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SUBURETHRAL SLINGS – ARE ALL MESH TYPES THE SAME?

Hypothesis / aims of study

Since the introduction of the TVT sub urethral sling a variety of surgical modifications of the procedure have been introduced. These differ both by the surgical technique and the type of material implanted. Proponents of these new techniques argue that the sling types are similar to the TVT tape and can therefore claim similar levels of safety. Mesh materials differ according to the type of polymer employed, the type of filament, pore size and weave. Because of this careful evaluation of each mesh is essential so that its behaviour in vivo can be predicted. Failure to establish the biological compatibility of these meshes may lead to premature introduction and possible surgical complications. The MONARC polypropylene mesh has previously been shown to have substantially similar physical characteristics to the TVT polypropylene mesh.(1) The TYCO I.V.S. mesh and the Mentor ObTape have different physical features and should behave differently after implantation. This study aims to identify if these theoretical differences lead to different characteristics in vivo.

Study design, materials and methods

The three mesh types were examined microscopically in the laboratory to establish the precise fibre diameter and pore size. In addition tensile strength tests using an automated testing system were completed. Mesh was also implanted subcutaneously in Sprague-Dawley rats. All animals were treated according to institutional animal care and use committee guidelines. Mesh was explanted along with adjacent tissues after 13, 28, 57 & 91 days. The sections were stained with H&E and Picrosirius Red to allow histological analysis of cellular responses and fibrous collagen in growth respectively. Ability to withstand infection was not examined.

Results

All three tapes differed according to fibre size, pore size and weave. Only the MONARC tape fulfilled the criteria of a type I mesh. The TYCO and ObTape had different slopes on the stress strain curve. This implies less elasticity. The minimal inflammatory response was observed around the MONARC mesh. A thin layer of fibroblasts lined the surface of each filament. A good collagen in growth was noted by day 13. Collagen density increased with each interval. Both the TYCO and ObTape meshes had a marked inflammatory response which remained consistent through all visits. This inflammatory response prevented the formation of appropriate amounts of fibrous tissue.

Interpretation of results

The ObTape and TYCO mesh demonstrate a similar initial slope on the stress/strain curve. This is substantially different from the MONARC and implies that they are less elastic.
Although there was a chronic inflammatory response for all three types the degree of response was far greater with the TYCO and ObTape meshes. Their large inflammatory response prevented formation of decent amounts of fibrous tissue within and across the mesh. In this experimental model, there was poor incorporation of the TYCO and ObTape into the surrounding tissue. The tissue reaction was only observed for 91 days; a longer period of observation may establish the final outcome. If the inflammatory response persists, these findings have serious implications for the long term stability of the grafts. An ongoing inflammatory response coupled with failure to deposit collagen may also predispose to higher rates of erosion. Differences in mesh characteristics impart very different properties on the meshes in terms of tissue reaction in vivo.

Concluding message

The three mesh types are similar only in terms of the polypropylene used in their manufacture. Differences in weave, fibre type and pore size result in different responses in vivo. All mesh manufacturers need to conduct independent laboratory testing before claiming similar properties to existing mesh types. Failure to do this could lead to the introduction of

new procedures before the accumulation of adequate safety data. These findings have implications for all surgical procedures utilizing the placement of artificial meshes.

References

Mechanical properties of urogynaecologic implant materials. Int Urogynaecology J;14:239-243.

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