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Case Report

Hyperpyrexia from Diencephalic Injury - An Additional Complication of Ventriculo-Peritoneal Shunting: Case Report

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Abstract

Ventriculo-peritoneal shunting for hydrocephalus is a safe procedure [1,2]. But, it is fraught with complications, like obstruction, sepsis, sinus thrombosis, over-drainage, intracranial hemorrhage and bowel perforation [1,2].

Immediate post-operative pyrexia is usually attributable to anesthetic complications including atelectasis and halothane hypersensitivity. Rarely, if ever, has an injury to the hypothalamus, been reported as a cause.

We recently had a 15-month old female with post-infective hydrocephalus who had ventricular-peritoneal shunting but developed hyperpyrexia from 1st to 10th post-operative day, with no laboratory or clinical evidence of the cause. A cranial scan revealed the ventricular catheter in the trajectory of the diencephalon.

Introduction

Ventricular-peritoneal shunting for hydrocephalus is a very rewarding and safe procedure. But, it is fraught with different complications in 5-47% cases, the most common of which include shunt obstruction, neurological injuries, sepsis, sinus thrombosis, intracranial hemorrhage, over-drainage, pseudocysts and shunt migration [1-7].

An estimated 50% of shunts in the pediatric population fail within two years of placement, and repeated surgical operations are required [2]. Pyrexia or hyperpyrexia in the immediate post-operative period is usually attributable to anesthetic complications including single lung ventilation, atelectasis or halothane hypersensitivity with malignant hyperthermia. We searched through available reports and literature on the internet and hardcopy texts but were unable to find previous reports of persistent post-operative hyperpyrexia from diencephalic injury following a ventricu-

lar-peritoneal shunt placement.

The diencephalon is one of the two parts of the embryological forebrain or prosencephalon; the other is the telencephalon [8]. It is composed, mainly, of the hypothalamus, thalamus, sub-thalamus and epithalamus [9]. The center of autonomic activities of the human system, including the control of body temperature, is the hypothalamus.

Physiologically, the hypothalamus is an integral part of the endocrine system, with the key function of linking the nervous system to the endocrine system via the pituitary gland. It regulates the body temperature, controls some metabolic functions and regulates the autonomic nervous system [8,9].

On account of the close anatomical and spatial relationship between the diencephalon and third ventricle, lesions affecting the ventricle, especially those leading to pressure or mass effect, readily impact on the diencephalic organs, not least, the hypothalamus. In third ventricular dilatation from hydrocephalus, the hypothalamus and its subordinate gland, the pituitary, have been known to be functionally affected by either the expanding ventricle or the direct pressure effect from growing mass lesions [10].

In order to minimize the possibility of injury to eloquent intracranial organs and tissues during the placement of aventricular-peritoneal shunt, there are standard landmarks that are employed, because once this accident occurs the course of recovery may become complicated.

We recently had a 15-month old female patient with post-infective hydrocephalus who had ventricular-peritoneal shunting but developed hyperpyrexia from the 1st till the 10th post-operative day. There was no laboratory or clinical evidence of the source or cause, and the situation left us in a diagnostic dilemma. However, a post-operative cranial computed tomography revealed a possible hypothalamic injury from a wrongly placed ventricular catheter, which was in the trajectory of the diencephalon.

We searched through available reports and literature on the internet and hardcopy texts but were unable to find previous reports of persistent post-operative hyperpyrexia from diencephalic injury following a ventricular-peritoneal shunt placement.

Case Report

A 15-month old female child presented to our service with a progressive head enlargement and a radiologically diagnosed pan-ventricular enlargement. She was born pre-term with her mother's antenatal clinic attendance and routine drug compliance were both sub-optimal. Her serial antenatal ultrasonography scans could not make a prenatal diagnosis of hydrocephalus or neural tube defects. She was managed for neonatal sepsis and subsequently, discharged. The only red flag in her subsequent history was her delayed milestones and inability to stand or walk without support up until her presentation to our service, at 15months of age. Her two elder siblings were normal and well. There was no spine, chest or limbs anomaly.

She had a full work-up and there was no evidence of sepsis, but there was mild anemia. She, subsequently, had a right frontal ventricular-peritoneal shunting done under general endotracheal anesthesia, and the procedure was uneventful and well tolerated. However, within the first 24hours post-operatively, she developed relentless hyperpyrexia which persisted till the 10th post-operative day, in spite of all symptomatic physical and pharmacological antipyretic measures taken to bring down the temperatures. Maximum daily temperatures ranged from 37.5 to 39.3°C, from the 1st to the 10th post-operative, as follows: 37.9, 37.5, 38.5, 38.3, 38.2, 38.2, 39.1, 39, 38.5 and 39.3°C, respectively (Table 1) (Biochemistry). Except for hypokalemia on two consecutive laboratory evaluations [K+ 3.0 and 3.2mmol/L], the rest of her biochemical parameters remained normal.

Sepsis work-up, well after the immediate post-anesthetic period, detected no evidence of infection, while physical and pharmacological therapies for hyperthermia yielded only transient re-

Table 1: Maximum daily body temperatures for 10 days following VP Shunting.

Post-operative Day	Maximum Temperature
1st	37.9°C
2nd	37.5°C
3rd	38.5°C
4th	38.3°C
5th	38.2°C
6th	38.2°C
7th	39.1°C
8th	39.0°C
9th	38.5°C
10th	39.3°C

ductions in body temperature. Post-operative shunt series x-ray images obtained 12hours after surgery, however, showed the ventricular catheter crossing the midline to the contralateral ventricle (Figure 1).

A post-operative CT was, immediately but most reluctantly, done which revealed the ventricular catheter in the trajectory of the diencephalon, and most likely, traversing it from the right to the left lateral ventricle. We, therefore, made a diagnosis of a diencephalic injury from a wrong ventricular shunt placement (Figure 2).

We did an immediate shunt revision following the CT, to withdraw the ventricular catheter from the diencephalon and re-position it appropriately in the body of the ipsilateral lateral ventricle. The CSF remained clear and colorless, and yielded no bacterial growth after 48hours laboratory incubation.

The patient was placed on multiparameter monitoring, and from the first 24hours post-revision of shunt, till her discharge from hospital 10days after, and up until her first post-discharge clinic review 6weeks later, she remained normothermic. She just had two minimal spikes of 37.5°C at convalescence, on days 6th and 7th, post-operatively. Her maximum daily temperatures for the 10 post-shunt-revision days till discharge read: 37, 37.3, 37.2, 37.2, 37.5, 37.5, 37.1, 37.1, 37.1 and 37.2°C, respectively (Table 2).

Table 2: Maximum daily body temperatures following shunt-revision.

Post-Revision of Shunt Days	Maximum Temperatures
1st	37.7°C
2nd	37.0°C
3rd	37.3°C
4th	37.2°C
5th	37.2°C
6th	37.5°C
7th	37.5°C
8th	37.1°C
9th	37.1°C
10th	37.1°C

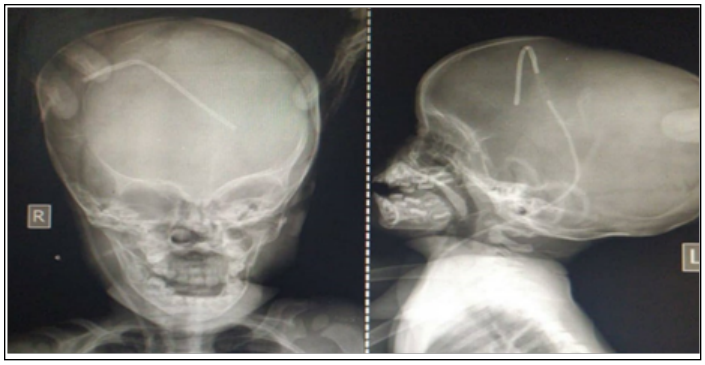

Figure 1: Post-operative shunt series x-ray study showing the ventricular catheter crossing the midline to the left lateral ventricle.

Discussion

When our post-operative cranial CT evaluations revealed a wrong ventricular shunt trajectory across the midline, and the clinical

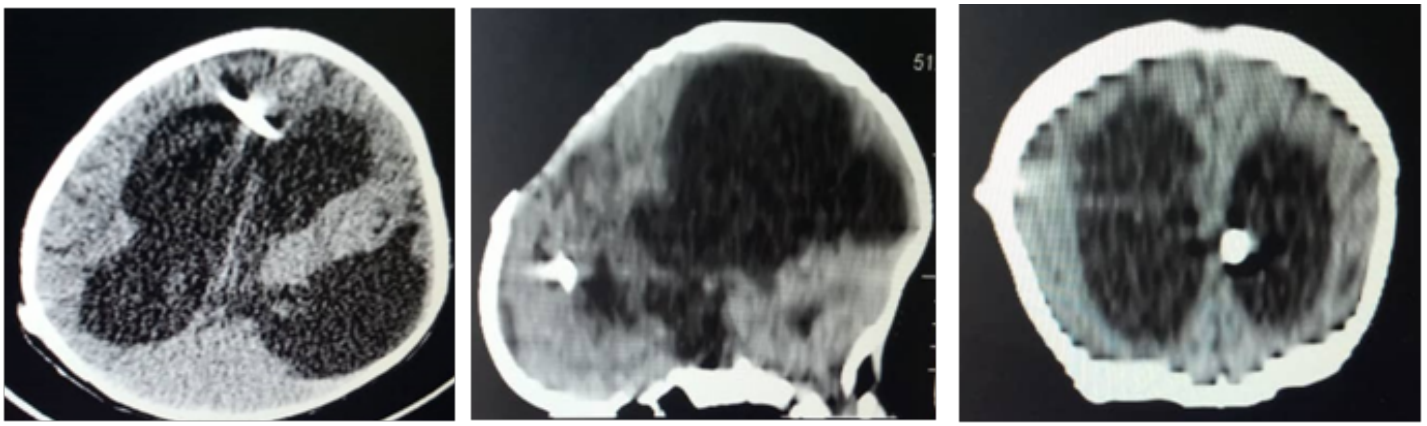

Figure 2: Post-operative CT showing the ventricular shunt in the trajectory of the diencephalon.

and laboratory reports did not support any evidence of sepsis, we did an immediate shunt revision for the patient. The ventricular catheter was withdrawn, evaluated for any obstructions and distal flow, and subsequently, carefully re-inserted in the ipsilateral lateral ventricle. The peritoneal catheter was, also, pulled out and evaluated for distal CSF flow and then, re-internalized.

The dramatic resolution of the hyperpyrexia and normalization of body temperature made us conclude that there was indeed an initial hypothalamic injury, which simply resolved after the shunt revision. Post-revision CSF specimen analysis revealed no abnormal findings.

This was the first time that we encountered such a complication in our service, and therefore, makes the call for a high index of suspicion for a possible diencephalic injury, as a possible complication of ventricular catheter placement during shunting procedures. And, this can create some anxiety and diagnostic dilemma for the operative team.

Wrong placement of ventricular shunts could arise from anatomical distortions due to the primary disease, use of wrong coordinates and landmarks at surgery, poor pre-operative imaging quality/protocol, poor surgical techniques, wrong positioning of patient's head, or errors in the operative procedure.

We, therefore, opine that a diencephalic injury should be high on the list of differential diagnoses following post-ventricular-peritoneal shunting hyperpyrexia of early onset [within the first 24hours of surgery], especially if it remains defiant to all standard anti-pyretic measures.

This incidental finding, therefore, calls for caution in the placement of ventricular catheters in order to ensure that the delicate diencephalic structures are not put at risk. Endoscopic or ultrasound-guided placement is, therefore, advocated in this procedure, especially in post-infective and post-traumatic types of hydrocephalus which are usually associated with fibroblastic reaction and adhesions within the CSF flow and drainage systems. Nonetheless, when this is not feasible like in resource-poor settings, the appropriate use of radiological and anatomical landmarks is strongly advocated, as dependable alternatives.

Conclusion

Diencephalic injury should be recognized as an unusual complication of ventricular-peritoneal shunting, and should be high on the list of differential diagnoses of hyperpyrexia within the first 24hours following the surgical procedure, more especially if it remains defiant to all standard anti-pyretic measures.

Endoscopic or ultrasound-guided placement of the shunt hardware is, therefore, advised, especially in post-infective and post-traumatic hydrocephalus which is usually associated with fibroblastic response and adhesions.

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