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Intradermal suture effect using polypropylene materials on post-operative scar tissue in cases of lower extremities closed fracture cases



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ABSTRACT

Introduction: Hypertrophic scarring is the most common complication in postoperative wounds. One of the preventive measures for scarring is by adding intradermal sutures when closing the surgical wound. This study aims to prove that the addition of intradermal sutures using polypropylene materials can reduce the complications of scarring in postoperative wounds on lower extremities closed fracture cases under internal fixation procedure.

Method: Experimental studies using Randomized Controlled Trial Post Test Only Design were carried out in patients with lower extremity fractures in Saiful Anwar General Hospital, Malang. The sample was chosen by proportional sampling which was the group given the

treatment as well as the control group (n = 36). The variable measured was the clinical appearance of scar tissue formed 6 months after surgery using the Vancouver Scar Scale.

Result: The results showed that the addition of intradermal sutures using polypropylene materials had a significant effect on the formation of postoperative scar tissue. The total Vancouver Scar Scale score has a value of $p = 0.000$ ($\alpha = 5\%$) for Mann Whitney test.

Conclusion: The conclusion of this study is that the addition of intradermal sutures using polypropylene threads in cases of closed fractures with internal fixation can reduce the appearance of postoperative scar tissue.

Keywords: Hypertrophic scar, intradermal sutures, vancouver scar scale

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INTRODUCTION

In a simple sense, scarring is a sign of scarring, a matter that is avoided by surgeons. Clinically, scarring is a natural defect that occurs as a result of the wound healing process. This disruption of the healing process of the wound results in the formation of excessive scarring or abnormal scarring which can be either keloids or hypertrophic scars.¹⁻³

Hypertrophic scarring is the most common complication of surgical wounds. Hypertrophic scar causes itching, pain creates discomfort and is aesthetically wrong, and when it occurs in the joint area, hypertrophic scar can affect joint movement. Prevention of the possibility of an injury becoming an abnormal scar is essential in handling scar tissue.^{2,4}

Scar tissue formation is one part of the wound healing process, which is influenced by the number of fibroblast cells and fibrocytes formed. Fibroblasts are responsible for the process of deposits and remodeling of collagen and extracellular matrix needed to repair traumatized tissue. During the healing process, fibroblasts fill the granulation tissue and play a very important role.⁴

Prevention of the occurrence of abnormal scarring has begun to be carried out during surgery, which is by performing a surgical technique and proper wound care. The series of prevention of abnormal scarring is done with appropriate surgical

techniques: as little as possible removing tissue, eliminating dead space, avoiding hematoma, adaptation, and approximation of tissue, supporting sutures to reduce strain strength with nonabsorbable threads, removing skin sutures after the wound connection is strong enough. Prevention of infection in surgical wounds. The type of thread chosen is in the form of a more minimal mono-filament material which causes an inflammatory reaction in the wound compared to multi-filament thread, with the smallest size that can maintain the wound connection. Use of special needles for skin suturing. With the addition of intradermal sutures to distribute wound stress, maintain wound attachment and guarantee wound eversion.^{1,5-7}

Lower extremity is a limb that plays a role in daily life. Therefore management is needed comprehensively to be able to restore the function of this organ optimally so that individuals can return to carrying out their daily activities. Abnormal scarring can cause pain and limited mobility. Medical rehabilitation is needed to restore the function of the post-traumatic lower extremity. Management of rehabilitation is more complicated because special methods are needed to deal with conditions with abnormal scarring such as with scar tissue massage techniques to steroid injections.⁸

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Research on the effectiveness of adding intradermal sutures using polypropylene materials in reducing the occurrence of abnormal scar tissue in postoperative wounds has been carried out in the Dr. Saiful Anwar General Hospital, Malang. But the results of these studies are still limited to experimental animals. Therefore it is necessary to do further research on human subjects.

METHODS

The exploratory study was carried out using the Randomized Controlled Trial Post Test Only Design design using patients from Dr. Saiful Anwar General Hospital, Malang for 6 months, from November 2018 to April 2019, with cases of closed fractures in the lower extremities under internal fixation. In each sample that has been done internally, fixation will be given a treatment in the form of adding intradermal sutures using polypropylene materials to 50% of wounds during surgical wound closure and 50% of the remaining wound length is only sutured to the cuticle layer and is considered a control group.

Data will be presented in the form of tables and boxplots. Descriptive statistical techniques and input statistics using SPSS 20 were used by the authors in this study. Normality of the data will be tested by the Kolmogorov-Smirnov test. As for knowing the difference between Controls and Treatments, the authors use statistical tools that differ on average, namely Mann Whitney, because it is assumed that the Controls and Treatments are mutually independent (not affecting each other). The value of $p < 0.05$ indicates a statistically significant difference.

RESULTS

Descriptive analysis is intended to determine the general description of the research variables. Descriptive analysis is expected to provide an

overview of the state of the results of the data of Pigmentation, Vascularity, Pliability, Height, and Vancouver Scar Scale Total Score with cases of closed fractures of the lower extremities undergoing internal fixation surgery and obtaining treatment in the form of adding intradermal sutures in RSSA. To find out the description for each variable can be seen in [Table 1](#) & [Figure 1](#).

Based on the results of the descriptive analysis in [Table 1](#), pigmentation for Control, as many as 36 samples obtained an average value of 1.306 and a standard deviation of 0.668. For the treatment group, the average was 0.972, with a standard of 0.696. Vascularity for Control as many as 36 samples obtained an average value of 2.111 and a standard deviation of 0.523. For the treatment group, the average was 1.583, with a standard of 0.500. Pliability for Control as many as 36 samples obtained an average value of 2,250 and a standard deviation of 0,500. For the treatment group, the average is 1.722, with a standard of 0.454. Height to Control, as many as 36 samples obtained an average value of 1.583 and a standard deviation of 0.500. For the treatment group, the average was 1.222, with a standard of 0.422. Vancouver Scar Scale Total Score for Control, as many as 36 samples obtained an average value of 7.250 and a standard deviation of 1.052. For the treatment group, the average was 5.528, with a standard of 0.910.

Therefore, it can be concluded that there is a significant difference between the Control and Treatment-related to pigmentation, vascularity, pliability, height, vancouver. Where the value of control is higher than treatment ([Table 2](#)).

DISCUSSION

Suturing techniques are an essential factor to produce good post-operative wounds cosmetically. Suturing wounds can ideally produce maximum eversion of wounds, can maintain the strength of wound strain (Tensile Strength) during the wound healing process and can close the edges of the wound so as to minimize the risk of occurrence post suturing scar tissue. The above criteria can be fulfilled using intradermal sutures.^{1,9}

In the study, participating patients were patients with closed fracture cases who underwent internal fixation and added intradermal sutures during the surgical wound closure procedure. The selection of patients with closed fracture cases is related to the category of operative technique which is a clean operation to minimize the possibility of complications of local infection in surgical wounds that can aggravate scarring in postoperative wounds. The selection of fracture location cases in the lower extremity is because the location has the strongest

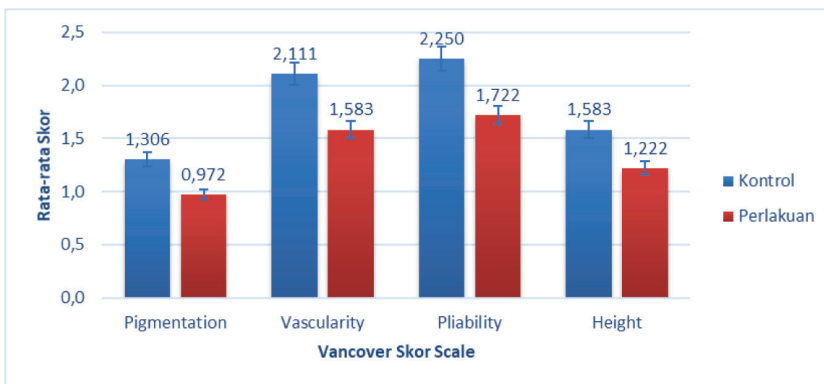
Table 1 Descriptive statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pigmentation	Control	36	1.306	0.668	0.111
	Treatment	36	0.972	0.696	0.116
Vascularity	Control	36	2.111	0.523	0.087
	Treatment	36	1.583	0.500	0.083
Pliability	Control	36	2.250	0.500	0.083
	Treatment	36	1.722	0.454	0.076
Height	Control	36	1.583	0.500	0.083
	Treatment	36	1.222	0.422	0.070
Vancouver	Control	36	7.250	1.052	0.175
	Treatment	36	5.528	0.910	0.152

Table 2 Comparison of study variable between control and treatment group

	Group	N	Mean	Std. Deviation	p
Pigmentation	Control	36	1.306	0.668	0.043*
	Treatment	36	0.972	0.696	
Vascularity	Control	36	2.111	0.523	0.000*
	Treatment	36	1.583	0.500	
Pliability	Control	36	2.250	0.500	0.000*
	Treatment	36	1.722	0.454	
Height	Control	36	1.583	0.500	0.002*
	Treatment	36	1.222	0.422	
Vancouver	Control	36	7.250	1.052	0.000**
	Treatment	36	5.528	0.910	

*Significant ($p < 0.05$); *Independent t-test

**Figure 1** Descriptive chart

skin tension. Therefore, the possibility of scarring will increase. Postoperative wounds made in the lower extremities are then carried out by adding intradermal sutures to 50% of the wound and the remaining 50% without intradermal suturing in order to form dead space which will subsequently form granulation tissue that will stimulate fibroblast cells to synthesize collagen in more amounts much to cover surgical wounds with the formation of scar tissue.

Each scar tissue formed according to the inclusion criteria is then evaluated by using the Vancouver Scar Scale with 4 components of assessment (Pigmentation, Vascularity, Pliability and Height) after 6 months post-surgery.

Descriptive analysis was carried out on the research data. It was found that the average Vancouver Scar Scale for the control group was 7.250 with a standard deviation of 1.052, for treatment groups obtained an average of 5.528 with a standard deviation of 0.910. Of the four Vancouver components scar scale, the component that has the highest average number is Pliability, which is for Control as many as 36 samples, and the average

value is 2,250 and the standard deviation is 0,500. For the treatment group, the average is 1.722 with a standard of 0.454. The Total Scar Scale Score has a value of $p > 0.05$. Therefore it has a normal distribution.

To find out the difference between Controls and Treatments, the Mann Whitney mean difference test statistic tool is used, because it is assumed that Control and Treatment are mutually independent (not affecting each other). The Mann Whitney test value for the Vancouver Scar Scale Total Score has a p-value of 0.000. Therefore, it can be concluded that there is a significant difference between the Control and Treatment of the Vancouver Scar Scale Total Score where the value of control is higher than treatment.

Through the above results it can be seen that the treatment in the form of adding intradermal sutures to the surgical wound can reduce the mechanical load factor in the surgical wound and reduce tissue hypoxia. At the beginning of wound healing, fat and debris will be obtained in the extracellular fluid and will soon be replaced by granulocytes and macrophages, a few days later it will be followed by the appearance of fibroblast cells and collagen. The combination of changes in oxygen pressure and lactate levels is a control for the synthesis and accumulation of collagen when new blood vessels have reached the area of young fibroblasts and changed the area from areas of high lactate and low oxygen pressure to areas of high lactate and high oxygen pressure. Hence fibroblasts will increase the synthesis and accumulation of collagen. Changes in tissue oxygen pressure will be responded to at the cellular level through a transcription factor, HIF (Hypoxia Inducible Factor). When the oxygen demand is fulfilled, there will be hydroxylation of HIF α , whereas if there is a decrease in oxygen content, the rate of hydroxylation of HIF α will decrease.

Furthermore, the reduction in the hydroxylation of HIF α will cause the cell transcription process to increase. Increasing the transcription process is very important for cell survival and division. The result of increasing cell transcription is the formation of glycolysis enzymes for the establishment of ATP and the production of VEGF (Vascular Endothelial Growth Factor) which functions to stimulate angiogenesis.

In the group of patients who did not get additional intradermal tissue where the wound was exposed to strain, the area in the middle of the wound (the area that experienced the greatest strain) will always cause tissue hypoxia conditions. The combination of hypoxia and mechanical load in the wound will result: decreased fibroblast apoptosis increased collagen synthesis, and decreased collagen degradation. Whereas in the group of patients

with intradermal suture treatment, the possibility that occurred was: (1) by performing intradermal sutures, the distance between the edge and center of the wound is relatively fixed and relatively shorter so that tissue hypoxia is quickly resolved, (2) by doing intradermal stitching the mechanism for the occurrence of mechanical load due to strain injury is eliminated. The use of non-absorbable yarn (Polypropylene) which is a monofilament material can reduce the inflammatory factor which can also trigger scarring.

Limitation in this study are clinical assessment of scar tissue formed postoperatively subjective and in this study conducted by the researchers themselves so that there is a possibility for bias. The treatment and control groups were carried out at the same wound location (adjacent location) without any clear boundaries to allow interdependence.

CONCLUSIONS

The addition of intradermal sutures using polypropylene materials has been clinically proven to reduce the formation of scar tissue in postoperative wounds. By doing intradermal sutures, the distance between the edge and center of the wound is relatively fixed or relatively shorter. This can reduce the mechanical load factor due to the strain of tissue injury that can cause scar tissue. This research strengthens the concept of the results of previous studies conducted in animals, and it has been shown that the addition of intradermal sutures using polypropylene materials can reduce the formation of postoperative scar tissue clinically.

SUGGESTION

Further research is needed in laboratory and biomolecular studies by taking samples from patients who participated in this study to compare the collagen density formed between the control group and the group that received the treatment of intradermal sutures. Evaluation of clinical scarring in postoperative patients should be carried out by different people from the researchers themselves and have competence especially in the field of plastic surgery and reconstruction.

CONFLICT OF INTEREST

The author declares there is no conflict of interest regarding all aspect of this article.

FUNDING

Current study doesn't receive any specific grant from government or any private sectors.

ETHICAL ASPECT

All study protocol has been verified by the Committee Ethics Faculty of Medicine, Universitas Brawijaya, Malang-Indonesia.

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