



Intraventricular Pneumocephalus Complicating Pneumothorax in a Case of Ventriculopleural Shunt: A Rare Complication and Its Management

Abhishek Katyal¹ Prakash Singh² Kavita Sandhu³ V. K. Jain² Bipin S. Walia²

¹ Department of Neurosurgery, BLK-Max Superspeciality Hospital, New Delhi, India

² Department of Neurosurgery, Max Superspeciality Hospital, New Delhi, India

³ Department of Neuroanaesthesia and Critical Care, Max Superspeciality Hospital, New Delhi, India

Address for correspondence Abhishek Katyal, MCh Neurosurgery, Department of Neurosurgery, BLK-Max Superspeciality Hospital, Rajender Place, New Delhi 110005, India (e-mail: ak.neurosx.47@gmail.com).

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The peritoneal cavity is widely used as the destination of choice for cerebrospinal fluid (CSF) shunts. Various alternative distal sites have been used, particularly in the presence of certain contraindications, which include the cardiac atria, for ventriculoatrial (VA) shunt, or the pleural cavity for ventriculopleural (VPL) shunt.¹ Each procedure is associated with its own set of complications and the choice of selection of the distal site of CSF drainage is often based on surgeon's preference along with patient's factors.² While the historical literature describes pleural effusion and pneumothorax as complications of a VPL shunt, there is paucity of data justifying the application of one technique over the other. We report a rare case of postoperative pneumothorax in a case of VPL shunt being further complicated by pneumocephalus.

A 41-year-old gentleman, who is a known case of operated grade II tectal plate glioma with hydrocephalus for which resection of glioma and ventriculoperitoneal (VP) shunt placement was done 25 years ago, presented with complaints of persistent watery discharge from abdominal site scar with abdominal distension and memory disturbances. Patient also had history of VP shunt revision done 20 years ago. After further workup, the diagnosis of Koch's abdomen with tubercular ascites with VP shunt malfunction was made. Since the patient had no neurological complaints, the shunt assembly was removed and antitubercular therapy was started.

The patient was readmitted with complaints of headache after 2 weeks. Non Contrast CT (NCCT) brain was done that

was suggestive of hydrocephalus. In view of abdomen being unfavorable due to tubercular ascites, right-sided programmable VPL shunt with antisiphon device was done. On the first postoperative day, patient was clinically normal. The postoperative computed tomographic (CT) scan brain revealed pneumocephalus and pneumoventricle involving both the lateral and third ventricles. The next day patient had deterioration in the neurological status. On examination, the Glasgow Coma Scale was E2V2M5 with development of subcutaneous emphysema over the thorax. However, there was no respiratory distress. Patient was intubated and put on mechanical ventilation. Fresh CT scan brain revealed increase in the ventricular dilatation and pneumoventricles (→**Fig. 1**). CT thorax was also done simultaneously, which revealed right hydropneumothorax, pneumomediastinum, and subcutaneous emphysema on the right side (→**Fig. 1**). Cardiothoracic surgery consult for CT thorax findings was done and right-sided intercostal drainage (ICD) tube was inserted. The patient was then taken up for surgery and right frontal external ventricular drainage (EVD) with Ommaya insertion was performed. Taking care to remove any air column in the distal shunt tube and after confirmation of adequate distal flow, the ligation of pleural end of VPL shunt was done. CSF examination was normal and the cultures were sterile. There was improvement in the neurological status the next postoperative day and patient was extubated. The patient was conscious, oriented with no focal neurological deficits. Postoperative CT scan brain showed decrease in the

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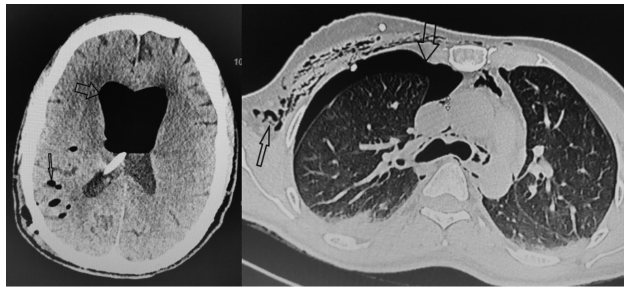


Fig. 1 Computed tomographic (CT) scan brain showing pneumocephalus (thin arrow) and pneumoventricle (thick arrow). Shunt tube is seen in situ. CT thorax showing right pneumothorax (thick arrow) with subcutaneous emphysematous changes (thin arrow). Pleural end of shunt tube can be seen at 10 o'clock position in right hemithorax.

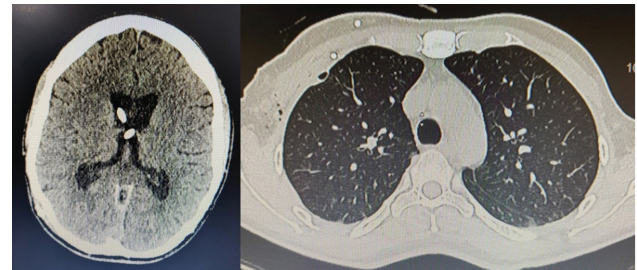


Fig. 2 Postexternal ventricular drainage insertion computed tomographic (CT) scan showing complete resolution of pneumocephalus and postintercostal drainage insertion CT thorax showing complete resolution of pneumothorax.

air column in ventricles with subsequent resolution of pneumoventricles in the follow-up repeat scans (►Fig. 2). The repeat CT thorax on 3rd postoperative day revealed resolution of pneumothorax following which the ICD was removed (►Fig. 2). On 6th postoperative day, the EVD was removed and the ligated pleural end of shunt tube was reopened. The patient was discharged in a stable condition and is now under follow-up.

VPL and VA shunts are an alternative option to the VP shunt, when the peritoneum is unsuitable due to abdominal pathology, abdominal adhesions, or recurrent complications with abdominal distal tubing. The VPL shunts serve as safe and feasible second-line option of utility for CSF diversion.^{2,3} While they are associated with the complications like pleural effusions, over drainage, and pneumothorax, there is, theoretically, greater potential for severe complication following VA shunt placement, including shunt nephritis (3.5–11%), injury to major vessels, cardiac thrombi, and endocarditis. Moreover, since the surgeon's preference is a taken into account in selecting a particular approach, the decision for a VPL shunt was taken in this case.² Since the patient had memory impairment, endoscopic third ventriculostomy (ETV) was not done in this case owing to few reports of post-ETV persistent cognitive inefficiencies in some cases.⁴ The incidence of distal complications in VPL shunts is 10 to 20%, most common being pleural effusion and pneumothorax.¹ The probable reason for the development of pneumothorax in the present case was inadvertent injury to the visceral pleura at time of insertion of distal end of shunt tube. Haret et al have reported development of pneumothorax and subcutaneous emphysema in two cases of VPL shunts.⁵ The occurrence of subcutaneous emphysema in our case could be due to air migration via the surgical approach into the subcutaneous tissue, easier subcutaneous plane dissection by air due to recent shunt removal surgery, and non-re-establishment of normal negative intrapleural pressure relationship. The problem of overdrainage can be addressed with the use of shunt catheters with antisiphon valve mechanism as done in this case.^{2,5} The pneumothorax usually resolves and responds well to insertion of an ICD tube that was performed in our case.

Tension pneumocephalus is defined as the presence of air in the intracranial space that can be due to neurosurgical procedures, skull base fractures, sinus fractures, and congenital skull defects. However, symptomatic tension intraventricular pneumocephalus complicating pneumothorax post-shunt surgery is of rare occurrence; and the studies in literature regarding this are sparse. Sharifabad et al reported a case of pneumocephalus post-pneumothorax in a patient with VPL shunt surgery that was managed by a shunt revision.⁶ The probable mechanism of development of concomitant subcutaneous emphysema and pneumoventricle in our case could be intracranial air migration through shunt catheter along with peri catheter subcutaneous dissection by air column. However, the exact cause could not be identified in the present case.

The possible steps to avoid such complications at time of distal catheter insertion are taking a “figure of 8” suture in the intercostals muscle to allow careful sealing, deflation of the ipsilateral lung by the anesthetist, and avoidance of nitrous oxide during the procedure.^{1,7} In our case, the tension pneumocephalus was managed by EVD that was kept patent along with temporary ligation of distal shunt tube until the resolution of pneumothorax; and the patient responded well to the given management.

Conclusion

Tension pneumocephalus complicating pneumothorax is a rare but not an unreported complication of VPL shunt surgery. However, a careful and meticulous surgical technique particularly at distal shunt catheter end, anticipation of such complications with timely diagnosis, and management are imperative for a better patient outcome.

Conflict of Interest

None.

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