Clinical Cases of Keystone Island Perforator Flaps

Michel Saint-Cyr, M.D., F.R.C.S
2015
Keystone flaps

Introduction

- **Felix Behan** *ANZ J. Surg. 2003;73:112-120*
  - KDPIF (keystone design perforator island flap)
  - 4 flap types:
    - Type 1: direct closure
    - Type 2: +/-skin graft required
    - Type 3: double keystone
    - Type 4: rotation-advancement +/- STSG

- Terminology evolution: Arc flap ➔ Arcade flap ➔ Keystone flap
- ‘Keystone’: Critical stone that supported weight of heavy roman arches
Keystone Flaps

Traditional ratio 1:1

Redistribution of tension

Other Key Publications
Keystone Flap
Technique (Traditional)

- Excise lesion in elliptical fashion
- Side of lesion with maximal laxity should be selected
- Incisions 90° to side of defect
- Width of the flap = width of the defect (1:1)
- Curvature of flap = curvature of defect
- No undermining, blunt dissection
- Fascia incised lateral only if additional mobility needed
- Flap based on random perforators
Design Modifications to Keystone Flap

- Multi-perforator advancement flap
- Perforator often known (ex: PTA, LCFA, RA)
- Incise fascia circumferentially routinely
- Width often greater than 1:1
- Greater width = more perforators = more aggressive advancement
- Multiple options possible:
  - Bilateral opposing keystone flaps
  - Rotation only
  - Combination with other local flaps ex: pedicle-free flap
Perforator cluster distribution **predictable**
Design axis of flap parallel and centered over major perforator clusters e.g. Lateral Circumflex Femoral Artery.
Keystone Flap Design: Centered over Perforators
Multi-perforator Advancement flap

Centre over dominant perforators and align according to axially
Broad Design incorporates multiple linking vessels

Encourages inter-perforator flow via direct and indirect linking vessels and improves overall vascularity
Case 1: Anterior Thigh Sarcoma

De-epithelialization of proximal flap can be used to reduce dead space in groin
Case 2: Posterior unilateral keystone flap

- 68 year-old male with posterior mid-thoracic sarcoma
Case 2: Posterior unilateral keystone flap

- Defect extended to near mid axillary line
- 40 x 25 cm defect dimensions
- Paraspinal muscle flaps for central defect coverage
- Reasonable lateral tissue laxity
Case 2: Posterior unilateral keystone flap

- Postoperative results at 2 weeks
- Perforators cluster map of the back
Case 3: Lateral thigh keystone

- 66 year old female with recurrent squamous cell carcinoma of anus, previous chemoradiotherapy and extensive disease involving the groin, abdominal cavity and retroperitoneal space
Case 3: Lateral thigh keystone

- Abdominal wall reconstruction with Prolene mesh, coverage of exposed femoral vessels with a sartorius flap and a large lateral keystone flap raised for coverage.
- The proximal portion was de-epithelialized and buried to dead space
- Circumferential fascial incision permitted greater advancement and rotation
Case 4: Combination keystone flaps

- 44 year old male with myonecrosis over lateral hip region
- A posterior keystone was advanced to cover the lower wound and a smaller anterior type IV keystone was transposed into the upper portion of the defect
Case 4: Combination keystone flaps

• Early postoperative result
Case 5: Keystone as a “life-boat”

- 47 year-old female with medial thigh sarcoma
Case 5: Keystone as a “life-boat”

- 47 year-old female with medial thigh sarcoma
- Planned freestyle pedicle perforator flap 10 x 26cm
Case 5: Keystone as a “life-boat”

• A free-style proximal superficial femoral artery perforator had reduced perfusion laterally and excised, leaving a residual defect inferiorly
Case 5: Keystone as a “life-boat”

• Lateral Keystone harvested to cover inferior residual defect

• Early postoperative result
Case 6: Incomplete skin incision keystone

16 year old female with a left lateral thigh sarcoma

Asymmetric limbs designed to avoid crossing joint crease and Inferior skin incision not completed as sufficient advancement gained from fascial incision

Early post operative result
Case 7: Bilateral Keystone

Caucasian male with lateral thigh sarcoma resected. Previous local irradiation → limited skin laxity either side. Consider two opposing keystone flaps.
Case 7: Postoperative result
Case 8: Beyond the 1:1 ratio design

Lateral thigh sarcoma defect, heavily irradiated with restricted tissue laxity adjacent to defect
Case 9: Anterior Thigh Keystone

66 F, Recurrent SCC, Chemo-XRT, groin disease, extending into abdominal cavity, retroperitoneal space. Abdominal wall reconstruction with mesh, Sartorius flap, keystone flap (700cm²)
Case 9: Anterior Thigh Keystone

Aesthetic units of thigh

- Designed within aesthetic units of thigh
- Incisions kept in mid-axial line
Case 9: Anterior Thigh Keystone
Proximal flap de-epithelialized for dead space management in groin

700cm² flap harvested.
Key points

- Incorporate known perforator ‘hot spots’
- Fascial incision as needed (advancement)
- ‘Go big or go home’
- Consider local skin laxity ex: XRT (bigger flap)
- Avoid lymph node regions (modify limb angles PRN)
- PTS for donor site closure
- Bilateral for larger defects or limited skin laxity
- Design flap along aesthetic units and on side of maximal skin laxity and no XRT/trauma
Conclusion

Keystone flaps

• Easy to harvest
• Very reliable
• Low morbidity and complication rate
• Early patient mobilization and DC
• Replace like with like
• Multiple options