

## Application of ventriculoperitoneal shunt placement through fontanelle in a hydrocephalus dog: a case report

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**ABSTRACT:** A two and a half year old Chihuahua intact male dog weighing 1.7 kg was referred to our Animal Medical Centre presenting with ataxia, seizure, nystagmus, tremor, and tilt. Additionally, it was not able to stand and sit. Physical examination, palpation, neurology examination, complete blood count (CBC), serum chemistry test, radiographs (X-ray), ultrasonography (US), and magnetic resonance imaging (MRI) were all performed. Open fontanelle, domeshaped calvarium, a thinning of bone structure, and asymmetrically enlarged lateral ventricles on the right were found on diagnostic imaging. Accordingly, the dog was diagnosed with hydrocephalus. A VP shunt placement was performed as surgical treatment. The ventricular catheter was placed into the right lateral ventricle through the fontanelle insertion site and the distal catheter was placed in the abdomen using the percutaneous technique. After surgery, anorexia, seizure, tremor, and nystagmus disappeared. Also, the dog could stand and walk without support; however, gait was slow and not completely normal and the tilt remained.

**Keywords:** hydrocephalus; ventriculoperitoneal shunt; fontanelle

Hydrocephalus is a term to used to describe the presence of an abnormal accumulation of cerebrospinal fluid (CSF) within the cranial cavity with ensuing dilation of the ventricular system (Coates and Axlund, 2006). The choice of treatment is generally based on physical status, age, and the cause of hydrocephalus (Harrington and Moore, 1996). Usually, medical treatments such as diuretics and glucocorticoids are applied to the animal to decrease CSF volume before surgical treatment (Coates and Axlund, 2006). Surgery is generally required when medical treatments do not result in improvements within two weeks (Kim and Itamoto, 2006). Ventriculoatrial (VA) and ventriculoperitoneal (VP) shunt are commonly employed as surgical methods. Both are effective but VP shunts are easier to install. VP shunt systems are composed of three parts: a ventricular catheter, siphone control mechanism, and distal catheter (Harrington and Moore, 1996). The following case report describes the installation of a ventricular catheter through the fontanelle insertion site.

### Case history

A two and a half year old Chihuahua intact male dog weighing 1.7kg was referred to the Animal Medical Center. It presented with ataxia, seizure, nystagmus, tremor, tilt was not able to stand and sit. The owner reported that the dog exhibited symptoms of ataxia one month previously and that two weeks subsequent to this, a seizure had occurred. The physical examination, palpation, neurology examination, complete blood count (CBC), serum chemistry test, radiographs (X-ray), ultrasonography (US), and magnetic resonance imaging (MRI) were performed to evaluate the health status of the dog. The CBC/chemistry revealed no abnormalities. On neurological examination, proprioceptions of limbs were decreased. An X-ray examination revealed four thin wide suture lines on the domeshaped calvarium. Open fontanelle and thinning of bone structure were also detected. On US and MRI, severe non-asymmetrically enlarged lateral ventricles on the right were shown. The dog was therefore diagnosed with hydrocephalus.

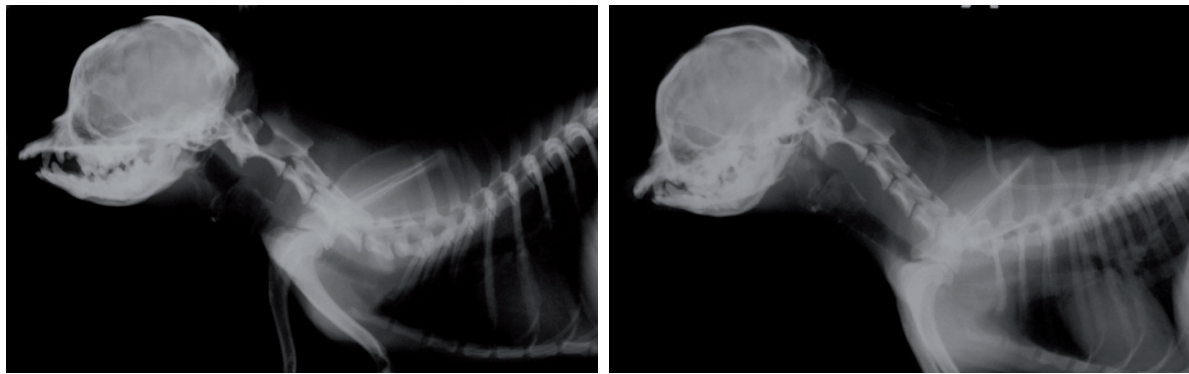


Figure 1. Preoperative and postoperative radiograph. Thin wide suture lines on domeshaped calvarium. Open fontanelle and thinning of bone structure were detected

Mannitol, furosemide, methylprednisolone, prednisolone, and corticosteroids were administered to limit the reduction in cerebrospinal fluid and so reduce the intracranial pressure but improvement was negligible. The dog presented with seizure, tilt, and tremor and was not able to stand and sit. After consulting with the owner, we decided on a VP shunt placement as surgical treatment. The VP shunt was placed using the method described by Bagley and Harrington (as cited by Kim and Itamoto, 2006). 'Metronic CSF-Flow Control Valve-Ultra Small Low Low Pressure' and 'Metronic Cardiac Peritoneal Catheter, Small Barium Impregnated, 90cm' were used for the catheter. We modified the protocol for

the placement of the ventricular catheter. It was placed into the right lateral ventricle through the fontanelle insertion site instead of through parietal bone. The distal catheter was placed into the peritoneal cavity using the percutaneous technique.

Seven days after the surgery, anorexia, seizure, tremor, and nystagmus had disappeared. The dog also could stand and walk without support but gait was slow and had not been completely corrected. Also, tilt remained. The dog was discharged one week later. After two months, an MRI was performed. The volume of CSF in the right lateral ventricle had decreased by more than one half and was almost normal.

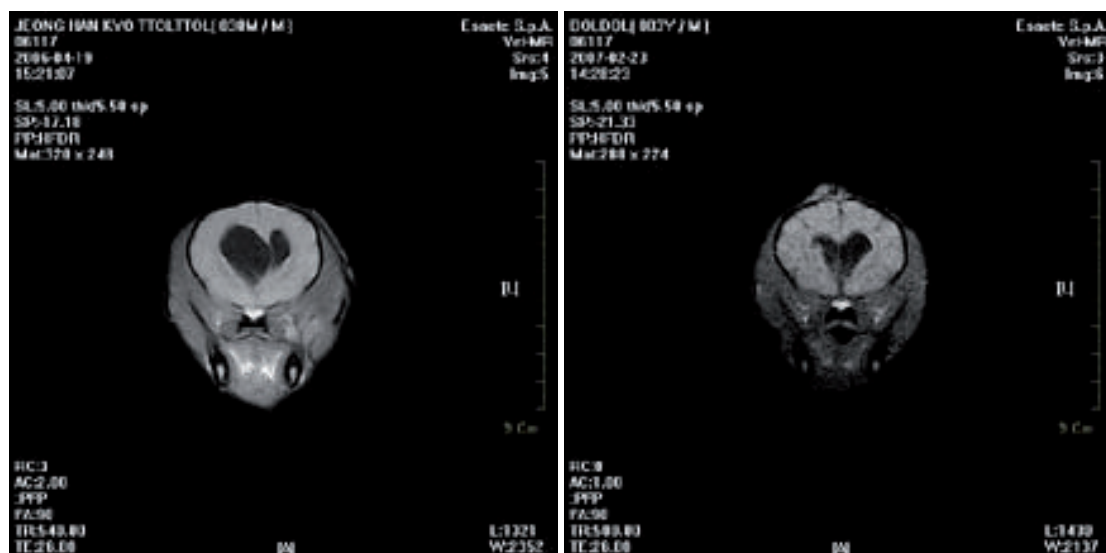


Figure 2. Preoperative and postoperative MRI of the Brain. In preoperative MRI, severe non-symmetrically enlarged lateral ventricles on the right were shown. After the operation, the volume of right lateral ventricles decreased to almost normal size similar to the left lateral ventricles

## DISCUSSION

Hydrocephalus is the term used to describe a condition characterized by abnormal accumulation of cerebrospinal fluid within the cerebral ventricular system. Surgical treatment is generally necessary for hydrocephalus cases that do not improve within two weeks or if worsening occurs during corticosteroid therapy. Surgical procedures aim to control CSF flow from the ventricles of the brain to either the peritoneal cavity or the right atrium. Ventriculoperitoneal (VP) shunt placement is the most popular surgical technique for hydrocephalus. One study of hydrocephalus revealed a success rate range of improving clinical signs ranging from 50% to 90% in dogs that had undergone ventriculoperitoneal shunting. VP shunt systems have three required components: a ventricular catheter, siphon control mechanism, and distal catheter (Harrington and Moore, 1996). There are two approaches of placing the ventricular catheter in the frontal horn: anterior placement and posterior placement. The advantages of the anterior placement are a shorter distance through the brain and a greater likelihood of placing the ventricular catheter in the proper position. In human studies, no differences in function, seizure frequency, or infection rate are thought to exist between anterior and posterior placement. Thus, the choice of approach should be considered a matter of personal preference (Rekate, 1994).

In this case, the dog had a very thin skull and its body condition was bad. For these reasons placing the ventricular catheter into the lateral ventricle became more problematic. In order to limit the invasiveness of the operation, therefore, we used a fontanelle insertion site instead of making a burr on the bone. The fontanelle was wide enough to allow installation of a ventricular catheter. Considering

the age of the dog, head growth had already finished. Accordingly, there was no danger of narrowing the fontanelle.

## CONCLUSION

VP shunt placement is considered a suitable surgical method for hydrocephalus. Inserting the ventricular catheter through the open fontanelle into the dilated ventricle does not need to proceed by the creation of a hole in the skull and is easy to approach. VP shunt placement surgery greatly improved clinical signs but the condition of the dog did not fully return to normal.

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