Case report

Prepubic sling in curing non-stress leakage following complete cure of stress incontinence by a midurethral sling

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Abstract: A 46 year old woman entirely cured of stress incontinence by a midurethral sling, continued to leak a large amount of urine. A tampon improved this urine loss from a mean 227 gm/24 hours to 44 gm/24 hours, and a prepubic sling to a residual complaint of drops of urine on bending for household chores. It was concluded that the external urethral ligaments are an important component of distal urethral closure, and that this mechanism is concerned primarily with sealing of the urethra, rather than stress incontinence control.

Key words: Prepubic sling; Minisling; Non-stress incontinence; External urethral ligaments.

HISTORY & EXAMINATION

A 46 year old woman with Von Willebrand's disease gave a history of urodynamically diagnosed severe stress incontinence (SI) cured initially with a tension-free (monofilament) retropubic midurethral sling in August 2002.

The patient was completely cured for almost 2 years. She presented in late 2005 with a history of gradually worsening SI, continuous leaking, no urgency, and no evidence of overactive bladder (OAB) on urodynamic testing.

On transperineal ultrasound, it was evident that the mesh tape was pulling open the posterior urethral wall on straining. At the second operation in November 2005 the mesh was densely adherent to a thin dilated posterior urethral wall. The mesh was carefully excised, piece by piece, and the urethral wall plicated. With 300 ml saline in the bladder, a Tissue Fixation System (TFS) midurethral minisling [1] was applied under local anaesthetic (LA) and sedation (Fig. 1). The sling was tightened until no urine was lost during coughing. The patient was 100% cured until day 9, when she lifted a heavy exercise bike forcibly. Within 20 hours, the patient was admitted as an emergency, with severe vulval swelling and urinary retention, requiring suprapubic catheterisation. The haematoma gradually resolved over 7 days, and the patient was able to urinate spontaneously. However, her SI was far worse than before. Mean urine loss /24 hrs was 900 gm (range 700-1100). With a vaginal tampon, the loss/24 hrs was a mean of 300 gm (range 50-400 gm).

At the 3rd operation in June 2006 the old sling was removed, and a new midurethral TFS minisling was applied under LA/sedation. The vaginal epithelium overlying the urethra was devoid of underlying fascia. The fascial layer with vagina attached was brought across to cover the urethra, and anchored with sutures into the paraurethral tissues. The patient was entirely dry for 4 weeks, when she reported commencement of insensible urine loss, much worse in the 2nd part of the day, and loss of urine with sudden movement accompanied by a "bubble". There was no evidence of OAB on urodynamic testing. Mean urethral closure pressure was 56 cm H_2O.

Multiple tests over some weeks demonstrated a mean urine loss/24 hrs after 3 months of 227gm (range 190-265) reducing to 44 gm/24 hours (range 36-55) with a vaginal tampon. There was no urine loss with 10 coughs with 300 ml saline in the bladder. The external urethral ligaments (EUL) attaching the external meatus to the anterior surface of pubic bone on each side were extremely lax (Fig. 2). It was reasoned that these had become dislocated, and were a major factor in the insensible urine loss.

At the 4th operation in November 2006 the vaginal epithe-

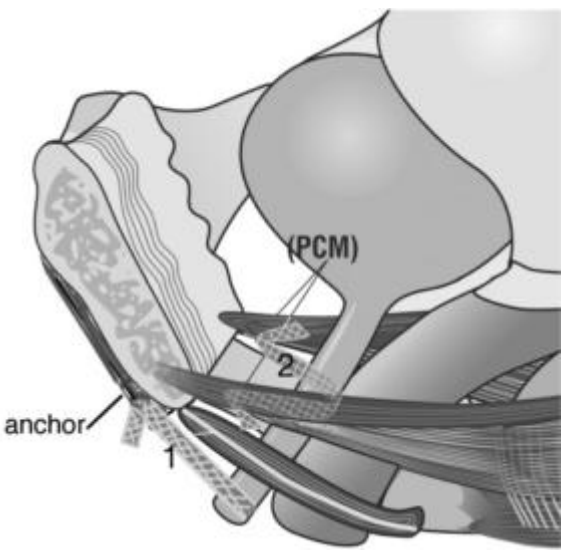

Fig. 1. – TFS pre-pubic and midurethral slings. '1' = prepubic TFS sling; '2'= midurethral TFS sling; 'PCM'= anterior portion of pubococcygeus muscle.

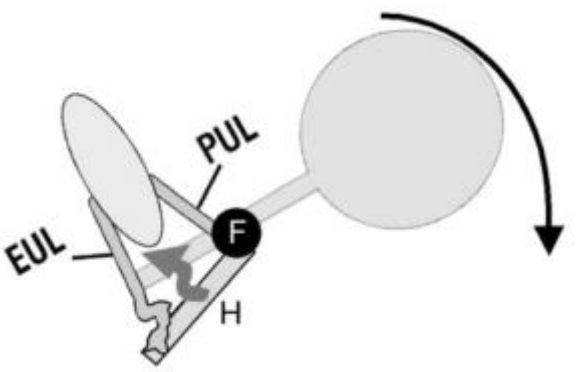

Fig. 2. – Proposed role of a lax external urethral ligament (EUL) in non-stress incontinence. The hammock (H) "tips down", and so cannot be closed by the anterior portion of m. pubococcygeus (small crooked arrow). The curved arrow represents the rotating force acting against the pubourethral ligament insertion point 'F' to close the bladder neck.[2, 3] PUL = pubourethral ligament; crooked arrow represents diminished muscle force consequent on loose EUL. A loose fibrosed mesh tape may interfere with this "sealing" mechanism by 'holding open' the urethra, and preventing 'sealing' by the hammock closure mechanism.

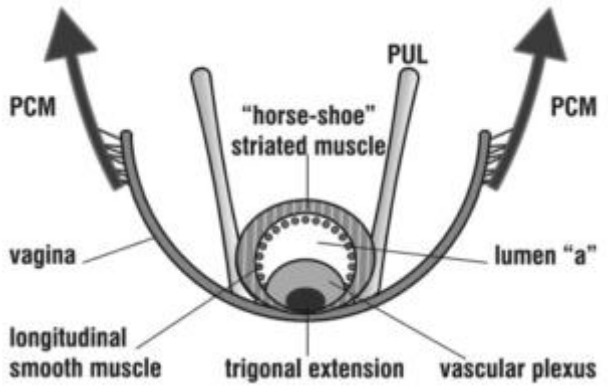

Fig. 3. – Proposed components of the "sealing" mechanism. PUL = pubourethral ligament; PCM = slow-twitch fibres of m. pubococcygeus.

lium was very thin, adherent to the urethra, with no intervening fascia. Under LA/sedation, a prepubic TFS was inserted to repair the damaged EUL. The fascial layer of the vagina was again stretched up and sutured to the suburethral tissues. Within 3 months, the patient was almost 100% continent. There was no SI even on repeated sneezing. She reported a few drops of urine loss mainly on bending down for household tasks. The mean urine loss was 7 gm/24 hours (range 5-20). This pattern has continued unchanged for 12 months. On recent examination, the vaginal epithelium was thin, and tightly attached to the urethra, with no apparent fascial layer.

DISCUSSION

The primacy of the pubourethral ligament (PUL) in SI control during effort is well documented. *a*) Pre-operatively, digital anchoring at midurethra prevents "funnelling" during coughing, and restores continence.[2] *b*) Surgically, a midurethral sling cures SI.

The pathogenesis of non-stress incontinence is not so well understood. The sequence of events in this patient, continued leakage after SI cure, and cure thereof with a pre-pubic sling, indicates that the EUL (Fig. 2) may have a key role in this condition. In 1990, it was demonstrated ultrasonically that the distal urethra was closed by a muscle force acting on the vaginal hammock between the external urethral meatus and midurethra,[3] (crooked arrow, Fig. 2). Firm EUL and PUL ligaments are required for this mechanism to function.

This muscle, the anterior portion of m. pubococcygeus, has a preponderance of slow-twitch muscle fibres,[4] consistent with our proposal that the structures in Fig. 2 have a key role in sealing the urethra: the suburethral vagina is pulled upwards like a trapdoor; this closes off the venous return, and "pumps up" the vascular plexus described by Huisman[5] to close the urethral space (Fig. 3) the thin periurethral striated muscle superiorly, contracts sufficiently to tension the smooth muscle around the urethral cavity.

We hypothesize that a lax EUL will allow the hammock to 'droop', much like an open trapdoor, invalidating every part of this sealing mechanism.

Vastly increased urine loss in the afternoon is consistent with such a 'breaking of the seal'. Vastly decreased urine loss with a tampon, from 227 gm/24 hours to 44 gm, is consistent with preventing downward 'droop' of the distal vagina (Fig. 2).

Enhorning[6] and Constantinou[7] both demonstrated a rise in urethral pressure 0.25 seconds before a cough was registered, indicating a finely co-ordinated neural control of the continence mechanism. The suspensory ligaments contain smooth muscle, nerves, and blood vessels, all of which indicate they are active contractile structures. A sling creates collagen only,[8] and so does not have neural control. We attribute lack of total cure to the inability of the slings to contract the ligaments and fascia, an essential requirement for water-tight tension and, added to this, a deficient fascial layer of the hammock, irreparably stripped by the post-operative haematoma.

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Interest Declared: Professor Petros is the original designer and developer of the TFS.

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