Value of the Pedicle Omentum Transfer for the Healing of Large Skin Wound in Dogs

CaiXia Wang[#]

Chengye Li[#]

Ganzhen Deng*

Xian Xu

Lei Shu

Xiangyang Liu

Qihong Chen

#The authors contributed equally to this paper.
**Corresponding author:*
Veterinary Medical College, Huazhong Agricultural University,
Wuhan, Hubei 430070, China
Tel and fax number: +86-27-87280408
Email: dgz@mail.hzau.edu.cn

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ABSTRACT

Pedicle omentum transfer has been used for the treatment of human tissue trauma. Eight large skin wound cases of 6-10 months, 5kg-10kg body weight, hybrid local dogs were chosen and medially divided into two groups. Every group had four cases including two males and two females. The size of all skin wound surface on abdominal wall were approximately 5cm×5cm. One group were reshaped as "H" saturation(H), and another group were sutured as "H" shape with the overlap of pedicle omentus on the wound surface(OH). Although the essential clinical physical signs had no difference in both groups, the vigor of wound skin in OH was obviously higher than that in H. That the cases in OH recovered better and earlier than that in H, suggested that the pedicle omentum transfer be valuable to the healing of large skin wound in dogs.

INTRODUCTION

Large skin wound was common ailment, and was formidable in canine clinic.[1] Although many methods can be used to deal it, they have more or less defect in veterinary clinic. Mechanical debridement easily induces excessive granulation proliferation.[2] Surgical debridement is an available for fresh trauma, but aggravates wound with disunion or quiescence.[3] Biological debridement is archaic and had not applied in veterinary clinic now.[4] Simple closure beseem to lively high tension of skin with aplenty subcutaneous fat, and the eligible treatment for large skin wound was skin orthopedics.[5, 6] Skin flag plasty is extensively applied to human skin wound, but rarely used to veterinary clinic due to the complicate process and long time of therapy,[7] and was practically easy to result in transplantation failure.[5] Scarring is easily affected with dicey sanitation factors in long veterinary clinical attendance.[8-11] Otherwise, mast cell was also applied for the treatment of surgical wound. [12]

Canine large omentum is an abdominal structure similar to mesentery and formed from peritoneum. The visceral peritoneum covers the stomach and extends on both sides into large, double-layered sheets and appears as lace-like with prominent patches of fat; the lesser omentum originates from the lesser curvature of the stomach and extends to the liver. On another hand, the greater omentum arises from the greater curvature of the stomach, and forms a large diaphanous membrane structure that lies over the intestines, and then converges into parietal peritoneum.[13] Canine omentum is extremely plastic, and can be extended beyond the distal extremities and the muzzle, and the vascular patent length of the omental pedicle is even to 82cm after full extension.[14] Otherwise, omentum containing rich vascular net can quickly adhere to impaired tissues and forms the collateral circulation, and this phenomenon takes the strong abilities of anti-infection, absorbing exudates and recovery to injured tissues.[15] With these characters, omentum makes it possible to transfer omentum or pedicle omentum for any tissue reconstruction with allotransplantation.[16] An experimental model of canine surgical transfer validated that omentum caused the significant reduction of experimental lymphoedema.[17]

The aim of this test was to evaluate the effect of skin orthopedics on large skin wound with pedicle omentus transplantation in dogs.

MATERIALS AND METHODS

Cases

Eight large skin wound cases of 6-10 months, 5kg-10kg body weight, hybrid local dog were chosen from the veterinary teaching hospital of Huazhong Agricultural University and medially divided into two groups; every group had four cases including two males and two females. The size of all skin wound surface on abdominal wall were clipped approximately as 5cm×5cm. Small wound surface were slightly enlarged to optimal size(H). One group were reshaped as "H" suturation, and another group were sutured as "H" shape with the overlap of pedicle omentus on the wound surface(OH).

Operation and Postoperative Care

All cases were anaesthetized by intravenation with 0.1ml/kg Zoletil® 50 (Virbac France, 81918602).

Simple skin orthopedics(H): Skin wound in H was cleared and aseptic operation was processed. The wound surface was sheared as a square with 5cm×5cm (figure 1). Skin flaps was liberated along the stress direction of belly skin (up and down) (figure 2). The up and down skin flaps were firstly connected with interrupted suture, and then, ambilateral skin were closed with same suture method. Finally, the drainage tube was placed under tresis vulnus (figure 3).

Skin orthopedics with the transplantation of pedicle omentum(OH): The cases were treated as previously. Before the connection of skin flags, a small incision on umbilical part was cut and omentum was pulled out, and then a subcutaneously tunnel was formed. After that, pedicle omentum was passed through the tunnel and overlapped and fixed with catgut on the wound surface (Figure 4, 5).

Postoperative care and clinical investigation: Anti-infection with antibiotics had been administrated intravenously for five days post operation. Especially, animal spirit, body temperature, appetite, exudates on tresis vulnus and skin alive were noted down in the later five days. Otherwise, blood routine, such as total white blood cells(WBC), lymphocytes(LYM), middle white cells(MID) and granulocytes(GRAN) were calculated with autohematology analyzer(BC-2600, Mindray, China).

Statistical Analysis

WBC, LYM, MID and GRAN were statistically analyzed with the software Microsoft Excel 07(Microsoft, USA), and data were compared with variance analysis.

RESULTS

Clinical Observation

The spirit, appetite, urination and defecation had no obviously difference in both

two groups. Otherwise, the respiratory, pulse and body temperature in all dogs were within normal limits. The edema intensity of the tresis vulnus had not difference, and appeared two days post operation in both groups, but it eliminated on the third day in HO and on the fourth days in H. The operative site temperature had not obviously change in both groups, and was only 0.6C higher in three days post operation than the preoperative temperature, but recovered back to normal temperature on the fourth days.

The time of wound healing in OH was one to two days earlier than that in H.

Exudate on Tresis Vulnus

Only little exudate appeared on the tresis vulnus in HO in the first three days and that eliminated in the drainage tube on the fourth day postoperation. However, the exudate was more on the second day and keeps on to the fourth day postoperation in H. After that, it tapered till the tresis vulnus recovered.

Skin Color

The color of tresis vulnus of a case in H appeared fuscous (figure 6) and this pathological change induced the skin necrosis in the final. The color of the tresis vulnus was pink in all dogs of HO. The wound of entry on umbilical part in HO also recovered well (Figure 5).

Blood Conventional Analysis

All the blood indexes were obviously different in both groups on the first three days. WBC on the day of operation (Day 0) were the highest than on any other days ($p<0.01$), and recovered to the normal levels on the third day in HO and on the second day in H postoperation (Table 1). LYM increased to the highest levels on the first day (Day 1) in HO and on the second day (Day 1) in H, but fleetly decreased to the normal levels (Table 1). Both MID and GRAN were the highest on the day of operation (Day 0) and decreased to the normal levels on the fourth day pospoperation (Table 1).

DISCUSSION

The functions of the greater omentum are ditissimus with fat deposition and immune contribution. Certainly, the special contributes of the omentum is its innumerable applications in surgical practice.[18] Cause of the rich various angiogenic factors, neurotransmitters, neurotrophic factors, inflammatory mediators and omnipotent stem cells, omentum can promote blood vessels into any tissue where it is placed closely to.[18, 19] Otherwise, the potent lymphatic system of the omentum can absorb enormous amounts of edema fluids and remove metabolic wastes and toxic substances.[18, 20, 21] With the characters of the length, caliber of the vascular pedicle and the malleability and surface area of the flap, free omentum transfer is presumed as a versatile method of tissue reconstruction for head, neck, trunk, and extremity. [16, 22, 23] Nowadays, omentum was extensively applied in human surgical reparation. Especially, omental transfer

Table 1. *The values of the indexes of blood conventional analysis (10^9 /L)*

Index	Group	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5
WBC	II	35.8±0.915	24.5±1.69**	18.5±0.203**	15.4±0.120**	9.78±0.229**	8.75±0.137**
	I	27.6±0.747	17.3±0.376**	15.5±0.750**	11.8±0.0967**	12.4±0.662**	11.7±0.287**
LYM	Trials	5.63±0.649	6.58±0.439*	3.55±0.633**	4.325±0.0225**	2.73±0.0891**	2.30±0.0200**
	Control	4.40±0.193	5.75±0.0700*	6.13±0.0892**	5.50±0.0467**	4.10±0.127**	5.48±0.0492**
MID	Trials	9.53±0.876	4.15±0.117**	2.18±0.0625*	1.20±0.113**	1.08±0.0492**	0.850±0.0700**
	Control	4.70±0.0867	2.08±0.0558**	2.63±0.0625*	1.98±0.102**	4.25±0.0433**	2.7±0.113**
GRAN	Trials	20.6±1.05	13.8±0.320**	12.5±0.320**	9.73±0.169**	6.00±0.0333*	6.00±0.227**
	Control	18.6±1.38	9.30±0.180**	6.70±0.120**	4.28±0.0292**	4.075±0.409*	3.53±0.0291**

*The comparisons were taken between the values of "day 0" with that of any other days (day 1, 2, 3, 4 and 5). *means significant difference ($P < 0.05$) and **means extremely difference ($P < 0.01$) between two groups.*

Figure 1. The size and shape of wound skin. The wound size of any case was near to 5cm×5cm.

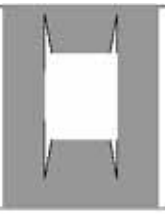

Figure 2. "H"shape of wound surface was prepared before orthopedia

Figure 3. Large skin wound was reshaped as "H"

Figure 4: Wound surface was overlapped with pedicle omentum.

Figure 5. Appearance of the orthopedia of the skin wound with pedicle omentus transfer.

Figure 6. The pathological fuseous the wound skin with normal orthopedia

was applied in many complicate operations in human medicine, for example, omental transplantation was believed as an excellent choice in the management of the most complex cardiothoracic surgical problems.[24] Otherwise, a closed wound was achieved without infection in all eight patients for the reconstruction of the chest wall with omentum transfer.[25] Furthermore, the complex upper-extremity defects were recovered with omental free flap coverage.[16]

Pedicle omentum with the powerful immunodominance and the ability of absorption and vasculogenesis was also used in experimental animals.[26] Mouse with omentus extirpation produced lower antibody postinnoculation, and moreover, omentum could produce antibody while contacting with antigen in vitro.[23] Autogenous free greater omentum graft can influence the healing of rabbit tibia fracture through the augmentation of vasculogenesis. [27]

As well, radiological and histopathological study revealed that the reconditioning effect of omental pedicle flap on the transverse and oblique rib fracture in dogs was predominant.[28] The predominant ability of the omentum to rapidly revascularizing the bronchus makes the ischemic bronchial anastomoses possible in canine lung transplantation.[29] Canine tracheocarinal allografts covered with pedicled omentus could be well operated, and case recovered better.[30] A tubular skin graft as a carrier prefabricated with omentus successfully reconstructed the ureteral defects in dog.[31] Moreover, a large dorsal wound in a dog with disunion was healed utilizing pedicle greater omentum to fill the wound and provide a vascular bed for a full thickness mesh skin graft.[32]

Skin orthopedic with pedicle omental transfer could obviously reduce the exudant of the tresis vulnus, and increase skin activity. Meanwhile, the white blood cells were significantly lower than that in simple skin orthopedic, and skin wound was cicatrized per primam early one or two days in this test. The results suggested that skin orthopedic with the overlap of pedicle omentus could effectively promote the cicatrization of large wound skin in dogs.

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