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Rectus abdominis detrusor myoplasty (RADM) for acontractile/hypocontractile bladder in spinal cord injury patients: Preliminary report

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KEYWORDS
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Summary *Background:* Urinary bladder dysfunction in the form of acontractile/hypocontractile bladder is very common after spinal cord injury and it may lead to recurrent urinary tract infection (UTI), stones formation, and deteriorating renal function. Conventionally, these patients evacuate their bladders by life-long clean intermittent catheterization (CIC) or an indwelling catheter (IC). For these patients, another option is to use innervated skeletal muscle wrap around the bladder to augment detrusor function and voluntary evacuation of bladder.
Methods: We selected 5 patients with acontractile/hypocontractile bladder following spinal cord trauma. These patients were assessed by urodynamic study for post void residual volume (PVRV), detrusor pressure (Pdet), urine flow rate (Vmax), and bladder contractility index (BCI). All five patients underwent Rectus Abdominis Detrusor Myoplasty (RADM).
Results: Complete spontaneous voiding was achieved in all patients. Rectus abdominis detrusor myoplasty (RADM) elicits a statistically significant reduction in PVRV and statistically significant increase in urine flow rate, bladder contractility and detrusor pressure after 6 months. Recurrent UTIs ceased in all patients. There were no immediate or late complications.
Conclusion: RADM appears to be a promising option in a patient with acontractile/hypocontractile bladder to restore the bladder function. It avoids CIC in all patients leading to improvement in quality of life in select group of patients.

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Introduction

Urinary bladder dysfunction in the form of acontractile bladder is very common after spinal cord injury. Acontractile bladder leads to recurrent urinary tract infection (UTI), vesicoureteric reflux, stones formation, back pressure changes and deteriorating renal function.[1] As no effective pharmacotherapy is available; thousands of these patients are ill-fated to evacuate their bladders by life-long clean intermittent catheterization (CIC) or an indwelling catheter (IC).[2] It is well known that both CIC and IC have their attendant morbidities (recurrent UTI, Epididymitis, Epididymo-orchitis, Urethral trauma and stricture, Bladder injury, Urolithiasis, Deteriorating renal function) and adverse effects on patient's quality of life.[3,4]

Sacral neuromodulation can restore voluntary bladder emptying; provided the entire neural pathway – spinal cord, micturition center and spinal roots are intact.[5,6] For other patients, another exciting option has come up in last few years: innervated skeletal muscle (latissimus dorsi detrusor myoplasty, LDDM) wrap has been used around the bladder to augment detrusor function and voluntary evacuation of bladder.[2,7] The purpose of this study was to determine the feasibility and effectiveness of rectus abdominis muscle wrap around urinary bladder – rectus abdominis detrusor myoplasty (RADM) to improve voluntary voiding in patients with acontractile bladder following spinal cord injury.

Material and methods

This prospective interventional study was conducted over a period of two years from March 2015 to March 2017 in a tertiary referral center. Before commencing the study local ethics committee approval and written/informed consent from all patients were taken. STROBE guidelines were followed for the study. We evaluated 20 patients with spinal cord injury to determine the type of bladder dysfunction; only 5 patients were found suitable for rectus abdominis detrusor myoplasty (RADM). Before surgery 4 patients were catheterized and 1 patient was on CIC. All patients with upper motor neuron lesion (i.e., multiple sclerosis, apoplectic stroke, spinal trauma above the 12th thoracic vertebra) and intact spinal cord, micturition center and spinal roots (candidate for sacral neuromodulation) were excluded from the study.

All 5 patients (median age 38.31years, range 30–50 years, all 5 were male) had spinal cord injury below D12 level 1–3 years back. All patients were examined to determine the type of urinary bladder dysfunction by relevant history and through clinical examination. MRI of dorso-lumber region was done to determine the level of spinal injury, USG pelvis was done to see bladder outlet obstruction and to determine post void residual urine (PVRV). Preoperative urethroscopy was done to rule out any bladder outlet obstruction and incontinence. Preoperative urodynamic assessment was done in all five patients (4 had indwelling catheter and one was on CIC). Indwelling catheter was removed and all patients were given trial of voiding 6 hours after removal of catheter. Urodynamic assessment was performed; though none of the patients could void; but during the process there was subtle rise in the detrusor pressure which was recorded and bladder contractility index was calculated. The amount of urine in bladder was taken as residual volume of urine. Bladder contractility index (BCI) was calculated according to the formula, BCI = detrusor pressure at Qmax + 5× Qmax.[8] Using this formula it is possible to define ranges of contractility as BCI greater than 150-strong contractility, BCI less than 100 weak contractility and BCI 100 to 150-normal contractility. Preoperatively, we assessed the RA function clinically and by EMG. Preoperative urine culture and sensitivity were performed to document UTI. All paraplegic patients with acontractile bladder/hypocontractile with no improvement for at least 1 year with no infravesical obstruction or incontinence were included in the study. After doing all preliminary investigations and preanesthetic clearance, rectus abdominis detrusor myoplasty was performed in cases of acontractile bladder.

Data was collected and entered in Microsoft excel sheet and then transferred to IBM-SPSS software version 21.0 for analysis. Data was analyzed using ANOVA repeated measures statistical tests. A p-value < 0.05 was taken as level of significance.

Operative plan

Patients were operated in a supine position and under general anesthesia without muscle relaxant. Midline abdominal incision was given starting 2 cm below the xiphisternum up to 2 cm above the pubic symphysis; skin and subcutaneous tissue were incised. Linea alba and anterior rectus sheath on left side were identified and skin flap was raised until lateral border of rectus abdominis (RA) muscle. Anterior rectus sheath was opened and rectus muscle on left side was identified and was freed from the surrounding structures without opening posterior rectus sheath. Sutures are used to mark the resting length of the muscle, which is important to adjust tension for final fixation of muscle around bladder. Superior epigastric artery was identified, ligated and cut. All the intercostal nerves supplying the rectus muscle were identified. Arteries accompanied by intercostal nerves were coagulated with bipolar cautery and proper hemostasis was achieved. Entire length of rectus muscle was dissected and muscle was cut at the upper end, and mobilized preserving the three lower intercostal nerves of rectus muscle. The attachment to the pubic symphysis and the inferior epigastric artery was preserved. Bladder dissection was done through extra peritoneal approach. Bladder was freed from all its surrounding structures by blunt and sharp dissection. It was filled with 100 ml saline to partially distend it. Rectus muscle was taken down and wrapped around bladder with moderate tension. Resting length was determined by previously placed sutures. Upper 2/3rd of bladder was covered by rectus muscle and muscle was fixed to the dome of bladder, lateral walls of bladder and to the muscle itself to form a wrap around bladder (Figure 1). Two intercostal nerves of superior part of rectus muscle were anastomosed with the opposite side lower intercostal nerves using nylon 8-0 sutures. Intraoperative muscle contraction was assessed by directly stimulating the muscle as well as stimulating the intact intercostal nerves. Hemostasis was achieved and rectus sheath and skin was closed (Figure 2–7). None of our patients required intensive care unit management and were managed in general ward after surgery.