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Fixation of Bilateral Pelvic Osteotomies with external fixator in exstrophy bladder complex

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Abstract

Objective: To present the early results of pelvic osteotomies performed for repair of exstrophy bladder.

Methods: Five cases of exstrophy bladder were treated with closure following bilateral iliac osteotomies. Three patients underwent closure of pubic symphysis diastasis by use of external fixator, one by screws and cerclage wires, and one by use of K-wires and suture. The patients were followed up by the pediatric urologist and orthopedic surgeon.

Results: All patients achieved a closure of diastasis and a tension free repair after the index surgery. The average follow-up was 3.6 years with range of 4 months to 6 years. All osteotomies healed within two months and had closure of the diastasis, except one which had a partial failure with loss of 50% correction. No patient had any wound dehiscence or breakdown of the bladder repair. Preoperative mean diastasis of symphysis pubis was 6 cm (range; 4.5 cm to 7 cm) and post operative mean diastasis was 3.5 cm with the range of 2.5 cm to 4 cm at 12 months follow up. All patients achieved urinary continence post operatively and were passing urine per urethra with satisfactory urinary control as followed-up with the pediatric urologists.

Conclusion: Bilateral iliac osteotomies and use of external fixator in our series was found to be helpful in achieving a tension free closure and preventing dehiscence of the repair (JPMA 55;537:2005).

Introduction

Primary bladder exstrophy is a rare congenital defect that requires surgical repair and reconstruction procedures.¹ Bladder-exstrophy complex involves genitourinary tract, the musculoskeletal system, and some times the gastrointestinal tract. The anomaly is due to the failure of normal development of lower anterior abdominal wall and pubic bones, such that the anterior bladder wall is absent, and the posterior bladder opens directly onto the lower central abdomen.^{2,3} The mucosal edges of the bladder are fused with the skin, and urine drains directly from the ureteric orifices onto the abdominal wall.³ Bony mal-development results in wide separation of the symphysis pubis and external rotation of the pelvis.^{2,3}

Role of pelvic osteotomies in surgical repair has now been well established. In the primary closure of bladder exstrophy the main objectives are to reconstruct anterior wall of urinary bladder, obtain secure and tension free pelvic and abdominal wall closure, preserve renal function, reconstruct functional and cosmetically acceptable genitalia and improve continence.^{1,4-7} If the bladder is very small, urinary diversion or bladder augmentation may be appropriate.⁸ The primary closure of the exstrophied bladder is best achieved in the newborn period⁹ as the soft elastic pelvis allows easy re-approximation, without the need of pelvic osteotomy.^{10,11} This offers the best opportunity for normal bladder development and optimizes the potential for urinary continence.¹²

A number of pelvic osteotomy techniques have been described which primarily aim at reducing the pubic bone diastasis and reconstruction of the pelvic floor thus helping in reconstruction of anterior bladder and abdominal wall closure. With bony approximation of the pelvis the stress on the midline structures and incision is lessened and the chances of wound dehiscence are decreased.^{6,13,14} Reapproximation of the pubic symphysis at the time of primary closure does not appear to offer any long-term benefits to these patients from an orthopaedic viewpoint. However, long-term follow-up of these patients clearly demonstrates that the pubic diastasis reoccurs over time despite osteotomies.¹⁵ In this study, we are presenting our early results of pelvic osteotomies, performed to assist in the repair of exstrophy bladder.

Patients and Methods

We reviewed the case series of five children with urinary bladder exstrophy in whom the pelvic osteotomies were performed as part of a reconstructive surgery for the bladder exstrophy complex. These cases presented between May 1991 and June 2000 at The Aga Khan University Hospital, Karachi. All five patients underwent bilateral pelvic osteotomies and repair of bladder exstrophy by a collaborated team of orthopedic and pediatric urological surgeons. Two of our five patients had failed attempts of bladder exstrophy closure before presenting to our hospital. None of the patients had had a previous bony procedure done. All the patients had excessive pubic diastasis of about

5cm. or more and it was considered that these patients would benefit from pelvic osteotomy (Indications of osteotomy used by Mathews and Sponsellar et al Inter symphyseal diastasis of more than 5 cms or a soft inter symphyseal bar).¹⁶

The pelvic osteotomy procedure was performed with the patient in supine position. Oblique inguinal incision was given over the ilium as described for Salter osteotomy and the innominate bone was exposed by separating periosteum on either side. The posterior and inferior limits of the subperiosteal exposure were the sacroiliac joint and the pectineal tubercle, respectively. The sciatic notch is clearly identified and an oblique osteotomy is done from iliac crest to greater sciatic notch using a saw, avoiding the sacroiliac joint. The oblique osteotomy leaves adequate bone for external-fixator-pins placement into the distal pelvic segment and avoids entering the sacroiliac joint. Two parallel 4 mm Shanz screws were then placed into the distal pelvic segment. Similar procedure was performed on the contra lateral side. Bladder and abdominal soft tissue repair was then carried out by the pediatric surgery team. After complete bladder reconstruction and repair, the fixator pins were connected by a rectangular anterior AO small fragment frame and compressed to decrease the diastasis. An intraoperative X-ray is done to confirm this (Figure 2A). Few other techniques were employed in fixation of osteotomies in two patients which included screws and cerclage wires. This (screw-cerclage wire) technique was also used to supplement an external fixator in one of the patients (Figure 2B). In another case, only K-wires were used to fix the osteotomies along with a single prolene No.1 suture. These two patients required application of a double hip spica for six weeks. Further urologic reconstruction procedures like epispadias repair were done at appropriate intervals by the pediatric urology team.

Results

There were four males and one female patient. The mean age at surgery was 40 ± 36.726 months (Range: 47 days to 8 years). The mean follow-up was 43.2 ± 30.17 months (range: 4 months to 72months). All patients were born with exstrophy bladder with no urinary control and associated epispadias in all males and absence of urethra in the female patient. The patients were operated for pelvic osteotomies and exstrophy repair simultaneously in which all patients postoperatively achieved a closure of diastasis and a tension free repair with no intraoperative complications. All osteotomies healed radiographically and clinically within eight weeks. Two of the 3 patients with external fixator had removal of the fixator at 6 weeks whereas the third patient lived in remote location and had delay in removal. Average preoperative diastasis of symphysis pubis was $6 \pm .935$ cm (range: 4.5 cm to 7 cm) and post operatively the average

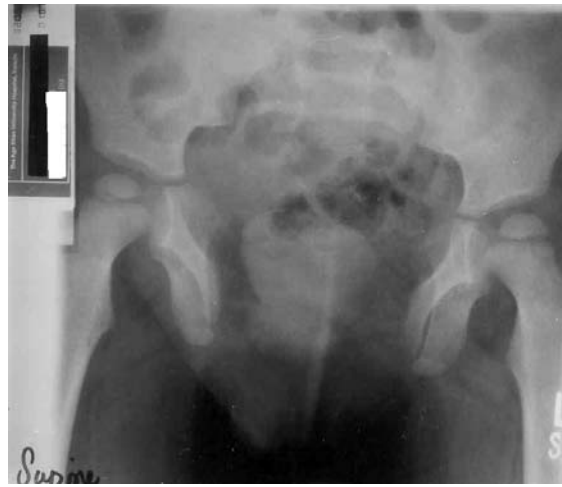


Figure 1. Pelvic radiograph of a 4 year old boy with classic bladder exstrophy.

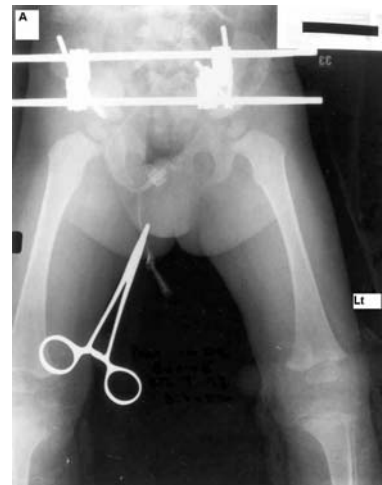


Figure 2 (A) Intra-operative radiograph of a 2 month old boy after the technique of pelvic osteotomy used.



Figure 2 (B). External fixator supported by cerclage wires and screws. The same patient at 1 year post operative follow up with pubic diastasis of 3.5 cm.

diastasis was $3.5 \pm .651$ cms with the range of 2.5 cm to 4 cm at 12 months of follow up (Figure 2B). All patients achieved urinary continence post operatively.

Two complications were noted in our series. One patient had (External Fixator) pin tract infection requiring debridement at 6 weeks after application. His infection settled with debridement and the fixator was removed after 16 weeks. Another patient who had fixation of osteotomies using K-wires had recurrence of the diastasis in first week of repair but fortunately there was no dehiscence of the repair.

Discussion

The role of pelvic osteotomies in achieving closure in patients with bladder exstrophy is appreciated by multiple studies. Pelvic osteotomies help in decreasing the soft tissue tension, chances of dehiscence, reconstruction of intra pubic urethra and re-approximation of the pelvic floor musculature contributing to long term continence. In females, osteotomy may reduce the likelihood of uterine prolapse.

In our case series, external fixator was the preferred mode of fixation. It was used in 3 cases. Our experience with the rest of the two cases also showed satisfactory healing of the osteotomies (8 weeks) though we had failure of fixation in one of these cases. A recent review also showed that a major factor in success of exstrophy closures was the performance of iliac osteotomy.^{2,6}

Similar anterior osteotomies have been described by Yazar¹⁷ and Watts.¹⁸ In patients with concomitant cloacal exstrophy, there have been reports of bilateral pubic rami osteotomies resulting in decreased tension over the repair.^{11,19} From a urological point of view, osteotomy allows for decreased stress on the anterior closure as well as more near normal approximation of the pelvic floor muscles.

A study performed by doing 3-D CT scans by Andrew Stec et al showed that the mean intersymphyseal distance in children with exstrophy was 4.2 cms (mean age 7 months) and in controls were 0.6 cms.¹⁴ In another study Mathews et al¹⁶ found the mean intersymphyseal diastasis in exstrophy bladder to be 5.78 cms (range 3.8 - 9 cms). The review by Aadalen et al of 100 patients showed that those achieving symphyseal approximation of less than or equal to 2 cm had a significantly higher rate of good to excellent urological function than others.²⁰ The outcome of our cases is highly satisfactory when compared to the international data.

No definitive conclusions can be drawn from this small series. We, however, found external fixator to be an

effective device for providing stable fixation of pelvic osteotomies, rendering a secure fixation and obviating the need for hip spica cast. It also does not hinder abdominal dressing, allows regular wound monitoring and helps in early patient mobilization. This makes its application relatively easy and quick in experienced hands.

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