

# The Comparison Effect between Albumin Infusion and Normal Protein Diet on the Acceleration of Wound Healing: A Randomized Control Trial

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**Keywords:** Hypoalbuminemia, albumin infusion, nutrition, wound healing.

**Abstract:** The aim of this study was to compare the role between albumin infusion or normal protein diet in the process of wound healing during the state of hypoalbuminemia. The samples were fifteen Sprague Dawley Rats that met inclusion criteria which were fed with casein for standardization and fed with casein 2% for 14 days to induce the state of hypoalbuminemia. Then the samples were divided into three groups: group (A) preoperative albumin infusion, group (B) pre and postoperative 20% diet casein, and group (C) fed with 2% casein as control. The four incisions (2 cm each) were made on the back of the rat, kept in sterile dressing, and evaluated on day 1, 3, 5, and 7. Measurement of the wound area using VisiTrak and statistical analysis used ANOVA methods. The acceleration of wound healing in the hypoalbuminemia group starting on the third day and maximal acceleration was achieved by feeding the protein on the fifth day sooner than albumin infusion group.

## 1 INTRODUCTION

Wound is discontinue of the tissue or skin that may be caused by trauma, surgical procedures, neuropathic, vascular disorders, suppression and malignancy (Baranoski, *et al.*, 2003; Dipietro, Luisa, Aime, Burns, 2003). The process of wound healing on the damaged tissue begins increased cellular activity and metabolic intensity. The wound healing process occurs in 3 phases: (1) the inflammatory phase, (2) the proliferative phase and (3) the remodeling phase (Hess and Cathy, 2002; Dipietro, Luisa, Aime, Burns, 2003; Enoch and Price, 2004). In all phases of wound healing requires adequate blood flow, tissue perfusion and oxygenation (Jonsson, *et al.*, 1991; Leaper, 2007). In patients with malnutrition with less nutritional adequacy would have a high risk of infection, wound healing time, and length of stay in the hospital. One of the proteins that are important in the wound healing process is albumin (Haydock and Hill, 1986; Agung and Hendro, 2005).

The study of pre operative albumin levels associated with long-term complications of wound healing with

normal albumin levels was significantly associated ( $p < 0.05$ ) with post operative wound healing, 23% - 52.46% in elective and 29% found in 44% of patients with orthopedic surgery (Haydock and Hill, 1986; Agung and Hendro, 2005).

Protein is needed in every stage of wound healing of the inflammatory phase, the proliferative phase and the formation of granulation until the remodeling phase. One of the roles of proteins is the formation of collagen tissue to determine the strength of the wound. Low protein intake even in a short time can affect the speed of wound healing significantly (Agung and Hendro, 2005).

So in this study we wanted to prove the role of albumin either be given normal protein diet and given preoperative albumin infusion to the circumstances hypoalbuminemic prior to the occurrence of an injury, so that it can be used as a reference for the management of the use of albumin in the state hypoalbuminemia who will do the surgery planned or emergency, so as to help reduce mortality and morbidity.



Figure 1: Sprague Dawley Rats : (A) kept in steril dressing; (B) incisions 2 cm each; and (C) healed wound.

## 2 MATERIAL AND METHODS

This research was an experimental research. The design used in this research is *randomize post test only control group design*. The samples were fifteen Sprague Dawley Rats that met inclusion criteria which were fed with casein for standardization and fed with casein 2% for 14 days to induce the state of hypoalbuminemia. Then the samples were divided into three groups: group (A) preoperative albumin infusion, group (B) pre and postoperative 20% diet casein, and group (C) fed with 2% casein as control. The four incisions (2 cm each) were made on the back of the rat, kept in sterile dressing, and evaluated on day 1, 3, 5, and 7 (Figure 1). Heal skin tissue when fused with the tensile strength 2.62 N / mm<sup>2</sup>, was not found signs of inflammation, observed 7 days after injury (Forrest and Corter, 1995 ; Gottrup, Melling, and Hollander, 2005). Measurement of wound area used visitrak tool and statistical analysis used ANOVA methods.

## 3 RESULTS

At the beginning of albumin analysis with homogeneity between groups using the Tukey HSD ( $p = 0.129$ ) obtained a homogeneous variance. And the Kolmogorove-Smirnov normality test of Z obtained the normal distribution ( $p = 0.490$ ). To know the difference between the initial albumin group used one-way analysis of variance (one-way ANOVA) obtained the value of  $F = 2.200$  and  $p = 0.016$ . Initial albumin difference between groups did not show any significant difference, and this group has a homogeneous distribution.

Measurement of wound area using visitrak tool and with statistical analysis seen in table 1, on day 3 of wound on preoperative albumin infusion (A) were almost the same as normal protein diet (B), but on day 5 in normal protein diet (B) an acceleration of wound closure were faster than preoperative albumin infusion (A) and on the seventh day of normal protein diet (B) showed faster wound healing compared to preoperative albumin infusion (A).

Table 1: Comparison of mean and standard deviation of wound days to 1,3,5,7 after surgery between groups: group (A) preoperative albumin infusion, group (B) pre and postoperative 20% diet casein, and group (C) fed with 2% casein (hypoalbumin) as control.

Group	Wound's Width				n
	Mean $\pm$ SD				
	1	3	5	7	
A	5,40 $\pm$ 1,81	3,40 $\pm$ 1,14	2,40 $\pm$ 0,89	2,60 $\pm$ 1,52	5
B	5,40 $\pm$ 0,89	3,40 $\pm$ 1,14	1,80 $\pm$ 0,84	1,80 $\pm$ 0,84	5
C	6,00 $\pm$ 1,58	6,20 $\pm$ 1,92	5,80 $\pm$ 1,48	5,60 $\pm$ 0,90	5

In the state of hypoalbuminemia (C) widened the wound area still same until the seventh day, but we got a slowing of wound closure in preoperative

albumin infusion (A) and normal protein diet (B) (Figure 2).

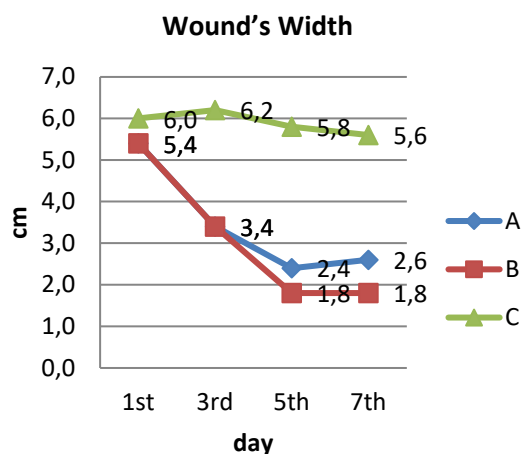


Figure 2: Wound's Width.

## 4 DISCUSSION

This study described the role of albumin on wound healing in hypoalbuminemia state. Improving the hypoalbuminemia state by using an preoperative albumin infusion or normal protein diet was a solution to this problem, since albumin was one of the important proteins in the wound healing process (Haydock and Hill, 1986; Agung and Hendro, 2005).

To obtain an optimal wound healing was needed nutritional adequacy. In people with malnutrition will had a high risk of infection, prolong wound healing, prolong hospitality, and increased risk of death (Pedersen, 1992). This situation can be due to decreased synthesis of proteins needed for growth and repair of cells, which may affect metabolic function and decrease the body's immune response, duration of the inflammatory phase, a decrease of fibroblasts, the synthesis of proteoglycans, collagen, neoangiogenesis and improved form of injury (Stadelmann, Digenis, and Tobin, 1998; Hunt, Hopf, and Hussain, 2000). Patients with serum albumin levels above 3 gm/dl were much more likely to have uncomplicated wound healing (Casey *et al.*, 1983).

Measurement of wound area using visitrak tool and with statistical analysis seen in table 1, on day 3 of wound on preoperative albumin infusion (A) were almost the same as normal protein diet (B), but on day 5 in normal protein diet (B) an acceleration of wound closure were faster than preoperative albumin infusion (A) and on the seventh day of normal protein diet (B) showed faster wound healing compared to preoperative albumin infusion (A). This

is according to research Repertinger (2004) occurred after the fifth full reepitelialisasi EGFR wild-animal in mice, whereas the increase in epithelial proliferation has begun on day three (Repertinger *et al.*, 2004).

In the state of hypoalbuminemia (C) widened the wound area still same until the seventh day, but we got a slowing of wound closure in preoperative albumin infusion (A) and normal protein diet (B) (Figure 2).

In this study the contribution to normal protein diet did not differ significantly with preoperative albumin infusion to help repair damaged tissue. So we argued for giving nutritional and or albumin infusion on hypoalbuminemia state may affected directly or indirectly the target tissue, particularly affect cytokine production and inflammation and affect the expression of proteins and growth factors required in the wound healing process.

## 5 CONCLUSION

The acceleration of wound healing in the hypoalbuminemia group starting on the third day and maximal acceleration was achieved by feeding the protein on the fifth day sooner than albumin infusion group.

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