The effects of Curcuma Longa extract on fibroblast count and collagen density in left colon anastomosis with acute intraoperative loss of 15% circulating blood volume in rats

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ABSTRACT

Introduction: Intestinal anastomosis leakage is a significant concern following intestinal suturing due to its potential to cause morbidity and mortality. Curcuma longa, commonly known as turmeric, has been observed to have wound-healing properties by promoting collagen deposition and increasing the number of fibroblasts. However, the effect of Curcuma longa on left colon anastomosis with acute intraoperative loss of 15% circulating blood volume is unknown. This study aimed to determine the impact of oral administration of Curcuma longa extract on the number of fibroblasts and collagen density in the left colon anastomosis with acute intraoperative loss of 15% circulating blood volume.

Methods: This is an experimental study; the researchers investigated the effect of Curcuma longa extract on the healing process of colon anastomosis in white rats - Rattus norvegicus.

Results: A total of 30 white rats - Rattus norvegicus underwent laparotomy for left colon anastomosis resection, and they were randomly divided into two groups. One group was given Curcuma longa extract orally after surgery, and the other group did not receive it. After five days of treatment, the group that received Curcuma longa extract orally had a significantly higher mean number of fibroblasts (1168.13) compared to the control group (749.60) (p-value: 0.006). Moreover, the collagen density in the treated group was also higher, with a density range of 50-72% (60% of rats) and 75-100% (33.30% of rats), compared to the control group's density range of 25-50% (66.70% of rats) and 10-25% (13.30% of rats) (p-value: 0.000).

Conclusion: Oral administration of Curcuma longa extract can increase the number of fibroblasts and collagen density in the left colon anastomosis with acute intraoperative loss of 15% circulating blood volume.

Keywords: acute intraoperative loss, collagen density, Curcuma longa, fibroblast, left colon anastomosis.

INTRODUCTION

Intestinal anastomosis leakage is a significant concern following intestinal suturing due to its potential to cause morbidity and mortality. Anastomotic leakage is known to occur more frequently after surgery on the left colon at 5.9% compared to 2.7% in the right colon in emergency cases.1 with high mortality rates of 3.2% for the right colon and 10.9% for the left colon.2,3 This is partly due to a high bacterial load and anatomic variation of distal colon vascularization. The presence of bacteria in healing tissue affects all healing processes and increases disruption of collagen synthesis and release of proteolytic enzymes, which can lead to dehiscence by reducing the tissue suture holding capacity.4 One important factor in the success of anastomosis surgery to prevent anastomotic leakage is the wound healing process.5,6 Curcuma longa, commonly known as turmeric, has been observed to have wound healing properties by promoting collagen deposition and increasing the number of fibroblasts. However, the effect of Curcuma longa on left colon anastomosis with acute intraoperative loss of 15% circulating blood volume is unknown. This study aimed to determine the impact of oral administration of Curcuma longa extract on the number of fibroblasts and collagen density in the left colon anastomosis with acute intraoperative loss of 15% circulating blood volume.7-10

METHODS

This is experimental study. A total of 30 rats were included in the study, divided into two groups of 15 rats each using a simple randomization design. The procedure involved laparotomy, acute intraoperative loss of 15% circulating blood volume by aspirating 15% of the estimated blood volume through the inferior vena cava, resection of the left colon, and anastomosis with simple interrupted stitches. The rats were given either Curcuma longa extract at a dose of 40 mg/kg body weight or a placebo orally. After five days of treatment, the operator performed re-laparotomy and resected the colon 2 cm proximal to the anastomosis and 2 cm distal to the anastomosis. The
number of fibroblasts and collagen in each group was assessed to determine the difference in the healing process. The fibroblast samples were stained with hematoxylin-eosin. The collagen samples were stained with Masson's Trichrome. The data all specimens were analyzed using SPSS version 23.0 for windows. Numerical data will be compared using independent t-test or mann whtney test, all value considered significant if p<0.05

RESULTS

The characteristics of the research subjects were based on the age and weight of the rats shown in Table 1.

The normality test of fibroblast is shown in Table 2. The fibroblast count are shown in figure 1 and figure 2 and statistical analysis are shown in Table 3 for control and treatment group. The Mann-Whitney test results showed that the number of fibroblasts in the treatment group was significantly higher than that in the control group (p-value 0.006).

Collagen density score shown in Table 4, control group, the collagen density tended to be in the range of 25-50%, with 10 out of 15 rats or 66.70% and 10-25% with 2 out of 15 rats or 13.30% (Figure 3). Meanwhile, for the treatment group, the density tended to be in the range of 50-72%, with 9 out of 15 rats or 60% and 75-100% with 5 out of 15 rats or 33.30% (Figure 4). The Mann-Whitney test showed significant differences between the 2 group (p-value 0.000).

DISCUSSION

Previous studies have reported the positive effects of curcumin in accelerating wound healing and increasing the number of fibroblasts and collagen. Topical application of curcumin has been shown to significantly reduce wound healing time in rats with grade two burn injury, while oral administration of curcumin extract for five days can increase the number of fibroblasts and collagen density in a rat model.11-13 Research on curcumin absorption in animal models has shown that it is very good in the gastrointestinal tract.14 Curcumin's wound healing activity occurs by reducing the inflammatory phase by controlling the production of tumor necrosis factor alpha (TNF-α) and interleukin-1 (IL-1), two main cytokines released from monocytes and macrophages that play a crucial role in regulating the inflammatory response. Curcumin also regulates Nuclear Factor κB (NF-κB) by suppressing kinase activity. By binding to Inhibitor κB (IκB), curcumin suppresses inflammation caused by the activation of NF-κB.
Histopathological specimens were obtained and stained with Hematoxylin-eosin to evaluate fibroblasts using a light microscope with 400x magnification in five fields of view. This study found that the number of fibroblasts in the treatment group was significantly higher than in the control group, and the Mann Whitney test showed that the difference was statistically significant with a p-value of 0.006.

Collagen, which is abundant in the extracellular matrix, is considered a main structural element that assists chemotaxis, migration, and provides strength and regulates the adhesion of new cells. In a previous experimental study, Sarwenda et al. demonstrated that Curcuma longa has a good wound healing effect. The study was conducted on small intestine anastomosis in animal models, where oral administration of Curcuma longa extract had an effect on the anastomosis by increasing the number of fibroblasts and collagen density. Another study by Foster et al. also reported a significant decrease in collagen density in the group that underwent anastomosis resection with acute bleeding conditions of 10% blood volume. Whether the decrease in collagen density is caused by a decrease in collagen synthesis or an increase in collagen lysis is still uncertain. Overall, this study shows that the administration of Curcuma longa extract with 15% intraoperative acute bleeding condition on the left colon can accelerate the healing of intestinal anastomosis.

CONCLUSION

Oral administration of Curcuma longa extract has an effect on left colon anastomosis with acute intra operative loss of 15% circulating blood volume by increasing the number of fibroblasts and collagen density.

DISCLOSURES

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Ethical consideration
This study has been approved by Animal Care and Use Committee, Faculty of Veterinary, Universitas Airlangga, with ethical clearance reference number 2.KEH.021.02.2023.

Conflicts of Interests
There are no potential conflicts of interest to declare.

Author Contribution
Tomy Lesmana involved in concepiting, designing and supervising the manuscript. Nasrul Haidi conducts the study and analyses the data. All authors prepare the manuscript and agree for this final version of manuscript to be submitted to this journal.

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