



Prevention of ventriculoperitoneal shunt complications after intraperitoneal urological surgeries



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ABSTRACT

Purpose: To evaluate perioperative management for the prevention of postoperative shunt infection and malfunction after intraperitoneal urological surgery in patients with myelodysplasia and a ventriculoperitoneal shunt.

Methods: From 2005 to 2015, 20 consecutive patients with myelodysplasia and a ventriculoperitoneal shunt who underwent intraperitoneal urological surgeries were managed with the same perioperative regimen. Intraperitoneal surgeries involved opening gastrointestinal tracts, including bladder augmentation by enterocystoplasty, creating continent catheterizable channels and Malone antegrade continent enema. We compared results with those from seven previous reports regarding postoperative shunt complications, surgical histories of previous shunt revisions, management of bacteriuria before surgery preoperative bowel preparation, antibiotic regimens, and duration of indwelling drain.

Results: Of 20 patients, 18 received prior shunt revisions, and 14 had positive urine culture before surgery that was managed with oral antibiotics. Thirteen patients underwent bladder augmentation with ileum, and one underwent augmentation with sigmoid colon. Nineteen patients underwent Malone antegrade continent enema using the appendix. All parenteral antibiotics were stopped on postoperative day 2.5. Mean duration of indwelling peritoneal drain was 2.7 days. Mean follow-up period was 59.8 months. Neither postoperative shunt infections nor intraperitoneal shunt malfunctions were recognized during follow-up period.

Conclusions: This is the first study to evaluate postoperative ventriculoperitoneal shunt complications in patients with myelodysplasia who underwent intraperitoneal urological surgeries with a specific perioperative regimen. Shunt complications are greatly reduced by rigorous perioperative management, including preoperative control of bacteriuria, appropriate administration of prophylactic antibiotics, and early removal of intraperitoneal drains.

Levels of evidence: The type of study: Case series with no comparison group, IV.

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Patients with myelodysplasia often require a ventriculoperitoneal shunt at an early age. Most of these patients have some degree of urinary incontinence and bowel dysfunction [1]. Intraperitoneal urological surgeries, such as enterocystoplasty or Malone antegrade continent enema (MACE), are often needed for these patients, but these intraperitoneal procedures can potentially lead to shunt complications, especially infections [2]. Although postoperative shunt infections are uncommon, they can lead to serious complications, such as meningitis and even death [3]. There are several previous reports that retrospectively investigated ventriculoperitoneal shunt complications after intraperitoneal urological surgeries, but no specific perioperative management has been evaluated with regard to prevention of postoperative shunt complications. When we started intraperitoneal urological

surgeries in pediatric patients with ventriculoperitoneal shunts at our institution in 2005, we established a specific regimen for perioperative management based on data from previous reports [2,4–9]. The aim of this study was to assess the validity of this specific regimen with regard to short-term and long-term outcomes.

1. Methods

This study was approved by Kanagawa Children's Medical Center Institutional Review Board for the Protection of Human Subjects (IRB 1507–08). Given the retrospective nature of the study design, informed consent was waived.

1.1. Patient population and data collection

From 2005 to 2015, 20 consecutive patients with myelodysplasia and a ventriculoperitoneal shunt who underwent intraperitoneal urological surgeries were managed with the same perioperative regimen as described below. We reviewed all medical records from these

Abbreviations: MACE, Malone antegrade continent enema; SSI, surgical site infection; GIA, gastrointestinal anastomosis.

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patients. The mean (range) age at surgery was 14.8 (range, 5–20) years. Intraoperative surgeries involved opening gastrointestinal tracts, such as bladder augmentation by enterocystoplasty, creating continent catheterizable channel (appendicovesicostomy or Monti procedure) and MACE. All patients continued to be regularly followed at our urology and neurosurgery clinic at our institution.

1.2. Preoperative management

Urine cultures were performed in all patients within 1 month before surgery. If urine cultures were positive, antibiotics were selected based on the organism and were administered 3 consecutive days before admission. Urine cultures were performed again in patients with enterocystoplasty just before incision to confirm that they were negative.

On admission to the hospital at 1 day before surgery, patients received mechanical and antimicrobial preoperative bowel preparation using polyethylene glycol and oral kanamycin. Preoperative bowel preparation also included retrograde colonic enema or glycerol suppository and sodium picosulfate for 3 consecutive days before admission. Initial antibiotic prophylaxis using both amikacin and flomoxef were administered within 12 h preoperatively. The dosing of both antibiotics was based on body weight. Re-dosing of amikacin began within 120 min before surgical incision. Re-dosing of flomoxef was done within 30 min before surgical incision.

1.3. Intraoperative management

A tip of the ventriculoperitoneal shunt was kept away from surgical field but not wrapped in gauze soaked with antibiotics. Externalization of the shunt was not performed. To lessen the contamination with bowel contents, a stapled side-to-side bowel anastomosis was used in the case of enterocystoplasty, and intraperitoneal closed suction drains were used routinely after bowel anastomosis. Suprapubic tubes were generally used in patients with enterocystoplasty, and indwelling Foley catheters were left in place of a continent catheterizable channel and MACE. A urethral catheter was not used in addition to the suprapubic tube. Intraoperative re-dosing of flomoxef was performed every 4 to 6 h. Re-dosing of amikacin was not performed during surgery.

1.4. Postoperative management

Parenteral administration of amikacin and flomoxef was continued for 24 h and 48 h, respectively. Prophylaxis with trimethoprim-sulfamethoxazole or cefaclor once a day was continued until all catheters were removed. Intraperitoneal drain tubes were removed within 3 days postoperatively. Suprapubic tubes and indwelling Foley catheters were left in place for at least 3 weeks and then removed after x-ray imaging of the augmented bladder.

1.5. Assessment of ventriculoperitoneal shunt complication

Postoperative shunt infections were defined as those occurring within 6 months after intraperitoneal surgery. To assess for shunt malfunction in the long term, any shunt malfunction that occurred after intraperitoneal urological surgery was evaluated with regard to the location of malfunction (intraperitoneal or extraperitoneal) by the neurosurgeon (S. I). To evaluate the appropriateness of our perioperative management, we compared our results with those from seven previous reports with regard to patient characteristics, surgical histories of previous shunt revisions, antibiotic regimens, duration of indwelling drain, and management of bacteriuria before surgery.

2. Results

Six male and 14 female patients underwent intraperitoneal urological surgery with a median follow-up of 56 months (Table 1). Eighteen

Table 1
Patient demographics.

Total patients	20
Male	6
Female	14
Age at surgery (years) mean \pm SD	14.8 \pm 4.5 (range 5–20)
Follow up (months) median	56 (range 7–138)
Operation time (minutes) mean \pm SD	511 \pm 189 (range 200–877)
Previous shunt revisions (number of patients/times)	18/31
Previous shunt infection (number of patients)	3
Previous urological surgeries (number of patients/times)	4/4
Peritoneal drain (number of patients)	16
Duration of drain indwelling (postoperative days)	2.7 \pm 1.0

patients received previous shunt revisions (mean number, 1.5 times; range, 1–5 times) before urological surgeries. Table 2 summarizes the details of all surgical procedures. Thirteen patients underwent bladder augmentation with ileum, and one patient underwent bladder augmentation with sigmoid colon. Nineteen patients underwent MACE using the appendix, and one patient underwent laparoscopically assisted MACE. In addition, bladder neck reconstruction with sling and ureteral reimplantation were performed in 10 and nine patients, respectively.

Fourteen patients had positive urine culture before surgery, and all except for two patients were confirmed to have negative cultures according to subsequent urine cultures done before incision (Table 3). All parenteral antibiotics were stopped on postoperative day 2.5 (range, 1–3). During the postoperative period intraabdominal complications, such as ileus, urinary leakage, and perforation of the augmented bladder, did not occur in any patients. Shunt infections did not occur in any patient during the entire observation period. None of the patients experienced intraperitoneal shunt malfunctions after urological surgeries. However, extraperitoneal shunt malfunctions occurred in three patients. These three patients had extraperitoneal shunt obstruction at 21, 30, and 106 months after urological surgeries, respectively.

There were seven previous reports describing shunt complications after intraperitoneal urological surgeries [2,4–9]. Table 4 summarizes the shunt complications and perioperative management of these reports and compares them with our results. Details of the bowel preparation and prophylactic antibiotics before surgery were described in six and two reports respectively. From these eight studies including 273 patients, shunt infections occurred in 14 patients (5%) with an incidence ranging from 0 to 20%. Three studies (including the present study) described no postoperative shunt infection [6,7]. In these three studies, oral antibiotics were prescribed for bacteriuria before surgery. Intraperitoneal shunt malfunctions were described in five studies (152 patients), occurring in 17 patients (11%) (range, 0–36%) [2,7–9].

Table 2
Surgical procedures.

Procedures	Number of patients
Intraperitoneal urological surgeries	
Augmentation cystoplasty	1
Augmentation cystoplasty and MACE procedure	11
Augmentation cystoplasty, MACE procedure and continent catheterizable channel	2
MACE procedure	6
Additional simultaneous surgeries	
Bladder neck reconstruction with sling	10
Ureteral reimplantation	9

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