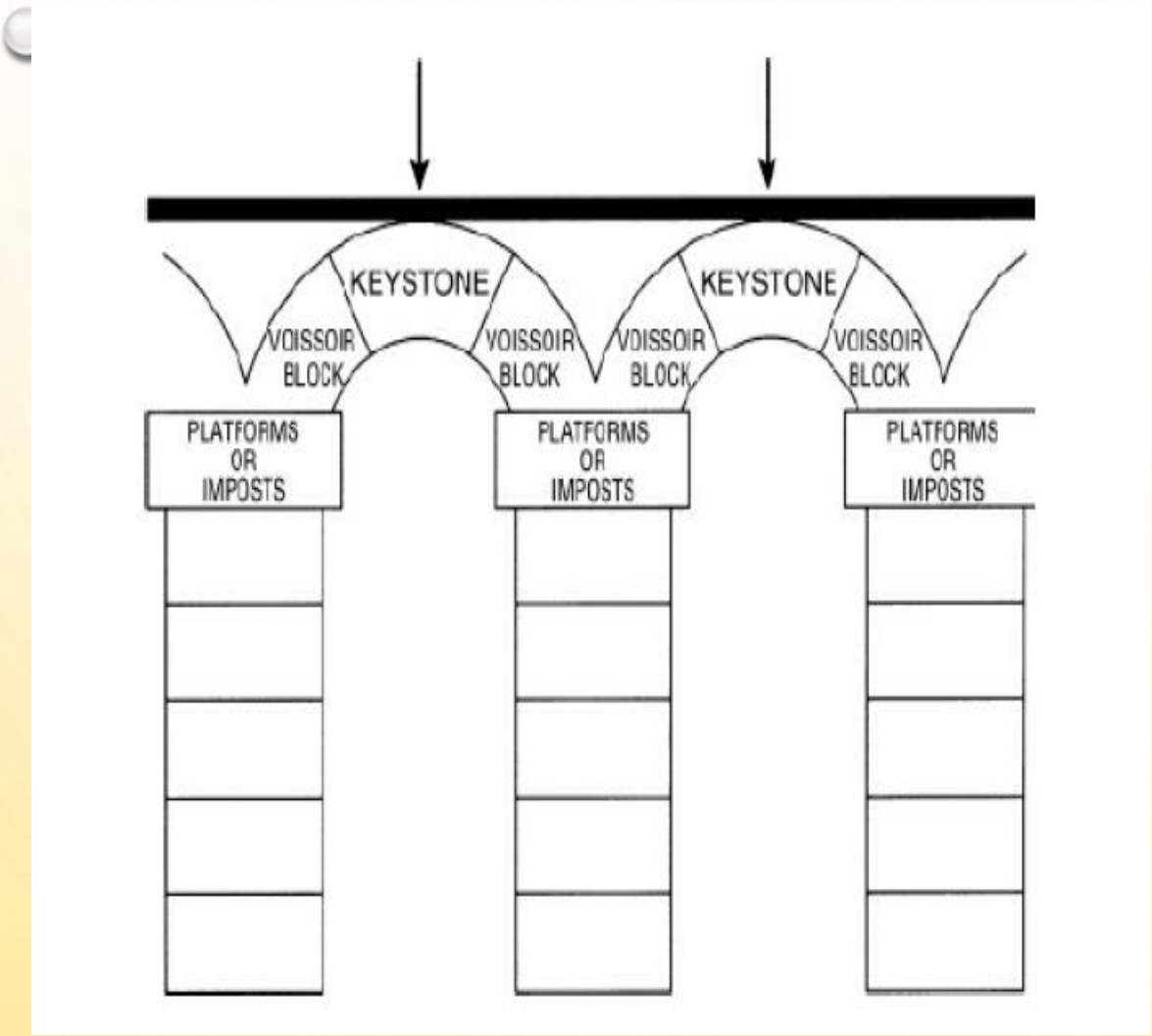
RECONSTRUCTIVE SURGERY IN MSF PROJECTS

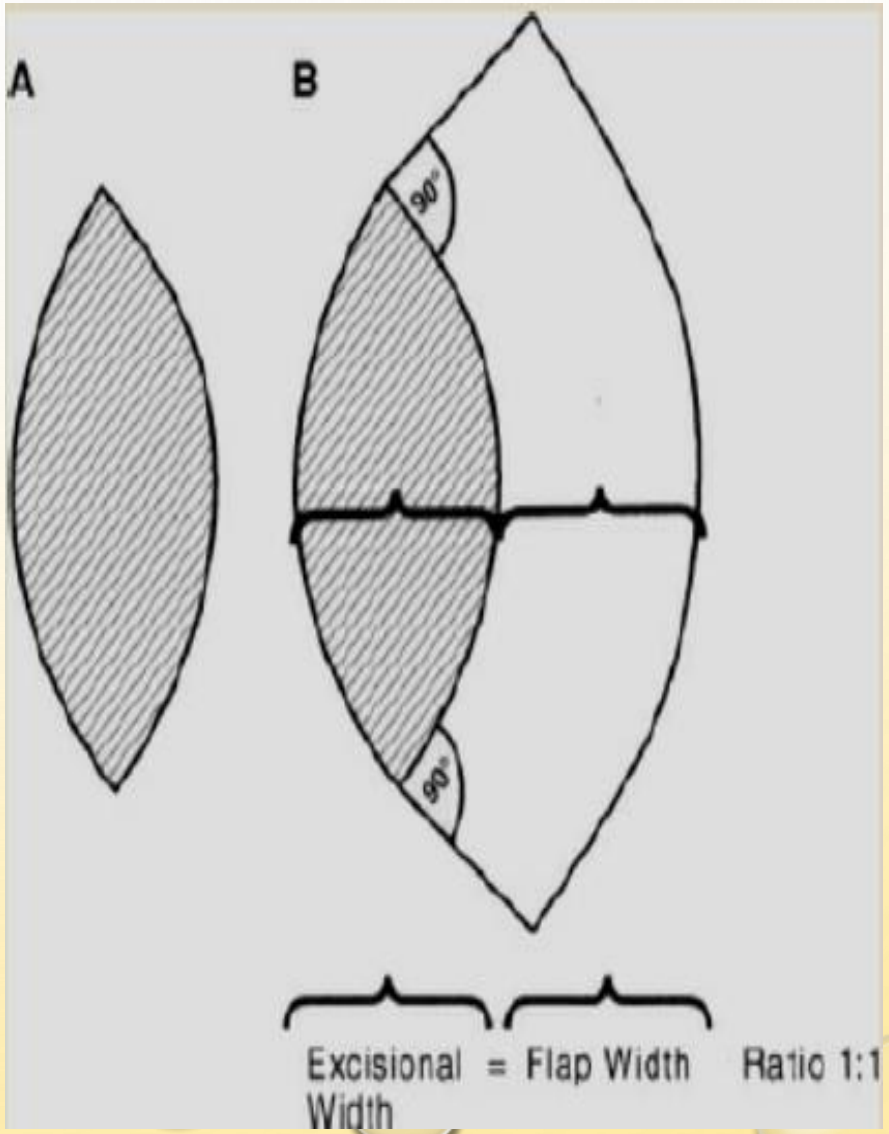
PART 4



Dr Ryan Ko Chi Cheong

KEYSTONE FLAPS





TRAINING STATISTICS

Number of keystone flap:

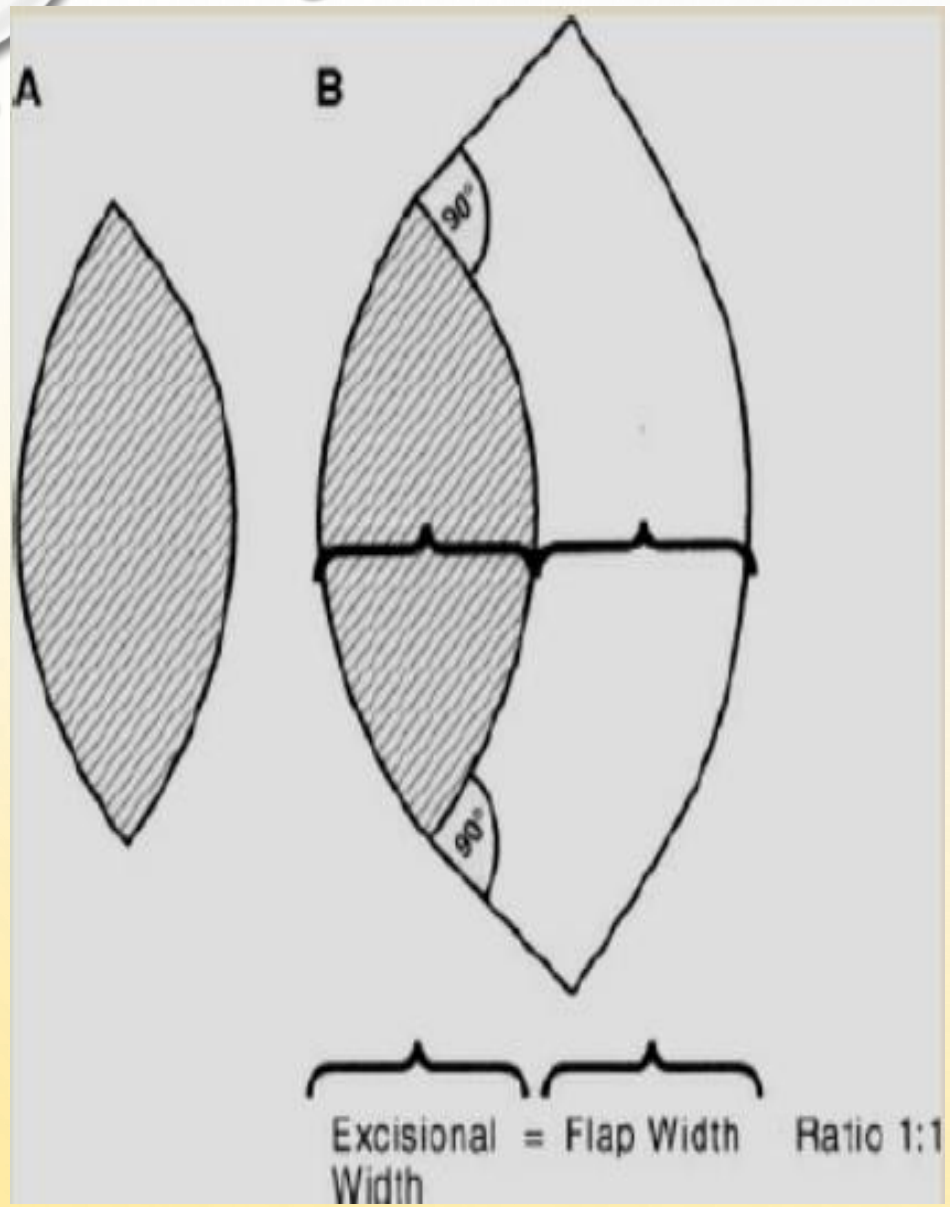
14 out of 57	Kilo, Yemen 2019
13 out of 45	Mocha, Yemen 2021
15 out of 48	Hudaydah, Yemen 2022
11 out of 55	Lashkar Gah, Afghanistan 2023
32 out of 111	Kilo, Yemen 2024

85 out of 316 flaps; 26.9% of all difficult open wounds could be covered with keystone flap

VASCULAR SUPPLY FOR KEYSTONE FLAP

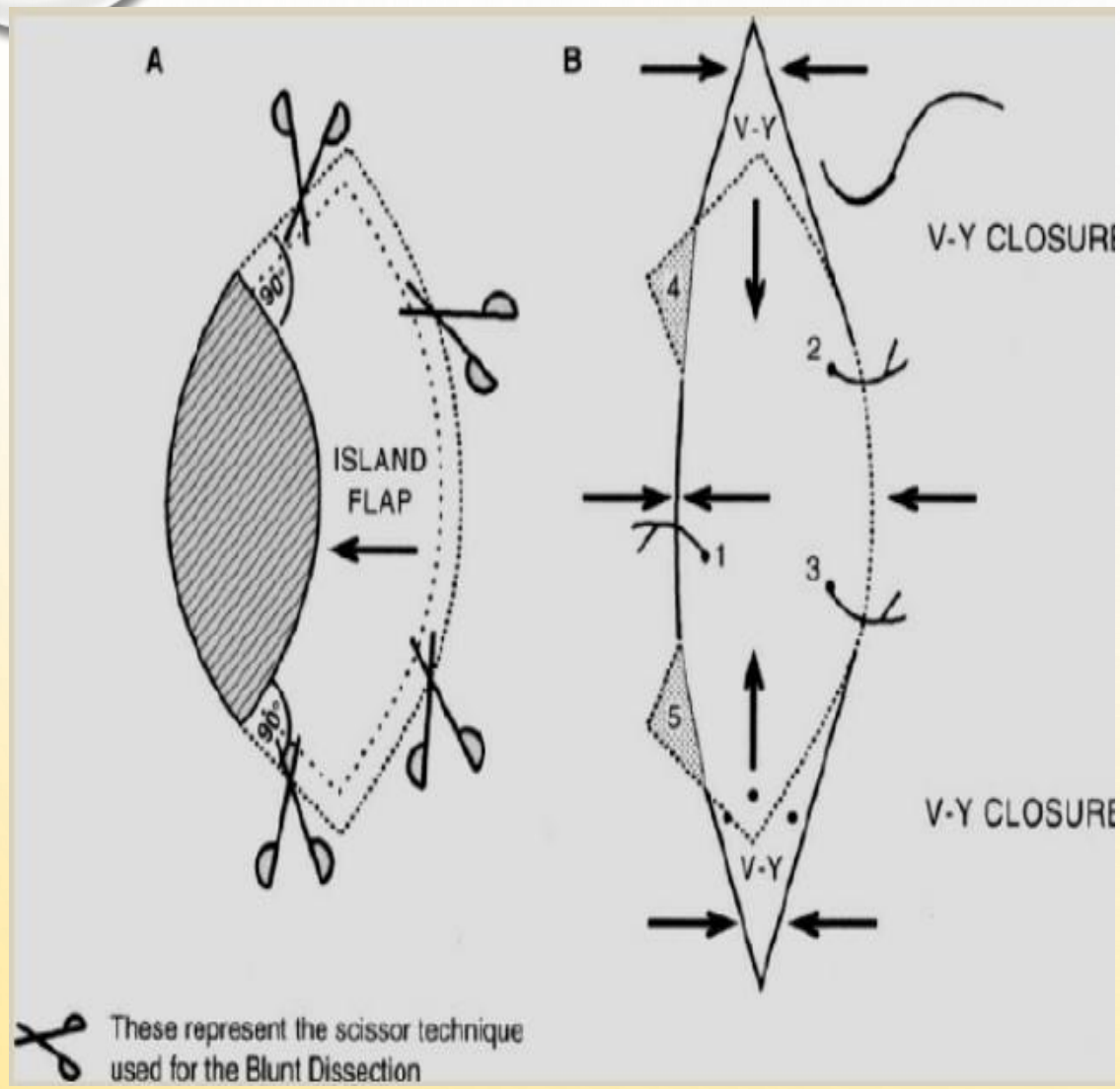
The main arterial supply to keystone flaps is typically perforator-based (keystone perforator island flap [KPIF]), but depending on the region of the body, direct vessels may be involved (e.g., in the scalp, groin). Vessels are typically not seen during keystone flap dissection, but knowledge of the main perforators, the safe principles of elevation, and stepwise attainment of experience lead to increased confidence with keystone reconstruction.

One of the KIF principles is that, where possible, seek blood supply from both arterial and neurovascular sources (conjoint supply). This maximizes blood supply and the potential for keystones to be designed with axial vessels within the flap because vessels and cutaneous nerves often follow similar courses. For this reason, the dermatomes act as a useful aide-memoire to identifying the axis of the flaps without specific need for understanding the underlying perforator anatomy in significant detail.



Flap width to Defect width Ratio must be larger than 1:1

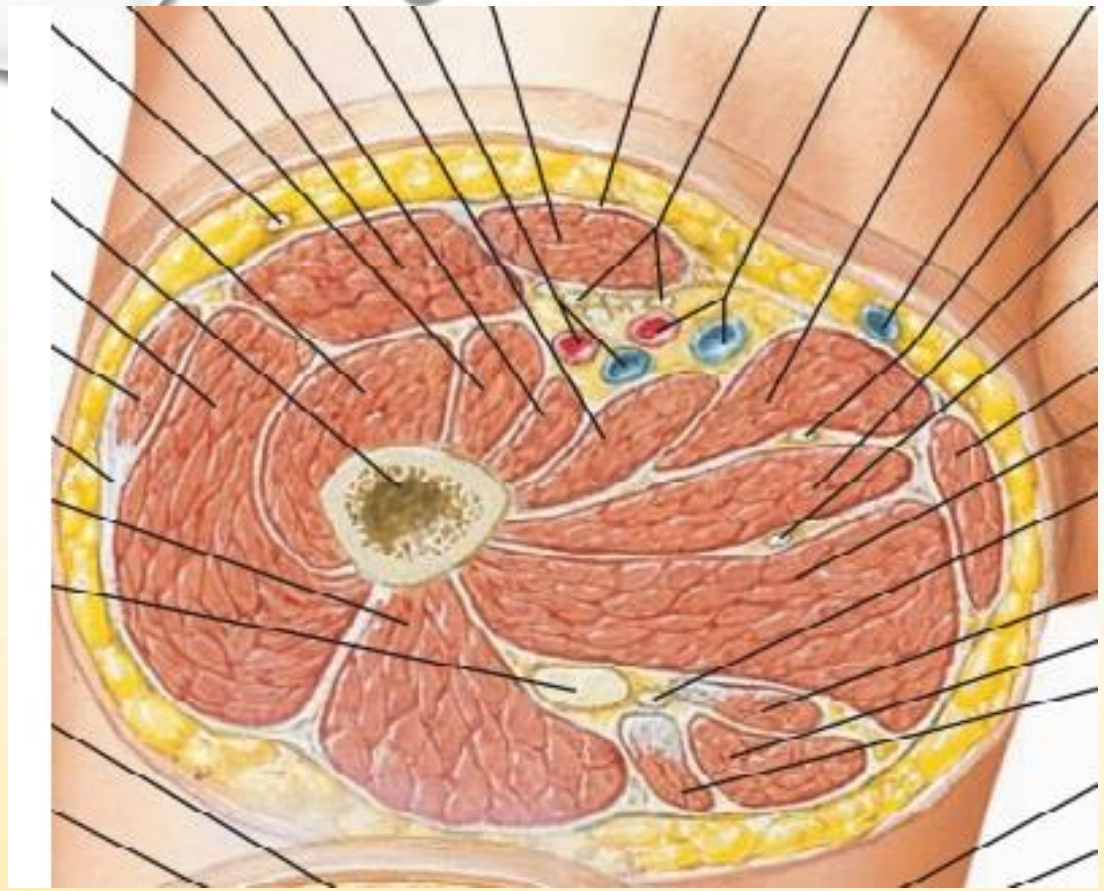
The dermatomes act as a useful aide-memoire to identifying the axis of the flaps without specific need for understanding the underlying perforator anatomy in significant detail.

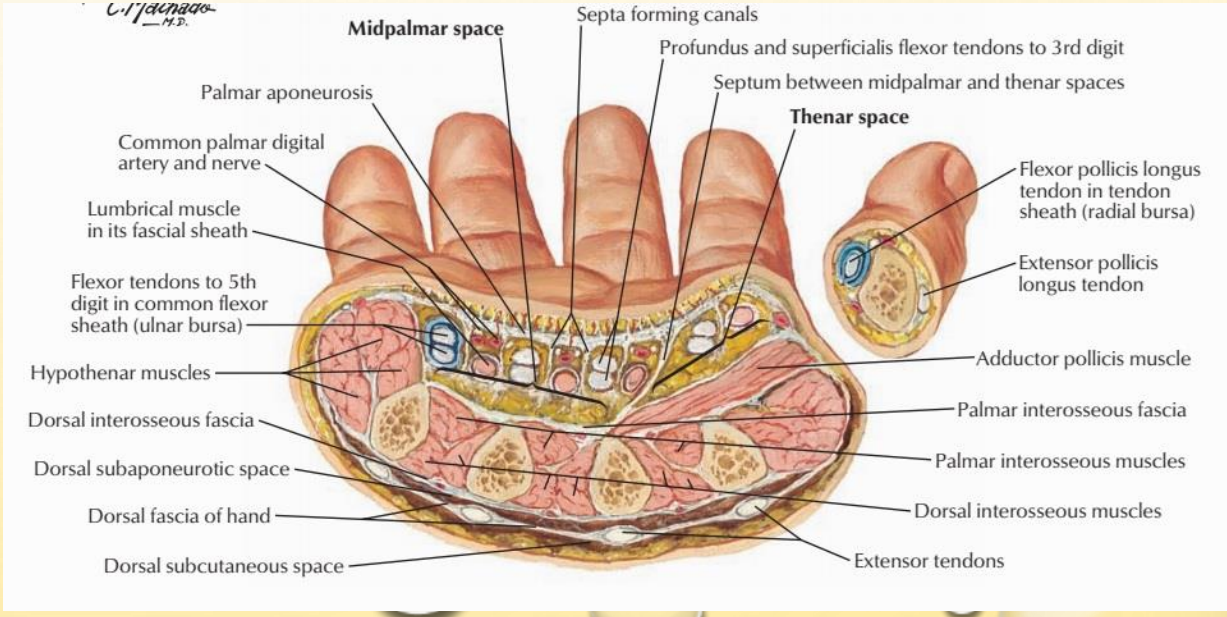


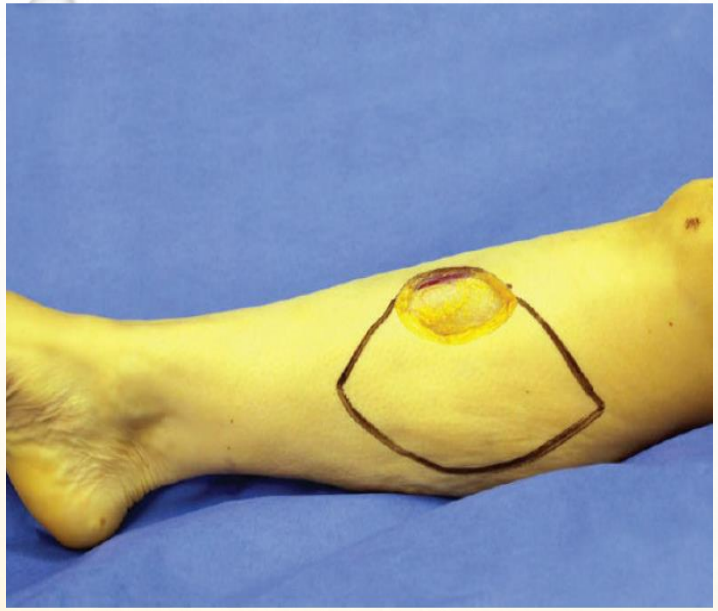
Following sharp dissection through the skin, the **subcutaneous tissues are preserved as much as possible by gentle blunt dissection.**

The underlying fascia can be accessed through small windows in the subcutaneous tissue followed by careful scissor-based mobilization.

Step 1: Assess defect, pathology, and available vascular pedicles and tissue
Step 2: Mark out flap and determine the form of mobilization
Step 3: Determine degree of islandization
Step 4: Maintain Subcutaneous Neurovascular Structures Where Possible
Step 5: Release tourniquet If used and assess flap vascularity
Step 6: Utilize Creep, Place Strategic Mattress Sutures, and undertake continuous closure to produce even physiological tension
Step 7: Determine whether an additional small Skin Graft is necessary to prevent supraphysiological tension
Step 8: Assess need for postoperative splinting to prevent movement of nearby joints
Step 9: Document the flap type, outline, and movement to facilitate re-operation, if required




Midpalmar space
Septa forming canals
Profundus and superficialis flexor tendons to 3rd digit
Septum between midpalmar and thenar spaces
Palmar aponeurosis
Thenar space
Common palmar digital artery and nerve
Lumbrical muscle in its fascial sheath
Flexor tendons to 5th digit in common flexor sheath (ulnar bursa)
Hypothenar muscles
Dorsal interosseous fascia
Dorsal subaponeurotic space
Dorsal fascia of hand
Dorsal subcutaneous space
Flexor pollicis longus tendon in tendon sheath (radial bursa)
Extensor pollicis longus tendon
Adductor pollicis muscle
Palmar interosseous fascia
Palmar interosseous muscles
Dorsal interosseous muscles
Extensor tendons



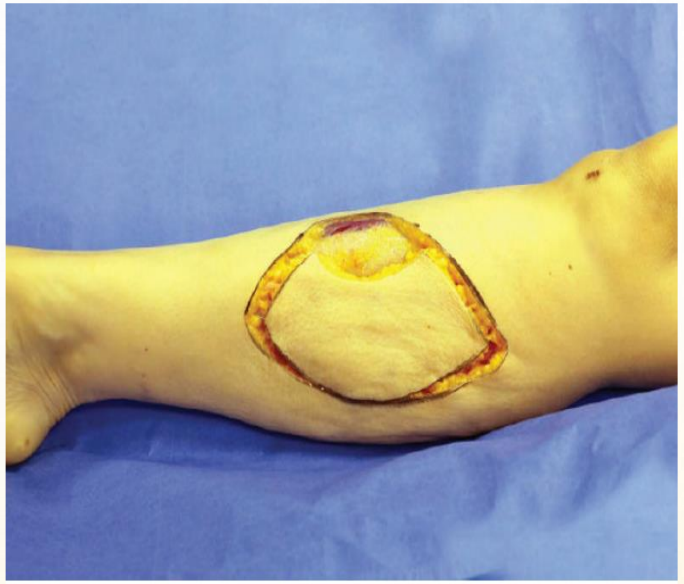
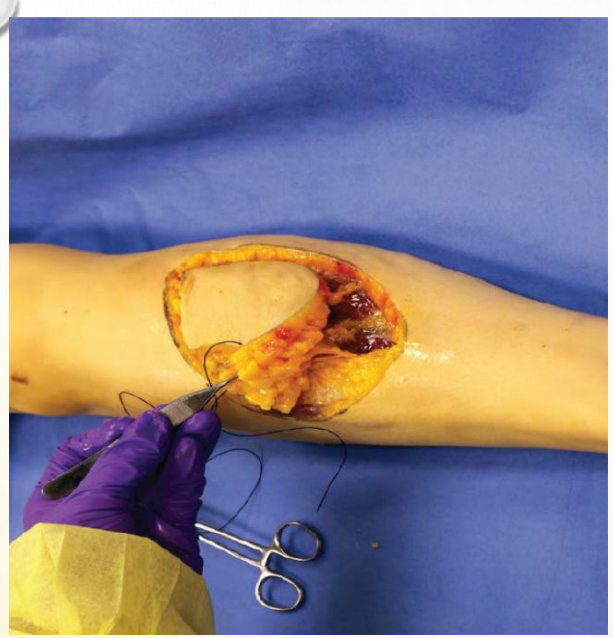
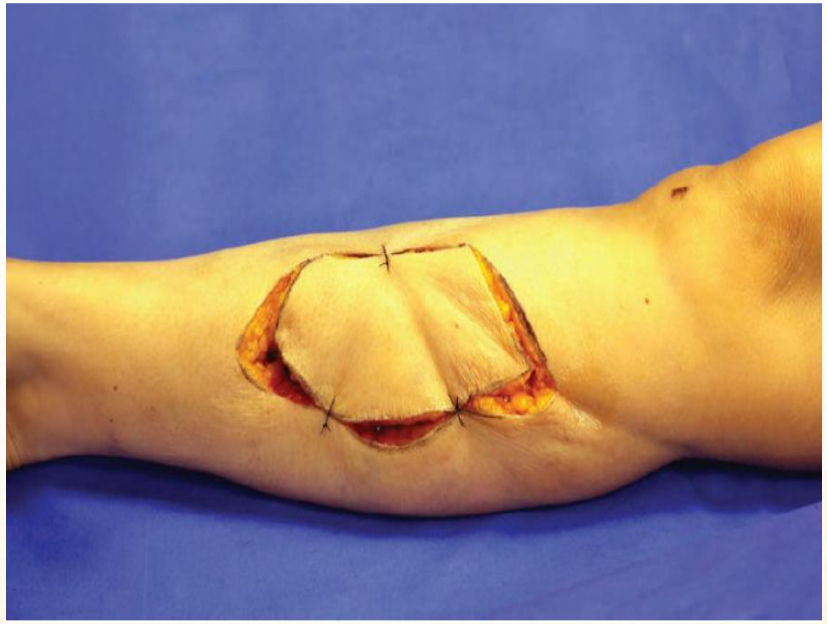


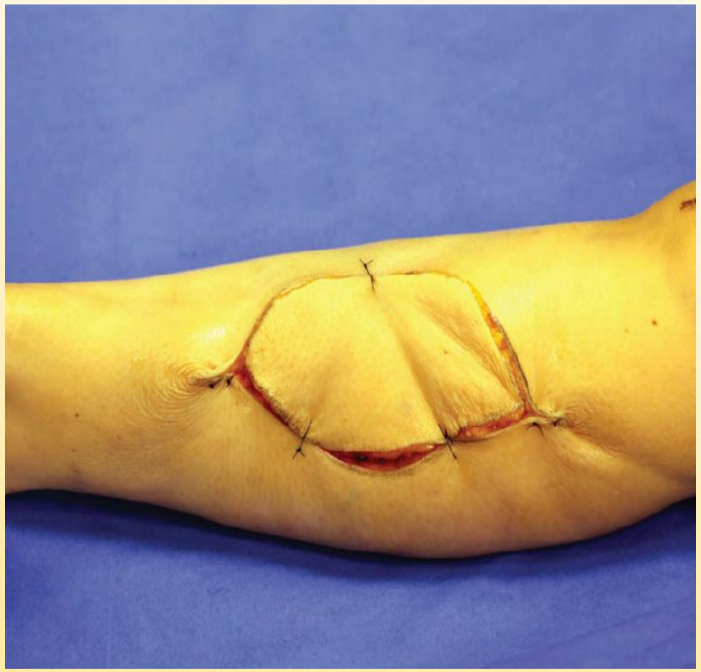
Fig. 23.6 Full skin islandization is undertaken sharply, while preserving subcutaneous structures.

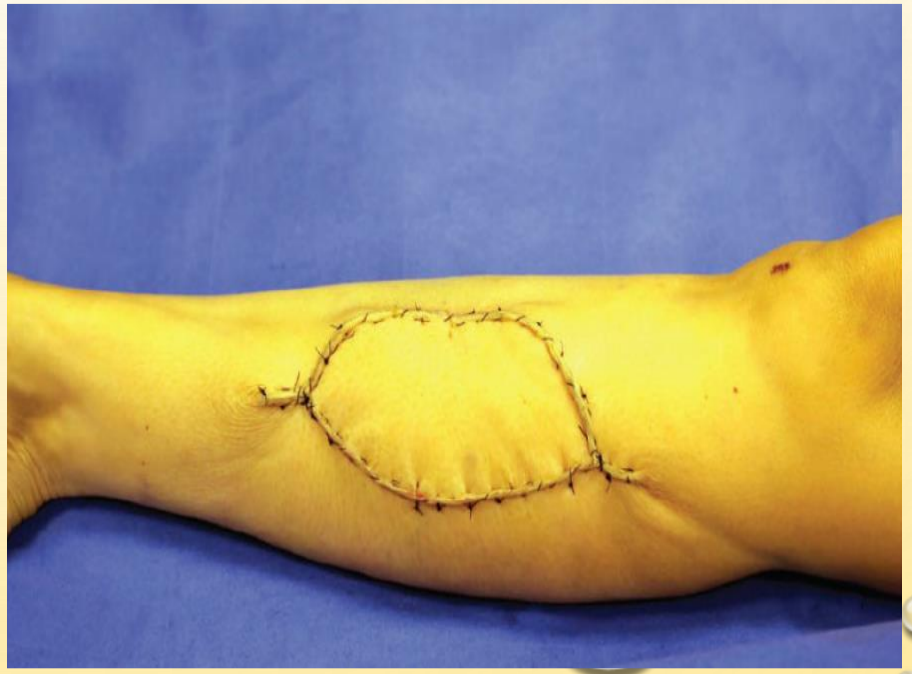






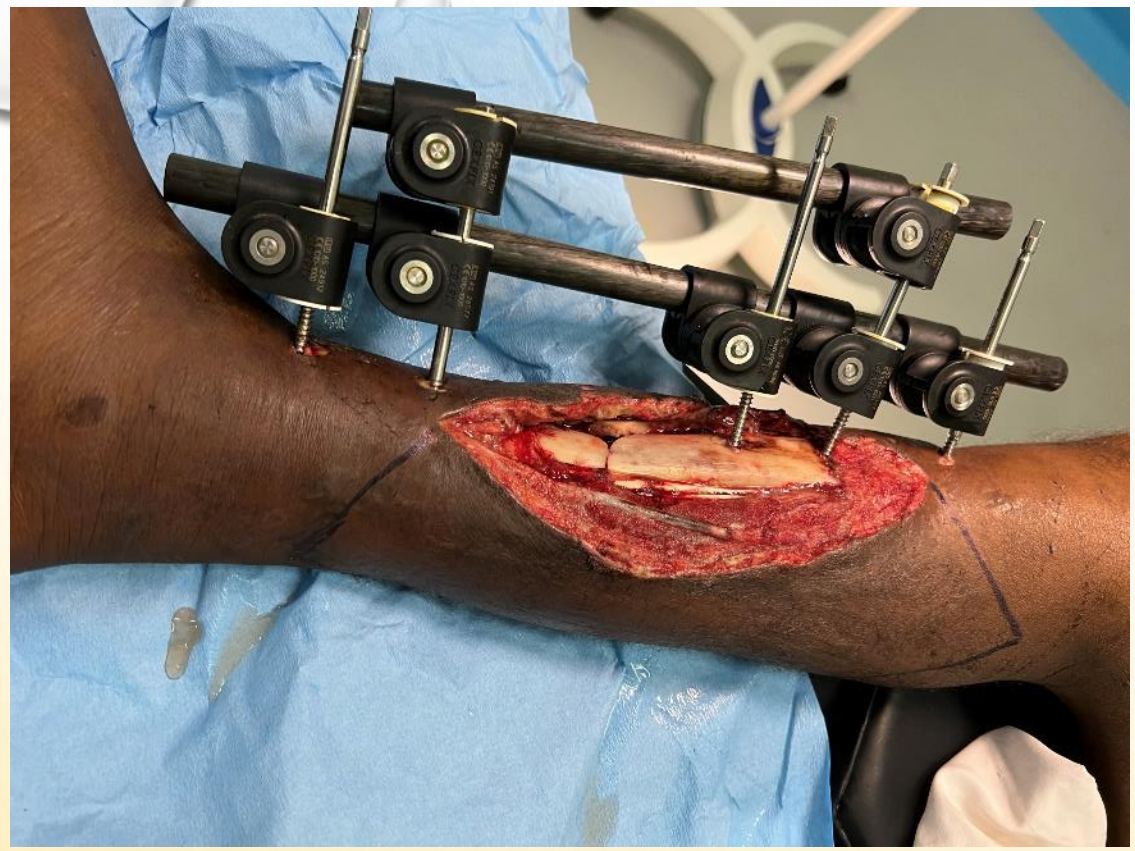








Mocha, Yemen 2021



Hudaydah, Yemen 2022



Open # ® tibia, wound closed by keystone flap

In the past similar wound need Soleus muscle flap + PTSG which take 14 days hospitalization; but with flap we did now, patient can be discharge after 2 days once the flap is consider safe





Kilo, Yemen 2019



GSW at leg, keystone flap was done instead of skin graft. The resulting wound quality would be so much better and patient could be discharged home as early as D1 or D2.





Kilo, Yemen 2019



Open fracture of (L) tibia with external fixator done followed by fasciotomy. Fasciotomy wound was closed by keystone flap instead of PTSG

Mosul, Iraq 2018







Mocha, Yemen 2021









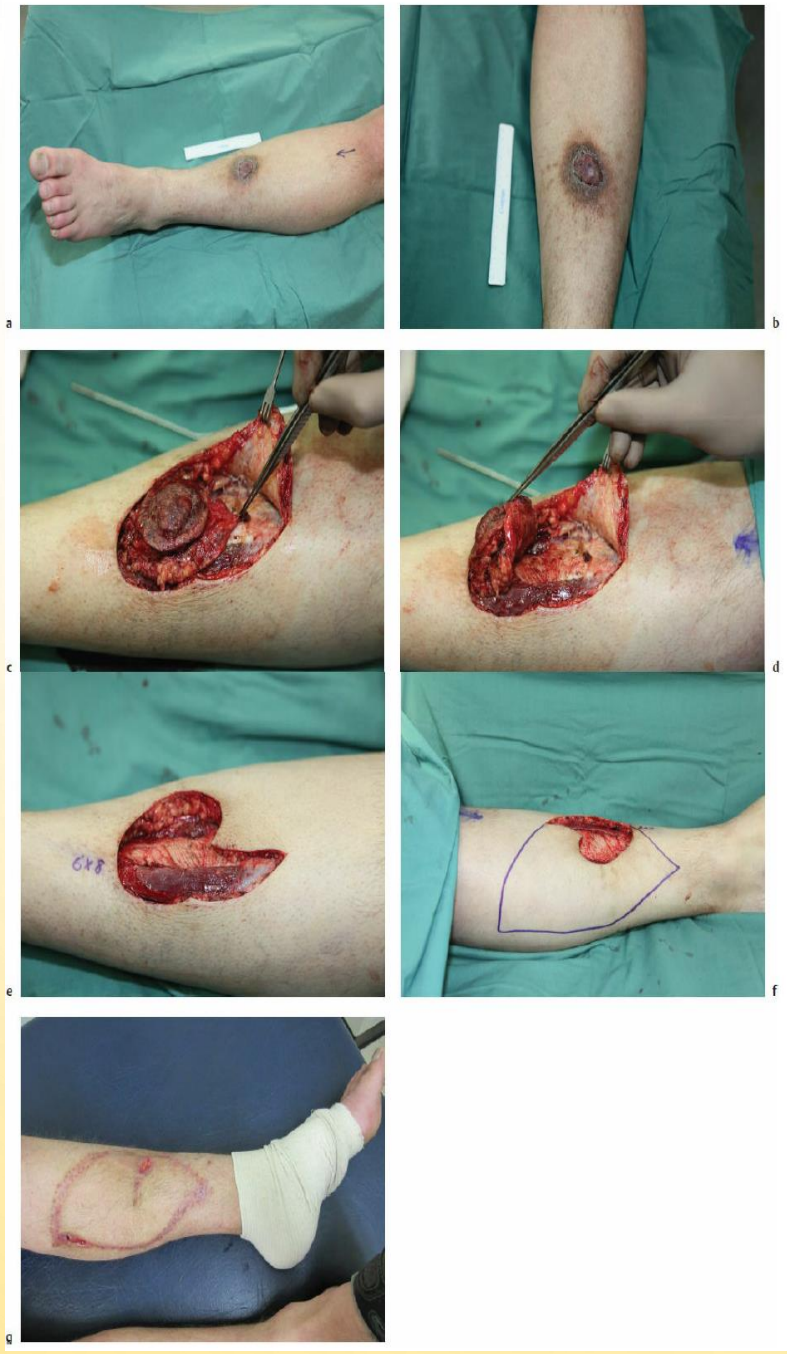
® knee wound with patella exposed, keystone flap was performed
To avoid future linear longitudinal scar across the knee joint.
Operation was performed by Dr Amr alone. Wound healed good in Follow up

Hudaydah, Yemen 2022

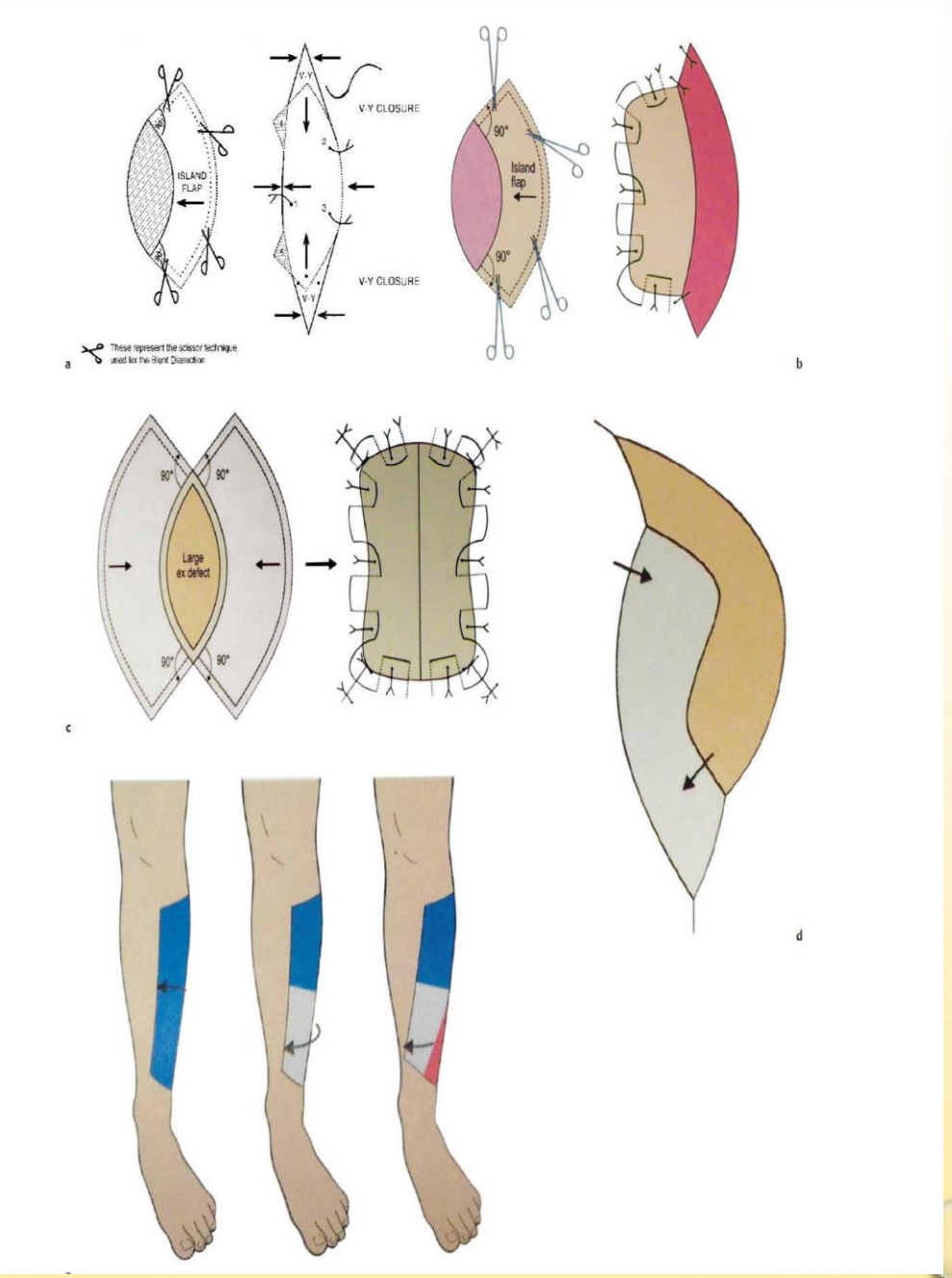




Open # ® femur, external fixator was done in Kilo, patient referred back for wound management for knee wound. Keystone flap was performed


a
b
c
d
e
f
g


a
b
c
d
e


ISLAND FLAP
V-Y
V-Y CLOSURE
V-Y CLOSURE
These represent the scissor technique used for the Blunt Dissection
a
90°
Island flap
90°
b
90°
90°
Large ex defect
90°
90°
c
d

Mocha, Yemen 2021





Open fracture ® tibia with extensive skin loss, keystone flap was performed covering 80% of the original wound, remaining area covered by PTSG

Kilo, Yemen 2019







Wound in dorsum (L) hand, bilateral keystone flap was done instead of PTSG, which will give much better wound quality





Kilo, Yemen 2024









Mocha, Yemen 2021

Gunshot wound with open fracture of humerus, Bone exposed in the wound, so keystone flap was performed with omega variation to cover such wide wound







Kilo, Yemen 2024



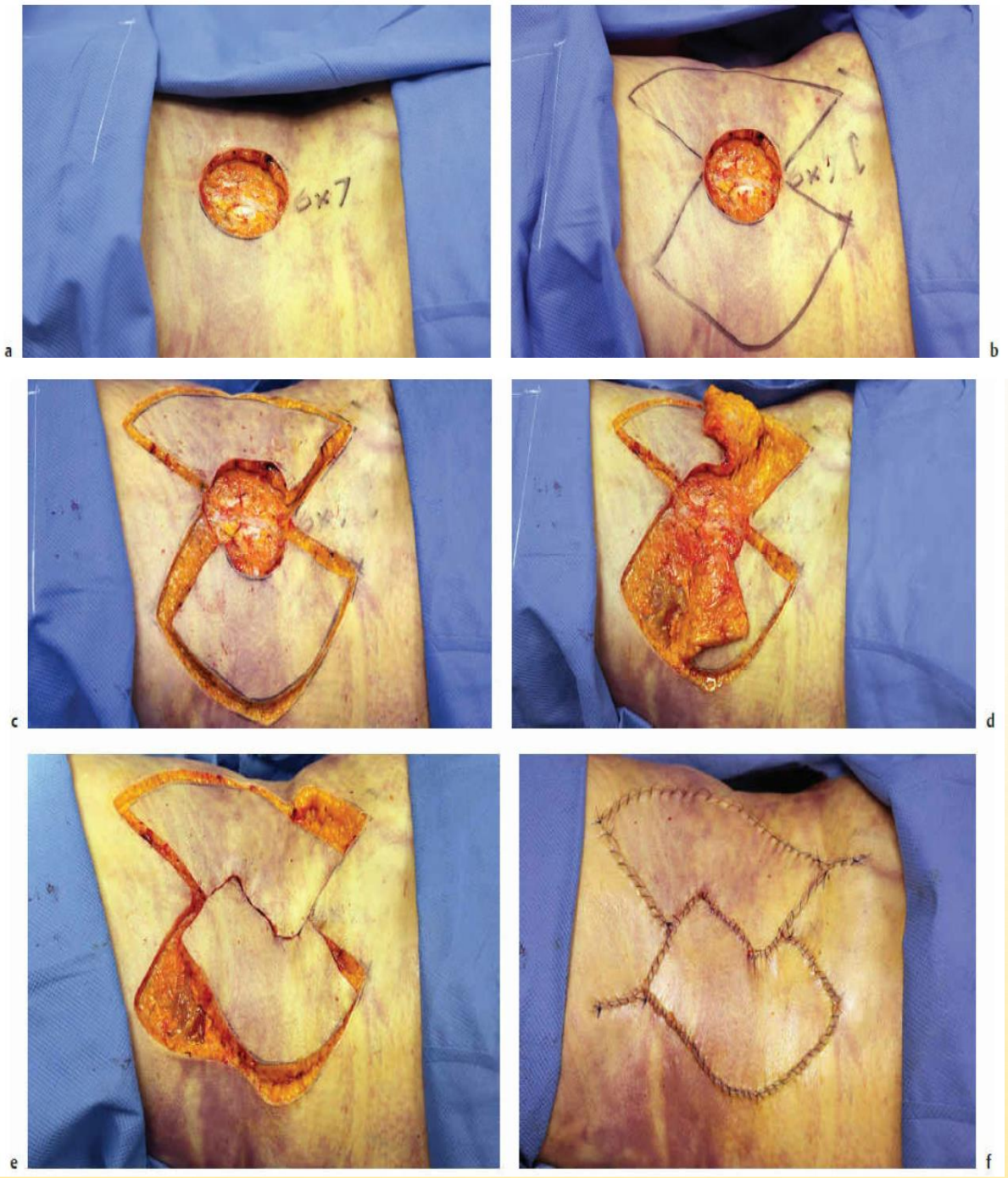
Necrotizing fasciitis ® arm, Keystone flap with omega variation was performed, the wound was closed with the elbow flexed, as there's no linear wound across the elbow so normal skin is stretchable after the wound healed

Lashkar Gah, Afghanistan 2023





Dog bite at ® flank, bilateral keystone flap was done
Patient was discharged on D1 with wound gapped on follow up but one can see the gap is way much smaller than the initial wound which can be closed by secondary suture but patient defaulted.
So we count this as partial failure.


6x7
a
b
c
d
e
f


g



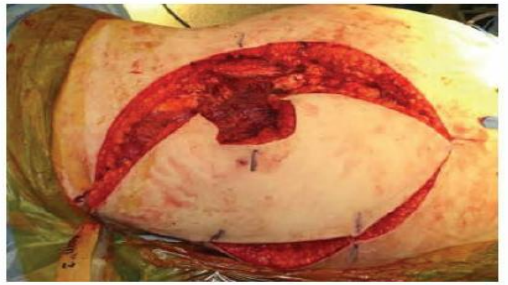








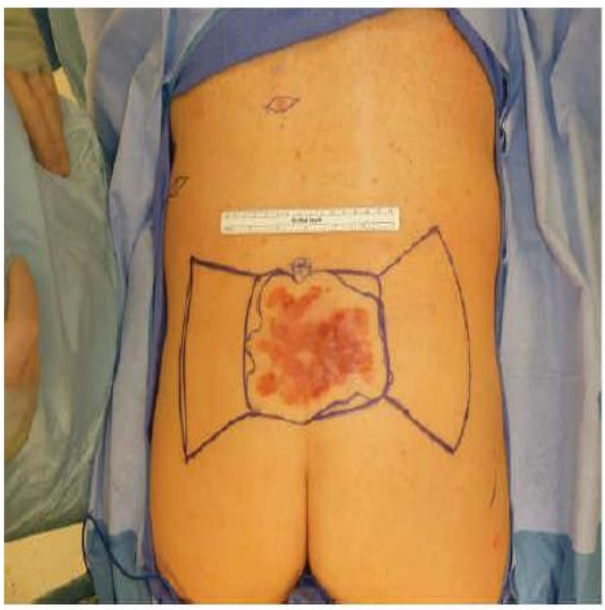








a



b



c



d



e

