Comparison of adhesion reformation after laparoscopic and conventional adhesiolysis in an animal model

Introduction

Peritoneal adhesions are undesirable but unavoidable sequelae of abdominal surgery. Frequency and extent increases with the dimension of the operation performed. Nearly 6% of all patients who have undergone celiotomy with intra-abdominal and pelvic surgery must be reoperated on for adhesion-related complications [3, 9].

Surgical dissection of adhesions is the only approach to deal with those complaints and complications. Most surgeons generally deny elective adhesiolysis in symptomatic patients without any objective evidence of intestinal obstruction. Their argument is the likelihood of adhesion reformation with the possibility of symptoms that are worse than before.

Laparoscopic adhesiolysis, however, may reduce the reformation of adhesions as a result of its minor operative trauma. Therefore, we performed this animal study comparing the reformation of adhesions after laparoscopic with that after conventional adhesiolysis.

Methods

The animals were kept under standard laboratory conditions and operated on under sterile conditions using intravenous anesthesia (ketamine and xylazine). A total of 36 rabbits underwent induction
of standardized adhesions via a 4-cm median laparotomy. An area of 6 cm² of the cecum was deserosalized and fixed to the right lateral abdominal wall by two 5–0 polypropylene single sutures. The abdominal incision was closed by 3–0 polyglactin running suture, the skin by single 3–0 polyglactin sutures.

Six weeks after this first operation, 24 randomly selected rabbits underwent laparoscopic adhesiolysis. After insufflation of CO₂ through a Veress-needle with a pressure of 5 mmHg, a 5-mm optic trocar and two 3-mm trocars were inserted into the left abdomen semicircular to the right lateral abdominal wall. Twelve animals (group 1) underwent a sharp and a blunt dissection of the cecum and adherent abdominal wall, performed using scissors and graspers. Localized bipolar electrocautery was applied to control major bleeding. In another 12 rabbits, monopolar electrocautery was used for dissection (group 2). At the end of the operation, the pneumoperitoneum was evacuated, the cannulae were removed, and the skin wounds were repaired using single 3–0 polyglactin sutures.

The remaining 12 rabbits (group 3) underwent conventional adhesiolysis via a left paramedian incision of 6 cm in length. The adhesions between cecum and the right lateral abdominal wall were dissected using scissors. Control of major bleeding was achieved by bipolar electrocautery. A continuous 3–0 polyglactin suture was used to close the abdominal cavity without suturing the peritoneum. The skin wound was closed using interrupted 3–0 polyglactin sutures.

On the eighth day after surgical adhesiolysis, all rabbits were killed by an overdose of pentobarbital. Postmortem examination was carried out via a right paramedian incision for complete exploration of the peritoneal cavity. All adhesions and their adjacent organs were localized and dissected. The surface area involved in adhesions of all organs was quantified by computer-aided morphometry using a digitizer board connected to a personal computer running custom-made software [15]. Statistical analysis of the adhesion surface areas was carried out using the Wilcoxon-Mann-Whitney-U test (data as median and interquartile range). The student’s t-test was used for analysis of the operating times (data expressed as mean±SD).

**Results**

After the first operation, all rabbits developed adhesions between cecum and right lateral abdominal wall as intended (Fig. 1). There were no adhesions to the abdominal incisions. Operating time for adhesiolysis was 35±15 min for the laparoscopic and 30±8 min for the conventional approach. There was no significant difference between groups.

All 36 rabbits survived without wound infections or other complications until the eighth day after adhesiolysis. Reformation of adhesions occurred in all groups (Fig. 2). At postmortem examination, only 79% of the rabbits treated laparoscopically but all of the laparotomized animals had developed new adhesions. The overall area of adhesions was greater after conventional (2724 mm², 1664–3130 mm²) than after laparoscopic adhesiolysis (228 mm², 19–653 mm²; \( P<0.001 \)). Laparoscopic dissection of adhesions by monopolar electrocautery led to an overall extent of adhesions of 307 mm² (21–689 mm²; Table 1, Fig. 3). This did not differ from standard laparoscopic adhesiolysis (\( P>0.05 \)). There were no adhesions to the trocar wounds after standard laparoscopic adhesiolysis and only a minor extent of adhesions to trocar sites after laparoscopic electrocautery (Fig. 4). The conventional group, however, showed an interquartile range from 0 mm² to 477 mm² of adhesions involving the abdominal incision (Table 1). Reformation of adhesions to the right lateral abdominal wall caused a larger area after open (1532 mm², 1104–2137 mm²) than after laparoscopic adhesiolysis (Table 1, Fig. 5). There was no significant difference between each laparoscopic dissection technique with regard to the surface area of adhesions to the right lateral abdominal wall (Table 1, Fig. 5). The interenteric adhesions predominantly developed between the adhesiolysed cecum and the neighboring colon and ileum. The extent of those adhesions was...