



PERIOPERATIVE CONCERNS OF VENTRICULOATRIAL SHUNT - A RETROSPECTIVE ANALYSIS OF 40 CASES

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ABSTRACT **Background:** Ventriculo-peritoneal [VP] shunt is the most commonly used cerebrospinal fluid (CSF) diversion procedure for the management of hydrocephalus. However, when the absorption of CSF from the peritoneum is defective, it results in abdominal distension with CSF ascites. In such cases, an alternate diversion procedure - the ventriculo-atrial [VA] shunt – may be performed. However, this procedure is also associated with several perioperative problems like arrhythmias, air embolism and infection. **Materials and methods:** A retrospective analysis of 40 cases on the perioperative concerns of VA shunt procedures, performed in our institute, was done. Indication of the shunt, preoperative status & work-up, intraoperative adverse events & management and immediate post-operative complications were assessed. **Results:** Out of the 40 patients, there were 25 males and 15 females and there were a total of 12 paediatric patients. Blocked shunt, abdominal infection and CSF ascites were common indications for VA shunt. All patients received general endotracheal anaesthesia with preoperative hypovolemia correction. Intraoperative tachycardia and arrhythmia were noted. **Conclusion :** Various preoperative concerns like distended abdomen and compromised respiration increase risk of VA shunt procedures. A better understanding of the underlying disease pathology and anticipation of related complications along with cautious and meticulous management can help prevent most of the complications of VA shunt procedure and thereby improve outcome

KEYWORDS : Ventriculo-peritoneal shunt, CSF Ascites, Ventriculo-atrial shunt, perioperative concerns

INTRODUCTION

Hydrocephalus usually requires surgical diversion of cerebrospinal fluid (CSF). Ventriculo-atrial (VA) shunts were historically the leading treatment for hydrocephalus. However, various complication of VA shunt such as obstructions, malposition, shunt infections, and cardiac complications such as endocarditis, intra-atrial thrombus, and pulmonary hypertension caused this procedure to fall into disrepute. (1) Also, with the introduction of ventriculo peritoneal (VP) shunt, which was easier to place and safer, the indications of VA shunts were curbed to few. Yet their use is critical to a narrow subset of patients who are not candidates for endoscopic third ventriculostomy and are also not candidates for a VP shunt because of peritoneal insufficiency, abdominal infection or CSF ascites. (2,3,4) Also, minimal invasive methods and radiographic & ultrasonographic guidance have also been developed for VA shunts. (5,6) However, VA shunt is still associated with several adverse perioperative issues related with the condition or the procedure.

AIMS AND OBJECTIVES

The study aimed to assess the perioperative concerns of ventriculo – atrial shunt.

The objectives of the study were to (1) to assess indications of VA shunts, (2) the perioperative issues of concern related to the procedure, (3) assess intraoperative and immediate postoperative complications & their management.

METHODOLOGY

A retrospective evaluation of anaesthesia records of 40 ventriculo-atrial shunt surgeries done in 40 patients over a period of 10 years from 2012 to 2022, in our institute, were done. Demographic details including age and sex of the patients were noted down. The primary diagnosis, history of previous VP shunt procedures and indication of the VA shunt were analysed. Preoperative assessment included general condition of the patient, systemic examination, haematological investigations and imaging study reports. Intraoperatively details regarding general endotracheal anaesthesia administered along with various agents of anaesthesia and drugs used were studied. All ASA standard monitoring parameters; ECG, HR, SpO₂, NIBP; were analysed. Any details about intraoperative adverse events & their management were also noted. Occurrence of immediate post-operative complications and related details also were noted. Statistical analysis was done by entering data in Microsoft Excel and analysing data in terms of frequency of occurrence and percentages.

RESULTS

As shown, this series included 25 male and 15 female patients with age ranging from 11 months to 50 years. Out of 40 patients, 12 were paediatric patients (i.e. less than 12 years in age) and mean age of the patient was 6.5 years.

The primary diagnosis was tubercular meningitis in 18 patients, congenital hydrocephalus in 16 and space occupying lesions (SOL) in 6 of them. In all cases, the procedure was considered as second or third choice and they all had undergone ventriculo-peritoneal shunt earlier, one or more times. The indications of V-A shunt were blocked shunt in 25 cases, abdominal infection in 5 cases and CSF ascites in 10 patients. Preoperatively, in addition to routine blood and diagnostic radiological investigations, 2D ECHO was done in only half of these cases- mostly those done in last 6-7 years. Doppler ultrasonography of neck vessels was also done in 20 cases.

In the operation theatre, all patients had received antibiotic prophylaxis before start of the surgery. All patients received general endotracheal anaesthesia using drugs as per the discretion of the anaesthesiologist on the case, keeping in mind presence of increased intracranial pressure and taking care not to increase it further during anaesthesia. Almost all patients underwent intravenous induction with agents such as propofol/ thiopentone along with sevoflurane inhalational anaesthetics. Any inadvertent raise in ICP(intracranial pressure) as response to intubation was avoided with administration of titrated doses of opioids (inj fentanyl). Anaesthesia was maintained on sevoflurane/ isoflurane with medical air and adequate neuromuscular blockade. The use of nitrous oxide was avoided. Though pre-existing hypovolaemia was corrected, restrictive fluid strategy with isotonic crystalloids was used in most patients.

Right internal jugular vein (IJV) was the most commonly used as access to right atrium. Only in one out of the 40 patients, left IJV access was chosen as it was a case of redo VA shunt.

Bradycardia was noted preoperatively and during ventricular puncture due to sudden ICP reduction in many patients. Transient arrhythmia – mostly ventricular premature beats- were seen in 31 patients during catheter insertion in atrium, which did not require antiarrhythmic treatment. We did not see any complications related with volume overload.

Intraoperatively, fluoroscopy was used in 11 patients and transthoracic echocardiography confirmation of position of shunt tip was also done

in 10 out of 40 patients. Postoperatively, all patients had undergone X-Ray chest A-P (anteroposterior) view to confirm the shunt tip position. Postoperatively delayed recovery and delayed extubation was noted in 2 of these patients. Patients with preoperative ventilatory support required continued support postoperatively as well. On follow up, it was noted that 6 out of the 40 patients required re-surgery including exteriorisation, VP or repeat VA shunt.

Table 1.1 :- Incidence of perioperative complications in patients undergoing VA shunts

PERIOPERATIVE CONCERNS	PERCENTAGE INCIDENCE (N=40)
Preoperative	
CSF ascites	25% (10)
Abdominal infection	12.5% (5)
Blocked shunt	62.5% (25)
Preoperative ventilatory support (poor GCS and aspiration)	15% (6)
Intraoperative	
Tachycardia	75% (30)
Arrhythmia (at Right atrial catheter insertion)	77% (31)
Postoperative	
Delayed recovery and extubation	5% (2)
Post-operative ventilatory support	25%(10)
Re-surgery	15% (6)

DISCUSSION

The literature on VA shunt is sparse with few case reports on management and several case series evaluating outcome. As per this study, common indications for V-A shunt are - blocked V-P shunt, impaired absorption of CSF from peritoneum causing abdominal pseudocyst or CSF ascites and abdominal infection. Similar indications were reported by other studies and case reports as well (7). V-A shunt is contraindicated in presence of bacteraemia, CSF infection or endocarditis. It is also not advocated in presence of prothrombotic state, pulmonary hypertension and congestive heart failure – as the procedure can aggravate the condition.

From our analysis it was found that VA shunt is associated with various primary disease related preoperative concerns. Increased ICP with resultant depression of sensorium in these patients may lead to pulmonary aspiration and infection. Poor GCS (Glasgow Coma Scale) and presence of preoperative evidence of aspiration necessitating preop ventilatory support was found in 6 of these patients. Also observed commonly was abdominal distension related basal atelectasis and respiratory embarrassment. Further, IVC (inferior vena cava) compression and decreased venous return from lower half of body -caused sinus tachycardia (observed in 30 out of 40 patients) with or without hypotension. To solve this problem, preoperative drainage of ascitic fluid could be done though it may often lead to increased risk of infection. Similar findings were also observed by Mishra et al in their studies (8). Adding to these problems, most of these patients had poor nutritional status, especially those with tubercular meningitis related hydrocephalus.

The reduced functional residual capacity (FRC), due to reasons already mentioned, often led to rapid intraoperative desaturation in some of these patients. Similar problems were found by Mishra et al as well. This could be prevented by 100% oxygen administration and head high position for induction(8). Sympathetic stimulation leading to tachycardia and hypertension needs to be managed with maintaining appropriate depth of anaesthesia and adequate analgesia. Arrhythmia at the time of shunt insertion is common as seen in our series as well. These are transient and usually do not require any active treatment. However, atrial fibrillation has been reported by Natarajan et al in a patient with VAS in situ (5).

Venous air embolism during shunt insertion may occur due to air bubbles entering through atrial end of shunt and hence nitrous oxide is to be avoided in these cases(9). However, we did not encounter this complication in any of the studied patients.

Another important complication is shunt malposition. As a measure to avoid this complication, intraoperative fluoroscopic confirmation of shunt position was done in some of our patients. Another method available for this purpose is transoesophageal echocardiography as mentioned by Chuang et al. (10) Postoperatively confirmation was done in all patients with chest X Ray AP view.

Another preventable complication is bacterial endocarditis which could be managed with thorough asepsis and broad spectrum antibiotic coverage as stated by Engelman et al (11). All our patients received antibiotic prophylaxis with ceftriaxone and vancomycin as per standard doses.

The immediate postoperative complications are often cardiac failure and air embolism related. Although, no evidence of volume overload or failure was noticed in any of our patients. The delayed complications include wound / CSF shunt infection and shunt malfunction as also mentioned by others such as Ben -Ami et al and Yavuz et al (7,12). Six out of 40 patients required re-surgery in the form of exteriorisation, VP shunt and repeat VA shunt. Other less common but serious complications of VA shunt are venous thrombosis- IJV, SVC (leading to superior vena cava (svc) syndrome) (13), pulmonary hypertension due to micro emboli (11,14). Chronic shunt infection –leading to immune mediated glomerulonephritis, delayed cerebral haemorrhage, endocarditis (11).

Another problem associated is outgrowing of shunt in paediatric population. The length of distal tip of shunt in VA shunt is fixed. Hence as the child grows shunt displacement and malfunction may occur needing revision surgery.

However, our study was a retrospective analysis performed in a small population of patients. We recommend further prospective studies with larger sample size for better understanding and generalisation of results.

CONCLUSION :

Hence from the present analysis, it can be concluded that V-A shunt, as a procedure, is safe in adults as well as in children. The preoperative issues related with the disease (raised ICP) and abdominal distension are common and need to be managed accordingly. Intraoperatively, arrhythmias are transient and easily managed. Also, fluid and electrolytes need to be meticulously managed. The postoperative need for ventilatory support is mainly related with the pre existing disease status. Hence, a better understanding of the underlying disease pathology and anticipation of related complications along with cautious and meticulous management can help prevent most of the complications of VA shunt procedure and thereby improve outcome.

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