Ascites and abdominal pseudocysts following ventriculoperitoneal shunt surgery: variations of the same theme


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Object. Ascites and abdominal pseudocysts are two complications that can occur following placement of a ventriculoperitoneal (VP) shunt. Although various factors have been implicated, the exact pathogenesis of the two conditions remains elusive. To the authors’ knowledge, there are no studies in which these two obviously related conditions have been compared.

Methods. The authors retrospectively reviewed the cases of children with abdominal complications caused by a VP shunt. There were 15 patients who developed a pseudocyst and five patients who developed ascites. The cases were analyzed to identify common and distinguishing factors that may help in identifying the mechanism involved.

Abdominal symptoms were the mode of presentation in 60% of those with pseudocysts. Culture-proven infection, abdominal surgery, and the number of revisions seemed to be more common in cases with pseudocysts than in ascites. The fluid in ascites was found to be a transudate irrespective of the origin of hydrocephalus. Alternative drainage sites were required in the treatment of patients with ascites, and reimplantation in the peritoneum was possible in 66.7% of those with pseudocysts. In the long term, however, peritoneal reimplantation was possible in three of the five patients with ascites.

Conclusions. Abdominal pseudocysts and ascites, after VP shunt treatment, are distinct conditions with different modes of presentation and findings during examination of fluid, and therefore they require different management strategies.

KEY WORDS • abdominal complication • ultrasonography • shunt ascites • pseudocyst • pediatric neurosurgery

Abdominal pseudocysts and ascites are two relatively uncommon abdominal complications (2%) following VP shunt insertion procedures. Both complications are characterized by abnormal intraperitoneal CSF collections, and in some studies no distinction has been made between the two entities. Authors of most reports tend to treat them as separate conditions, but no attempts have been made to identify the differences, if any, among clinical features and their pathogenesis. In this study we attempt to identify the differences between the two entities with regard to diagnosis, clinical behavior, pathogenesis, and management.

Clinical Material and Methods

Between 1985 and 2005, patients with shunt-related ascites or abdominal pseudocysts who presented to British Columbia Children's Hospital were identified in the neurosurgical database. For the purposes of this study, patients were defined as having an ascites or abdominal pseudocyst based on the findings of abdominal ultrasonography. We performed a retrospective chart analysis of these patients and extracted demographic data, the origin of hydrocephalus, details of prior shunt operations, management of the abdominal pseudocyst or ascites, and available follow-up data.

The study was approved by the Ethics Committee of the University of British Columbia and the Research Review Committee of British Columbia Children's Hospital.

Statistical Analysis

The data were entered into a Microsoft Excel spreadsheet. Statistical analyses were performed using SPSS version 8.0 (SPSS, Inc.). Six univariate analyses were performed, and accordingly, a Bonferroni correction was applied to determine the alpha level to be used to determine statistical significance. We therefore used a probability level less than 0.00833 as the threshold to declare statistical significance.
Ascites and abdominal pseudocysts following VP shunt surgery

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Results

Patient Demographics

Three boys and two girls were in the ascites group (age range 7 months–9 years, mean 3.7 years), and six boys and nine girls were in the abdominal pseudocyst group (age range 4 months–18 years, mean 9.5 years). This trend toward older age in patients with an abdominal pseudocyst did not reach the level of statistical significance (p = 0.084, unpaired t-test). The follow-up period ranged from 4 months to 14 years (mean 49.5 months).

Clinical Presentation

The clinical presentation of patients with ascites was uniformly abdominal distension and discomfort. None had symptoms suggestive of shunt obstruction. In the abdominal pseudocyst group, however, six patients (40%) presented with abdominal symptoms, six (40%) with symptoms of shunt obstruction, and three patients (20%) had both features. There was a tendency toward presentation with abdominal symptoms in the ascites group (p = 0.0195, chi-square test).

The origins of the hydrocephalus are given in Table 1. Posthemorrhagic hydrocephalus was most common in the abdominal pseudocyst group. Up to four shunt revisions (mean 1.4) had been performed prior to the complication in patients with ascites, and up to nine (mean 1.4) had been performed prior to the complication in patients with abdominal symptoms, six (40%) with symptoms of shunt obstruction, and three patients (20%) had both features. There was a tendency toward presentation with abdominal symptoms in the ascites group (p = 0.0195, chi-square test).

The salient differences between abdominal pseudocysts and CSF ascites are summarized in Table 2. With the exception of the shunt placement procedure, none of the patients in the ascites group and three of those in the abdominal pseudocyst group had undergone previous abdominal surgery. A history of shunt infection or meningitis was noted in seven (46.7%) of the patients with an abdominal pseudocyst but in none of those with ascites (p = 0.0581, chi-square test). Six of the seven patients with an abdominal pseudocyst had prior shunt infections, and of these, three had remote infections with Propionibacterium acnes (one patient) or Staphylococcus epidermidis (two patients) at 1, 7, and 14 years prior to the development of the abdominal pseudocyst. Three patients received a diagnosis of abdominal pseudocyst within 1 month of a shunt infection: two had multiple prior shunt infections with various organisms and one had an infection with S. epidermidis. A culture-positive infection of the abdominal fluid was seen in seven patients (46.7%) in the abdominal pseudocyst group, but this did not necessarily correlate with a prior CSF infection. The organisms cultured from the abdominal fluid included P. acnes in three (combined with S. epidermidis in one), Streptococcus fecalis in two, Acinetobacter sp. in one, and Staphylococcus aureus in one. None of the cultures was positive in patients in the ascites group (p = 0.0581, chi-square test). Analysis of the protein content of the fluid revealed a transudate (< 3 g/dl, range 0.79–2 g/dl) in all four of the five ascitic fluids tested. In three of the five patients tested from the abdominal pseudocyst group, the fluid was an exudate (≥ 3 g/dl, range 2–7.39 g/dl).

Management of the conditions was based on the clinical situation and the individual preferences of the six surgeons involved and also on the evolving knowledge of the conditions themselves during the many years encompassed by the review. Four of the five patients with ascites underwent VA shunt placement after multiple aspirations had failed, three of which were done primarily and one after a failed VP shunt revision. However, three of the four patients with VA shunts eventually underwent placement of a VP shunt after 5 to 6 years due to shunt-related complications, and there was no recurrence of CSF ascites at that later time. In one patient, the CSF ascites was probably due to hypoproteinemia secondary to protein-losing enteropathy, and in this child the ascites resolved spontaneously as the hypoproteinemia was treated.

In the abdominal pseudocyst group, external ventricular drainage followed by VP shunt placement at a different site was performed in six patients (40%); the average interval from external ventricular drainage to VP shunt insertion was 10 days. External drainage followed by ventriculopleural shunt placement was performed in three patients (20%). Primary reimplantation at a different site was performed in three patients; the procedure was successful in two patients,
but the third patient required a VA shunt. One patient underwent cyst aspiration and endoscopic third ventriculostomy; these procedures failed, and eventually the patient underwent VP shunt placement. One patient underwent a laparotomy and reimplantation at a different site, and another had a VA shunt placed. Peritoneal reimplantation was eventually possible in 10 (66.7%). Recurrence was seen in one patient with ascites and three with abdominal pseudocysts; one of these recurrences happened 12 years later. None of the recurrences was associated with a new infection and two required VA shunts, whereas two underwent temporary external drainage and reinsertion to a different peritoneal site.

Discussion

Abdominal fluid collections are relatively uncommon complications of VP shunts. Encysted collections, also known as abdominal pseudocysts, by far outnumber the reported cases of CSF ascites, where there is free intraperitoneal fluid. Authors of some reports have collected the conditions under the single heading of ascites or have described them as variations of the same theme. It has also been mentioned that it may not be practical to distinguish a large abdominal pseudocyst from an ascites. On the other hand, the management of the two conditions may be different, as was the case in this series, and it would therefore be important to distinguish between the two. Some authors have suggested that an x-ray study of the abdomen can distinguish these two conditions based on the bowel gas pattern, with an abdominal pseudocyst showing characteristic displacement of bowel gas and an ascites showing a uniform ground-glass appearance. However, the definitive diagnosis is readily made by abdominal ultrasonography, which is able to distinguish a generalized fluid collection of ascites from a loculated collection of the pseudocyst. Computed tomography scanning can be a useful adjunct.

Although it is well recognized that an abdominal pseudocyst and ascites are two distinct entities, there are no studies in which the two conditions have been compared. A CSF ascites has been described secondary to various causes including infections, tumors particularly in the choroid plexus, opticocochiasmatic gliomas, shunt-disseminated metastasis, and foreign body reaction to the peritoneal catheter. The various mechanisms proposed include high protein content of the CSF especially the opticochiasmatic gliomas; increased CSF production as in choroid plexus hyperplasia and papillomas; tumor-secreted vascular permeability factors; and chronic serosal inflammation. In the current study, one patient harbored an opticochiasmatic glioma, one of the frequent tumors reported to be associated with ascites, and one had craniopharyngioma. Our observations in common with other studies were the predominance of abdominal symptoms in the clinical presentation and the need to find an alternative drainage site for the CSF. The findings unique to this study were the absence of infection and the transudative nature of the ascites. This suggests that high protein content in the CSF is not a significant contributor to ascites formation except possibly in the specific setting of an opticochiasmatic glioma.

Pseudocysts are more common than ascites with an incidence of 0.33 to 68% of shunt procedures. Unlike cases of CSF ascites, infection seems to be of major significance, occurring in 17 to 80% of cases of pseudocysts. Analysis of findings in the current study revealed a positive abdominal fluid culture in 46% of patients. However, the possibility of underrepresentation of infection based on a single culture report and empiric antibiotic use has been mentioned.

Multiple shunt revisions and major abdominal surgeries have been indicated by authors as a factor in some publications but refuted in others. In the current study the average number of revisions was 2.9 in the abdominal pseudocyst group and 0.75 in the ascites group. In 20% of the patients in the abdominal pseudocyst group major abdominal surgery was performed, whereas none was performed in patients in the ascites group. These findings indicate clearly that abdominal pseudocysts and ascites are two pathogenetically distinct entities. An abdominal pseudocyst is associated with inflammatory processes, resulting in loculation of the CSF intraperitoneally. A CSF ascites seems to relate to other factors that either cause production of excess CSF or reduce the ability of the peritoneum to absorb CSF.

The clinical presentation varied between patients in the two groups; patients with ascites uniformly presented with abdominal symptoms but no shunt dysfunction, whereas 60% of those with pseudocysts presented with shunt dysfunction.

If one recognizes that the pathogenesis of the two conditions is different, it is not surprising that their management should also be different. For a CSF ascites, authors of most reports have indicated that there is a need for alternative drainage sites, regardless of the pathological entity, and they recommend placement of a VA, ventriculopleural, or ventricle–gallbladder shunt. In our study, four of the five patients required a VA shunt. However, in the long term (2 months, 5 years, and 6 years), three of the four VA shunts were satisfactorily converted to VP shunts, suggesting that something had changed that allowed the peritoneum to adequately absorb CSF.

The management of abdominal pseudocysts has varied based on the pathophysiology and the evolving trends in management. Aspiration of the cyst has been more often diagnostic than therapeutic. The difficulty is that a large percentage, but not 100%, of abdominal pseudocysts is associated with shunt infection, and treatment of this subgroup of patients requires treatment of the shunt infection. Furthermore, the shunt infection may not be readily apparent on initial cultures, so that a case initially thought to be noninfective and treated as such may require additional treatment if infection becomes recognized on delayed cultures. A limited laparotomy and reinsertion at a different abdominal site has been performed in noninfective cases, but some authors have reported high failure rates with this approach. Findings in the current study also show a successful primary reintervention in only two of four patients. Laparoscopic fenestration of the pseudocyst wall has also been successfully attempted sporadically. Authors of the majority of the reports have had the best success with temporary external drainage, followed by shunt reinsertion in the peritoneum or another cavity after there is clearly no evidence of residual infection, with success rates up to 78%. In this study we found the incidence of eventual shunt reinsertion into the peritoneum was 60%.

The principal limitations of this study are that it was performed retrospectively and that the overall numbers of patients are small, particularly in the ascites group. As a re-
sult, the statistical comparisons need to be interpreted with caution. We have corrected our alpha values to reflect the fact that multiple univariate comparisons were performed, and using this corrected alpha threshold (p < 0.0833), none of the comparisons performed was statistically significant. From a statistical point of view, at best, we can say that the differences between groups might represent trends.

Conclusions

Abdominal pseudocysts and CSF ascites are two different entities with different pathogenesis, clinical presentations, and management strategies. Patients with an abdominal pseudocyst tend to be older, present with symptoms suggestive of shunt blockage, and have had previous infections; additionally, samples of their abdominal fluid are more likely to culture positively. Impaired absorption of the CSF load seems to be the dominant cause for ascites, whereas infection or low-grade inflammation seems to account for pseudocysts. Pseudocysts respond to short-term diversion by external drainage and treatment of infection, and the catheter can, in many instances, be replaced intraperitoneally thereafter. On the other hand, ascites require CSF drainage to a site other than the peritoneal cavity, at least for a period of time. In the long term, if subsequent shunt revision is required, the catheter can be placed again in the peritoneal cavity without recurrence of the ascites.

References


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