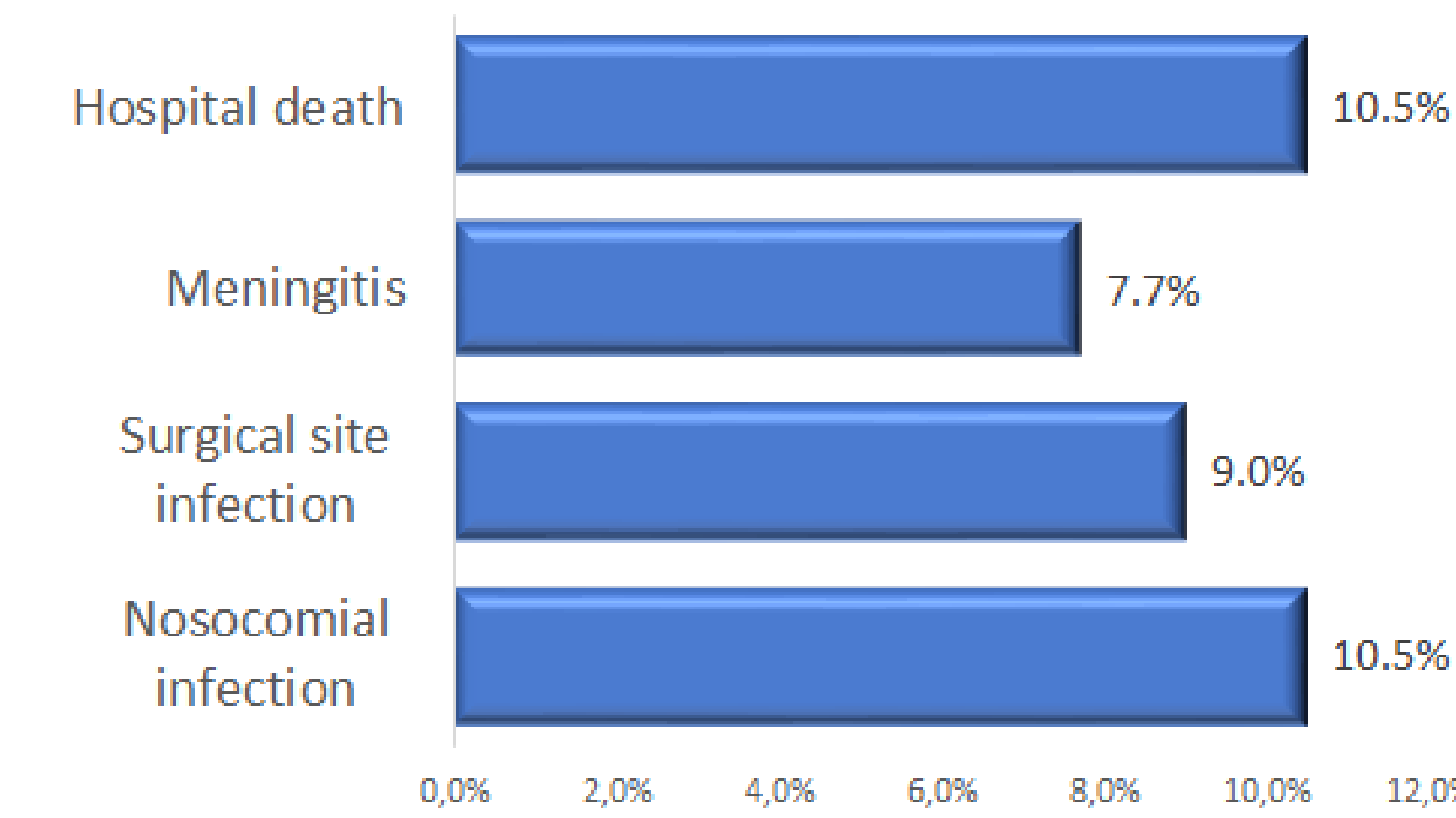


Figure 1: Etiology of meningitis: from 71 meningitis, in 45 (63%) the etiologic agent was identified.

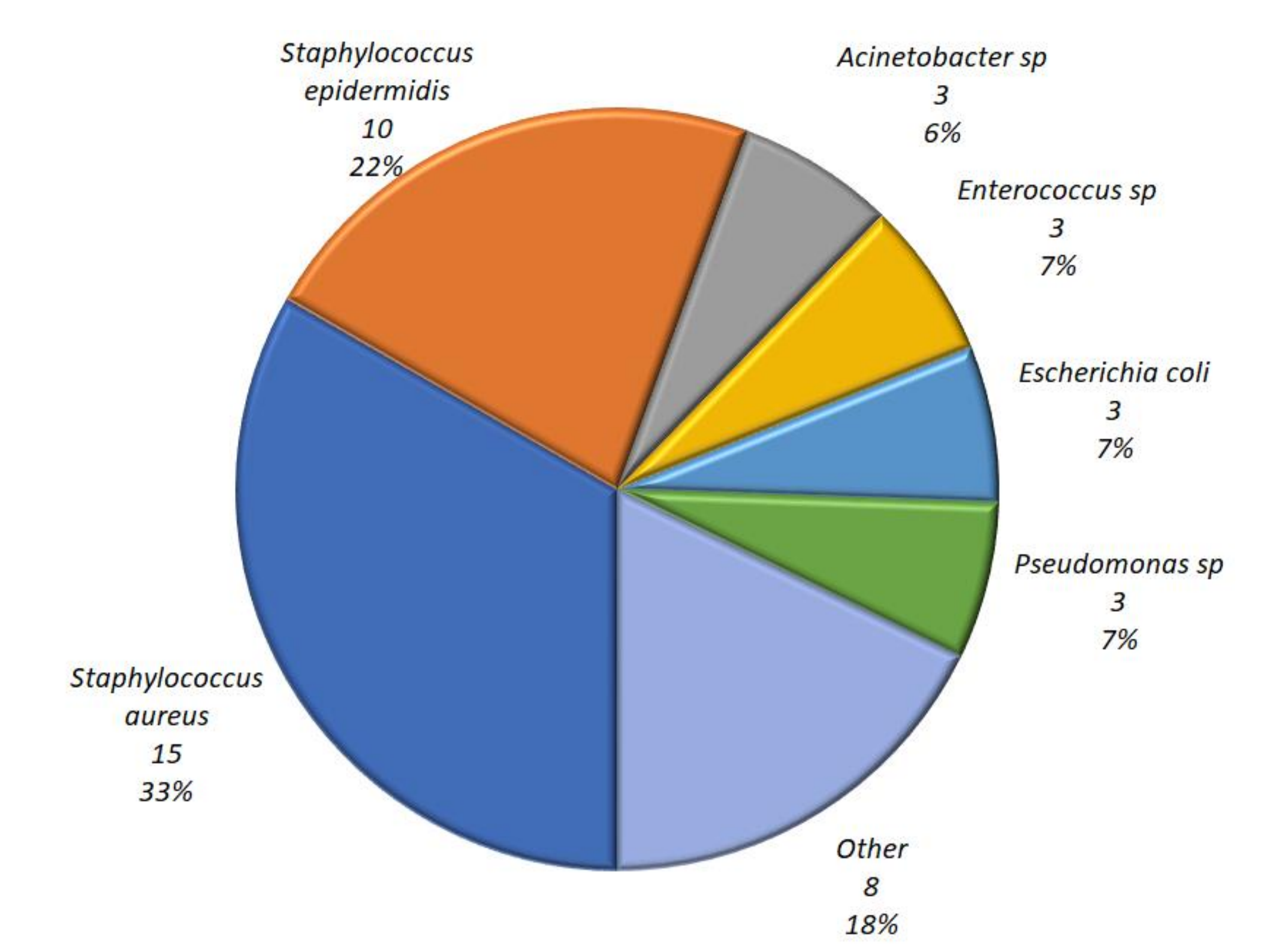


Table 2: Univariate analysis for meningitis.

Variable	Categories	n	Percent	Meningitis	Risk of meningitis	Relative Risk (RR)	p-value																																																																																																																															
Age < two years old	Yes	290	31%	40	13.8%	2.83	< 0.001																																																																																																																															
	No	636	59%	31	4.9%			More than 3 professionals on surgery	Yes	143	15%	4	2,8%	0,33	0.016	No	783	85%	67	8,6%	General anesthesia	Yes	795	90%	64	8.1%	1.69	0.390	No	84	10%	4	4.8%	ASA physical status > 2	Yes	300	41%	23	7.7%	0.88	0.683	No	436	59%	38	8.7%	Surgical wound: contaminated, dirty or infected	Yes	103	11%	6	5.8%	0.74	0.558	No	804	89%	63	7.8%	Duration of surgery > 2 hours	Yes	211	24%	14	6.6%	0.83	0.656	No	677	76%	54	8.0%	Emergency surgery	Yes	110	15%	8	7.3%	0.89	0.851	No	634	85%	52	8.2%	First hospitalization	Yes	631	68%	65	10.3%	5.06	< 0.001	No	295	32%	6	2.0%	More than one surgical procedure	Yes	25	3%	4	16.0%	2.15	0.118	No	901	97%	67	7.4%	Preoperative hospital length of stay > 4 days	Yes	430	46%	45	10.5%	2.00	0.004	No	496	54%	26	5.2%	NNIS risk index categories	0	186	26%	17	9.1%	1.09	0.761	1, 2, 3	525
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Table 3: Multivariate analysis for meningitis by logistic regression model.

Risk factor	Logistic coefficient	S.E.	p-value	Odds Ratio	[95% C.I.]
Age beneath two years old	1.16	0.26	< 0.001	3.2	[1.9; 5.3]
Preoperative hospital length of stay greater than four days	0.70	0.26	0.007	2.0	[1.2; 3.3]
More than one surgical procedure, besides ventricular shunt	1.17	0.58	0.043	3.2	[1.0; 10.0]
Constant	-3.41				

Figure 2: Risk index = number of main risk factors based on logistic regression model (0, 1, 2 or 3).

