Abstract:
Injuries to upper limb has been on the increase which is invariably associated with significant soft tissue loss requiring a flap cover. Local tissue for covering the wound may not be available in a majority of situations. Hence there is a need to import tissue from a distant source. Most of the time conventional flaps like groin and abdomen flap may not be available. We have utilized the thoraco-abdomen flap taken from the trunk for this purpose. This flap is based on the perforators of the deep inferior epigastric artery which are maximally centred on the periumbilical region.

Keyword:
Thoraco Abdomen flaps, Periumbilical perforator, Upper limb soft tissue defects

Introduction:
The injured upper limb on many occasions necessitates cover with a full thickness flap from a distant region. Even in the modern era of micro-vascular surgery, pedicled distant flaps still have a place in the soft tissue reconstruction of the hand and forearm. In the past, the abdominal flap was used based on sub-dermal random blood supply, and the flap size was restricted by the length to breadth ratio. The description of the axial groin flap revolutionized the management of hand injuries and it has remained a workhorse for management of hand injuries. However, this flap has some limitations; mainly the dependent position of the limb leads to flap oedema. The groin flap may be insufficient if large areas of hand and adjacent forearm need to be covered.
Taylor and Boyd[7] in 1975 described the vascular territory of the deep inferior epigastric artery and the thoraco abdomen flap. The predominant vascular connections were oriented upward and laterally. The flap is used as both pedicled and free flap under varied clinical situations[9]. It is used for upper limb[4] and groin reconstruction as a pedicled flap.[5][6]

Material and Methods
This flap was used in 15 patients and the defects include:

- Hand defects – when conventional groin flap is not available or difficult positioning is anticipated, -raw areas in dorsum of hand
- Wrist -circumferential defects which often needs two flaps
- Fore arm defects – when there is a necessity for large random abdomen flap
- Elbow defects - raw area in the cubital fossa

All patients remained under clinical observation for a minimum period of 3 weeks. Immediate and early complications including flap loss, marginal necrosis, infection, dehiscence .. were assessed. Donor site complications were also recorded including donor site infection, dehiscence, unsightly scar and donor site hernia.

Vascular Anatomy of the Flap:
The vascular anatomy of the parambilical region is well known [2][3][7]. The skin island of the thoraco-umbilical flap is supplied by parambilical perforators from the deep inferior epigastric vessels. The largest perforator is located at approximately 2 cm from the umbilicus, and it directs toward the inferior angle of the scapula. It anastomoses with the posterior intercostal artery and angulates 45° with the midline. It courses as muscularocutaneous perforator vessels in the deep subcutaneous fat and then superficial to the Scarpa fascia until their final destination. It was demonstrated that, superficial to the Scarpa fascia, the direct perforators turn to take a course parallel to the skin, where they started to divide forming a rich subdermal plexus[6]. These perforators were also found to be anastomosing with the superficial
vessels in the abdominal wall.

**Operative Technique:**

All procedures are done under general anaesthesia. A sand bag is placed under the lower ribs on the same side. The axis of the flap is marked as a line extending superiorly and laterally from the umbilicus to the tip of the scapula.[3] The mid and posterior axillary lines are marked. Pinching the skin assesses the elasticity of the skin and hence the width of the flap that can be closed primarily. Flap is raised from distal (lateral) to proximal end (medial).

It is elevated superficial to the underlying musculature. It includes not only the subdermal plexus but also the vessels within the fat and the thin fascia over the abdominal muscles. The dissection ceases about 2-3 cm medial to the lateral border of the rectus muscle or at a point where adequate length of the flap is obtained.

The surrounding tissues are undermined and the donor site is closed primarily. The arm is immobilized on the patient's side with the help of adhesives and a pillow is placed beneath the elbow. The flap division and final inset are performed 3 weeks later.

**Results:**

This flap was used in 15 patients. The age group was 15-45 years. Aetiology of injury included vehicular accidents in 7 patients, machinery injury in 2 patients, electrical burns in 4 patients and post-surgical in 2 patients. Partial flap
loss was found in one case - a post electrical burn circumferential wrist defect. Recipient site infection occurred in 3 cases which was controlled with antibiotics and local wound care. Donor site was closed primarily in 13 cases and 2 cases needed split skin grafting. Donor site infection occurred in 1 case with partial suture line dehiscence which healed by secondary intention. Abdominal wall hernia was not seen in any patient. 

**Advantages... Comfort zone** Strict positioning is not needed with this flap. Arm rests in a comfortable natural position and this greatly reduced edema. Physiotherapy to the fingers and wrist can be instituted much earlier. Lastly patients can wear their conventional clothes comfortably unlike the groin flap. 

**Flap width**- depends on the defect and pinching of the abdomen skin would assess primary closure of the donor site. 

**Pedicle tubing** - this is the main advantage over abdomen flaps which aids greatly in the post op positioning and reduces discharge from the base of the flap. 

**Attachment percentage**- upto 80 to 95% can be provided with this flap depending on the site for which it is used. 

**Patients positional Comfort** - The natural positioning of hand with adequate tubing allows the patient to keep their hand in a very good positional comfort compared to other flaps. 

**Donor site scar** - Most of the cases can be closed primarily resulting in a linear scar and thereby avoiding SSG to donor area. 

**Flap ratio**-ranges from 4:1 to 5:1. Such a large flap can be harvested.
CONCLUSION:

Thoraco umbilical perforator based flap is a very useful flap for reconstruction of complex upperlimb defects. It is easy to harvest and donor site can be closed primarily in most of the cases. There is no need to isolate the pedicle. Patients comfort is far superior to other conventional flaps. Lastly it is much reliable and much larger flap can be harvested with ease.

References: