

EFFECT OF MONOCRYL FIBERS ON THE EARLY INFLAMMATORY RESPONSE AND COLLAGEN DEPOSITION AROUND A LIGHT WEIGHT POLYPROPYLEN MESH

Hypothesis / aims of study

Implant materials are increasingly being used in an effort to reduce recurrence after prolapse repair with native tissues. Non-absorbable synthetic implants induce a chronic inflammatory response which can be associated with bothersome side effects. Polypropylene (PP) is the most widely used material. In order to improve surgical handling characteristics, and potentially also biocompatibility, PP-constructs have been supplemented with absorbable monofilament polyglactone (PG; Monocryl, Ethicon) fibers (1). The aim of this study is to compare the early inflammatory response, neovascularization and collagen deposition around implants that are either hybrid (containing a mixture of PP and PG) or PP only, with the same density of PP fibers.

Study design, materials and methods

This experiment involved the use of a lightweight macroporous Amid type I PP-mesh. The hybrid mesh is commercialized as UltraPro or Prolift PlusM (Ethicon, Norderstedt, Germany). For the purpose of this experiment we also obtained PP-mesh that is identical to the above, but without PG fibers. Tested materials originated from the same production lot, were pre-cut to a standard size of 4.0 by 5.0 cm and provided sterile by the manufacturer.

Eight New-Zealand white rabbits underwent experimental surgery. The experimental rabbits were randomly divided into two groups of four each, further referred to by the implant material used and the time point at sacrifice (7, 14 days; 2 rabbits for each time point). Operated rabbits were operated under general anaesthesia in sterile conditions. After raising skin flaps, four longitudinal 2.0 cm long full-thickness incisions were made in the four quadrants of the lateral anterior abdominal wall and parallel to the midline. These incisions were primarily closed by a continuous 4/0 polyglactone (Monocryl, Ethicon) suture at an inter-run distance of 0.5 cm. These repairs were overlaid by the implant of interest with the longest and stiffest axis transverse to the axis of the body. Implants were fixed tension-free with separate 4/0 Monocryl sutures with an inter-suture distance of 1 cm. The subcutis and skin were closed with continuous 3/0 Monocryl sutures. Only one type of implant was used per rabbit.

Euthanasia was performed at the given time points. During necropsy, the presence of herniation, fluid collections, exposures, adhesions or infections was noted. The size of the implant was measured to allow the calculation of the proportional change to the initial dimensions, further referred to as shrinkage. The implant material, ingrown tissue and underlying abdominal wall muscles are further referred to as the explant. These explants were kept in 10% formalin for at least 2 days, before further processing. Hematoxylin–eosin (H&E) stained sections were used to quantify the presence of foreign body giant cells (FBGC), polymorphonuclear (PMN), and newly formed vessels at the interface of the implant material. Organization, composition, and amount of collagen were assessed semi-quantitatively analyzing Movat-stained slides. Immunohistochemical staining was done with a primary monoclonal rabbit RAM11 antibody.

Results

During explantation no macroscopic signs of infection nor herniations were observed.

In the PP group, in one animal one implant had a limited fold in one corner of approximately 5 mm. At 7 d, the PP implants did shrink significantly more (7% vs 0%; p-value 0.0003) whereas at 14 d there was no difference (7% vs 4%). The number of PMN in the inflammatory infiltrate was lower in PP+M explants both at 7 (p-value 0.02) and 14 d (p-value 0.001). At 14 days the number of macrophages was also lower (p-value 0.02).

On Movat stain, PP+M specimens displayed a less organized and less mature collagen deposition both at 7 (p-value 0.0072 and 0.0013) and 14 d (p-value 0.0004 and 0.0004).

Interpretation of results

The presence of PG fibers in a PP mesh modifies the early inflammatory response and collagen characteristics. The early inflammatory response is milder, in terms of PMN (7 and 14 days) and macrophages (14 days) counts. Early on, shrinkage is less in the monocryl-containing meshes. Overall collagen deposition was less organized and less mature. The biomechanical relevance of it is not yet clear, and a later response was neither documented.

Concluding message

Addition of monocryl fibers modifies the inflammatory response to PP mesh.

References

1. Hernia 2005;9:212–217

<i>What were the subjects in the study?</i>	ANIMAL
<i>Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?</i>	Yes
<i>Name of ethics committee</i>	Ethics Committee Katholieke Universiteit Leuven