



## Original research

# The effect of methylprednisolone and tenoxicam on the protection of damage of the nerve physiormorphology caused by prolene mesh



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## H I G H L I G H T S

- Prolene mesh used in hernia repair caused increased inflammation and fibrosis and effected latency and denervation negatively.
- We investigated methylprednisolone and tenoxicam's prevention effect of nerve changes caused by prolene mesh graft.
- Single dose methylprednisolone administration decreased nerve damage and inflammation.
- Daily administration of methylprednisolone and tenoxicam for 4 weeks caused increased inflammation and fibrosis.
- Daily administration of methylprednisolone and tenoxicam for 4 weeks wasn't affective on protection of nerve physiormorphology.

## A R T I C L E I N F O

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## A B S T R A C T

**Introduction:** Aim was to investigate the effect of methylprednisolone and tenoxicam on the protection of damage of the nerve physiormorphology caused by prolene mesh used in hernia repair.

**Methods:** Fifty male Wistar-albino rats weighing 250–350 gr, were randomly divided into 5 groups. Sciatic nerve was dissected in all rats after performing EMG on basal neural transport. In group 1, only sciatic nerve manipulation was performed. Other groups received a monofilament polypropylene cuff around the sciatic nerve. No additional procedure was performed in group 2. In group 3, 2 mg/kg single dose methylprednisolone was injected around the nerve and mesh. In group 4 and 5, 0.5 mg/kg/day methylprednisolone and 1 mg/kg tenoxicam was injected around the nerve and mesh for 4 weeks, respectively. Neural transport was evaluated by electromyography 4 weeks later and compared with pre-procedural values. Then the rats were sacrificed and, sciatic nerves including 1 cm around the mesh were excised. Inflammation and fibrosis were scored histopathologically.

**Results:** While basal latency was similar, postoperative latency was significantly different among groups. Latency was significantly longer in group 2 than the group 1. It was significantly shorter in group 3 when compared to group 2 ( $p = 0.007$ ). Preoperative and postoperative amplitudes were similar among groups. Denervation was significantly different among groups ( $p < 0.05$ ). Denervation was higher in group 2 than group 1. It was similar to group 2 in study groups. Inflammation and fibrosis was significantly different among groups ( $p < 0.05$ ). Inflammation and fibrosis scores were significantly higher in group 2 than group 1. The highest inflammation and fibrosis scores were detected in repetitive drug administrated groups. Although it wasn't statistically significant, inflammation was lower in single dose steroid administrated group than group 2. Similarly, the highest fibrosis scores were detected in repetitive drug administrated groups. Single dose steroid administration didn't increase fibrosis when compared to group 2.

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**Conclusions:** Prolene mesh used in hernia repair caused increased inflammation and fibrosis and effected latency and denervation negatively. Single dose methylprednisolone administration decreased nerve damage and inflammation. On the other hand, daily administration of methylprednisolone and tenoxicam for 4 weeks caused increased inflammation and fibrosis and wasn't affective on protection of nerve physiomorphology.

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## 1. Introduction

Inguinal hernia is one of the most common diseases in General Surgery clinics. Tension-free hernioplasty with graft is widely accepted because of low recurrence rate [1–3]. In recent years, the new techniques are being used in inguinal hernia operations especially in laparoscopic area. It's important to take into consider not only compare these techniques to each other or to open surgery but also learning curve and applicability of technique, post-operative performance and hospitalization period of patient, complications, recurrence rate and cost of operation. Pain may occur after inguinal hernia operations and may affect quality of life and work performance of patient. This pain is associated with various factors such as partial or complete cut of iliohypogastric and genitofemoral nerves, crushing, electrical damage, suture compression, and ischemia. But chronic pain can occur despite avoidance of nerve injury, gentle dissection and even non-existing of nerve damage. In recent studies showed that prolene mesh which is used for histopathological and electrophysiological effect can cause fibrosis which has negative impact on nerve.

In this study, we aimed to investigate activity of methylprednisolone and tenoxicam's prevention effect of nerve physiomorphological changes which caused by prolene mesh graft.

## 2. Material and methods

This study was approved by the Ethics Committee of Gaziosmanpasa University Faculty of Medicine. Rats were obtained from the Gaziosmanpasa University Experimental Research Center. All animals received humane care in accordance with local laboratory animal research regulations. Fifty male Wistar-albino rats, weighing 250–300 g, were randomly allocated into five groups ( $n = 10$  per group). All operative processes and follow-ups were held at Gaziosmanpasa University Animal Studies Research Center. Rats were housed in wire cages with free access to food and water under standard laboratory conditions (room temperature 23 °C, 12-h light–dark cycles). They were fasted 12 h before operation, but had free access to water. Before the operative process, anesthesia was induced by intraperitoneal injection of ketamine hydrochloride (75 mg/kg, Ketalar, 500 mg flacon, Pfizer Istanbul) and xylazine hydrochloride (10 mg/kg, Rompun % 2 Flacon, Bayer Istanbul). Under general anesthesia, rats were fixed to the operating table in the prone position and electromyography (EMG) of the left sciatic nerve was performed in each model. Next, the hair along the left buttock and gluteal area was shaved with an electrical razor, and with the aid of a surgical microscope the left sciatic nerve was explored.

**Group 1 (Control group)**-In this group only sciatic nerve of rats were dissected and no medications were administered.

**Group 2 (MFPPM group)**-In this group, after sciatic nerve dissection, a  $1 \times 1$  cm monofilament polypropylene (PP) mesh was wrapped around the nerve to investigate effect of monofilament polypropylene mesh on nerve conduction and histopathological change (Fig. 1). No medications were administered.

**Group 3 (MFPPM-SDMP group)** – In this group, after sciatic nerve dissection, a  $1 \times 1$  cm monofilament PP mesh was wrapped around the nerve to observe short term effects on nerve conduction and histopathological change. 1 dose of 2 mg/kg methylprednisolone was administered around nerve and graft area.

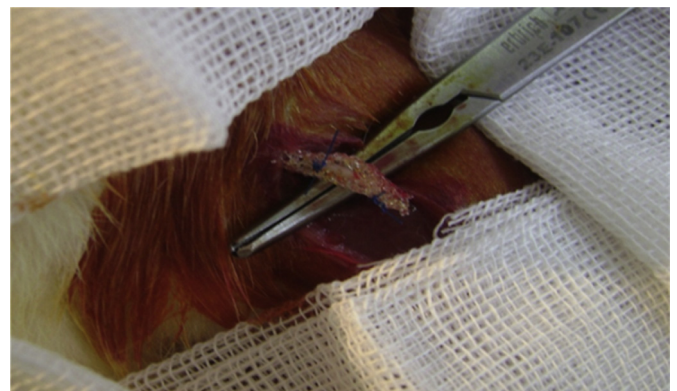
**Group 4 (MFPPM-MP group)**- In this group, after sciatic nerve dissection, a  $1 \times 1$  cm monofilament PP mesh was wrapped around the nerve to observe long term effects on nerve conduction and histopathological change. 0.5 mg/kg methylprednisolone per day for 4 weeks was administered around nerve and graft area.

**Group 5 (MFPPM-NSAI group)**-In this group, after sciatic nerve dissection, a  $1 \times 1$  monofilament PP mesh was wrapped around the nerve to observe long term effects on nerve conduction and histopathological change. 1 mg/kg tenoxicam per day for 4 weeks was administered around nerve and graft area.

Incisions were closed in anatomic layers with 4-0 monofilament prolene sutures and rats were resuscitated with a subcutaneous injection of saline (8–10 mL/kg) to the dorsal area. Four weeks after the initial intervention, rats were reanesthetized with an intraperitoneal injection of ketamine hydrochloride (75 mg/kg) and xylazine (10 mg/kg). Under general anesthesia, rats were fixed to the operating table in the prone position and EMG of the left sciatic nerve was reperformed for comparison with preoperative EMG results. All animals were sacrificed with high-dose Pentothal (200 mg/kg, Thiopental Sodium, 0.5 G IE Ulugay, Istanbul), and the left sciatic nerve and the prosthesis were resected en-bloc with 1-cm proximal and distal margins for histopathological analysis.

### 2.1. Electromyography procedure

Under general anesthesia, sciatic nerve trace and gastrocnemius muscles were localized. EMG assessments were performed with a Nihon Kohden Neuropack  $\mu$ EMG Instrument (Nihon Kohden Corporation). Recording was done with a disposable concentric needle electrode, nerve stimulation by small bipolar nerve stimulator, and



**Fig. 1.** Monofilament PP mesh which is wrapped around the nerves. A  $1 \times 1$  cm monofilament polypropylene mesh was wrapped around the nerve to investigate effect of monofilament PP mesh on nerve conduction and histopathological change.

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