Procedure Selection Criteria for Ankle Equinus Based on Associated Medical Conditions, Adjunctive Procedures, Patient Positioning, and Risk Profile

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STATEMENT OF PURPOSE

Beyond the Silfverskiold test, ankle equinus procedure selection is frequently based more on surgeon familiarity with a few favorite techniques rather than objective findings. This case study highlights our procedure selection protocol which is based on multiple parameters including associated medical conditions, adjunctive procedures, patient positioning, and procedure risk profile.

LITERATURE REVIEW

Ankle equinus is associated with a wide variety of foot and ankle conditions and can be commonly performed as an adjunctive procedure. The Silfverskiold test has traditionally been used to differentiate between gastrocnemius and soleus contractures, but positive Silfverskiold sign is defined as ankle equinus that is present when the knee is extended until it disappears when the knee is flexed which indicates gastrocnemius equinus (1). Combined gastrocnemius-soleus equinus does not improve with flexion of the knee (1). DiGiovanni defined gastrocnemius equinus as >15° dorsiflexion with the knee extended and gastrocnemius-soleus equinus as >30° dorsiflexion with the knee flexed (2). DiGiovanni definitions allow for diagnostic criteria while surgical positioning, multiple findings, and surgical execution varies by case. We have defined gastrocnemius recnesion as >10° gastrocnemius muscle lengthening with or without soleus recession.

The natural history of equinus surgery has implications regarding patient positioning and postoperative ambulatory status. Initially the surgeon must decide between tendon Achilles lengthening (TAL) versus gastrocnemius recession (GR) (3). The TAL approach can be performed with an open 2° lengthening, maximal invasive triple-segment approach, or percutaneous complete tenotomy. Within the GR group there are generally 3 choices (Proximal GR/Silvorskiold, Intermediate GR/Baumann, Distal GR). DiGiovanni, Endoscopic GR, and tongue and groove GR. Figure 1 illustrates typical patient positioning, incision and exposure for the various procedures. Procedure selection beyond TAL vs. GR ideally be ideally be established on evidenced-based guidelines yet these criteria are not well defined. We believe that there is an opportunity to approach procedure selection based on factors specific to the individual patient and planned adjunctive procedures.

CASE STUDY

61 yr diabetic male with a past medical history of hypertension, atrial fibrillation, and DVT, and DODs with presentation right posterior talonavicular dislocation, pathologic promontion, and equinus contracture. He had significant pain with walking moderate distances and with attempted daily exercise.

Figure 1. Procedure Selection: Gastrocnemius Recession (top) and TAL (bottom)

Table 1. Ankle Equinus Procedure Selection Considerations

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Table 1. Ankle Equinus Procedure Selection Considerations

- **Supine Baumann**
  - Ideal for patients with limited posterior tibial tendon function, minimal foot deformity, and may not be ideal for patients with severe foot deformity.
  - May be performed in both supine and prone positions.

- **Endoscopic Hoke**
  - Less invasive compared to open procedures.
  - May be performed in both supine and prone positions.

- **Prone Open Z**
  - Ideal for patients with severe foot deformity and limited posterior tibial tendon function.
  - May be performed in prone position.

- **Office Achilles Tenotomy**
  - Less invasive compared to open procedures.
  - May be performed in both supine and prone positions.

**Objective**

- **Medial-Plantar joint range of motion (°)** - (knee extended) (knee flexed) and (°) DVT
- **Surgery heath history and recency status**
- **Posterior tibial tendon function**, if lower extremity is non-weight bearing.

**Radiographic** - plantar fascia deformity, subarachnoid and diaphragmatic degeneration with first metatarsal cuneiform foot.

- **Laboratory Workup:** vitamins D, T2L.

**Conclusion:**

- **Decision to perform a subtalar joint fusion because the patient was a middle aged, overweight, non-weight-bearing walker with TTOO**
  - Midfoot fusion procedure secondary to pes planus deformity without navicular reconvert deformity and midfoot degenerative joint disease.

- **Equinus procedure selection was based on the patient’s medical history, adjacent flatfoot procedures, patient position, anticipation of non-weight-bearing for 5 weeks, and desire to avoid over burdening knee**

Based on procedure selection criteria in Table 1, a Strafter (distal gastrocnemius recession) was performed. See Figure 2 for case study example infratarsal images and radiographs.

**ANALYSIS & DISCUSSION**

The Strafter procedure is the workhorse of equinus surgery since it is highly conducive to supine surgery, provides adequate lengthening, and is relatively friendly to the sural nerve. The more equivocal patient selection based on the level (1), preference (2), or necessity (3) to perform gastrocnemius only Strafter lengthening but only if exposure is above the calcaneal tendon joint below gastrocnemius (4,5). Immediate weight bearing in a below knee fracture cast is generally tolerated and often desirable depending on adjunctive procedures. Ideal candidates for Strafter surgery are patients who have multiple procedures that require supine positioning, such as Statick reconstruction or total ankle replacement (6,7). An advantage of distal GR over TAL in conjunction with a total ankle replacement is the Strafter procedure allows for early weight bearing once the anterior ankle incision is healed (7).

Procedure selection among the various approaches to address ankle equinus can be viewed as either an opportunity or a challenge. While all approaches work, guidelines are lacking to assist the surgeon with ideal procedure selection based on an individual patient’s operative needs. The majority of the literature involving equinus procedure selection is level three or four evidence (13). This case study highlights the multiple factors that contribute to ideal procedure selection including positioning for adjunctive procedures (supine or prone), site of incision which has implications regarding scope, visibility, post-operative weight bearing status, risk of injury to the sural nerve or over lengthening, and degree of lengthening desired. Our approach is to incorporate these factors along with patient specific indications for optimal procedure selection.

**REFERENCES**