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TIME DEPENDENT VARIATIONS IN INFLAMMATORY REACTION AND SCAR FORMATION OF CADAVERIC FASCIA, PORCINE DERMIS, PORCINE SMALL INTESTINE SUBMUCOSA, POLYPROPYLENE MESH AND AUTOLOGOUS FASCIA IN THE RABBIT MODEL: IMPLICATIONS FOR SLING SURGERY

Hypothesis / aims of study
The pubovaginal sling has become the gold standard for treating stress urinary incontinence. Many different materials are currently available for use as suburethral slings. The current available options are cadaveric fascia, porcine dermis, porcine small intestine submucosa and synthetic material. Each sling material has specific advantages and disadvantages. When choosing a sling material physicians must weight the risk of rapid deterioration of material and possible recurrence of incontinence, versus correction of incontinence with the risk of material erosion. Recent animal studies have demonstrated a significant loss of tensile strength and stiffness in porcine and cadaveric sling materials in the rabbit model (1). We attempted to correlate these biomechanical properties with pathologic evidence. Time-dependent variations in microscopic development of inflammation, fibrosis and scar formation of 6 materials commonly used for transvaginal anti-incontinence surgery were investigated.

Study design, materials and methods
A total of 10 rabbits were randomized into 2 survival groups (6 and 12 weeks respectively). Each rabbit had porcine dermis, porcine small intestine submucosa, polypropylene mesh, autologous fascia, and 2 different types of human processed cadaveric fascia lata implanted on the anterior rectus fascia. Five rabbits were sacrificed at 6 weeks and the rest at 12 weeks. At harvest each sling material was fixed in paraffin wax and standard H&E staining was performed. Immuno-histochemical staining for the T cell marker CD3, B cell marker CD20, and DNA proliferative marker MIB-I was also performed. The slides were then reviewed by a blinded pathologist. Degree of inflammation and fibrosis was quantified using autologous rabbit fascia as a baseline.

Results
When compared to autologous rabbit fascia, each type of human cadaveric fascia and porcine allografts showed a marked degree of inflammatory rind formation ($p=0.03$), percentage inflammation ($p=0.016$), CD3 infiltrate ($p=0.017$), and MIB-I infiltrate ($p=0.019$) at 6 and 12 weeks. There was no difference between the different sling material with regards to CD 20 infiltrate at 6 and 12 weeks. Polypropylene mesh showed no evidence of inflammatory rind formation and had minimal inflammatory infiltrate at six weeks. At 12 weeks polypropylene mesh showed the highest degree of fibrosis and scar formation ($p=0.010$) as well as granulomatous reaction ($p=0.025$) compared to the cadaveric fascias and porcine allografts.

Interpretation of results
The high degree of inflammatory infiltrated noted with porcine and human cadaveric materials may contribute to more rapid deterioration as compared to autologous tissue and mesh. This data supports prior biomechanical studies which have demonstrated rapid loss of tensile strength and stiffness in cadaveric and porcine materials. Early reemergence of symptoms following midurethral sling surgery could also be explanation for these findings. Additionally, the significant development of fibrosis and scarring associated with polypropylene mesh may contribute to a more lasting repair

Concluding message

This study noted a higher degree of inflammatory infiltrate associated with porcine and human cadaveric materials and increased fibrosis associated with polypropylene mesh when compared to autologous fascia. These results add further objective evidence to distinguish the different synthetic materials used in anti-incontinence surgery. Urologists performing these procedures should be aware of the time dependent tissue reactions when choosing a sling material.

1. Time Dependent Variations in Biomechanical Properties of Cadaveric Fascia, Porcine Dermis, Porcine Small Intestine Submucosa, Polypropylene mesh and Autologous Fascia in the Rabbit Model: Implications for Sling Surgery. J Urol. 171(5):1970-3, 2004 May.

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