Ventriculoatrial shunt

- Surgical Nuances in Ultrasound-Guided Percutaneous Distal Catheter Placement in Pediatric Ventriculoatrial Shunts
- Ventriculoatrial Shunt Versus Ventriculoperitoneal Shunt: A Systematic Review and Meta-Analysis: Corrigendum
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- Ventriculo-atrial shunt and European regulations: a delicate balance
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- Scrotal migration of the peritoneal catheter of a ventriculoperitoneal shunt: A case series in a single center

The ventriculoperitoneal shunt (VP) option is more popular than ventriculoatrial (VA) shunts. However, shunt revisions may be required due to shunt infection, shunt obstruction, and shunt migration conditions in VP shunts. In such special events, VA shunts may be an appropriate option for continuous cerebrospinal fluid drainage.

The intraoperative appropriate vein selection and exact shunt placement is important to reduce complications such as obstruction.

Placement strategies and monitoring methods have been improved to achieve more success in VA shunt catheter replacement. [1].

58 patients with iNPH underwent primary VA shunting at a median age of 74 (IQR: 70-80) years. The most common comorbidities included hypertension (n=39, 67%) and diabetes mellitus (n=11, 19%). Median duration of symptoms prior to VA shunting was 24 (IQR: 12-36) months. All patients had gait impairment, 52 (90%) had cognitive decline, and 43 (74%) had urinary incontinence. Forty-three (74%) patients had all three symptoms. At a median last follow-up of 16 (IQR: 7-26) months, median iNPH score improved from 6 to 3 ($p<0.0001$), mini mental status exam (MMSE) tended to increase from 26 to 29 ($p=0.082$), timed up-and-go (TUG) improved from 18 to 13s ($p<0.0001$), and Tinetti score improved from 19 to 25 ($p<0.0001$) after VA shunting. 78% of patients had improvement in at least one of their symptoms with 66% of patients having improvement in gait, 53% having improvement in their cognition, and 52% having improved urinary incontinence. A total of 21 patients (36%) had improvement in all 3 symptoms.

There were significant improvements in functional outcomes as evaluated via the iNPH score, TUG, and Tinetti score, while improvement in MMSE trended toward significance. Patients also had improvement of clinical symptoms related to gait, urinary function and cognition. These results suggest that VA shunting can be an effective primary treatment alternative to VP shunting for iNPH [2].

Indications

A ventriculoatrial shunt (VAS) proves to be an excellent alternative in the hydrocephalus treatment. Its usage is a viable option when ventriculoperitoneal shunt (VPS) is contraindicated in any age of patients [3].

Disadvantages

1. requires repeated lengthening in growing child

2. higher risk of infection, septicemia

3. possible retrograde flow of blood into ventricles if valve malfunctions (rare)

Complications

Ventriculoatrial shunt complications.

Retrospective comparative cohort studies

In a Retrospective comparative cohort study Massimi et al. addressed children undergoing VAS in the 2020-2022 period at a single Institution. Patients receiving VAS with Pudenz cardiac catheter (distal slit “valves”) were assigned to group A (2020-2021) while those with VAS harboring proximal adjustable valve to group B (2021-2022, Pudenz no more available). The complications leading to shunt malfunction within 2 years from VAS were analyzed.

Twenty-four children belonged to group A (M/F ratio: 2.4; mean age: 42.5 months) and 18 to group B (MF/ratio: 1.8, mean age: 48.1 months). Statistically significant differences were found about: 1) patients needing shunt revision: 7 cases (29%) in group A vs. 11 cases (61%) in group B; 2) number of shunt revisions: 8 in group A vs. 16 in group B; 3) number of children with mechanical complications: 2 (8.3%) in group A vs. 7 (39%) in group B; 4) number of mechanical complications: 2 (group A) vs. 9 (group B). No differences in other complications or placement-to-revision time were detected.

The lack of simple surgical tools (Pudenz catheter) may make VAS more prone to mechanical complications. Prospective and multicenter trials are needed to produce scientific evidence. In the meantime, a multidisciplinary discussion on the European regulation (including Doctors and Manufacturers) is welcome. [4)]

The authors investigate the clinical consequences of the withdrawal of the Pudenz cardiac catheter, a simple distal component used in ventriculo-atrial shunts (VAS), due to European regulatory changes. They compare outcomes in children who received VAS with Pudenz catheters (Group A, 2020–2021) versus those who received alternative shunt systems with proximal adjustable valves (Group B, 2021–2022).

 Strengths Topical Relevance: The study tackles the unintended clinical consequences of new European medical device regulations (MDR 2017/745), a rarely quantified but highly important topic.

Clinical Significance: The findings are directly tied to patient safety, especially in a vulnerable pediatric population.

Clear Outcomes: The endpoints—shunt revisions and mechanical complications—are objective,

measurable, and clinically meaningful.

Comparative Design: Despite being retrospective, the study design facilitates a temporal comparison between pre- and post-regulation cohorts.

⚠ Limitations Retrospective and Single-Center Design Limits internal validity and generalizability. No control for confounding variables such as surgeon experience, comorbidities, or technique variation.

Small Sample Size Only 42 children (24 in Group A, 18 in Group B) were included. This limits statistical power and may increase the chance of both Type I and Type II errors.

Device Heterogeneity in Group B While Group A exclusively used the Pudenz catheter, the exact specifications of the adjustable valve system in Group B are not detailed. Differences in valve type or distal tubing may independently influence complication rates.

Short Follow-up Window A two-year follow-up may not capture long-term complications such as shunt infection, central venous thrombosis, or late catheter migration.

No Adjustment for Confounders The analysis is unadjusted. Factors like patient comorbidities, ventricle size, venous anatomy, and surgeon-specific practices could confound the observed differences.

 Interpretation of Results The study found significantly higher complication and revision rates in Group B:

Shunt revision rate: 29% vs. 61%

Mechanical complications: 8.3% vs. 39%

These findings suggest that the removal of a simple and effective tool (the Pudenz catheter) may have introduced mechanical vulnerabilities into the VAS procedure. However, the observational nature and limited sample size preclude strong causal inference.

 Regulatory Implications The study serves as a cautionary example of how well-intentioned regulations may inadvertently disrupt clinical practice without a scientific basis for device removal. It calls for:

Multidisciplinary regulatory dialogue, involving neurosurgeons, manufacturers, and policymakers.

Scientific oversight of device discontinuation decisions.

Bridging clinical evidence and regulatory pathways to prevent similar gaps in care.

 Conclusion Massimi et al. present an important early warning about the clinical fallout from rigid regulatory transitions. While the data are preliminary and hypothesis-generating, the findings highlight the critical need for clinical evidence to guide device policy. Until larger prospective studies are done, the neurosurgical community and regulators must collaborate to ensure evidence-based decision-making in pediatric device availability.

Case series

Rymarczuk et al. retrospectively analyzed all cerebrospinal fluid shunting procedures performed over a 13-yr period at a single institution. A total of 544 pediatric shunt patients were followed for at least 90 d (VPS: 5.9 yr; VAS: 5.3 yr).

A total of 54% of VPS and 60% of VAS required at least 1 revision. VPS demonstrated superior survival overall; however, if electively scheduled VAS lengthening procedures are not considered true "failures," no statistical difference is noted in overall survival (P = .08). VPS demonstrated significantly greater survival in patients less than 7 yr of age (P = .001), but showed no difference in older children (P = .4). VAS had a significantly lower rate of infection (P < .05) and proximal failure (P < .001).

VAS can be a useful alternative to VPS when the abdomen is unsuitable, particularly in older children. Although VPS demonstrates superior overall survival, it should be understood that elective VAS lengthening procedures are often necessary, especially in younger patients. If elective lengthening procedures are not considered true failures, then the devices show similar survival [5].

Case reports

A report highlights a successful case involving a 6-month-old patient who underwent VAS catheter positioning. The child presented with hydrocephalus and biliary atresia, making him a candidate for a liver transplant. Notably, a VPS was considered a relative contraindication in this scenario.

The VAS emerges as a viable option for patients in whom a VPS might be contraindicated. This case demonstrates the successful application of a VAS in a pediatric patient [6].

References

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