



Impact of pelvic osteotomy on the incidence of inguinal hernias in classic bladder exstrophy



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ABSTRACT

Background/purpose: The high prevalence of inguinal hernias in the bladder exstrophy population is well documented. The authors' aim is to determine whether pelvic osteotomy reduces the incidence of primary and recurrent inguinal hernias in patients with classic bladder exstrophy.

Methods: Using an institutionally-approved database, patients who underwent immediate or delayed primary bladder closure between 1974 and 2012 were identified and stratified by the use of pelvic osteotomy at the time of closure. Data were analyzed using Fisher's exact test and multivariate logistic regression analysis.

Results: One hundred thirty-six patients were identified with a median follow up of 8 years. The incidence of inguinal hernias following closure was 25% in the osteotomy group versus 46% in the non-osteotomy group ($p = 0.017$). Osteotomy was associated with a significant decrease in recurrence of inguinal hernias amongst patients who underwent previous repair (17% versus 47%, osteotomy versus non-osteotomy, $p = 0.027$) and the development of primary inguinal hernias in whom initial groin exploration was negative (20% versus 39%, $p = 0.029$). Osteotomy and female sex were associated with a decreased rate of inguinal hernia development after bladder closure while age at closure was not.

Conclusions: Pelvic osteotomy at the time of exstrophy closure decreases the likelihood of primary or recurrent inguinal hernia development.

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1. Background/Purpose

Pelvic osteotomy remains a cornerstone in the surgical management of the exstrophy–epispadias complex, as it decreases tension across the abdominal wall, reduces the pubic diastasis, and helps restore the pelvic ring and floor to the normal anatomical configuration [1]. Patients with classic bladder exstrophy develop inguinal hernias at higher rates compared to the general population rate of 0.8 to 4% [2]. Moreover, bladder exstrophy has been identified as a risk factor for inguinal hernia recurrence after repair [3]. The authors hypothesize that pelvic osteotomy stretches the inguinal ligament as the pubic diastasis is narrowed, resulting in an increase in the obliquity of the inguinal canal and tightening of the canal floor, which could potentially reduce de novo hernia development as well as decrease inguinal hernia recurrence in patients who have undergone a previous inguinal hernia repair. In this study the authors seek to determine the impact of pelvic osteotomy on the development of inguinal hernia and recurrence.

2. Materials and methods

Following institutional review board approval, an exstrophy epispadias complex database consisting of 1178 patients was investigated to identify patients with a diagnosis of classic bladder exstrophy who underwent immediate or delayed primary closure at the authors' institution between 1974 and 2012. One hundred thirty-six patients were identified and their medical and surgical records were retrospectively reviewed. Patients excluded from analysis included those with no record of follow up for at least 1 month after primary closure, as well as patients who underwent inguinal hernia repair at another hospital and were referred to our institution for continued care. Each patient's medical record was reviewed for gender, age at closure, repair of a hernia during or prior to primary bladder closure, use of pelvic osteotomy at the time of bladder closure, development of either a primary or recurrent hernia after closure, and age at follow up. The diagnosis of an inguinal hernia was determined by clinical examination pre- or post-operatively, or was made intraoperatively during bladder closure.

At the authors' institution, bilateral inguinal canals are explored via the pre-peritoneal approach during all primary exstrophy closures given the high incidence of inguinal hernias in this patient population, along with

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the known high incidence of a contralateral patent processus vaginalis when a hernia is present on the opposite side. When hernias are identified, they are closed via this approach. The surgical technique for the pre-peritoneal approach to an inguinal hernia was described by Connolly et al. [1]. After mobilization of the bladder, the spermatic cord is identified and the hernia sac is dissected and tied off. Next, the spermatic cord is mobilized laterally and sutures are placed medially between the transversus arch and the iliopubic tract to increase the obliquity of the inguinal canal and to tighten the internal ring. An inguinal approach is utilized when performing hernia repair as a separate procedure, such as when patients are undergoing other surgical procedures prior to bladder closure, or when patients will have a delayed primary repair owing to a small bladder template. Inguinal hernia repair through an inguinal incision in the exstrophy population is performed in the standard fashion, with dissection of the hernia sac from the vas deferens and spermatic cord vessels, division, and high ligation. In patients with a wide internal ring, sutures are placed medially to minimize the defect and to increase the obliquity of the inguinal canal. Care is taken not to close the ring too tight in order to ensure that vascular flow in the testicular vessels is not compromised. This is not a concern in the female patient, as the inguinal ring is routinely closed completely during hernia repair.

Patients were stratified into two groups for data analysis: patients who underwent pelvic osteotomy with primary bladder closure and those who underwent primary closure without an osteotomy. In both groups, the presence of a hernia at the time of primary closure or prior to definitive bladder closure was recorded. Data were analyzed for the development of inguinal hernia after closure. Primary outcomes assessed were the development of de novo inguinal hernias or the development of recurrent inguinal hernias after bladder closure. Variables were evaluated using Fisher's exact test and multivariate regression analysis. All statistical analyses were performed with Microsoft Excel (Redmond, Washington, USA) & Stata IC 12 (College Station, Texas, USA). Odds ratios were used to identify variables directly or indirectly associated with development of inguinal hernias after bladder closure. A p -value of < 0.05 was used to determine statistical significance.

3. Results

Upon review of the exstrophy database, 136 (98 male, 38 female) patients with classic bladder exstrophy were identified whom had their initial bladder closure performed at the authors' institution. Follow up data were available on all 136 patients with a median follow up time of 8 years (range: 1 month–35 years) after initial bladder closure.

Seventy-three patients (57 male, 16 female) underwent osteotomy with primary closure while 63 patients (41 male, 22 female) did not. Included amongst the former group were five patients requiring hernia repair prior to primary closure because of an incarcerated inguinal hernia. The overall incidence of inguinal hernia formation amongst all patients with classic bladder exstrophy was 52% (males: 69%, females: 8%).

Twenty-four (33%) patients who underwent osteotomy with primary closure and twenty (32%) patients who did not undergo osteotomy had hernias identified during primary closure and underwent simultaneous hernia repair. Amongst these patients, 4 (17%) had a hernia recurrence in the osteotomy group compared to 11 (55%) in the non-osteotomy group ($p = 0.027$). The incidence of inguinal hernia following primary closure amongst all patients was 25% in the osteotomy group compared to 46% in the non-osteotomy group ($p = 0.017$). Fig. 1a breaks down the incidence of subsequent hernias after primary repair in males and females. Of the 98 males undergoing primary closure, 57 had an osteotomy while 41 did not. Sixty-six percent of the male patients that did not have osteotomy with bladder closure had subsequent inguinal hernia, while only 32% who had osteotomy with primary closure had subsequent hernia. Multivariate regression

analysis was used to determine independent risk factors for hernia formation after closure. These results are portrayed in Fig. 1b.

Of the 39 patients that had hernia repair performed via the pre-peritoneal approach, 11 (28%) had a hernia recurrence. Four (13%) of the 31 patients that underwent hernia repair via an inguinal incision had a hernia recurrence. No patient had more than one hernia recurrence on the same side. Eight patients developed an incarcerated hernia after bladder closure. All patients were males in whom initial exploration was negative. Seven patients were in the osteotomy cohort while one patient did not undergo osteotomy. No patient with a prior hernia repair had reported recurrence with incarceration.

4. Discussion

Since its initial description in 1958 [4], pelvic osteotomy remains an essential component in the urologic reconstruction of classic bladder exstrophy by alleviating tension across the abdominal wall and bladder closure [5]. Other cited benefits include reducing the risk of postoperative wound dehiscence, enabling successful revision of previous failed exstrophy closures, and improved continence after bladder neck reconstruction [6,7]. This study suggests that the use of pelvic osteotomy reduces de novo and recurrent inguinal hernia development in patients with classic bladder exstrophy.

Previous studies have revealed an incidence that exceeds 80% in males and 10% in females [1,5]. This finding is suspected to arise from an increase in intra-abdominal pressure following abdominal wall closure as well as a lack of obliquity of the inguinal canal [1,8]. The increased risk of inguinal hernia development in the exstrophy population can be associated with significant morbidities, including the risks of incarceration and strangulation of bowel, testicular atrophy, and the potential need for further surgical procedures. Inguinal hernia repairs in the exstrophy population are performed either through a standard inguinal incision or in a pre-peritoneal fashion at the time of bladder closure, which takes advantage of the exposure afforded by dissection of the bladder template.

Inguinal hernias are a common physical examination finding seen with classic bladder exstrophy. The authors report a 69% incidence of inguinal hernias in males and 8% in female patients, which is similar to previously reported outcomes in the literature. Husmann et al. [8] found a 68% incidence of hernias in male patients who underwent staged reconstruction. Stringer et al. [3] noted in a retrospective review of 70 consecutive patients with classic bladder exstrophy an incidence of 86% in male patients and 15% in female patients over a mean follow-up period of 5.9 years. The authors have previously reported an incidence of 82% in males and 11% in females. An increase in the intra-abdominal pressure after bladder and abdominal wall closure and the lack of obliquity between the internal and external rings are thought to contribute to the increased risk of inguinal hernia development in the exstrophy population. This conjecture is supported by Husmann et al. who noted a decreased incidence in inguinal hernia formation in patients who underwent cystectomy with urinary diversion versus patients that underwent a staged reconstruction. The authors felt that placement of the bladder deep within the pelvis, continued bladder growth after closure, and repair of the fascial defect all contribute to these observations [8]. Similar findings of higher incidences of inguinal hernia development have been documented in patients after ventriculoperitoneal shunt (VPS) placement and peritoneal dialysis catheter insertion [9], scenarios in which patients are suspected to have higher intra-abdominal pressures after device placement. Wu et al. [10] demonstrated an overall incidence of inguinal hernia after VPS placement of 23 per 1000 person-years compared to 6.13 per 1000 years in the general population. These observations suggest that pelvic osteotomy provides a protective benefit that counteracts the rise in intra-abdominal pressure after primary closure of the bladder by increasing and stabilizing the obliquity of the inguinal canal. Lower extremity immobilization

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