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TRAUMA AND RECONSTRUCTIVE UROLOGY

Use of Martius flaps in complex female urethral surgery and the tethered vagina syndrome

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The paper by Kaysan et al. [1] is timely, given the vast increase in the eroded and transected urethras which are increasingly being reported as a consequence of the midurethral sling operation. A Martius transposition graft is an important tool for management of such problems.

From a practical perspective, a vascularized fat graft without the bulbocavernosus muscle attached is sufficient as an interposition flap. Deeper dissection and transposition of the bulbocavernosus only creates the potential for bleeding, hematomas, and infections. It is not necessary in our experience. We would draw attention to the “skin-on” Martius graft which offers several advantages to the simple fat graft, not least of which is restoration of vaginal skin volume and elasticity, an absolute requirement in patients who have the “Tethered Vaginal Syndrome” [2, 3, 4]. In patients with radiation necrosis, adding healthy skin to the fat graft may be helpful to the healing process. In regards to damage inflicted by the TVT to the urethra, a “skin-on” Martius graft allows another tape to be applied over the skin to cover the urethra after the urethral fistula has been repaired [5].

A “skin-on” Martius graft is especially helpful in patients with the “Tethered Vaginal Syndrome”, Figure 1. The “Tethered Vaginal Syndrome” is not a well recognized condition. It was first reported in 1990 [2]. It is an entirely iatrogenic condition that needs to be considered in patients with scarring after vaginal operations or after Burch colposuspension. The incontinence is severe. Urinary stress incontinence is very mild or absent. It is somewhat equivalent to ‘motor detrusor instability’ (MDI). The classical symptom is commencement of uncontrolled urine leakage as soon as the patient’s foot touches the floor, indeed, often commencing as the patient rolls over to get out of bed. The patient does not complain of bed-wetting during the night. The symptoms are caused by loss of elastic-

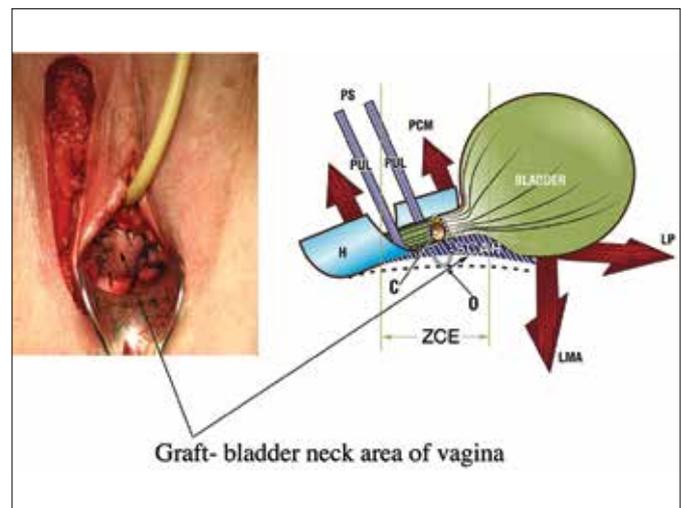


Figure 1. Zone of critical elasticity (ZCE) allows for separate function of the three directional vectors for urethral closure [4]. Figure 1 illustrates why elasticity at the ZCE is necessary for the separate function of urethral (U) and bladder neck (BN) closure mechanisms. The ZCE stretches from the mid-urethra to the bladder base. Scarring across the ZCE ‘tethers’ muscle vectors PCM and LP/LMA. LP/LMA overcomes PCM to pull open the vaginal hammock on effort, causing uncontrolled urine loss.

ity in the bladder neck area of the vagina: the ‘zone of critical elasticity’ (ZCE). Because scar tissue contracts with time, it may present twenty years after vaginal repair or bladder neck elevation. This condition can be cured by plastic surgery, whose aim is to restore elasticity to the bladder neck area of the vagina.

Pathogenesis of the tethered vagina syndrome

This condition is entirely iatrogenic and is caused by excessive tightness in the bladder neck area of the

vagina [2, 3]. It is far more common in regions where surgeons are taught to remove significant amounts of vaginal skin during vaginal repairs. Often, there is very little stress incontinence. The reason is that cough creates short and sharp fast-twitch contractions, which may provide sufficient elasticity at the ZCE to prevent urine leakage on coughing.

Getting out of bed in the morning stretches ZCE far more, as the pelvic floor contracts to support all the intra-abdominal organs. This explains the classical symptom: commencement of uncontrolled urine leakage as soon as the patient's foot touches the floor. A scar at the ZCE 'tethers' the more powerful backward forces (arrows, Figure 1) to the weaker forward forces, so the bladder is pulled open as in micturition.

Specific clinical findings

Generally, the tightness in the bladder neck area of the vagina is obvious on speculum examination. Often no urine loss is evident during coughing or even straining. On ultrasound there is generally very little descent of the bladder neck, perhaps only 2 to 3 mm. One provocative test, which may be useful, is to grasp the bladder base part of the vagina gently with Littlewood's forceps and press backwards while asking the patient to cough. This removes any residual elasticity at the ZCE, and very frequently a spurt of urine comes out when there was previously no urine loss on coughing.

This test is specific for low elasticity at the ZCE, not necessarily for the tethered vagina *per se*. Care must be taken not to clamp the forceps. This may cause

severe pain, a consequence of the visceral nerve innervation of the vagina.

Skin-on Martius flap surgery, Figure 1

The aim is to restore elasticity in the bladder neck area of the vagina, the ZCE, so that oppositely acting vectors can act independently of each other.

No matter what technique is used, it is essential to dissect the vagina from the bladder neck and urethra, and then to free all scar tissue from urethra, bladder neck ('urethrolysis'), and pubic bones.

The surgical principle applied is that fresh vaginal tissue must be brought to the bladder neck area of vagina. If there is a severe shortage of tissue, the only solution is a skin graft. This can be a free graft, a Martius labium majus skin graft, or a split labium minus flap graft. A free graft can be problematic as up to one third may not 'take' or shrink excessively. Labium minus or Martius grafts are technically challenging, but bring their own blood supply. Cure rates reported with this operation exceed 80% [6].

ZCE and the urethral (U) and bladder neck (BN) closure mechanisms. ZCE extends from mid-urethra to the bladder neck area of the vagina. A scar at the ZCE tethers the PCM (pubococcygeus) muscle vector to the levator plate/longitudinal muscle of the anus (LP/LMA) vectors. As LP/LMA are more powerful, the posterior urethral wall is pulled open, from C to O, resulting in uncontrolled urine loss. C = closed urethra; O = open urethra; PUL = pubourethral ligament; PS = pubic symphysis.

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