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MANAGEMENT OF FINGER TIP INJURIES USING LOCAL AND DISTANT FLAPS – AN INSTITUTIONAL EXPERIENCE

Plastic Surgery

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ABSTRACT

Introduction: While considering hand injuries , the most common portion of the hand involved is the finger tip. While Indian Statistics are lacking , studies from the United states have shown that nearly 4.8 million individuals sustain fingertip injuries every year. The number , may be , postulated to be higher in the Indian scenario. In this article , we elucidate different methods of flap cover for these injuries , that we have used over a period of one year at our institute.

Methods: In the time period between August 2018 and August 2019 , patients with fingertip injuries who underwent flap cover (and were willing to participate in the study) , without significant other systems injuries were enrolled in the study.

Results: Most cases (25/50) were treated with a cross finger flap , while 14 were treated with an abdominal or groin flap , 7 patients underwent V-Y plasty , 4 required more nuanced approaches. Most of the patients had an outcome characterised as 'Good' (39 patients) , 8 patients had a 'Fair' outcome and only 3 patients had a ' poor ' outcome , likely attributable to the initial severity of injury.

Conclusion: Fingertip injuries are common and the modalities of treatment numerous . Treatment ranges from simple primary closure to complex flap reconstruction . The literature is awash with numerous methods for flap reconstruction . However , our institutional experience illustrates that barring a few special circumstances , most cases can be treated by one of the above mentioned flaps.

KEYWORDS

Finger tip injury , Flap cover

INTRODUCTION:

Owing to the disproportionately large utility of the hand in performing skilled tasks and overall utility , the hand is prone to significant trauma . While considering hand injuries , the most common portion of the hand involved is the finger tip (1). While Indian Statistics are lacking , studies from the United states have shown that nearly 4.8 million individuals sustain fingertip injuries every year(2). The number , may be , postulated to be higher in the Indian scenario , owing to the larger population and a higher proportion of the population involved in manual or agricultural labour(3). Goals in fingertip amputation reconstruction are covering the defect, establishing maximum tactile gnosis, keeping the length of the finger, protecting the joint function, acquiring a well padded pulp tissue, providing a bed for growing nail, obtaining a satisfactory cosmetic appearance and allowing the patient to return to work as soon as possible(4). A variety of methods are available and described, it is a reconstructive surgeon's duty to choose the best method which meets the patient's needs(5).

In this article , we elucidate different methods of flap cover for these injuries , that we have used over a period of one year at our institute.

Subjects and Methods:

This was a retrospective study conducted at the Dept of Plastic Surgery , Father Muller Medical College , enrolling patients with finger tip injuries admitted and treated in the period between August 2018 and August 2019 . The study was conducted after obtaining clearance from the Institutional Ethics Committee and after obtaining consent from subjects involved in the study.

Methods:

In the time period between August 2018 and August 2019 , patients with fingertip injuries who underwent flap cover were enrolled in the study with the following inclusion and exclusion criteria.

Inclusion Criteria :

1. Patients with single or multiple finger tip injuries treated with flap cover, without significant other trauma.
2. Patients with Rosenthal Grade 2 or Grade 3 injuries (6).

Excusion Criteria :

1. Patients with finger tip injuries who were treated by modalities other than flap cover .
2. Patients with finger tip injuries with significant trauma involving other systems.
3. Patients with Rosenthal Grade 1 injuries (6).
4. Patients unwilling to participate in the study or patients who did not return for their follow up visits.

Using hospital records , patient records , post procedure as well as follow up questionnaires data was collected and categorised.
Patients were categorised into four groups based on the procedure that was employed , namely :
1.V-Y Plasty
2.Cross Finger Flap
3.Abdominal / Groin (Distant Flaps)
4.Miscellanous Flaps

Data was collected on the finger(s) involved , mechanism of injury and basic demographic details of the patients.

Post-operative follow up was undertaken for upto 2 months following surgery and a scoring system was devised to quantify the ultimate outcome of the patient . Four factors were considered , namely, general appearance , use , sensations and static two point discrimination . Each of these factors were scored using a modified Likert scale with a best possible score being 3 and the least possible score being 1 . The aggregate score was then used to quantify the outcome as Good (9-12) , Fair (5-8) and Poor (<5).

The results were tabulated using Excel sheets and statistical analysis was carried out using the IBM SPSS software for windows

RESULTS :

A total of 50 patients were enrolled into the study , staggered across the four various groups. The results are considered in each sub group individually .

Group 1 : V- Y plasty :
A total of 7 patients underwent V-Y plasty , with a male preponderance (no female patients in this subgroup) . The vast majority of the patients were in 10 – 30 age group(6 patients). the most common finger involved was the middle finger (4 cases) and the most common mechanism of injury was secondary to crush injury (5 cases). With regard to outcome , 5 patients had a 'Good' outcome , 1 patient had a

'Fair' outcome and one patient had a 'Poor' outcome .This is tabulated in Table 1 and 2.

Table 1 : Age distribution of patients treated with V-Y flap cover

Age group	No. Of Patients
<10 years of age	Nil
10-20 years of age	3
20-30 years of age	3
30-40 years of age	1
40-50 years of age	Nil
50-60 years of age	Nil
>60 years of age	Nil

Table 2 : Summary of patients treated with V-Y flap cover

Number of Patients	7	
Sex distribution of Patients	Male : 7	Female : Nil
Finger Involved	Multiple: Nil Middle finger : 4 Little Finger :2 Index Finger:1 Ring Finger : Nil Thumb: Nil	
Mechanism of Injury	Crush: 5 Laceration:2 Clean Cut Amputation: Nil Blunt Cut Amputation : Nil Mangling: Nil	
Outcome	Good:5 Fair:1 Poor:1	

Group 2 : Cross Finger Flap:

The majority of patients underwent a cross finger flap (25 of 50 cases). This group also showed a male preponderance (20 male , 5 female) . A larger portion of this group were under 10 years of age (6 patients) . the most common finger involved was the middle finger (11 cases) followed by the index and ring fingers (5 cases each). The most common mechanism of injury was secondary to crush injury(11 cases). With regard to outcome , 20 patients had a 'Good' outcome , 4 patients had a 'Fair' outcome and one patient had a 'Poor' outcome .This is tabulated in Table 3 and 4. A case in which a cross finger flap was utilised is depicted in Figure 1.

Table 3 : Age distribution of patients treated with Cross Finger Flap

Age group	No. Of Patients
<10 years of age	6
10-20 years of age	4
20-30 years of age	4
30-40 years of age	2
40-50 years of age	4
50-60 years of age	4
>60 years of age	1

Table 4: Summary of patients treated with Cross Finger Flap.

Number of Patients	25	
Sex distribution of Patients	Male:20	Female:5
Finger Involved	Multiple:0 Middle finger :14 Little Finger :1 Index Finger :5 Ring Finger :5 Thumb:0	
Mechanism of Injury	Crush:11 Laceration:5 Clean Cut Amputation:4 Blunt Cut Amputation:3 Mangling:2	
Outcome	Good:20 Fair:4 Poor:1	

Figure 1: Pre and post operative images of a case of Cross Finger Flap

Group 3 : Abdominal or Groin (distant) flaps :

A total of 14 patients underwent Abdominal or Groin flaps , of which 6 patients underwent an Abdominal flap and 8 patients underwent a Groin flap , with a male preponderance (10 male and 4 female patients) . The majority of the patients were in 20 – 30 age group(7 patients) . The most common finger involved was the middle finger (5 cases) and the most common mechanism of injury was again secondary to crush injury(6 cases).9 patients had a 'Good' outcome , 3 patients had a 'Fair' outcome and 2 patients had a 'Poor' outcome .This is tabulated in Table 5 and 6. A case in which a groin flap was utilised is depicted in Figure 2.

Table 5 : Age distribution of patients treated with Abdominal /Groin Flap.

Age group	No. Of Patients
<10 years of age	Nil
10-20 years of age	Nil
20-30 years of age	7
30-40 years of age	1
40-50 years of age	4
50-60 years of age	1
>60 years of age	1

Table 6: Summary of patients treated with Abdominal/Groin Flap.

Number of Patients	14	
Sex distribution of Patients	Male:10	Female:4
Finger Involved	Multiple: 4 Middle finger :5 Little Finger :Nil Index Finger :3 Ring Finger :1 Thumb:1	
Mechanism of Injury	Crush: 6 Laceration:3 Clean Cut Amputation:2 Blunt Cut Amputation :2 Mangling:1	
Outcome	Good:9 Fair:3 Poor:2	

Figure 2: Pre and post operative images of a case of Groin Flap

Group 4 : Miscellaneous flaps :

In 4 cases , alternative methods of reconstruction were used at the surgeons discretion . These included two cases in which the Thenar flap was used , 1 case in which the Moeberg flap was used (thumb defect) and 1 case in which a Littlers flap was used.The patient demographics are tabulated in Tables 7 and 8

Table 7 : Age distribution of patients treated with miscellanous Flap.

Age group	No. Of Patients
<10 years of age	0
10-20 years of age	2
20-30 years of age	1
30-40 years of age	1
40-50 years of age	0
50-60 years of age	0
>60 years of age	0

Table 8: Summary of patients treated with miscellanous Flaps.

Number of Patients	4	
Sex distribution of Patients	Male: 2	Female : 2
Finger Involved	Multiple:Nil Middle finger :2 Little Finger :1 Index Finger :Nil Ring Finger :Nil Thumb:1	
Mechanism of Injury	Crush:1 Laceration:1 Clean Cut Amputation:1 Blunt Cut Amputation :Nil Mangling:1	
Outcome	Good:3 Fair:1 Poor:0	

DISCUSSION:

Finger tip injuries are common injuries, these injuries are often erroneously believed to be minor injuries.However, improper management of these injuries leads to significant loss of skilled hand function , morbidity and affects the patients occupational and social activities(7).

Complexity of the injury usually dictates complexity of repair . Numerous classification systems have attempted to streamline management of these injuries. Of these systems , the Rosenthal system has stood the test of time . This is based on three zones: zone I injuries are distal to the bony phalanx, zone II injuries are between the lunula and distal phalanx, and zone III injuries are proximal to the lunula(6). Zone I injuries are usually managed conservatively (and have been excluded from this study) , Zone II injuries require flap reconstruction and can be further classified as dorsal , transverse or volar , based on the plane of the amputation. Zone III injuries are usually not amenable to elaborate reconstruction. A newer classification system is the PNB system , which uses a point system to provide a 3-digit code to better describe injury severity to the pulp, nerves, and bone(8).However the validity of this system is still under intense speculation(9).At our institute , we use the Rosenthal system owing to its validity and reliability.

The management of smaller injuries is usually more straight forward. Injuries smaller than 1cm may be treated with primary closure , split thickness skin grafts or full thickness skin grafts(10)(11). The advantage of full thickness grafts is their ability to re-innervate early and provide durable coverage(12).

Injuries that lead to tendon and/or bone exposure require local or distant flaps. The type of flap reconstruction which is appropriate depends on the extent and configuration of the tip loss and the discretion of the treating surgeon(13). In those amputations which are oblique, the direction and degree of obliquity also influences the choice of flaps. Local flaps if properly applied can provide a very satisfactory functional and aesthetic result. The various local flaps used to reconstruct fingertips include volar V-Y, bilateral V-Y flaps, cross-finger flap, thenar flap and island flaps. Flap choice depends on the orientation and configuration of the wound, injured digit and sex of the patient. If the wound is small and involves a finger with a transverse amputation beyond the mid-nail level and dorsal oblique amputations beyond the proximal nail fold, the volar V-Y flap gives good results(14).The cross-finger flap is preferable if the wound is volar directed without sufficient volar pulp to facilitate V-Y flap(15).However, if local flap is not possible, a distal flap such as abdominal or groin flaps may be used(16).

At our institute , the commonly used flaps are local V-Y flaps , Cross finger flaps, abdominal or groin (distant flaps) and rarely other modifications . Of these we use the cross finger flap extensively due to its versatility and owing to the nature of cases presenting to us. Of the 50 cases enrolled in this study , 25 patients underwent a Cross finger flap , the limitation obviously being the utility of this flap in single digit injuries , the inability to use this flap in extensive injuries crossing the joint and the inability to use this flap for the thumb and little finger. Of the 25 patients , 20 had an outcome that was characterised as ' Good' by both the treating surgeon and the patient with full return to function and adequate aesthetic outcome. 4 patients had a ' Fair ' outcome , owing to partial flap necrosis in one patient , sensory paraesthesia in two patients and one patient had abnormal thickness of the flap .1 patient had a poor outcome due to complete flap necrosis . This patient was later treated with a groin flap , with less than an ideal outcome . The advantages of this flap is the utility in patients of all ages , as demonstrated in this study , with patients ranging across all age groups (Table 3). However , the cross finger flap and its counterpart , the reverse cross finger flap ,have limitations as mentioned earlier(17).

Terminal pulp V-Y flaps, also known as Atasoy flaps, are most effective in repairing small dorsal transverse and oblique injuries. They cannot be used for volar injuries(18)(19). Despite these obvious limitations , this technique is excellent for highly specific injuries . In our series 7 patients were treated with these flaps , of which 5 had a 'Good' outcome , 1 had a ' Fair' outcome , due to a partial flap necrosis , and one patient had a 'poor outcome' due to a superadded flap infection that required a revision finger tip amputation. The limited number of cases that were managed using this technique probably reflects its highly nuanced nature.

The groin flap (or abdominal flap) is of significant utility when extensive soft tissue cover is required and is especially useful in 'mangled' fingers or when multiple fingers are involved. These flaps are bulky and may require repeated debridements for adequate outcome , however they remain a time tested and useful alternative in certain cases due to the abundance of soft tissue(20). In our series 14 patients were treated with groin/abdominal flaps (8 groin flaps and 6 abdominal flaps) . This series had the largest number of 'poor' outcomes(2 cases) , possibly due to the extent of the initial injury . 9 cases had a 'good' outcome and 3 cases had a 'fair ' outcome , proving that this technique still has its merits in certain curated cases.

4 cases required a more nuanced , tailor made approach , with two cases requiring thenar flaps , 1 case requiring a Moeberg flap and 1 case requiring a Littler flap . Of these patients 3 had a 'Good' outcome and one had a 'Fair' outcome. Although these cases required more complex approaches , they may be considered to be rare scenarios.While it is desirable for the treating surgeon to be aware of these techniques , they do not warrant routine utillisation.

Therefore , although the modalities of treatment of finger tip injuries are legion(21) and often mired in significant controversy , we aim to elucidate , in this study , the success of a variety of methods in treating these deceptively simple injuries . Apart from a few cases , which required additional contemplation and methods , most of our cases could be managed with V-Y , Cross finger or abdominal/groin flaps .

The common complications encountered postoperatively were marginal necrosis, cold intolerance and hypersensitivity. The marginal necrosis was attributable to tension closure, and other minor complications like partial wound dehiscence, partial graft loss were independent of the surgical technique employed to treat them. Hypersensitivity and cold intolerance are essentially complications of the injury and not the treatment. Review of the literature suggests that the rates of hypersensitivity and cold intolerance approximate 50% regardless of the modality of treatment(22).

CONCLUSION:

Fingertip injuries are common and the modalities of treatment numerous . Treatment ranges from simple primary closure to complex flap reconstruction . The literature is awash with numerous methods for flap reconstruction . However , our institutional experience illustrates that barring a few special circumstances , most cases can be treated by one of the above mentioned flaps.

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