REVERSE POSTERIOR INTEROSSEOUS FLAP; USEFUL BUT PROBLEMATIC FLAP

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ABSTRACT

Objective: To highlight the problems associated with harvesting and insetting of reverse Posterior Interosseous Artery (PIA) flap and their solutions.

Study Design: Descriptive case series.

Place and Duration of Study: The study was conducted at Combined Military Hospital Rawalpindi from January 2013 to July 2015.

Material and Methods: Thirty one patients of both sexes with hand defects secondary to trauma, burn or tumor excision who underwent coverage with reverse PIA flap were included in the study. Patients were operated and reviewed by the same team. Age, sex and complications were recorded and data was evaluated.

Results: Major complications were found out to be venous congestion as 5 (16.1%) of our flaps developed venous congestion and had to be replaced at the donor site. Four (12.9%) flaps developed partial necrosis. These flaps were debrided and reinsetting was done. One (3.22%) flap developed complete necrosis. Eight flaps were delayed on suspicion of congestion preoperatively. In all delayed flaps the recovery was uneventful and smooth.

Conclusion: PIA flap is a useful option for coverage of hand defects. The major issue is flap congestion which can be improved by delaying the flap and it helps in improving the flap survival.

Keywords: AIA flap, Hand wounds, Reverse PIA flap.

INTRODUCTION

Hand being one of the most exposed parts of the body is always prone to injury. Hand injuries may range from simple abrasions to extensive soft tissue loss with exposure of vital structures like nerves, tendons and vessels. In order to preserve the hand function, these structures require coverage, which remains a daunting challenge for reconstructive and hand surgeons.

There are numerous options available in the armory of a plastic surgeon to reconstruct a hand defect, which may range from simple skin grafts to complex and tedious procedures like free tissue transfer. Among these options reverse Posterior Interosseous Artery flap (PIA) is a much favoured technique. Its anatomy was first described by Penteado et al[1] in 1986 and Zancolli et al[2] introduced the reverse flap for the first time in 1988. Since then it has been popularized by hand and reconstructive surgeons for reconstruction of first web space and wounds on the dorsum and volar surface of the wrist and hand[3,4]. It is basically a flap which is based on reverse flow PIA through its anastomosis with Anterior Interosseous Artery (AIA)[5].

PIA flap has the advantage of being thin with good reach and colour match, using ipsilateral limb as donor for reconstruction[6]. It involves no immolation of major vessels[7,8]. Despite these advantages this flap is notorious for complications like congestion, edema, nerve injury, partial or complete loss of flap, scarring of the donor site, hair growth on the flap, variable anatomy and difficult dissection[9,10]. These complications are a cause of agony both for the patient and the surgeon. The patient may end up with multiple visits to the operation theatre thus increasing both the cost of treatment and prolonging the hospital stay. The uses and

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advantages of this flap have been extensively described in literature but short comings and limitations have mostly been overlooked.

The purpose of conducting this study is to share our experience with this flap and highlight the problems associated with harvesting and insetting of flap and their solutions.

MATERIAL AND METHODS

This descriptive study was conducted at Department of Plastic and Reconstructive Surgery CMH Rawalpindi from January 2013 to July 2015. Permission for study was taken from the hospital ethical committee. Total 31 patients were included in this study. Patients were selected using purposive sampling technique. Patients of both sexes with hand and wrist defects due to trauma, burn and tumor resection undergoing coverage with PIA flap were included in this study. Patients having age less than 10 years and greater than 75 years of age, diabetes with vasculopathy, peripheral vascular disease and severe crush injuries of wrist were excluded from our study. Surgeries were performed by the same operator using the following technique. Post operatively patients were followed up by the same team. Patients age, sex and complications were recorded and data was evaluated using SPSS 20. Mean and standard deviation were calculated for quantitative variables. Categorical variables were expressed as frequency and percentage.

Operative technique

All the procedures were carried out under general anesthesia and under tourniquet control. A line was drawn between lateral epicondyle and distal radioulnar joint. The flap was marked according to the defect in a tear drop fashion to minimize the pressure over the pedicle. Proximal 1/3rd of forearm was excluded from the flap. Incision was made through the deep fascia to the Extensor Carpi Ulnaris (ECU) and Extensor Digiti Minimi (EDM) muscles. These muscle bellies were separated proximally and Supinator muscle was visualized. PIA was visualized deep to it. Posterior Interosseous Nerve (PIN) was preserved. PIA and posterior interosseous vein were divided proximally, just distal to Supinator muscle. The flap was elevated with its segmental septocutaneous vessels extending between ECU and EDM to overlying fascia and skin. At the inferior edge a vertical incision was made to mobilize the pedicle. The anastomisis with the AIA was preserved which was usually 2cm proximal to radio-ulnar joint. The flap was transposed. Donor site was closed primarily or was covered with skin graft depending on size of defect.

Table-1: Age and Sex distribution among the patients.

Age ranges	Male	Female
Less than 10	0	0
11-20yr	1 (4.2%)	0
21-30yr	4 (16.7%)	0
31-40yr	8 (33.3%)	4 (57.1%)
41-50yr	6 (25%)	2 (28.6%)
51-60yr	3 (12.5%)	1 (4.3%)
More than 60yr	2 (8.3%)	0
Total	**24**	**7**

RESULTS

Of the 31 patients included in the study 24 (77.4%) were male and 7 (22.5%) were females. Mean age of patients was 41.03 ± 12.1, with a range of 17-71 years. All of the patients had defects of hand with exposure of vital structures. Of these cases we could not trace out perforators in 2(6.45%) of the cases and we had to replace the flap and proceed with alternate options. Five (16.1%) flaps developed venous congestion on the same day. These patients had to be retaken to operation theatre during the night and had to

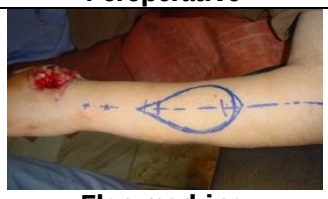
be replaced back to donor site. Four (12.9%) flaps developed partial necrosis. These flaps were debrided and reinsetting was done. One (3.22%) flap developed complete necrosis. Seven flaps were delayed on suspicion of congestion peroperatively. In all delayed flaps the recovery was uneventful and smooth. We had no incidence nerve injury, while donor site had to be covered with skin graft in all cases except three.

DISCUSSION

With rapid advancement in science and technology, the frequency of patients presenting with traumatic injuries to the hand have also increased. These injuries usually have high morbidity. In order to cover these defects different flaps have been designed. These include local flaps, regional flaps, perforator flaps, distant flaps and free flaps.We used PIA flap in 31 cases. It is a type B fasciocutaneous flap according to Cormak and Lamberty classification[11]. The mean age of patients in our study was 41.03 ± 12.11 years with range of 17-71 years. Mago conducted a study on 20 patients with mean age being 31 years and range of 20-60 years[12]. While Gavaskar studied 52 patients whose average age was 38 years with a range of 18-64 years[8]. Maximum number of patients in our study were from the age group of 30-50 years comprising 64.5% of patients while a study conducted in Multan had 60% patients in 20-40 years[3]. This slight difference may be due to the fact that most of our patients comprised of retired soldiers and few soldiers who worked in their farmlands during holidays. In our study male patients dominated with 77.41% being males with females making only 22.5%. Shahzad et al has shown male dominance at 72%[3]. While studies by Acharya et al[4] and Costa[13] have shown 90% and 88% male dominance respectively. This is due to the fact that males are usually involved in high energy jobs so are more prone to hand injuries. The slightly higher ratio of females in our study shows that women in our part of the world especially in lower socio economic group are involved in harder jobs like working in industries, farmlands and especially cutting fodder for their cattle.

Anatomic variations have been described by different authors. Panteado et al found absence of anastomosis or disappearance of artery in the middle third of forearm in 5 cases[1]. Angrigrani et al also found discontinouity in middle third of forearm in 2 cases[2]. Naheed et al found no

Table -2: Operative results.

Patient -1	 **Defect**	 **Delayed flap**	 **Healed flap**
Patient -2	 **Defect**	 **Peroperative**	 **Good web space**
Patient -3	 **Defect**	 **Flap marking**	 **Postoperative**

anatomic variation[3]. While Costa H failed to harvest a flap in two out of 202 cases[13]. In our study we did not find any variation in PIA in middle third but we could not appreciate the perforators or anastomosis between AIA and PIA in 2 cases so we could not harvest the flap and had to cover the defect with alternate options like groin flap. To avoid this, different authors have advocated the use of Doppler before venturing into the procedure to identify anastomosis between PIA and AIA and converting the flap into free flap[14, 16].

A study conducted by Heitmann had incidence of venous congestion of 12.5%[15]. This was almost same as our study in which we had venous congestion in 16.1%. A study conducted in 1996 showed very high incidence of venous congestion with 34% of its flaps developing this complication[17]. Shehzad et al had this complication in none of their flaps[3]. To avoid this complication some authors have recommended leaving a cuff deep fascia around the pedicle[3, 10]. While Cheng et al managed it by adding a venous anastomosis when this complication occurred[18]. In our experience delaying the flap by replacing it in its original site was the safest way to manage it whenever it was suspected, as flaps mostly appeared congested late in the night.

We had 4 (12.9%) partial or marginal flap necrosis and 1 (3.22%) complete necrosis in our series. Another series had 8% partial flap necrosis[19]. Dap [20] and Buchler and Frey[21] had 21% and 25% partial necrosis of flap respectively, which was very high. Another study had 10% complete loss of flap[12]. This high incidence was due to both venous congestion and ischaemia. Literature has recommended avoiding dissection of AIA and PIA anastomosis, creating a broad peddle with a cutaneous handle and avoiding tunnelling to decrease this flap loss[4]. In our experience this can be prevented by delaying the flap for 5-7 days because our results improved with flap delaying.

For donor site we had no nerve injury but in a study of 16 patients the author had radial nerve injury in one (6.25%) patient[23]. A Chinese study also had nerve injury in one of its patients[7]. We were able to primarily close the donor site in only 3 cases while rest of the cases had to be skin grafted which gave an ugly scar on forearm. We had no problem with the hair growth on the flap or weakness of muscles. El – Sabbagh et al had to skin graft the donor site in all of their cases while one of their patients had serious complaints regarding hair growth on the flap[9]. In another study conducted Gavasker et al had to graft the donor site in 24 patients out of 32 while one patient had complaint of bulkiness and three patients developed ECU weakness[8].

CONCLUSION

PIA flap is a useful option for coverage of hand defects. The major issue is flap congestion which can be improved by delaying the flap and it helps in improving the flap survival.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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