

# The Effect of Modified Postoperative Treatment on Finger Replantation Survival Rate

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**Abstract:** *Objective:* To explore the clinical effect of modified treatment after finger replantation and its impact on the survival rate of replantation. *Methods:* The research was conducted from March 2022 to March 2023. A total of 58 patients who underwent finger replantation at our hospital were selected. These patients were divided into two groups using the digital table grouping method: the research group ( $n = 29$ ) and the control group ( $n = 29$ ). Patients in the control group received standard treatment following finger replantation, while patients in the study group received modified treatment after the procedure. The incidence of vascular crisis and the survival rate of replantation were compared between the two groups. *Results:* The incidence of vascular crisis in the study group was lower than that in the control group ( $P < 0.05$ ); the replantation survival rate in the study group was higher than that in the control group ( $P < 0.05$ ). *Conclusion:* Modified treatment after replantation of severed fingers can reduce the incidence of vascular crisis replantation and improve the survival rate of replantation, so it should be popularized and applied in medical institutions.

**Keywords:** Finger replantation; Vascular crisis; Survival rate of replantation

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## 1. Introduction

Broken fingers are usually caused by accidents, which need to be repaired in time to avoid affecting the motor function of the hand<sup>[1]</sup>. Finger replantation involves reconnecting partially or fully severed finger blood vessels using a microscope, repairing nerves, bones, tendons, and skin tissues after cleaning, and utilizing postoperative treatments to restore fine hand movements and functionalities<sup>[2,3]</sup>. Following finger replantation, the blood viscosity in the vascular anastomosis region rises, increasing the risk of thrombus formation. This, in turn, poses a vascular hazard, potentially resulting in the failure of finger replantation. Therefore, postoperative nursing intervention should be strengthened to improve the survival rate of replantation. The conventional treatment plan after a finger replantation includes measures such as bed rest, pain management, anticoagulation, infection prevention, and muscle relaxation. However, prolonged bed rest and the consumption of certain drugs can induce complications and affect the survival rate of replantation, so it is necessary to improve the postoperative treatment plan<sup>[4]</sup>. In this study, 58 patients who underwent finger replantation were selected to explore the

clinical effect of the modified treatment plan after severed finger replantation.

## 2. Materials and methods

### 2.1. General information

The sample selection and operation procedures of this study were submitted to the approval of the hospital's medical ethics committee. The research period spanned from March 2022 to March 2023. The patients were divided into a research group ( $n = 29$ ) and a control group ( $n = 29$ ) by the digital table grouping method.

In the research group, there were 18 males and 11 females, aged between 25 and 64 years old, with a median age of  $44.52 \pm 3.67$  years. This group included 15 cases of complete amputation and 14 cases of partial amputation, along with 9 cases of cutting injury, 12 cases of crush injury, and 8 cases of avulsion injury.

The control group consisted of 17 males and 12 females, aged between 27 and 61 years old, with a median age of  $44.48 \pm 3.72$  years. This group included 16 cases of complete amputation, 13 cases of partial amputation, 10 cases of cutting injury, 13 cases of crush injury, and 6 cases of avulsion injury. There was no significant difference between general data between the patients of both groups ( $P > 0.05$ ).

Inclusion criteria: (i) Patients eligible for severed finger replantation. (ii) Patients with normal cognitive and conscious functioning. (iii) Patients who were informed about the research details and willingly provided signed consent for participation.

Exclusion criteria: (i) Patients with immune system diseases. (ii) Patients with coagulation dysfunction. (iii) Patients with incomplete clinical data.

### 2.2. Methods

Both groups underwent finger replantation. The anesthesia plan was brachial plexus block anesthesia. Pneumatic tourniquet was used to stop the bleeding for 1 hour, so that the fracture surface was completely exposed. The wound tissue was properly washed with normal saline and disinfected. Blood vessels and nerves were anastomosed, phalanges were shortened and aligned, and proper fixation was applied after aligning the joint ends. The extensor tendon tissue was sutured, and tension was adjusted. The flexor tendon was repaired, and debridement was performed on the venous blood vessels to remove contused venous tissue and internal blood clots. The broken end was flushed with heparin, and the venous tissue was properly sutured. The distal and proximal digital arteries and nerve tissue were probed and determined. The bilateral arteries were properly fixed and sutured. Debridement of the proper arterial tissue was performed, and the arterial orifice was observed and appropriately trimmed. The bilateral digital arteries were sutured intermittently without tension. The wound was closed after a 30-minute interval and properly wrapped with a dressing.

The patients in the control group received conventional treatment after operation. (i) The patients were required to undergo 7–10 days of bed rest post-operation, refraining from getting up even for meals and defecation. (ii) The severed finger was warmed using a hot lamp, and the ward temperature was maintained at 20–25°C with a relative humidity of 40–50%. Patients were advised against the consumption of strong tea, coffee, smoking, and alcohol. (iii) Regular monitoring of replanted finger skin's temperature, elasticity, color, and capillary refill time was conducted. (iv) Continuous anti-infection treatment was administered for 3 days post-operation. Intramuscular injections of 30 mg papaverine were administered every 6–8 hours for 3 days. Daily subcutaneous injections of 4100 U low-molecular-weight heparin were administered for 5 days. Anisodamine was administered at 10 mg dosage. The total daily rehydration volume was controlled at 3000 mL, and in cases of significant blood loss, an appropriate amount of concentrated red blood cells and fresh plasma were supplemented. The patients in the research group received a modified treatment plan after

operation. (i) Post-operation, patients underwent a 3-day period of bed rest. If the blood supply to the replanted finger remained stable after 3 days, patients were assisted in getting up, eating, and using the restroom. After 5 days, they were aided in getting out of bed. (ii) Warmth was provided to the severed fingers using hot lamps. The ward temperature was maintained at 20-25°C, with a relative humidity of 40-50%. Patients were advised to avoid strong tea, coffee, cola, etc., as these substances could lead to sympathetic nerve stimulation and vasoconstriction. (iii) Routine monitoring included observing the temperature, elasticity, and color of the replanted finger's skin, as well as measuring the capillary refill time.

(iv) A continuous 3-day anti-infection treatment was administered post-operation. Intramuscular injections of 30 mg papaverine were given every 6–8 hours for 3 days. Daily subcutaneous injections of 4100 U low-molecular-weight heparin were administered for 5 days. Fluid replacement was limited to 2500–3000 mL. In cases of severe blood loss, an appropriate quantity of concentrated red blood cells and fresh plasma was supplemented. (v) Health education and psychological counseling were provided to the patients. They were informed about precautions to take after finger replantation, comforted psychologically, and given information about successful postoperative recovery. Patients were also advised that negative emotions could lead to excessive catecholamine secretion, causing vascular constriction and potentially leading to replantation failure. Patients were guided on relaxation techniques such as listening to music and practicing deep breathing to help alleviate stress and anxiety.

### **2.3. Evaluation criteria**

(i) The incidence of vascular crises in both patient groups was recorded. The criteria for evaluating vascular crises included pale replanted fingers, lack of capillary refill, low abdominal tension, shrunken and atrophied fingers, and a temperature 4–5 °C lower than that of healthy fingers, with no bright red blood flowing from the lateral incision of the fingertip. The criteria for venous crises were identified by the finger's purple color, disappearance of the caterpillar vascular filling reaction, increased tension in the finger pulp, decreased finger temperature, dark purple blood followed by bright red blood when the finger's side was cut, subsequent capillary refill, gradual increase in finger temperature, and sustained high finger pulp tension. (ii) The survival rate of severed finger replantation was determined in both patient groups. Replanted fingers were considered to have survived if they displayed a rosy appearance at the fingertip, normal tension and skin temperature, and a normal capillary response.

### **2.4. Statistical analysis**

SPSS 23.0 was used for data analysis. Measurement data were expressed as mean ± standard deviation and analyzed using the t-test, while count data (%) were assessed with the  $\chi^2$  test.  $P < 0.05$  indicated statistical significance.

## **3. Results**

### **3.1. Incidence of vascular crisis**

As shown in **Table 1**, the incidence of vascular crisis in the research group was lower than that in the control group ( $P < 0.05$ ).

**Table 1.** Comparison of the incidence of vascular crisis between the two groups (*n* [%])

Group	Vascular crisis	Venous crisis	Incidence of vascular crisis
Research group ( <i>n</i> = 29)	2	3	5 (17.2)
Control group ( <i>n</i> = 29)	6	8	14 (48.3)
$\chi^2$ value			6.340
<i>P</i> value			0.011

### 3.2. Survival rate of severed finger replantation

As shown in **Table 2**, the survival rate of severed finger replantation in the study group was higher than that in the control group ( $P < 0.05$ ).

**Table 2.** Comparison of the survival rate of severed finger replantation between the two groups (*n* [%])

Group	Successful replantation	Failed replantation	Survival rate of finger replantation
Research group ( <i>n</i> = 29)	26	3	26 (92.9)
Control group ( <i>n</i> = 29)	19	10	19 (65.5)
$\chi^2$			4.858
<i>P</i>			0.027

## 4. Discussion

Severed fingers are a common type of injury, and finger replantation is often performed in these cases. During the operation, the damaged blood vessels and nerves need to be reconstructed and replanted to restore the motor function of the hand. The survival rate of severed finger replantation is closely related to the postoperative blood supply status. If the patient has vascular crisis, it may lead to the failure of severed finger replantation. Therefore, effective postoperative treatment is necessary <sup>[5,6]</sup>.

In conventional postoperative treatment, the patient needs to stay in bed for 7 days, and antispasmodic, anticoagulant, and anti-infective drugs are administered <sup>[7]</sup>. This scheme is easy to operate and is widely used in medical institutions. This approach is commonly employed in medical settings and has resulted in successful finger replantation. Nonetheless, it necessitates an extended period of bed rest and immobilization, which can be costly and lead to clinical issues like abdominal distension and constipation in some patients. Increased body discomfort can induce pulmonary embolism and deep vein thrombosis of the lower extremities, leading to an increased risk of vascular crisis, which in turn affects the survival rate of the implanted finger. Besides, low molecular weight dextran, which is a commonly drug can induce skin itching and other complications. Recent studies have also validated that not using low molecular weight dextran after finger replantation does not impact the survival rate of replanted fingers <sup>[8]</sup>. 24–48 hours after is the peak period of vascular crisis after finger replantation. Through the modified postoperative treatment, and the risk of vascular crisis was significantly reduced 72 hours after the surgery, and the microvascular endothelium could be repaired within 72 hours, and changing the body position after the repair had little effect on blood vessels. Therefore, shortening the patient's bed rest time to 3 days, allowing the patient to get up, eat, and go to the toilet 3 days after the operation, and allowing the patient to get out of bed 5 days after the operation can significantly reduce the incidence of deep vein thrombosis and reduce the risk of vascular crisis <sup>[9]</sup>. Besides, low-molecular-weight dextran was replaced with Lactated Ringer's solution, and the duration of antibiotic administration was shortened to 3 days, which

reduced the incidence of adverse reactions. The modified postoperative treatment plan aims to prevent vascular crises, enhance the survival rate of replanted fingers, reduce bed rest duration, adjust postoperative medication, and provide dietary and psychological support. This approach improves both the patient's physical and mental condition, expedites postoperative recovery, and proves more effective than conventional treatment<sup>[10,11]</sup>.

The results of this study showed that the incidence of vascular crisis in the research group was lower than that in the control group, and the survival rate of replantation was higher than that in the control group, suggesting that modified treatment after finger replantation can reduce the incidence of vascular crisis and increase the survival rate of replantation. This is because in conventional treatment, patients are instructed to remain bedridden for 7–10 days, which can increase the risk of venous thrombosis due to lack of physical activity. Moreover, the use of low molecular weight dextran in traditional drug regimens may cause skin itching and discomfort in patients<sup>[12]</sup>. Clinical studies have shown that microvascular endothelial tissue typically requires around 3 days for repair after injury. Patients are prone to vascular crisis within 48 hours after replantation of amputated fingers. The main causes of vascular crisis induced 72 hours after operation are smoking and infection. Therefore, simple activities during this period will not affect the recovery of vascular endothelium, and will not cause vascular crisis<sup>[13]</sup>. Therefore, in the modified treatment plan, the postoperative immobilization time is reduced to 3 days, so that patients are allowed to move earlier, so as to prevent deep vein thrombosis, improve blood circulation, and enhance the patient's body resistance<sup>[14]</sup>. Besides, lactated Ringer's solution is used instead of low molecular weight dextran, which can reduce the incidence of skin itchiness. Health education, psychological counseling, diet guidance and other intervention measures are also carried out, which can improve patients' knowledge of finger replantation. This approach can enhance the patient's emotional well-being, increase their adherence to various treatment protocols, and, consequently, effectively prevent vascular crises while improving the replantation survival rate<sup>[15]</sup>.

## 5. Conclusion

In summary, the modified postoperative treatment after finger replantation can reduce the incidence of vascular crisis in patients with severed finger replantation and improve the survival rate of replantation. However, the sample size of this study is small, and the analysis and evaluation process still need to be improved and adjusted. Besides, the timeline of the study is relatively short, further in-depth and detailed analysis and research is still needed to further improve the treatment plan.

## Disclosure statement

The authors declare no conflict of interest.

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