Treatment of hemihydranencephaly with ventriculoperitoneal shunt in a cat

Mehmet Nur ÇETİN[1,a,✉], Yusuf Sinan ŞİRİN[1,b], Muhammed Yusuf ŞİRİN[1,c], Batuhan NEYSE[2,d]

[1]Mehmet Akif Ersoy University Department of Surgery, Burdur, Turkey; [2]Mehmet Akif Ersoy University Institute of Health Sciences Burdur, Turkey

[a]ORCID: 0000-0003-2610-8477; [b]ORCID: 0000-0003-1322-7290; [c]ORCID: 0000-0002-7419-5774; [d]ORCID: 0000-0001-6862-482X

ARTICLE INFO

Article History
Received : 24.03.2024
Accepted : 15.08.2024
DOI: 10.33988/auvfd.1458104

Keywords
Hemihydranencephaly
Cat
Ventriculoperitoneal shunt

✉Corresponding author
mncetin@mehmetakif.edu.tr

How to cite this article: Çetin MN, Şirin YS, Şirin MY, Neyse B (2025): Treatment of hemihydranencephaly with ventriculoperitoneal shunt in a cat. Ankara Univ Vet Fak Derg, 72 (2), 247-250. DOI: 10.33988/auvfd.1458104.

ABSTRACT

Hemihydranencephaly is extremely rare in cats. In this case report, the aim is to share data on the diagnosis and treatment of a hemihydranencephaly in a cat. This case report is for an 1 year old, 3 kg, male, Scottish fold cat. The cat was brought in by its owner with behavioural changes and decreased activity since birth. Cranial nerve examination revealed that threat reflex and lateral palpebral reflex were decreased and corneal reflex was delayed. Spinal reflex examination revealed a decreased patellar reflex and proprioceptive deficit in all extremities in the postural reaction test. As a result of the tests, a cranial lesion was suspected. Magnetic resonance imaging revealed that the right cerebral hemisphere and ependyma were absent and instead were filled with fluid. In light of the findings, the patient was diagnosed with a hemihydranencephaly. Furosemide, and prednisone were used for medical treatment. However, despite a week of medical treatment, no improvement was observed. Ventriculoperitoneal shunt placement was preferred as the surgical method. Although all of the patient's neurological findings did not disappear in the postoperative period, they improved. A cat with haemihydraocephaly was successfully treated with ventriculoperitoneal shunt for the first time.

Hydranencephaly is a rare congenital abnormality characterized by absence and replacement of the cerebral hemispheres by a large cerebrospinal fluid pool (3). Hydranencephaly contiguous with the lateral ventricles but not completely lined by ependyma; the cavity does not communicate with the subarachnoid space (2, 6) Hemi-hydranencephaly is a rare brain anomaly characterised by unilateral complete or near complete absence of the cerebral hemisphere (7). There are three case reports associated with hydranencephaly in cats (1, 2, 6). Hemihydranencephaly was also described in a cat (5).

This case report, it is aimed to present the findings related to the diagnosis and treatment of a case of hemihydranencephaly in a cat.

A 1-year-old, 3-kg male Scottish fold cat was brought to Burdur Mehmet Akif Ersoy University Faculty of Veterinary Medicine Animal Hospital with a history of behavioural changes and decreased activity since birth. Cranial nerve examination revealed that menace reflex and lateral palpebral reflex were decreased and corneal reflex was delayed. Spinal reflex examination revealed a decreased patellar reflex and proprioceptive deficit in all extremities in the postural reaction test. The complete blood count and serum chemistry profile were within the normal ranges for all parameters. The serologically evaluated feline immunodeficiency virus, feline leukemia virus tests, toxoplasma and feline infectious peritonitis tests were negative. As a result of the tests, a cranial lesion was suspected. Under general anaesthesia, magnetic resonance images (MRI) of the brain were obtained with the patient in the prone position using a 1.5 T MRI scanner (Magnetom Avanto, Sıemens). Sedation was provided with xylazine (1mg/kg intramuscular (IM)) and induction with ketamine (15mg/kg, IM). T1 (TR: 599, TE: 12) and T2 weighted (TR: 6180, TE: 105), sagittal, and axial images of the brain were obtained on MRI. The original MRI data were transferred to the MicroDicom DICOM Viewer programme for image analysis. On T1-weighted

sequence, it was determined that the right cerebral hemisphere and ependyma were absent, and hypointense fluid was present instead. On T2-weighted sequence, it was determined that the right cerebral hemisphere and ependyma were absent and hyperintense fluid was present instead. Based on these data, the patient was diagnosed with hemihydranencephaly (Figure 1). First, the patient received medical treatment. Furosemide (2 mg/kg IV, q 12h) as diuretic and prednisone (0.5 mg/kg, q 24h) were administered as medical treatment. However, despite treatment, no improvement was observed, so surgery was decided.

Ventriculoperitoneal shunt placement was preferred as the surgical method. Cefazolin (22 mg/kg, intravenous (IV)) was used half an hour before the operation for premedication, and butorphanol (0.1 mg/kg, IV) was used for analgesia. Diazepam (0.2 mg/kg, IV) was used for premedication in anesthesia, then propofol (6 mg/kg, IV) was used for induction and maintenance with sevoflurane. The patient was placed in a sternoabdominal lying position with a neutral angle to the head. The pelvic extremities were oriented laterally, towards the surgeon. The patient's skin area from the level of the medial canthus rostrally to the cranial side of the second cervical vertebra caudally and the entire lateral surface up to the level of the tuber coxae were shaved and prepared according to routine antisepsis rules. An incision was made on the caudodorsal region of the os parietale, then two holes were opened in the os parietale with the help of a dental drill, one for the shunt and the other for the stabilizing stitch. The meninges over the area where the shunt would enter were incised with a size 11 scalpel, and the previously

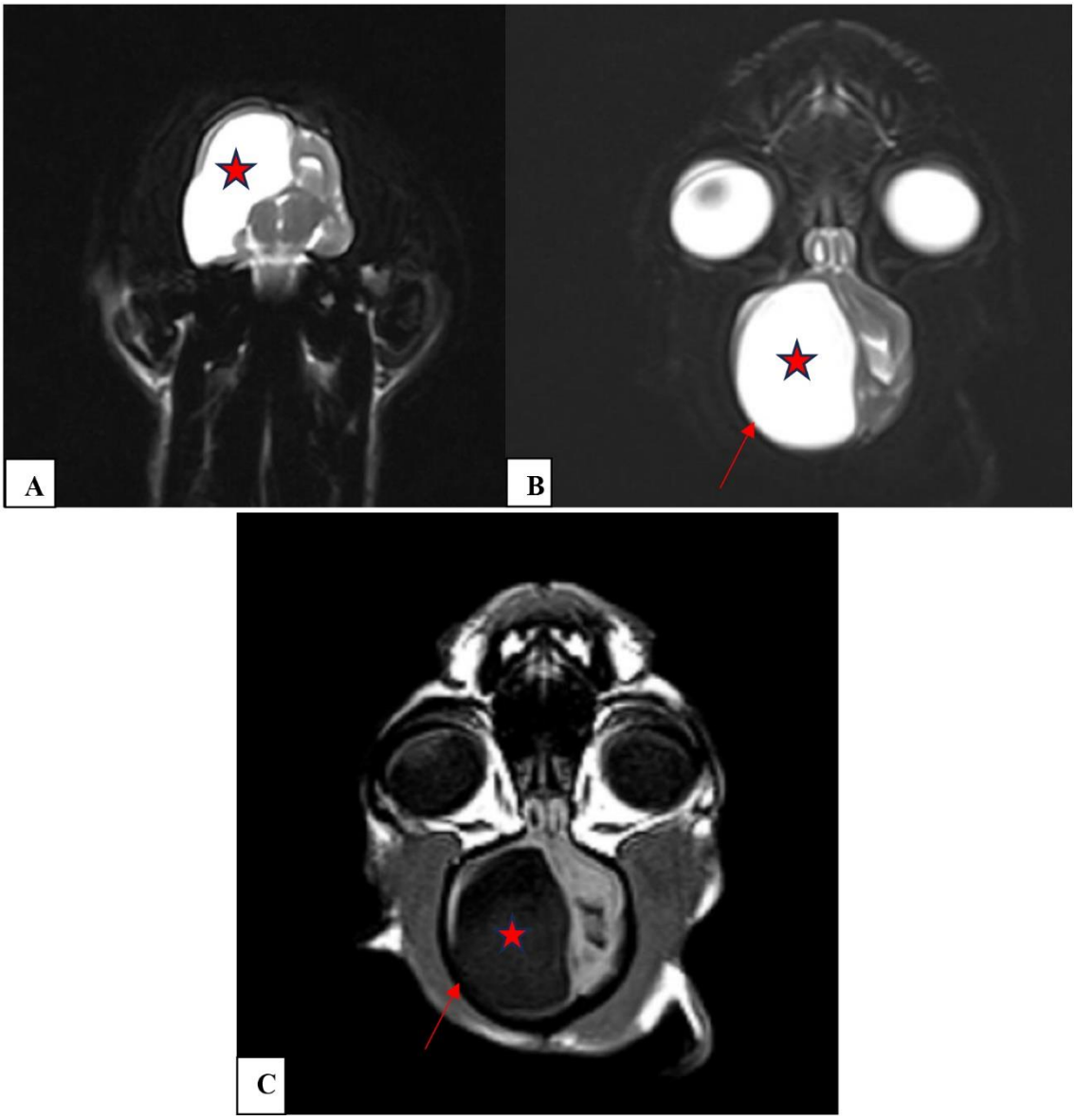

Figure 1. Hyperintense fluid (star), absence of cerebral hemisphere and ependyma (arrow) on coronal and axial T2-weighted sequences (A, B), On axial T1-weighted sequence, hypointense fluid (star), absence of cerebral hemisphere and ependyma (arrow) (C).

DOI: 10.33988/auvfd.1458104

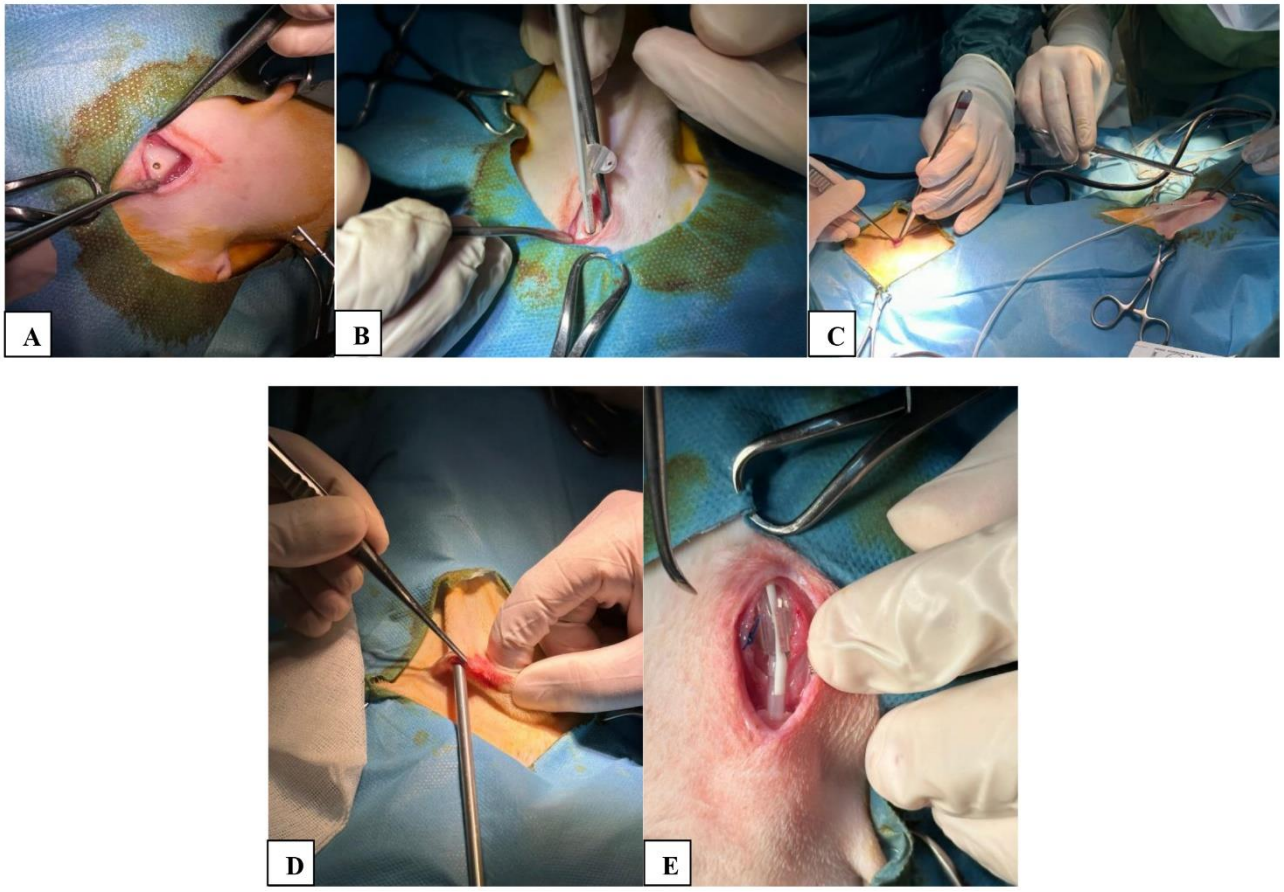

Figure 2. Drilling a hole in the os pariatale with a dental motor (A), placing the shunt in the opened hole (B), incision made at the level of the last rib to place the shunt into the abdomen (C), advancing the shunt subcutaneously towards the last rib with a shunt advancer (D), fixing the shunt (E).

measured shunt was placed into the dorsal side of the lateral ventricle. After the rostral end of the shunt was placed in the lateral ventricle, it was fixed to the fixation hole using 3-0 prolene thread and a grid approach was made to the peritoneal cavity. The distal end of the shunt was tunneled from the cranial incision to the caudal incision using a long Doyen forceps, and the distal end of the shunt tube was placed into the peritoneal cavity. While the muscle layers were closed with separate sutures using appropriate 3-0 PDS thread, the skin layer was closed with separate sutures using 3-0 PDS thread (Figure 2). The patient was awakened from general anesthesia and placed in a softly filled cage. Tramadol hydrochloride (1 mg/kg, subcutan (SC), q 12h) was used postoperatively for analgesia. Postoperative cefazolin (22 mg/kg, IV, q 8h) was used as antibiotic therapy. Postoperative neurological examination revealed that the delay in the menace reflex continued and the corneal reflex, patellar reflex and proprioceptive deficit improved. In the feedback received from the patient owner, it was reported that there was an increase in activity.

The defect is the result of a destructive process that occurs in utero, usually during midgestation, the most common cause being an intrauterine viral infectio. Numerous viruses are known to cause hydranencephaly as well as central nervous system malformations (6). It is thought to occur in humans as a result of blockage of the internal carotid arteries (3). In three case reports, hydranencephaly in cats was associated with parvovirus (1, 2, 6), while in one case, hydranencephaly in a cat could not be associated with any virüs (5). In the case report, hydranencephaly could not be associated with any cause or virus. This is because many viruses can cause this disease.

In a study, it was reported that there was no ependyma in the MRI images obtained and the cerebral hemisphere was filled with fluid (6). In another study, it was reported that cerebral hemispheres were absent (5). In the present study, both the absence of ependyma and the absence of the right cerebral hemisphere were found to be compatible with other studies.

There is no standard treatment for hydranencephaly. Treatment is symptomatic and supportive (4). However, in a human case, hemihydranencephaly was treated by placing a ventriculoperitoneal shunt and good results were obtained (7). The cat with haemihydranencephaly did not

receive any treatment and neurological symptoms persisted (5). In the case report, hemihydranencephaly was treated with the ventriculoperitoneal shunt method and successful results were obtained. Although not all neurological symptoms have disappeared, the patient has improved.

Haemihydranencephaly, which is extremely rare in cats, has been successfully treated in a cat for the first time using the ventriculoperitoneal shunt technique. It has been demonstrated that the ventriculoperitoneal shunt technique can be used in cases of hemihydranencephaly in cats, and successful results can be obtained.

Financial Support

This research received no grant from any funding agency/sector.

Ethical Statement

Patient consent form was received from the patient owner.

Conflict of Interest

The authors declared that there is no conflict of interest.

Author Contributions

MNÇ and YSŞ conceived and planned the experiments. MNÇ and YSŞ carried out the experiments. MNÇ, YSŞ, MYŞ and BN contributed to the interpretation of the results. MNÇ took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

Data Availability Statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Animal Welfare

The authors confirm that they have adhered to ARRIVE Guidelines to protect animals used for scientific purposes.

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