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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/18731
DOI URL: http://dx.doi.org/10.21474/IJAR01/18731

RESEARCH ARTICLE

"STUDY OF OUTCOME OF RESULTS IN LIGAMENTOTAXIS WITH EXTERNALFIXATIONIN DISTALRADIUS FRACTURES"

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Manuscript Info

Manuscript History
Received: 19 March 2024
Final Accepted: 25 April 2024
Published: May 2024

Key words:-
Gartland and werley's, Functional, Evaluationscores

Abstract

Introduction: External fixation for distal radius fractures relies on the principle of ligamentotaxisin which, a distraction force applied to the carpus, aligns the fragments by meansof intact ligaments. Distraction assisted reduction and maintenance of distalradius fracture is a widely used reliable treatment method. If the principles ofligamentotaxisareappliedrationallythefactorsthatcauseinstabilityareidentified clinically and managed surgically, and a satisfactory outcome can beexpected.

Methods: The present study was carried out in Chalmeda Anand Rao Institute of MedicalSciencesfromDecember2021toJune2023.Thisstudyconsistsof30 patientswithfracture of distal radius treated with ligamentotaxis with external fixation and thereresults were analysed with pre operative and post operative radiographs and usingGartlandand werley's functionalevaluation scores.

Results:17%patientsachievedexcellentresultswithmildcomplicationsand nopainafter3months of the procedure,40% had good results, 33% had fair results,10% had poorresults,10%patientshad DRUJ Pain,7%hadDRUJ instability,13%hadPTI.

Conclusion: Thepresentstudyconcluded thattheexternalfixationandligamentotaxisprovedto be a very useful method for treating unstable distal radius fracture. Though aneffective method, it is not a solution for all the injuries as different patterns ofinjuriesneeddifferent treatmentprocedure.

Introduction:-

Fractures of the distal radius are among the most common fractures seen in anemergencydepartment.In a young, active individual with a severely comminuted fracture, acceptableclosed reduction may be achieved easily but difficult to maintain. When reduction is lost,ashortened,dorsallyangulatedcarpuswithsubsequentpoorfunctionandearlyosteoarthritissecondary toarticularincongruity mayoccur.

Many unstable distal radial fractures are treated by closed reduction and castingwith even small degrees of malalignment adversely affects functional outcome hasstimulatedinterestin externalfixationand ligamentotaxis.

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External fixation for distal radius fracture relies on the principle of Ligamentotaxisin which, a distraction force applied to the carpus aligns the fragments by means ofintact ligaments. Distraction assisted reduction and maintenance of distal radius fractureis a widely used and reliable treatment method. If the principles of ligamentotaxis areapplied rationally the factors that cause instability are identified clinically and managedsurgically,a satisfactory outcome canbe expected.

Aim of Study:-

Theaimwastostudythefunctionaloutcomeofunstablecomminuteddistalradiusfracturesmanagedby ligamentotaxis withexternal fixation.

Materials and Methods:-

StudyDesign:
Prospective study.

StudySampleSize:
Atotalof30caseswerestudied.

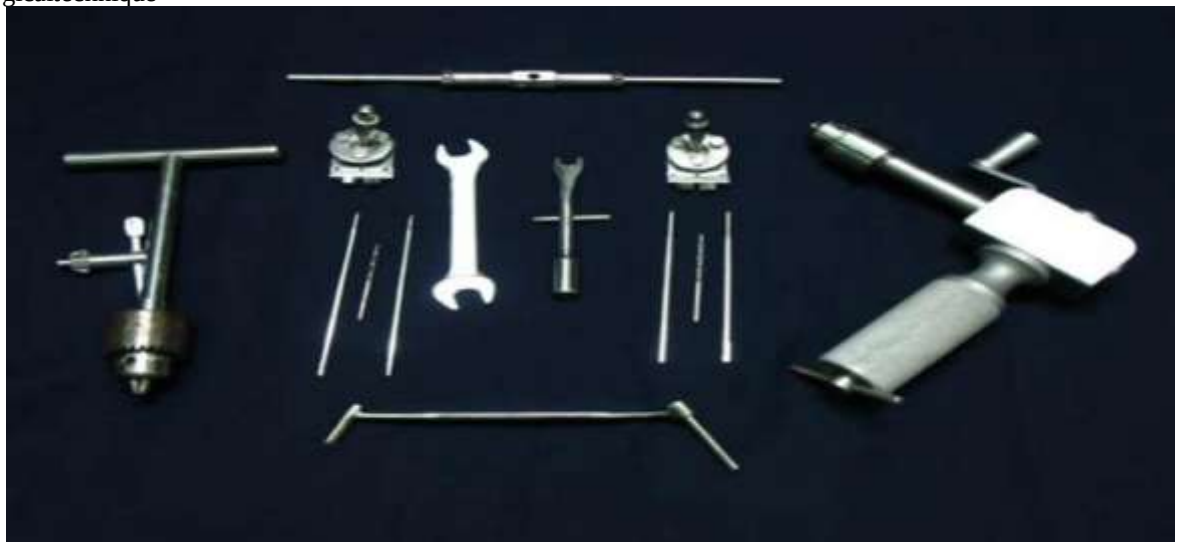
Center ofStudy:
ThestudywasconductedintheDepartmentofOrthopedics,ChalmedaAnand RaoCollege of MedicalSciences

StudyPeriod:
December2021Tojune2023.

StudyPopulation:
Adultpatientswithfractureofdistalradiusfracturewhowereadmitted for treatment in the department of Orthopedics , Chalmeda Anand Rao CollegeofMedicalSciences.

Inclusioncriteria:
Intra-articularcomminutedfracturesofthedistalendofradiusintheagegroupof20-80years treated byexternal fixator.
Frykman classificationtype5 totype8**.**

Exclusioncriteria:
Stablefracturewithdorsalangulation<20%.
Previousipsilateralfractureofwrist.
Patientswithdementiaorpsychiatricillness.
Agelessthan20 yearsandmorethan80years.
Compoundforearmfractures
Surgicaltechnique



In external fixation (ligamentotaxis) group, the fracture reduction was first achievedunder anaesthesia by the same method as for closed reduction group. Then, the limbwas painted anddraped. The metacarpal pins were appliedfirst. 1cmincision madeover metaphyseal flare of second metacarpal. Blunt dissection was carried out avoidinginjuryofsuperficialradialnerveandfirstdorsalinterosseousmuscle.Second metacarpal was drilled with 2.0mm drill bit while protecting soft tissues using drill guide.Then 2.5mm × 100mm schanz pin inserted. A second pin was applied distally by samemethod. Radial pins were applied 10cm proximal to radial styloid. 1 cm incision wasmade along the line joining lateral condyle Humerus and Lister's tubercle of distalRadius, blunt dissection carried out to reach radial shaft avoiding injury to radial sensorynerveandextensortendons.Radialshaftwasdrilledwith2.5mmdrillbitwhileprotecting soft tissues with drill guide. Drilling was done in such a way that pins wereplaced on radial side and 30º dorsally. A 3.5mm × 100mm schanz pin inserted. Secondradial pin was applied distal to first pin by same method. The metacarpal pins wereconnected to multiaxial ball clamp and radial pins were connected to another multiaxialball clamp. The ball clamps were connected to distraction rod. Check X rays taken andfine tuning of distraction done. No more than 2 - 3mm distraction was applied over radiocarpaljoint.

Postoperatively patients were encouraged to do active finger movements from day one.Six pack exercises were taught. Limb was kept elevated for 24 – 48 hours. Parentalantibiotics were given for two days followed by oral antibiotics for one more week. Pinsites were regularly inspected and Betadine dressings given. Patients were dischargedby fifth day and reviewed every week till six weeks. On every visit, extent of fingermovementswasnoted. Pinsitewas examined for infection

Follow up:
At six weeks after confirming union, external fixator was removed and sterile dressingandelasticcrepebandageapplied.Aradiographwasalsotaken.Activewristmobilizationwasstarted.Patientsw erereviewedonthreemonthsoftreatment.Every timefunctionalandradiologicalassessmentweremadeandcomparedtothenormalside.

Radiographicmeasurementsinclude-radial inclination, Length,widthOrshift,Slope.

FunctionalscoringdoneusingGartlandandwerley'sfunctionalevaluationscores. Both subjective andobjectiveEvaluationhas tobe done

Results:-

GARTLAND AND WERLEYS SCORE	Frequency	Percentage
Excellent	5	17
Good	12	40
Fair	10	33
Poor	3	10
Total	30	100

ThestudywasconductedintheDepartmentofOrthopedics,ChalmedaAnandRaoCollegeof MedicalSciences.Theresults ofthe studyare given below:

Table 1:- Showingtheagedistributionofpatients:

Age inyears	Frequency	Percentage
21-30	3	10
31-40	3	10
41-50	8	27
51-60	6	20
61-70	6	20
71-80	4	13
Total	30	100

10% of the patients belonged to the age group of 21-30 and 31-40 years, followed by27% in 41-50years, 20% of the patients belonged to age group of51-60 and 61-70yearsand13%ofthepatients belongedto71-80years. (Table 1)

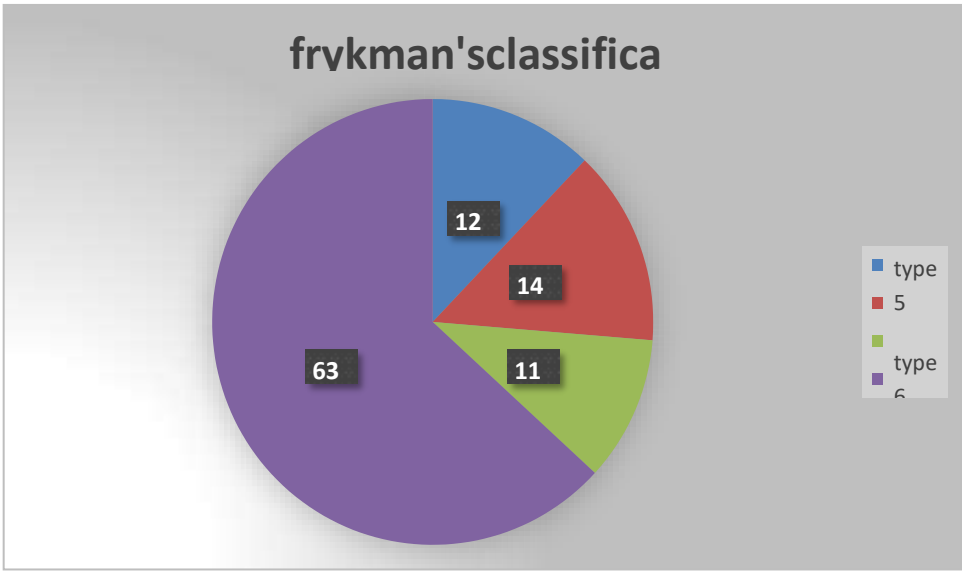
Table 2:- Showingtypeoffracture:

FRYKMAN'SCLASSIFICATION	Frequency	Percentage
Type5	7	23
Type6	8	27
Type7	6	20
Type8	9	30
Total	30	100

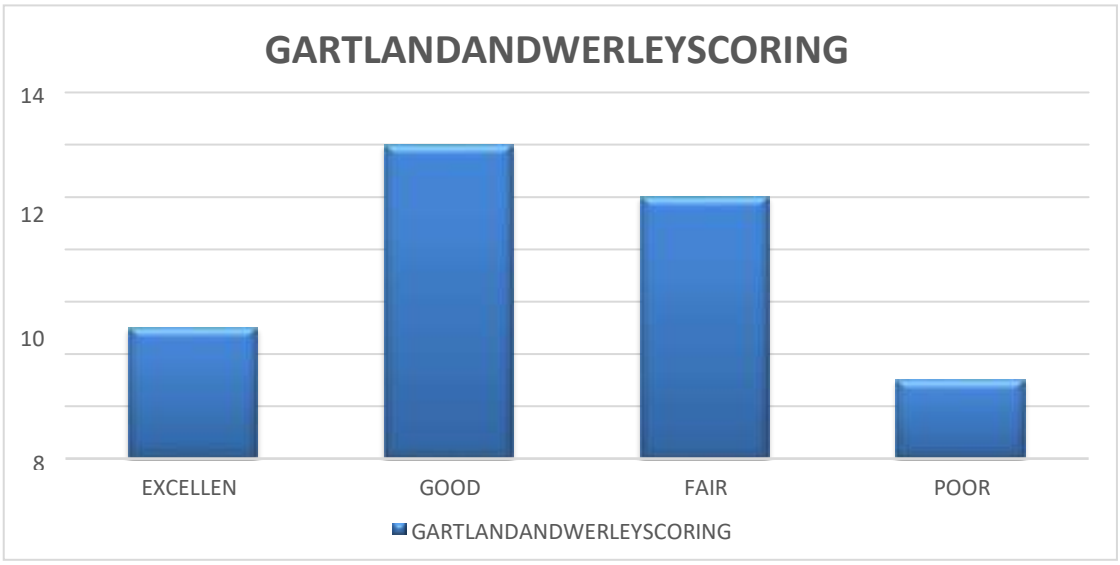
23% of the study population had frykman type 5 fracture, 27% had type 6, 20% had type7,30% had typetype8. (Table 2)

Table 3:- Showingoverallgartlandandwerleysscoring:
FigureshowingoverallGARTLANDANDWERLEYS scoring:

Graph 1:-



Graph 2:-



Case 1:-

Fig 1:- Preoperativexray

Fig 2:- Intraoperativeimage

Fig 3:- Postoperativexray

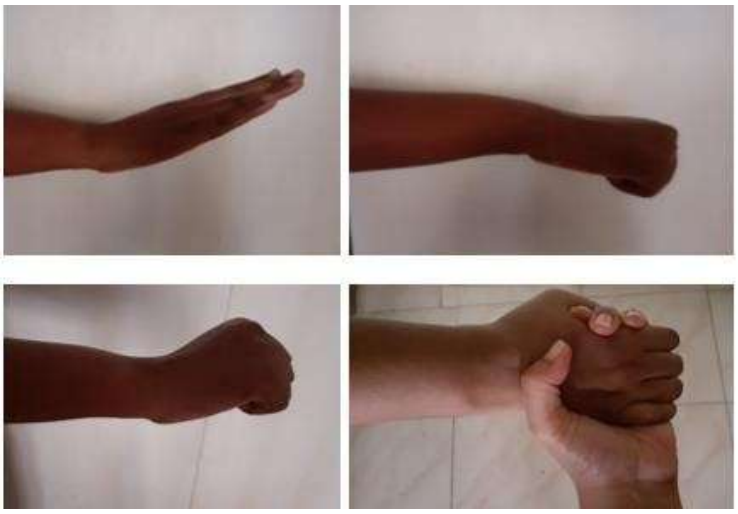


Fig:4

Fig 5 **Fig:6**

Postoperativeromandxray.

Case 2:-

Fig 7:- Preoperativexray **Fig 8:-** Intraoperativeimage **Fig 9:-** Postoperativexray

Fig 11:- **Fig 12:-** **Fig 13:-** **Fig 14;-** Postoperativeromandxray.

Discussion:-

TheresultsofthepresentstudyarediscussedMany fractures of the distal aspect of the radius are relatively uncomplicated and areeffectivelytreatedbyclosed reductionandimmobilization incast.

However unstable / intra-articular fractures can jeopardize the integrity of the articularcongruenceand/orkinematicsofthesearticulations.Severalfactorshavebeenassociatedwiththeinstability, theseinclude the following:

Theinitialdisplacementofthefracture.Thegreaterthedegreeoftheinitialdisplacement is (especially radial shortening), the more energy was imparted to thefracture, resultingin ahigherlikelihoodthatclosedtreatmentwillbeunsuccessful.

The age of the patient. Fractures in elderly patients with osteopenic bones tend todisplaceparticularlylate.The extent of metaphyseal comminution (the metaphyseal defect) especially whencomminution extends into the palmar buttress, collapse occurs even in the face of castimmobilisation.Theamountof intra-articularcomminutionand steps.Finally, displacement after closed treatment is a predictor of instability, and repeatmanipulationisunlikelyto resultin asuccessfulradiographicoutcomeThe Complex distal radius fractures appear simple and its management is a challengefororthopaedic surgeons.

Distalradialfracturesaccounts16%of totalupperlimbfractures.Vaughan et al in their study on unstable distal radius fracture treated by externalfixationobtained 29%excellentand 60%good result.

Methods like external fixation and ligamentotaxis are commonly preferred to manageunstabledistal radiusfracture.This study was designedto assess the efficacy ofligamentotaxis withexternal fixationtomanageunstable distal radial fractures.

A total 30 cases with complex distal radial fractures between age group 21-80 yearswere considered. In males, majority cases were in between 41-50 years in both sexes(males13%,females13%).Study by Ashok K Syam et al., included cases between age group 23-79 years withmeanage42.84andmalesweremorethanfemale cases.

Restoration of normal anatomy is important for restoration of function. Normally 82% ofthe compressive load across the Wrist is borne by distal radius and remaining by distalulna.

With2.5mmlossofradiallength,ulnabears42%loadandat20degreedorsalangulation,ulna bears50% load.Preservation of radial length is the most important factor for preservation of function.Loss of radial length can lead to ulnar impaction or dysfunction of Distal Radio UlnarJoint,withlimitedrangeofmotioninpronationandsupination,dependingonthevolarordorsal subluxationoftheulnar headwithinthe sigmoid notch.The main shortening of the method is its inability to maintain volar tilt and in cases

ofoverdistraction itproduceda dorsal tilt.Along with ligamentotaxis, K wire fixation was performed in 18.7% cases and palmarsupportiveslabin 9.3% cases.

Failure to identify the unstable fracture by the degree of displacement, severity of thecomminution, the involvement of radio carpal or radioulnar joint . Recently surgicalmanagementisbeingpreferredoverconventionalmethodtopreventdisabilityinunstable fracture

WeagreewithGREENthatagoodfunctionalresultusuallyaccompaniesagoodanatomicalreduction.

Thesmall A.O externalfixator provides asimple and reliable meansoftreatingdistalend radial fractures especially unstable intraarticular fractures employing the concept ofligamentotaxisthat was proposedby Vidaletal.

The efficacy of ligamentotaxis in neutralizing detrimental compression forces, which arelikely to cause displacement of unstable fracture with radial shortening, is a significantandincreasinglyappealingadvanceinthemanagementofdistalradiusfracture.Since the fracture occurs in cancellous region, the distraction causes a gap at thefracturewhichoccursduetofractureimpaction.So,incaseswithmetaphysealcomminutionthefracture actuallytakeslong timeto consolidate.So in cases with metaphyseal comminution, the external fixator has to be kept for alonger time or there should be addition of cancellolus bone graft to avoid metaphysealcollapse.

Residual dorsal angulation can precipitate ulnar impaction, midcarpal instability andaltered stressconcentrationwhichmay leadto early arthritis.Porter, in his study, felt that loss of function did not occur until at least 20 degrees ofpalmartilt was lost.

Inligamentotaxiswithexternalfixation,radiallength,ulnarvarianceandradialangulation are restored to normal but correction of volar tilt though adequate, is notcomplete.

This is attributed to the fact that volar ligaments are stronger and become taut ondistractionbeforethedorsalligamentswhichareinarelative‘Z’orientation.

So, on distraction, palmar cortex is brought out to length before dorsal cortex preventingfullcorrectionofdorsaltilt.The external fixator was also unable to correct the depressed lunate fossa(as pointedout by Melone), which may need additional procedures like pinning and elevation ofthedepressedfragment.The ulnar styloid fractures with displacements > 3 mm indicates higher degrees offracturedisplacementsandinjurytotriangularfibrocartilage&itneedsto befixed.

Higher velocity injuries yield poor results. This reiterates the role of soft tissue andligamentsinfracture healing.So, the addition of palmar plaster splint (as advocatedby Fernandezand Palmerwas effective in giving rest to soft tissues and also supportive in unstable fracturepatterns.WeencounteredPintractinfectionin13%patients,DRUJpainin10%patientsand DRUJ instability in7%patients.

A small Uniplaner external fixator is a simple and reliable means of treating unstableseverely comminuted intraarticular fracture of the distal radius with the proved andacceptedconceptof ligamentotaxis.

In 2010, Aktekin et al. found that wrist extension, ulnar deviation, palmar tilt and radialheightwerebetter in those treatedwithexternal fixation.

In2012,Weietal.reportedgoodresultswithexternalfixationwhensatisfactoryreduction is obtained. In 2013, Rajeev shukla et al concluded from their studies in 72cases ofintraarticulardistalradiusfractures thatJoshi'sExternalStabilizingSystemisa costeffectivetechniqueandagoodoptionindisplaceddistalendradialfractures.

In 2014, Deepak CD, Gopalakrishna G, Ravoof A et. al. assessed the results of 20patients of unstable distal radius fractures with / without intra-articular extension andconcludedthatexternalfixationandligamentotaxisprovidesbetterfunctionalandanatomicalresultsincomminutedintra-

articularandunstableextra-articularwristinjuries.In 2015, reports from Rakesh K Yalavarthi, Amar Vishal et al yielded similar findings ontreating33casesoffractures ofdistal radiuswithexternal fixator.

Conclusion:-

Our study equalled previous studies on external fixation for unstable distal radiusfracturesinresults,showingsimplicityandsuperiorityofligamentotaxiswithexternalfixationforthemanagemento fthesefractures.Thusthedistalradiusfracture is no longer a simple fracture to treat by cast alone and more aggressivetreatmentisneededtorestorethearticularcongruityandfunctionaloutcome.

The present study concluded that the external fixation and ligamentotaxis provedto be a very useful method for treating unstable distal radius fracture. Though aneffective method, it is not a solution for all the injuries as different patterns ofinjuriesneeddifferent treatmentprocedure.

Conflict of Interest:-
Nil.

Findings:-
Nil.

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