

EFFECT OF MENOPAUSE, DIABETES AND STEROID ON TISSUE REACTION INDUCED BY POLYPROPYLENE MONOFILAMENT TYPE I MESH: EXPERIMENTAL STUDY IN RAT MODELS

Hypothesis / aims of study

Polypropylene monofilament mesh materials are used for various urogynecologic interventions. Implant materials used in urogynecologic surgery are classified in 4 types according to inflammatory reaction they created, and those inducing minimal reaction and complication in living models are most desirable (1). Polypropylene monofilament macro porous, namely Type I mesh, is the commonly preferred material. Urogynecologic surgical procedures are usually applied to patients in advanced age group who may suffer from diabetes or other chronic illnesses requiring the use of steroid. All mesh materials result in an inflammatory process after mesh insertion. Although the inflammatory processes seen with different mesh types were studied in animal models (2,3), the menopausal status was disregarded in those studies. Furthermore, we could not find any study investigating the inflammatory process in diabetic and steroid using animal models. The aim of this study was to compare the inflammatory process in premenopausal, menopausal, diabetic and steroid using rat models to shed light to safety of mesh materials in different patient groups.

Study design, materials and methods

Inflammatory reaction and mesh-tissue detachment strength were studied in 4 different animal models. Forty mature Wistar type albino rats were used in the study. Thirty of them underwent ovariectomy to obtain menopausal status, and the remaining ten rats formed the control group (Group 1). One week after ovariectomy, methylprednisolon 1 mg/kg was begun to be injected daily to mimic steroid treatment in rheumatologic diseases in 10 rats (Group 2; steroid + menopause group). In the third group, intraperitoneal streptozosin (50 mg/kg) was administered to induce diabetes (Group 3; menopause + diabetes group) one week after ovariectomy. Blood glucose levels checked 3 days after administration, and values >250mg/dl accepted as diabetes. The remaining 10 rats formed the menopause control group (Group 4). Two week after the first operation, all the rats were operated again for the mesh placement. After shaving and preparing the abdomen, anterior abdominal muscle was exposed with midline excision under anesthesia. Two pieces of 1x1 cm type I macro porous polypropylene monofilament mesh were fixed with direct contact over rectus abdominis muscle about 1 cm lateral to midline on both side. Three rats in diabetes group were died during follow-up. Nine weeks after second operation all the rats were sacrificed. The mesh on the right side was removed and investigated for the inflammatory process. Presence of inflammation, granulocytes, macrophages, fibroblast, and lymphocyte infiltration, foreign body type reaction, collagen deposition, muscle penetration, and necrosis was graded from 0 to 4. Presence of fibrosis, mast cells and muscular infiltration were graded from 1 to 3. The mesh on the left side was used for the measurement of detachment strength. The groups were compared with each other.

Results

At the end of the study there were 7 rats in group 3 (Diabetes + menopause) and 10 in the others. The mean detachment strength in groups was as follows; 595.0±274.3gr for group 1, 610.0±202.5 for group 2, 457.1±250.7 for group 3 and 410.0±161.2 for group 4. There were no difference between groups for the detachment strength ($p>0.05$). Lymphocyte and fibroblast infiltration, necrosis and collagen deposition were more intense in menopausal group compared to group 1 ($p<0.008$). Besides mentioned parameters inflammation, granulocyte and macrophage infiltration, muscle penetration and fibrosis were seen more intensely in group 4 compared to group 2 ($p<0.008$). Only necrosis, macrophage and lymphocyte infiltration were higher in group 3 compared to group 1 ($p<0.008$). No difference were detected between group 1 and 2 ($p>0.008$), and group 3 to 4 ($p>0.008$).

Interpretation of results

The mesh reaction and inflammatory process were more intense in postmenopausal rats compared to normal controls and those using steroid. However no difference was detected between menopausal groups with and without diabetes. Therefore, local estrogen supplementation should be considered in postmenopausal patients to reduce the effect of diminished estrogen which may suppress the inflammatory process. Diabetes seems to have no major role in increasing inflammatory process. On the other hand, most likely due to suppressive effect of steroid, inflammatory reaction created by menopause was not observed in the menopause + steroid group.

Concluding message

The use of Type I mesh seems to be safe in patients taking steroid therapy and the ones with Diabetes. However, the menopause is the most determining factor over the intensity of the inflammatory process caused by urogynecologic meshes.

References

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Disclosures

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