Perforator flaps
Perforator flaps

• New concept: dissection of the perforator from the skin paddle to the main vessel through the muscle

• Dissection can be either through muscle or septum
Perforating vessel

....perforator as any vessel that enters the superficial plane through a defined fenestration in the deep fascia, regardless of origin...

Blondeel PN, Van Landuyt KH, Monstrey SJ Hamdi M, Matton GE, Allen RJ Dupin C, Felle AM, Koshima I, Kostakoglu N, Wei FC.

Perforating vessels

1. Direct perforators perforate the deep fascia only;
2. Indirect muscle perforators predominantly supply the subcutaneous tissues;
3. Indirect muscle perforators predominantly supply the muscle but have secondary branches to the subcutaneous tissues;
4. Indirect perimysial perforators travel within the perimysium between muscle fibers before piercing the deep fascia;
5. Indirect septal perforators travel through the intermuscular septum before piercing the deep fascia.
Perforator

• 1 artery
• 1 or 2 collateral veins
# Terminology of Muscular and Septal Perforator Flaps

<table>
<thead>
<tr>
<th>Flap/Abbreviation</th>
<th>Flap/Full Name</th>
<th>Nutrient Artery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Muscle perforator flaps</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIEP</td>
<td>Deep inferior epigastric perforator</td>
<td>Deep inferior epigastric vessels</td>
</tr>
<tr>
<td>TAP</td>
<td>Thoracodorsal artery perforator</td>
<td>Thoracodorsal vessels</td>
</tr>
<tr>
<td>SGAP</td>
<td>Superior gluteal artery perforator</td>
<td>Superior gluteal vessels</td>
</tr>
<tr>
<td>IGAP</td>
<td>Inferior gluteal artery perforator</td>
<td>Inferior gluteal vessels</td>
</tr>
<tr>
<td>IMAP</td>
<td>Internal mammary artery perforator</td>
<td>Internal mammary vessels</td>
</tr>
<tr>
<td>ICAP</td>
<td>Intercostal perforator</td>
<td>Intercostal vessels</td>
</tr>
<tr>
<td>PLP</td>
<td>Paralumbar perforator</td>
<td>Paralumbar perforating vessels</td>
</tr>
<tr>
<td>GP</td>
<td>Gracilis perforator</td>
<td>Medial circumflex femoris vessels</td>
</tr>
<tr>
<td>TFLP</td>
<td>Tensor fasciae latae perforator</td>
<td>Transverse branch of the lateral circumflex femoris vessels</td>
</tr>
<tr>
<td>ALTP</td>
<td>Anterolateral thigh perforator</td>
<td>Descending branch of the lateral circumflex femoris vessels</td>
</tr>
<tr>
<td>AMTP</td>
<td>Anteromedial thigh perforator</td>
<td>Innominate branch of the descending branch of the lateral circumflex femoris vessels</td>
</tr>
<tr>
<td>SAP</td>
<td>Sural artery perforator</td>
<td>Sural vessels</td>
</tr>
<tr>
<td>PTAP</td>
<td>Posterior tibial artery perforator</td>
<td>Posterior tibial vessels</td>
</tr>
<tr>
<td>ATAP</td>
<td>Anterior tibial artery perforator</td>
<td>Anterior tibial vessels</td>
</tr>
<tr>
<td><strong>Septal perforator flaps</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAP</td>
<td>Radial artery perforator</td>
<td>Radial vessels</td>
</tr>
<tr>
<td>AP</td>
<td>Adductor perforator</td>
<td>Medial circumflex femoris vessels</td>
</tr>
<tr>
<td>AMTP</td>
<td>Anteromedial thigh perforator</td>
<td>Innominate branch of the descending branch of the lateral circumflex femoris vessels (if perforator runs only in the septum)</td>
</tr>
<tr>
<td>ALTP</td>
<td>Anterolateral thigh perforator</td>
<td>Descending branch of the circumflex femoris lateralis vessels (if perforator runs only in the septum)</td>
</tr>
</tbody>
</table>
Perforator flap

Koshima I, Soeda S
Inferior epigastric artery skin flaps without rectus abdominis muscle.
Vascular anatomy of the integument

Manchot (1880)
Salmon (1936)
Cormark and lamberty (1986)
Taylor (1987)
Fig. 2-1  The cutaneous arteries of the human body. This figure is based on Carl Manchot’s dissections in the 1880s clarifying the vascular anatomy of skin of the body.
Angiosome concept

• 3-dimensional composite unit of tissue supplied by a given source artery
• This contains muscle, nerve, connective tissue, bone and overlying skin
• 374 perforators to the skin
Fig. 2-8  This composite schematic illustration shows the vascular territories of the body that correspond to source arteries providing musculocutaneous or septocutaneous perforators to the skin. Vascular territories and their abbreviations are listed in Table 2-1. The details of the anatomy of these vascular territories are further described in Chapters 8, 12, 18, and 30.
Vascular anatomy of the integument

• role of choke anastomotic vessels and true anastomoses

• Venous drainage
Preoperative assessment

- Hand-held Doppler
  - Readily available
  - Cheap
  - Too sensitive
  - Path and course difficult
Preoperative assessment

- Color Doppler
  - Vessels (0.2mm)
  - Relationship between different tissues
- Expertise
- Large expensive equipment
- Slow
Preoperative assessment

Preoperative assessment

Masia J, Kosutic D, Cervelli D, Clavero JA, Monill JM, Pons G.

In search of the ideal method in perforator mapping: noncontrast magnetic resonance imaging.

Perforator flap dissection

- Use standard landmarks and try to map the perforators
- Make the incision only on one side of the flap
- Preserve each perforator until you encounter a larger one
- Select the best perforator, check the pulsation of the artery
- Consider the easiest dissection
- Transect perforators that will not be used after the entire pedicle is dissected
Perforator flaps

- Pedicled perforator flap
- Free perforator flap
Pedicled perforator flaps

Propeller flap
VY advancement flap
Transpositional flap
Propeller flap

The propeller flap is a local island fasciocutaneous flap based on a single dissected perforator.
Transpositional flap

Mehrotra S.

Perforator-plus flaps: a new concept in traditional flap design.
Radial artery perforator flap

Volar hand coverage from distal radial a. perforator flap

Dorsal hand coverage from distal radial a. perforator flap

Dorsal & volar arm coverage from proximal radial a. perforator flap

Pedicle perforator flap based on distal radial a. perforators

Pedicle perforator flap based on proximal radial a. perforators
Ulnar artery perforator flap

Yu P, Chang EI, Selber JC, Hanasono MM
Perforator Patterns of the Ulnar Artery Perforator Flap.
Forearm perforator flap

Akin S
V-Y advancement island flap based on the perforator of the anterior interosseous artery.
Dorsal Metacarpal Artery Perforator Flap

Sandeep JS
Application of the Dorsal Metacarpal Artery Perforator Flap for Resurfacing Soft-Tissue Defects Proximal to the Fingertip
Plastic and Reconstructive Surgery, September 2011
Palmar perforator flaps

Seyhan T.

Dorsal digital artery perforator flap

Motohisa Kawakatsu, Kozo Ishikawa
Dorsal digital perforator flap for reconstruction of distal dorsal finger defects.
Volar digital artery perforator flap

Koshima I, Urushibara K, Fukuda N, Ohkochi M, Nagase T, Gonda K, Asato H, Yoshimura K.

Volar digital artery perforator flap

......If there are no dominant perforators at the flap base, adiposal tissue should be preserved at the flap base, because the subcutaneous tissue often contains superficial arterioles and it could nourish the flap.....

Figure 1  A: Anatomy of the digital artery and digital artery perforators. Blue arrow: Digital artery perforator suitable for use as a DAP flap pedicle. Black arrow: narrow arteriole arising from the digital artery. B, C: Digital Artery Perforator (DAP) flap design: The design of the digital artery perforator flap is outlined on the radial or ulnar aspect of the fingers. B: The designed flap is elevated superficial to the digital neurovascular bundle. C: The perforator-based island flap is then rotated 180 degrees to cover the defect, and the donor site is closed.
Free perforator flaps
Thoracodorsal artery perforator flap

Fig. 23-1  Detailed anatomy of the perforators and sensory nerve branches on top of the latissimus dorsi muscle.
Anterolateral thigh flap
ALT suprafascial dissection
Free-style perforator flap

.... will aid in dealing with anatomic variations that are encountered during conventional flap harvest....

Wei FC, Mardini S.
Free-style free flaps.
DIEP
SCIPF
Bassiri Gharb B, Rampazzo A, Spanio di spilimbergo S, Xu E, Chung PK, Chen HC. Vascularized Lymph Node Transfer Based on the Hilar Perforators Improves the Outcome in Upper Limb Lymphedema.
Ann Plast Surg. 2011
fibula
Perforator flaps

• Advantages
  – Preserve main vessels, muscles, nerves
  – Can be found anywhere

• Disadvantages
  – Long dissection
  – Long training
  – Is the morbidity really reduced?
Post op protocol and evaluation

- Clinical
- Doppler (perforator)
- Post op therapy similar to the other flaps
- Avoid tension on the perforator during the dissection
- Venous congestion
- If only one perforator check if there is torsion of the pedicle
- Sometimes major complications are possible