Case Report

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.143149
Quick Response Code:

Complex bladder-exstrophy-epispadias management: Causes of failure of initial bladder closure

Kouame Dibi Bertin, Kouame Yapo Guy Serge, Sounkere Moufidath, Koffi Maxime, Odehouri Koudou Thierry Hervé, Yaokreh Jean Baptiste, Tembely Samba, Dieth Atafi Gaudens, Ouattara Ossenou, Dick Ruffin

ABSTRACT

The success of the initial closure of the complex bladder-exstrophy remains a challenge in pediatric surgery. This study describes a personal experience of the causes of failure of the initial closure and operative morbidity during the surgical treatment of bladder-exstrophy complex. From April 2000 to March 2014, four patients aged 16 days to 7 years and 5 months underwent complex exstrophy-epispadias repair with pelvic osteotomies. There were three males and one female. Three of them had posterior pelvic osteotomy, one had anterior innominate osteotomy. **Bladder Closure:** Bladder closure was performed in three layers. Our first patient had initial bladder closure with polyglactin 4/0 (Vicryl® 4/0), concerning the last three patients, initial bladder closure was performed with polydioxanone 4/0 (PDS® 4/0). The bladder was repaired leaving the urethral stent and ureteral stents for full urinary drainage for three patients. In one case, only urethral stent was left, ureteral drainage was not possible, because stents sizes were more important than the ureteral diameter. Out of a total of four patients, initial bladder closure was completely achieved for three patients. At the immediate postoperative follow-up, two patients presented a complete disunion of the abdominal wall and bladder despite an appropriate postoperative care. The absorbable braided silk (polyglactin) used for the bladder closure was considered as the main factor in the failure of the bladder closure. The second cause of failure of the initial bladder closure was the incomplete urine drainage, ureteral catheterisation was not possible because the catheters sizes were too large compared with the diameters of the ureters. The failure of the initial bladder-exstrophy closure may be reduced by a closure with an absorbable monofilament silk and efficient urine drainage via ureteral catheterisation.

Key words: Bladder, exstrophy, osteotomy, surgery

Department of General Pediatric Surgery, Teaching Hospital of Yopougon, Abidjan Côte d'Ivoire, BP 632 Abidjan, Cote d'Ivoire

Address for correspondence:
Prof. B. D. Kouame,
University Hospital of Yopougon Abidjan Ivory Coast,
21 BP 209 Abidjan 21 Ivory Coast Abidjan, Côte d'Ivoire.
E-mail: kouadb@yahoo.fr

INTRODUCTION

Bladder exstrophy is a rare congenital abnormality, its incidence is estimated at 1/30,000-50,000 live births with males to females ratio ranging from 1.5-5 to 1.[1-4] When untreated, there is a urinary incontinence, and recurrent urinary tract infections may lead to renal failure.[5,6] The exposed mucosa of the bladder may become metaplastic, and malignant change is possible.[7-9] The management of bladder exstrophy is properly planned. The ideal age to start treatment of this complex anomaly is right at birth. Generally bladder, abdominal wall and posterior urethral closure are done immediately after birth with osteotomy indicated if the child presented 72 h after birth. Epispadias repair is done from 6 months to 1 year of age and bladder neck reconstruction with antireflux procedure at 4-5 years of age.[2,4]

Osteotomy is essential to achieve good closure of the pelvic ring, and it helps to restore the pelvic anatomy and thus increase the chances of potential continence and reduce the likelihood of uterine prolapse. There have been two main approaches of pelvic osteotomy in exstrophy, the posterior iliac osteotomy and the anterior innominate osteotomy. In the first 72 h of life, while the newborn is still under the affect of the maternal hormone relaxin, the pelvic ring can sometimes be closed effectively without need for osteotomy.

In our area, because of certain cultural considerations and because of the low socioeconomic status of patients, bladder exstrophy is rarely managed during the neonatal

period. Surgical procedures were carried out according to the age and according to the technical equipment available in the operating room.

Our first patients had bladder closure after posterior osteotomy with Bryant traction; recently we performed an anterior innominate osteotomy with Batchelor's type plaster immobilization. Initial bladder closures have been performed with various silks. Urinary drainage was possible in all patients, except in one case, the catheter size was larger than the diameter of the ureters. All patients were operated by the same surgeon.

We reported our personal experience in the management of complex exstrophy-epispadias repair. We attempted to understand the reasons of the failures of initial complex exstrophy-epispadias repair and postoperative complications observed based on our surgical procedures compared to current knowledge's on the management of this condition.

PATIENTS AND METHODS

From April 2000 to March 2014, four patients aged 16 days to 7 years and 5 months underwent complex exstrophy-epispadias repair with pelvic osteotomies. There were three males and one female. Three of them had posterior pelvic osteotomy, one had anterior innominate osteotomy.

Procedures of osteotomy

Posterior pelvic osteotomy: Three patients had posterior pelvic osteotomy

Under general anaesthesia, patients were in the prone position. Incision was made along the iliac crest. The innominate bone periosteum was detached from either side, and innominate bone was split vertically from the cartilage of the iliac crest to the acetabumum with a large bone cutter. We applied bone wax to reduce bleeding, and the incision was closed in two layers with polyglactin 2-0 without suction redon. Patients returned for the bladder closure.

Anterior innominate osteotomy: One patient had anterior innominate osteotomy

The patient is positioned supine; an ilio femoral incision (SMITH PETERSSON incision) was performed expose the iliac bone [Figure 1]. The cartilage of the iliac crest has been split, and the periosteums of the internal and external iliac fossa were peeled. Salter osteotomy was performed with a Gigli saw.

The closure of the cartilage, the periosteum and the skin were performed with an absorbable silk (polyglactin 2-0) over a suction redon.

Bladder closure

The sizes of the bladder plate are well-defined by an approximation of the bladder mucosa to the skin around the plate [Figure 2].

The bladder plate was detached from the umbilical area with electrocoagulation and was gradually detached from the anterior parietal peritoneum. The bladder plate was dissected on the sides to bladder the neck, his pubic insertions were sectioned. The bladder plate was completely mobilised with preservation of its vascularisation. Bladder closure was performed in three layers.

Our first patient had initial bladder closure with polyglactin 4/0 (Vicryl® 4/0 Ethicon Johnson & Johnson New Brunswick, NJ, United States), concerning the last



Figure 1: Bladder exstrophy: Anterior innominate osteotomy: Smith Peterson incision on the iliac crest

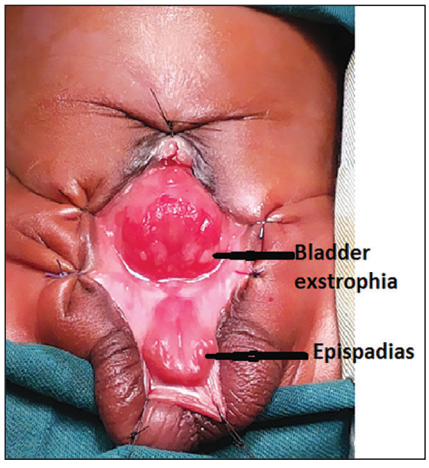


Figure 2: Complex bladder-epispadias exposition before bladder plate dissection

three patients; initial bladder closure was performed with polydioxanone 4/0 (PDS® 4/0 Ethicon Johnson & Johnson New Brunswick, NJ, United States) [Figure 3]. The bladder was repaired leaving the urethral stent and ureteral stents for full urinary drainage for three patients [Figure 4].

In one case, only urethral stent was left, ureteral drainage was not possible, because stents sizes were more important than the ureteral diameter.

The pubis bones were approximated in the midline with a non-absorbable silk (Nylon 0. Ethicon Johnson & Johnson New Brunswick, NJ, United States) passed through the two pubic tubercles. This approximation was achieved, while operating aids realized the pressure on the hip bone. The abdominal wall was closed with a polyglecaprone 2-0 on the abdominal rectus fascia, and the skin was closed with separated knot with nonabsorbable silk (Nylon. Ethicon Johnson & Johnson New Brunswick, NJ, United States).



Figure 3: Total mobilisation of the bladder plate, closed in three layers with polydiaxone 4/0

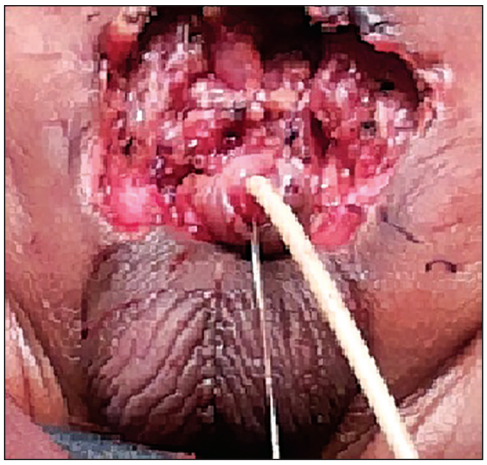


Figure 5: Epispadias repaired in the same time of initial bladder closure

Epispadias repair

Epispadias repair was performed with the initial bladder repair and included urethroplasty with repair of the dorsal curvature of the penis. The corpus cavernosum was completely detached from the spongiosum body and urethroplasty was performed on the urethral catheter with PDS 6/0 [Figure 5].

The bladder closure and epispadias repair were performed over a ureteral stents and urethral stent.

All the procedures have been summarized in Table 1.

Postoperative care

A postoperative immobilization was performed with Bryant's traction for three patients and the patient who underwent innominate anterior osteotomy was stabilized with a Batchelor's type-plaster [Figure 6].

The prevention of postoperative infection was done with metronidazol and ceftriaxon. Pain was treated with paracetamol. The ureteral catheters were removed on the 10th postoperative day. Bryant's tractions were maintained for 3 weeks after bladder closure.



Figure 4: Initial bladder closed leaving the urethral stent and ureteral stents for full urinary drainage



Figure 6: Osteotomy stabilisation and immobilisation with Batchelors type plaster

Table 1: Summary of the surgical procedures, post-operative complications, the follow-up and the outcomes for four children who underwent bladder and extrophia and epispadias repair

Birth days	Sex	Age of surgery	Type of osteotomy and post-operative immobilisation	Post-operative complications	Revision surgery	Hospital stay	Follow-up duration	Cosmetic and functional outcomes
04-14-2000	Male	First surgery 05-03-2000 (19 days) Secondary surgical revision 08-11-2002 (28 months)	Posterior iliac osteotomy Posterior iliac osteotomy and Bryant traction	Complete disruption of the bladder closure due to parietal sepsis. Bladder closure have been made with polyglactin	Bladder closure Urethroplasty	18 days 30 days	14 years	Good cosmetic aspect of the penis Good urinary continence
04-28-2012	Female	11-20-2013 (19 months)	Posterior iliac osteotomy Bryant traction	None	None	21 days	6 months	Excellent
12-29-2013	Male	01-14-2014 (16 days)	Posterior iliac osteotomy and Bryant traction	Convulsion Accidental ablation urethral Catheter at 10th post-operative day Parietal infection Evisceration	Surgery for intestinal reintegration for evisceration	30 days	3 months	Incomplete disruption of the bladder closure Bilateral inguinal hernia
09-15-2006	Male	First surgery 03-15-2014 (7 years 5 months)	Anterior innominate osteotomy Batchelor — type plaster	Pressure necrosis Infected secretion due to urethral stent	None	21 days	2 months	Moderated varus of the left femoral head Good cosmetic aspect of bladder closure

Batchelor's type-plaster was removed 6 weeks after surgery.

Bladder neck reconstruction

Bladder neck reconstruction has been performed for the first patient at age of 6 years. He was old enough to cooperate with toilet training. The bladder was exposed and opened using a lower transverse incision and the bladder neck has been dissected completely. The intersymphyseal bar was incised to enhance visualisation. Detrusorian muscular flaps were isolated and sutured around the bladder neck to enhance the external sphincter without ureteral reimplantation. The cystography performed before surgery did not show vesico-ureteral reflux.

RESULTS

Two patients underwent the initial bladder repair before one month age respectively at the 16th and 19th day and two others at the 19th month and 7 years-5 and 5 months [Table 1].

Our first patient was operated in 2000, he had a posterior pelvic osteotomy and a bladder closure was performed with an absorbable silk (polyglactin 4/0: Vicryl® 4/0. Ethicon Johnson & Johnson New Brunswick, NJ, United States). He presented a complete disunion of the abdominal wall and bladder at the 8th postoperative day despite an appropriate postoperative care. The polyglactin used for the suture was considered as the main factor in the failure of the bladder and parietal closure. Revision surgery was performed at the 28th month age with bilateral posterior pelvic osteotomy, bladder closure and abdominal wall closure were performed with PDS 4/0 (PDS® 4/0 Ethicon Johnson and Johnson New Brunswick, NJ, United States). Its hospital stay was 30 days with complete successful bladder and epispadias repair.

The follow-up of the first patient was 14 years ago. He had a good penis aspect, and he had a good urinary continence. Computed tomography urography carried out for exploring the urinary tract revealed no anomaly upper urinary tract. Urine remained sterile on several cytobacteriological urinalysis. He had a normal biological renal function. He had a normal walking. He had a good social and academic integration. He was a student in the first cycle of secondary education and was on the top of his class.

The second patient was a female. She had a posterior pelvic osteotomy and bladder repair with PDS. Immediate postoperative outcome was excellent. In the

external follow-up, she presented a vesico-cutaneous fistula. The vesico-cutaneous fistula was successfully closed at the revision surgery.

The third patient was a male operated at the 16th day of life. He had bilateral posterior osteotomy, bladder repair was achieved complete closure with a urethral catheter. We did not derive the urine by ureteral catheters, catheters sizes were too large compared to the diameters of the ureters. Urine drainage was carried out only with a urethral sent. Accidental ablation of the urethral catheter led to complete disunion of the bladder and abdominal wall repair led to evisceration. The evisceration was successfully repaired. Incomplete urine derivation at the initial bladder was the primary reason of failure of the bladder closure.

The fourth patient was operated at 7 years and 5 months. He underwent a bilateral innominate anterior osteotomy, bladder repair, bilateral ureteral catheter and urethral catheter. Osteotomies were stabilised with Batchelor's type plaster. The postoperative complications were necrosis pressure and an infected secretion due to urethral stent.

After 6 weeks Batchelor's type plaster immobilisation, he had a good consolidation of the innominate osteotomies and a good cosmetic of the bladder and the abdominal wall repair. He had a moderate varus of the left femoral head, which regressed with self-reeducation.

DISCUSSION

The treatment of vesical exstrophies is well-documented, but we believe that technical adjustments are needed depending on the patient. Three patients had posterior pelvic osteotomy at different ages respectively at 16th, 19th days of birth and at the 19th month. It's important to be sure that the osteotomy evolves along iliac bone and acetabular with a total separation of the medial and the lateral sides of iliac bone. Pelvic osteotomy performed at the time of initial bladder closure confers several advantages, including easy approximation of the symphysis with diminished tension on the abdominal wall closure and elimination of the need for fascial flaps. It also places urethra deep in pelvic ring and brings large pelvic muscles near the midline; both factors contributing to continence.[10] Osteotomy helps to restore the pelvic anatomy and thus increases the chance of possible continence and the likelihood of uterine prolapsed.[6-7]

We performed posterior pelvic osteotomy at the revision surgery at 28 months after the failure of the initial bladder closure of our first patient. Anterior innominate osteotomy is advocated after failure of the initial bladder closure.

The fourth patient had innominate osteotomy. The advantages of anterior innominate osteotomy are: No turn the patient intraoperatively, less blood loss, better apposition and mobility of pelvic rami at the time of closure allowing for secure external fixation in children over 6 months of age.[11]

The author's current preference is the anterior innominate osteotomy which involves dividing the innominate bone above the acetabulum. The most modern approach used for osteotomy today is the bilateral anterior innominate and vertical iliac osteotomy, popularised by Gearhart, Sponseller and coworkers in 1996.[11-13] Combined anterior innominate and posterior iliac osteotomy are done within the periosteum through the same anterior skin incision for better correction.[11,13-15] Varus of the left proximal femur was due to innominate osteotomy too close to the hip joint. Immobilisation in internal rotation of the proximal femur during 6 weeks with Batchelor's type plaster led to a vicious attitude. Innominate anterior osteotomy can be stabilized with an external fixator during 4-6 weeks.[8] Whatever the type of osteotomy carried out in our patients, we always opted for stabilisation by traction or the plaster. Orthopedics procedures for stabilization of pelvic osteotomies avoid infectious risks associated with osteosynthesis by external fixators.

We noted that bleeding was less in posterior osteotomies compared to the anterior innominate osteotomy. Patients who underwent posterior osteotomy had no suction redon without any postoperative infection or haematoma. In contrast, peroperative bleeding of the anterior innominate osteotomy was important, and needs suction redon.

Two patients had a failure of the initial closure of the bladder. The failures were related in one case to the silk used for closure, and in the other case, the failure was due to the non-catheterisation of ureters. We concluded that the absorbable braided silk may consist of nests of bacteria and be the starting points of the disunity of the bladder and abdominal walls. A study showed that the bacterial adherence to braided silk sutures was five- to eight-folds higher when compared to nylon to which the least numbers of bacteria adhered.[16-18] Bacterial adherence to sutures plays a significant role in the

induction of tissue reactions that lead to total disunion of bladder closure.

Improper drainage of urine can also lead to a failure of the bladder closure. Concerning our third patient, the bladder plate was wide enough to allow easy closure. However we did not have any ureteral catheter to drain urine. The catheters sizes were greater than the ureteral diameter; urethral catheter was not effective for complete drainage of urine. Bladder closure failed at the 8th postoperative day. Out of a total of four patients, initial bladder closure was completely achieved for three patients.

The factors that are important for achieving successful primary closure have been well documented, and they include the use of osteotomy, avoidance of urethral tubes and abdominal distention, the use of postoperative antibiotics, pelvic immobilization, urethral stenting catheters, and maintenance of the patient free of pain.[19,20]

Failure of the initial bladder closure was the major complication; other minor complications observed, were pressure necrosis and infected secretion due to urethral stent. This complication did not lead to bladder closure failure, but an infection of the soft tissues around the bladder neck. This complication was observed with the fourth patient, operated at the age of 5 years and 7 months. We think that bladder plate chronic infection plays a role in infected secretion. Soft tissue infection around the bladder neck was successfully treated with sodium hypochlorite concentrated solution (Dakin Cooper Stabilised®, COOPER Cooperation Pharmaceutique Française, Lucien-Auvert, Melun, France). In order to avoid pressure necrosis and prevent accumulation of infected secretions, the urethra is not stented. The bladder is drained by a suprapubic malecot catheter for 4 weeks and ureteral stents for 2 weeks to avoid ureteral obstruction and hypertension.[12]

A recent study shows that, patients with a large diastasis are more likely to fail initial closure. Delaying initial closure for at least 3 months, performing pelvic osteotomy, and using an external fixation device post-operatively are strategies that improve closure success.[21]

Moderated varus of the left femoral head observed with the patient who had anterior innominate osteotomy, was promptly corrected with walking.

Epispadias repair is usually performed at 2-3 years of age before the continence procedure since it has been shown that the epispadias repair contributes significantly to the development of bladder capacity. The bladder capacity is measured under anesthesia, if the capacity is 60 ml or greater, bladder neck reconstruction can be considered. Since all exstrophy patients have vesicoureteral reflux, an antireflux procedure is required at the time of bladder neck reconstruction.

CONCLUSION

Complex bladder-exstrophy management remains a challenge for pediatrics surgeons. The failure of the initial bladder-exstrophy closure may be reduced by a closure with an absorbable monofilament silk and efficient urine drainage by an adequate ureteral stendind. Anterior innominate osteotomy through iliac bone is required to prevent varus of the femoral head. Immobilisation and stabilisation of pelvic osteotomy by Batchelor plaster is more comfortable for the patient than Bryant traction, and it allows easier postoperative care.

REFERENCES

1. Epidemiology of bladder exstrophy and epispadias: A communication from the International Clearinghouse for Birth Defects Monitoring Systems. Teratology 1987;36:221-7.
2. Gearhart JP, Jeffs RD. Management of the exstrophy-epispadias complex and urachal anomalies. In: Walsh PC. editors. Campbell's Urology. Philadelphia: Saunders; 1992. p. 1772-821.
3. Jeffs RD, Guice SL, Oesch I. The factors in successful exstrophy closure. J Urol 1982;127:974-6.
4. Chaudhary R, Apte A, Mehta R, Varshney A, Singh K, Jain N, *et al*. Combined bladder exstrophy and epispadias repair. BMJ Case Reports 2011;10:4-9.
5. Kurbet SB, Prashanth GP, Patil MV, Mane S. A retrospective analysis of early experience with modified complete primary repair of exstrophy bladder (CPRE) in neonates and children. Indian J Plast Surg 2013;46:549-54.
6. Taskinen S, Suominen JS. Lower urinary tract symptoms (LUTS) in patients in adulthood with bladder exstrophy and epispadias. BJU Int 2013;111:1124-9.
7. Sharma PK, Pandey PK, Vijay MK, Bera MK, Singh JP, Saha K. Squamous cell carcinoma in exstrophy of the bladder. Korean J Urol 2013;54:555-7.
8. Patil S, Jain SK, Kaza R, Rao S. Squamous cell carcinoma in bladder exstrophy: A rare entity. Singapore Med J 2012;53:e254-7.
9. McIntosh JF, Worley G Jr. Adenocarcinoma arising in exstrophy of the bladder: Report of two cases and review of the literature. J Urol 1955;73:820-9.
10. Ansell JS. Surgical treatment of exstrophy of the bladder with emphasis on neonatal primary closure: Personal experience with 28 consecutive cases treated at the University of Washington Hospitals from 1962 to 1977: Techniques and results 1979. J Urol 2002;168:214-7.
11. Oesterling JE, Jeffs RD. The importance of a successful initial bladder closure in the surgical management of classical bladder exstrophy: Analysis of 144 patients treated at the Johns Hopkins Hospital between 1975 and 1985. J Urol 1987;137:258-62.
12. Gearhart JP, Jeffs RD. State-of-the-art reconstructive surgery for bladder exstrophy at the Johns Hopkins Hospital. Am J Dis Child 1989;143:1475-8.

13. Sponseller PD, Gearhart JP, Jeffs RD. Anterior innominate osteotomies for failure or late closure of bladder exstrophy. J Urol 1991;146:137-40.
14. Gökçora IH, Yazar T. Bilateral transverse iliac osteotomy in the correction of neonatal bladder extrophies. Int Surg 1989;74:123-5.
15. Jacob BC, Steven GD, Robert DJ, Gearhart JP. Bladder exstrophy from childhood into adult life. J R Soc Med 1986;89:39-46.
16. Lowe FC, Jeffs RD. Wound dehiscence in bladder exstrophy: An examination of the etiologies and factors for initial failure and subsequent success. J Urol 1983;130:312-5.
17. Javed F, Al-Askar M, Almas K, Romanos GE, Al-Hezaimi K. Tissue reactions to various suture materials used in oral surgical interventions. ISRN Dent 2012;2012:762095.
18. Katz S, Izhar M, Mirelman D. Bacterial adherence to surgical sutures. A possible factor in suture induced infection. Ann Surg 1981;194:35-41.
19. Gearhart JP, Forschner DC, Sponseller PH, Jeffs RD. A new combined vertical and horizontal pelvic osteotomy approach for the initial and secondary repair of bladder exstrophy. AUA 90th Annual Meeting, April 1995, AUA; 1995.
20. Husmann DA, McLorie GA, Churchill BM. Closure of the exstrophic bladder: An evaluation of the factors leading to its success and its importance on urinary continence. J Urol 1989;142:522-4.
21. Shah BB, Di Carlo H, Goldstein SD, Pierorazio PM, Inouye BM, Massanyi EZ, *et al*. Initial bladder closure of the cloacal exstrophy complex: Outcome related risk factors and keys to success. J Pediatr Surg 2014;49:1036-9.

Cite this article as: Bertin KD, Serge KY, Moufidath S, Maxime K, Hervé OK, Baptiste YJ, *et al*. Complex bladder-exstrophy-epispadias management: Causes of failure of initial bladder closure. Afr J Paediatr Surg 2014;11:334-40.

Source of Support: Nil. **Conflict of Interest:** None declared.