

## Research Article

# Reconstruction of the Neck Post-Burn Contracture using Island Flap based on the Pectoral Fasciocutaneous Branch of Cervical Transverse Artery

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### Abstract

**Background:** Soft tissue defects in the cervico-facial region can result from burn, electrical injury and trauma. Most common defect is post-burn contracture. Anterior scar of neck after burn results in cosmetic and functional trouble, which fall in quality of life so that is very important problem in plastic surgery.

**Methods:** Between August 2007 and October 2016, 58 patients with neck scar contracture (study group 35 patient, control group 23 patients) underwent reconstruction of neck defects after release of post-burn contractures with the pectoral fasciocutaneous branch of cervical transverse artery based skin flap at our hospital. After discharge the first follow-up visit was on the 10<sup>th</sup> postoperative day. The patients were subsequently

followed up at 3 months, 6 months and 1 year. The dimensions of the flap were measured and the patients photographed at the time of discharge and at subsequent visits. Control group underwent the thick split thickness skin graft.

**Results:** All the flaps survived almost completely. Function and appearance of the necks improved obviously. All patients were satisfied with the result.

**Conclusion:** This flap is one of the axial flaps with characters of reliable blood supply matched color and texture.

**Keywords:** Contracture; Flap; Cervical transverse artery; Burn

## **1. Introduction**

The post-burn neck contracture may result in restriction of neck movements, a bowed down head and aesthetic issues, all resulting in psychological distress. Soft tissue defects in this region can result from trauma, tumor excision or post-burn scarring. The ideal flap for the head and neck should be thin and pliable with a good color and texture match. The movements of the neck and jaw should be unrestricted and the lower lip should not be everted after the reconstruction [1]. In addition, the donor site should have minimal morbidity. The island flap based on the pectoral fasciocutaneous branch of cervical transverse artery is an extremely reliable local flap. It offers thin and pliable skin with good color match and minimal donor site morbidity. We conducted an investigation to establish the length, width and angle of rotation of pedicle based on the pectoral fasciocutaneous branch of cervical transverse artery, and its application and effectiveness.

## **2. Materials and Methods**

Between August 2007 and October 2016, 58 patients with neck scar contracture (study group 35 patient, control group 23 patients) underwent reconstruction of neck defects after release of post-burn contractures with the pectoral fasciocutaneous branch of cervical transverse artery based skin flap at our hospital. Gender and age were as following: 33 males and 25 females, from age 19 to 48. Also causes of contracture were as following: burn 51 patients (87.9%), electrical injury 5 patients (8.6%), external injury 2 patients (3.5%). After discharge the first follow-up visit was on the 10<sup>th</sup> postoperative day. The patients were subsequently followed up at 3 months, 6 months and 1 year. The dimensions of the flap were measured and the patients photographed at the time of discharge and at subsequent

visits. Control group underwent the thick split thickness skin graft.

### **2.1 Preparation of recipient bed**

Simple scar tissue without contracture was incised between scar and normal skin and scar tissue was removed completely. Scar tissue with contracture was incised in the center of scar tissue and we expanded it extremely and removed scar tissue completely.

### **2.2 Design of skin flap**

Expectation line of skin incision was defined: longitudinal incision was made on the anterior axillary line and transvers incision was made on the vertical line pass suprasternal notch. After longitudinal incision along the expectation line of skin incision, found superficial branch of the transverse cervical artery under fascia and ligated and cut between center and peripheral. Fascia flap with the artery along the expectative line was ablated. Pedicle flap was covered and turned out in normal saline clothes. Pedicle flap was induced through the subcutaneous tunnel and examined the block of blood flow (anemia and cyanosis) and sutured skin. Like this, 35 patients were operated.

Speaking of the control group, rejection of scar was like study group and the recipient bed was sutured with the thick split thickness skin graft and over-tie.

### **2.3 Dealing of donor site**

Study group: Donor site was covered by approximation suture and the thick split thickness skin graft. Donor site was the lateral side of thigh and covered with 10% saline gauze and sterilized bandage.

### **2.4 Control group**

Donor site was the lateral side of thigh and covered with 10% saline gauze and sterilized bandage.

**2.5 Postoperative care**

For 5~6 days after the operation a million of penicillin unit per day and a million streptomycin unit per day were injected to the patients. Upper body was raised slightly. Observation of the block of blood flow (anemia and cyanosis) was done for 72 hours after the operation. Discharge of suture was done from 6 days after the operation.

**2.6 The index of observation and criteria of result**

Good: when the pedicle flap is survival completely and color of the flap is like that of neighbor-skin; Normal: when the pedicle flap is survival over 80% and color of the flap is different from that of neighbor-skin slightly; Bad: when the pedicle flap is survival under 80% and color of the flap is different from that of neighbor-skin obviously.

**2.7 Statistical test**

T-test and  $\chi^2$ -test was used.

**3. Results**

**3.1 Size of skin flap**

**3.1.1 Length of skin flap:**

Patients, n	Length (cm)					$\bar{x} \pm SE$ (cm)
	~8	9	10	11	12~	
35 (100.0)	2 (5.7)	4 (11.4)	15 (42.9)	12 (34.3)	2 (5.7)	10.23 ± 0.16

**Table 1:** Length of skin flap.

Table 1 shows that length of skin flap was 10.23 ± 0.16 cm.

**3.1.2 Width of skin flap:**

Patients, n	Width (cm)					$\bar{x} \pm SE$ (cm)
	~3	4	5	6	7~	
35 (100.0)	2 (5.7)	5 (14.3)	16 (45.7)	10 (28.6)	2 (5.7)	5.14 ± 0.16

**Table 2:** Width of skin flap.

**3.2 Size of artery pedicle**

**3.2.1 Length of pedicle:**

Patients, n	Length (cm)				$\bar{x} \pm SE$ (cm)
	~3	4	5	6~	
35 (100.0)	2 (5.7)	13 (37.1)	17 (48.6)	3 (8.6)	4.60 ± 0.13

**Table 3:** Length of pedicle.

Table 3 shows that length of pedicle was 4.60 ± 0.13 cm.

**3.2.2 Width of pedicle:**

Patients, n	Width (cm)					$\bar{x} \pm SE$ (cm)
	~0.5	0.6~0.9	1~1.4	1.5~2	2~	
35 (100.0)	1 (2.9)	3 (8.6)	3 (8.6)	24 (68.5)	4 (11.4)	1.60 ± 0.07

**Table 4:** Width of pedicle.

Table 4 shows that width of pedicle was 1.60 ± 0.07 cm.

**3.3 Distance from clavicle to rotation point of pedicle**

Patient, n	Distance (cm)				$\bar{x} \pm SE$ (cm)
	~6	7	8	9~	
35 (100.0)	2 (5.7)	14 (40.0)	15 (42.9)	4 (11.4)	7.60 ± 0.13

**Table 5:** Distance from clavicle to rotation point of pedicle.

Table 5 shows that distance from clavicle to rotation point of pedicle was 7.60 ± 0.13 cm.

**3.4 Result of flap**

**3.4.1 Result according to rotation angle:**

**3.4.1.1 Block of blood flow according to rotation angle:**

Rotation angle	Patients	Block type		
		(-)	(+)	
			anemia	cyanosis
~69	1 (2.9)	1 (2.9)	-	-
70~79	3 (8.6)	3 (8.6)	-	-
80~89	20 (57.1)	20 (57.1)	-	-
90~	11 (31.4)	11 (31.4)	-	-

**Table 6:** Block of blood flow according to rotation angle.

Table 6 shows that block of blood flow was not recognized in 90 degrees.

**3.4.1.2 Result according to rotation angle:**

Patients	Complete	Over 80%	Under 80%
35 (100.0)	35 (100.0)	-	-

**Table 7:** Result according to rotation angle.

Table 7 shows that 35 patients (100%) was engrafted.

**3.4.2 Result according to length and width:**

**3.4.2.1 Block of blood flow according to length and width:**

Length: width	Patient	Block type		
		(-)	(+)	
			anemia	cyanosis
1:1	8 (17.4)	8 (17.4)	-	-
2:1	25 (71.4)	25 (71.4)	-	-
3:1	1 (2.9)	-	1 (2.9)	-
4:1	1 (2.9)	-	-	1 (2.9)

**Table 8:** Block of blood flow according to length and width.

Table 8 shows that block of blood flow was not recognized in 1:1 and 2:1 of ratio of length and width, but in 3:1 was 1 patient and in 4:1 was 1 patient.

**3.4.2.2 Result according to length and width:**

Patients	Complete	Over 80%	Under 80%
35 (100.0)	33 (94.2)	1 (2.9)	1 (2.9)

**Table 9:** Result according to length and width.

Table 9 shows that complete engraftment was 33 patients (94.2%), over 80% was 1 patient (2.9%), and under 80% was 1 patient (2.9%).

**3.4.3 Result according to length of particle:**

**3.4.3.1 Block of blood flow according to pedicle:**

Length (cm)	Patients	Block type		
		(-)	(+)	
			anemia	cyanosis
3	1 (2.9)	-	-	1 (2.9)
4	13 (37.1)	13 (37.1)	-	-
5	18 (51.4)	18 (51.4)	-	-
6	3 (8.6)	3 (8.6)	-	-

**Table 10:** Block of blood flow according to pedicle.

Table 10 shows that in 4, 5, 6cm block of blood flow was not recognized, in 3cm was 1 patient.

**3.4.3.2 Result according to the length of pedicle:**

Patients	Complete	Over 80%	Under 80%
35 (100.0)	34 (97.1)	-	1 (2.9)

**Table 11:** Result according to the length of pedicle.

Table 11 shows that complete engraftment was 34 patients (97.1%), undue 80% was 1 patient (2.9%).

#### **4. Discussion**

A disfiguring scar on the head and neck region also affects the function of various parts. The skin in this region is thin and pliable and contractures can result in abnormalities of lip competence, facial expression and decreased neck movements. To date, numerous methods have been used to reconstruct the normal contours in patients with post-burn neck contracture. These include skin grafts, preexpanded axial and random flaps, free tissue transfer from the scapular and deltoid area, groin, forearm, anterolateral thigh, and tensor fascia lata [2-4]. Preexpanded free flaps from these regions have also been reported. The skin graft has the obvious disadvantage of color mismatch and postoperative graft contracture [5, 6]. For preexpanded local flaps the neighboring tissue is often itself badly scarred thus precluding the possibility of expansion. Furthermore, it is a two-stage procedure requiring repeated implant filling sessions. Free tissue transfer is an attractive option and when used as a super thin flap does provide excellent texture match. However, the color match is suboptimal and it also requires much longer operating time and microsurgical facilities. The head and neck region suffers from a lack of local tissues available for reconstruction. Reconstruction in this region is best achieved by a thin pliable flap with good color match [7]. The supraclavicular and shoulder areas can provide skin which fulfills most of the criteria of an 'ideal flap' for this region. It employs tissue from the adjacent anatomical region with excellent color and texture characteristics. It does not require pre-expansion or microsurgical expertise and the donor defect can be closed primarily. We have used the flap in 33 patients with post-burn contracture on the cervical region. There are numerous methods in plastic and reconstructive surgery, but this method is the simple technique, good cosmetic effect and short healing time. Our average operating time was 2 h.

#### **5. Conclusion**

Treatment of anterior scar of neck using island flap with superficial branch of the transverse cervical artery is the good method in the reconstruction of post-burn neck contracture. In this case length and width of skin flap were respectively  $10.23 \pm 0.16$  cm,  $5.14 \pm 0.16$  cm the rotation point was  $7.60 \pm 0.13$  cm laterally from the caput of clavicle: pedicle must have the fascia and artery: the length of pedicle must be 4~6 cm. Effective ratio of treatment was 94.3% in the study group and 73.9% in the control group ( $p < 0.05$ ).

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