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### Shunt malfunction and Slight edema surrounding the ventricles: Ten case series

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#### KEYWORDS

Shunt Malfunction,  
Manifestation,  
Imaging finding

#### A B S T R A C T

Most cases of shunt malfunctions occur due to occlusion (blockage) of the proximal ventricular catheter. In these instances, pumping of the shunt will show a valve that is slow to refill, or does not refill at all. In a majority of cases, infection is the cause of shunt malfunction when a distal blockage is suspected. The aim of this study was evaluation shunt malfunction in patients with Ventriculoperitoneal shunt and its presentation. In a cross-section and descriptive-analytical study that performed in neurosurgery department of Tabriz University of medical sciences on patients with shunt malfunction, signs, symptoms and imaging findings in patients with shunt malfunction evaluated. 4 of patients were male and 6 of them were female. Mean age of male patients was  $33.00 \pm 25.17$  year and in female patients was  $31.83 \pm 24.95$  ( $P=0.944$ ). Clinical finding in the studied patient's including nausea in 50% of patients, vomiting in 30% of patients, headache in 80% of patients and sunset eyes in 30% of patients. At evaluation of patients in the study, shunt infection role out in all patients. In Ophthalmoscopic examination of patients, none of patients had Papilledema. Shunt pump had well work at all patients. At the CT scan that performed in all patients, only positive finding was Slight edema surrounding the ventricles.

### Introduction

Cerebral shunts are commonly used to treat hydrocephalus, the swelling of the brain due to excess buildup of cerebrospinal fluid (CSF).

If left unchecked, the cerebrospinal fluid can build up leading to an increase in intracranial pressure (ICP) which can lead to intracranial hematoma, cerebral edema,

crushed brain tissue or herniation(Hlatky, 2003). The cerebral shunt can be used to alleviate or prevent these problems in patients who suffer from hydrocephalus or other related diseases. Shunts can come in a variety of forms but most of them consist of a valve housing connected to a catheter, the end of which is usually placed in the peritoneal cavity. The main differences between shunts are usually in the materials used to construct them, the types of valve (if any) used, and whether the valve is programmable or not(Bradley, 2006).

Another leading cause of shunt failure is the blockage of the shunt at either the proximal or distal end. At the proximal end the shunt valve can become blocked due to the buildup of excess protein in the CSF. The extra protein will collect at the point of drainage and slowly clog the valve. The shunt can also become blocked at the distal end if the shunt is pulled out of the abdominal cavity (in the case of VP shunts), or from similar protein buildup. Other causes of blockage are overdrainage and slit ventricle syndrome(Gary, 2009).

Most cases of shunt malfunctions occur due to occlusion (blockage) of the proximal ventricular catheter. In these instances, pumping of the shunt will show a valve that is slow to refill, or does not refill at all. In a majority of cases, infection is the cause of shunt malfunction when a distal blockage is suspected. A preoperative CSF specimen from a shunt tap should be obtained to exclude this possibility. The proximal system can be tested by ensuring free flow of CSF, whereas the distal system can be tested by runoff using a manometer. Symptoms of shunt malfunction were included in infants: Enlargement of the baby's head, Fontanelle is full and tense when the infant is upright and quiet, Prominent scalp veins, Swelling along the shunt tract, Vomiting, Irritability,

Sleepiness, Downward deviation of the eyes, Seizures , in toddlers: Head enlargement, Vomiting, Headaches, Irritability and/or sleepiness , A loss of previous abilities (sensory or motor function) , Seizures and in children and adults: Vomiting, Headache, Vision problems, Irritability and/or tiredness, Personality change, Seizures, Difficulty in waking up or staying awake. There is a heightened risk of shunt blockage in the first few months following placement.

The ventriculoperitoneal shunt (vps) is the CSF shunting device usually used to treat hydrocephalus. All shunting systems regularly malfunction despite the best efforts of physicians and biomedical engineers(Ventureyra and Higgins, 1994). Although the patients age, sex and underlying condition in some studies do not influence the shunt complication rate, age and the etiology of the hydrocephalus remains to be the most important complicating factors. Proximal shunt obstruction is the main cause of majority of shunt malfunctions(Grosfeld, 1974). Although the primary factor determining proximal catheter malfunction is not the surgical approach, stated in some studies(Dickerman and McConathy, 2005). The aim of this study was evaluation shunt malfunction in patients with Ventriculoperitoneal shunt and its presentation.

## **Methods**

In a cross-section and descriptive-analytical study that performed in neurosurgery department of Tabriz University of medical sciences on patients with shunt malfunction, signs, symptoms and imaging findings in patients with shunt malfunction evaluated. In this study, 44 patients with shunt malfunction that diagnosed and were under treatment in neurosurgery ward of Emam Reza hospital selected and evaluated.

Signs, symptoms and imaging findings these patients were studied.

The initial portion of the statistical analysis included descriptive statistics. We used t-tests, chi-square analysis, and Fisher exact tests to statistically analysis of data and  $P < 0.05$  was considered significant.

## **Results and Discussion**

Of 10 patients, 4 of patients were male and 6 of them were female. Mean age of male patients was  $33.00 \pm 25.17$  year and in female patients was  $31.83 \pm 24.95$  ( $P=0.944$ ) (Chart 1). Age distribution of patients in tow gender was shown in chart 2.

Clinical finding in the studied patient's including nausea in 50% of patients, vomiting in 30% of patients, headache in 80% of patients and sunset eyes in 30% of patients. Clinical findings was shown in chart 3 based on patients gender.

At evaluation of patients in the study, shunt infection role out in all patients.

In Ophthalmoscopic examination of patients, none of patients had Papilledema. Shunt pump had well work at all patients. At the CT scan that performed in all patients, only positive finding was Slight edema surrounding the ventricles. The causes for shunt malfunction include shunt infection, obstruction, distal catheter migration, shunt disconnection etc (Morina, 2013).

Ventriculoperitoneal shunt malfunction is a relatively common problem encountered in shunted hydrocephalic patients and is attributed most frequently to mechanical obstruction of the ventricular catheter (Charalambides and Sgouros, 2013). Most pediatric patients with hydrocephalus are

treated with ventriculoperitoneal (VP) shunt placement.

However, shunt malfunction is common and is usually caused by mechanical failure. Shunt obstructions may be confirmed with radioisotope examination or with fluoroscopically guided injection of iodinated contrast material into the shunt reservoir (Goesser, 1998). Imaging analysis is an essential adjunct to the clinical evaluation of patients with suspected VP shunt malfunctions or complications (Goesser, 1998).

In this study, CT scan of all patients was normal and only positive finding of imaging was Slight edema surrounding the ventricles. The traditional management of hydrocephalus still is the placement of ventriculoperitoneal (VP) shunts. However, the majority of patients require one or more revisions over their lifetime. Revisions may be required for infections, proximal site malfunction, or distal catheter complications (Nfonsam, 2008). Regardless of the patient's presenting symptoms, appropriate imaging studies should be obtained preoperatively in a sequential manner (Nfonsam, 2008).

Diagnosis of ventriculoperitoneal (VP) shunt pathology remains a dilemma in patients with nonspecific constitutional signs and symptoms (McClinton, 2001). In our study patients manifestations included nausea in 50% of patients, vomiting in 30% of patients, headache in 80% of patients and sunset eyes in 30% of patients. In patients suspected of having a VP shunt malfunction, the presence of  $>$  or  $=5\%$  eosinophils in the ventricular fluid indicates shunt pathology. The combination of fever and ventricular fluid neutrophils  $> 10\%$  is predictive of shunt infection (McClinton, 2001).

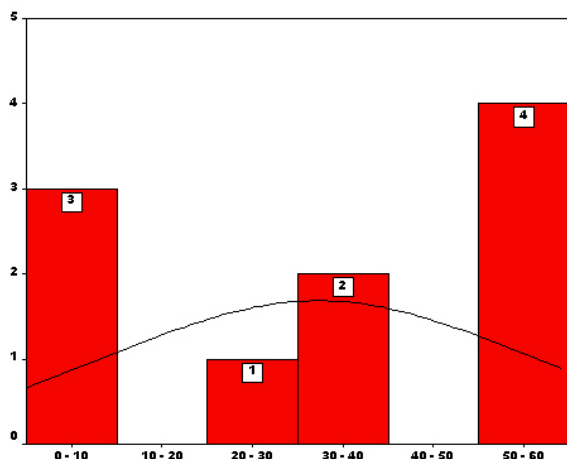


Chart.1 Age distribution of patients

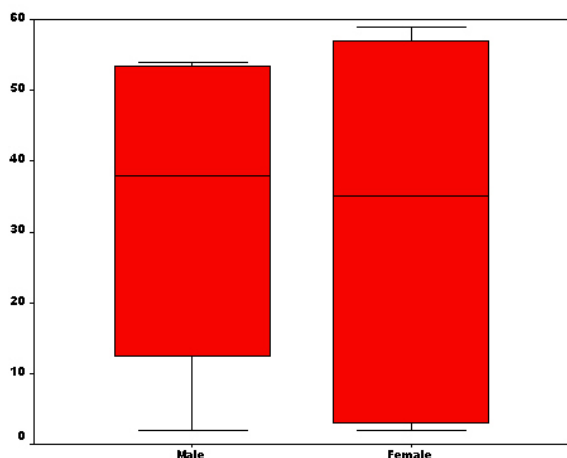


Chart.2 Age distribution of patients between two genders

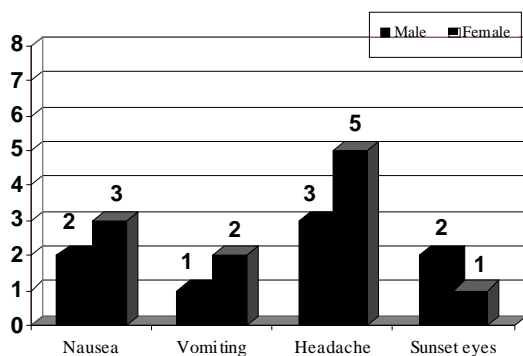


Chart.3 Clinical finding of patients between two genders

Ventriculoperitoneal (VP) shunts are widely used for treating hydrocephalus. These devices are prone to malfunction with up to 70% requiring revision. Shunt infection and obstruction comprise the majority of malfunctions and usually present dramatically (Samdani, 2005). VP shunt malfunction usually presents with signs and symptoms of increased intracranial pressure and/or infection (Samdani, 2005). In this study, all patients had increased intracranial pressure manifestation.

### Conclusion

Shunt malfunction can be present by several manifestations, and in patients with normal examination of shunt function, Slight edema surrounding the ventricles can be a sign of shunt malfunction.

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