Association between Radiological and Clinical Outcomes in Osteoarthritis of the Tibiotalar and Midfoot joints after Triple Arthrodesis in Talipes Equinovarus Deformity

Cherian Jacob¹, Anoop R. L.², Nithin Thomas Philip³, Virat Swaroop Srivastava⁴, Samson Nessiah⁵

¹,⁵Professor, ³Resident, ⁴Resident, Department of Orthopaedics] [²Assistant Professor, Department of Psychiatry] Dr. S.M.C.S.I. Medical College and Hospital, Karakonam, Trivandrum 695011, Kerala, INDIA.

Corresponding Address:
chrn72@gmail.com

Abstract: Triple arthrodesis(TRA) is a reliable method of correcting severely deformed, painful and paralytic feet, giving stability, reducing symptoms and improving function in complex situations in which very few, other suitable alternatives exist. It provides a painless, stable, plantigrade foot. However there have been reports regarding late onset osteoarthritis(OA) of the tibiotalar and midfoot joints going up to 77% in some series. This has resulted in reluctance to do the procedure on the part of many surgeons. Consequently many patients are probably unnecessarily, forced to live with a deformity and its disability.

Materials and Methods: In this prospective cohort study done on all consecutive patients treated with triple arthrodesis between 2005 and 2013, we determined the incidence of radiological osteoarthritis changes at the ankle and midfoot graded according to the van Dijk grading, and clinical symptoms and signs of pain, tenderness, stiffness of the ankle joints and attempted to study the correlatory significance between the two. Changes in the contralateral feet in unilateral cases were also recorded pre-op and postoperatively. We also attempted to gauge patient satisfaction with the procedure using a 5 point visual analogue scale.

Results: The results show a high incidence of radiological OA, up to 50%, as graded by Van Dijk with majority in grade 1 and a couple in grade 2. However clinical findings of pain etc were found only in 16% of those with radiological OA and 9% of all feet. Progression of radiological OA changes was also seen in the normal feet in unilateral cases raising the question as to whether the OA changes are really a result of the surgical procedure. Despite the patients having symptomatic OA, they were satisfied with the outcome (95%) and would readily undergo the procedure again and recommend the procedure to other patients (95%).

Conclusion: We conclude that there is low correlation between radiological OA and clinical symptoms and signs of the same. The fear of OA should not be a deterrent to performing the procedure when indicated.

Keywords: Triple arthrodesis (TRA), Talipes Equinovarus (TEV), Osteoarthritis (OA), Clinical and radiological Correlation.

Introduction
The human foot is an anatomically and biomechanically complex structure that must endure tremendous stresses even in normal gait. The indications have expanded since Ryerson first described triple arthrodesis, in 1923 for the treatment of neurogenic foot deformities, to include a broad spectrum of deformities as well as arthrosis of the hindfoot (1, 2, 3, 4). It comprised resection arthrodesis of the talonavicular, calcaneo cuboid and subtalar joints. Currently triple arthrodesis is done in the western world mainly for post traumatic arthritis(5). However in India where appropriate treatment for clubfoot has only been available for the last 20 years, there remains a large number of cases of neglected clubfoot (6, 7). Young adults with these deformities are often reluctant to enter the social mainstream and as a result are disadvantaged socially, physically and economically. Despite some studies about the possibility of late degenerative arthritis, the desire of most of the patients was only to look normal (8). Triple arthrodesis represents the single most effective procedure capable of delivering a stable, plantigrade and painless foot in patients with foot deformities involving the mid and hindfoot of various etiologies. Triple arthrodesis is used to correct deformity, relieve pain and achieve a plantigrade foot, but secondary osteoarthritis(OA) of the tibiotalar joint is a possibly severe adverse effect of such arthrodesis. It has been well documented that triple arthrodesis accelerates the progression of arthritis at adjacent joints both proximally and distally. The radiographic progression of arthritis at adjacent joints, however, does not correlate with clinical outcomes or patient satisfaction scores (9). Even so, if there is significant degeneration at adjacent joints, triple arthrodesis may require adjunctive or alternative procedures. However several studies, which documented development of secondary OA in the ankle and tarsometatarsal joints after triple arthrodesis, had discouraged surgeons from performing this procedure (8). Mackenzie first reported degenerative
changes in the foot and ankle in long term follow up of patients after TRA(10). Other authors have reported degeneration in adjacent joints of foot. The changes ranged from mild to severe with flat topping and collapse of dome of talus. At times it has appeared that the surgeons evaluating the procedure were more critical of the results than the patients themselves. This however has not universally been the case. Hill and associates failed to find OA changes in the ankle in any of their series of 43 cases after a 9 year follow up. No degeneration was reported in the foot joints either(11). Duncan and Lovell in a series of 109 cases in 1978 found no evidence of degeneration or malfunction in the ankle or foot(12). These studies mainly focused on the development of radiological OA with little clinical correlation. This has led to a reluctance on the part of many surgeons to do this procedure. The result being that many patients are forced to accept and live with the deformity, it’s disability and the social stigma that invariably is attendant on these, probably due to an overemphasis on the radiological rather than the clinical findings. Our study seeks to determine the effect of triple arthrodesis on the ankle joint, degree of clinical correlation with radiological changes and functional status in the tibio-talar joint and midfoot joints after triple arthrodesis and patient satisfaction.

Materials and Methods

In this prospective cohort study, all patients with Talipes Equinovarus Deformity treated with triple arthrodesis between 2005 and 2013 were included. The approval of the institutional ethical committee was obtained. The sampling technique was continuous and purposive. All patients with coexisting deformities of hip or knee and all patients with prior surgery other than posteromedial soft tissue release were excluded. Patients were assessed for clinical symptoms and signs of arthritis. Symptomatic ankle arthritis was inferred from pain localized to the ankle joint line, morning stiffness of ankle joint, swelling corresponding to the ankle joint line, tenderness corresponding to the ankle joint line anteriorly and posteriorly and painful movements of the ankle joint, function was graded by American Orthopaedic Foot and Ankle Society-Ankle Hindfoot Scale (AOFAS AHS Scale). Patients were also assessed for radiological OA changes on an anteroposterior and lateral view of ankle, AP, lateral and oblique views of both feet, preoperatively and postoperatively. The radiological changes were graded by van Dijk grading (13). A correlation between residual hindfoot varus and degenerative changes at the ankle were sought. A comparison between OA changes in the affected foot and contralateral normal foot was also done. Patient satisfaction was assessed on a 5 point visual analogue scale.

Results

Between 2005 and 2013, a total of 18 patients underwent triple arthrodesis at the Dr. SM C.S.I Hospital Karakonam. 22 limbs were operated upon. 9 cases were females and 9 male. .4 cases were bilateral. Of the bilateral cases, 1 was female and 3 male. The etiologies were: 4 cases of polio, 1 case of cerebral palsy and the rest 13 were neglected or relapsed clubfoot. Of the bilateral cases, 3 were due to neglected talipes equinovarus. Median follow up was 6 years (ranging from 2 to 8 years).

Table 1: Distribution of study subjects based on symptoms Preop (n=22)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deformity</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>Pain</td>
<td>21</td>
<td>95</td>
</tr>
<tr>
<td>Limitation of activities</td>
<td>22</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Distribution of subjects based on Symptoms and Signs of OA Postoperatively

| Signs of cartilage damage with or without osteophytes | 8 |
| Death or amputation                                      | 3 |
| Joint space narrowing                                   | 2 |
| Osteophytes                                             | 1 |
| Subchondral 1 Sclerosis                                 | 0 |
| Subchondral 1 cysts                                     | 0 |

Pain was complained of in 2 limbs corresponding to the ankle joint, morning stiffness was complained of in 2 limbs, swelling localized to the ankle was seen in 2 limbs, post surgery. Painful movement was complained of by 1 patient in the ankle joint. The most reliable sign was taken to be joint line tenderness of ankle which was present in 1 limb.

Table 3: Radiological OA changes in the foot and ankle after triple arthrodesis

<table>
<thead>
<tr>
<th>Joint space narrowing</th>
<th>Osteophytes</th>
<th>Subchondral 1 Sclerosis</th>
<th>Subchondral 1 cysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>At time of arthrodesis</td>
<td>9</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>At time of arthrodesis</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Degenerative changes in the ankle were most common, followed by the midfoot joints. The changes were graded according to Van Dijk(10) as given in the following table.

Table 4: The grading of radiological evidence of osteoarthritis of the ankle according to Van Dijk et al.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No abnormality or subchondral sclerosis</td>
</tr>
<tr>
<td>1</td>
<td>Signs of cartilage damage with or without osteophytes</td>
</tr>
</tbody>
</table>
Radiological OA changes were not seen preoperatively in 20 feet (91%), and postoperatively in 11 (50%) feet. Radiographic changes of osteoarthritis were seen in 11 limbs (50%) postoperatively. Maximum were in grade 1 (9 feet), 2 feet had grade 2 changes including flat topping of talus, and all the others were grade 0. No feet were found to have grade 3 changes. There were 2 feet with radiological OA changes preoperatively which were grade 1. They were the same feet which showed grade 2 changes post surgery. Eleven feet showed progression of radiological OA changes, maximum was in the feet that already had such changes prior to surgery.

Excluding the 4 cases which were bilateral, there were 14 cases of unilateral TRA procedure. 7 patients showed no increase in degenerative changes on the operated side and remaining 7 showed an increase of one grade. However the same increase in degenerative changes of one grade was also seen in the contralateral normal leg in 5 of the seven patients who showed increase of one grade on the operated side. No significant difference was seen in the Mann-Whitney U Test between the operated side and the normal side.

Good ankle function was reported in 18% and excellent function in 77% according to AOFAS AHS score. Clinical correlation in the form of ankle joint line tenderness was present in 1 (4.5%) foot that had grade 2 changes. One patient with radiological arthritis in grade 1 had morning stiffness. All the remaining patients in grade 1 were asymptomatic. No significant correlation between radiological degenerative changes and clinical features of OA and AHS scores was found when analysed with Spearman’s correlation. Analysing the 22 feet for satisfaction, using a five point visual analogue scale, the mean score was high up to 4.64 with a median value of 5.00. 21 patients (95%) were either satisfied or very satisfied, only one patient (4.5%) was neither unsatisfied nor satisfied. No patients were unsatisfied with the procedure. All things remaining the same, 95% of patients would undergo the procedure again and 94% would recommend the procedure to another patient. No correlation between degenerative changes and residual hind foot varus was found.

**Discussion**

Though triple arthrodesis provides a painless, stable, plantigrade foot in the short term, there are many articles which point to the degenerative changes in the ankle starting as early as 2 years post surgery, as a deterrent to performing this procedure (8). Numerous studies have documented radiographic osteoarthritic changes from in as few as 40% to as many as 77% of cases (14). The reviews by de Heus et al. with a 10 year follow-up showed that degenerative changes did not occur with any great frequency (9). Pell et al showed that despite radiological evidence of osteoarthritic patients were satisfied with the procedure (4). Beischer et al. showed that the presence of radiological OA of the ankle did not correlate with the level of pain or functional disability experienced by the patient (17). Degenerative changes may be present prior to any surgical intervention as recorded by Graves et al. in all cases of their series of patients (18). Arthritis may occur in the natural history of untreated TEV even without surgery and TRA may actually help to reduce the likelihood of arthritic changes if the foot is restored to good alignment and stability. Duncan and Lovell postulated that the deformity placed more stress on the ankle preoperatively than was present after TRA (12). In our series 2 feet (9%) had radiographic changes preoperatively, 11 feet (50%) had radiological OA changes. The most severe changes were in those feet that had pre-existing OA changes. The tibiotalar joint was affected in 9 feet, the naviculo-cuneiform in 3 and the cuboid fifth metatarsal joint in 2 feet. Of these only 2 limbs (9%) had clinically corresponding symptoms or signs. From this we infer that the fears of degenerative OA, based only on radiographic changes, are unfounded. Symptomatic OA is seen only in 2 feet (9%) in our series. 91% of our cases did not have clinically significant OA. In spite of the OA in these two patients they would still choose to have the operation again, all things being the same and they would also recommend the operation to
other patients. Triple arthrodesis per se does not change the relationship of the talar dome in the ankle joint, unless a tendon Achilles lengthening is also done. Even if a tendon Achilles lengthening is done there is very little improvement in range of motion at the ankle joint after long years of deformity since the talus has probably forfeited the right of domicile in the ankle joint. Therefore any degenerative changes, which might result from altered relationships of the hindfoot bones, are unlikely to produce much symptoms since there is very little movement possible at the tibiotalar joint. This could possibly explain the poor clinicoradiological correlation. Fortunately, for most patients, these are incidental findings on radiographs rather than functional or symptomatic concerns. Triple arthrodesis results in elimination of some of the major shock-absorbers of the foot placing undue stresses on the ankle and midfoot. The strengths of our study include the prospective cohort design, documentation of preoperative radiographic changes allowing their follow up, and rural Indian setting allowing the generalisation of results. The drawbacks of our study are small sample size, and absence of a control group.

Conclusion
There is low clinical correlation with radiological findings in osteoarthritis of tibiotalar and midfoot joints after triple arthrodesis only 2 out of 22 feet (9%) had clinical changes corresponding to the radiological changes. Tibiotalar joint degenerative changes following triple arthrodesis should be thought of more as a sequel than a complication of joint arthrodesis. The rapidity with which they occur appears to be related more to the position than the number of joints fused. There are relatively few papers on the long term effects of triple arthrodesis on the other joints of the foot especially tibiotalar and tarso-metatarsal joints. Our study shows that symptomatic osteoarthritis changes are rare in long term follow up of triple arthrodesis and the bogey of degenerative secondary osteoarthritis as a deterrent to doing this procedure needs to be dispelled and not be allowed to dissuade surgeons from performing this procedure which is the best available salvage procedure for severe foot deformities especially in resource deficient rural settings. Despite these problems the procedure remains a valuable treatment option especially in resource constrained settings in developing countries.

References
12. Mackenzie G, Lambrinudi’s triple arthrodesis,JBJS Br(1959);738-748.