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Use of human acellular dermal matrix during classic bladder exstrophy repair

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Summary

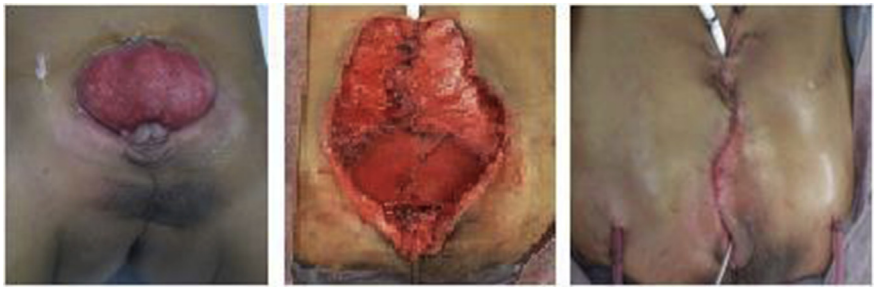
Introduction
The extent of the abdominal wall defect in people with classic bladder exstrophy (CBE) varies, and can be extensive. In this study, human acellular dermis (HAD) was used to bridge the fascial gap, as an alternative to osteotomy, to support a fascial repair of the abdominal wall, and as a filler in selected cases of CBE.

Objective
To demonstrate the efficacy of the employed techniques of using HAD within the bladder exstrophy population.

Materials and methods
The medical records of six males, born with CBE, and who had abdominal wall defects were reviewed. Two children, aged 6 and 8 years old, were referred from overseas with unrepaired bladder exstrophy plates and large abdominal wall defects (8 cm and 12 cm wide). Both had their bladders reconstructed, placed within the pelvis, and HAD was used to replace the absent abdominal wall (bridged repair) without the use of pelvic osteotomy. In three other patients, HAD reinforced the native fascial repair (bolster repair). In three patients, HAD also served as a filler for the abdominal depression that was present following initial staged repair. Where HAD was used for bridged or bolster repair, the edges of the allograft were extended 2–3 cm circumferentially beyond the perimeter of the abdominal wall defect.

Results
All six patients healed well, without evidence of abdominal wall hernias at 1–3 years post-operatively. Functionally, each patient regained an appropriate level of abdominal wall strength. Two children successfully underwent a secondary procedure through the bridged allograft repair, as each required bladder neck reconstruction and bilateral ureteral reimplantation through the reconstructed abdominal wall. Continence was achieved in these two patients, with one child voiding at 2-hourly intervals and the second at 3-hourly intervals. One patient developed a urethral-cutaneous fistula, distant to location of the allograft. There were no associated wound complications.

Conclusions
In this series of patients born with classic bladder exstrophy, HAD acted as a biologic scaffold and allowed native cellular ingrowth and tissue remodeling. It served as an alternative to pelvic osteotomy in older patients with unrepaired CBE. The material reinforced a weak or potentially suboptimal fascial repair and filled a tissue gap, resulting in improved aesthetics. Given its ease of preparation and the lack of significant morbidity associated with its use, combined with the functional and esthetic results in the present series, HAD may be considered during delayed reconstruction of abdominopelvic tissues in people born with CBE.



Figure

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Introduction

The abdominal wall defect in people born with congenital bladder exstrophy is variable, and may extend from the umbilicus to the intersymphysial band. The bladder exstrophy—epispadias complex is thought to arise from a defect in reinforcement of the cloacal membrane, with an ingrowth of mesoderm, resulting in a congenital lack of development of the lower abdominal musculature and pubic bone diastasis. This space, which is occupied by the bladder plate and posterior urethra, has a distinct lack of structural support.

The role of human cadaveric acellular dermal grafts has been well documented throughout literature. From its use in neurosurgical closure of myelomeningocele [1], burn-related trauma [2], breast reconstruction following mastectomy [3], and abdominal wall incisional hernias [4,5], acellular dermal matrices have been investigated and implemented in standards of care to reconstruct congenital, traumatic or iatrogenic deficiencies. Human acellular dermal (HAD) grafts are created from the cleansing of human cadaveric donor dermal layers of their immune reactive cells and cellular components through a complex chemical process. This theoretically allows tissue regeneration through the migration of nearby tissue progenitor cells permeating the newly implanted biologic matrix scaffold [6—8], providing a recreation of absent tissue.

This is a report of a series of selected cases from the present database of patients born with CBE where human cadaveric acellular dermal (HAD) matrix (Alloderm and Allomax) was utilized for anterior abdominal wall repair.

Methods

A retrospective analysis was performed of all patients born with classic bladder exstrophy, with the use of HAD as an adjunct by a single surgeon (MKH). A total of six male patients were identified. AlloDerm (AlloDerm (LifeCell Corporation, Branchburg, New Jersey, USA)) and AlloMax (AlloMax (CR Bard/Davol Inc, Cranston, RI)) were prepared according to the manufacturers' instructions. Alloderm was rehydrated without adding antibiotic to the sterile rehydration dish. AlloMax was rehydrated with triple antibiotic wash.

Two boys, aged 6 and 8 years old, were referred from overseas with unrepaired bladder exstrophy plates and associated large ventral abdominal defects, 8 cm and 12 cm wide. Following bladder reconstruction, HAD was used as an interposition tissue for the lack of lower abdominal fascia in a bridged repair without the use of pelvic osteotomy. Postoperatively, neither boy was immobilized, but each was confined to bed rest for 10 days. Three patients, who underwent a staged repair of their exstrophy plate beginning with neonatal closure without the aid of pelvic osteotomy, subsequently developed abdominal hernias underneath an unpleasantly scarred skin. Human acellular dermal matrix was used to reinforce their fascia in a bolster repair, as subjectively, the fascial closure was on significant tension despite extensive peripheral mobilization. In these five patients, the edges of the graft were extended 2—3 cm beyond the perimeter of the abdominal wall defect and sutured with long-lasting, absorbable sutures. Three patients had significant midline scarring with a depression in the inferior third of the wound, one of whom the scar tissue caused severe upward tethering of the penis, which prevented sexual intercourse. The HAD served as a tissue filler in these patients, reconstructing the contour of the mons pubis, thereby supporting normal erection. None of the six patients had osteotomy during their initial repair.

Results

All six patients healed well without evidence of abdominal wall hernia at 1—3 years postoperatively (Table 1). Functionally, each patient regained an appropriate level of abdominal wall strength. Two children underwent a secondary procedure through the bridged allograft repair, as each required bladder neck reconstruction and bilateral ureteral reimplantation through the reconstructed abdominal wall. During dissection, the tissues encountered during the secondary surgery were indistinguishable from native tissue. Continence was achieved in these two patients, with one child voiding at 2-hourly intervals and the second at 3-hourly intervals. Following this procedure, phallus length was not significantly improved in any of the six patients. One patient developed a urethral-cutaneous fistula, which was distant to location of the allograft. There were no associated wound complications. All patients and, where

Table 1 Patient characteristics and type of repair using dermal matrix.

	Age	Type of classic bladder exstrophy surgery performed	Type of repair (human acellular dermal matrix)	Year	Follow-up
Patient 1	21	Staged repair	Bolster[b]	2010	2 years
Patient 2	6	Staged repair	Bridged[a]	2010	2 years
Patient 3	12	Mainz-II ureterosigmoidostomy	Bolster and filler	2011	12 months
Patient 4	18	Staged repair and bladder augmentation with Mitrofanoff	Bolster and filler	2012	3 years
Patient 5	8	Staged repair	Bridged	2013	2 years
Patient 6	23	Staged Repair and Bladder Augment with Mitrofanoff	Filler[c]	2014	12 months

[a] Bridged repair: Replacement tissue for native fascia.
[b] Bolster repair: Provides support to the native fascia.
[c] Filler: Provides contour and substance to the mons pubis region.