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Use of Scaffolding Tissue Biografts To Bolster Vesicourethral Anastomosis During Salvage Robot-assisted Prostatectomy Reduces Leak Rates and Catheter Times

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Abstract

Background: One of the key factors contributing to morbidity associated with salvage radical prostatectomy is a significant vesicourethral anastomosis (VUA) disruption or postoperative tissue dehiscence in the region of the distal bladder neck that causes a large prolonged urinary leak, perineal pain, and delayed catheter removal.
Objective: To describe our surgical technique using a urinary bladder extracellular matrix (UB-ECM) scaffold incorporated into the base of the VUA and the distal bladder neck during salvage robot-assisted radical prostatectomy (sRARP) and to assess outcomes and safety.
Design, setting, and participants: From March to July 2015, 15 patients underwent sRARP performed after primary therapy failure by a single surgeon. Two other groups were identified via analysis of propensity score matching. Group 2 ($n = 45$) underwent sRARP with standard suturing without use of the graft. Group 3 (control group; $n = 45$) underwent primary RARP with no graft placement. These two groups were compared group 1 ($n = 15$), in which patients underwent sRARP and received the scaffold in a 1:3:3 match.
Surgical procedure: sRARP with use of a UB-ECM scaffold in the posterior aspect of the VUA and distal bladder neck.
Outcome measurements and statistical analysis: Clinical data were prospectively collected in a customized database and retrospectively analyzed. Analysis of variance and Student's *t*-test were used to test the equality of means for continuous variables, while the χ^2 test was used to test categorical variables.
Results and limitations: There were no anastomotic leaks in the control group, with an average catheter time of 6.3 d (5–7 d). However, a clinically significant VUA/bladder neck disruption was observed in 16 patients (35.5%) in group 2, with a median catheterization time of 17.4 d (9–47 d), while in group 1 only one patient (6.66%) had a significant anastomotic leak on cystography ($p = 0.045$), with median catheterization time of 11.2 d (10–52 d) for this group ($p < 0.05$).
Conclusions: Incorporation of a UB-ECM scaffold into the base of the VUA and distal bladder neck should be considered as an option to decrease morbidity associated with sRARP since it decreased the rate of VUA disruption, enhanced healing, and reduced catheterization time. This technique could be a valuable tool for all surgeons performing sRARP.
Patient summary: We investigated the use of a scaffolding tissue graft when connecting the urethra to the bladder during salvage robot-assisted laparoscopic prostatectomy. This technique was found to be effective and safe.

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1. Introduction

Vesicourethral anastomosis (VUA) after salvage robot-assisted radical prostatectomy (sRARP) for recurrent prostate cancer can be complicated by an anastomotic leak in up to 18–33% of cases [1,2]. VUA leaks play a major role in patient outcomes and contribute to a significant morbidity burden. Patients who experience VUA leaks are at higher risk of developing urethral strictures, bladder neck contractures, and other clinical manifestations that require longer catheterization time. In addition, as a result of intraperitoneal urine leakage, patients may experience a protracted course of postoperative ileus, along with chemical and metabolic derangements [3]. These not only require closer monitoring in cases of persistent extravasation but may also necessitate a reconstructive procedure in many cases to repair a defect in the anastomotic wall. Therefore, minimizing this problem is beneficial for patients. In the case of sRARP, tissue friability and postoperative necrosis are possible as a result of prior therapy. Even if the VUA is intact, the tissue around it can undergo necrosis and lead to a urinary leak, so creating a good anastomosis may be technically challenging.

Clinical use of connective tissue for reinforcement of the VUA and distal bladder neck is a novel approach [4]. The scaffold used in this study was MatriStem (ACell, Columbia, MD, USA). It is an acellular and resorbable scaffold derived from the basement membrane and subjacent lamina propria of porcine urinary bladder extracellular matrix (UB-ECM), which is a source of implantable collagen, protein, and carbohydrates [5]. A recent clinical study showed that use of urinary UB-ECM around the esophagojejunal anastomosis following total gastrectomy decreased the leak rate by 60% in comparison to the control group [6]. The aim of our study was to ascertain whether incorporation of this scaffold into the posterior VUA has any significant impact on preventing and mitigating VUA disruption.

2. Patients and methods

2.1. Study population

After obtaining institutional review board approval, we prospectively collected data for 15 patients (group 1) who underwent sRARP with a UB-ECM scaffold incorporated into the VUA from March 2015 to July 2015. sRARP was performed after failure of initial treatment and local recurrence of cancer, as demonstrated by a positive transrectal ultrasound-guided biopsy of the prostate. Of the 15 patients, 12 (80%) were previously treated with radiation therapy (6 external beam radiation therapy [EBRT], 3 proton beam, and 3 brachytherapy), two patients (13.33%) had been treated with cryotherapy, and one patient (6.66%) with high-intensity focused ultrasound (HIFU). Group 1 was matched to 45 other patients undergoing sRARP in the same setting without incorporation of the tissue graft (group 2). Patients in these two groups were compared to 45 patients who had undergone primary RARP with no use of the UB-ECM scaffold (group 3) and served as a control group in a 1:3:3 match.

2.2. Propensity score matching

To control for measured potential confounders in the data set, a propensity score was generated for each patient from a multivariable logistic regression model, in a 1:3:3 proportion, according to ten preoperative clinical covariates: age, body mass index (BMI); number of previous biopsies; race; hypertension; diabetes; coronary artery disease (CAD); dyslipidemia; smoking history; and American Society of Anesthesiologists (ASA) score (Table 1).

2.3. Surgical technique

All procedures were performed by a single surgeon (V.P) using a transperitoneal six-port technique on a da Vinci Xi surgical system (Intuitive Surgical, Sunnyvale, CA, USA) [7]. An antegrade approach was

Table 1 – Patient characteristics and distribution of groups

Patient characteristic	Group 1 (n = 15)	Group 2 (n = 45)	Group 3 (n = 45)	p value
Age (yr)	66 (54–76)	67 (53–78)	66.5 (57–76)	0.977
Body mass index (kg/m^2)	30 (24–40)	28 (25–32)	29 (24–43)	0.810
Prior biopsies (n)	1 (1–3)	1 (1–2)	1 (1–4)	0.873
Race				0.825
Black	2 (13.3)	5 (11.1)	7 (12.5)	
White	13 (86.7)	40 (88.9)	37 (82.2)	
Comorbidities				
Diabetes	2 (13.3)	5 (11.1)	5 (11.1)	0.969
Coronary artery disease	2 (13.3)	6 (13.3)	4 (8.9)	0.778
Hypertension	7 (46.7)	25 (55.5)	21 (46.7)	0.666
Dyslipidemia	2 (13.3)	3 (5)	6 (13.3)	0.543
Smoking history				0.835
Current	2 (13.3)	5 (11.1)	3 (6.7)	
Former	4 (26.7)	11 (24.4)	9 (20)	
Never	9 (60)	29 (64.4)	33 (73.3)	
Mean ASA score	2.7 (2–3)	2.7 (2–3)	2.5 (2–3)	0.114
Operating time (min)	131 (120–150)	127.5(100–165)	86.2 (72–101)	>0.001
Intraoperative EBL (ml)	129.4 (100–150)	134.2 (100–200)	120.7 (75–150)	0.189

Data are presented as median (range) for continuous variables and as n (%) for categorical variables.
ASA = American Society of Anesthesiologists; EBL = estimated blood loss.

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