739

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FUNCTIONAL AND IMMUNOHISTOCHEMICAL COLLATIONS AFTER VAGINAL SYNTHETIC MESH IMPLANT ON A RAT MODEL

Hypothesis / aims of study

To create a rat model for a synthetic mesh implantation between bladder and vagina, mimicking the vaginal mesh in humans. We examined the functional and immunohistochemical changes to study the mechanism behind these complications.

Study design, materials and methods

38 female Sprague Dawley (SD) rats were divided into 3 groups: mesh implantation (Study), no mesh implantation (Sham), and Control groups. esh and Sham group were further divided into two subgroups for Urodynamics (UDS), leak-point pressure (LPP) testing, and immunohistochemistry study of vaginal tissue harvested at 4 or 10 days after mesh implantation. Nerve growth factor (NGF) was measured with immunohistochemistry and Western blot analysis. UDS and NGF results were compared between groups. Paired-samples t-test and Fisher exact test were applied for comparison of continuous and categorical data, respectively. Values of $p<0.05$ were considered statistically significant

Results

Among the 38 female Sprague Dawley (SD) rats (weighed 268 - 334g and aged 12-15 week), 16 and 16 rates were used for mesh implantation (Study group) and Sham group respectively, and the remainder 6 for the Control group. Both the Study and Sham group has 8 rats tested with Urodynamics before sacrificed for immuno-histochemical studies at Day 4 and the remainder at Day 10.

The UDS results between groups are shown in Table 1. There were no differences in voiding pressure (VP) and voided volume (VV) comparison in between groups at Day 4 and Day 10. For the voiding interval, both the Study group and Sham group have measured with a shorter voiding interval when compared with the Control group, yet, only the study group presented on Day 4 revealed a statistically significant difference ($p=0.034$). On the LPP measurement, the Mesh group and Sham group showed a tendency of a lower value than the Control group. Yet, only the Study group presented on Day 10 has shown with a statistically significant difference when compared with the Control group ($p=0.048$).

The results of NGF level by immunoflourescent test in rats' urogenital tissue are presented in Table 2. The NGF level increased significantly in the Study and Sham group at day 4 postoperatively as compared to the Control group. However, the transient rise noted in the Sham group returned to the same level as compared to the Control group on the 10th postoperative day. However, the abrupt increased in NGF level in the Study group was significantly higher than the Control group and also to the Sham group at postoperative day 4. NGF level in the Study group has decreased by postoperative day 10. However, the magnitude of the decline was lesser in the Study group, which reflected that the NGF level was significantly higher than the Control and Sham group at postoperative day 10

Interpretation of results

There was significant NGF overexpression in the group which has the surgery performed and as well as mesh implantation. Yet, the magnitude and duration on NGF expression was very much higher and longer in the mesh implanted group. This possibly explains the inflammatory process underlying mesh implantation was more intense and could last for a longer period than the surgery without mesh insertion. NGF levels of the Sham group returned to baseline whereas the NGF levels of the Study group declined but was still increased compared to the Sham group. This may be explained by the interplay of inflammation and healing.

The urodynamic parameter on voiding interval has shown to be shorter after surgery without mesh and surgery with mesh implanted. However, the magnitude of shortening of voiding interval was significant only on post-operative day 4 in mesh implanted group. The increase of NGF expression in lower urogenital tract tissue correlated with the lower urinary tract dysfunction developed as a result of mesh implantation. The finding further supports other study that increased levels of NGF in the bladder urothelium, smooth muscle and urine of patients with sensory urgency and DO.

The leak point pressure (LPP) in the Study group and Sham group were lower as compared to the Control group. However, the LPP was only significant in the mesh implanted group at 10^{th} postoperative day. This may be the consequent of dissecting paravesical space for mesh implantation. This indicates that in clinical practice we might encounter patients who complain of de novo urinary incontinence after mesh implantation surgery.

Concluding message

Transvaginal mesh implantation in SD rats was associated with significant overexpression of NGF in the bladder, urethra and vaginal tissue, which last for a longer period than those surgeries without mesh insertion. The magnitude of shortening and the duration in the urodynamic parameters was reflected to be significant on the 4th postoperative day of the mesh implanted group

Disclosures
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