

RISK FACTORS FOR UNCHANGED VENTRICLES DURING PEDIATRIC SHUNT MALFUNCTION

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INTRODUCTION

- Hydrocephalus is one of the most common pediatric neurosurgical conditions
- Ventriculoperitoneal shunting remains most common method of surgical treatment.
- Increased ventricular size on CT or MRI usually a indicator malfunction
- However, an estimated 10-20% of all malfunctions associated with unchanged ventricular size
- Diagnostic dilemma with prolonged workup
- Opinions vary as to the cause of symptomatic shunt failure without radiographic findings
- This multicenter case-control study aimed to identify risk factors for unchanged ventricular size

METHODS

- Retrospective 1:1 age-matched case-control study at three institutions
- Children with shunted hydrocephalus who underwent shunt revision with intraoperative evidence of malfunction
- Cases = patients with a change in the frontal-occipital horn ratio (FOR) between malfunction and baseline of < 0.05,
- Controls = FOR changes ≥ 0.05 .
- Presence of infection, abdominal pseudocyst, pseudomeningocele, wound drainage, and lack of baseline cranial imaging at the time of malfunction warranted exclusion.

RESULTS

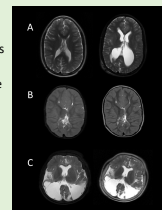
- On multivariable analysis with collinear variables removed, unchanged ventricles were associated with frontal shunt, programmable valve, non-siphoning shunt, larger baseline FOR, and no prior shunt infection

Variable	Odds ratio [95% CI]	p-value
Larger baseline FOR	3.63 [2.49, 5.31]	<0.001
Frontal entry point malfunction	1.74 [1.06, 2.86]	0.028
Malfunction valve: programmable	2.12 [1.06, 4.31]	0.039
Malfunction system: non-siphoning	2.90 [1.69, 4.97]	<0.001
No prior shunt infection	2.34 [1.27, 4.32]	0.007
First shunt malfunction	1.37 [0.83, 2.24]	0.215

ABSTRACT

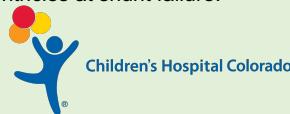
Children whose ventricles do not change during shunt malfunction are a diagnostic dilemma. This study identifies risk factors for unchanged ventricular size at shunt malfunction. This retrospective 1:1 age-matched case-control study identified children with shunted hydrocephalus who underwent shunt revision with intraoperative evidence of malfunction at one of the three participating institutions from 1997-2019. Cases were defined as patients with a change in the frontal-occipital horn ratio (FOR) between malfunction and baseline of < 0.05, while controls included FOR changes ≥ 0.05 . The presence of infection, abdominal pseudocyst, pseudomeningocele, wound drainage, and lack of baseline cranial imaging at the time of malfunction warranted exclusion. In a multicenter cohort of children with shunt malfunction, those with a frontal shunt, programmable valve, non-siphoning shunt, baseline large ventricles, and no prior shunt infection were more likely than others to have unchanged ventricles at shunt failure.

- (A) normal baseline frontal-occipital horn (FOR) score whose ventricles change at malfunction
 (B) normal baseline FOR score whose ventricles do not change at malfunction
 (C) large baseline FOR score whose ventricles do not change at malfunction (Left: baseline FOR 0.58, Right: malfunction FOR 0.61).



CONCLUSION

Children with a frontal shunt, programmable valve, non-siphoning shunt, baseline large ventricles, and no prior shunt infection were more likely than others to have unchanged ventricles at shunt failure.



LIMITATIONS

- Multiple neurosurgeons performed the operations. Thresholds for surgical revision may have varied, which was mitigated by documented catheter or valve malfunction and replacement in the operative report
- May be some variables with high degrees of freedom that are underpowered
- Patients may have ventricular change in third or fourth ventricles that would misclassify them as unchanged ventricles (used FOR)
- Many people were involved in measuring FOR, increasing variability

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- The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.
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