DUPLEX GUIDED LOCALIZATION OF FIRST DORSAL METACARPAL ARTERY FOR THUMB RECONSTRUCTION BY FIRST DORSAL METACARPAL ARTERY FLAP

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Article History: Received: 10.05.2023 **Revised:** 15.06.2023 **Accepted:** 26.06.2023

Abstract

Objectives : To evaluate the use of duplex ultrasound in the flap of the first dorsal metacarpal artery for thumb reconstruction

Background: For thumb reconstruction, the first dorsal metacarpal artery flap is employed. The flap's design is based on the first dorsal metacarpal artery's anatomical position.

Method :Twenty cases with different types of thumb defects of different causes came to emergency department at beni seuf university hospital over the past 2 years between November 2018 &November 2020. Ten patients had preoperative duplex for localization of first dorsal metacarpal artery and ten patients were operated after anatomical localization of first dorsal metacarpal artery as a control group

Results : For the first group (pre op. Duplex) Eight patients experienced no complications postoperatively. However, one patient had partial flap loss and one patient had partial graft loss.

For the second groupSeven patients had no complication one has partial flap loss one had wound infection and one had donor site graft loss

Conclusion : Comparing results of thumb coverage with FDMA flap were nearly equal in both groups of study

Key words :Thumb , reconstruction ,duplex guided , first metacarpal artery.

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DOI: 10.48047/ecb/2023.12.9.220

INTRODUCTION

Importance of the thumb:

The thumb is necessary to preserve pinch and grab ability.Fine finger manipulation and strong grip enable a wide range of sophisticated motions, from everyday jobs to occupational activities and the performing arts.The loss of the thumb, whether entire or partial, leads in considerable long-term disability.Even the loss of sensation is enough to cause issues with hand function.

The thumb is prone to damage due to its exposed position in compared to the other fingers, and when permanently injured, can limit dominant hand function by up to 40 percent . (Saba and colleagues, 2008) Almost every activity that involves the arm and hand uses the thumb. An opposable thumb makes daily tasks like pinching, gripping, grasping, and precision handling much easier. The impact of a traumatic thumb injury on daily life is much greater than that of other digit injuries. Traumatic pulp tissue loss on the first finger is a typical issue that demands significant reconstructive procedures**. (2012, Makkar)** Correction of deformities involving the thumb is eventually necessary due to its significant contribution to overall hand function. The goals of a functional thumb reconstruction are adequate length, mobility, stability, and sensation. (Eski and colleagues, 2007)

Introduction to thumb reconstruction:

Because the key functions of the thumb are always in relation to the rest of the hand, thumb reconstruction is considered in the context of the entire hand. As with any digital injury, initial evaluation includes an assessment of soft tissue deficits, bone loss, condition of joints, the nail bed, zone of tendon injuries, and neurologic status.**(Eaton, 2007)**

Digital reconstruction aims to achieve primary wound healing using "like-for-like" local donor tissue, limiting donor site morbidity to the same hand while also providing thin, pliable, and robust vascularized tissue for resurfacing exposed tendon and bone.**(Lee J. Y.-L., et al., 2006)**

Thumb reconstruction is technically demanding, and patient motivation and accommodation are critical factors for good outcome. Strong contraindications to elective thumb reconstruction include significant vascular disease, short life expectancy, and chronic pain with disuse of the limb, unreconstructable sensory loss, unrealistic patient expectations, and other contraindications dictated by the common sense of

the surgeon.**(Eaton, 2007)**

The skin kite flap is a dependable and versatile island flap that gives you a large, well-vascularized skin area with some sensory discrimination. The neurovascular pedicle's length allows for a wide arc of rotation, allowing the flap to reach even the tip of the thumb.**(Genechten & Foucher, 2009)**

The idea of using the nerves in the thumb to reinnervate the island sensory flap is a good one**.(Venkataswami, 2009).**

PATIENT AND METHODS

Patients:

twenty cases with different types of thumb defects of different causes that came to emergency department at beni seuf university hospital over the past 2 years between November 2018 &November 2020.

Inclusion criteria :

1- Traumatic injuries to the thumb.
2- Age 15-70 years old.
3- Both sexes included.

Exclusion criteria :

1- patients who additionally had previous trauma or operation affecting the donor area of the flap.
2- Any radial nerve injury of same limb.
3- Morbid patients with diabetes mellitus or peripheral vascular diseases or any disease that affect the area of the flap.
4- Complete degloving of the thumb

Method:

Patients were allocated into two groups at random each of 10 patients The included cases of thesis were evaluated by several manners including ; history taking, physical examination ,laboratory investigations, and consent taking with photographing preoperatively.

- Duplex examination for localization of FDMA was done to the first group only

The technique used was First Dorsal Metacarpal Artery Island (Kite) flap and The duration of the follow-up period varied from one to seven months (mean of 3.5 months).

History:

The history was directly taken from patients in all cases, which was stressing on:

1- Dominant hand of the patient.
2- Patient age and work.
3-Types and mechanism of injury
. 4 –smoking or not.
5- Time window between presentation to us and initial injury.

Physical Examination:

The standard examination protocol of hand has been followed to all patients, stressing on:

1- Grips.
2- Functioning muscle, tendon and nerves.
3- Degree of substances of tissues loss.

Investigations:

Plan X-Ray AP and Lateral views Laboratory and radiological investigations in form of hematological tests, CBC, Renal functions.

Duplex examination of the hand for FDMA localization was done for the first group only and preoperative marking of the vessel location

Photographing:

All patients were consented for preoperative ,intraoperative ,and postoperative photographing

Consent:

All patients were consented by written consent after explaining the details of surgery and postoperative follow up period for the possible complications such flap necrosis or graft loss and need of further interventions.

Operative procedure:

All of our procedures were performed in the emergency room under general anaesthesia, with a tourniquet and magnification loop in place. The flap size is determined by the thumb deformity after debridement (if necessary) (if needed). The flap's width was adjusted so that it did not extend beyond the proximal phalanx's radial and ulnar midaxial lines. The flap is lifted from the proximal to the distal side, as well as from the ulnar to the radial side. During flap harvest, the tourniquet was eased to ensure flap viability. The limb was exsanguinated and the tourniquet was tightened after preoperative planning and markings. To locate the first dorsal metacarpal artery and its branch to the index finger, the skin on the dorsum of the hand proximal to the flap was incised and undermined. Sensory branches leading to the index finger have been discovered.

To avoid damaging the pedicle in the subcutaneous tissue, the undermining plane was subdermal.

The branches were cauterised using bipolar cauterization when the main pedicle was identified. The flap was then distally removed, with a suitable cuff of subcutaneous tissue and the pedicle proximally disected. The flap was tunnelled into the defect, which had been appropriately debrided, after ensuring appropriate pedicle length. After ensuring enough bleeding, the islanded flap was insetted. The paratenon at the flap's donor position was carefully preserved. Under general anaesthesia, a full thickness graft was obtained from the inner portion of the lower arm to cover the donor area. Graft dressing and protective splinting were administered on the sixth day.

After the graft had settled for 2 weeks, the hand and fingers were mobilised. Post-operatively.

Satish and Nema **(Satish & Nema, 2009)**

I. <u>Post-operative follow up of the patients</u>

- For the first group (pre op. Duplex)

eight patients experienced no complications postoperatively. However, one patient had partial flap loss and one patient had

partial graft loss.
Seven patients had no flap parathesia

- For the second group

Seven patients had no complication one has partial flap loss one had wound infection and one had donor site graft loss
six patients experienced no flap paresthesia and four patients had flap paresthesia.

Table (1): Post-operative follow up of the patients:

	Group 1	Group 2
No complication	**8 (80%)**	7(70%)
p. flap loss	**1 (10%)**	1(10%)
Graft loss	**1 (10%)**	1(10%)
Wound infection	**N0**	1(10%)

Fig 1 skin loss of the thumb ,coverage by FDMA flap ,and post operative results

(Fig 2) : patient with post traumatic contracted first web

(Fig 3) patient with volar skin loss ,coverage FDMA flap ,post op. partial flap loss

DISCUSSION

For key-pinch preservation, it is critical to obtain sensate contact surfaces during thumb rebuilding. **(Ricardo Horta et al., 2009**) Historically, non-sensate flaps such as the cross-fingerered flaps were used to restore thumb pulp deformities. Satish and Nema **(Satish & Nema, 2009)** The FDMCA flap looks to be one of the finest options for covering simple or complex thumb skin loss.

Its technical performance is simple, and it provides long-lasting, sensual, and consistent skin protection. .**(Makkar, 2012)** Experience shows that in most situations a regional neurovascular flap is a good choice and provides adequate coverage of the defect. Foucher's flap represent a valid surgical method in resurfacing The disappearance of the thumb's pulp. The Foucher flap resulted in little donor site morbidity, full cerebral reorientation, and improved hand function overall. Among the merits of this flap are the constant arterial anatomy, the reliable venous drainage, and the wide arc of **(Delikonstantinou, et al., 2011)**The initial dorsal metecarpal artery flap allows for rapid postoperative mobilisation, resulting in little function loss and stiffness. **(Karaca, et al., 2005**) In certain circumstances, an unsightly scar on the donor site may prevent this flap from being used. However, in certain circumstances, the skin-grafted donor defect seems unsightly.

Many patients, particularly female patients, are concerned about the donor defect's aesthetic aspect, as it appears unattractive. **(Cil, et al., 2008)**

The ideal flap for thumb reconstruction has yet to be discovered. Important concerns about pedicled neurovascular island flaps include the dual location phenomenon and the problem of cortical reorientation. Some patients still had issues **with their thumb's limited sensitivity. (Trankle, et al., 2003; Trankle, et al., 2003)** Technical variables

such as pedicle traction or compression, ischemia, or increasing fibrosis of the terminal nerve branches are all examples of technical factors. may be responsible for the lack of sensation in some flaps. As a result, incorporating a large amount of subcutaneous tissue around the pedicleis has been recommended as a method of preserving sensory fibres. For venous drainage, the paired venae comitantes are usually sufficient. **(Saba, et al., 2008)**The area of the first dorsal phalanx has a s2PD from 10 to 15 mm, and 15 mm is the maximum acceptable distance for useful discrimination. **(Delikonstantinou, et al., 2011)**Regarding complications, We believe our patient's complications were caused by a combination of factors; After surgery, the patient continued to smoke, which contributed to arterial vasospasm. In addition, disobedience with the suggested arm elevation in the face of a small-caliber draining vein may have resulted in venous congestion. and in comparison that's approximately the same recognized complications in other literatures such as Saba, et al. .**(Saba, et al., 2008)**

Conclusion

One of the most useful thumb fingertip options is the First Dorsal Metacarpal Artery Island Flap. & other injuries of the thumb at emergency or elective repair for many reasons; There is a consistent and dependable anatomy that is easy to dissect. It is possible to cover the entire dorsal or palmar aspect of the thumb with a one-stage procedure that provides neurovascular skin cover. To cover a complete degloving injury of the thumb, the flap can be combined with other flaps. The sensation is provided by the flap. In comparison to other available options, minimal complications may occur. Comparing results of thumb coverage with FDMA flap were nearly equal in both groups of studyDuplex localization of FDMA preoperatively is a simple, accurate and cheap method ,help in more safe flap dissection specially for young surgeons and difficult cases like children FDMA flap is a technique dependent not a tool dependent

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