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Case Report

Thoracic abscess due to unusual migration of a ventriculoperitoneal shunt and literature review

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ABSTRACT

Background: Thoracic complications of ventriculoperitoneal (VP) cerebrospinal fluid shunting are rare and the diagnosis is difficult without neurological impairment.

Case Description: We report a case of a 36-year-old woman who had a VP shunt in the right side when she was 13 years for a posterior fossa ependymoma and hydrocephalus. 23 years after surgery, she developed acute yellowfish cough and sputum, and the computed tomography scan found an intrathoracic cyst. She had a thoracotomy for the cyst and during surgery, we found the peritoneal catheter of the VP shunt, with a collected abscess in the left side. The patient was treated for the abscess and the VP shunt was removed. We also review the literature cases of thoracic complications after VP shunts.

Conclusion: Thoracic abscess due to VP shunt migration is extremely rare and could happen after a long time delay VP shunt surgery.

Keywords: Abscess, Migration, Pleural, Pseudocyst, Thoracic, Ventriculoperitoneal shunt

INTRODUCTION

The ventriculoperitoneal (VP) shunts were first introduced in the early 1900s.[2,7] They are considered to be one of the main treatments of hydrocephalus. However, this treatment is not without risks. These among other things include those related to the actual operation as well as those that may occur days to years later. These complications involve the obstruction in the proximal catheter, valve, distal catheter, hernia, disconnection, valve failure that are mechanical failures, and infections. Indeed, establishing the correct diagnosis based on the clinical history and physical examination can be challenging. Thus, imaging plays an important part in the diagnosis and management of VP shunts complications.

Thoracic complications of VP shunts are rare and rarely reported in the literature, such as pleural effusion, bronchial perforation, pneumothorax, and pneumonia.[8] Thoracic abscesses have not been reported yet in those complications.

We report the case of a young woman operated for a tumor of the cerebral fossa with hydrocephalus who developed 23 years later a contralateral thoracic abscess due to a migration of the abdominal tip of the VP shunt. We also present a review of the literature.

CASE REPORT

A 36-year-old female patient, with a history of posterior fossa ependymoma, was operated 1997 when she was 13 years old with hydrocephalus. She had prior a VP-Shunt on the right side. No other medical history. The evolution was good with no complications.

In 2020, 8 months ago before her admission, she presented thoracic pains followed by yellowish cough and sputum, without fever and headaches, everything evolving in a context of conservation of general condition.

She was seen prior by the thoracic surgeons, that suspected a hydatic cyst, they performed a thoracic X-ray, that showed a rounded left diaphragmatic collection. She had an abdominal computed tomography (CT) scan that revealed a rounded left diaphragmatic collection with some peripheric calcifications. The dimensions were 31.8 mm × 31.1 mm × 25.5 mm [Figure 1].

She was turned to the operating room, by thoracic surgeons. She had a thoracotomy and the diaphragm was ruptured, with a mass that they punctured and it was a puriform collection, the wall had been opened and they found a VP Shunt catheter. Then they called the neurosurgeons to the operating room.

When we came, we saw the herniated catheter in the thorax surrounding the abscess that has been removed and drained. The abdominal tip of the VP Shunt was still permeable and the liquid was citrus then gradually thinned out [Figures 2 and 3].

At the same time, we removed the functional VP Shunt after a retro-auricular incision. The ventricular tip was still functional. We removed initially the reservoir and after the distal part in the thorax. We decided to watched her clinically and with a cerebral CT scan and physical examination because of the risk of acute hydrocephalus.

She remained clinically fine with a Glasgow Coma Scale of 15, post-operatively, without headache and vomiting. The biological analysis found a gram-negative bacterium *Escherichia coli*, and also Beta (2 transferrin a protein-specific of cerebrospinal fluid (CSF) and perilymph was found confirming The CSF Leak treated by Trimethoprim/Sulfamethoxazole and Carbapenem for 14 days and treated as meningitis. The CSF analysis showed a normal dose of glucose and protein but the leukocytes were found 30 cells. The postoperative CT scan was performed and no active dilatation has been observed. The evolution was good without intrathoracic collection and without hydrocephalus. We planned to evaluate her condition 1 month after the infection. Hence, if she remains stable she will not need a shunt again. But if she came with hypertension signs we will choose then to operate.

DISCUSSION

VP shunts surgery is a common surgery for neurosurgeons, a well-known procedure but with its complications. Most frequently those complications are mechanical failures and infections.[13] Shunt infections rate is around 5–8% in the literature,[22] while mechanical failure occurs more often. In the review, event-free survival after VP shunt at 1 year is ranged from 62% to 80% and at 10 years from 35% to 48%.[12,21,23] Therefore, up to 80% of patients will require at least one or more shunt revisions during their lifetime.[16] Thoracic complications of VP shunts have been rarely reported, but are potentially serious. Thoracic abscesses due to VP shunt have not been reported yet in the literature.

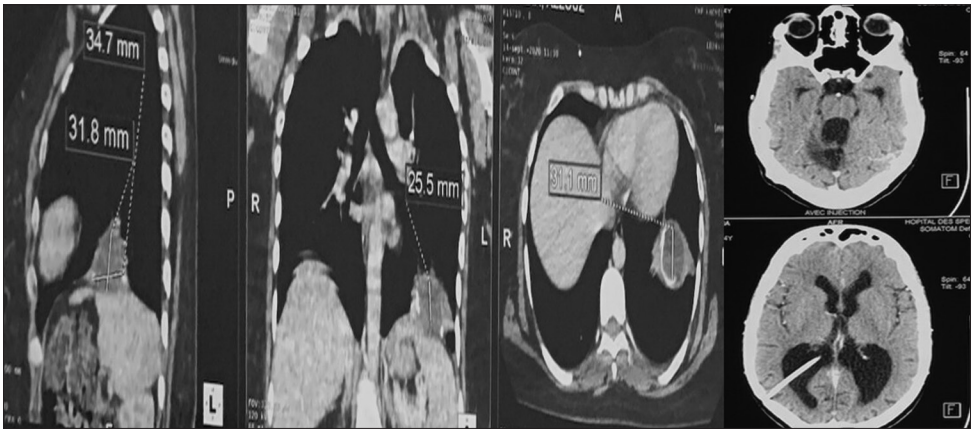

Figure 1: (a-c) Thoracic computed tomography (CT) scan in the mediastinal window. Sagittal, frontal and axial views of the collection above the diaphragm and surrounding by a hyper-density on the outskirts. (d) Head CT scan showing the ventriculoperitoneal Shunt before the surgery.

Indeed, the mechanism of migration of the peritoneal catheter into the thorax is analyzed in the literature. Three hypotheses are discussed. First, the migration of the catheter in the thoracic cavity by a supradiaphragmatic route (created during the VP shunt surgery on the passage along with the subcutaneous tissue). Second, through transdiaphragmatic hiatuses (through Bochdalek's foramen or Morgani's). Moreover, third the inflammatory reactions induced by the shunt tip can erode the diaphragm and then facilitate the shunt migration into the thorax.[18] Taub and Lavyne classified thoracic complications of VP shunt in three types: intrathoracic trauma during surgery, migration of the peritoneal catheter into the chest, and pleural effusion accompanying CSF ascites.[20] While transdiaphragmatic migration is seen mostly in the pediatric population, supradiaphragmatic migration can be seen in any age group as it depends on false surgical intervention.[15]

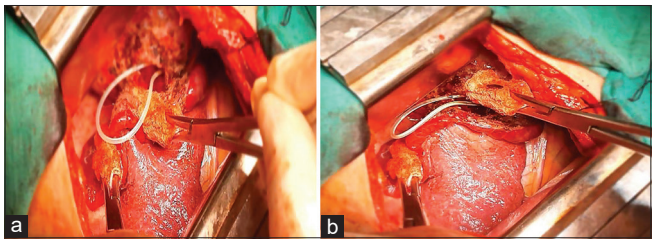

Figure 2: (a) Operative view showing the thoracotomy with the ventriculoperitoneal shunt catheter in the thorax via a diaphragmatic rupture. (b) The abscess has been already punctured.

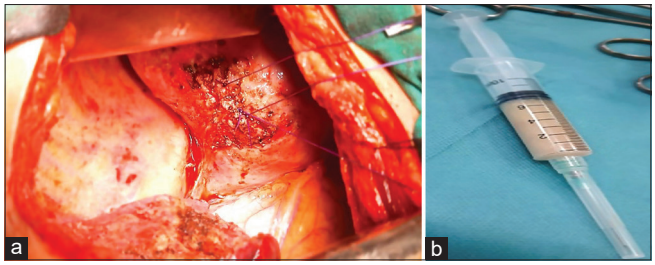

Figure 3: (a) Intraoperative view showing the closure of the ruptured diaphragm. (b) The aspect of the abscess punctured.

In our case, we supposed that with the long delay of surgery (23 years) the peritoneal tip has moved in the thorax through the diaphragm through natural hiatuses because of an inflammation induced by the catheter and make our case special. After migration, a pseudocyst is formed and got infected. A part of the catheter was seen in the peritoneal cavity.

In definition, a CSF pseudocyst is a loculated fluid collection, which forms around the distal catheter tip, and is a common cause of distal catheter obstruction. Concerning the mechanisms, multiple factors are thought to predispose to pseudocyst formation such as abdominal surgery, multiple shunt revisions, increased CSF protein, and infectious, inflammatory, and other processes which may affect the resorptive capacity of peritoneal or pleural surfaces.[5,6] Small size pseudocyst is more likely to be infected.[3,17] Our case is special because of the rarity of the pseudocyst in the thorax. Our cyst was small and infected as described in the literature.

We performed research using the following MeSH terms: VP shunt and thoracic abscess, VP shunt and thoracic migration, VP shunt, and thoracic complications, on Pubmed, Science Direct, and Google Scholar, Medline. We did not find a thoracic abscess resulting from VP shunt migration. Hence, we considered our case as extremely rare.

Hence, we reported in the review some of the thoracic complications of a VP shunt migration [Table 1]. In the literature, hydrothorax as a complication has been found in 23 reported cases. Most of the cases were pediatrics. The mechanism is still discussed. Almost all the patients had a correct VP shunt placement initially. The patients were treated by thoracocentesis most of the cases and pleural drainage, some needed thoracotomy.[18,19] In addition, in the literature most frequent thoracic complications were the migration of the catheter into the pulmonary artery. In these cases, the complication occurs few months after surgery,

Table 1: Summary of some thoracic complications secondary to VP shunt insertion.

Authors	Age	Type of complications	Mechanism	Treatment	Interval from VP shunt insertion
Samdani *et al*.[19]	13 ys F	Pleural effusion (+23 cases)	Intrathoracic migration	Thoracentesis Shunt replacement	13 ys
Hajdarpasic[11]	56 ys M	Pulmonar artery (+16 cases)	Trauma of the cervical vein during tunnelization	Supraclavicular incision shunt removal	3 ys
Lyon *et al*.[18]	71 ys M	Left pulmonar artery	Direct trauma during shunt	Retroauricular incision shunt removal	1 mo
Adib *et al*.[1]	38ys M	Superior cava vein (+ 27 cases)	Dislocation of the shunt	Supraclavicular incision	7 mo
Bolster *et al*.[3]	36 ys M	Intrapleural Intrathoracic (1 case/48 collections) pseudocyst	Migration	ND	ND

ND: Not defined

suggesting that the mechanism could be directly imputed to the VP shunt placement by a direct vein trauma.[9,11,14] Some studies also reported the migration of the VP shunt into the heart through the superior cava vein. We found 28 cases.[1] Furthermore, In our research of thoracic pseudocyst due to VP shunt. We found many cases but all are in abdominal spaces. Bolster *et al*. reported in their cross-sectional imaging of complications, only one pleural pseudocyst among 48 collections related to VP shunt placement. However, in the study the Shunt catheter was ventriculopleural.[4]

Fewel and Garton[10] concluded that intrathoracic migration of shunt catheters is unusual, but might lead to life-threatening complications, such as pulmonary embolism, respiratory distress, bronchial perforation, pleural effusion, tension hydrothorax, pneumothorax, arrhythmia, cardiac insufficiency, and pneumonia. In our case, the patient suffers from a yellowfish cough and sputum.

CONCLUSION

VP shunt complications in the thorax are unusual. Our rare case represented the opportunity to discuss a rare thoracic complication of VP shunt catheter in patients treated for hydrocephalus.

Even if the infected thoracic pseudocyst was not found in the literature yet, some thoracic complications do exist. Hence, patients with respiratory symptoms like respiratory failure, mechanical ventilation, oxygen requirement should get an appropriate examination and imaging with a multidisciplinary discussion before the surgery. This case proved that patients should be followed even after a long time VP shunt surgery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

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