

# Scalp Reconstruction with Novel Unopposing Double Hatchet Flaps- A Case Series

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## ABSTRACT

Though there are regional and distant approaches for acquired scalp defect reconstruction, use of local flaps always have the advantage of retaining the topography of scalp. As in treatment of any other defect the choice of a local flap in scalp wound coverage is dictated by the location, size, and depth of the defect and by the availability of adjacent tissue for reconstruction. The versatile and adaptable triangular hatchet flap with a partial skin and subcutaneous bridged pedicle has great versatility. When used singularly or in pair to cover small and medium sized defects, utilising both rotation and advancement components for its movement, has the benefit of maintaining cosmetic appearance. Double hatchet flaps are used commonly in an opposing manner so as to convert a circular wound to a 'S' shaped suture line. In the current case series, with a description of four representative cases, authors have presented a modification of this double hatchet flap in unopposing configuration instead of an opposing pattern to cover scalp defects when the type and extent of injury affecting the scalp prevents in heaving flaps at 180 degree to each other. Authors opine that this technique adds into the ever expanding armamentarium of reconstructive surgeon and can be made use of in the aforementioned conditions wherein the standard pattern cannot be employed to cover moderate sized scalp defects.

**Keywords:** Advancement flap, Bear mauling, Road traffic accident, Rotation flap, Scalp defect

## INTRODUCTION

Scalp reconstruction is a no ordinary challenge for a reconstructive surgeon. Successful reconstruction of the scalp encompasses complete knowledge of patient's condition, appropriate debridement with maximum retaining of normal vascular tissue, careful adequate planning of procedure preoperatively and precise intraoperative execution and adequate postoperative care to sustain blood supply, and proper wound drainage. Also, having knowledge of scalp anatomy, skin biomechanics, hair physiology, and expertise of utilising available best local tissue rearrangements contributes excellent aesthetics to the reconstructed scalp. While reconstructing scalp defects comprehensive consideration of size, location, radiation history if any, and potential for hairline distortion should be taken into account [1].

Scalp reconstruction as in any other plastic surgery procedure follows reconstructive ladder from lower to upper rungs as follows i.e., granulation (healing by secondary intention); primary closure; split-thickness skin graft or full-thickness skin graft; local flaps such as advancement flap, rotational flap, transpositional flap; regional flaps or use of free flaps. Uses of allografts, xenografts and dermal regeneration templates have also been mentioned in literature. The selection of one or a combination of methods depends not only on anatomical considerations like skin laxity, wound depth, location, concomitant calvarial defects, foreign body implantation, radiotherapy status and patient related factors such as smoker, general health, mental health, ability to care for wound but also on the surgeons choice and expertise, and of course patient's expectation [2].

Traumatic scalp avulsive injuries can be devastating and many a times require potentially significantly extensive surgeries [3]. Koss N et al., have made extensive research in trauma-related scalp injuries and their subsequent management [4].

Having vascularised soft tissue coverage with acceptable cosmetic appearance and minimal donor site morbidity are the objectives of scalp reconstruction. The benefits of use of local

flaps are reliability, lessened donor site morbidity, good colour and texture match, and a relatively short operative time in a vascular rich region prone for excessive bleeding [5].

The reliable, versatile and greatly amenable double/bilateral hatchet flap, first described by Emmett AJ in 1977, has the advantage of being able to both rotate and advance, affording maximal translational movement of contiguous tissue to cover the defect [6]. The incisions are made in an irregular pattern, allowing effective camouflage. In this case series, we present our modification of the double/bilateral hatchet flap arranged in unopposing fashion.

## CASE SERIES

### Case 1

A 54-year-old male presented to casualty with history of bear attack resulting in scalp avulsion and injuries over lower extremities. On presentation in the Emergency Room (ER), the surgical team did an emergency debridement and suturing with anti-tetanus and anti-rabies prophylaxis. The scalp avulsion was closed incompletely due to tissue loss resulting in raw area measuring of 6.5x5 cm over the crown area. With the right parieto-occipital and left occipital suture wounds, for first time we planned and implemented our non opposing double hatchet flaps at 95° axis to each other. Patient was operated under general anaesthesia and had no complication in the postoperative period [Table/Fig-1,2].



**[Table/Fig-1]:** Patient at presentation in Emergency Room (ER) (Left); Patient on 7<sup>th</sup> day after primary surgery (Centre); Planning of the unopposing double hatchet flap (Right).



**[Table/Fig-2]:** Immediately after closure of the defect (Left); Postoperative day 5 (Centre); Status of reconstructed scalp after three weeks (Right).

### Case 2

A 23-year-old male presented with history of road traffic accident resulting in scalp avulsion with extradural haemorrhage. Patient was operated by the neurosurgery treatment and once patient was stabilised patient was taken up for reconstruction. After closing multiple lacerated wounds a defect of 6×5 cm was left on the occipital region. With inability to employ the traditional bilateral hatchet flap our variation with flaps at axis of 120° to each other were raised from right parietal and occipital region and used to close the defect with patient under general anaesthesia and drain in situ. Postoperative period was uneventful.

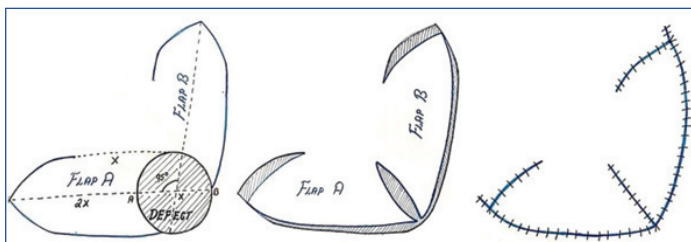
### Case 3

A 28-year-old female presented to Outpatient Department with a scalp defect measuring 4.5×5 cm over right parietal region. She had been assaulted few weeks back with sickle and was treated primarily at another centre and had sutured wounds over adjacent temporal and occipital region. Double hatchet flaps were raised extending into left parietal and occipital region at 140° axis to each other under local anaesthesia. Patient had no postoperative complications.

### Case 4

A 45-year-old male presented to ER with scalp avulsion over the occiput region and after closure resulted in a defect measuring 5×5.5 cm. Under general anaesthesia, dual flaps in hatchet shape were raised from the occipital and left parietal areas and defect was closed with drain in situ. Patient had complication free postoperative period with drain removed on 3<sup>rd</sup> day.

**Surgical technique:** Patient was prepped with betadine solution under appropriate anaesthesia and desired position as required. Two hatchet flaps were planned adjacent to defect and away from scarred or injured areas. The flap length was twice the diameter of the defect with the vascular pedicle kept as much as the size (i.e., the diameter) of the defect. Dissection was performed at a subgaleal, avascular loose areolar tissue, level. Sufficient haemostasis was achieved by cauterisation and/or ligation along with Raney's clips, if situation necessitated. Flaps that were raised were advanced and rotated into defect and the medial flap edges were adapted upon the primary defect with buried galeal sutures using absorbable sutures; and the donor areas at the bilateral poles are closed in a V-Y fashion. Flap edges were sutured with interrupted vertical mattress sutures using nylon. Buried sutures with vicryl were added, if necessary [Table/Fig-3]. Drain was kept if required.



**[Table/Fig-3]:** Flap design and dimension (Left); Flap positioning over the defect after being raised (Centre); Final suture line (Right).

No relevant complications were noticed during follow-up such as extensive flap necrosis, wound dehiscence, or scar retraction. All patients were followed for up to a minimum of three months [Table/Fig-4].

Cases	Mode of injury	Location of wound	Wound size (cm <sup>2</sup> )	Degree of flap axes to each other	Type of anaesthesia	Postoperative complications
Case 1	Bear attack	Crown	32.5	95°	GA	None
Case 2	RTA	Occipital	30	120°	GA	None
Case 3	Assault	Parietal	22.5	140°	LA	None
Case 4	RTA	Occipital	27.5	135°	GA	None

**[Table/Fig-4]:** Summary of the cases.

RTA: Road traffic accident; LA: Local anaesthesia; GA: General anaesthesia

## DISCUSSION

Scalp being inherently rigid with scarce redundant tissue, its defect poses several unique challenges and is not an easy region to reconstruct. It precludes primary closure of moderate sized defects while limits the movement of local flaps in coverage of large defects. And its natural spherical shape adds to the misery of the original defect demanding extra manoeuvring of tissue, for the defect to be covered. Commonly followed algorithm in deciding the type of procedure to be hired for reconstructing a scalp defect is helpful while considering reconstruction options [7].

Authors recommend the use of modified double hatchet flaps in non opposing pattern in scalp reconstruction for intermediate and slightly larger defects that are not amenable to other methods of tissue re-arrangement because of extensive injury or scarring of adjacent scalp tissue preventing traditional pattern to be employed. Principal author is of opinion that this flap might be useful only in scalp, benefiting from its robust vascularity and can be oriented (with caution) in any direction relative to the defect. This is because the hatchet flaps in our variation of the traditional opposing double hatchet flaps (180° axis), is at an acute angle degree of axis with both flaps sharing a common base. Thus, in our humble opinion, this flap can only be made use of in regions such as the scalp with a rich blood supply. Hence, being wary of it we have refrained from its use in other anatomic areas in our practise.

Scalp reconstruction is nevertheless challenging owing to anatomical convexity limiting tissue displacement, resistance to flap movement because of restrictive nature with inter-individual variation. Hence, the diameter of the defect is not the best criterion to consider when choosing procedure for reconstruction and demands surgeon to be flexible owing to same. Though primary closure in its simplicity is pleasing, a significant amount of undermining is required to bring the scalp tissue together [7].

The principal patterns in local flap reconstruction are advancement, rotation, and transposition. Selection of type depends on anatomic considerations including depth of wound, site of wound and amount of local tissue laxity. Though advancement flaps have a limited role in scalp due to limited elasticity and multidirectional lines of tension provided by the galea, still they are employed for small defect closures. Transposition flaps involve transferring tissue from one position to another via a pivot point and carries the same disadvantage as in an advancement flap along with the need of skin grafting to cover the donor site, resulting in a bald patch in the hair bearing scalp. As in advancement flaps, the lack of tissue laxity hinders the ability to transpose tissue. Some examples for this are temporoparietal flap, the temporoparieto-occipital flap (Juri flap), and the parietal temporal postauricular vertical flap [8]. Rotational flaps however seem to be most practical pattern in scalp reconstruction but require extensive dissection to raise a very large flap to cover a relatively smaller defect [7]. Though local flaps are random patterned because of extensive networking of the principal vessels supplying the scalp-anteriorly (supratrochlear/supraorbital arteries), laterally (superficial temporal/posterior auricular arteries), and posteriorly (occipital arteries) they are inherently rich in vascular supply owing to better tolerance of ischaemia inducing variables. The blood supply for these flaps comes via pedicle, in the epidermis, dermis, and subcutaneous fat layers. Of late it has been established

that in scalp, local flaps can survive on subdermal plexus alone and same holds true for the double hatchet flap. Hence, dividing the subcutaneous part of the pedicle allows larger extent of liberty in flap movement without compromising flap viability.

Techniques such as galeal scoring and galeaectomies are employed to obtain that extra movement of tissue/flaps. Free flap has the advantage of being reliable and providing excellent soft tissue bulk [9]. But they require longer operative times and good expertise with adequate operation theatre infrastructure and is not always advantageous for patients with a poor underlying health status [10]. Also, like other reconstruction options (except for local flaps) they result in suboptimal cosmetic results with depressed/raised, dyschromic, and hairless scars [11].

Conventional local flaps have restrained role in restoring moderate size defects of the scalp. Though healing by secondary intention or skin grafting are rational options especially in patients not amenable for prolonged surgeries and in old, they result in below par cosmetic outcome. Hence, novel scalp reconstruction approaches are always appreciated [11]. The double hatchet flap is a useful flap as it allows to closure of moderate to large defect, with the distribution of the scar in two opposite directions from the defect, in a single stage. The above described technique, a modification in alignment of the traditionally employed pattern of double hatchet flaps, in a non opposing way carries the advantages of the original flap design which are good colour, texture, and depth match along with maintaining the hair line which also camouflages the end resultant scar. Unlike in traditional bilateral hatchet flaps the pedicle size was kept twice the radius, (i.e., as same as diameter of the wound) rather than the size of defect radius, and flap length was kept twice the wound diameter contrasting to the original description of 1.5 times the wound size. The rationale was that since both the flaps were to share a common base, if the pedicle size were to be kept same as described in the original hatchet flap it might result in a narrow base and compromise vascularity. Since the pedicle size was kept larger, the flap size was designed to be twice larger than the usual 1.5 times, so that it would compensate the restriction of rotation and advancement movement of the flaps because of a larger base.

This flap design was conceived as need aroused to counter condition when need for double hatchet flap roused but could not be applied in opposing manner due to compromised blood supply and quality of the scalp affected by primary trauma or previous surgeries limit its deployment.

Cosmetic result of this procedure is excellent, as tissue of similar characteristics is used for reconstruction, with preservation of

hair and texture along with rapid healing, and minimal scarring and comorbidity. None of the possible complications of local flap reconstruction which include flap necrosis, dehiscence, or formation of hypertrophic scars occurred in our series. Hence, principal author shares the opinion that our variation of double hatchet flap can be made use in conditions not permitting use of opposing pattern, with advantage of being simple in design, speed of operability, ease of postoperative care, and excellent outcome.

Unlike elsewhere in the body because of its innate rich vascularity the scalp can withstand some degree of tension and skin pallor after reconstruction does not foretell failure as it does in other parts of the body. However, the principal author was apprehensive of this technique, as it might not suit large soft tissue scalp defects, as reconstruction could be challenging due to intolerant soft tissue elasticity and procedure should be cautiously exercised keeping in mind as the dual flaps are recruited with shared vascular base.

## CONCLUSION(S)

To conclude, in practice, choosing the simplest effective technique and then adapting it according to individual circumstances, as in the above described cases ensures good results and satisfaction of both the surgeon and patient.

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