ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 3, June - 2023, Page No. : 20 - 30

Comparison between Conventional PMMC flap and Double Pedicled PMMC flap for Reconstruction in Oral Cancer Defects

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How to citation this article: Dr. Mohit Negi, Dr. Abhishek Singh Panwar, Dr. Priyank Gupta, Dr. Anurag Yadav, Dr. Arjun Agarwal, "Comparison between Conventional PMMC flap and Double Pedicled PMMC flap for Reconstruction in Oral Cancer Defects", IJMACR- June - 2023, Volume – 6, Issue - 3, P. No. 20 – 30.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Purpose: There are variety of flaps that can be utilized for oral cancer defects reconstruction but it is observed that while raising PMMC flap based on thoracoacromial artery there are more chances of partial necrosis of lateral part of the island especially on the part covering the oral cavity, hence it is always helpful to use double pedicled flap using multiple arterial supply like taking additional lateral thoracic artery which usually gets compromised while raising conventional PMMC flap. So, this study was conducted to observe and analyse the difference of outcome in conventional PMMC flap and double pedicled PMMC flap.

Materials and methods: This study included 74 patients who were surgically treated for oral cancer defects and required reconstruction in Oral & Maxillofacial surgery department at Institute of Dental Sciences & Rohilkhand Medical College and hospital Bareilly between November 2019 and May 2021. Two study groups were divided into Group A (Single artery based Conventional flap) and Group B (Double Pedicled flap). Both the flaps were compared and evaluated on the basis of 4 parameters namely stripping of pectoralis minor, tension in flap, and necrosis of flap and suture line exposure/dehiscence. In this study all patients operated requiring reconstructions in the mentioned time period were evaluated considering selection of flap.

Results: Of all 74 patients, in this study the sex distribution of the study population were males (n=60, 81%) and were females (n=14, 19%). Higher prepondence in male population was observed as compared to females. The age was evaluated in terms of decades in which range was set. Highest incidence was seen in age range of 20-40 followed by 40-60. Regarding the involvement of various intra oral sites by the primary tumour most commonly carcinoma of buccal mucosa. The most common type of procedure carried out in the study population was wide local excision (WLE) + Hemi Mandibulectomy + Modified Radical Neck Dissection (MRND). Double pedicled PMMC flap (Group B) flap

was used in (n=31,42 %) out of 74 patient for reconstruction and single pedicled PMMC flap (Group A) was used in (n=43,58%) patients. The only significant finding was stripping of pectoralis minor signifying significant muscle damage in Double pedicled (Group B 96.8% p-value).

Conclusion: By assessing a plethora of parameters the only significant difference worth mentioning was stripping of pectoralis minor having more prevalence in double pedicled flap rest when compared were non-significant hence according to this study conventional flap was superior when compared to double pedicled flap. However further prospective studies should be conducted to get a more precise consensus over selecting the types of flap to be implemented while reconstructing oral and oropharyngeal defects.

Keywords: maxillofacial,oral cancer, pectoralis major, lateral pedicle, reconstruction, oral cancer, double pedicle.

Introduction

Reconstruction in oral cancer defects is always a challenging task for surgeons and requires meticulous selection of flap for reconstruction of the defect site. There are variety of flaps that can be utilized for oral cancer defects reconstruction like radial forearm flap, free fibular flap, scapular flap, abdominal flap, lattissmus dorsi flap and many more. However, Pectoralis major myocutaneous flap stands out to be the work horse among all other flaps described by Ayrian in 1969. It is based on vessels of the thoracoacromial artery.[1]However, it is observed that while raising PMMC flap based on thoracoacromial artery there are more chances of partial necrosis of lateral part of the island especially on the part covering the oral cavity[2], hence it is always helpful to use double pedicled flap using multiple arterial supply like utilizing /preserving additional lateral thoracic artery which usually gets compromised while raising conventional PMMC flap. Hence this study was done to evaluate the credibility of double pedicle PMMC flap over conventional PMMC flap.

Materials And Methods

This prospective study was conducted on patients referring to the maxillofacial department of Institute of Dental Science hospital & Rohilkhand medical college and hospital in Bareilly in duration between November 2019 & May 2021 (18 months). The inclusion criteria were all requiring reconstruction for oral cancer defects using pectoralis major myocutaneous flap (n = 74). Exclusion criteria was cases with missing vessel (anatomic variation), cases in which vessels got damaged during surgery. Patients were divided into 2 groups (Group A & B). In Group A patients the oral cancer defect was reconstructed using conventional single pedicled flap and in Group B patients double pedicled (preserving the lateral thoracic artery) PMMC flap was used for reconstruction. Data was analysed using SPSS version 22.0 using descriptive analysis. Based on four criteria—pectoralis minor stripping, flap tension, flap necrosis, and suture line exposure/dehiscence—both flaps were compared and assessed. In this research, every patient who underwent surgery requiring reconstruction during the specified time period was assessed with regard to flap selection.

Results

The current study was conducted in the Department of Oral and Maxillofacial Surgery, Institute of Dental Sciences & Rohilkhand Medical College and Hospital, Bareilly. The aim of the study was to evaluate and inter-compare the efficacy of thoraco-acromian artery with

lateral thoracic artery based PMMC flap versus thoraco-acromian artery based PMMC flap for reconstruction in oral cancer cases.

In this research, 74 patients who underwent ablative surgery for head and neck cancer between 2019 and 2021 and underwent reconstruction using a major myocutaneous flap from the pectoral muscle were included. The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel, 2010) and then exported to data editor page of SPSS version 20 (SPSS inc., Chicago, Illinois, USA).

Descriptive statistics included computation of percentage, mean and standard deviations were calculated. Statistical test applied for the analysis was chi-square test and student t-test. The level of confidence interval and p-value were set at 95% and 5%.

Graph 1 & Table 1 shows that in (n=31,42 %) out of 74 patients double pedicled PMMC flap (Group B) was used for reconstruction and single pedicled PMMC flap (Group A) was used in (n=43,58%) patients.

Graph 2 & Table 2 shows the first parameter stripping and damage to the pectoral is minor muscle, in Group A damage was seen in 1 (2.3%) patient only out of 43 patients and in the remaining 42 (97.7%) patients no damage was done. In Group B damage was seen in 30 (96.8%) patients only out of 43 patients and in the remaining 1 (3.2%) patient no damage was done. This was a significant finding as the positive predictive value came out to be 0.001.

Graph 3 & Table 3 shows next parameter pressure and tension in flap, In Group A patient was seen in 3(7%) patients out of 43 and in the remaining 40 (93%) patients no pressure and tension was seen while in Group B in 4(12.9%) patients out of 31 pressure and tension was observed and in the remaining 27 (87.1%) patients no pressure and tension was observed.

Graph 4 & Table 4 shows the 3rd parameter necrosis of flap was observed at intervals of 1st, 2nd, 3rd, 7th, 14th days. At day 1 number of cases with necrosis of flap was nil (0) in both the groups (A&B). In day 2 necrosis was seen in 4(9.3%) out of 43 patients of Group A and in Group B no necrosis was seen in 31 patients on 2nd day (p value = 0.081 Non Significant). On 3rd day in Group A 5 (11.6%) patients were having necrosis in flap out of 43 patients and in Group B only 2 (6.5%) patients out of 31 patients were having necrosis (p value = 0.453 (NS). On 7th day in Group A 10 (23.3%) patients were having necrosis in flap out of 43 patients and in Group B 4 (12.9%) patients out of 31 patients were having necrosis (p value = 0.262 Non Significant). Likewise on 14th day in Group A 14 (32.6%) patients were having necrosis in flap out of 43 patients and in Group B 6 (19.4%) patients out of 31 patients were having necrosis (p value = 0.207 Non Significant).

Graph 5 & Table 4 shows the last 4th parameter suture line exposure was also observed at intervals of 1st, 2nd, 3rd, 7th, 14th days. At day 1 number of cases with suture line exposure was nil (0) in both the groups (A&B). In day 2 suture line exposure was seen in 3 (7%) out of 43 patients of Group A and in Group B no suture line exposure was seen in 31 patients on 2nd day (p value = 0.081 non-Significant). On 3rd day in Group A 8 (18.6%) patients were having suture line exposure in flap out of 43 patients and in Group B only 3 (9.7%) patients out of 31 patients were having suture line exposure (p value = 0.287 non-Significant). On 7th day in Group A 13 (30.2%) patients were having suture line exposure out of 43 patients and in Group B 6 (19.4%) patients out of 31 patients were having suture line

exposure (p value = 0.291 non-Significant). Likewise on 14th day in Group A 15 (34.9%) patients were having suture line exposure out of 43 patients and in Group B 8 (25.8%) patients out of 31 patients were having suture line exposure (p value = 0.207 non-Significant).

Discussion

Reconstructive oncology history reveals that initial efforts to achieve soft tissue healing and bony continuity, involved staged procedures that were long and tedious. Experience gained over years has led us to recognise the advantage of immediate reconstruction at the time of initial operation which led the patients to being more willing for extensive resection with reasonable expectation that an immediate reconstruction will provide an adequate cosmetic result.3

Based on this information, changes to the pectoralis major myocutaneous flap were made, including

Arc of rotation: Pectoralis paddle myocutaneous flap is used for reconstruction, the paddle of skin distal to pectoralis major muscle, which was supplied by the fascia of the rectus abdominus and serratus muscles was used. This went on to become the work horse of head and neck reconstruction as it offered numerous advantages which permitted greater arc of rotation. Additional measures that have been used to enhance the arc of rotation are related to the method of transfer of muscular component of the flap. In most cases, muscle is transported over the clavicle and tunneled deep to the cervical skin which helps to provide coverage to the carotid artery and augment soft tissue defect following radical neck dissection.4

Additional 3 cm length of the flap can be gained by removing segment of a clavicle while the flap is being raised.5 As a further modification, tunnelling the muscle pedicle deep to the clavicle can be done in a sub-periosteal plane, but there is a potential risk of vascular compression.6 Robert describes modification of Pectoralis major that extends the arc of rotation by about 8 cm cephalad. Here, the attachments of the muscle are freed more completely especially at its insertion in the humerus just medial to the axilla and advances the centre of arc of rotation for a more distal placement of flap and more tension free closure without damaging the axillary artery and vein. A sub-mandibular incision should be placed to produce a neck tunnel to pass the flap into the oral cavity or face at the level of sub-cutaneous layer of the skin.7

Bulk: Excess bulk is rarely a problem in most patients with head and neck cancer. However, there may be a problem when tubing of skin is required to reconstruct the pharyngoesophagus or introduction of excess tissue in the oral cavity results in interference of tongue function. One modification to overcome the bulk associated with Pectoralis major myocutaneous flap i.e., thin flap. Here, the skin paddle is elevated upto the fascial covering the muscle. Once the bulk is assessed, the skin paddle can be completely amputed and defatted. This can be used later as a full thickness graft by placing it on the fascia by quilt sutures.8 The Pectoralis myofacial flap can be used for reconstruction of oral cavity and pharyngeal defects. The muscle flap along with the fascias elevated along with the vascular pedicle. Successful reconstruction is seen in most of the defects and the surface of flap is covered by squamous epithelium within a month.9

Inclusion of an osseous segment for mandibular reconstruction: Pectoralis osteo-musculocutaneous flap can be used for oromandibular reconstruction. The viability of the transferred 5th rib can be demonstrated using fluorescence microscopy. Pulse labeling with

different color markers showed the deposition of new osteoid and hence indicated active metabolism. An alternative source of vascularised bone for transfer with Pectoralis major is described. The outer cortex of the sternum with parasternal skin paddle can be used. The harvest of this composite flap is associated with fewer pulmonary complications, but has not been taken up with much enthusiasm.10

Excess hair growth on the chest in males: A myodermal modification of myocutaneous flap was introduced to prevent hair growth i.e by de-epithelialization retaining only the dermis layer. Use of myodermal modification resulted in the reduction of dermal appendages including hair follicles with little effect on the flap survival and mobility.11

Poor circulation and consequent partial necrosis: A method was described that preserves circulation during preparation of Pectoralis major myocutaneous flap in head and neck reconstruction. They analysed the circulation and hemodynamics of the Pectoralis major myocutaneous flap and said that the perforator of the anterior intercostal branch located about 12cm medial to the areola in the 4th intercostal space is important. The safe donor site was evaluated in the chest wall for skin island which included the perforator in the central axis improved the surgical procedures for elevation and prevent perforator injuries and transferred the flap under the clavicle there by increasing the range.12

This gradual evolution of PMMC flap also leads to another modification of utilization of lateral thoracic artery in the flap reconstruction. The pectoral branch of the thoracoacromial artery provides a singular vascular supply during the traditional method of harvesting a PMMC flap. However, this method impairs the distal skin island of the flap and necessitates a communicating vessel-mediated indirect blood supply, which raises the possibility of partial distal flap necrosis.

Preserving the lateral thoracic artery and using the subclavian route are alternatives that ensure adequate blood supply and a greater rotation arc when harvesting a PMMC flap for oral and maxillofacial reconstruction. With this method, there is no chance of vascular insufficiency to the distal skin island and the PMMC flap can be harvested to cover the entire oral cavity, including the infraorbital region, palate, middle pterygopalatine fossa, and nasopharynx.13

In this study the sex distribution of the study population were males (60, 81%) and were females (14, 19%). Higher prepondence towards male population was observed as compared to females.

Regarding the type of flap used in 31(42 %) out of 74 patients double pedicled PMMC flap (Group B) was used for reconstruction and single pedicled PMMC flap (Group A) was used in 43(58%) patients.

First parameter stripping and damage to the pectoralis minor muscle, in Group A damage was seen in 1 (2.3%) patient only out of 43 patients and in the remaining 42 (97.7%) patients no damage was done. In Group B damage was seen in 30 (96.8%) patients only out of 43 patients and in the remaining 1 (3.2%) patient no damage was done. This was a significant finding as the positive predictive value came out to be 0.001. There was one case in which along with pectoralis minor the intercostal muscles also got stripped which was managed by primary suturing of the defect.

Stripping of pectoralis minor at times becomes essential especially if the plan is to take a double pedicled flap (due to course of lateral thoracic artery) however in one case we were able to save stripping of pectoralis minor due to anatomic variation in which the lateral thoracic

was present more lateral and superficial to pectorals minor muscle.

The parameter pressure and tension in flap basically depends upon length of neck and relative length of chest. Tension in flap is mostly seen in long neck and short chest cases due to decrease in length in the flap pedicle there is undue pressure on the flap also due to restricted range of motion in neck(after surgery) it is observed that the flap gets stretched frequently. Hence utmost importance of post-op care is always expected.

The 3rd parameter necrosis of flap was observed at intervals of 1st, 2nd, 3rd, 7th, 14th days. Extra pedicle always gives an edge to the conventional flap and reduces the chances of distal end necrosis but if we observe taking in consideration all the concomitant factors it cannot be judged based on increasing the supply of blood certain diseases like diabetes, immune-compromised patients, undue pressure in flap & performance scale may also have an impact leading to necrosis.

The last 4th parameter suture line exposure was also observed at intervals of 1st, 2nd, 3rd, 7th, 14th days. Suture line dehiscence is frequently concomitant with necrosis and tension in flap. Other factors like use of staples, trifurcation suturing errors always affects the outcome.

Conclusion

The advent of myocutaneous flap has afforded the surgeon an opportunity to more critically address the esthetic and functional outcome of complex orofacial reconstructions. The Pectoralis major myocutaneous flap being one of them has been in use since its introduction by Ariyan in 1979 and several authors have described its value and versatility. This study was done to evaluate the efficacy of double pedicled flap over single pedicled Pectoralis Major Myocutaneous Flap and the results showed that by evaluating all the 4 parameters only significant difference was seen is stripping to pectoralis minor which was more prevalent in double pedicled `flap rest when compared were non-significant hence according to this study conventional flap was superior with double pedicled flap.

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Legend Tables and Graph

Table 1

		Group		Total	p-value
		A	B		
Gender	Male	35	25	60	0.935 (NS)
		81.4%	80.6%	81.1%	
	Female	8	6	14	
		18.6%	19.4%	18.9%	
Total		43	31	74	
		100.0%	100.0%	100.0%	

Test applied: Chi-square test

Graph 1

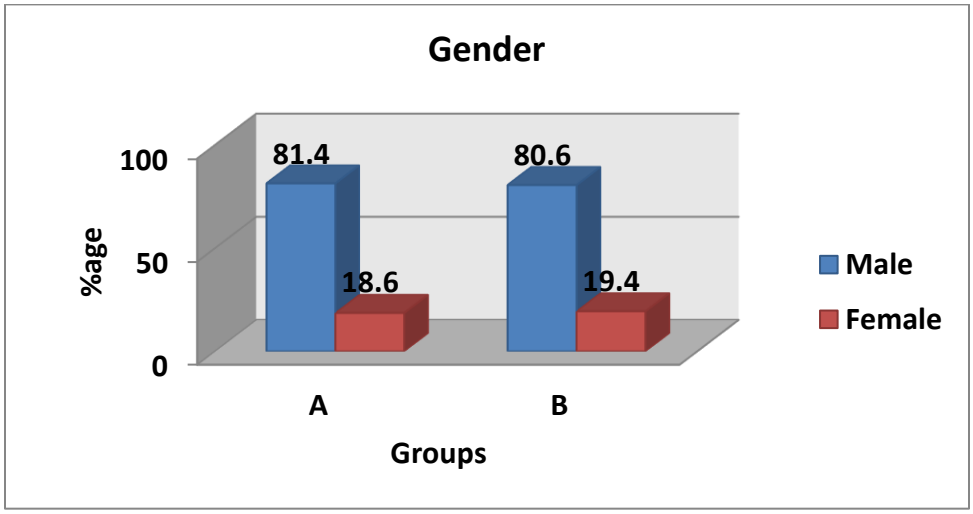

Table 2

Stripping and damage to pec minor		Group		Total	p-value
		A	B		
	Yes	1	30	31	0.001 (Sig.)
		2.3%	96.8%	41.9%	
	No	42	1	43	
		97.7%	3.2%	58.1%	
Total		43	31	74	
		100.0%	100.0%	100.0%	

Test applied: Chi-square test

Graph 2

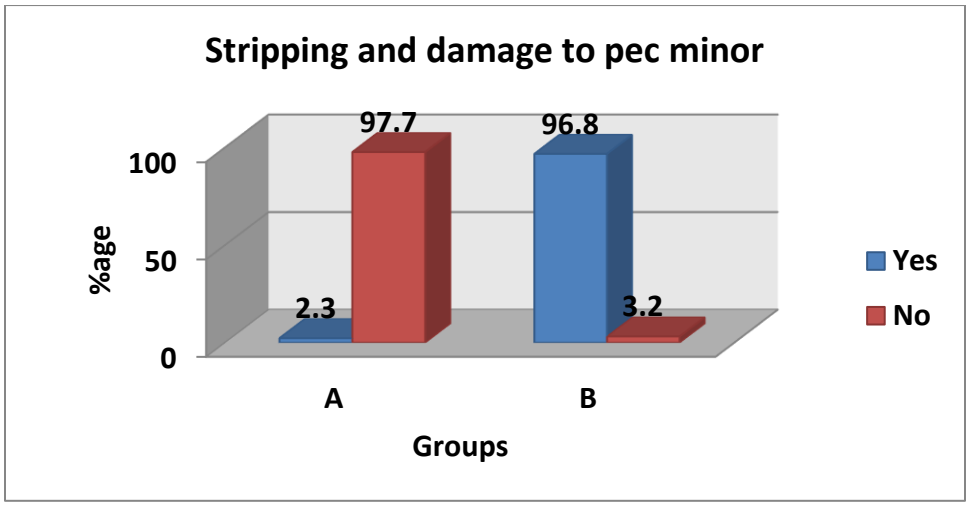

Table 3

Pressure and tension in flap		Group		Total	p-value
		A	B		
	YES	3	4	7	0.390 (NS)
		7.0%	12.9%	9.5%	
	NO	40	27	67	
		93.0%	87.1%	90.5%	
Total		43	31	74	
		100.0%	100.0%	100.0%	

Test applied: Chi-square test

Graph 3

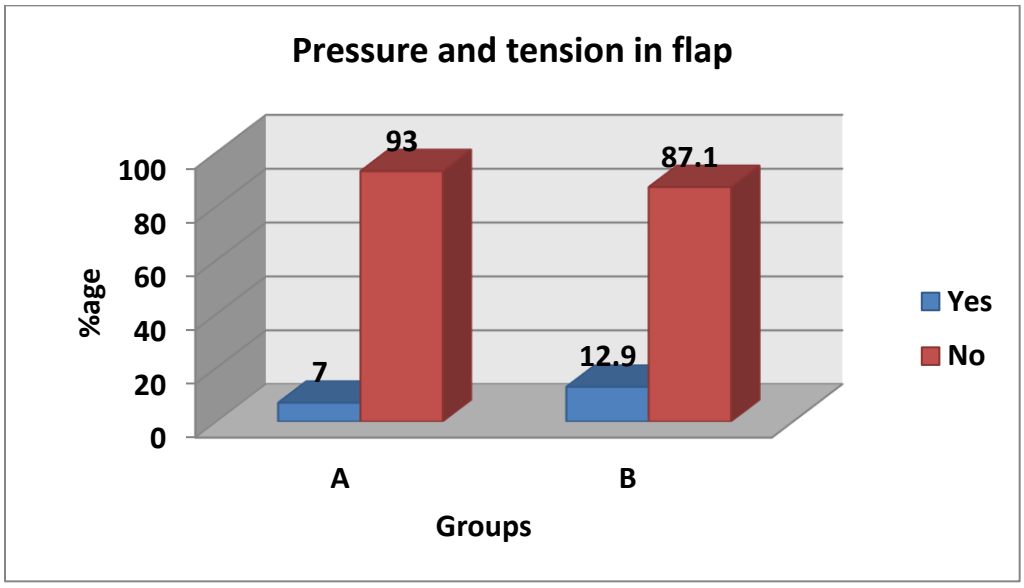

Table 4

Necrosis Of Flap	Group		Total (n=74)	p-value
	A (n=43)	B (n=31)		
Day 1	0	0	0	-
	0.0%	0.0%	0.0	
Day 2	4	0	4	0.081 (NS)
	9.3%	0.0%	5.4%	
Day 3	5	2	7	0.453 (NS)
	11.6%	6.5%	9.3%	

Day 7	10	4	14	0.262 (NS)
	23.3%	12.9%	18.9%	
Day 14	14	6	20	0.207 (NS)
	32.6%	19.4%	27.0%	

Test applied: Chi-square test

Graph 4

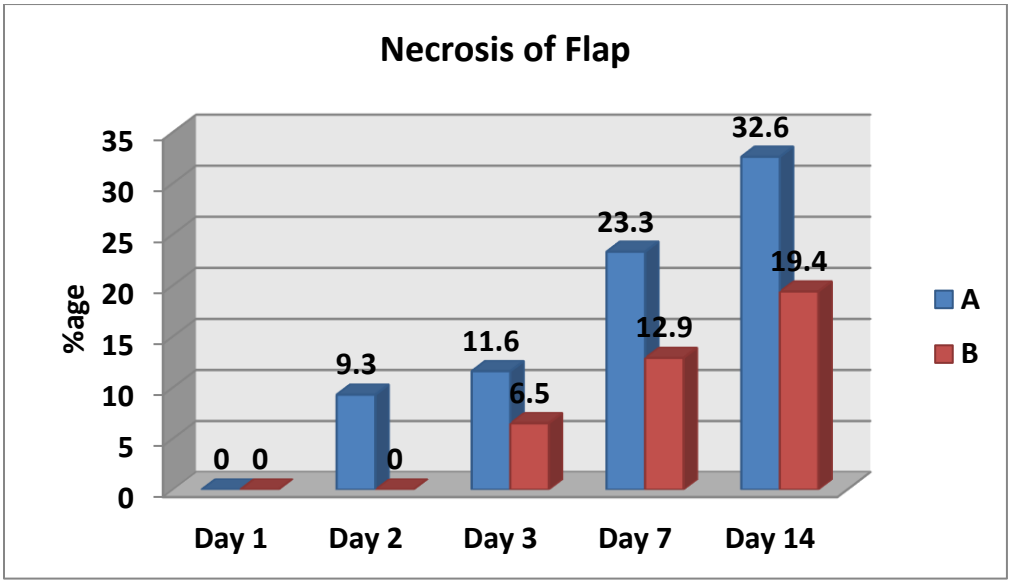

Table 5

	0.0%	0.0%	0.0	
Day 2	3	0	3	0.081 (NS)
	7.0%	0.0%	4.1%	
Day 3	8	3	11	0.287 (NS)
	18.6%	9.7%	14.9%	
Day 7	13	6	19	0.291 (NS)
	30.2%	19.4%	25.7%	
Day 14	15	8	20	0.207 (NS)
	34.9%	25.8%	31.1%	

Test applied: Chi-square test

Graph 5