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Case Series

Distal Shunt Migration; A Case Series

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Abstract

Ventriculoperitoneal shunts are one of the commonest surgical procedures performed in neurosurgery and the most commonly used method to treat hydrocephalus worldwide. The mechanical complication of shunt migration is a rare event roughly noted in 1 in 1000 patients who have undergone a shunt procedure. Ventriculo-peritoneal shunt migration to mouth, thorax, transdiaphragmatic, heart, pulmonary artery, breast, stomach, gallbladder, liver, small bowel, umbilicus, colon, inguinal hernia sac, bladder, vagina, anus, and scrotum have been reported in the literature.

Keywords: *distal shunt migration, neurosurgery, ventriculo peritoneal shunt, early onset neonatal sepsis*

Abbreviations

CBC: Complete blood count; CSF: Cerebrospinal fluid; CT: Computed tomography; EVD: External ventricular Darin; EONS: Early onset neonatal sepsis; HC: Head circumference; SD: Standard divination; VPS: Ventriculo peritoneal shunt; WBC: White blood cell.

Introduction

Ventriculoperitoneal shunts are one of the commonest surgical procedures performed in neurosurgery. [3] Ventriculoperitoneal shunt is the most commonly used method to treat hydrocephalus worldwide. [1,3,5] Ventriculoperitoneal shunt complications can be separated into 3 categories: mechanical failure, infection, and functional failure. [2] The most distressing mechanical complication is shunt migration, and often when this occurs, it becomes difficult to work out the mechanism and the management protocol. [3] The mechanical complication of shunt migration is a rare event roughly noted in 1 in 1000 patients who have undergone a shunt procedure. [7,8]

There have been many reports on migration of the distal catheter of the ventriculoperitoneal shunt (VPS) since this phenomenon was recognized 50 years ago. [4] there are three different anatomical patterns of migration based on catheter extension and organs involved: (1) internal, when the catheter invades any viscus inside the thoracic, abdominal, or pelvic cavity; (2) external, when the catheter penetrates through the body wall either incompletely (subcutaneously) or completely (outside the body); and (3) compound, when the catheter penetrates a hollow viscus and protrudes through a pre-existing anatomical orifice. [4] Most of the reported cases are the result of spontaneous migration. However, shunt catheter migration could be iatrogenic as well. [6] age appears to be a factor in that external migration occurred mostly in infants. In contrast, internal migration occurred mostly in adults. [4] Shunt duration was a critical factor in the migration pattern, as most newly-replaced shunts tended to migrate externally. [4]

In this study we report cases with distal shunt migration and their subsequent management.

Cases

Case-1

Initially referred to our center at the age of 19 days with the diagnosis of Term + AGA + Early onset neonatal sepsis (EONS) + Chiari II malformation with ulcerated MMC. She was operated for Meningomyelocele after completing the antibiotics for EONS.

She then had progressive head increment, which was noticed in the same admission, after which CSF analysis reviled normal parameters (No cell, Protein 38 and Glucose37) and Culture was -ve, medium pressure ventriculoperitoneal shunt was inserted.

After 3 months of being discharged, she brought to the emergency with a complaint of protrusion of the shunt through the anus which was noticed by the mother with clear fluid dripping from the tube of 1-hour duration. At this time there was no vital sign derangement. Head circumference was 41.5 cm between mean and +2 SD which showed no increment from measurement taken 1 week back during follow up. Anterior fontanelle was soft, shunt valve was easily compressible and refilled fast. The tip of the shunt was clearly visible protruding via the anus with clear fluid draining from the tip.

Patient was taken to the OR on the same day, proximal catheter was removed via the previous scalp incision and the distal catheter was pulled via the anus. External ventricular drain (EVD) was placed on the Kocher's point on the right side After which she was placed on intravenous antibiotics (ceftriaxone and metronidazole). She averaged daily CSF output of ~300ml, which was clear.

Initial CSF analysis (taken at the time of EVD insertion) was non normal and culture was negative. After being on systemic antibiotics for 2 weeks and had 3 culture results where negative with normal CSF parameters, medium pressure ventriculoperitoneal shunt was inserted.

Case-2

She was diagnosed with congenital hydrocephalus secondary to Dandy Walker malformation at the age of 1 month and for which ventriculoperitoneal shunt was inserted (medium pressure), after which he discharged on the second post-operative day.

At the age of 6 month, she came to the emergency room after the mother noticed shunt tube protruding from the anus. During evaluation, she had normal vital signs and head circumference of 46 cm which was similar to measurement taken a month back. The distal catheter was visible protruding from the anus.

She was operated on the same day, shunt was removed. The proximal catheter was removed via previous scalp incision and distal catheter was removed via the anus. After which EVD was inserted on the same operation, then she was put on intravenous antibiotics (ceftriaxone and metronidazole). At the time of EVD insertion CSF analysis showed cell count of 50 with neutrophil 56% and lymphocyte 33%, protein 140 and glucose 25. Culture showed *staphylococcus aureus* which was sensitive to ceftriaxone and Vancomycin, antibiotics where continued for 2 weeks.

After CSF parameters normalized, 2 culture negative results were obtained the third CSF culture showed Acitinobacter species which was sensitive to imipenem and amikacin antibiotics where switched based on culture results for additional 3 weeks. Patient had 3 culture negative results and normal CSF parameters then medium pressure ventriculoperitoneal shunt was inserted. She was discharged on the third post-operative day.

Case-3

She was referred to our center with a diagnosis of lumbar meningomyelocele, for which closure was done at the age of 2 months.

At 4 months of age she developed progressive head size increment, for which the diagnosis of post meningomyelocele repair hydrocephalus was made and medium pressure ventriculoperitoneal shunt was inserted. She had smooth postoperative hospital stay and was discharged on the second post-operative day.

She came to the pediatrics emergency at the age of 11 months with shunt protruding through the anus with clear fluid running from the tip of the tube. Her r vitals where normal, she had no fever and head circumference was 45cm which was between mean and +2 SD, anterior fontanelle was soft and she had no abdominal tenderness. She had CBC which showed WBC10,000 cells with 18% neutrophils and 73% lymphocytes.

She was taken to the OR on the same day and shunt removal was done. She was put on ceftriaxone and metronidazole for 10 days and CSF parameters where in the normal range, she was discharged improved without shunt reinsertion.

The patient is still in follow up and currently 9 years old, with normal head circumference for her age. She has some gait difficulty and clean intermittent catheterization is being done for neurogenic bladder.

Case-4

She presented initially at the age of 9 days, she was diagnosed with meningomyelocele and underwent surgical repair, 4 months later she developed progressive head size increment and for the diagnosis of post meningomyelocele repair hydrocephalus ventriculoperitoneal shunt (medium pressure) was inserted and discharged on the second post-operative day.

After 9th post op month she presented to the pediatrics emergency with tube protruding through the anus. On evaluation she had normal vital signs the anterior fontanelle was sunken; shunt valve was in the normal place which was easily compressible and refills fast. There was distal tip of the shunt visible protruding per anus with no CSF from the tip. Initial CBC showed WBC count of 13,000 with 56.7% neutrophils and 33% lymphocytes, hemoglobin was 9.3g/dl.

She was taken to the OR and shunt removal was done, CSF sample was sent which reviled WBC count of 1,165 cells with 93% neutrophils and 7% lymphocytes, protein was 537.2 mg/dl and glucose 74.5mg/dl but culture was non reviling. For which she was put on ceftazidime and vancomycin for 14 days. During the course of hospital stay she had no increment in head circumference it remained the same since admission. It was decided to follow her conservatively and she was discharged improved after completing the course of antibiotics.

Case-5

She initially presented to at the age of 1 year and 3 months, with progressive head size increment. Prior to this she was treated for meningitis in another center, for the diagnosis of post infectious hydrocephalus she had ventriculoperitoneal shunt (medium pressure) insertion was done, and sample taken during shunt insertion showed no cell, protein of 27.4mg/dl and glucose of 41.6mg/dl, gram stain was negative and culture had no growth. she was discharged on her second post-operative day.

At 9th post-operative month patient came to the pediatrics emergency after the mother noticed a tube protruding through the anus with clear fluid coming from the tip of the tube. On evaluation she had stable vital sign, head circumference was the same from pre-operative measurements (63 cm), shunt valve was in the normal place which was easily compressible and had fast refill but distal shunt was visualized per anus. CBC showed WBC of 8,400 with neutrophils 25.8% and lymphocytes 56.1%, hemoglobin was 11.6g/dl. She underwent shunt removal and external ventricular drain placed. CSF sample taken at the time of shunt removal and EVD insertion WBC 15 cells with neutrophil of5% and lymphocyte of 95%, glucose 33mg/dl and protein 451mg/dl, culture showed no growth. She was put on ceftriaxone and metronidazole for 14 days. CSF repeat analysis was done and culture was 3 times negative, EVD removal and ventriculoperitoneal shunt (medium pressure) was inserted, she was discharged. She is currently on follow up, she was last seen 1-year post op and in stable condition with functional shunt and stable HC.

Case-6

She was referred to our center at the age of 3 months, she was being managed for intraventricular hemorrhage and anemia. Mother noticed progressive head size increment and vomiting of ingested mater, she was also on treatment for seizure disorder since birth. She had normal vital signs and head circumference was 38cm, anterior fontanelle was flat. She came with CT scan with contrast which showed dilated ventricles including the 4th ventricle with enhancement of the ventricles. CBC showed WBC of 7,100, hemoglobin of 9.5g/dl and platelet 279,000.

EVD was inserted, CSF sample was obtained which showed WBC count of 2,400 cells with 85% neutrophils and 15% lymphocytes, protein 669.4mg/dl and glucose 42.2mg/dl, gram stain was negative and culture showed no growth. She was put on ceftriaxone for 14 days and intra-thecal gentamycin. ventriculoperitoneal shunt (medium pressure) was inserted and she was discharged on the second post-operative day.

3 years post op patient came with a complaint of protrusion of tube through the anus for 4 days, no other complaint, on evaluation her vital signs were in the normal range, shunt valve was in the normal position which was compressible and had fast refill, distal shunt tip was visualized protruding through the anus. Shunt removal and EVD insertion was done. She was put on ceftazidime and vancomycin.

CSF analysis showed no cell with protein 110mg/dl and glucose 62mg/dl culture initially didn't show any growth but repeat culture showed staphylococcus aureus, after completing antibiotics for 14 days and CSF culture was negative 3 times patient had ventriculoperitoneal shunt (medium pressure) insertion done she was discharged on the second post-operative day.

Case-7

4-month-old male child who had progressive head size increment with vomiting, underwent VP shunt insertion (medium pressure) at the age of 4months and was discharged on second post-operative day without any complications and was on follow up. At the age of 8 months the mother brought him to the pediatric emergency with a complaint of tube protruding per anus for 24 hours with clear fluid running from the tip. On evaluation, he was not febrile nor tachycardic the anterior fontanelle was sunken, the shunt valve was in place and was compressible with fast refill, the distal tube was visible protruding via the anus (fig1.1)

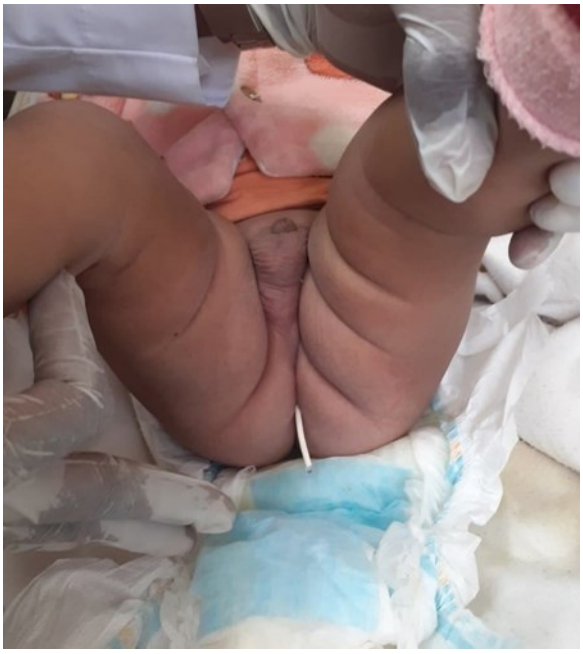

Fig 1.1: *Distal shunt tip visible protruding through the anus.*

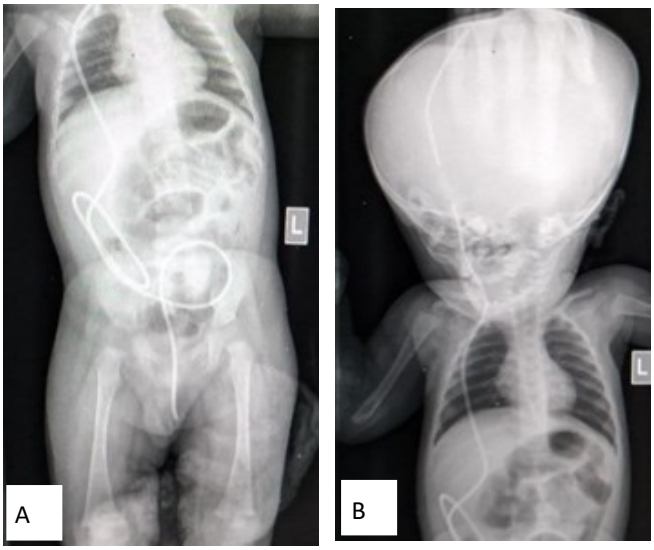

Fig 1.2: *Shunt sires X-ray (A, B)*

The initial work up showed WBC of 11,000 with 71% neutrophil and hemoglobin of 12.9. he also underwent shunt series X-ray; the shunt was visualized but no shunt disconnection no free air in the peritoneum and no evident fluid collection (fig)

After which patient underwent shunt removal and was placed on antibiotics and CSF was sent for analysis and culture. Initial CSF analysis reviled a cell count of 1,300 with 84% neutrophils and 16% lymphocytes, glucose was 48mg/dl protein was 2400mg/dl, culture was negative.

He continued IV antibiotics for 14 days meanwhile had 2 consecutive cultures which were negative and the cell count was correcting but the protein was still high 1800mg/dl, after which b/c of social reasons the parents went out of the hospital against medical advice after several attempts.

Data summary

Case	Sex	Age during shunting	Age during migration	Presentation	Route	Initial CSF	Management	Re-shunted	Outcome
1	F	1 month	4 months	No fever	Anal	No cell P 38mg/dl G 37mg/dl Culture 3X -Ve	Shunt removal EVD + 14 days of antibiotics	Yes	Good
2	F	1 month	6 months	No fever	Anal	50 cells P 140mg/dl G 25mg/dl Staphylococcus aureus on initial culture Acitinobacter species on repeat culture Culture 3X -Ve	Shunt removal EVD + 14 days of antibiotics	Yes	Good
3	F	4 months	11 months	No fever	Anal	No cell Culture 3X -Ve	Shunt removal 10 days of antibiotics	No	Good
4	F	4 months	13 months	No fever	Anal	1,165 cells P 537.2mg/dl G 74.5mg/dl Culture 3X -Ve	Shunt removal 14 days of antibiotics	No	Good
5	F	15 months	24 months	No fever	Anal	15 cells P 451mg/dl G 33mg/dl Culture 3X -Ve	Shunt removal EVD + 14 days of antibiotics	Yes	Good
6	F	3 months	36 months	No fever	Anal	No cell P 110mg/dl G 62mg/dl Culture 3X -Ve	Shunt removal EVD + 14 days of antibiotics	Yes	Good
7	M	4 months	8 months	No fever	Anal	1300 cells P 2400mg/dl G 48mg/dl Culture 3X -Ve	Shunt removal 14 days of antibiotics	No	Unknown

Discussion and Conclusion

Ventriculoperitoneal shunt insertion is one of the most commonly performed procedures for hydrocephalus.[9] Shunt migration is the one of the rare complications after ventriculoperitoneal shunting. [3,9] Visceral perforation is rare. Bowel is most common site of perforation, with mortality rate up to 15%. [9,10] In our case series the mortality rate was 0%. The time from initial shunting and presentation with migration was 3-33 months, with an average of 10 months. All of our patients had medium pressure ventriculoperitoneal shunts. All of our patients did not have systemic features of infection on presentation. Culture was negative in all except 1 patient who had Staphylococcus aureus on initial culture and Acitinobacter species on the repeat culture. After completion of systemic antibiotics 4 of 7 patients required shunting while the rest did not. All except the last case are on follow up are in stable condition.

Conflict of Interest

None.

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None.

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