b-FGF Loaded Polypropylene Meshes in Repair of Incisional Hernias in Rats: Tensiometric Study

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Introduction

Mesh repair is recommended for the repair of incisional hernias since its use can lower the recurrence rate. However, recurrence still remains as a problem some group of patients in spite of mesh use.

The strength of meshes and their tissue integration create a new abdominal wall. Nevertheless, an adequate mesh-tissue integration and fibroplasia may not be observed in some cases. To overcome this problem, some studies in the literature have searched the effects of growth factors in wound healing with or without mesh use.

In this experimental study, the standard and basic fibroblast growth factor (b-FGF) loaded polypropylene meshes were compared by tensiometry in repair of incisional hernias in rats.

Methods

80 Wistar albino rats were divided into 5 groups after an experimental incisional hernia model had been carried out by excising a 3x2 cm abdominal wall segment and closing it primarily with 3/0 plain cat-gut (ref). The below listed procedures was performed in separate groups:

- Group 1: Primary closure (Control group)
- Group 2: Primary closure + polypropylene (PP) mesh
- Group 3: Primary closure + gelatine coated PP mesh
- Group 4: Primary closure + 1 µg b-FGF loaded gelatine coated PP mesh
- Group 5: Primary closure + 5 µg b-FGF loaded gelatine coated PP mesh

The mesh size was 2x2 cm in each case. All the groups then divided into 1.month and 2.month subgroups according to sacrification dates. A mesh centered 3x3 cm abdominal wall sample was excised and sent for tensiometric study by using Lloyd® LRX5K test machine (Lloyd Instruments Ltd. Hampshire, UK).

Findings

Control group showed a 92.3% incisional hernia rate. No herniation was observed in the other groups. Tensiometric values of the groups are presented in the Table.

Table. Tensiometric values (N/mm3).

	1st month	2nd month	Difference	p
G1	9.61	8.99	↓	ns
G2	9.82	9.41	↓	ns
G3	10.54	10.24	↓	ns
G4	9.35	**12.17**	↑	<0.05
G5	8.80	**11.43**	↑	<0.05

At the end of the first month, tensiometry displayed no differences between 4 mesh groups. However, b-FGF loaded mesh groups (G4 and G5) showed a significantly better improvement in tensile strength values between the first month and the second month ($p<0.05$).

At the second month, G4 and G5 had significantly higher tensiometric values in comparison with the control subjects (G1). G4 also showed a significantly better value than G2. No differences were recorded between two groups in which different doses of b-FGF used.

Comments

Growth factors are generally known to activate cellular and molecular response during wound healing. b-FGF has an ability of promoting angiogenesis, fibroproliferation and eventually collagen accumulation. McGee and colleagues reported that local injection of b-FGF can accelerate wound healing in rats. In 2002, Aachen group carried out a rat study using meshes and revealed that the alteration of the scar composition is closely connected to an increased b-FGF expression. b-FGF and count of fibroblasts highly correlated. In 2004, Dubay et al., in another rat model, showed that treatment with polymer rods with delayed-released b-FGF significantly increased abdominal wound breaking strength. One year later, Korenkov and colleagues studied another incisional hernia model and local administration of growth factor. They used Vicryl mesh and intramuscular transforming growth factor beta injection. However, local application of TGF-β1 did not augment the strength of abdominal wall after 6 weeks. Recently, Günes et al. reported that bFGF had a positive effect on tensile strength, hydroxyproline content, and wound healing parameters in abdominal wall fascia of rats.

In fact, the doses of growth factors that should be given in human beings have not been determined exactly. Different doses were used in different studies to date. The present study also tested two different doses and found no difference between 1 µg and 5 µg doses. Both doses were found to be beneficial in abdominal wound healing. As a results, the present study supported the observation that b-FGF may effective in increasing abdominal wall strength.

Conclusion

The use of b-FGF loaded polypropylene mesh may be more effective in repair of incisional hernias in comparison with standard polypropylene mesh.

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