



Research Article

Tibial Plateau Fractures During COVID-19 Pandemic in a Trauma Unit, Impact of Lockdown and the Pressures on the Healthcare Provider

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Abstract

The aim: of this study was to assess the impact of COVID-19 lockdown on the incidence, injury pattern and treatment of tibial plateau fractures in a combined rural and urban population.

Methods: Retrospective study was performed to identify and compare tibial plateau fractures in 15-month period of COVID-19 lockdown 15-month period immediately before lockdown and previous study. Patient demographics, injury mechanism, injury severity and associated injuries, treatment methods and outcome of fractures in the COVID-19 period were studied.

Results: The incidence of tibial plateau fracture and patient demographics were similar in the COVID-19 and control groups. High-energy injury was less common in COVID-19 group when compared to the control groups ($\chi^2=12$, $p<0.025$). Same rate of associated injuries was present in COVID-19 and the control groups ($\chi^2=0.09$, $p>0.95$). Higher severity fractures (Schatzker 5-6) were seen more commonly in the COVID-19 group when compared to the control groups ($\chi^2=7.8$, $p<0.02$). Treatment mode was not impacted by COVID-19 but was much less than external control ($\chi^2=42$, $p<0.00001$). The complication rate was low in spite of higher number of complex fractures and impact of COVID-19 pandemic.

Conclusion: There were unexpectedly worst tibial plateau fractures in the COVID-19 period as compared to the control groups. This was especially relevant for medial condyle and shaft fractures. This was postulated to be caused by reduction in bone density caused by lack of vitamin D and reduction in activity. The treatment mode and outcome was not affected by the impact of COVID-19 on the care of the tibial plateau fractures.

Keywords: COVID-19; Knee; Tibial plateau fracture; Trauma

Introduction

Over the period of COVID-19 lockdown there was a halt on elective and non-essential clinical work and non-essential work and recreation [1-4]. Yet there was no shortage of operative trauma as compared to available resources [5-7]. This was also relevant to tibial plateau fractures [5]. The tibial plateau fracture patterns witnessed seemed to be much worse in severity. The lack of access to operative theatres and presence of isolation and

COVID-19 precautions resulted in difficult clinical decisions and postponement of the surgical care [5,7]. The aim of this study was to perform a comprehensive Computed Tomography (CT)-based study of tibial plateau fracture in catchment area of Swansea Bay Trust. We studied incidence, basic epidemiology, mechanism of injury, presence of associated injuries and injury severity according to a validated fracture classification [8]. The mode of treatment, the success of treatment and associated complications were studied. The incidence, basic epidemiology, mechanism and severity of injury and treatment methods were compared with the

same period prior to COVID-19 lockdown to see if there is any difference in epidemiology, incidence, injury severity, mechanism of injury attributable to COVID-19 [9].

Methods

Computer Tomography (CT) scans of the knees between January 2019 and July 2021 were studied in order to identify patients with tibial plateau fracture who presented in the Swansea Bay Health Board in the fifteen months prior to COVID-19 lockdown on first of April 2020 and end of lockdown in early July of 2021. The age, sex of the patient, mechanism of injury, injury severity based on the Schatzker classification of the fracture, associated injuries, mode of treatment and outcome of treatment and possible future load on arthroplasty services from mal-united tibial plateau fractures in clinically suitable patients were studied [8]. The complication rate in the operative cases during COVID-19 period was also studied. Incidence was presented as number of cases per annum per 100000 of the population. Fractures that were referred from out of the catchment area for Orthoplastic care were excluded from the study, as they were not the incidence in the population of the catchment area. The period prior to the COVID-19 period was used as a local control group. In order to compare our population with similar demographics in western Europe we compared the incidence, patient demographics, mechanism of injury, associated injuries and severity of fracture, rate of surgical treatment were compared to the COVID-19 period and pre COVID-19 control period to see any local differences [9].

The significance of the difference between categorical data such as sex, mechanism of injury, severity of injury, and percentage of surgical treatment were compared using χ^2 test. The significance

of quantitative data such as age of the patients was compared using one-way Analysis of Variance (ANOVA test). The null hypothesis was chosen as lack of difference between groups and significance was presented as p value of less than 0.05. The null hypothesis was chosen as lack of difference between groups and significance was presented as p value of less than 0.05.

Results

Forty-one fractures were identified to have occurred in the COVID-19 lockdown period whereas 38 occurred at the immediate pre COVID period. The incidence of tibial plateau fracture was 8.5 per 100000 per year during COVID-19 period and 8 per 100000 per year in the period just prior COVID-19 lockdown. This was very similar to our external control by Elsoe et-al, which was 10 per 100000 per year [9]. The breakdown of incidence of injury, patient demographic, severity of injury and fracture and associated injures as well as rate of operative treatment is presented on Table-1. The average age of patients in the COVID-19 period was 51+/-19 and 48+/-17 in the pre-COVID-19 period. The age distribution was same as the external control, which was 51+/-18. There was no difference between any groups (DF=442, F=0.42, P=0.61). Male to female ratio was 1.1:1 in the COVID period and 1:1 in the pre COVID-19 period. The male female distribution was same as the external control which was 0.9:1 ($\chi^2=0.31$, $p=0.86$). The mechanism of injury was deemed high energy in 20% of the COVID-19 period. However high energy injury caused 36% of tibial plateau fractures in pre-COVID period. The high-energy rate for external control was as 38% identical to pre-COVID-19 period but significantly higher than the COVID-19 lockdown ($\chi^2=12$, $p<0.025$).

	COVID group	Pre-COVID control	External control (9)	
Numbers	41	38	364	
Incidence rate 100000/year	8.5	8	10	
Age	51+/-19	48+/-17	51+/-18	(DF=442, F=0.42, P=0.61)
Sex M:F	1.1:1	1:1	0.9:1	($\chi^2=0.31$, $p=0.86$)
high energy injury %	20%	36%	38%	($\chi^2=12$, $p<0.025$)1
Associated injury %	14%	16%	14%	($\chi^2=0.09$, $p>0.95$)
Bicondylar fracture	53%	32%	30%	($\chi^2=7.8$, $p<0.02$)2
Surgical treatment	50%	52%	92%	($\chi^2=42$, $p<0.00001$)3

Table 1: The patient demographics, injury severity based on Schatzker classification, associated injuries, rate of high-energy injury, Rate of surgical treatment. 1) There was a significantly higher rate of high energy injury in the control groups. 2) There was a significantly higher rate of Schatzker 5 and 6 in the COVID group. 3) There was a significantly higher rate of surgical treatment in the external control group.

Fourteen percent of the patients in the COVID-19 period had associated injury and 16% of patients in the pre-COVID-19 period. This was similar to the external control which was 14% ($\chi^2=0.09$, $p>0.95$). In the COVID-19 period, 53% of the tibial plateau fractures were multi-condylar condyle fractures (Schatzker 5 or 6). Injury severity was 32% in the pre-COVID-19 period and 30% in the external control. The difference was statistically significant ($\chi^2=7.8$, $p<0.02$) and the breakdown of injury severity in the COVID-19 period and pre COVID-19 period is presented on (Table 2). Surgical fixation was performed in 50% of the COVID-19 tibial plateau fractures. This was the same in the pre-COVID-19 and the COVID period ($\chi^2=0.0553$, $p>0.8$). However, in the external control cohort 92% were treated surgically which was in stark contrast to our unit in the pre and post COVID-19 period ($\chi^2=42$, $p<0.00001$). The reason for conservative treatment in the pre and COVID-19 period was already established arthritis in six patients, severe morbid obesity in three patients and undisplaced fracture in ten patients. One patient was treated conservatively due to lack of expertise and lack of titanium implant because of Nickel allergy during COVID-19 period and is awaiting arthroplasty procedure due to gross malunion and early post-traumatic arthritis. In spite of COVID-19 presence and severity of injury, there were only three postoperative complications. They included one death from myocardial infarction 10 days after fixation of fracture, one case of arthrofibrosis that required arthroscopic arthrolysis and extensive physiotherapy. There was one case of infection of the plate in a diabetic patient 5 months after surgical fixation. This was successfully treated with removal of metalwork, arthroscopic washout of the knee and antibiotics that resulted in eradication of the infection.

Schatzker classification	COVID group	Pre-COVID control
1	3	5
2	13	17
3	0	2
4	4	2
5	5	7
6	15	5

Table 2: Severity of injury based on Schatzker classification in the COVID group and pre COVID control group.

Discussion

The main finding of the study is that the incidence of tibial plateau fracture has not changed neither has the demographics of the patient specifically age and sex distribution during the lockdown [9,10]. Lockdown had resulted in less traffic, less high impact recreation and work that often resulted in high-energy injuries. Yet

the fracture rate stayed the same and so did the rate of associated fracture [11]. Majority of the injuries happened while in lockdown and at home which is same as other authors experiences [5,7,11]. There was a significantly higher rate of highly comminuted fracture resulting in more challenging operative fixations [8]. This was more relevant to association of medial column fracture. Sixty-three percent of the patients during COVID-19 had medial column injury. Which raises the question is lockdown a predisposing factor for more complex tibial plateau fracture in spite of more innocuous mechanism of injury. Association is not causation however one can postulate that lack vitamin D caused by reduction to exposure to the sun, change in diet caused by lockdown, reduction in weight bearing caused by being more sedentary during lockdown all resulting in reduction in bone mass or lack of proprioception due to being sedentary can result in being more prone to falls and fracture [12-14]. This association could be relevant for both the tibial plateau fracture and associated fractures [5]. Ironically association between poor bone metabolism and outcome of tibial plateau fracture is already made especially in more severe bone injuries [15,16]. It is likely that the bone metabolism causes poorer outcome by more severe bony injury and more difficult fixation resulting in higher rate of failure rather than impacting healing and resulting in fixation failure [15].

This is more relevant as the medial tibial plateau fracture is an area of bone that is prone to insufficiency fracture [17]. None of the patients had prodromal medial condyle pain and as such tibial plateau fracture was the first time the patient had symptoms but the involvement of medial tibial plateau mirrored the types presented by Yukata et-al for stress fracture of medial tibial condyle [17]. Any decision for treatment mode did not get impacted by COVID-19 rather by what the presenting unit was comfortable to perform. This was evident by identical fixation rate being similar in the pre-COVID-19 and COVID-19 period but very different to the external control [8]. There are two aspects to this. Firstly, if the patient cohort is unfit and overweight then the propensity is to accept deformity and resulting arthritis in order to avoid complications [16,18-20]. Secondly if techniques of anatomical reduction and stable fixation is lacking, a higher level of deformity will result in surgical fixation in order to avoid the difficult situation of plate over poorly reduced fracture [16,18-20]. These may explain the gross variability in rate of fixation [8,16,18-22]. In spite of cohort of patients who were less well, had more complex fracture patterns, and lack of availability of prompt rehabilitation, outcomes were acceptable and complication rates were low [17-23]. However, we anticipate a higher rate of early total knee replacement due to an increased rate of early arthritis as both in the pre-COVID-19 and COVID-19 series have been referred for arthroplasty due to malalignment and arthritic pain [24].

Conclusions

COVID-19 resulted in no change in the incidence of tibial plateau fracture or the cohort of patients. However, it resulted from lower mechanism of injury causing more complex fracture patterns. This is undoubtedly due to the impact of COVID-19 lockdown on bone quality. Any variation in treatment of tibial plateau fracture is caused by a philosophy of fixation in the unit rather than the impact of COVID-19 on the availability of operative opportunity.

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