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Clinical Study on Serum Biochemical Factors and Vascular Crisis of Reconstruction of Oral and Maxillofacial Defects with Free Skin Flap

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ABSTRACT

Objective: To investigate the relationship between serum biochemical factors and free skin flap of oral and maxillofacial defects in the repair of vascular crisis.

Methods: 105 cases received oral and maxillofacial free skin flap transplantation from January 2015 to June 2017 were selected, including 9 cases of vascular crisis and 96 cases of skin flap without crisis. Based on the results of retrospective analysis, the corresponding biochemical factors were divided into crisis group and normal group. Fibrinogen, 2h postprandial glycemia, albumin, D-2 polymer and fasting plasma glucose were compared and analyzed in two groups.

Results: The incidence of skin flap crisis in patients with high fibrinogen, high fasting plasma glucose and 2h postprandial increase was higher than that in normal group, and the difference was statistically significant ($P < 0.05$). Based on the results of Logistic regression analysis, the high fibrinogen, high fasting glucose and 2h postprandial increase were all risk factors for vascular crisis ($P < 0.05$).

Conclusion: Preoperative high fibrinogen and high blood glucose may be associated with postoperative skin flap crisis.

Key words: Free tissue flap, vascular crisis, biochemical factors.

1. Introduction

Most maxillofacial tissue defects are caused by maxillofacial trauma, tumors, or congenital malformations. The technique of free tissue flap transplantation is to anastomose the blood vessels of the tissue flap with the blood vessels of the defect through vascular anastomosis, so that it can make up the defects of the maxillofacial region and achieve a better survival of blood supply in the transplantation site. (Qiu Weiliu, 2005). Although the successful rate of free tissue flap transplantation is high, there are still a few patients had failure of flap transplantation because of vascular crisis, nutritional status and other factors, which not only wastes medical resources, but also brings great pain to patients, even threatening patients' life.

Post-transplant flap status is the key to successful transplantation, but other factors such as diabetes and radiation history may also increase the risk of vascular crisis. The results showed that albumin level could accurately predict the survival of skin flaps after operation. (Khuri S.F. et al., 1997). Under the same postoperative nursing condition, some patients with vascular crisis have abnormal serum

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biochemical factors. Early studies in the study group found that fibrin was a risk factor for vascular crisis in flaps. The mean value of the crisis group was 3.5g/ L. (Yang Lianghui et al., 2017). However, the study included patients who had been operated by different microsurgical surgeons, whose surgical operation had an impact on vascular crisis, and the blood sugar and D-2 aggregates data related to thrombus were not perfect. In order to reduce the incidence of vascular crisis and improve the success rate of free skin flap transplantation, this study will employ the same group of doctors to conduct free skin flap and microsurgical blood anastomosis, and exclude other non-biochemical factors when the case is included, and further verify the effect of serum biochemical indexes on free skin flap transplantation.

2. Data and Methods

2.1. Case selection

105 patients who received free skin flap transplantation in Oral and Maxillofacial Surgery of Guangxi Medical University College of Stomatology (GXMUCS) from January 2015 to June 2017 were selected. Two experienced surgeons in the same group were selected to perform free skin flap transplantation according to a uniform and standardized surgical technique. The patients included after free skin flap transplantation were divided into crisis group and normal group according to whether flap crisis occurred or not. Normal group, i.e. patients who never developed flap crisis.

Inclusion criteria: 1) Arterial crisis: Observe the skin flap temperature, color, and capillary filling and swelling degree, compare with the healthy side, conduct acupuncture bleeding experiment (Guo Hongyan $ Ma Zhongjin, 2012) and record in detail. Arterial crisis is manifested as blackish or even pale skin flap, decreased flap temperature and skin tension, prolonged capillary filling time, and puncture depth of 0.5 cm, and no bleeding at more than 3 points; 2)Venous crisis is manifested as skin flap color change from ruddy to dark purple or dark red, high tension, disappearance of skin striae and disappearance of capillary filling. Exclusion criteria: The patient had radiotherapy of head and neck; the patient had insufficient length of recorded blood vessel in surgery; suture tension and other obvious surgical interference factors; thrombosis was found during vascular anastomosis; the drainage tube compressing the blood vessel in the postoperative exploration; no blood glucose and D-dimer detection was performed.

2.2. Methods

The preoperative general data of the patients were collected, biochemical indicators included serum fibrinogen, fasting plasma glucose (FPG), 2h postprandial glycemia (PPG), and D-dimer, etc. Basis for grouping: The obtained data were grouped as the mean value of fibrinogen (3.50 g/L) and albumin (37.73 g/L) in the crisis group in the retrospective study (Yang Lianghui et al., 2017); and the upper limit reference value of fasting plasma glucose (6.11 mmol/L), the upper limit reference value of 2h postprandial glycemia (7.8 mmol/ L) and the reference value of D-dimer (0.3) were grouped by the clinical laboratory test.

The specific groups were as follows: high fibrinogen group (> 3.50 g/L) and low fibrinogen group (≤ 3. 50 g/L); high albumin group (> 37.734 g/L) and low albumin group (≤ 37.734 g/L); fasting plasma glucose: high group (> 6.11 mmol/L) and normal group (3.4 - 6.11 mmol/L); 2h postprandial glycemia: high group (> 7.8 mmol/L) and normal group (3.6 - 7.8 mmol/L); D-dimer: high group (> 0.3) and low group (≤ 0.3).

2.3. Statistical methods

All the data were analyzed by using SPSS 22.0 software. The measurement data were expressed as mean ± standard deviation (x ± s). When the mean values of the two groups were in normal distribution, independent sample t test was used for inter-group comparison; the count data were expressed as absolute number, χ2 test was used for comparison, and binary variable Logistic regression analysis was used for risk factors. P <0.05 was considered as statistically significant difference.

3. Results

3.1. Biochemical indicators of patients with free skin flap transplantation

A total of 105 patients were included, including 9 patients with flap crisis and 96 patients without flap crisis. The difference was statistically significant (P＜0.05) in patients with higher 2h postprandial glycemia (> 7.8 mmol/L) compared with those with lower 2h postprandial glycemia (≤ 7.8mmo/L); the difference was statistically significant (P< 0.01) in patients with higher fasting plasma glucose (> 6.11 mmol/L) compared with those with lower fasting

plasma glucose (≤ 6.11 mmol/L), suggesting that higher 2h postprandial glycemia and fasting plasma glucose are risk factors for the occurrence of vascular crisis of skin flap. However, there was no significant difference in skin flap crisis between patients with higher serum D-dimer and those with lower serum D-dimer. See Table 1 for the results of various serum biochemical indicators.

Table 1: **Biochemical Indicators of 105 Patients with Free Skin Flap Transplantation (x ± s)**

Biochemical indicators	Crisis group (n = 9)	Normal group (n = 96)	t value	P value
Fibrinogen	3.50±0.79	16±0.66	-1.41	0. 16
2h postprandial glycemia (mmol/L)	9. 35±1. 87	7. 25±2. 59	—2. 74	0. 00
Albumin (g/L)	40. 59±3. 17	40. 26±4. 14	—0. 2	0. 84
Fasting plasma glucose (mmol/L)	7. 12±2. 98	5. 23±1. 39	—3. 9	0. 00
D-dimer (mg/L)	0. 19±0. 21	0. 32±1. 93	—0. 2	0. 84

3.2. Comparison of biochemical indicators between normal group and crisis group

The incidence of skin flap crisis was different between high fibrinogen group and low fibrinogen group (X^2=4.36, P<0.05), the difference was statistically significant, and the incidence of skin flap crisis was higher in high fibrinogen group. The incidence of skin flap crisis was different between high 2h postprandial glycemia group and low 2h postprandial glycemia group (X^2=8.53, P<0.01), the difference was statistically significant, and the incidence of skin flap crisis was higher in high 2h postprandial glycemia group. There was no statistically significant difference in the incidence of skin flap crisis between high and low albumin groups (X^2=0.02, P>0.05). There was no statistically significant difference in the incidence of skin flap crisis between high D-dimer group and low D-dimer group (X^2=0.05, P>0.05). Fisher's exact probability method showed that the incidence of flap crisis was different between high fasting plasma glucose group and low fasting plasma glucose group (P<0.01), the difference was statistically significant, and the incidence of flap crisis was higher in high fasting plasma glucose group (as shown in Table 2).

Table 2: **Comparison of Biochemical Indicators between Normal Group and Crisis Group**

Quota	Normal grou	Crisis grou	Tota	X^2 value	P value
Fibrinogen (g/L)				4.36	0.04
High group	26	6	32		
Low group	70	3	73		
Total	96	9	105		
Albumin (g/L)				0.02	0.88
High group	72	6	78		
Low group	24	3	27		
Total	96	9	106		
Fasting plasma glucose (mmol/L)					0.00
High group	71	3	74		
Normal group	6	4	10		
Total	77	7	84		
2h postprandial glycemia (mmol/L)				8.53	0.00
High group	57	1	58		
Normal group	19	6	25		
Total	76	7	83		

Note: Fisher's exact probability method was applied for fasting plasma glucose analys

3.3. Results of logistic regression single factor analysis of serum biochemical indicators

Dichotomous variable logistic regression analysis showed that high fibrinogen was a risk factor for vascular crisis (P<0.05); high 2h postprandial glycemia was a risk factor for vascular crisis (P<0.01); high fasting plasma glucose was a risk factor for vascular crisis (P<0.01) (as shown in Table 3).

Table 3: **Results of Logistic Regression Single Factor Analysis of Serum Biochemical Indicators**

Biochemical indicators	RR value	P value	95% confidence interval
Fibrinogen	5.34	0.03	1.21~23.49
2h postprandial glycemia	19.40	0.01	2. 16 ~174. 53
Albumin	1.40	0.66	0.31~6.28
Fasting plasma glucose	15.26	0.02	2.73~85.23
D-dimer	1.78	0.50	0.33~9.55

4. Discussion

Free tissue flap transplantation is an important method of maxillofacial surgical repair and reconstruction. The survival rate of skin flap is closely related to the follow-up treatment of patients, and therefore, it is crucial to prevent the flap crisis early after surgery. Using microvascular anastomat to anastomose the vein during operation can reduce the operation time and improve the successful rate of vascular anastomosis, but the vascular anastomat is expensive, increasing the patients' financial burden. At present, most of vascular anastomosis is still dominated by microsurgical suture. In addition, postoperative oral care and diet care can also reduce the incidence of postoperative skin flap crisis, and free tissue flap transplantation is the important method of maxillofacial surgical repair and reconstruction, the survival rate of skin flap is closely related to the follow-up treatment of patients, and therefore, it is crucial to prevent the flap crisis early after surgery. Using microvascular anastomat to anastomose the vein during operation can reduce the operation time and improve the successful rate of vascular anastomosis, but the vascular anastomat is expensive, increasing the patients' financial burden. At present, most of vascular anastomosis is still dominated by microsurgical suture. In addition, postoperative oral care and diet care can also reduce the incidence of postoperative skin flap crisis.

The finding of this study showed that albumin had no effect on vascular crisis of skin flap in postoperative patients. Albumin is one of the most important nutrients in human body. In addition to maintaining the alternating osmotic pressure, albumin can also maintain the integrity of capillary intima, enhance the anti-platelet agglutination and inhibit the thrombus formation. The results of this study showed that the level of albumin after operation was not related to the vascular risk of skin flap. D-dimer antigen, a specific marker of fibrin degradation, requires the co-action of Xlla factor, thrombin and fibrinolytic enzyme for production. D-dimer antigen has been proved to be one of the highly sensitive indicators of thrombosis and dissolution. (Adam S.S. et al., 2009). There are no D-dimer in the normal blood, but when there is coagulation and secondary fibrinolysis (such as malignancy, surgery, infection, pregnancy, and trauma) in the body, D-dimer in the blood gradually occurs and increases. The study indicated that normal plasma D-dimer can exclude the incidence of thrombus in patients (Liu Yongli et al., 2017), while increased plasma D-dimer indicates a risk of thrombosis. However, this study found that D-dimer was not a risk factor for flap crisis. To sum up, both high fibrinogen and high blood glucose are high risk factors for vascular crisis in free skin flap. In the reconstruction of maxillofacial defect, serum biochemical indicators should be combined; if fibrinogen and blood glucose are high, the possibility of vascular crisis should be considered, and the corresponding regulation should be carried out before operation to make it reach or near the normal level; if multiple high-risk factors are combined, pedicle skin flap should be considered to reduce the possibility of skin flap crisis after operation and improve the success rate of operation. If free skin flap is necessary, postoperative care should be strengthened.

References

Qiu Weiliu. (2005). Study on Present Situation and Prospect of Oral and Maxillofacial Defect Repair and Reconstruction. *Chinese Journal*

of Reparative and Reconstruction Surgery, 19 (10), 769-772.

Yang Shuyong, Zheng Weiyin, and Li Hao, et al. (2011). Clinical Analysis of 106 Cases of Oral and Maxillofacial Tissue Defect Repaired by Free Skin Flap. *Journal of Practical Stomatology*, 27 (6),798-800.

Khuri SF,Daley J,Henderson W, et al. (1997). Risk adjustment of the postoperativemortality rate for comparative assessment of the quality of surgical care: results of the National Veterans Affairs Surgical Risk Study. *J Am Coll Surg*, 185(4), 315-327.

Yang Lianghui, Mai Huaming, and Wu Jiaxiao, et al. (2017). Analysis on Serum Biochemical Factors and Vascular Crisis of Oral and Maxillofacial Free Tissue Flap. *China Journal of Oral and Maxillofacial Surgery*, 15 (5), 431-434

Guo Hongyan and Ma Zhongjin. (2012). Study on Nursing Care of 30 Patients with Postoperative Defects of Oral Cancer Repaired with Pedicled Fibular Flap. *Chinese Journal of Misdiagnostics*, 12 (3), 163-165.

Yu Zhigang, Ma Zhuang, and Huang Jiang. (2017). Study on Application of Microvascular Aastomat in Repairing Maxillofacial Defect with Free Skin Flap. *Journal of Clinical Stomatology*, 33 (1), 46-48.

Li Dalan. (2003). Study on Nursing Care of Repairing Oral and Maxillofacial Tissue Defect with Free Skin Flap. *Modern Journal of Integrated Traditional Chinese and Western Medicine*, 21 (2), 115-116.

Zhou Zhegang, Wan Shengxiang, Xiao Yingfeng, et al. (2016). Analysis of Causes and Clinical Results of Failure Cases of Free Skin Flap . *Journal of Practical Orthopaedics*, 22 (9), 802-805.

Ma Zhuang, Huang Hongwei, Yu Zhigang. (2017). Study on Effect of Age on Perioperative Complications of Free Anterolateral Femoral Flap for Oral Cancer . *Journal of Clinical Stomatology*, 33 (7), 429-432.

Chen Guosheng. (2017). Study on the Value of Plasma Fibrinogen and D-dimer Detection in the Early Diagnosis of Deep Vein Throm--bosis in Elderly Patients with Femoral Neck Fractures. *Henan Journal of Surgery, 23 (6),* 136-137.

Hou Y,Carrim N,Wang Y,et al. (2015). Platelets in hemostasis and thrombosis:novel mechanisms of fibrinogen-independent platelet aggregation and fibronectin-mediated protein wave of hemostasis. *Biomed Res*, 29(6) , 437-444.

Bozikow K, Arnez ZM. (2006). Factors predicting free flap complications in head and neck reconstruction. *Plast Reconstr Aesthet Surg*, 59(7), 737-742.

Tan Zhao and Li Wenge. (2018). Correlation between Serum Uric Acid and Urinary Microalbumin Levels and Chronic Vascular Complications in Patients with Type 2 Diabetes. *Journal of China Medical University*, 47 (1), 67-72.

Jayashankar CA,Andrews HP,Vijayasarathi,et al. (2016). Serum uric acid and low—density lipoprotein cholesterol levels are independent predictors of coronary artery disease in Asian Indian patients with type 2 diabetes mellitus. *J Nat Sci Biol Med*, 7(2), 161-165.

Hammer MJ,Casper C,Gooley TA, et al. (2009). The contribution of malglycemia to mortality among allogeneic hematopoietic ce Il transplant recipients. *Biol Blood Marrow Transplant*, 15, 344-351.

Goldberg RB. Cytokine and cytokine-like inflammation markers, endothelial dysfunction, and imbalanced coagulation in development of diabetes and its complications. *Clin Endocrinol Metab*, 94, 3171-3182.

Fuji S,Einsele H,Savani BN, et al. (2015). Systematic nutritional support in allogeneic HSCT recipients. *Biol Blood Marrow Transplant*, 21(10), 1707-1713.

Adam SS, Rey NS, Greenberg CS. (2009). D-dimer antigen: current Concepts and future prospects. *Blood*, 113(13), 2878-2887.

Liu Yongli, Cheng Fuli, and Jing Xiaobo, et al. (2017). Study on the Significance of Plasma D-dimer in Predicting Deep Venous Thrombosis after Lower Extremity Fracture in School-age Children. *Chinese Journal of Bone and Joint*, 6 (7), 526-529.