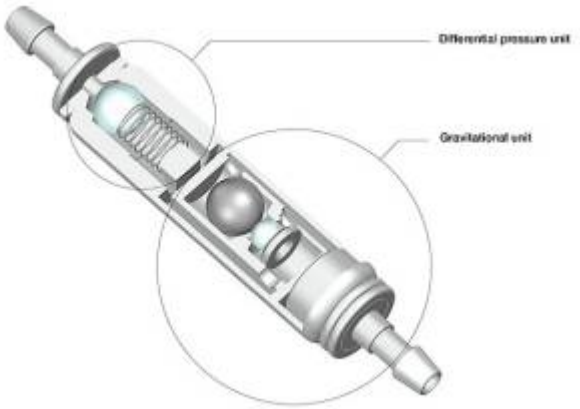
Miethke GAV

- Assessment of MRI issues for a new cerebral spinal fluid shunt, gravitational valve (GV)
- Gravitational shunt complications after a five-year follow-up
- Pediatric gravitational shunts: initial results from a prospective study
- Gravitational valves: relevant differences with different technical solutions to counteract hydrostatic pressure
- On the optimal opening pressure of hydrostatic valves in cases of idiopathic normal-pressure hydrocephalus: a prospective randomized study with 123 patients
- Effect of 3T MRI on the function of shunt valves--evaluation of Paedi GAV, Dual Switch and proGAV
- The treatment of hydrocephalus in infants and children using hydrostatic valves

---



Miethke Paedi-Gav

Miethke Paedi-Gav

MIETHKE GAV 2.0

MIETHKE GAV 2.0

The MIETHKE GAV® is a unique gravitational valve for the treatment of adult hydrocephalus. It automatically varies its opening pressure as soon as this becomes necessary due to alterations in the patient’s body position. Thus it effectively prevents symptoms of overdrainage. Thanks to the physiological drainage and its variable concept, the MIETHKE GAV® is well suited for the treatment of NPH patients, as well as for extreme forms of hydrocephalus in adults. The MIETHKE GAV® is made from titanium, a material that guarantees outstanding precision, reliability and biocompatibility.

The use of adjustable pressure valves with gravity-assisted units in shunt therapy of children with hydrocephalus was reported to be feasible and promising as a way to avoid chronic shunt overdrainage.

Two common valve types used to treat hydrocephalus include gravity assisted valves (GAV) and medium pressure valves (MPV). Despite their different mechanism of action, differentiated surgical indications per type are not well defined. One could assume that due to a higher complexity of the GAV system, it may be more prone to valve-related malfunction.

Due to the prompt switching function when the patient changes posture (lying down, standing, sitting, slanting etc.), the Miethke gravity-assisted valve (GAV) is more suitable in such cases than the Miethke Dual-Switch valve (DSV) [1)]

Case series

2016

All data were collected from a cohort of infants (93 patients [37 girls and 56 boys], less than 1 year of age [mean age 4.1 ± 3.1 months]) who received their first adjustable pressure hydrocephalus shunt as either a primary or secondary implant between May 2007 and April 2012. Rates of valve and shunt failure were recorded for a total of 85 months until the end of the observation period in May 2014.

During a follow-up of 54.2 ± 15.9 months (range 26-85 months), the Kaplan-Meier rate of shunt survival was 69.2% at 1 year and 34.1% at 85 months; the Kaplan-Meier rate of valve survival was 77.8% at 1 year and 56% at 85 months. Survival rates of the shunt were significantly inferior if the patients had previous shunt surgery. During follow-up, 44 valves were exchanged in cases of infection (n = 19), occlusion (n = 14), dysfunction of the adjustment unit (n = 10), or to change the gravitational unit (n = 1).

Although a higher shunt complication rate is observed in infant populations compared with older children, reasonable survival rates demonstrate the feasibility of using this sophisticated valve technology. The gravitational unit of this valve is well tolerated and its adjustability offers the flexible application of opening pressure in an unpredictable cohort of patients. This may adequately address overdrainage-related complications from early in treatment [2)].

2013

Cordero Tous et al., prospectively analysed 40 patients. The diagnosis of idiopathic normal pressure hydrocephalus was established when patients met 3 criteria: (i)clinical; (ii)radiological (Evans >0.3), and (iii)hydrodynamic (Katzman infusion test with Rout >12) or pathological ICP monitoring (B waves in over 20% of a nocturnal registration). We used a low-pressure DVP 5/35 GAV in all cases. Clinical assessments were conducted at 3, 6 and 12 months and radiological assessments at 6 months postoperatively. The clinical improvement of patients was assessed with the NPH, modified RANKIN and modified PFEIFFER rating scales.

The study of risk factors (age, gender, smoking, drinking, arterial hypertension, diabetes mellitus,

dyslipidemia) did not establish statistically significant relationships. A statistically significant improvement was observed (P<.01) in the NPH and RANKIN tests at 3, 6 and 12 months. Clinical improvement values obtained were: NPH 73%, 74% and 64%, and RANKIN 54%, 72% and 56%, respectively. The PFEIFFER scale only showed a significant improvement at 12 months. These improvements were classified into various levels (high, moderate, mild and no improvement). The initial mean Evans index was 0.385, and 0.3675 postoperatively. There was only one infection of the valvular system (2%) without further complications. Morbidity and mortality related to the procedure were 0%.

An appropriate selection of patients through clinical, radiological, hydrodynamic and ICP monitoring criteria enables us to obtain good results and a low complication rate [3].

The purpose of a retrospective study was to compare the valve-related complication rates of GAV and MPV in patients with communicating hydrocephalus.

Patients aged 16 years or older undergoing their first shunt implantation using GAV or MPV were included. We recorded demographic data, implantation diagnosis, outcome, complications, valve type and valve adjustments. Symptoms were documented at discharge and follow-up. Valve-related malfunctions were distinguished from other shunt complications.

N = 252 patients (range 16.6-88.4, mean 65.0 years, 116 male and 136 female) underwent shunt placement for the first time. N = 122 GAV (48.4 %) and n = 130 MPV were implanted (51.6 %) over a period of 5 years. The most frequent diagnoses were normal pressure hydrocephalus (NPH) in 86 cases (34.1 %) and posthemorrhagic hydrocephalus in 114 cases (45.2 %). About two thirds of patients were free of hydrocephalus-related symptoms at follow-up. N = 66 subjects (26.2 %) underwent at least one shunt revision. N = 29 revisions (11.5 %) were due to valve-related malfunction. Valve-related revisions were the main cause for revision in 18/37 cases (48.6 %) in the GAV group and in 11/29 (37.9 %) in the MPV group. Neither clinical improvement nor valve-related malfunctions were found to be statistically different among groups [4].

From January 2002 to December 2009, 111 patients underwent ventriculoperitoneal (VP) shunting.

Overall shunt survival time was 268 weeks. Mean survival time of gravity-assisted valve (GAV) was 222 weeks versus 286 weeks for other shunts. Survival time of programmable valves (264 weeks) was longer than that of pressure-controlled valves (186 weeks). The most common cause for shunt revision was underdrainage (13 valves). The revision rate due to underdrainage in patients with GAV (7 of 10 patients) was higher than that for other valve types. Of 7 patients requiring revision for GAV underdrainage, 6 patients were bedridden. The overall infection rate was 3.6%, which was lower than reported series. Seven patients demonstrating overdrainage had cranial defects when operations were performed (41%), and overdrainage was improved in 5 patients after cranioplasty.

Although none of the differences was statistically significant, some of the observations were especially notable. If a candidate for VP shunting is bedridden, GAV may not be indicated because it could lead to underdrainage. Careful procedure and perioperative management can reduce infection rate. Cranioplasty performed prior to VP shunting may be beneficial [5]

The performance of GAV may be affected by its inclination as a tantalum sphere in the valve, which generates a downhill force in proportion to the sine of the angle with respect to level. Accordingly, the aim of this study was to evaluate the effect of valve inclination relative to the vertical on shunt performance.

In 24 adult patients who underwent ventriculoperitoneal shunting using a GAV for hydrocephalus, valve inclination relative to the vertical was measured using AP and lateral projections of skull x-rays that were taken in a standing position, and the relationship between valve inclination and ventricular volume change after ventriculoperitoneal shunting in CT scans was evaluated.

The Pearson correlation coefficient between valve inclination in a sagittal plane and ventricular volume change was -0.768 ($P < .01$), whereas lateral valve inclination had no correlation with ventricular volume change. Eleven patients with a posterior valve inclination relative to the vertical exhibited a greater ventricular volume reduction of 34.1% +/- 8.2% compared to the volume reduction of 13.4% +/- 9.2 % in 13 other patients with an anterior valve inclination ($P = .000$). Two (40%) of 5 patients with a severe anterior valve inclination of more than 20 degrees relative to the vertical underwent shunt revision for underdrainage.

A severe anterior inclination of the valve by more than 20 degrees relative to the vertical can lead to underdrainage owing to an increased OP in a lying position, especially in patients who are nonambulatory at the time of GAV implantation [6)].

Case reports from the HGUA

Title: Case Report: Idiopathic normal pressure hydrocephalus with Peri-Drainage Cerebral Hemorrhage

Abstract: This case report presents a Ventriculoperitoneal shunt for idiopathic normal pressure hydrocephalus treatment with peri-drainage cerebral hemorrhage using a ventricle-peritoneal shunt (Miethke GAV 5/35) and a positive infusion test. The patient showed improvements in responsiveness and consciousness after 13 days of admission. A follow-up was performed due to unexplained episodes of fever. The latest cranial CT scan indicated a stable evolution of the right frontal parenchymal hematoma associated with the ventricular shunt, with no signs of increased ventricular size or hydrocephalus.

Introduction: Idiopathic normal pressure hydrocephalus is a condition characterized by an abnormal accumulation of cerebrospinal fluid (CSF) within the ventricles of the brain in adults. It can lead to increased intracranial pressure, impairing neurological function and causing various symptoms. In this case, we present a patient with chronic adult hydrocephalus who experienced a peri-drainage cerebral hemorrhage after undergoing ventricle-peritoneal shunt placement using the Miethke GAV 5/35 valve.

Case Presentation: A 59-year-old male patient presented with a history of chronic adult hydrocephalus, which had progressively worsened over the past few months. The patient underwent a ventricle-peritoneal shunt placement on June 22, 2023, using the Miethke GAV 5/35 valve to manage the hydrocephalus.

On the 13th day of admission, the patient's condition showed notable improvement. He was afebrile and had a blood pressure reading of 130/79. The patient was more awake and responsive, demonstrating the ability to respond to and follow simple commands. The wound at the site of the shunt placement was found to be dry, without any signs of inflammation.

The patient was also experiencing unexplained episodes of fever (UEI), leading the medical team to perform a reservoir puncture two days prior to this report. However, the cerebrospinal fluid cultures came back negative after 24 hours.

Results: The latest cranial CT scan, revealed stable evolution of the right frontal parenchymal hematoma associated with the ventricular shunt. The shunt's entry point was identified in the right frontal region, with the distal end located in the ipsilateral frontal horn. Despite the hematoma, there were no signs of increased ventricular size or hydrocephalus.

However, the cranial CT scan did show persistent intraventricular hemorrhage contamination, primarily hyperdense and considered recent. There was no evidence of any significant increase in the size of the hemorrhage.

Discussion: The management of chronic adult hydrocephalus with a ventricle-peritoneal shunt is a well-established treatment option. In this case, the Miethke GAV 5/35 valve was utilized, providing an effective means to drain excess cerebrospinal fluid and relieve intracranial pressure.

The presence of a peri-drainage cerebral hemorrhage can be a potential complication associated with shunt placement. However, the patient's stable condition and lack of increased ventricular size suggest that the shunt is effectively draining CSF without causing additional hydrocephalus.

Conclusion: This case highlights the successful management of chronic adult hydrocephalus with peri-drainage cerebral hemorrhage using a ventricle-peritoneal shunt (Miethke GAV 5/35) and a positive infusion test. The patient's neurological status improved after the shunt placement, and there were no signs of hydrocephalus progression on the latest cranial CT scan. Close monitoring and follow-up are necessary to ensure the continued efficacy and safety of the ventricular shunt system.

1)
Meier U, Kiefer M, Neumann U, Lemcke J. On the optimal opening pressure of hydrostatic valves in cases of idiopathic normal-pressure hydrocephalus: a prospective randomized study with 123 patients. Acta Neurochir Suppl. 2006;96:358-63. doi: 10.1007/3-211-30714-1_74. PMID: 16671485.
2)
Gebert AF, Schulz M, Schwarz K, Thomale UW. Long-term survival rates of gravity-assisted, adjustable differential pressure valves in infants with hydrocephalus. J Neurosurg Pediatr. 2016 May;17(5):544-51. doi: 10.3171/2015.10.PEDS15328. Epub 2016 Jan 22. PubMed PMID: 26799410.
3)
Cordero Tous N, Román Cutillas AM, Jorques Infante AM, Olivares Granados G, Saura Rojas JE, Iañez Velasco B, Sánchez Corral C, Roldán Serrano MÁ, Horcajadas Almansa A. [Adult chronic idiopathic hydrocephalus-diagnosis, treatment and evolution. Prospective study]. Neurocirugia (Astur). 2013 May-Jun;24(3):93-101. doi: 10.1016/j.neucir.2011.12.007. Epub 2013 Mar 22. Spanish. PubMed PMID: 23523476.
4)
Schatlo B, Hamed M, Grote A, Schramm J, Neuloh G. Gravity assisted vs. medium pressure valves for communicating hydrocephalus show similar valve-revision rates. Acta Neurochir (Wien). 2013 Oct;155(10):1987-91. doi: 10.1007/s00701-013-1852-4. Epub 2013 Aug 29. PubMed PMID: 23989996.
5)
Lee WC, Seo DH, Choe IS, Park SC, Ha YS, Lee KC. A comparative result of ventriculoperitoneal shunt, focusing mainly on gravity-assisted valve and programmable valve. J Korean Neurosurg Soc. 2010 Sep;48(3):251-8. doi: 10.3340/jkns.2010.48.3.251. Epub 2010 Sep 30. PubMed PMID: 21082054; PubMed Central PMCID: PMC2966728.
6)
Park J, Kim GJ, Hwang SK. Valve inclination influences the performance of gravity-assisted valve. Surg Neurol. 2007 Jul;68(1):14-8; discussion 18. PubMed PMID: 17586212.