

TRANSTIBIAL SURGICAL TECHNIQUE

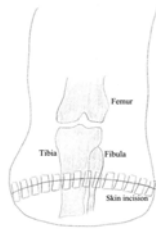
A Review and Panel Discussion

TRANSTIBIAL AMPUTATION: Surgical Technique

- Most common surgical techniques are:
 1. Long Posterior Flap
 - a) Burgess Technique
 - b) Bruckner Technique
 2. Anterior/Posterior Fish Mouth flap
 3. Sagittal Flap
 4. Skewed Flap
 5. Ertl Procedure

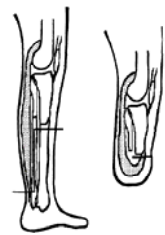
TRANSTIBIAL AMPUTATION: Long Posterior Flap – Burgess Technique

- Designed by Kendrick 1956 and made popular by Burgess 1969.
- Most common surgical technique for transtibial amputation.



TRANSTIBIAL AMPUTATION: Long Posterior Flap – Burgess Technique

- Tibia cut 10-15cm from knee joint line
- Fibula cut 1-1.5cm shorter than tibia
- Long posterior flap marked with length 5cm longer than the diameter of the calf at the cut end of the tibia



TRANSTIBIAL AMPUTATION: Long Posterior Flap – Burgess Technique

- Long posterior flap consisting mainly of the lateral and medial gastrocnemius muscle and some soleus.
- Debulking the soleus muscle may be required.
- To avoid dog ears rounding up of the perpendicular incisions has been recommended.



TRANSTIBIAL AMPUTATION: Long Posterior Flap – Burgess Technique

- Flap fixed anteriorly by fascioperiosteal sutures
- Skin and subcutaneous tissue sutured.
- Anterior scar line runs medial/lateral.



TRANSTIBIAL AMPUTATION: Long Posterior Flap – Bruckner Technique

- Modified long posterior flap technique developed in Germany by Bruckner in the 1980's
- Landmarks and skin incisions are equivalent to the Burgess technique.



TRANSTIBIAL AMPUTATION: Long Posterior Flap – Bruckner Technique

- Fibula disarticulated proximally and resected
- Complete resection of the anterior and lateral compartments and complete resection of the soleus muscle.



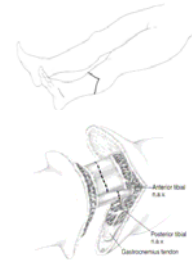
TRANSTIBIAL AMPUTATION: Long Posterior Flap – Bruckner Technique

- Flap consists mainly of medial gastrocnemius with some lateral gastrocnemius if needed
- Closed in similar fashion to Burgess technique



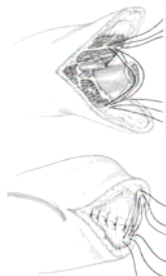
TRANSTIBIAL AMPUTATION: AP 'Fish Mouth' Flap

- Early surgical technique for transtibial amputation described by Persson.
- Semicircular skin flaps with length $\frac{1}{4}$ the circumference around the cut end of the tibia
- Equal anterior and posterior flaps.



TRANSTIBIAL AMPUTATION: AP 'Fish Mouth' Flap

- Posterior musculocutaneous flap consisting of gastrocnemius.
- Anterior flap consists mainly of skin and subcutaneous tissue.
- Myodesis of posterior musculature to end of tibia.



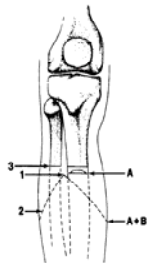
TRANSTIBIAL AMPUTATION: AP 'Fish Mouth' Flap

- Suturing of superficial fascia and skin.
- Scar line runs medial/lateral on inferior surface of stump.



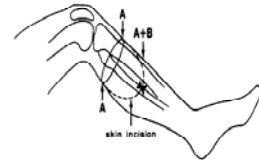
TRANSTIBIAL AMPUTATION: Sagittal Flap

- First described by Tracey 1966.
- Incision lines for skin flaps marked on skin.
- Tibia cut 13-15 cm from knee joint line (A).
- Anterior apex of skin flap 1 cm lateral to tibial crest(1).



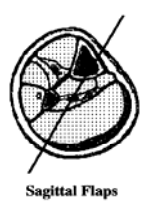
TRANSTIBIAL AMPUTATION: Sagittal Flap

- Semicircular flaps medial and lateral.
- Inferior margin of flap = 13-15cm + $\frac{1}{4}$ circumference of the calf at the cut end of tibia.



TRANSTIBIAL AMPUTATION: Sagittal Flap

- Lateral flap consists of the anterior and lateral muscles and overlying skin.
- Medial flap consists mainly of medial gastrocnemius and overlying skin.
- Muscle flaps brought over end of tibia and fibula to form a myoplasty.



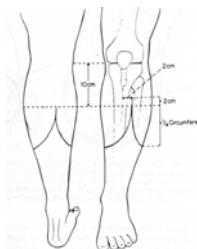
TRANSTIBIAL AMPUTATION: Sagittal Flap

- Skin and subcutaneous tissue sutured.
- Scar line runs anterior to posterior



TRANSTIBIAL AMPUTATION: Skewed Flap

- First described by Robsinson et al 1982.
- Incision marks for skin flaps marked on skin.
- Anterior junction between the two flaps is at least 2cm from the tibial crest.



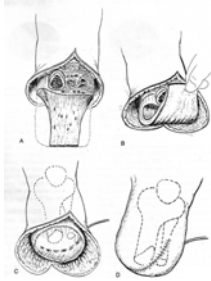
TRANSTIBIAL AMPUTATION: Skewed Flap

- Posterior junction 180° from anterior junction.
- Length of skin flaps the same as for the Sagittal technique.



TRANSTIBIAL AMPUTATION: Skewed Flap

- Posterior muscle flap of gastrocnemius is trimmed and fashioned to cover the distal end of the tibia and fibula.
- Myoplasty of the posterior flap to the periostium and deep fascia of the anterior tibial compartment.



TRANSTIBIAL AMPUTATION: Skewed Flap

- Anteromedial and posterolateral fasciocutaneous flaps are closed in an oblique fashion
- Scar line runs from anterolateral to posteromedial



TRANSTIBIAL AMPUTATION: Ertl Procedure

- Technique developed by Dr Janos Ertl in Hungary in the 1920's and first described in the literature in 1939.
- Performed by his three grandsons now in the USA, mainly on traumatic amputees.
- Performed both as primary operation and as a revision.
- Designed to seal the medullary cavity of the tibia and fibula to allow end weight bearing.

TRANSTIBIAL AMPUTATION: Ertl Procedure

- Both techniques can be performed with a long posterior, sagittal or skewed flap incision.
- Two different techniques to seal the medullary cavity:
 1. Periosteal sleeve
 2. Bony wedge fashioned from removed fibula

TRANSTIBIAL AMPUTATION: Ertl Procedure: Periosteal Sleeve

- Long posterior (6cm) and short anterior periosteal flap created off of the end of the tibia.
- Periosteal flap is taken with some flakes of bone from the posterior surface of the tibia.



TRANSTIBIAL AMPUTATION: Ertl Procedure: Periosteal Sleeve

- Flaps are sutured over the tibial osteotomy as a pouch.
- Bone chips and bone slurry placed in the pouch.
- Same procedure done for the fibula.
- Sealing callus develops over weeks to months



TRANSTIBIAL AMPUTATION: Ertl Procedure: Periosteal Sleeve

- Variation of periosteal sleeve is to suture the periosteal flaps of the tibia and fibula together to form a tube.
- In this technique periosteum is incised anterior to posterior creating medial and lateral flaps.
- Medial flap of the tibia sutured to lateral flap of the fibula.
- Lateral flap of the tibia sutured to the medial flap of the fibula.

TRANSTIBIAL AMPUTATION: Ertl Procedure: Fibular Bone Block

- Consists of a osteotomy of the fibula
- Hinged on a lateral periosteal sleeve transversely into a notch on the lateral distal tibia.



TRANSTIBIAL AMPUTATION: Ertl Procedure: Fibular Bone Block

- Sutures through drill holes are used to secure the bone block to the distal ends of the tibia and fibula.

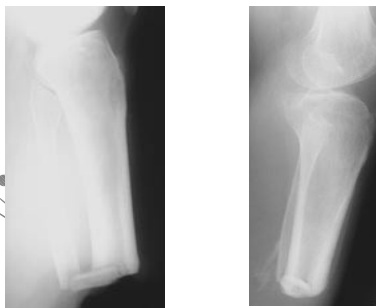


TRANSTIBIAL AMPUTATION: Ertl Procedure: Fibular Bone Block

- Bone block covered by periosteal sleeve
- Myoplasty completed by suturing the posterior to anterior and lateral muscles
- OR
- Securing the posterior muscles into the osteoperiosteal bridge.
- Skin flaps sutured.



TRANSTIBIAL AMPUTATION: Ertl Procedure: Fibular Bone Block



EVIDENCE COMPARING SURGICAL TECHNIQUE

- Cochrane Review 2007 , 'Type of incision for below knee amputation'
- Three RCT's met the criteria.
- One trial (Ruckley et al 1991) compared skew flap versus Burgess long posterior flap.
- One trial (Termansen et al 1977) compared sagittal versus Burgess long posterior flap.

EVIDENCE COMPARING SURGICAL TECHNIQUE

- Found no significant difference between surgical techniques in regard to:
 1. Failed primary stump healing
 2. Post-op infection rate
 3. Reamputation at same level
 4. Reamputation at higher level
 5. Mortality
 6. LOS
 7. % fit with a prosthesis

UPCOMING RESEARCH

- In Oklahoma USA a RCT comparing Ertl procedure to other surgical procedures started in January 2006 and will be completed in December 2008.

REFERENCES

- Ruckley et al 1991, '*Skewflap vs long posterior flap in below knee amputations: Multicenter trial*'. *Journal of Vascular Surgery*. 13:3 p423-427.
- Stahel et al 2006, Concepts of transtibial amputation: Burgess technique versus modified Bruckner procedure. *ANZ Journal of Surgery*. 76: p942-946.
- Tisi PV & Callam MJ. 'Type of incision for below knee amputation', *Cochrane Collaboration* 2007:3.
- Robinson et al 1982, Skew flap
- www.ErtlReconstruction.com
- www.bonebridge.com