

A study on across knee external fixation in adults

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Abstract

External fixation is a commonly performed orthopedic surgical intervention . Across knee external fixation is carried out for various indications related to bones , joints and soft tissues . We report our observations on 41 across knee external fixators applied on 39 patients studied over a period of 4 years .

Introduction

A joint spanning external fixator plays an equally important role in management of acute trauma befitting a part of damage control orthopedics as well as for multiple non traumatic conditions involving the lower limb/s . Across knee external fixation is mostly done fixing the femur and the tibia , with or without limited internal fixation simultaneously .

Review

Francois Malgaigne (1840s) is credited for the earliest form of modern external fixator , a claw like device used for management of patellar fractures . Parkhill (1894 USA) , Lambotte (a Belgian surgeon 1902) , and Hoffman (1938 Switzerland) are noteworthy in the ensuing evolution of external fixation systems . In 1950s Ilizarov (USSR) and others were instrumental in the development of ring or circular external fixators which they successfully utilized for distraction osteoneogenesis and other indications . External fixators have been applied on tibia , femur and other bones as well as across joints like knee , ankle , wrist etc. [5, 12, 8] .

Materials & methods

In a study carried out between January 2012 and December 2015 , 39 patients with 41 across knee external fixators [2 patients with bilateral fixators] were selected on fulfillment of inclusion and exclusion criteria cleared / approved by research , ethics and other related committees . Inclusion criterion was patients 18 years or older. Exclusion criteria : patients

with neurological deficits , patients with implants in situ due to earlier surgery .

Observations

Initial enrolment included 45 patients with 47 across knee fixators over 4 years but 39 patients with 41 external fixations could be followed up until end of study : 6 patients were lost to follow up for various reasons . Age ranged from 18 to 65 years : 37 males , 02 females . Mean age was 37.36 years . Male female ratio 18.5 : 1 . Majority 10 patients were between 41 & 50 years [25.64% , 10 males] , followed by 9 between 21 & 30 [23.08% , 8 males , 1 female] together accounting for nearly half of all the patients. The other female was in her fourth decade.

In 39 patients the commonest mode of injury was road traffic accidents [RTA n = 34 , 87.1%] , followed by industrial accidents [n= 3 , 7.89%] . 2 patients had flexion deformity of knee . RTA and industrial accidents caused 44 fractures : 20 femur fractures , 24 tibia fractures and 1 knee dislocation . 25 fractures [56.8%] were open , 19 [43.2%] closed . Of open fractures 21 [84%] were Gustilo Anderson III B , followed by 8% III C and 4% III A & II [1] each . According to AO classification : of 20 femur fractures 1 = 32 , 19 = 33 : of 24 tibia fractures 16 = 41 & 8 - 42 .

Indications : 36 patients were managed with across knee external fixation for 44 fractures on 38 limbs . 1 patient needed it after reduction of dislocation of knee . In 2 patients it was indicated for flexion deformity of knee . Majority 24 of 37 [64.8%] patients had across knee fixation within 2 days . 2 patients with flexion deformity were taken up 1 day after admission . The rest were operated within 1 week or later . Mean time for external fixation following injury was 2.65 days . Out of 39 across knee fixators in males 18 were applied on left side , 21 on right . Both female patients had left side involvement . In 2 males bilateral lower limb fixators were applied.

1 ring and 40 tubular fixators were applied . 36 fixators were unilateral biplanar with Schanz pins inserted laterally on femur and anteriorly /anteromedially on tibia . 4 fixators were bilateral uniplanar spanning both knee and ankle joints with Denham pins through calcaneum . 163 Schanz

screws were applied on 40 tubular fixators . 8 pins passed through open wounds . Majority 80% fixators [32/40] had 2 pins each in femur and tibia . 9 K wires were inserted in 1 Ilizarov fixator . None of the K wires was through wound . 8 out of 38 knees were stabilized initially with limited internal fixation with K wires and /or cannulated screws .

All patients were started on physiotherapy from first post op day , made to stand and ambulate within 1st week . Post fixator removal all were started on knee range of motion and muscle strengthening exercises .

Results & Analysis

39 adult patients underwent 41 across knee external fixation on 41 lower limbs for 44 fractures of femur and tibia , 1 dislocated knee , and knee flexion deformity . They were followed up for an average period of 43.8 weeks [0.84 year] : range 13 to 104+ weeks .

All 44 fractures united , fracture union 100% . Average union time was 25.75 weeks . Mal union was recorded in 5 out of 36 [13.88%] patients . Delayed union was seen in 5 out of 44 fractures [11.36%] in 5 of 36 [13.88%] patients .

Pin tract infection [PTI] was seen in 16 Schanz pins out of 163 , 7 passed through wounds . 9 screws had grade I infection , 6 grade II : these could be controlled by better pin tract care and / or local curettage and oral antibiotics . 1 screw had grade III infection with purulent discharge in 9th week , fixator was removed . Pin wise PTI was 9.82% [16/163] observed in 11 fixators of 40 tubular fixators [27.5% fixator wise PTI] in 11 of 38 patients [28.95% patient wise PTI] . In 1 patient with 1 ring fixator with 9 K wires no infection was seen .

Compartment syndrome was observed in 2 out of 41 [4.88%] limbs involved in 2 of 39 [5.13%] patients . Knee flexion contracture was observed in 2 out of 41 [4.88%] limbs involved in 2 of 39 [5.13%] patients . None had deep vein thrombosis , osteomyelitis , septic arthritis , haematoma formation around knee in any affected limb .

Mean ROM of knee following fixator removal was 74.76 +/-25.79 degree ranging from 05 to 130 degree .

Discussion

In the past decades starting with Marsh et al 1995 [6

] to Ganjwala et al 2014 [2] , 10 studies reported on from 4 patients with 5 across knee fixators to 75 patients with 75 fixators [5] for different indications . Park et al 2011 [7] recorded mean age of 17.5 years , other studies mostly above 40 and 50 years , in comparison to our 37.36 yrs. . Majority studies report higher male to female ratios e.g. 1.17: 1 , 1.29: 1, 3.7: 1 to 5: 1 [1 , 10] to the present 18.5 : 1 . Studies reported indications : tibial plateau fractures , distal femur fractures , arthrodesis , HTO non union , deformity correction [6 , 1 , 11 , 3 , 2] . Some studies reported greater number of closed fractures [10 , 5 , 9] others open fractures [4] in comparison to the present 56.8% open and 43.2% closed fractures . 84% open fractures were grade IIIB , 8% grade IIIC . Duration of fixators reported in different studies range from 5.5 weeks to 26 weeks in comparison to the present study's 10 weeks on an average , range 8 to 27.5 weeks [1 , 7] . Range of fracture union time in studies varies from 3 to 5.8 months [9 , 1] . In the present study average union time was 5.92 months .

Pin tract infections have ranged from 6.25% to 100 % of patients in studies [4 , 7] while in the present series PTI was 9.82% pin wise , 27.5% fixator wise and 28.95% patient wise . Incidence of mal union was 11.36% in comparison to 14% to 20% in other studies [6 , 9] . There was no nonunion but 11.36% [n =5] delayed union was observed which was one of the contributory factors in the higher average of fracture union time .

Knee ROM reported in different studies averaged from 85 degrees to 126.9 . By the time of last follow up the present study witnessed an average range of movement of 74.76 . It is noteworthy that 57% fractures were open , 92% of them grade III B & III C with soft as well as hard tissue loss/es in a number of victims . ROM was noted to be less with increasing grade of compound fractures , the longer period of delay in external fixation , and the longer the fixator remained on the limb/s across the joint/s .

Conclusion

Based on correlation analysis knee ROM was found to be inversely related to severity of open fractures , time of fixator application since injury , and duration of fixator prior to removal .

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