Correction of a relapsed clubfoot after Ponseti Method

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Abstract

Over the past few decades, surgical release has been nearly completely replaced by the Ponseti method for correcting idiopathic clubfoot, and the way this deformity is managed has changed significantly. Both the short-term and long-term functional outcomes of the Ponseti approach have been exceptionally good. Unfortunately, recurrence of the deformity is still a big concern; it affects as many as 40% of patients, and doctors still can't agree on how to treat recurrent clubfoot. Following initial surgical treatment with posteromedial release, there are a variety of options for managing a relapsed clubfoot deformity. These include casting, hemiepiphysiodesis, revised posteromedial release, osteotomies, fusion, and the use of gradual distraction with external fixators. Other methods that have been used in the past include the Ponseti method and tibialis anterior tendon transfer (TATT). This is covered in descending order of how intrusive they are. This study takes a look at the reported results, as well as the available evidence and limitations of the literature, regarding the treatment of relapses after the Ponseti method and initial surgical release. Relapse should be defined consistently with objective criteria for its control in future endeavors.

Keywords: relapsed clubfoot, Ponseti method

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Introduction

Relapsed idiopathic clubfoot has been better understood and treated in recent decades. Relapse treatment choices shifted to mirror the non-invasive nature of the Ponseti method as it gained popularity, reflecting the fact that surgical procedures were initially the mainstay of clubfoot treatment. As a resource for clubfoot practitioners, this review aims to address relapse prevention, relapse identification, and a synthesis of treatment modalities for relapsed clubfoot. The evaluation is split into two parts: first, the Ponseti approach for managing relapse after initial therapy, and second, surgical release for managing recurrence after initial treatment, which has become less prevalent in the last decade.

Recurrence following Ponseti technique therapy

Initial correction rates of more than 90% are indicative of the great success of the Ponseti technique in treating clubfoot. A relapse following Ponseti method treatment is typically more pliable and responsive to further casting, with or without less invasive procedures, with good functional outcomes; however, there are many reports in the literature discussing the rate of relapse following initial correction, which averages about 40% and is comparable to those corrected with surgery. Yet, there is a great deal of variation in the literature regarding the relapse rate and the necessity of additional treatment. This variation is attributable, in part, to departures from the initial principles outlined in the Ponseti method, but also to the fact that there is no agreement on how to handle these patients after initial correction and on what exactly constitutes a relapse (1,2).

Relapse is typically characterized as the return of any clubfoot deformity or a mix of them following the initial successful treatment. Relapses are most often defined using the Pirani score (2). No universal approach for identifying, classifying, or forecasting relapses has been established, despite several attempts (2-4). The most prevalent recurrence presentations include equinus and adductus, either alone or in combination, with or without dynamic supination (5). The likelihood of recurrence is significantly increased when patients do not adhere to the foot abduction orthosis (FAO). However, there are other potential reasons for this, such as when the treating physician stops using the FAO too soon, contractures in soft tissues, insufficient correction, or unidentified neuromuscular issues. Because of this, it is critical to educate parents, get their support, and closely monitor patients to catch compliance problems early and change or adjust bracing as needed.

There are no definitive suggestions for the best way to treat individuals who have relapse following initial correction using the Ponseti method, despite the abundance of literature on the topic. Methods such as tibialis anterior tendon transfer (TATT), Achilles tendon lengthening, repeat Achilles tenotomy, and repeat casting are among them. Avoiding significant bone or open joint surgery is possible in situations of clubfoot recurrence after initial full repair using the Ponseti procedure (6). Here we will go over the various treatment choices, ranked from least invasive to most invasive.

Casting without assistance

Initial treatment with the Ponseti approach has the advantage of leaving feet elastic and re-castable, rather than stiff as is the case with feet treated with considerable release. Following the guidelines of the Ponseti process, re-casting the feet is a sensible first step. Seven years following treatment, 74% of patients who experienced a relapse were able to be effectively treated with casting alone, according to research conducted by van Praag et al. (7). It is worth mentioning that the results of the Disease Specific Instrument (DSI) showed no statistically significant difference in function or pleasure between patients with recurrent idiopathic clubfoot and a control group of patients without relapse (7). The study also indicated that some patients who were re-evaluated after the follow-up period ended at 5 years of age had relapses, which is an important finding (7). This highlights the need for longer-term follow-up to detect and treat recurrences earlier and, maybe, achieve better success with casting alone for correction.

Based on the principles of the Ponseti method, re-casting after a relapse should begin with the forefoot being properly aligned, then abduction (or external rotation), and finally, equinus correction (if existent), if necessary. This will make sure that the entire deformity is taken into consideration and, more significantly, that no artificial deformity is caused.

After casting adjustment, nighttime bracing must be resumed. Although it may be difficult, it is crucial to emphasize to parents the need of compliance before beginning re-casting, since the original relapse was likely caused by non-compliance. It is possible to offer parents a number of alternatives to the regular Ponseti shoes and bar in an effort to boost compliance. According to the authors' research, when there are no major outside factors influencing compliance, parents view a recurrence as proof of bracing's significance and gain the conviction to use it correctly.

Surgery to extend the Achilles tendon, with or without releasing the plantar fascia

It is possible for patients to have residual equinus after casting has corrected other parts of their deformity, or for casting to fail to alleviate an isolated equinus contracture. A persistent deformity resulting from an inadequate initial tenotomy is a common cause of equinus contracture. Because early-stage relapses are more likely to produce residual abnormalities, this is especially important to keep in mind. Achilles tenotomies are used in patients less than 2 years old, while Achilles Z-plasty lengthenings are used in patients over the age of 2. The tenotomy should only be done in a surgical facility once the patient has reached the age of 10 to 12 months. This is to ensure that the bigger youngster is sedated adequately and to allow for the possibility of doing a mini-open tenotomy in cases of severe scarring, protecting nearby neurovascular systems from harm.

Oftentimes, equinus is made more noticeable by a cavus deformity that is present. A well-molded "Ponseti number one" cast can fix this, but if the deformity is severe enough to cause a deep transverse plantar crease across the midfoot, the Ponseti cast modification for complex clubfeet should be used instead (8). To do this, gently bend the thumbs dorsiflex against the metatarsal head and place the index fingers over the dorsum of the talar head as a fulcrum (8). When a tenotomy is scheduled, the plantar fascia might be released together with the cast utilizing the aforementioned approach if the tightness of the plantar fascia remains perceptible even after casting (9).

TATT

When the Ponseti approach has already been used to remedy a recurrence, the TATT is among the most popular procedures used to correct it. Dynamic supination during the swing phase of gait is the most frequently reported indication to perform a TATT. This is often seen in conjunction with an equinus contracture, so a Strayer procedure or Achilles tendon lengthening is done simultaneously with the transfer. Whether it was initially or after casting and bracing, nearly all of the 39 patients who relapsed more than four years after completing initial treatment using the Ponseti approach (10). A more recent study found that 38 percent of 101 patients who experienced a recurrence due to non-compliance with the bracing strategy had a TATT. Even though there was a significant risk of recurrence, most patients were happy with the cosmetic result and reported good functional outcomes (11). Unfortunately, a second relapse after a TATT can occur in around 15% of individuals (12). Possible causes include carrying out the transfer before the lateral cuneiform has fully osseointegrated or undetected neuromuscular problems.

The ability to passively adjust a supple foot that supinates only dynamically is necessary for executing a TATT. Although this does not always mean that a transfer is necessary, it is possible that a kid will be able to actively dorsiflex without supination if their foot is properly aligned with the casting, thus eliminating the necessity for a transfer in cases when dynamic supination is

present. Mistake number two: TATTing a patient who already has metatarsus adductus. Neither the patient nor their parents will be happy with the final look or functionality of the foot after this transfer because it will not straighten the foot. So, it's best to try casting it out and then re-evaluating the foot before deciding to do surgery to fix the deformity. It should be mentioned that neither the literature nor any of the research mentioned above provide clear signs for a TATT.

It is standard practice to place patients in a lengthy leg cast and instruct them not to bear weight for six weeks after a TATT. While opinions vary on the best way to support the foot once a cast is removed, the authors do suggest a bespoke ankle-foot orthosis be worn for about six months.

After the Ponseti procedure has been used to treat idiopathic clubfoot, this section has taken a look at the therapy options for relapse. Patients report high levels of pleasure and functional improvement. It is crucial to identify the deformity and re-cast appropriately. Close and regular follow-up is also necessary, as is teaching the parents and kid how to continue a nightly FAO after proper correction for a suitable duration. Surgical correction may be necessary for some patients, however such procedures are often confined to tenotomies, tendon lengthening, fascial release, or tendon transfers, and seldom include invasive intra-articular or bone surgery. Older patients with untreated abnormalities or those with non-idiopathic clubfeet may require more extensive surgical correction. These procedures are identical to those used to address relapse after the first surgical correction, which is covered in more detail below. It is difficult to draw firm conclusions from the literature because the vast majority of the data comes from low-quality studies that did not do sufficient follow-up. Research into the optimal length of time to use FAO at night, a more precise definition of relapses, and a methodical strategy for their management should all be priorities for the future.

Recurrence following surgery

When comparing relapse rates following posteromedial release with the Ponseti technique, what are the key differences? With a follow-up of nearly twenty years, Ippolito et al. compared the two groups (13). Relapse happened in 41-47% of patients in both groups, but functional outcomes were much better in the Ponseti group (13). Remarkably, six feet (66%) in the first group that experienced a relapse needed revision releases. It is worth noting that Clarke et al. did not find a difference in the relapse incidence between patients treated with the Ponseti method (32%) and those treated with operational release (31%), according to their 14 studies. The Ponseti approach has a high relapse rate, although it improves clubfoot function and reduces the need for invasive follow-up treatments (15,16).

Scarring is a common side effect of clubfoot treatments that involve posteromedial release. These cases still happen sometimes, even if their occurrence may be decreasing generally (9,17,18). These feet are particularly vulnerable to additional correction due to a number of causes. To begin, there's a greater chance of gangrene or amputation if the original surgery injured the vasculature, which reduces the foot's circulation. Second, when you try to move an opened joint, you may feel its decreased suppleness and notice pre-arthritic changes. Last but not least, damaged and fibrotic skin makes wound closure a challenge. These cases have a history of being among the most challenging that pediatric orthopaedists have ever faced.

When posteromedial release fails, Nogueira et al. described a novel way to use the Ponseti technique to fix recurrent clubfoot (19). After two years of follow-up, 86% of the feet were plantigrade or completely repaired, while 14% experienced a second recurrence (19). When treating recurrent clubfoot, the Ponseti technique should be considered first due to its minimal risk. The fact that it might work in some situations is the biggest drawback of this strategy (20,21).

On the other hand, in other cases, the deformity might be localized to a specific part of the body, like the midfoot or the distal tibia. To alleviate any remaining equinus, the distal tibia may undergo anterior hemi-epiphysiodesis. It is uncertain if relapse or arthritic changes may develop owing to changing the morphology of the tibiotalar joint, as there was limited follow-up after the 8-plates (22) were placed by Ebert et al., which improved dorsiflexion through altering the anterior distal tibial angle. Similarly, Al-Aubaidi et al. found that altering the anterior distal tibial angle had minimal effect on clinical dorsiflexion (23). Lateral column fusion is a great way to prevent future deformity in the middle of the foot from occurring. Maintenance of a straight lateral border of the foot without over-correction has been demonstrated in mid- and long-term follow-up after revision posteromedial release in conjunction with calcaneocuboid fusion (24,25).

According to Bensahel, the a la carte method is designed to break down the recurrent clubfoot deformity into smaller, more manageable parts (26). All patients had a plantigrade foot at the 5-year follow-up, according to Mubarak et al., who described navicular excision and cuboid osteotomy as a specialized method to repair cavus midfoot deformity (27). Another study that found good maintenance after approximately 5 years of follow-up (28), same to the one by Lourenco et al., also revealed successful closing wedge cuboid and opening wedge medial cuneiform osteotomies for residual adductus deformity. On average, Eidelman et al. used a Taylor spatial frame—also known as the "Butt" frame because its U-plate is oriented parallel to the plantar aspect of the foot—to execute a percutaneous midfoot osteotomy and progressive correction in children aged 14.7 years (29). Osteotomies are performed on both the midfoot and the calcaneus in individuals who have modest deformities of the hindfoot (30,31). Using cuneiform and calcaneal osteotomies, Wicart and Seringe were able to successfully treat a group of patients primarily with neurologic symptoms (32).

To fix the major midfoot and hindfoot deformities in the most severe cases of recurrent clubfeet, it is necessary to do repeat soft tissue releases. Acute and progressive correction are the two main categories into which this method falls. Acutely treated cases are more prone to soft tissue problems, thus it's wise to think about collaborating with plastic surgeons. Along with the soft tissue work, these procedures may necessitate bone osteotomies. Although some publications have used regional, local, or cross-leg fasciocutaneous flaps, Silver et al. detailed the use of preoperative tissue expansion (33–35). Souchet utilized calcaneal derotational osteotomies in conjunction with repetitive posteromedial releases, while Mehrafshan detailed the use of calcaneal excision (36,37).

Wound closure issues can be avoided by adopting a gradual correction technique using an external fixator, the most popular of which is an Ilizarov frame. Patients may be more likely to experience postoperative stiffness due to the lengthy immobilization period and the technical challenges of placing multiplanar external fixators. Using Ilizarov-type frames and soft tissue distraction, numerous writers have successfully corrected recurrent clubfeet (39,40). Tripathy et al. used a two-stage frame-construction method that was previously unknown, placing Ilizarov frames and

applying progressive correction using the Ponseti sequence (41). The first step was to correct the midfoot, and then the second step was to apply and rectify using the hindfoot frame. Eidelman et al. (9). paid tribute to Drs. Ponseti and Taylor (of the Taylor Spatial frame) by calling this approach the "Ponse-Taylor" strategy. Adjunctive osteotomies performed using the Ilizarov technique are necessary for older children, according to Khanfour (42).

Lastly, osteotomies and fusions can be used to treat the most severe cases of recurrent clubfoot. Triple arthrodesis is an option for senior individuals as a last resort, however it is not recommended for younger people. Patients with an average age of 8.4 years underwent triple arthrodesis when clubfoot soft tissue releases failed, according to Galindo et al. (43). The projected prognosis is poor, and there is a paucity of long-term follow-up data for this type of surgery in youngsters. Surgical removal of bone from the talus, navicular, and calcaneus is performed during the Lambrinudi osteotomy to alleviate severe equinus. After 37 years of follow-up, So et al. found fair to good results in a group of patients, the majority of whom had polio (44). Clubfeet caused by myelomeningocele or arthrogryposis can be treated with the Verbelyi-Ogston surgery, which involves subchondral excision of the talus and cuboid, as demonstrated by Spires et al. (45).

Finally, this section has ranked the various surgical and noninvasive methods for treating recurrent clubfoot following posteromedial release. Less invasive treatments have mostly replaced posteromedial release due to the difficulties and dangers of the procedures, as well as the increased stiffness that patients report (46). While the Ponseti approach has shown promising results for some authors in these circumstances, it is still unclear if all patients would be able to endure or undergo the procedure. Relapse following posteromedial release is probably less common since that clubfoot patients are more often treated nonoperatively. Due to the current rarity of these instances, it is recommended that they be handled by facilities or doctors that are proficient in a wide range of surgical procedures. Also, since the Ponseti approach is the gold standard treatment around the globe, it's highly doubtful that additional studies will be carried out on these individuals.

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