



Original article

Histopathological and Immunohistochemical Analysis of the Use of Collagen Dressing as a Reinforcement of Esophagic Anastomosis in a Rat Experimental Model^{☆,☆☆}

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ABSTRACT

Introduction: One of the most severe complications after esophagectomy is anastomotic dehiscence. The use of collagen sponges could be an effective way to resolve this complication. Our objective was to perform an experimental model of esophageal anastomosis in rats to study these mechanisms.

Methods: A total of 50 Sprague-Dawley rats were used divided into 2 groups, Tachosil[®] group (n=25) and control group (n=25). After the section of the abdominal esophagus a single-layer esophago-gastric anastomosis was performed reinforced with 1 cm of Tachosil[®] wrapping the anastomosis in group 1.

A functional study was performed using manometry as well as histopathological and immunohistochemical studies for angiogenic, fibrogenic and growth factors.

Results: The mortality in our series was 8% in the collagen dressing group, compared to 36% in the control group. When esophageal manometry was performed, the dehiscence pressure was higher in the reinforced anastomosis. On microscopical analysis, in the collagen dressing group a profuse inflammatory reaction with abundant neutrophils and macrophages surrounded by a connective matrix with fibroblasts and blood vessels was observed, the expression of VEGF, FGF1 and FGF2 was noticeably higher in the collagen dressing group.

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Conclusions: These results show that the application of collagen dressing facilitates tissue repair phenomena, and therefore could be very useful as a reinforcement of esophago-gastric anastomosis to prevent dehiscence.

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Análisis histopatológico e inmunohistoquímico del uso del apósito de colágeno como refuerzo de anastomosis esofágica en un modelo experimental en rata

R E S U M E N

Palabras clave:

Fístula anastomótica

Rata

Apósito adhesivo

Cicatrización

Esófago

Estómago

Esofagotomía

Introducción: Una de las complicaciones más graves tras la cirugía de resección esofagagástrica es la dehiscencia de la anastomosis. El uso de apósitos adhesivos podría constituir una ayuda eficaz para resolver esta complicación. Nuestro objetivo ha sido realizar un estudio experimental encaminado a estudiar dichos mecanismos en un modelo de anastomosis esofágica en rata.

Métodos: Se han utilizado un total de 50 ratas Sprague-Dawley divididas en 2 grupos, grupo Tachosil® (n=25) y grupo control (n=25). Tras la sección del esófago abdominal se realizó una anastomosis esófago-gástrica monoplaneo, reforzando con una tira de 1 cm de Tachosil® envolviendo la anastomosis en el primer grupo.

Se realizó un estudio funcional mediante manometría, así como un estudio histopatológico e inmunohistoquímico para factores angiogénicos, fibrogénicos y proliferativos.

Resultados: La mortalidad en nuestra serie alcanzó un 8% en el grupo en el que fue aplicado apósito de colágeno, frente a un 36% del grupo control. Al realizar la manometría esofágica, la presión de dehiscencia fue mayor en las anastomosis reforzadas. En el estudio microscópico, en el grupo en el que se aplicó apósito de colágeno se apreció una profusa reacción inflamatoria con abundantes PMN y macrófagos rodeados por una matriz conectiva con fibroblastos y vasos sanguíneos. La expresión de VEGF y FGF1 y FGF2 fue sensiblemente mayor en las anastomosis con apósito de colágeno.

Conclusiones: Estos resultados indican que la aplicación de apósito de colágeno facilita los fenómenos de reparación tisular, por lo que podría ser de gran utilidad como refuerzo de las anastomosis esofagagástricas para la prevención de dehiscencias.

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Introduction

One of the most serious complications after esophagogastric resection surgery is anastomotic dehiscence, with a prevalence that ranges between 3% and 12% in the main published series.¹ The use of adhesive patches could be an effective and reliable aid to resolve this complication.² Collagen dressings (Nycomed, Takeda, Zurich, Switzerland) are collagen sponges containing human fibrin and thrombin that, when in contact with physiological fluids, transform into a firm and mechanically stable network of fibrin with positive properties.³ There have been some experimental studies about the use of collagen dressings in gastrointestinal surgery⁴ with good results in reducing the rate of dehiscence.⁵ Although the usefulness of collagen dressings in experimental esophageal surgery has been confirmed,⁶ the physiological mechanisms of tissue repair that occur after the application of the sponge in this area have not been studied in detail.

Our objective was to perform a clinical, functional and histopathological study aimed at studying these mechanisms in an experimental model of esophageal anastomosis in rats.

Methods

To achieve the proposed goal, a total of 50 Sprague-Dawley (SD) male rats were used, weighing 210–240 g at 4 weeks of age. The animals were divided into 2 groups, the Tachosil® group (n=25) and control group (n=25), according to the application or not of Tachosil® once the suture was completed.

Surgical intervention: after anesthesia of the animal with a combination of intraperitoneal ketamine–xylazine (50 mg/kg and 10 mg/kg, respectively), a 3-cm midline laparotomy was performed and the abdominal esophagus was dissected at the cardias. The single-plane esophagogastric anastomosis was performed manually with 3 PDS 6/0 sutures. In the Tachosil® group, the anastomosis was reinforced with a 1-cm strip of Tachosil® (Fig. 1), whereas in the control group no reinforcement was used. The animals were kept under daily observation with a solution of water and buprenorphine (0.1 mg/kg) and food ad libitum during the entire duration of the experiment. This study was carried out with the approval of the Animal Experimentation Ethics Committee of the Murcian Institute of Biosanitary Research.

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