Hellenic Journal of Surgery (2017) **89**:3-4, 163-165

Laparoscopic Cholecystectomy in Patients with Ventriculoperitoneal Shunts: A Case Series

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Abstract

Introduction: Patients with ventriculoperitoneal shunts (VPS) are at risk of associated complications during laparoscopic surgery. Although these cases are rare, the surgeon should be aware of the pathophysiology of such complications in order to recognize and avoid them.

Case presentation: Three patients with a VPS who underwent laparoscopic cholecystectomy are presented. Two of the patients suffered from symptomatic gallstone disease, and the third, the oldest, from acute calculus cholecystitis. All patients had a VPS because of hydrocephalus. There were no intraoperative complications in this series.

Discussion: This small case series presents a rare condition that can be the cause of complications during laparoscopic surgery. Septic complications, including VPS infection and cerebrospinal fluid (CSF) infection, pneumocephalus, CSF pseudocyst, and adhesions due to the presence of the VPS, are all possible occurrences. These are discussed, with a short literature review.

Key words: *Laparoscopic cholecystectomy; case report; ventriculoperitoneal shunt; gallstones*

Introduction

Laparoscopic cholecystectomy is nowadays the gold standard for the treatment of symptomatic gallstone disease. Although in general a safe procedure, laparoscopic cholecystectomy, as other laparoscopic procedures, may put specific patients at higher risk of complications. Patients with ventriculoperitoneal shunts (VPS) for congenital or acquired hydrocephalus have a normal life expectancy [1], with the exception of those suffering from hydrocephalus of malignant etiology. The presence of a VPS catheter in the abdominal cavity at the time of a laparoscopic procedure has been reported to be associated with pneumoperitoneum induced aggravation of hydrocephalus [2], central nervous system (CNS) infection [3-5] and a higher conversion to open surgery because of adhesions [3, 6]. Only few relevant studies have been published, however, most concerning children, and single case reports. Three consecutive cases of patients with VPS requiring laparoscopic cholecystectomy are presented here, who were treated in a tertiary referral center.

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Received 20 May 2017; Accepted 3 Oct 2017

Presentation of Cases

Three patients, aged 48, 62 and 70 years, respectively, underwent laparoscopic cholecystectomy. Each had a VPS catheter with a valve mechanism, implanted more than 5 years previously, because of acquired hydrocephalus. The indication for laparoscopic cholecystectomy was symptomatic gallstones in the first two patients, while the third, the oldest patient, had acute calculus cholecystitis. Standard monitoring was applied, and a single shot of second generation cephalosporin was administered for prophylaxis during induction of anesthesia. The surgical setup was standard in all three cases. Pneumoperitoneum was achieved according to the open technique (Hassan's technique) and the intra-abdominal pressure was set at 12mm Hg. Minor adhesions were encountered that required quick and straightforward adhesiolysis. The free intra-abdominal tip of the VPS catheter was easily found and placed above the liver, and conventional laparoscopic cholecystectomy was performed. After completion of the cholecystectomy, the tip of the VPS catheter was repositioned in its original place. In all three cases, blood loss was unremarkable and the patients remained hemodynamically stable throughout the procedure. There was no breach of the gallbladder wall, and bile spillage was avoided. The gallbladder was meticulously manipulated, and extracted using a standard laparoscopic bag. The patients were discharged home the following day, and followed up for one month. The only event documented during this period was a lower urinary tract infection in the

62-year-old patient. No intra-abdominal or CNS infection was suspected at any point, and the patients had all returned to their normal activities at the time of final follow-up.

Discussion

The major concern related to laparoscopic procedures in patients with VPS is that of CNS infection, especially in the case of contaminated procedures [7]. In one of the largest reported series including both open and laparoscopic surgery in patients with VPS, there no infection was noted in patients who underwent clean-contaminated procedures [8]. Several techniques have been developed to prevent a possible infection from contamination with bowel content or urine, including externalization of the tip of the catheter [8], conversion to ventriculoatrial shunt, clamping [9] and placement of the tip in intracorporeal bag [3]. As far as antibiotic prophylaxis is concerned, there is inconsistency in the published data, ranging from single-dose single-antibiotic administration to a triple scheme of antibiotics for 1-2 days [3]. This inconsistency can be attributed to the variety of surgical procedures and medical backgrounds reported. The authors of the present study suggest that for a clean-contaminated procedure such as cholecystectomy, a single dose of a broad spectrum antibiotic is adequate, and no other action is warranted.

In a large study by Allam and co-workers [6] a postoperative VPS infection rate of 9 % within 30 days of cholecystectomy was reported. This was comparable with the 5% to 7% shunt infection rate reported after shunt insertion or revision [5, 10, 11].

Thus, VPS infection cannot be attributed entirely to laparoscopic clean or clean-contaminated procedures, since laparoscopic cholecystectomy has been shown to have a significantly lower risk of surgical site infection than the open procedure (0.62% vs 1.82%) [12]. In the open procedure, there is also a higher risk of postoperative adhesions [13], with the possibility of distal catheter entrapment and cerebrospinal fluid (CSF) pseudocyst formation, which in turn would introduce the risk of shunt infection [14].

The VPS tubing is itself an intraperitoneal foreign body, which may increase the chance of developing an infection. This risk can be managed intraoperatively by simple maneuvers, such as administration of perioperative antibiotics and packing the peritoneal end of the shunt away from the surgical field [6], both of which were done in all the cases presented here.

The surgeon must be aware that VPS infections can mimic an acute surgical abdomen. In such cases the recommended treatment is externalization of the shunt, with replacement after intensive antibiotic therapy and clinical improvement. If the abdominal findings have not improved within 6 to 8 hours, the patient should be reevaluated and an exploratory laparoscopy or even laparotomy should be considered [15].

Other concerns that have been voiced about laparoscopic surgery in these patients are aggravation of the hydrocephalus due to impaired shunt function as a result of increased intrabdominal pressure during surgery, and the possibility of carbon dioxide retrograde flow in the shunt resulting in pneumocephalus [16]. Such a theoretical risk has not been proven, even in *ex-vivo* studies with high pressures, given the advanced valve-mechanisms integrated in modern shunts [2, 14, 17]. In addition, no report of pneumocephalus due to retrograde valve failure has been published, even in *in-vitro* studies.

Intraoperative monitoring of the intracranial pressure (ICP), which was applied in several studies, demonstrated minimal and clinically insignificant deviation [1, 18, 19]. In a few case series only, a transient increase in ICP during laparoscopic procedure in patients with VPS was observed [2].

The ICP is hypothesized to increase secondary to pneumoperitoneum. Increases in the intra-abdominal and intrathoracic pressure from pneumoperitoneum cause venous outflow obstruction and increased resistance to outflow through the distal peritoneal catheter, leading to partial or complete shunt obstruction [8]. In addition, patients subjected to laparoscopy also may become mildly hypercapnic due to the absorption of carbon dioxide through the peritoneum and the mechanical effects of insufflation on ventilation; such hypercapnia causes intracranial arteriolar dilatation and increased cerebral perfusion. In this way, hypercapnia may also contribute to intraoperaive cerebral hypertension [2], and in the presence of an incompetent shunt valve, retrograde flow of CSF may also contribute to an intraoperative increase in ICP [9, 20].

In spite of these possibilities, it is not clear whether the ICP should be routinely monitored in patients with VPS undergoing laparoscopic surgery [21].

It is recommended that sudden increases in intraabdominal pressure be avoided by keeping the patient in a relaxant state at all times [14], while also keeping intra-abdominal pressure to the minimum that will allow adequate visualization during the surgical procedure. It is generally considered that maintaining the intra-abdominal pressure below 12mm Hg is a safe strategy, requiring no further adjustments or monitoring [1, 3].

The presence of dense adhesions or laparoscopic surgery complications that require conversion to open approach are further issues addressed in the relevant literature. Allam and colleagues reported a conversion rate of 57% in patients with VPS compared with a 5% rate for those without VPS [6]. The long-term presence of a foreign body in the abdominal cavity, in this case the VPS, particularly when complicated

by an infective abdominal process, such as cholecystitis, may be the substrate for the formation of dense adhesions. That study documented significantly longer hospitalization in patients with VPS, but it is not clear whether this was the result of the surgical procedure, or due to the underlying co-morbidities of these patients, that included a history of cancer, cerebrovascular accidents and diabetes mellitus. In the opinion of the authors of the present study, the incidence and significance of adhesions in patients with VPS is probably overestimated. Unless there has been severe abdominal infection, only minor adhesions should be encountered, which are managed easily and cause no intraoperative problems in terms of blood loss, operation time or need for conversion to open surgery.

In conclusion**,** laparoscopic cholecystectomy is a safe procedure for patients with VPS. Infection can be successfully prevented with a single dose of broad spectrum antibiotics. Increase in ICP should not be a major concern, although there is no clear consensus on whether ICP monitoring should be carried out. Adhesions can usually be managed easily without increasing the risk for conversion or complications. However, as there are no guidelines based on sound clinical evidence for the management of patients with VPS requiring laparoscopic procedures, further studies could shed more light on the concerns discussed above.

Conflict of Interest: *The authors declare that there is no conflict of interest.*

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