INTRODUCTION

Despite an increase in the proportion of surgeries that are performed by laparoscopy, complications arising from post-surgical adhesions are still a major cause of bowel obstruction, chronic pelvic pain and female infertility. Adhesions occur when ischemia, foreign material or infection disrupts the peritoneum and initiates an inflammatory cascade that culminates in the formation of dense fibrous bands between affected organs. A liquid instillate, or a gel, which could be applied through a laparoscopic trocar would be more appropriate for closed procedures. We have previously demonstrated that fucoidan, a polymer extracted from marine algae, significantly decreases adhesion formation when administered locally as a gel after cecal sidewall in rats (Figures 1 and 2) or intraperitoneally as a solution in both rats (Figures 3 and 4) and rabbits (Figures 5 and 6) after uterine horn-sidewall surgery. The objective of this work was to evaluate the safety of intraperitoneal fucoidan solution administration after abdominal surgery in rabbits. Our hypothesis was that fucoidan solution would have no effect compared with control Lactated Ringer’s Injection USP (LRS) on coagulation parameters, hematological parameters, presence of blood in the abdominal cavity, or body weight following bowel abrasion surgery with bleeding and intraperitoneal administration in rabbits.

METHODS

Bowel abrasion surgery was undertaken in White New Zealand rabbits as detailed in Figure 7. Following surgery 60 mL of control LRS or 0.03% w/v fucoidan solution was instilled into the abdomen using a syringe with a 16-gauge blunt needle (n = 16 per group). Blood samples were taken from the ear for coagulation and hematological analysis at 0, 1, 4, 8, 12 and 24 hours post surgery. Animals underwent necropsy at 24 hours post surgery during which time a peritoneal fluid red blood cell count was performed to measure blood in the abdominal cavity. Rabbits were weighed at 0 and 24 hours post surgery.

RESULTS

A. No significant difference in clotting time as measured by the activated partial thromboplastin time (aPTT) and prothrombin time (PT, standardized as international normalized ratio, INR) was observed between rabbits receiving control LRS and 0.03% w/v fucoidan solution at any time point examined (Figure 8).

B. No significant difference in any hematological parameter at any time point was observed between the group receiving control LRS and the group administered 0.03% w/v fucoidan solution (Figure 9).

C. No significant difference in RBC counts from the peritoneal fluid obtained at necropsy was observed between the rabbits administered control LRS and the rabbits that received 0.03% w/v fucoidan solution (Figure 10).

D. Both groups of rabbits lost a small amount of weight during the 24 hours after surgery and there was no significant difference between the control LRS and 0.03% w/v fucoidan solution groups (Figure 11).

CONCLUSIONS

- Fucoidan solution had no effect on hematological parameters, coagulation parameters, abdominal bleeding, or body weight following bowel abrasion surgery with bleeding and intraperitoneal administration in rabbits.
- Fucoidan solution was easily administered intra-abdominally after bowel surgery in rabbits.
- Fucoidan fucoidan solution was safely administered intraperitoneally in rabbits following abdominal surgery with bleeding and is a promising candidate for the reduction of adhesion formation in laparoscopy and laparotomy procedures.