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Love-heart flap for the reconstruction of skin defects

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***Abstract*---**Background and objectives: In any reconstructive surgery, when we plan to repair any soft tissue defect in the body, the priority will be to replace the tissues like with like, with taking into consideration the donor site morbidity, surrounding soft tissue availability, operative time, and long-term complications. The aim of this study is to assess reliability and feasibility, in addition to donor site morbidity of love-heart flap, in the reconstruction of the skin defects Methods: Reconstruction of skin defects by love heart flap were performed in the plastic surgery department (Rizgary teaching hospital) between (March 2021- July 2022), records of patient's age and sex, size, site, and pathology of the skin defect, flap's diminsion, and complications are documented to study the ability of the flap to cover the skin defect and its long-term survival. Results: Thirteen patients underwent reconstruction; ages were ranging from forty- tow to seventy- three-years-old with a mean age of 56 years, nine were males, and four were females. Size of the defect ranged from (20 mm^2) to (707 mm^2) with a mean defect size of 120.923 mm^2. Six flaps in the upper limbs, four flaps in the head and neck, and three flaps in the lower limbs. All flaps were successful in covering the defects, with no partial or total necrosis. Conclusions: Love heart flap is a feasible flap with a good survival rate, is versatile and can be used for skin defects in different regions of the body with a low complication rate, is an easy technique for learning by surgeons, and have short operative duration with the acceptable cosmetic outcome.

***Keywords*---**Love, Heart, Flap, reconstructive surgery, skin.

Introduction

Plastic surgery is the field of invention; particularly, it depends on principles more than techniques; therefore, plastic surgery developed in strides, especially in the last decade. The main goal of the plastic and reconstructive surgeon when he is dealing with any type of body defect is normalization this defect as much as possible, particularly because it deals with a problem that affect directly on the function and shape of the body. (1)

In any reconstructive surgery, when we are planning to repair any soft tissues defect in the body, the priority will be to replace the tissues like with like, with taking into consideration the donor site morbidity and where it is not possible to complete the primary closure, the main objective is replacing the missing tissue as near as possible with minimal tissue morbidity of the donor site.

The reconstructive ladder was used as guiding for reconstruction surgery as a principle for wound reconstruction with the aim of restoring shap and function to patients. (2)

The word 'flap' originated allegedly from the sixteenth-century Dutch word FLAPPE, which referred to *anything that hung broad and loose, fastened only by one side.*

Whilst the term flap is part of the plastic surgical nomenclature, we were unable to discover when it was first used in a surgical context. Flap repairs are an integral part of plastic and reconstructive surgery and can vary in tissue composition and size, depending on the surgical defect to be repaired (3)

Wars have caused a multitude of wounds that require reconstruction and, by necessity, have served as an important stimulus for flap innovation. Distant flaps are a good example. These include the cross-leg flap, described by Hamilton in 1854 for covering a chronic ulcer; the tube flap described by Filatov from Odessa, Russia, in 1917, taken from the neck for lower eyelid reconstruction; and others used by Esser in the Austrian war. Daniel and Kerrigan credited Esser with the concept of axial-pattern flaps. These were described by Esser as early as 1918 as "biological" flaps, having a narrow pedicle that included the requisite vessels, to demonstrate that a flap could survive as long as it had an arterial pedicle. (4)

In 1955, Owens documented the successful transfer of skin and muscle together as a flap to reconstruct major facial defects. It comprised the sternocleidomastoid muscle, overlying platysma, subcutaneous tissue, and skin. In 1968, Hueston and McConchie [5,12,13] performed a musculocutaneous pectoralis major flap to repair a sternal defect. The flap was better described by Ariyan in 1979 as a musculocutaneous flap based on the thoracoacromial artery (6). In 1964, Converse presented his classification schema of dermatocutaneous flaps, in which he listed the type of anatomic vascular basis as the most accurate point of differentiation. He divided flaps into cutaneous, arterial, and island flaps. In 1965, Bakanjiam described the deltopectoral flap based on intercostal perforators from the internal mammary artery for immediate coverage of defects after laryngopharyngectomy surgeries. (7,8)

Material and method

This is a prospective intervention study including a group of cases presented with skin defects that were received in Rizgary and Western Emergency Hospital and Emergency Hospital in Erbil city during the life of the study. The study was conducted over a period starting from March 2021 to July 2022. To study the love heart flap techniques for thirteen consecutive cases with skin defects.

The sampling was depended on the following including criteria:

-The skin defect size should be less than 32 × 32 mm with an average surface area of less than 804 mm^2.

Excluding criteria:

-Any condition that would limit the ability of the patient to participate in the study (Uncooperative patient).

-Any critical risk factor that affect directly on the process of wound healing (radiation, chemotherapy, uncontrolled diabetes mellitus, etc.....)

The surgical management of the cases will be done by the investigator and in coordination with Plastic Surgeons working in public outpatient clinics and operating theaters. The study will involve multiple stages, which are: patient selection, introduction and obtaining of informed consent, operative management of the cases, close follow-up, and data organization and archiving.

All the participants in the study have a questionnaire or information form filled out for them, with a unique code per case. The form was filled out by the investigator to ensure a uniform and cohesive collection of the required data. The data was collected using an electronic form (google forms) to aid in archiving and also for ease of accessibility of the information.

The questionnaire is composed of three main sections: section one will collect the demographic data of the cases, section two will collect information necessary for the operation and details in the procedure, while the last section will focus on operative results, complications, and visual analog scale for aesthetic results.

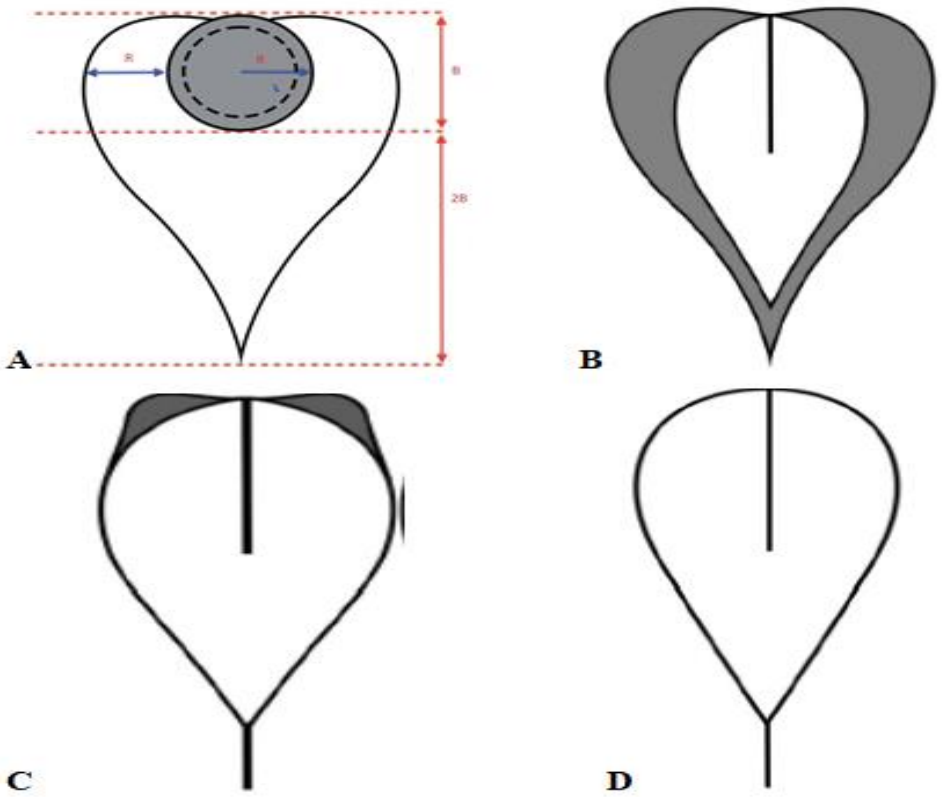
Adequate verbal and written information were provided to the patients and their families—the patient is having five follow-up visits within the life of the study.

The follow-up schedule will be 3rd day postoperatively, one week, two weeks, four weeks, and five months postoperatively. Photographs were taken for skin defect preoperatively and at each follow-up visit.

The love-heart flap is a random pattern flap designed around a circular or oval skin defect. Pre-operative Doppler ultrasound is not required as no specific perforator is used. The ideal axis of the flap is in line with cutaneous veins and

perforators. The vertical axis of the flap should be orientated perpendicular to the line of greatest skin laxity. In the lower limb, this was generally longitudinal. (38) The height of the flap has a 3:1 ratio to the diameter of the circular defect. Each lateral arm of the flap has a width that is equal to the radius of the circular defect. A heart shape is traced from the superior pole to the widest axis and then to the inferior portion of the defect. once the lesion has been excised, the outer margins of the flap are dissected to allow its mobilization into the defect. Careful dissection is performed to prevent any undermining of the flap, preserving the integrity of any perforators and cutaneous veins.

The deep fascia is not routinely divided in this dissection. The original cutaneous defect is closed firstly by direct apposition of the lateral arms of the flap, using interrupted deep dermal sutures. This creates a T-junction at the superior pole of the flap. There is now a resultant balloon-shaped island within the secondary heart-shaped defect. The secondary defect is closed from inferior to superior by completing a V-Y advancement of the inferior pole. This recruits the perpendicular laxity of the surrounding tissues. The skin can then be closed to complete the inset, leaving a balloon-shaped scar (Figure 2)



(Figure 2): Scheme of Love heart flap. **A**. marking of the donor area. **B**. Incising the flap edges with an original defect is closed firstly. **C**. secondary defect is closed

from inferior to superior by completing a V-Y advancement. **D**. skin is closed to complete the inset, leaving a balloon-shaped scar.

Table (1)

Patients' data in the study. SCC: Squamous cell carcinoma; BCC: basal cell carcinoma.

				cutaneous defect				flap dimensions			
Patient	gender	age	pathology	Location	Width. (Mm)	Length. (mm)	Area. (mm)	Maximal width	Maximal length	Follow-up time	Complicati
1	male	52	BCC	nose	5	5	20	6	9	2	Nil
2	male	55	melanoma	right lateral arm	30	30	707	60	90	3	Nil
3	female	46	BCC	forehead	5	5	20	10	15	2	Nil
4	male	66	melanoma	right forearm	10	10	79	20	30	3	Nil
5	male	68	BCC	left lateral leg	12	12	113	24	36	5	Dehiscenc
6	female	56	SCC	right forearm	7	7	38	14	21	3	Nil
7	male	49	SCC	Right medial leg	13	13	133	26	39	2	Nil
8	male	61	SCC	left lateral thigh	15	15	177	30	45	1	Nil
9	male	51	BCC	neck	7	7	38	14	21	1	Nil
10	female	73	SCC	left cheek	5	5	20	10	15	1	Nil
11	female	43	SCC	right forearm	12	12	113	24	36	2	Nil
12	male	57	SCC	left arm	8	8	50	16	24	3	Nil
13	male	50	SCC	right dorsal hand	9	9	64	18	27	2	Nil

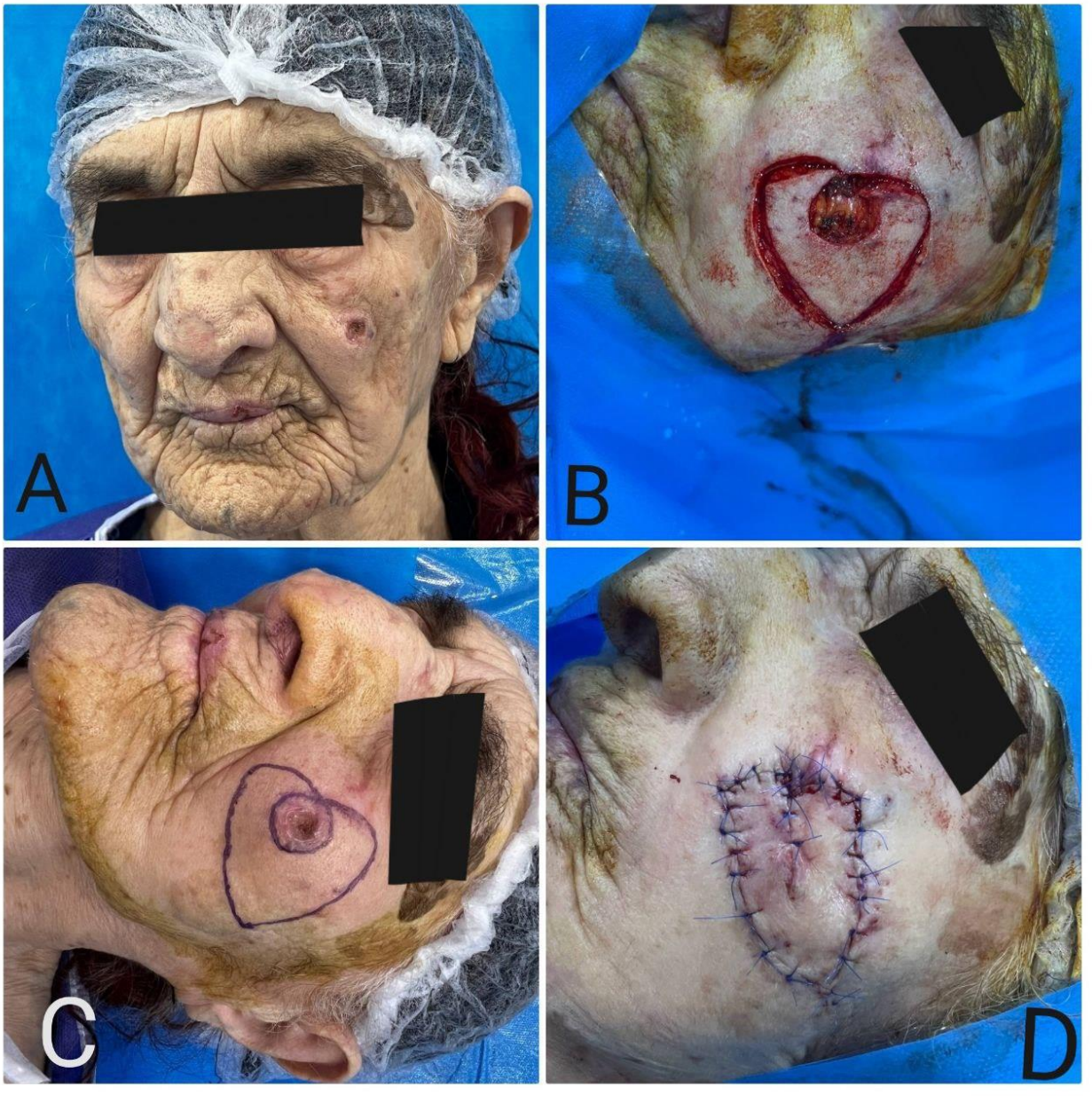


Figure (3): Patient with squamous cell carcinoma. **A**: skin lesion before surgery. **B**: Marking of the flap. **C:** flap elevation after excision of lesion **D:** immediately after operation.

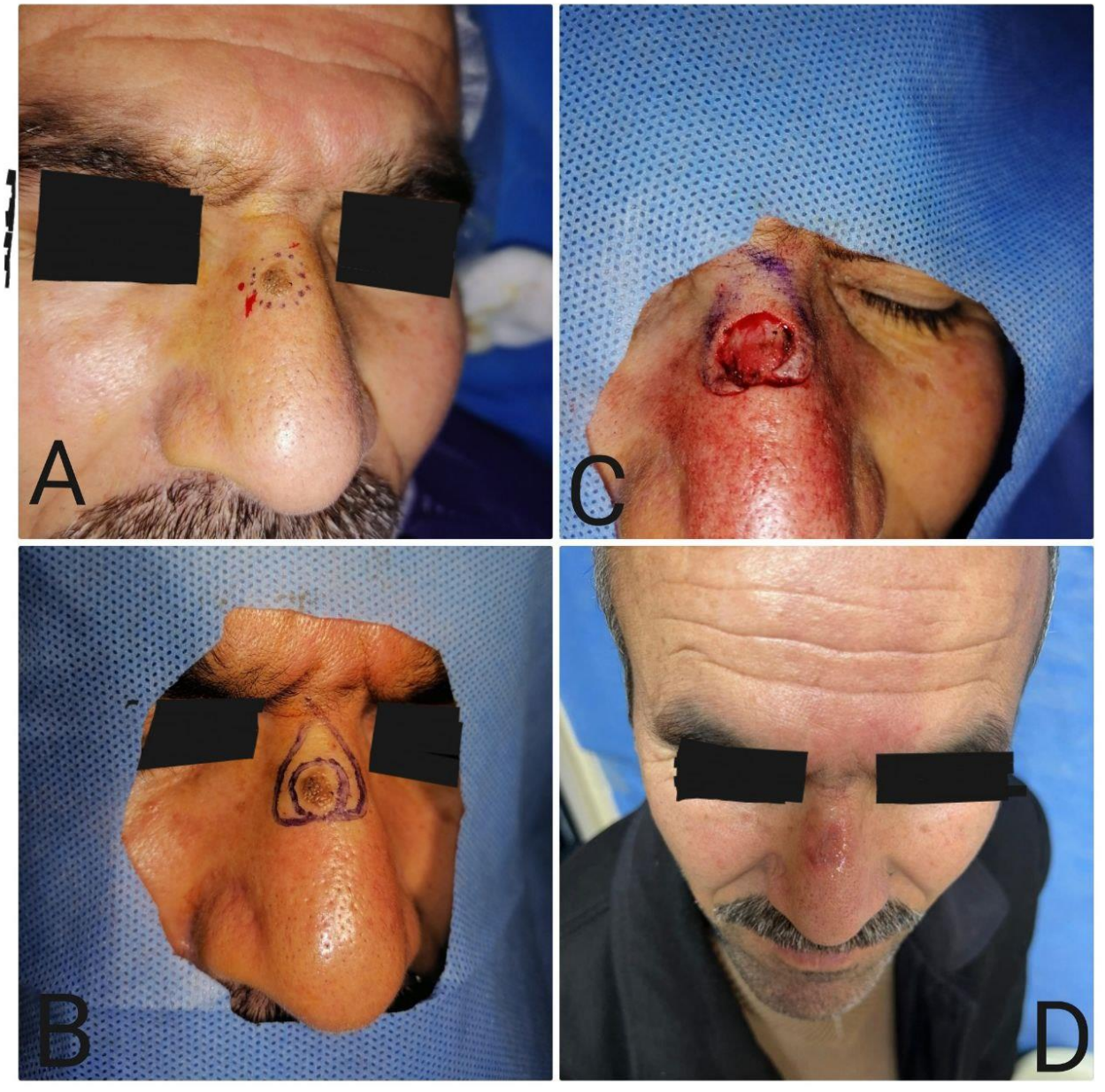


Figure (4): Patient with basal cell carcinoma. **A**: skin lesion before surgery **B**: Marking of the flap. **C:** flap elevation. **D**: two months after the operation.

Figure (5): Patient with melanoma. **A**: Marking of the flap. **B:** after excision of lesion **C:** immediately after operation. **D**: three months after the operation.

Figure (6) demonstrates the distribution of the study sample according to gender and shows that 69.2% are males and 30.8% are females.

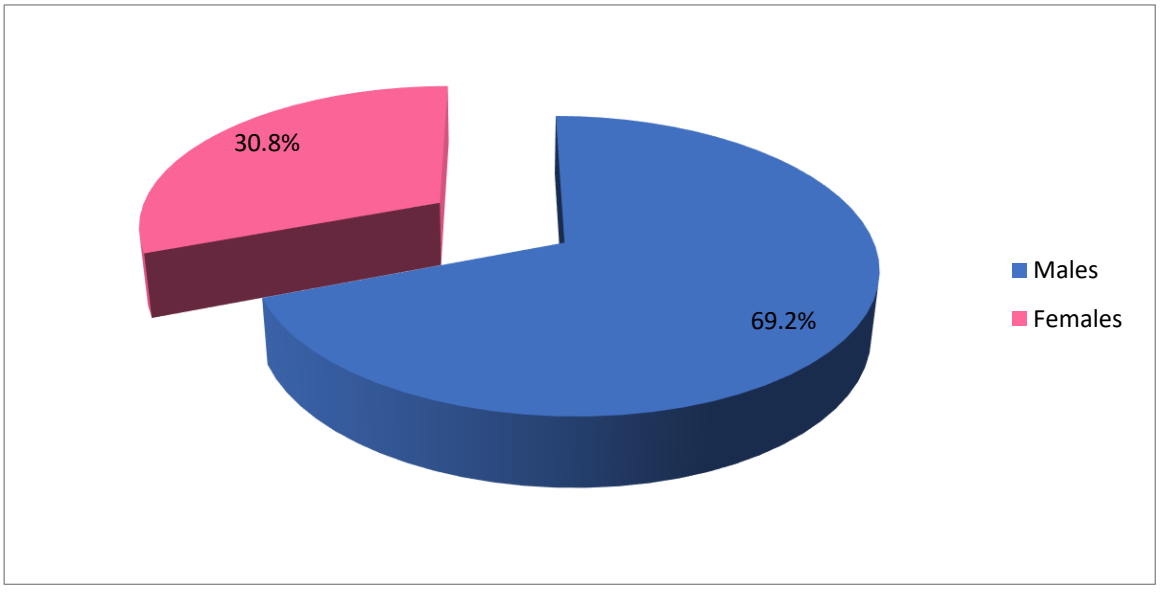


Figure (6): The distribution of the study sample according to gender.

Figure (7) demonstrates the distribution of the study sample according to the site of the lesion and reveals that 23.1% are at the forearm, 15.3% at the leg, while shoulder, thigh, nose, forehead, neck, cheek, arm, and hand each represent 7.7% of the total sample.

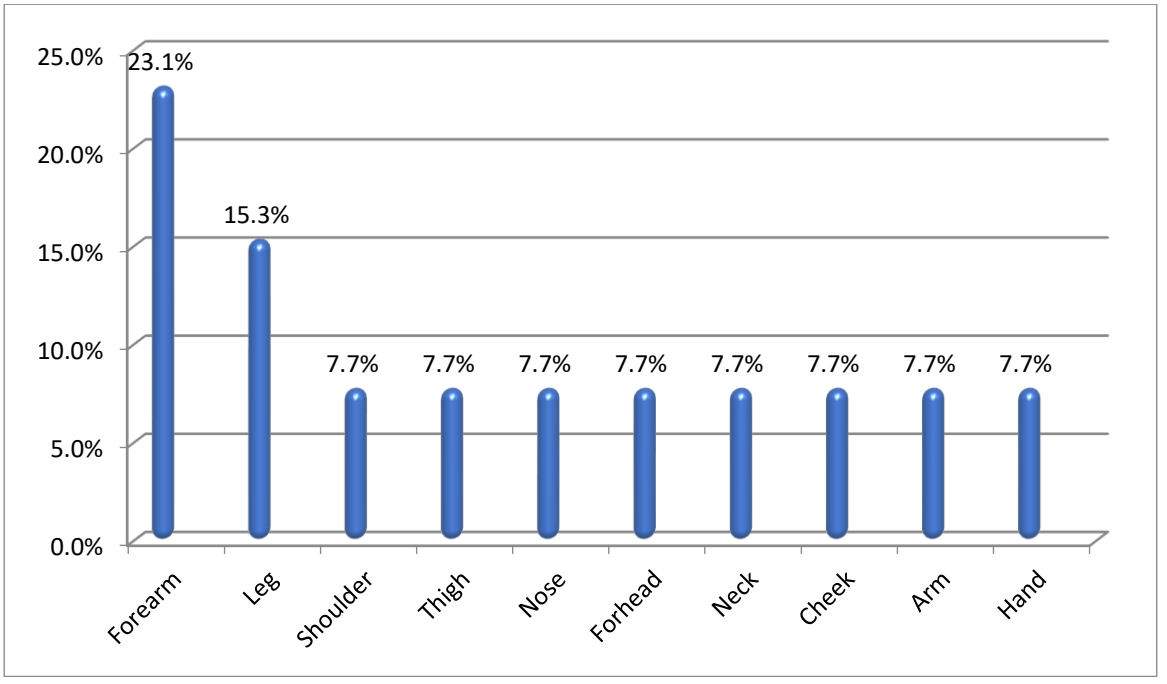


Figure (7): The distribution of the study sample according to the site of the lesion.

Figure (8) Demonstrates the number of patients for each studied lesion size and displays those three patients present with lesion size of 5*5, two patients for each 7*7 and 12*125, and one patient for each of the remaining sizes.

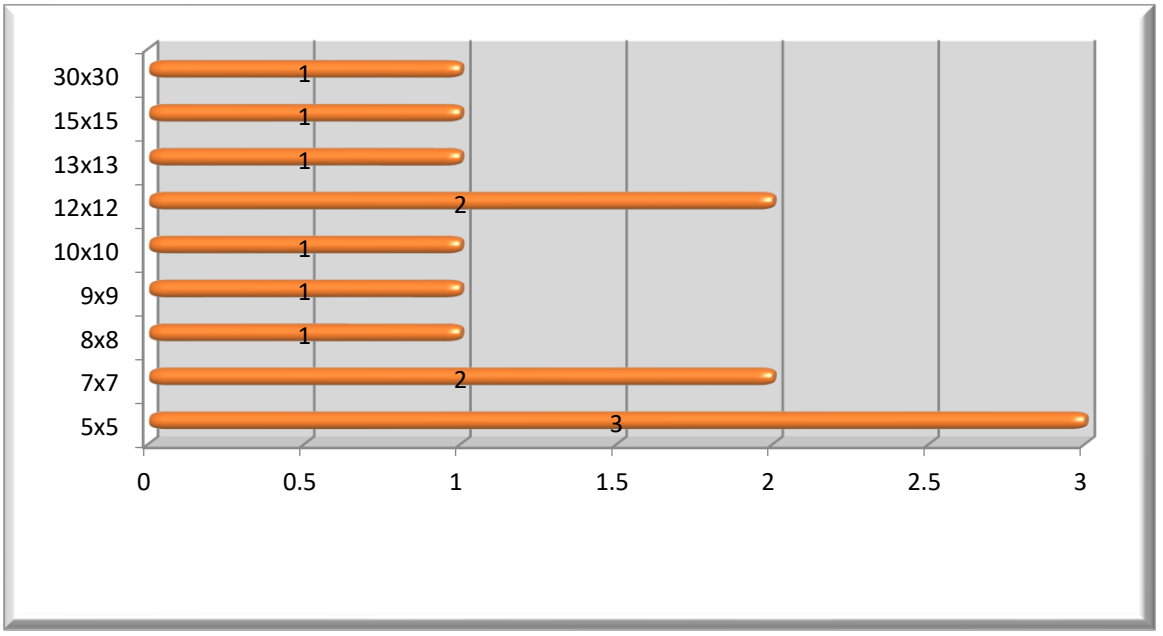


Table (2) demonstrates the statistical characteristics of the cutaneous defect and the flap dimensions with the follow-up time and shows that the mean width and length is 10.615 ±6.678 with the area of 120.923±182.857. Maximum width of the flap is 20.923 ±13.677, while the maximum length is 31.385±20.516. The mean follows up period is 2.308±1.109 months.

Table (2)
The statistical characteristics of the cutaneous defect and the flap dimensions with the follow-up time.

Study variables		**Mean**	**Standard deviation**
Cutaneous defect	**Width**	10.615	6.678
	Length	10.615	6.678
	Area	120.923	182.857
Flap dimensions	**Maximum Width**	20.923	13.677
	Maximum Length	31.385	20.516
Follow up time		2.308	1.109

Discussion

Love heart flap is a random pattern designed as an island flap around a circular skin defect. Love heart flap proved to be reliable for various complex defects with a simple technique, short operation duration, reliable blood supply, and predictable flap survival. Out of the thirteen cases, there was no partial or total necrosis of any flap, and this justifies the reliability of the flap; the high success

rate of the flap is due to the dual blood supply of both subcutaneous vascular network and perforator vessels from underlying muscle or fascia. We have one patient developed wound dehiscence, which was lower leg reconstruction, and the reason for dehiscence could be tension; and there was no necrosis or any flap loss, and the wound was managed with dressing conservatively. From monitoring and follow-up of the patients with head and neck reconstruction in our study, all flaps survived successfully with acceptable aesthetic result, color matching with adjacent tissue, and no contour deformity (Figure 3 and 4)

Love heart flap is versatile and can be used in almost to be an easy and more reliable option than other transposition and reverse flow and perforator flaps for small defects, closure of defects achieved with a simple technique, without the need for microsurgical expertise and short operative duration. We noticed love heart flap can cover larger defects in the trunk and thigh due to the laxity of skin where it can be stretched easily (9). In the leg, it is a good option for vertical defects oriented parallel to the limb in which the flap mobilized medially and laterally. Flap coverage for defects around the lower third of leg defects is more difficult and put extra tension on the flap due to limited tissue laxity in these areas, as one of the patients with lower leg reconstruction developed wound dehiscence (10).

Love heart flap is versatile and can be used in almost everywhere, and its application in the upper limb, especially for the arm and forearm, is being practiced recently as it offers local, sensate, and single-stage flap. (Figure 5)

As a comparison of this study with previous studies that used a love heart flap in the reconstruction of upper and lower limbs, the results were show that the love-heart flap is both a simple and reliable reconstruction method for cutaneous defects on the distal limbs. It provides a robust alternative to skin grafting, with the advantages of immediate postoperative mobilization, minimal patient morbidity as well, as satisfactory esthetic outcomes.

Conclusions and recommendations

Love heart flap is a reliable flap with an excellent survival rate, is versatile, and can be used for skin defects in different regions of the body with a low complication rate—an easy technique for learning by surgeons and have a short operative duration with the good cosmetic outcome.

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