Comparison of anchor methods for minimally invasive transobturator fascia urethral slings using a gelatin matrix model

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Objective:
Type 1 polypropylene (PP) mesh mid-urethral sling is the most common surgical procedure for the treatment of SUI and has become the standard of care[1]. However, in view of the risk of re-operation for erosion and mesh exposure, fascial slings remain a necessary alternative.

The objective of this study is to determine the optimum anchoring mechanism for fascial slings if placed using a transobturator approach[2]. The tensile strength of an ideal anchor should be similar to existing mesh mid-urethral slings and the technique of placement and tensioning be reproducible.

We hypothesize that fascia with our proposed anchoring mechanism, consisting of barbed sutures and/or delayed-absorbable poly-4-hydroxybutyrate (P4HB) mesh, will provide tensile strength which is non-inferior to macroporous polypropylene (PP) mesh.

Materials and Methods:
Various anchors were cured in 20 weight/volume ballistic gel to model approximately 3 weeks of tissue ingrowth once the sling has been implanted[3]. Anchored systems consisting of barbed sutures incorporated into bovine fascia with and without the augment of surgical P4HB mesh (Phasix Mesh, BD, Franklin Lakes, NJ) were tested against current standard PP mesh (Desara Blue, Caldera Medical, Westlake Village, CA). The anchored systems of nominal dimension 1.5x3cm were submerged 3cm into the ballistic gel and cured (Figure 1a). The suturing configuration within the anchoring region is shown in Figure 1b.

There were 5 anchor methods compared during this study, of which 6 samples were tested for each. PP mesh was used as the reference and P4HB mesh was used as a potential new delayed absorbable alternative. Fascia by itself was tested as the negative control. Size 0 polydioxanone barbed sutures (V-Loc, Medtronic, Minneapolis, MN) were used to create an anchor on the fascia strips by looping the sutures back and forth 4 times; this suturing technique was also used with overlaid P4HB mesh. Load-extension curves were created using an Instron 5544 device (Instron Corporation, Norwood, MA).

Results:
Adding barbed sutures and P4HB mesh to the fascia had the largest average max load at 68.8N. Comparative results of all other anchor types compared to the standard PP mesh can be seen in Figure 2a. Fascia with a barbed suture anchor showed a statistically significant greater max load compared polypropylene mesh (Figure 2a and 2b).

Conclusion:
Our results indicate fascia with a barbed suture anchor had a greater average max load compared to PP mesh and may provide an anchoring mechanism which is non-inferior to existing PP mesh anchoring mechanisms. Future studies with human tissue or beef tongue models are necessary to validate our outcomes and address limitations of a gelatin model.

Citations:
[1] AUGS-SUFU Joint Position Statement on Midurethral Slings for Stress Urinary Incontinence. Female Pelvic Med Reconstr Surg 2021;27: 707–710.
[2] Schrum, CJ, Shaw, JS, Strohbehn, K. Fascia lata autologous transobturator midurethral sling. OBG Manag. 2021 December;33(12).

Figure 1: a) dimensions of the fascia and mesh strips submerged in the ballistic gel; b) suture loops at the end of the fascia pieces

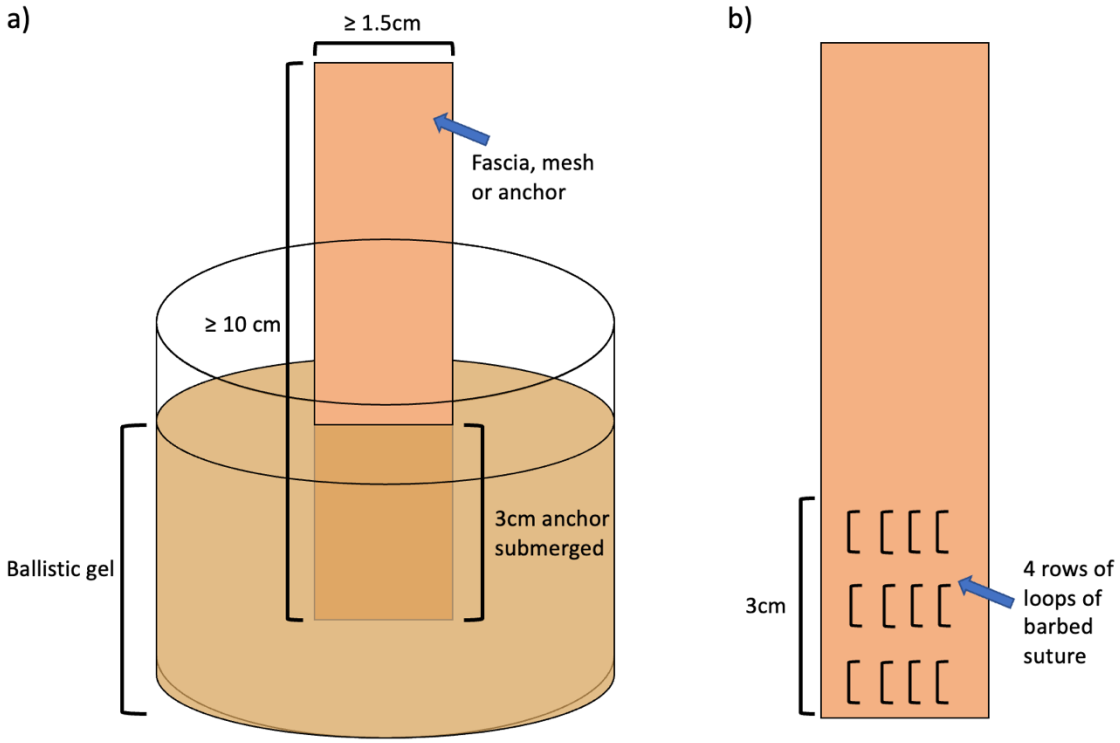

Figure 2: a) statistically significant differences between PP mesh, P4HB mesh and fascia anchor systems and their subsequent average max load. T-tests were conducted to determine level of

statistical significance (Key: * P ≤0.05, ** P ≤0.01, *** P ≤0.001) b) load vs. extension curves of fascia anchors compared to polypropylene mesh