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Invited Perspective

Pitfalls of Calcaneal Lengthening Osteotomies

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I would like to compliment the authors on highlighting the importance of technique when performing the calcaneal lengthening osteotomy. Management Principle #2 in my book states "A less-than-ideal surgical or nonsurgical outcome can be due to a poor technique, a poor technician, or both."[1] This principle certainly applies to clubfoot management by some pediatric orthopaedic surgeons who report unusually and unexpectedly high rates of surgery despite proclaiming utilization of the Ponseti technique. The Ponseti technique is exacting with excellent reported outcomes by all who implement it without modification. If the Ponseti method were being utilized exactly as he so clearly described it, clubfoot surgery would rarely, if ever, be performed.

Like the Ponseti clubfoot technique, flatfoot reconstruction surgery based on the calcaneal lengthening osteotomy has many components. Success is based on attention to all reported details.[1-4] One of those details is the prevention of subluxation at the calcaneo-cuboid (CC) joint during distraction of the calcaneal fragments. As the authors of this article point out, I described preventing subluxation at the CC joint when distracting the calcaneal fragments in my first description of the modified Evans procedure in 1995 and in all my subsequent published descriptions.[1-4] My recommendation was to simulate weight-bearing by fully everting the subtalar joint before advancing the pin retrograde across the CC joint. My reasoning was that 1) the CC joint is not subluxated in normal weight-bearing, 2) CC joint subluxation is often seen on lateral non-weight-bearing x-rays of the foot, 3) if the anterior calcaneal fragment subluxates dorsally (cuboid subluxates plantarward), it cannot follow the rest of the acetabulum pedis into inversion down and around the talar head; deformity correction is then limited.

To my knowledge, CC joint subluxation was not a recognized issue until I brought it to light while developing my modification of Evans' lateral column lengthening.[2,5] In the first 3 years of my clinical practice, I saw several children who had significant subluxation at the CC joint after having undergone Evans lateral column lengthening

at other centers; nothing had been done to stabilize the CC joint. These children had gross subluxation at that joint, resulting in pain at that location and a large bony prominence along the lateral column of the foot, the anterior end of the calcaneus. While the feet were reasonably well-shaped compared to preoperative x-rays and lateral column lengthening was probably the best procedure for correcting hindfoot valgus in these cases, I felt that soft tissue and bony management of the primary and associated deformities required further elucidation.

Evans' description of the operation was terse and lacked detail. This was his entire surgical technique description: *"An incision is made over the lateral surface of the calcaneus parallel with, and just above, the peroneal tendons, avoiding the sural nerve lest it be involved in the scar. The anterior half of the bone is exposed and the calcaneo-cuboid joint is identified. The anterior end of the calcaneus is then divided through its narrow part in front of the peroneal tubercle by an osteotome, the line of division being parallel with and about 1.5 cm behind the calcaneo-cuboid joint. The cut surfaces of the calcaneus are then prised apart by means of a spreader, and a graft of cortical bone taken from the tibia is inserted between the blades of the spreader to maintain separation of the two pieces of the calcaneus."*[5] Few surgeons outside of Cardiff, Wales (Evans' hometown) performed, or continued to perform, the operation following his report in 1975. I learned that some surgeons attempted it, but, because of poor technique description that resulted in poor outcomes, had abandoned it.

As I began performing calcaneal lengthenings, I observed many areas for improvement, including prevention of CC joint subluxation. I advised lengthening the lateral soft tissues that inhibit lateral column lengthening, plicating the redundant medial soft tissues, correcting structural forefoot supination deformity that is often present in flatfoot deformities, and lengthening contracted heel cords that are usually the source of pain in otherwise asymptomatic flexible flatfeet.

For years after my technique was published in *JBJS,*[2] I received e-mails or other types of communication from orthopaedic surgeons reporting subluxation at the CC joint. In all cases, the joint had not been pinned as I recommended. More recently, there have been reports on CC joint subluxation despite pinning. Note that if two solid objects with flat adjacent surfaces are pinned centrally, they cannot shift on one another. That's basic carpentry. They may rotate, but two solid, flat-surface objects do not have the soft tissue constraints, nor the undulating surfaces found at and around the CC joint that tend to prevent or limit rotation in the foot. So, if a "pinned" CC joint subluxates, it was either not pinned centrally, or it rotated (but it can't rotate more than a few degrees because of the soft tissue and bone shape constraints), or the pin cut through one or both bones. The authors of this *JPOSNA®* article reiterate that, perhaps, the most likely reason for CC joint subluxation is that the joint was pinned in a subluxated position. Their "thumbs up" technique seems quite sound as a method to supplement holding the hindfoot fully everted to ensure CC joint congruity at the time of joint pining.

The other and perhaps larger issue is whether mild subluxation matters. In 1983, Phillips reported an average 13-year follow-up on a series of Evans' patients, the longest reported follow-up for any flatfoot reconstruction surgery.[6] He found a small percentage of patients with painful CC joint subluxation, but he did not correlate the degree of subluxation with pain. Since Evans did not try to prevent subluxation with pinning, it's reasonable to assume that most CC joints subluxated and it didn't seem to matter in most. Also note, for those who have been concerned about the CLO being intraarticular in the subtalar joint, Phillips did not report any cases of subtalar joint pain. In fact, there are no reports in the literature of subtalar joint arthritis following CLO.

One of the nice things about having spent my entire 37-year career in one place is that I have had the opportunity to see my good and not-so-good surgical results. The sad news is that rarely have any of my nearly 600 CLO's followed up after 2 years, despite my requests to do so. I have assumed that they do not return because they are doing well. I also assumed that at least some of

those who were not doing well due to pain in the CC or subtalar joint would return to see me. Note that I pinned all CC joints, and I cannot recall any of the approximately 600 returning due to CC or subtalar joint pain during the 35 years that I've been performing my modification of the Evans procedure. On the other hand, I have seen several cases of painful gross CC joint subluxation in patients who were operated upon elsewhere and who did not have congruous joint stabilization.

The message seems to be that mild CC joint subluxation with CLO's probably occurs often and is well-tolerated long-term, but severe CC joint subluxation is not well-tolerated. Perhaps ongoing clinical research will be able to differentiate "mild" from "severe" and establish a threshold for acceptable CC joint subluxation with flatfoot reconstruction based on the CLO. Meanwhile, evert the hindfoot and push upwards on the cuboid when pinning the CC joint as Padgett et al. so nicely illustrate. And, as I recommended in my 1995 article, add a second pin if "subluxation" of a congruously pinned CC joint is noted intraoperatively following distraction of the calcaneal fragments. This phenomenon probably represents rotation that a second pin would prevent. Of course, remove the graft and realign the CC joint with hindfoot eversion and upward pressure on the cuboid before adding the second pin.

Disclaimer

The author has no conflicts of interest to report.

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