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Case Report

On-off malfunction in a pediatric shunt

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ABSTRACT

Three- years-old-boy with a history of ventriculo-peritoneal shunt placement was admitted to our neurosurgery department with headache, vomiting and sunset eye phenomena. Direct X-ray examination of the shunt system was completely normal. The palpation of the shunt dome resulted the unfilling of pumping device. Computerised Tomography (CT) of the head revealed ventricular enlargement and periventricular oedema. The patient was hospitalised for shunt revision. The symptoms were spontaneously disappeared within 48 hours. The pumping device returned to normal refilling. Follow up CT showed small ventricular size and shape.

This case indicates that the symptomatic intermittent occlusion of the proximal shunt catheter can be seen in the paediatric age group and the obstruction may continue for a certain period and spontaneously return to normal function with correlated clinical response.

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1. Introduction

Mechanical malfunction of inserted shunt system is the most common complication of ventriculo-peritoneal shunts (Little, 1972; Blount, 1993). Malfunction may be the result of either mechanical obstruction of the lumen or disconnection of the shunt components. Shunt may be obstructed at the ventricular part, within the pumping device, and/or at the distal catheter. Proximal shunt obstruction due to mechanical occlusion of the ventricular catheter is the most common cause of shunt malfunction with a 30% rate (Sainte-Rose, 1991; Sainte-Rose, 1993; Kast, 1994; Takahashi, 1998). The occlusion is multifactorial in origin. Choroid plexus, brain debris, fibrin, clotted blood, and/or developing granulation tissues can totally or partially block the ventricular catheter (Blount, 1993; Sainte-Rose, 1993; Kast, 1994; Takahashi, 1998).

Here we report a paediatric case with transient malfunction of ventriculoperitoneal shunt having a medium pressure valve. The possible mechanisms are discussed under the scope of literature.

2. Case Report

Three year-old-boy was admitted to our neurosurgery department with an acute onset of headache, vomiting, and sunset eye phenomena.

He had a history of implanted ventriculo-peritoneal shunt with medium pressure valve following post-meningitic hydrocephalus at the age of six months. The previous computerised tomography (CT) scans of the case were retrospectively evaluated. The first CT scan of the patient showed normal ventricular shape in the early phase of bacterial meningitis (Fig. 1). The second CT scan of the head taken sixteen days later from first CT revealed hydrocephalic ventricles and periventricular hypodensity (Fig. 2). After insertion of shunt device (Pudenz venriculo-peritoneal shunt), CT images showed small ventricles (Fig. 3).

In the present admission, direct X-Ray examination of the shunt system was found as normal. However the pumping device of shunt was non-functional on manipulation. CT scan of the head revealed ventricular enlargement and periventricular oedema during the symptomatic and unfilling pumping device period (Fig. 4). The patient was hospitalised for shunt revision. The symptoms were spontaneously disappeared within 48 hours of hospitalisation and the pumping device returned to normal refilling function. The early follow-up CT scan of the head showed smaller

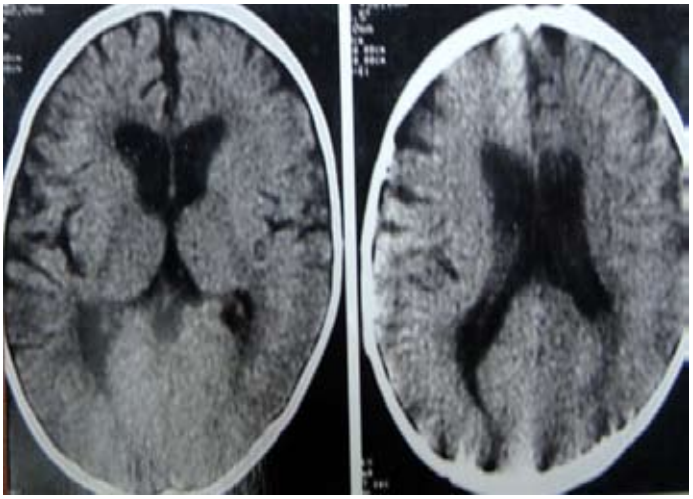

Fig. 1. The first CT scan of the patient showed normal ventricular shape in the early phase of bacterial meningitis.

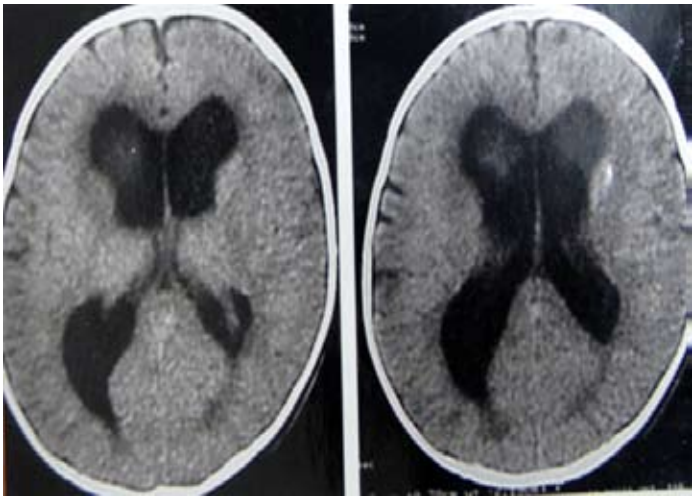

Fig. 2. The second CT scan of the head taken 16 days later from first CT revealed hydrocephalic ventricles and periventricular hypodensity.

Fig. 3. Follow up CT scan after operation demonstrated small ventricles.

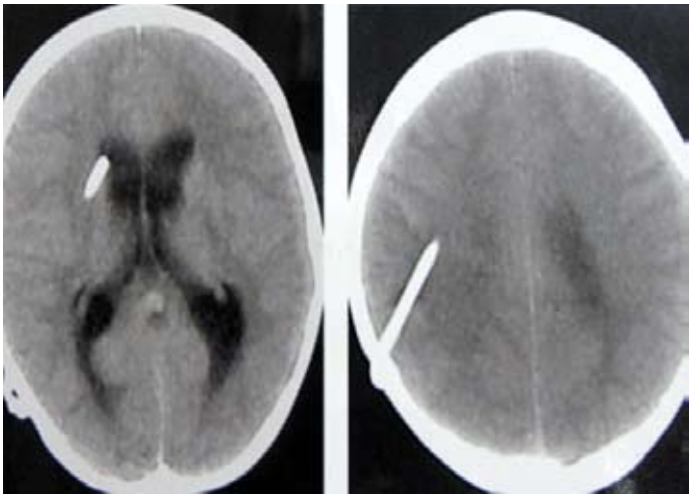

Fig. 4. CT scan of the head revealed ventricular enlargement and periventricular oedema during the symptomatic and unfilling pumping device period.

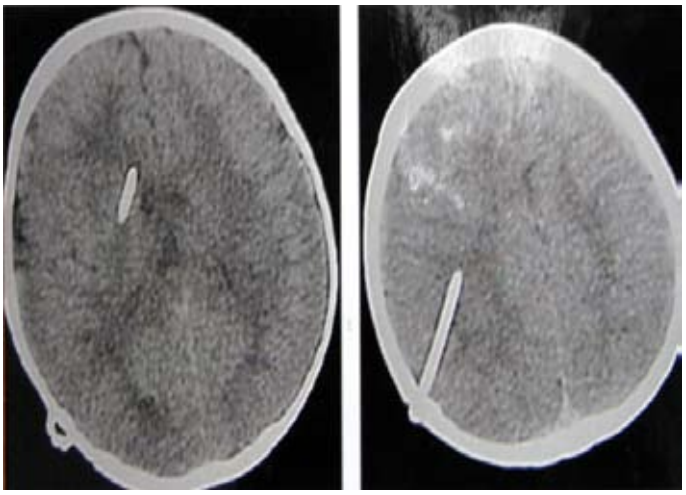

Fig. 5. The early follow up CT scan of the head showed small ventricles confirming normal functioning of shunt system.

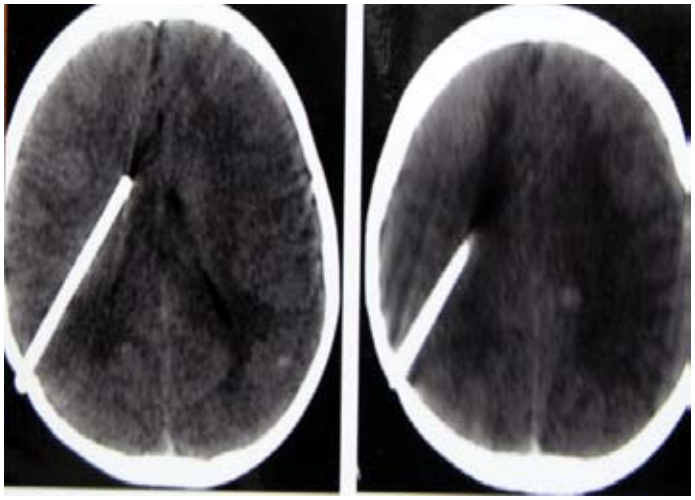

Fig. 6. The late follow up CT scan of the head (20 months later) demonstrated similar findings with those of early follow up CT.

ventricles confirming normal functioning of shunt system (Fig. 5). The late follow-up CT scan of the head (20 months later) demonstrated findings similar to those of early follow-up CT. (Fig. 6). In this period, the patient was still asymptomatic.

3. Discussion

The concept of intermittent shunt malfunction or on-off shunt failure is seen in two different clinical situations. One of which is the slit-ventricle syndrome. The triad of slit ventricle syndrome includes intermittent headache, smaller than normal ventricles on imaging studies, and slow refilling of the shunt pumping device (Rekate, 1993; Walker, 1993). Collapsed ventricle wall around the catheter is the main cause of intermittent obstruction (Rekate, 1993; Walker, 1993). The increased intracranial

pressure during the obstructed phase results in detachment of ventricle walls and allows the shunt to drain for a short period (Rekate, 1993; Walker, 1993).

The second situation is the presented case its characteristics include longer obstruction period, periventricular hypodensity with unfilling of the pumping device during the period of obstruction, and the presence of shunt mulfunction symptoms until normal refilling of pumping device.

Although the location of the proximal catheter tip is in its optimal place in front of the foramen monroe, the course of the catheter is localised in thalamic entrance to the right lateral ventricle. The length of the fenestrated part of proximal catheter in the lateral ventricle is shorter. During the small ventricle period the fenestrated part of the catheter is obstructed by the brain tissue (Takahashi, 1998).

When the intraventricular pressure rises to high levels the ventricles begin to dilatation and catheter is peeled, but some amount of brain tissue may remaine on the holes. The completely or incompletely obstructed holes stay under elevated CSF pressure for a while and then are opened by the forcing effect of pressure. Off period is ended and On period is started again (Takahashi, 1998).

This shunted patient had stayed asymptomatic for two years. CT scans during this period showed very small slitlike ventricles. The pumping device was normally refilling. Two years later after the first operation the patient became symptomatic with dilated ventricles on CT and unrefilling pumping device for two days.

The symptoms of the patient disappeared without any surgical intervention. The pumping device returned to normal refilling. Follow-up CT scan showed very small sized ventricles again. The patient was followed for 16 months and he has still been asymptomatic with small ventricles.

This case indicates that intermittent proximal catheter occlusion may be seen in paediatric age group and can disappear spontaneously. The mechanism of intermittent occlusion is different from that of the slit-ventricle syndrome. In this case, the catheter did not allow any CSF draining to peritoneal cavity for a long period.

We think that the occlusion was due to some debris inside the catheter. Increased intraventricular pressure was the main factor for sustaining the drainage. The main factors in the transient occlusion of the catheter are improper insertion of the proximal catheter, the aetiology of hydrocephalus itself, and small or slit ventricles.

4. Conclusion

Symptomatic intermittent shunt failure due to occlusion of the catheter may be seen in previously shunted patients. The clinical findings are similar to those of high intracranial pressure. CT images demonstrate dilated ventricles and periventricular hypodensity. The pumping device stays in the unfilling position for a period of time (two days in our case). The shunt can spontaneously be reactivated. Radiological images also return to normal. Hospitalisation and observation of patients with moderately symptomatic proximal catheter occlusion should be the treatment of choice before more radical approaches are considered.

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