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

Cherian Jacob[1*], Anoop R. L.[2], Nithin Thomas Philip[3], Virat Swaroop Srivastava[4], Samson Nessiah[5]

[1,5]Professor, [3]Resident, [4]Resident, Department of Orthopaedics}{[2]Assistant Professor, Department of Psychiatry}

Dr. S.M.C.S.I. Medical College and Hospital, Karakonam, Trivandrum 695011, Kerala, INDIA.

[*]Corresponding Address:

chrn72@gmail.com

Research Article

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 upto77% 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 it's 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 a5 point visual analogue scale.**Results**:The results show a high incidence of radiological OA ,upto50 %, as graded by Van Djik with majority in grade1 and a couple in grade2.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 expandedsince 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 possiblysevere 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 andtarsometatarsal 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 talusAt 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 a9 year follow up. No degeneration was reported in the foot joints either(11).Duncan and Lovell in aseries of 109 cases in 1978 found no evidence of degeneration or malfunction in the ankle or foot(12) These studies mainly focussed 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 procedureThe 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 localised to the ankle jointline,morning stiffness of ankle joint ,swelling corresponding to the ankle jointline, tenderness corresponding to the ankle jointline anteriorly and posteriorly and painful movements of the ankle .Ankle function was graded by American Orthopaedic Foot and AnkleSociety-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 hindfootvarus 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 2013a 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. Theetiologies were4 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 symptomsPreop (n=22)

Symptoms	Frequency	Percentage (%)
Deformity	22	100
Pain	21	95
Limitation of activities	22	100

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

Pain localized to joints	2
Morning stiffness of joints	2
Ankle joint line tenderness	1
Swelling localized to joints	2

Pain was complained of in 2 limbs corresponding to the ankle joint,morning stiffness was complained of in 2 limbs,swelling localisedto 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 tendernessof ankle which was present in 1 limb .

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

	Anklepreop	Naviculo-cueniformpreop	Cuboid-5th metatarsalpreop
Joint space narrowing	9	3	2
Osteophytes	8	3	1
Subchondral Sclerosis	2	0	0
Subchondral cysts	2	0	0

Degenerative changes in the anklewere 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.

Grade	Description
0	No abnormality or subchondral sclerosis
1	Signs of cartilage damage with or without osteophytes

2	Cartilage destruction, subchondral necrosis, cyst and collapse of bone
3	Cartilage destruction accompanied by a partial or complete disappearance of joint space and bony necrosis with deformation or subluxation

Table 5: Distribution of subjects according to van Dijk grading

Radiological grading of OA changes by Van Dijk(n=22)	PRE-OP	POST-OP
Grade 0	20	11
Grade 1	2	9
Grade 2	0	2
Grade 3	0	0

Radiological OA changes were not seen preoperatively in20 feet(91%), and postoperatively in11(50%) feet.Radiographic changes of osteoarthritis were seen in 11 limbs (50%) postoperatively. Maximum were in grade1 (9 feet),2 feet had grade2 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.

Table 6: Increase in degenerative changes on the operated side and the contralateral side

Increase in Degenerative changes	Operated side (n=14)	Contralateral side (n=14)
No increase	7	9
One grade	7	5
Two grades	0	0
Three Grades	0	0

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.

Table 7: Distribution of study subjects based on function AHS Score

	Frequency	Percentage (%)
Poor (AHS<55)	1	4.5
Good (AHS 55-74)	4	18.18
Excellent (AHS 75-94)	17	77.27

Good ankle function was reported in 18% and excellent function in77% 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 upto 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 a10 year follow up showed that degenerative changes did not occur with any great frequency(9).Pell et al showed that despite radiological evidence of osteoarthritis ,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,11feet(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-cueniform in 3 and the cuboid fifth metatarsal joint in 2 feet.Of these only 2 limbs(9%) had clinicallycorrespondingsymptoms 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 2feet(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 tendo Achilles lengthening is also done. Even if a tendoachilles 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 tibio-talar 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

1. Edwin W. Ryerson, M. D .The classic. Arthrodesing operations on the feet. Clinorthop related research :1977 Jan-Feb;(122):4-9.
2. Richard A. Brand, Arthrodesing Operations on the Feet; The 1st President of the AAOS 1932 Clin Orthop Relat Res. 2008 January; 466(1): 5–14.
3. Meyer MS, Alvarez BE, Njus GO, Bennett GL (1996) Triple arthrodesis: a biomechanical evaluation of screw versus staple fixation. Foot Ankle Int 17:764–767. [PubMed].
4. Pell RF 4th, Myerson MS, Schon LC (2000) Clinical outcome after primary triple arthrodesis. J Bone Joint Surg Am 82:47–57. [PubMed].
5. Saltzman CL, Fehrle MJ, Cooper RR, Spencer EC, Ponseti IV (1999) Triple arthrodesis: twenty-five and forty-four-year average follow-up of the same patients. J Bone Joint Surg Am 81:1391–1402. [PubMed] 11.
6. S. Suresh, A Ahmed, VK Sharma. Role of Joshis external stabilisation system fixatorin management of idiopathic clubfoot. Journal of orthopaedic surgery 2003:11(2):194-201.
7. Donatto KC (1998) Arthritis and arthrodesis of the hindfoot. Clin Orthop 81–92. [PubMed]
8. J. N. Penny, The Neglected Clubfoot, Techniques in orthopaedics20(2)153-166,2005Lippincott,Williams and Wilkins Inc. Philadelphia.
9. Kann JN, Parks BG, Schon LC (1999) Biomechanical evaluation of two different screw positions for fusion of the calcaneocuboid joint. Foot Ankle Int 20:33–36. [PubMed] .
10. Angus PD, Cowell HR (1986) Triple arthrodesis.A critical long-term review. J Bone Joint Surg Br 68:260–265. [PubMed]
11. de Heus JA, Marti RK, Besselaar PP, Albers GH (1997) The influence of subtalar and triple arthrodesis on the tibiotalar joint. A long-term follow-up study. J Bone Joint Surg Br 79:644–647. [PubMed]
12. MackenzieI G, Lambrinudi's triple arthrodesis,JBJS Br(1959);738-748.
13. Hill NA, Wilson Hj, Chevres F et al. Triple arthrodesis in the young child.ClinicalOrthop (1970);70:187-190.
14. Duncan JW, Lovell WW, Hoke, Triplearthrodesis. JBJSAm(1978);60:795-798.
15. vanDijk CN, Lim LS, Poortman A, Strubbe EH, Marti RK (1995) Degenerative joint disease in female ballet dancers. Am J Sports Med 23:295–300. [PubMed]
16. Wetmore RS, Drennan JC (1989) Long-term results of triple arthrodesis in Charcot-Marie-Tooth disease. J Bone Joint Surg Am 71:417–422. [PubMed]
17. Wulker N, Flamme C (1996) Hindfoot arthrodesis. Orthopade 25:177–186. [PubMed]
18. Donatto KC (1998) Arthritis and arthrodesis of the hindfoot. ClinOrthop 81–92. [PubMed]
19. Beischer AD, Brodsky JW, Pollo FE, Peereboom J (1999) Functional outcome and gait analysis after triple or double arthrodesis. Foot Ankle Int 20:545–553. [PubMed]
20. Graves SC, MannRA, Graves KO. Triple arthrodesis in older adults. Journal of bone and joint surgery Am (1993);75:355-362.