

## SHORT REPORT

## Shunt failure caused by valve collapse

Trygve Lundar, Iver A Langmoen, Karl H Hovind

**Abstract**

**Shunt failure due to collapse of the Mini-Holter valve was observed 13 times in 11 out of 179 children with an implanted Mini-Holter ventriculo-peritoneal (VP) or ventriculo-atrial (VA) shunt during a 10 year period. Intussusception of the proximal or distal end of the valve thus caused a shunt failure rate of 6% of the children in this series. Two children experienced this complication twice. All collapsed valves were part of a VP shunt system. Because of this experience use of the mini valve was abandoned and an adult Holter valve was implanted in children over the age of one month. Breakdown of this particular valve has not occurred in 102 children and two hundred adults with the adult Holter shunt system.**

No field of neurosurgery have complication rates comparable to ventricular fluid diversion to the peritoneum or the atrium.<sup>1,2</sup> The most frequent complications are proximal or distal catheter obstruction, overdrainage and shunt infection.<sup>3-5</sup> Disconnection or fracture of the shunt system are also well known complications. We report the collapse of the mini-Holter valve as a significant complication in our series of hydrocephalic children with shunts.

**Material and results**

During a nine year period 179 children had a mini-Holter VP or VA shunt inserted, either as the primary shunt procedure or at review. In November 1986, a five year old boy presented with shunt failure. The shunt had developed an intussusception of the proximal end of the valve inside the tubing. Since then we have observed this complication in another

ten children, twice in two of them. Patient and valve data are summarised in the table. In the 13 valve collapses observed, the proximal end was intussuscepted in nine, the distal end in three and both ends in one (table, fig). The time from implantation of the valve until the symptom of collapse occurred ranged from five to 36 months. All the collapsed valves were implanted between May 1985 and October 1987 and all were part of a VP shunt. In child 7 (table) with recurrent valve collapse, the shunt had been inserted by the frontal route. The other 10 children had VP shunts implanted by the occipital route.

Because of the valve breakdowns that were observed we changed to adult Holter valves in older children in 1987. As complications with the mini-Holter valve increased from June 1988, we decided to use the adult valves exclusively, even in children as young as one month. In premature children and neonates we have used an angular ventricular catheter and a Pudenz distal catheter without a pump as the primary procedure.

Similar breakdown of an adult Holter valve has not been observed in any of the 102 implanted in our paediatric series, or in any of the two hundred adult cases.

**Discussion**

To our knowledge, intussusception of one of the ends of the valve has not been reported as a significant problem. In contrast to the adult valve, the mini valve has cone tubing, which may be responsible for the collapses. The intussusception implies a discontinuity between the valve and the proximal or distal catheter. In 11 out of the 13 valve collapses, however, the disconnected catheter was left in place adjacent to the tubing with the non-absorbable securing suture attached. In child 8 the distal end of the proximal catheter was 4-5 mm from the tubing and in child 11 the

Table Clinical and valve data

Child number	Age in months, sex	Valve implant time (months)	VP low or medium	Proximal or distal internal collapse
1	9 M	30	Medium	Proximal
2	19 M	18	Medium	Proximal
3	36 M	16	Medium	Proximal
4	8 M	16	Low	Distal
5	55 M	14	Medium	Proximal
	72 M	15	Low	Proximal
6	74 M	10	Medium	Proximal
7	52 M	18	Medium	Proximal
	70 M	5	Medium	Proximal
8	4 M	27	Medium	Both
9	22 M	36	Medium	Proximal
10	6 F	9	Low	Distal
11	19 F	26	Medium	Distal

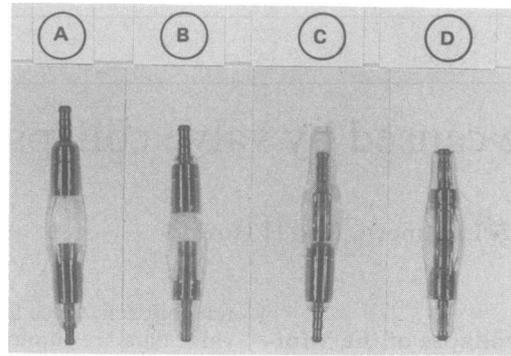
Department of Neurosurgery, The National Hospital, University of Oslo, Oslo, Norway

T Lundar  
I A Langmoen  
K H Hovind

Correspondence to:  
Dr Lundar, Department of Neurosurgery, Rikshospitalet, N-0027 Oslo 1, Norway

Received 2 April 1990 and in revised form 8 September 1990.

Accepted 1 November 1990



**Figure** Intussusception of valve ends into the valve tubing. A) Partial distal (child 10), B) complete distal (child 4), C) complete proximal (child 6) and D) complete, both ends (child 8) of the valve.

distal catheter was dislodged to the peritoneal cavity. The patient's families had not been advised to pump the valve.

The collapses may be due to a change in the quality of the valve as all these collapsed valves were implanted over a relatively short period. During the initial period of this clinical series of implanted mini-Holter shunts,

we did not experience this complication. In the first period, however, most of the children had VA shunts implanted. Like many other centres, we have experienced an increased incidence of overdrainage and slit-ventricle syndrome after changing from VA to VP shunts.

The intussusception might be the consequence of a syphoning effect causing a negative pressure in the valve chamber. It is surprising, that this has not been observed in adults, where the syphoning effect should be even greater. This could be due to construction differences between the mini valve and the adult valve.

- 1 Epstein F. How to keep shunts functioning, or "The impossible dream". *Clin Neurosurg* 1985;32:608-31.
- 2 French BN. Complications of surgery for hydrocephalus and shunting. In: deVries PA, Shapiro SR, eds. *Complications of pediatric surgery*, New York, Chichester: John Wiley, 1982:365-77.
- 3 McLaurin RL. Ventricular shunts: complications and results. In: McLaurin RL, Schut L, Venes JL, Epstein F, eds. *Pediatric neurosurgery: surgery of the developing nervous system*. London: WB Saunders, 1989:219-29.
- 4 Olsen L, Frykberg T. Complications in the treatment of hydrocephalus in children. A comparison of ventriculo-atrial and ventriculoperitoneal shunts in a 20-year material. *Acta Paediatr Scand* 1983;72:385-90.
- 5 Winston KR. *Complications of pediatric surgery*. London: WB Saunders, 1982:99-114.