Latissimus Dorsi Flap

**Available Components:** Muscle, skin, 10th rib

**Vascular Anatomy:** Thoracodorsal artery (2-4mm), vein (2-5mm); pedicle length 8cm, which can be lengthened by including subscapular trunk; paravertebral perforators (minor vascular supply)

**Innervation:** Thoracodorsal nerve (motor), lateral cutaneous branches of intercostals nerves (sensory)

**Flap Dimensions:** 9x22 cm (primary closure), 22x35 cm (skin graft donor site)

**Advantages:** Large size, long pedicle (15 cm); can be a functional transfer

**Disadvantages:** Need lateral positioning; large scar (less if endoscopic); functional shoulder loss, not usually clinically noticeable

**Key Points:** Chimeric flaps possible with subscapularis axis flaps (serratus, parascapular, etc.); possible to raise skin as perforator flap (TDAP); rib viability raised with flap questionable; can raise on minor paravertebral perforators as turnover flap
**Essential Landmarks:**

Posterior axillary fold is formed by proximal part of latissimus. Once anterior border of muscle is exposed, vessels are readily located in the loose areolar plane between latissimus and serratus. Serratus branch and circumflex scapular artery are divided as part of pedical dissection. Skin incision should reach dome of axilla to permit exposure of subscapular artery. Teres major is adherent to upper (posterior) margin of latissimus. Teres major arises from inferior angle of scapula.

Latissimus dorsi continues beyond it.

**Structures at Risks:** Brachial plexus  
Axillary vessels

**Donor Site Complications:** Seroma  
Loss of strength in adduction

**Special Advantages:** Large, flat muscle  
Large, dependable vessel

**Special Disadvantages:** Necessitates lateral decubitus position
Latissimus Dorsi Myocutaneous Flap

Developed by Tansini in 1906\(^1\)
Has been a workhorse flap since then
Based on thoracodorsal artery
High seroma rate \(\sim 47\%\)^2
Loss of LD function\(^3\), and back contour

Latissimus Dorsi, Extended Latissimus and Thoracodorsal artery perforator flap

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Latissimus Dorsi Muscle

- **Type V**: Muscle flap (20 X 40cm)
  - Origin: iliac crest and thoracolumbar fascia
  - Insertion: humerus
  - Adductor/medial rotator
- Innervated thoracodorsal nerve
- Thoracodorsal artery via subscapular system: 1-3mm
  - Descending branch
  - Transverse
- Perforators from thoracic intercostal and lumbar arteries
- Single venae comitans
- Pedicle length: up to 15 cm
Flap Options

1. Pedicled
2. Free
3. Reverse
4. Extended
5. Split
6. TDAP
Pedicled Latissimus Dorsi Flap

Arc of Rotation

- Posterior: parietal skull
- Anterior: middle third face; upper abdomen
- Can cover anterior/posterior upper extremity

  • Functional transfer

- Can extend by 5-10cm in all directions by detachment from humeral insertion

- Skin paddle as wide as 10cm if primarily close
Pedicled Latissimus Dorsi Myocutaneous Flap: Breast Reconstruction

Skin Paddle

Latissimus Dorsi Muscle with Skin Paddle

Latissimus Dorsi Muscle with Implant Underneath
Skin Island Design

Figure 1: By correctly positioning and orienting the dimensions of the skin island directly in the center of the muscle, the skin island inset into the mastectomy wound is facilitated and the edges of the flap can be used to soften the peripheral margins of the mastectomy defect.
Locally Advanced Breast Cancer

- 37 yo
- Inflammatory Ca, 2005
  - Neoadjuvant chemo
  - Neoadjuvant XRT
- MRM
- Large Soft Tissue Defect
Pedicled Latissimus Dorsi Myocutaneous Flap: Chest Wall Reconstruction

Defect

LD flap

LD flap design

LD flap inset
Latissimus Myocutaneous Flap

2007, pulmonary, bone, abdominal wall, axillary, mediastinal, hilar lymph node mets
- Xrt, chemo

2008, DOD
Split Latissimus Dorsi Flap

The pedicled descending branch muscle-sparing latissimus dorsi flap for trunk and upper extremity reconstruction

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**Preserve medial branch of thoracodorsal nerve**
Pedicled Split Latissimus Dorsi Myocutaneous Flap: Back Reconstruction
Pedicled Latissimus Dorsi Muscle Flap: Back Reconstruction
Free Latissimus Myocutaneous Flap: Extremity Reconstruction
Free Latissimus Myocutaneous Flap: Extremity Reconstruction
Free Latissimus Myocutaneous Flap: Extremity Reconstruction
Free Latissimus Myocutaneous Flap: Scalp Reconstruction
Reverse ("turn-over") LD Flap

- Based on posterior segmental perforators
  - 9th, 10th, 11th intercostal a&v

- Perforators 1-3 mm, 4-5cm lateral of midline

- Thoracolumbar defects

- Reliability of distal portion?

Bostwick PRS 1980
Reverse ("turn-over") LD Flap

- 74 yo with renal cell mets to spine
- Prior surgery, xrt, hardware and methylmethacrylate
- With open wound & infection

Courtesy P. Chevray
Reverse Latissimus Dorsi Muscle Flap Elevated and Inset Before Skin Graft

Post Operative Result
Reverse ("turn-over") LD Flap

- 63 yo male with unclassified high grade sarcoma involving soft tissues and 12th rib
- Neoadjuvant chemotherapy
- Planned radical resection
Reverse ("turn-over") LD Flap
Breast Reconstruction Flap for Autologous TRAM (Transverse Rectus Abdominis Musculocutaneous) Flap

- No need for implant
- 2.5 L of volume
- Additional volume and lumbar fat for inclusion of the parascapular

Extended Latissimus Dorsi Flap

Courtesy D. Chang
Extended Latissimus

- 42 yo morbidly obese (BMI 53) female with h/o right breast ca s/p extended LD now with left breast ca

- Multiple problems with seroma prior

- Planned mastectomy
Extended Latissimus
Extended Latissimus
Thoracodorsal Artery Perforator Flap

Perforators off the descending branch constitute blood supply (0.3-0.6mm)
First perforator located 6-8cm below the posterior axillary fold and 2-4cm from lateral border of muscle
  - Greatest concentration 9.5-15.4 cm below post. axillary fold, within 4.3 cm of lateral border
Other perforators arise at 1.5-4cm intervals inferiorly and 3-5 oblique course through muscle
Skin flap dimensions 18cm wide and up to 25 cm long
Thoracodorsal Artery Perforator Flap

- DB of TD Artery
- Subscapular Artery
- Circumflex Scapular Artery
- TA DB Perforator
- TA TB
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MSLD Flap

1. Thoracodorsal a.
2. Descending branches of thoracodorsal a.
3. Section of latissimus harvested along with skin flap.
4. Serratus anterior m.
5. External oblique m.

Length down from axilla / Length from lateral edge of latissimus
1. = 5.1 cm / 2.2 cm
2. = 10 cm / 2.4 cm
3. = 15 cm / 2.9 cm

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Thoracodorsal Artery Perforator Flap

Courtesy R. Skoracki
Thoracodorsal Artery Perforator Flap

Courtesy R. Skoracki

perforator
Trapezius Flap

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Trapezius Flap

Uses for Soft-Tissue Coverage
   Skull
   Head and Neck
   Oral Cavity
   Axilla
   Posterior Trunk
   Shoulder
Trapezius Flap

Anatomy

- **Origin**: External occipital protuberance, medial third superior nuchal line, spinous process of C7, and all 12 thoracic vertebrae

- **Insertion**: (1) superior fibers – lateral third of the clavicle, (2) middle fibers – scapula, (3) inferior fibers - acromion

- **Innervation**: Spinal accessory nerve, branches C3-4
  - Elevates shoulder & rotates the scapula
Trapezius Flap

Flap Type: Type II (Mathes and Nahai Classification)

Vascular Anatomy

Regional Source: Thyrocervical Trunk (80%) and subclavian artery and vein (20%)

Dominant pedicle: Transverse cervical artery and vein
  • Ascending: superior portion
  • Descending: inferior portion

Minor pedicles: Branch of Occipital, Dorsal scapular, and perforating posterior intercostal arteries and veins
Trapezius Flap

Dimensions of Skin Territory:
20 x 8 cm
15 x 20 cm with skin-fascial extension over deltotoid muscle

Standard Vertical Design:
Vertical flap
Vertical skin island
Trapezius Flap

Vertical skin island
Trapezius Flap

KEYS to Flap Harvest
Trapezius Flap

Landmarks for Skin Flap

Posterior Midline (Medial Border)
Vertebral Border of Scapula (Lateral Border)
Midpoint of Scapula (Cephalad Border)
Midpoint between tip of scapula and posterior superior iliac crest (Caudal Border)
Trapezius Flap

Positioning

Prone
Trapezius Flap

Positioning

Lateral decubitus
Trapezius Flap

Pedicle Location

Descending Branch of transverse cervical artery and vein

(1) located on deep surface of the trapezius muscle

(2) Immediately superior to rhomboid minor muscle
Trapezius Flap

Muscle Elevation
Raise in a caudal direction
Release fibers of origin from thoracic vertebrae
Fibers of insertion released from scapula but preserved to lateral clavicle and acromioclavicular joint
Trapezius Flap

CASES
• 53 yo

• Multiple previous surgery of spine
  – Renal cell mets
  – Thoracotomy

• Exposed hardware
• 57 yo

• Previous wide local excision of sarcoma
• Radiation therapy
• Recurrence
Gracilis Flap

Flap type: Muscle or musculocutaneous
Function of gracilis: Thigh adductor, expendable because of AL and AM muscles
Skin paddle orientation: transverse only, vertical only, or combination of both

Anatomy
Surface landmarks:
Origin: Pubic symphysis
Insertion: Medial tibial tuberosity
Between adductor longus and Sartorius anteriorly and semi-mb posteriorly
Size: 6 x 24-32 cm

Innervation
Motor: anterior branch of obturator nerve
Sensory: anterior femoral cutaneous nerve (L2-3)
Vascular Anatomy

Type 2 circulation (1 dominant, 1 minor pedicle)

Dominant pedicle:
- Ascending branch of medial circumflex femoral artery and vc.
- From profunda femoris artery
- Diameter 1.6-2.5 cm
- Length 6-10 cm
- Location: superior third of muscle, 6-10 cm below pubic symphysis (1 fist width (patient’s) below the pubic symphysis). This is the location of the pedicle entrance into the flap and also the location of the the largest cutaneous perforators.

Minor pedicle:
- 1-2 branches of the superficial femoral artery and vc.
- Length: 2 cm
- Diameter: 0.5 cm
- Location: inferior half of muscle
Gracilis Flap

Medial Circumflex Femoral Artery and Venae Comitantes

Gracilis Muscle
Free Flap Gracilis
Free Flap **Gracilis (TUG)**

Majority of Gracilis cutaneous vascularity is posterior in thigh

Breast reconstruction with TUG flaps
Gracilis flap and breast reconstruction
TUG Flap Anatomy

- Greater saphenous vein
- Accessory saphenous vein
- Gracilis muscle
- Adductor longus
- Pedicle
- Trilobe TMG flap
References


Anatomy

DIEA Vascularity and branching pattern

Lateral branch of deep inferior epigastric artery & vein
Superficial inferior epigastric artery & vein
Superficial iliococcygeal artery & vein
Zones of Perfusion Medial Perforator

Hartrampf's Zones of Perfusion
Anatomy

DIEA

- Type 1: remains as a single pedicle (29%)
- Type 2: divides into 2 rows (57%)
- Type 3: trifurcates (14%)
Rectus Muscle Innervation

**Innervation**

– Segmental from the lower 6 intercostal nerves
  • derived from T7 to T12
MS-TRAM Perfusion

TRAM vs MS-1M  \( p < 0.816 \)
TRAM vs MS-1L  \( p < 0.817 \)
Preservation of medial segment Lateral perforators
MS-1M Modified

Preservation of lat & med segments

Lateral perforators
Preservation of lateral segment
Medial perforators
Preservation of lat & med segments

Lateral and medial perforators
Flap harvest

- Harvest from lateral to medial both sides
- Identify all perforators from medial and lateral rows
- Identify size and location of perforators
Flap harvest

- Decide which side to use
- Dissect past midline
- Identify medial row perforators
- Leave contralateral flap intact if harvesting hemi-abdomen only
Fascial Sparing Technique

- Keep a small cuff of fascia around each perforator
- Direct fascial closure
MS-1M

- Lateral segment of rectus used
- Lateral perforators
- Most damage to intercostal nerves
Medial branch of DIEA

Lateral branch of DIEA

Rectus

DIEA

Can divide medial branch of DIEA to increase pedicle length
MS-1M

9-11 cm pedicle length

More freedom for insetting and micro
Mark orientation of pedicle to prevent twisting later
MS-1M modified

- Use lateral perforators
- Save medial and lateral segment
- Save as many intercostal nerves for rectus function
MS-1L vs DIEP same pt
De-epithelization

De-epithelize flap and taper prior to insetting
(immediate reconstructions)
Fascial sparing technique allows for primary fascial closure.
Medial Row Perforator DIEP

Cannulated medial row perforator

Umbilicus

Cannulated medial row perforator

Contralateral medial row perforator

Contralateral lateral row perforator

Midline crossover at level of subdermal plexus
DIEP Lateral Row Perforator

Umbilicus

Cannulated lateral row perforator

Ipsilateral medial row perforator

Cannulated lateral row perforator
Periumbilical Perforator Flap

Periumbilical Perforator Flap Anatomy
Type I (Intramuscular)

- Lateral branch D.I.E.A. perforators
- Lateral branch of deep inferior epigastric (I.E.) artery & vein
- Superficial inferior epigastric v.
- Superficial inferior epigastric a.
- Superficial iliac circumflex vessels

Type II (Extramuscular)

- D.I.E.A. Medial branch lateral to rectus m.
- Medial branch of inferior epigastric (I.E) artery & vein
- I.E. Medial branch deep to rectus m.
- Medial branch D.I.E.A. perforators

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Intra-muscular (Type 1)
Extra-muscular (Type 2)
Short Pedicle DIEP Flap
Dissect pedicle until large enough for Microsurgery