Primary Bladder Exstrophy Closure in Neonates: Challenging the Traditions

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Purpose: We describe a novel approach to neonatal bladder exstrophy closure that challenges the role of postoperative immobilization and pelvic osteotomy.

Materials and Methods: We reviewed the primary management of bladder exstrophy at our institutions between 2007 and 2011. In particular we compared postoperative management in the surgical ward using epidural analgesia to muscle paralysis and ventilation in the intensive care unit. Clinical outcome measures were time to full feed, length of stay, postoperative complications and redo closure. Cost-effectiveness was also evaluated using hospital financial data. Data are expressed as median (range). Significance was explored by Fisher exact test and unpaired t-test.

Results: A total of 74 patients underwent primary closure without osteotomy. Successful closure was achieved in 70 patients (95%). A total of 48 cases (65%) were managed on the ward (group A) and 26 (35%) were transferred to the intensive care unit (group B). The 2 groups were homogeneous for gestational age (median 39 weeks, range 27 to 41) and age at closure (3 days, 1 to 152). Complications requiring surgical treatment were noted in 4 patients (8.3%) in group A and 3 (11.5%) in group B ($p = 0.609$). Length of stay was significantly shorter for the group managed on the ward (11 vs 18 days, $p < 0.0001$). Median costs were $42,732 for patients admitted to the intensive care unit and $16,214 for those admitted directly to the surgical ward ($p < 0.0001$).

Conclusions: Primary closure of bladder exstrophy without lower limb immobilization and osteotomy is feasible. Postoperative care on the surgical ward using epidural analgesia results in shorter hospitalization.

Key Words: bladder exstrophy, osteotomy, urologic surgical procedures

Abbreviations and Acronyms

BE = bladder exstrophy

CBEX = classic bladder exstrophy

ICU = intensive care unit

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Management of bladder exstrophy remains one of the most significant challenges in pediatric urology.[1] Care of these patients is becoming centralized to a smaller number of centers worldwide (2 centers in England), although the techniques used and their results vary widely.[2–4]

It is universally agreed that successful initial bladder closure is the cornerstone of development of bladder capacity and continence.[5] A range of techniques is used to achieve successful primary closure supported by pelvic immobilization with or without pelvic osteotomy. The most common techniques described for postoperative pelvic immobilization are Bryant traction, modified Bryant traction, Buck traction and spica

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casting.[6,7] At those centers where osteotomy is used an external fixation device may also be applied. Most of these techniques require prolonged hospitalization, often longer than 1 month, and still might not result in a favorable outcome.[8–10]

In addition to clinical outcomes, evidence of cost-effectiveness in case management is becoming a fundamental part of care and is now a crucial point in the evaluation of therapy and management. We describe an approach to primary bladder exstrophy closure that does not require pelvic osteotomy or prolonged pelvic immobilization.

MATERIALS AND METHODS

We retrospectively studied all new cases of bladder exstrophy managed by primary closure at our institution between January 2007 and December 2011. Only patients with CBEX were included. Patients with CBEX who underwent primary closure elsewhere were excluded from the study. Surgical management of bladder exstrophy consists of initial bladder closure in the neonatal period. A radical soft tissue procedure is performed at age 9 to 12 months. This second stage, commonly referred to as the Kelly procedure, is performed in all cases regardless of bladder capacity, and incorporates reconstruction of the bladder neck and epispadias reconstruction. All patients were followed for a minimum of 1 year, and complete records were available for all.

The medical records for this cohort were reviewed and data were collected regarding patient demographics, surgical findings, postoperative analgesia techniques, location of postoperative care (urology ward/intensive care unit), duration of hospital stay, time required to establish oral feeding, epidural catheter related complications, surgical complications and need for redo closure. Successful exstrophy closure was defined as an intact repair that did not require a redo closure.

Primary closure was performed by any member of our team of 4 pediatric urologists. Anesthesia was administered by a pediatric anesthetist with expertise in neonatal epidural analgesia.

A similar surgical technique was used by all 4 surgeons. This procedure consists of mobilization and separation of the bladder plate from the rectus sheath and umbilicus. Dissection of the bladder plate ends distally adjacent to the verumontanum, and the umbilicus is excised in all cases. Ureteral stents (4Fr to 6Fr) are placed routinely, and the bladder is closed with interrupted absorbable monofilament sutures in a single layer. A silicone urethral stent is left in situ. The rectus muscle is closed with interrupted absorbable sutures, and the pubis is reapproximated with at least 2 interpubic sutures. The skin is closed in 2 layers using interrupted absorbable sutures. We no longer use the frog plaster, mermaid dressings or any form of lower limb traction.[11]

Cases were managed postoperatively along 1 of 2 clearly defined pathways. The first pathway involves delivery of postoperative analgesia via an epidural catheter placed at surgical closure with the patient returning to the surgical ward. In addition, some patients required nurse controlled analgesia. Patients were allowed to feed orally immediately postoperatively, and breastfeeding was actively encouraged. No form of pelvic immobilization was used. The second pathway involved elective paralysis and ventilation in the ICU for a median of 7 days (mean 8.5), followed by return to the surgical ward. Apart from muscle paralysis, no additional pelvic immobilization was used in this group. The second pathway was chosen based on individual surgeon preference, closure under excessive tension or failure to insert an epidural catheter.

Postoperative analgesia was managed by a dedicated acute pain team that uses the FLACC (Face, Legs, Activity, Cry, Consolability) and COMFORT scales for pain assessment to maintain an adequate level of analgesia for infants admitted to the ward and neonatal ICU, respectively.[12,13] Urinary drainage in both groups was achieved with ureteral stents, which were removed on postoperative day 7, and a urethral stent, which was allowed to dislodge spontaneously after postoperative day 7. If the urethral stent had not dislodged by postoperative day 14, it was actively removed. No patient had a suprapubic tube or wound drain placed. Patients were discharged home once the ureteral stents were removed, oral feeding was established and surgical site healing was deemed satisfactory.

Treatment dose antibiotics were administered to all patients for 5 to 7 days. These were delivered initially by intravenous route and then orally, with the usual choice of antibiotic being amoxicillin/clavulanic acid. In addition, patients were given oral antifungal prophylaxis for the length of time that the ureteral stents were in situ. Antibiotic prophylaxis was maintained for a minimum of 3 months. No patient received anticholinergic medication.

Outcome measures evaluated included postoperative complications and requirement for redo closure. Data are expressed as median (range). Fisher exact test was used to compare proportions, while unpaired t-test was used to compare normally distributed data, with $p < 0.05$ being considered significant.

Economic data were derived from data collected retrospectively from individual patient records. An economic evaluation was performed based on actual time in theater, days in ICU and days in surgical ward. Costs were calculated using the template of the National Commissioning Group costs for bladder exstrophy.

Economic outcome was calculated as the direct costs associated with in-hospital treatment (primary admission plus any readmission). The overall cost was subdivided into the categories 1) operating theater, 2) ward/ICU, 3) medical staff and 4) nonmedical staff (clinical nurse specialists, nurses, administrative workers).

RESULTS

A total of 74 neonates with CBEX were treated between January 2007 and December 2011. Primary closure without osteotomy was performed in all patients and was successful in 70 (95%). Those with failed primary closure underwent redo closure with bilateral pelvic osteotomy at age 4 months (3 patients) or 8 months (1). These patients had