Statement of Purpose

The intent of this study is to provide a reproducible technique for the Evans calcaneal osteotomy. A k-wire axis guide, utilizing intraoperative fluoroscopy and anatomical landmarks, can provide consistent results when performing an Evans calcaneal osteotomy and help avoid violating the subtalar joint facets.

Methodology and Hypothesis

16 fresh-frozen, adult, below the knee cadaver limbs were obtained from Emory University. All measurements, placement of the axis guide, and the osteotomies where performed by the senior and junior resident with presence of the attending Physician. All cadavens were then inspected by the authors’ and categorized based on the presence of coalition of the anterior and middle facets, and if the osteotomy violated a facet or the coalition.

We hypothesized that an axis guide placed under fluoroscopy, utilizing anatomical landmarks, would allow the physician to place the osteotomy in a consistent manner and avoid the anterior or middle facets.

Procedure

An Evan’s dissection technique (12) was performed, and the calcaneal cuboid (CCJ) was then identified. A 0.062” k-wire axis guide was placed, utilizing fluoroscopy, parallel to the CCJ and just anterior to the sustentaculum tali (middle facet). Lateral fluoroscopy was used to determine the appropriate placement of the axis guide (Figures 1a and 1b) and confirm parallel (lateral) placement of the axis guide. The axis guide was then attached with a “gaita” screw and the axis guide was confirmed to be just anterior to the sustentaculum tali (middle facet). An anterior osteotomy was performed on the axis guide in a posterosieral to anteromedial direction with the patient in the lateral decubitus position. A sagittal saw was cut to preserve a medullary hinge. The cadaver specimens were then disected and the subtalar joint was visualized for anatomic landmarks. Full mobilization of the osteotomy site (Figures 2 and 3). Any violation of the subtalare joint facets (anterior and middle) was then recorded.

Literature Review

The Evans calcaneal osteotomy is a commonly used procedure in the correction of both pediatric and adult collapsing pes planovalgus deformities. Evans created the lateral osteotomy on the calcaneus parallel to the sustentaculum tali and proximal to the CCJ. With this procedure (1), Evans was able to lengthen the lateral column, increase varus position of the heel, eliminate forefoot valgus, and improve extension of the ankle. After the discovery of such a powerful procedure, the indications expanded to overcorrected talipes equinovarus, calcaneovalgus after polimielitis, and rigid flat foot. Along with these indications, the Evans procedure can also be used for type II posterior tibial tendon dysfunction.

Placement of the osteotomy has been under scrutiny ever since its publication. Evans (1), among several others, recommended placing the osteotomy 1.5 cm proximal to the CCJ. Other authors from Kelikian to Trnka (4.5), have advocated varying distances in regards to placement of the osteotomy. Hyer et al (6), published a cadaver study that reported the ideal location for placement of the osteotomy. In this study, they determined that the ideal location varied from 1.1 to 1.5 cm, with the average being 1.3 cm. They also recommended performing the osteotomy in a posterosieral to anteromedial location. Keeping this orientation preserved the subtalar joint facets.

Another reason the Evans is such a practical procedure is because it is considered a joint preserving procedure (7). This can help limit the patient from undergoing an arthodesis procedure. However, Sarrafian’s (8) showed that with the presence of osculation the risks of this procedure, and of potential varus deviation, increase. The risk of osteotomies of the anterior and middle facets. Dating back to 1905, Laflawd (9) reported osteotomy of the calcaneus, revealing that 12% of the 75 cadavers, ranging from 15 to 80 years of age, had distinct anterior and middle facets. In 2003, Ragat et al (10) compared the results of their osteotomy (50%) versus a modified Bunning and Barnett (11) classification, they determined that 37% of specimens had a distinct anterior, middle, and posterior facets. In a postoperative study by Hyer et al, the prevalence of anterior and middle facet coalitions was found to be 56% (13).

Our study included 16 total cadaveric specimens. After dissection of specimens for evaluation of osteotomy, 7 specimens were found to have a coalition of the anterior and middle facets. Of the 9 limbs without a coalition, 8 osteotomies were successfully performed without violation of either facet, producing a success rate of 88.89%. With all cadaveric specimens considered, 50.00% of osteotomies were performed without violation of either the anterior or middle facet.

Analysis and Discussion

A review of current literature reveals a prevalence of anterior and middle facet coalitions to be 56% (13). In the present study, coalitions were found in 50% of the cadaveric specimens. It is also an incidental and unavoidable finding, as one can predict the coalition of the middle and anterior facets. Considering those specimens without coalition, 88.89% of osteotomies performed in this study did not violate either facet.

This is of particular interest in both the academic and clinical setting. Without years of previous experiences or routine access to cadaver labs, resident physicians are often performing Evans osteotomy solely on the experience of their attending physician. The axis guide as described by the authors can be routinely employed to allow the resident and attending physician to perform the osteotomy with relative ease, and with an increased level of confidence and consistency.

References