

Pneumocephalus: A Late Complication of VP Shunt Dysfunction

VP Şant İşlev Bozukluğunun Geç Komplikasyonu Olarak Pnömoşefalus

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Abstract: In this article we reported pneumocephalus, which developed ten years after a ventriculoperitoneal shunt operation. The operation was performed to treat hydrocephalus secondary to stenosis of aqueduct. In this case, the cause of pneumocephalus was frontal sinus fistula that occurred as a result of increased intracranial pressure due to the dysfunction of the ventricular shunt end. This uncommon complication is reviewed with the pertinent literature and the management is discussed.

Key Words: Stenosis of aqueduct, pneumocephalus, frontal sinus, ventriculoperitoneal shunt

Özet: Bu makalede ventriküloperitoneal şant ameliyatından on yıl sonra gelişen pnömoşefalus bildirilmiştir. Ameliyat akueduktus stenozuna bağlı hidrosefalinin tedavisi için yapılmıştı. Şantın ventriküler ucunun işlev bozukluğu sonucu gelişen kafa içi basınç artışının yol açtığı frontal sinüs fistülü pnömoşefalusa neden olmuştur. Nadir görülen bu komplikasyon ilgili yazılar eşliğinde gözden geçirildi ve tedavisi tartışıldı.

Anahtar Sözcükler: Akueduktus stenozu, frontal sinüs, pnömoşefalus, ventrikülo-peritoneal şant

INTRODUCTION

Cranio cerebral trauma is one of the leading pathologies causing pneumocephalus. Pneumocephalus can also be seen after facial trauma, nasal surgery, chronic subdural hematoma surgery, transphenoidal surgery, posterior fossa surgery in sitting position and infections like otitis media, sinusitis extending intracranially or brain abscess caused by gas producing micro-organisms and cranial irradiation (1,8).

Thirteen cases of pneumocephalus complicating shunt procedures have been presented in the literature so far (2,3,4,5,7,8,10-12) and only three of these pneumocephalus cases were due to frontal sinus fistula (3,6,10).

In this article we present a case of pneumocephalus that developed ten years after a ventriculoperitoneal shunt operation. The cause of pneumocephalus was frontal sinus fistula occurred by increased intracranial pressure due to dysfunction of ventricular end. No rhinorrhea was detected in this case and an emergency operation was performed.

CASE REPORT

A 24-year-old male began to have headaches fifteen days before he was referred to the clinic and became unconscious thereafter. In computed tomography (CT) taken in a local hospital pneumocephalus, ventriculomegaly was detected and ventricular end of the shunt in the left lateral ventricle (Fig-1). The patient was transferred to our

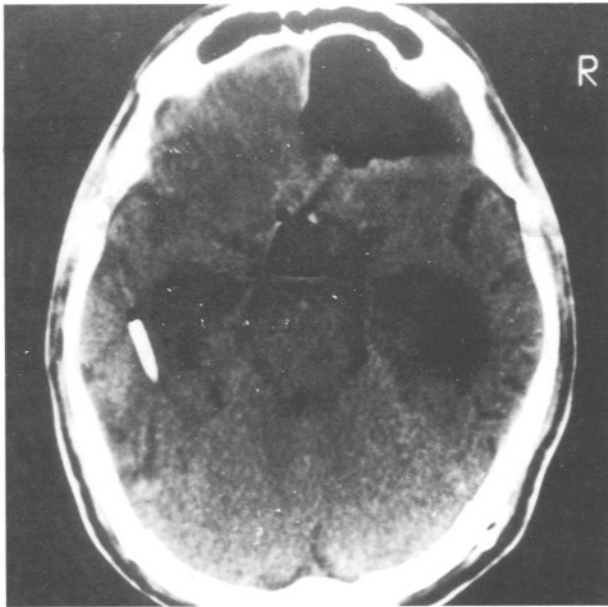


Figure 1: CT scan showing pneumocephalus adjacent to the right frontal sinus and shunt material in dilated left temporal horn.

hospital. He had a history of a ventriculoperitoneal shunt (medium pressure) procedure for his hydrocephalus. The underlying cause of hydrocephalus was stenosis of aqueduct.

When the patient was admitted to our clinic, his Glasgow coma score (GCS) was eight.



Figure 2: CT scan showing the bony defect on posterior wall of the right frontal sinus and large pneumocephalus adjacent to it.

An emergency CT scan revealed a large pneumocephalus adjacent to the right side of the frontal sinus. A bony defect of 5 mm size was noted on the posterior wall of the frontal sinus and shunt material was observed lying in the occipital horn of the right lateral ventricle. Ventricles were dilated and no ventricular asymmetry was detected (Fig-2,3). Rhinorrhea was no observed. Broad spectrum antibiotics, diphenylhydantoin and dexamethasone were administered. The disconnected ventricular shunt end in the left lateral ventricle in figure-1 had no relation with the reservoir. This shunt material probably belonged to the ventriculoperitoneal shunt procedure, which had been performed ten years ago. Patient underwent a bifrontal craniotomy. In the operation a bony erosion of the posterior wall of the right frontal sinus and a dural fistula communicating with this defect were seen. Prior to primary duraplasty, the subdural space was filled with saline. The mucosa of the frontal sinus was extirpated and the frontal sinus obliterated with subgaleal tissue and fibrin glue. The bony defect was repaired with acrylic bone cement. When ventricular end of the right parietal shunt was removed, it was completely occluded. Cytological examination of the cerebrospinal fluid (CSF) revealed no infectious findings. A new, medium pressure shunt was installed and connected with the peritoneal space.

The patient's clinical condition improved dramatically. In postoperative CT scans no

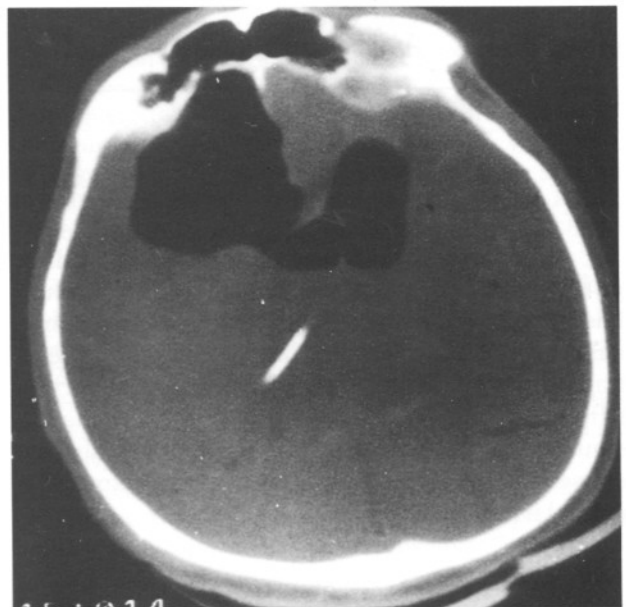


Figure 3: Bone window CT scan showing the bony defect on the posterior wall of the right frontal sinus and pneumocephalus adjacent to it.

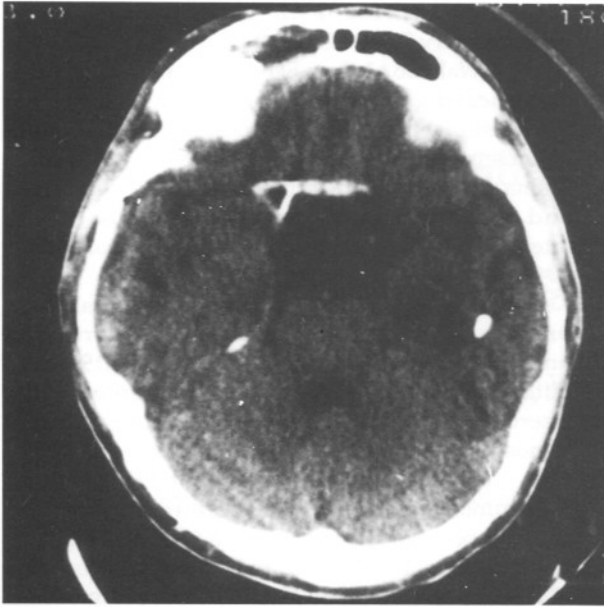


Figure 4: Postoperative CT scan showing the obliterated right frontal sinus no pneumocephalus has been observed.

pneumocephalus was observed and the ventricles were found to be normal (Fig-4).

The patient was discharged on the thirty second postoperative day with a GCS of fourteen, after a 1,5 year follow-up, normal neurological findings were obtained.

DISCUSSION

The first description of pneumocephalus was made by Chiari in 1884 at an autopsy of a patient died of etmoiditis (8).

The first pneumocephalus case with a ventriculoperitoneal shunt occurs when air is forced

through the shunt or enters through the cranial base because of iatrogenic postsurgical communication, congenital fistula, trauma or thinning cranial base. Also air can gain access to intracranial cavity only when there is a break in basal structures in connection with the paranasal sinus and when the nasal air pressure exceeds the intracranial pressure (3).

Thinning of the cranial floor and dorsum sellae has been clearly demonstrated in patient with stenosis of aqueduct (8).

In our case, we conclude that the main cause of the bony defect and the dural defect was pulsation's of the brain aggravated by chronically increased intracranial pressure.

The absence of CSF leakage in pneumocephalus has been ascribed to a ball-valve action of brain tissue or a dural leaflet that covers the defect and allows ingress of air without escape of fluid by Pitts et al. (12). The absence of rhinorrhea in our case may also be explained with this mechanism .

Three cases of pneumocephalus with ventricular shunts have been presented so far. In all of these cases the presence of the intracranial air was attributed to frontal sinus fistula. However, rhinorrhea had been observed in all of the cases (3,6,10) (Table I).

In the management of pneumocephalus, CSF leakage has a special place. In a patient with CSF leakage, intracranial pressure must be controlled by extra ventricular drainage (3,6,9). In our case, without CSF leakage the treatment was limited to primary repair of bony and dural defects and revision of the shunt.

Table I: Reported Cases of Shunt-associated Pneumocephalus with Frontal Sinus Fistulas.

Authors	Age-Sex	Shunt type	Shunt pressure	Causes of Hydrocephalus	CSF Leakage	Time after shunt
Little & Mac Carthy (1976)	22,M	V-P	Medium	Aqueduct stenosis	+	2 months
Ikeda et al. (1977)	22,M	V-P	Medium	Aqueduct stenosis	+	3 months
Steinberger et al. (1979)	29,F	V-A	Medium	Aqueduct stenosis	+	1 week
Kuzeyli et al. (1994)	24,M	V-P	Medium	Aqueduct stenosis	-	10 years

CT scan may be sufficient in determining the place of air entry. The unique value of CT scan in detecting very small amounts of intracranial air and in assessing location with accuracy is emphasized.

Despite the fact that pneumocephalus in shunted patients is a very rare complication, ours is a unique case which, we believe, may be of contribution to the literature with the following points emphasized; occurrence of clinical status ten years after surgery, absence of rhinorrhea and application of a different treatment protocol.

We conclude that in paranasal sinus originated in pneumocephalus cases with dysfunctioning shunts and without CSF leakage, the treatment protocol is early broad spectrum antibiotics, antiedema treatment and primary repair of the fistula with a revision of the dysfunctioning shunts.

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