Original Article

The Epidemiology, Management, and Outcome of Field Hockey-related Fractures in a Standard Population

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Abstract

Background: Field hockey is one of the most popular sports in the world, yet little is known about patient outcome following fracture injuries sustained during this sport. **Objectives:** The aim of this study is to describe the epidemiology, management, and outcome of field hockey-related fractures in a known UK population at all skill levels. **Materials and Methods:** All fractures sustained during field hockey from 2007 to 2008 within the adult Lothian population were prospectively recorded and confirmed by an orthopedic surgeon during treatment at the sole adult orthopedic center in the region. Nonresident individuals were not included in the study. Follow-up data were obtained in September 2010 to determine return rates and times to field hockey. **Results:** Nineteen fractures were recorded over the study period in 19 patients. Seventeen (89%) of the fractures were recorded in the upper limb, with 15 (79%) recorded in hand. Eighteen fractures (85%) in 18 patients (95%) were followed up at a mean interval of 31 months (range: 25–37 months; standard deviation [SD] 2.1 months). The mean time for return to field hockey from injury was 10.8 weeks (range: 3–26 weeks; SD 7.1 weeks). For patients with upper limb injuries, the mean time was 9.2 weeks (range: 3–20 weeks; SD 5.7 weeks), compared to 22 weeks (range: 18–26 weeks; SD 5.7 weeks) for patients with lower limb injuries. Eleven percent of the cohort did not return to field hockey. Seventy-eight percent of the cohort returned to field hockey at the same level or higher. Fifty percent had ongoing related problems, yet only 17% had impaired field hockey ability because of these problems. Fractures with the highest morbidity in not returning to field hockey were as follows: Metacarpal 14% and finger phalanx 13%. **Conclusions:** The significant majority of field hockey-related fractures are sustained in the upper limb, notably the hand. Around ninety percent of patients sustaining a fracture during field hockey will return to this sport at a similar level. While half of these will have persisting symptoms 2 years postinjury, only one-third of symptomatic patients will have impaired field hockey ability because of this.

Keywords: Epidemiology, fracture, hockey, management, outcome

Introduction

Field hockey is one of the most participated sports in the world.[1] Within the UK, between 2 and 5/1000 of the adult population participate in this sport at least once a week,[2,3] and over the past 5 years, participation numbers for this sport in the UK have risen by 5%.[3]

Due to the contact nature of the sport, the lack of protective clothing for the outfield players and the potential for collision with both the hockey stick and the hockey ball, there is a high risk for injury in this sport, particularly fractures.[4-9] Previous studies have recorded an injury incidence within field hockey of 8/1000 match exposures and 4/1000 practice exposures,[5] with fractures comprising around 15% of all field hockey-related injuries.[4]

Despite the frequency of such injuries, there has been limited research into the epidemiology, management and outcome of field hockey-related fractures.[4-12] Previous studies have either provided an overview of the injury patterns in the sport, restricting fractures to a subcohort within this,[4-6] or have focused on a particular region of the body,[6,7] failing to provide a comprehensive description of the epidemiology, management, and outcome of such fractures.

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Such data are important as it allows players and teams to plan rehabilitation schedules, based on expected recovery times, as well as enabling sports doctors and surgeons to define and provide the optimal management for these injuries.[4-6] Such information also allows the development and design of realistic injury prevention methods and equipment.[4-6,13] This in whole enables optimization of the return rates and times to field hockey for the players, as well as reducing the incidence of such injuries in the future.[4-6,13]

The aim of this study was to provide a comprehensive overview of the epidemiology, management and outcome of fracture injuries sustained during field hockey over a year period in a standard UK population.

Materials and Methods

Study design

All acute fractures sustained within the Edinburgh, Mid and East Lothian populations from July 2007 to 2008 in patients aged 15 years and over were prospectively recorded in a database. The population count for Edinburgh, Mid and East Lothian was 517,555. Information contained within the database included age, gender, mode of injury, site of the fracture, date of treatment, whether orthopedic treatment was as an in-patient or out-patient, and whether the fracture was open or closed. Fracture classification was performed using the Arbeitsgemeinschaft fuer Osteosynthesefragen classification, by individual review of each presenting radiograph by an orthopedic surgeon. The Gustilo classification was used to classify open fractures.[14] For fractures sustained during sport, the specific sport participated in at the time of the injury was recorded in the database. The database did not record stress fractures. Nonresident individuals were excluded from the database to allow accurate epidemiological analysis.

The mode of injury was recorded from the details of the admission history as well as from in-patient and out-patient hospital records and was confirmed with patients either on the ward or at the clinic, during the initial management period of their injury.

All patients who sustained a fracture during field hockey were identified from the database and telephoned in September 2010 to complete a standardized questionnaire. This provided a mean follow-up of 31 months postfracture (range: 25–37 months; standard deviation [SD] 2.1 months).

All the case notes of the patient cohort were retrospectively reviewed in September 2010 to determine the mechanism of injury, fracture treatment modalities and subsequent complications.

Statistical analysis

Analysis of the cohort data was performed using SPSS 19.0 (SPSS, Chicago, Illinois, USA). For the continuous (nonparametric) data, univariate comparisons were performed with the Mann–Whitney U-test. For the categorical (nonparametric) data, univariate comparisons were performed with the Chi-squared test (using Fisher's exact test if necessary). The Kaplan–Meier estimator, with the hazard function, was used to perform survival analyses for return to field hockey between: patients treated operatively versus patients treated conservatively; and patients below the age of 30 years versus patients over 30 years of age. These groups were chosen to illustrate the effect of treatment and age on sporting outcome. The significance level was $P < 0.05$.

Results

Out of a total 6871 fractures sustained during the study period in 6325 patients, 19 fractures (0.3%) were field hockey-related occurring in 19 patients (0.3%) [Table 1].

There were 17 (89.5%) upper limb fractures and 2 (10.5%) lower limb fractures [Table 2]. The annual incidence of field hockey-related fractures was 0.04/1000 of the general population per year.

The mean age of the cohort was 24.7 years (range: 15–47 years: SD 10.33 years). The gender ratio of the cohort was 10:9 (Male:Female). Of the fractures, eight occurred during club level hockey, five during university-level hockey, four during school level hockey, one during national level hockey and one during recreational hockey. Thirteen of the fractures occurred during competition; six occurred during practice. None of the patients had previously fractured the affected areas. None of the patients suffered multiple fractures.

The demographics of the field hockey fracture population are shown in Table 1. Twenty-one percent of the fractures required surgical management ($n = 4$). Surgical intervention included manipulation of the thumb metacarpal fracture with K-wire fixation ($n = 2$), syndesmosis screw fixation of a Weber C ankle fracture ($n = 1$), and washout and reduction of open fracture dislocation of a thumb metacarpal-phalangeal joint ($n = 1$). The mean duration of hospitalization for the fractures was 0.3 days (range: 0–2 days; SD 0.6 days).

Table 2 shows the demographics for upper limb and lower limb fractures. For the finger phalanx fractures, two involved the

Table 1: General fracture demographics

	n (%)	
Sports fractures	992	
Field hockey fractures	19 (1.9)	
Number of patients	19	Mean age: 24.7 years
Male	10 (52.6)	Mean age: 26.4 years
Female	9 (47.4)	Mean age: 22.9 years
Out-patient fractures	15 (78.9)	
In-patient fractures	4 (21.1)	All day case procedures
Conservatively managed fractures	15 (78.9)	
Surgically managed fractures	4 (21.1)	
Fractures with full follow-up data	18 (94.7)	
Patients with full follow-up data	18 (94.7)	Mean age: 24.9 years
Male	9 (50.0)	Mean age: 26.9 years
Female	9 (50.0)	Mean age: 22.9 years

Table 2: Fracture demographics

Type	Number	Mean age (year)	Male:female ratio	Surgically managed (%)	In-patient (%)	Main MOI (%)	Mean duration of hospitalisation (days)
Total	19	24.7	10:9	4 (21.1)	4 (21.1)	Stick (53)	0.3
Upper limb	17	25.8	10:7	3 (17.6)	3 (17.6)	Stick (59)	0.2
Finger phalanx	8	25.8	6:2	1 (12.5)	1 (12.5)	Stick (63)	0.1
Metacarpal	7	27.4	3:4	2 (28.6)	2 (28.6)	Stick (57)	0.3
Clavicle	1	18.0	0:1	0	0	Ball (100)	0
Distal ulna	1	22.0	1:0	0	0	Stick (100)	0
Lower limb	2	16.0	0:2	1 (50.0)	1 (50.0)	Ball (50)	1
Ankle	1	15.0	0:1	1 (100.0)	1 (100.0)	Twist (100)	2
Patella	1	17.0	0:1	0	0	Ball (100)	0

MOI: Mechanism of Injury

thumb, five the index finger and one the little finger. For the metacarpal fractures, three involved the thumb, two the middle finger, one the ring finger, and one the little finger. Fractures with high (nonsurgical) manipulation rates included finger phalanx (12.5%). There was one recorded open fracture: an open fracture dislocation of a thumb metacarpal-phalangeal Joint.

Figure 1 demonstrates the mechanism of injury for the cohort. Figure 2 demonstrates the location of the fractures by the playing positions of the cohort.

Full follow-up data were obtained for 18 (95%) of the fractures, with the mean age of this cohort being 25 years (range: 15–47 years; SD 10.6 years). Of these, 16 (89%) returned to field hockey (mean age 23 years: Range: 15–47 years; SD 9.2 years), with 14 (78%) returning to the same level or higher (mean age 22 years: Range: 17–38 years; SD 6.8 years). Patients returned to training at a mean duration of 7 weeks (range 1–16 weeks; SD 4.8 weeks), and return to preinjury level of field hockey at a mean duration of 11 weeks (range 3–26 weeks: SD 7.1 weeks). Figure 3 demonstrates the return times for the fracture types.

The "return" rates for the different preinjury competition levels were 100% for the national level cohort (100% to same level), 86% for the club level cohort (71% to same level), 100% for the university level cohort (100% to same level), 100% for the school level cohort (75% to the same level) and 0% for the recreational cohort (0% to the same level).

Of those patients managed surgically, none suffered complications. One required repeat surgery, which comprised of delayed removal of an ankle syndesmosis screw.

Of the whole cohort, 9 (50%) of the fractures were found to have persisting symptoms 2 year postinjury (mean age 27 years: Range 15–47 years; SD 12.9 years), the most common being fracture site pain (67%), stiffness of an adjacent joint (44%), and metalwork-related pain (11%). However, only 3 (17%) of all the fractures were found to have persisting symptoms which impacted on their ability to play field hockey (mean age 33 years: Range 15–47 years; SD 16.5 years), the most common symptoms being fracture site pain (100%), stiffness of an adjacent joint (33%) and metalwork-related pain (33%).

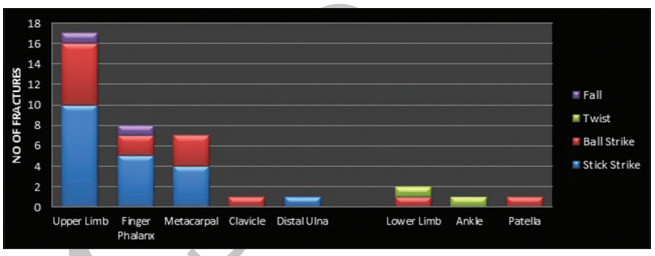

Figure 1: Mechanism of injury by fracture type

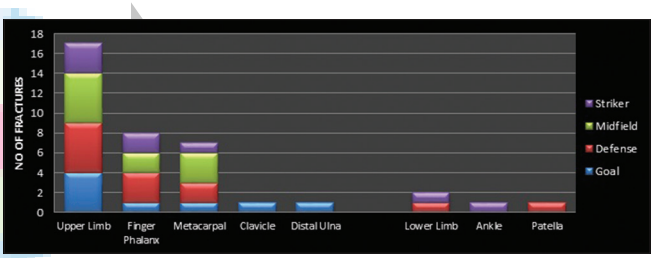

Figure 2: Location of fracture by position of play

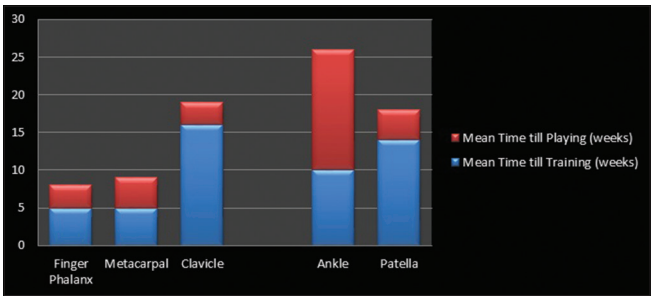

Figure 3: Return times to field hockey

For the patients who were managed operatively, the mean time to return to field hockey was 17 weeks (median 15 weeks; range 10–26 weeks; SD 6.8 weeks) and the return rate was 100%; for those managed conservatively, the mean return time was 9 weeks (median 6 weeks; range: 3–20 weeks; SD 6.3 weeks) and the return rate was 86%. The difference in return times to field hockey for operative compared to conservative management neared statistical significance ($P = 0.07$); there was, however, no difference noted in the return rates ($P = 1.00$) [Figure 4].

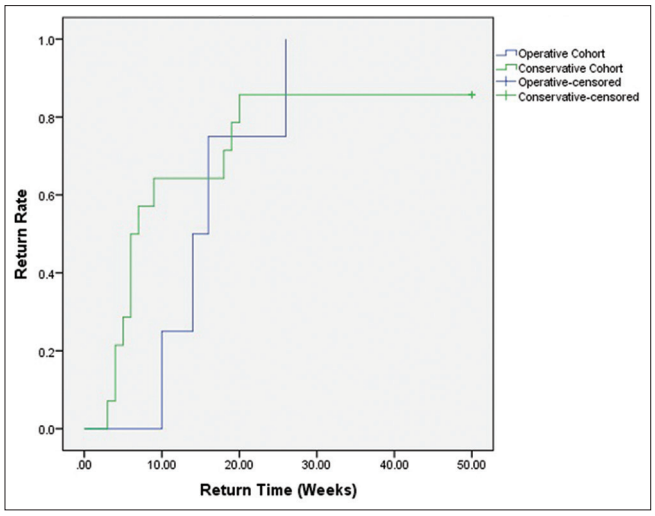

Figure 4: Return to field hockey: operative cohort versus conservative cohort (Kaplan–Meier Hazard Function)

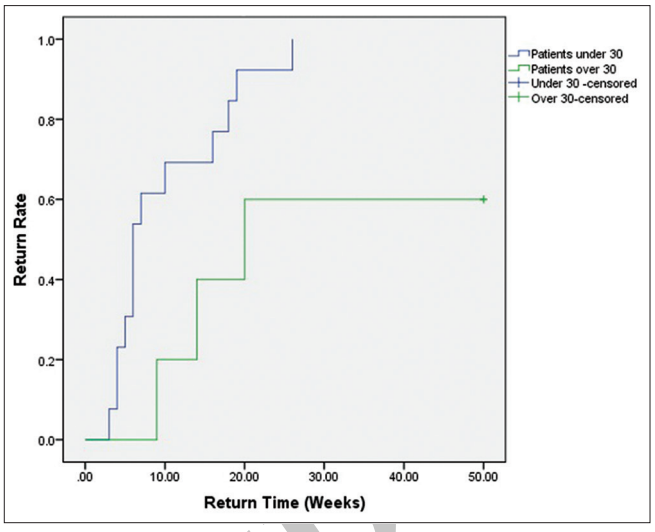

Figure 5: Return to field hockey: patients under 30 versus patients over 30 (Kaplan–Meier Hazard Function)

For patients over 30 years of age (mean age 40.4 years: Range 34–47 years; SD 5.4 years), the mean return time was 14.3 weeks (median 14 weeks; range 9–20 weeks; SD 5.5 weeks) and the return rate was 60%; for patients under 30 years of age (mean age 19.1 years: Range 15–26 years; SD 3.3 years), the mean return time was 10 weeks (median 6 weeks; range 3–26 weeks; SD 7.3 weeks) and the return rate was 100%. The difference in return rates to field hockey between the two groups neared statistical significance ($P = 0.06$); there was, however, no difference noted in the return times ($P = 0.20$) [Figure 5].

Seventy-five percent of patients treated operatively were found to have persisting symptoms at follow-up, with 50% of patients having symptoms which interfered with their ability to play field hockey. Of those treated conservatively, 43% had ongoing symptoms, and 7% had symptoms which interfered with their field hockey. The difference in "persisting symptom" rates ($P = 0.58$) and "persisting symptoms affecting field hockey ability" rates ($P = 0.11$) was not statistically significant.

Overall, two (11%) of the fracture patients had not returned to field hockey 2 years postinjury. None were from the operative cohort (no-return rate 0%), with both from the conservative cohort (no-return rate 14%) ($P = 1.00$) [Figure 4]. Fractures of the metacarpal (14%) and finger phalanx (13%) showed the highest "no return" rates.

Both patients who did not return to hockey stated they had done so for personal reasons. Both were over 30 years old (mean age 41.5 years: Range: 38–45 years; SD 4.9 years), and both reported they did not want to suffer a reinjury, necessitating more time off work.

Table 3 shows the outcome data for the upper limb and lower limb fractures.

Ninety-five percent follow-up was achieved for the upper limb cohort. Of these, 88% returned to field hockey, and 81% returned to the same level or higher. The highest return rates were seen in the clavicle (100%) and finger phalanx (88%) fractures, with the lowest seen in the metacarpal fractures (86%). Clavicle fractures took longest to return to hockey (mean 19 weeks: range 19 weeks; SD n/a) while finger phalanx and metacarpal fractures took the shortest times (finger phalanx: Mean 8.4 weeks: Range 3–20 weeks, SD 6.7 weeks; Metacarpal: Mean 8.5 weeks: Range 5–14 weeks, SD 3.3 weeks). For finger phalanx fractures, those of the thumb took a mean of 11 weeks (range 6–16 weeks; SD 7.1 weeks) to return to hockey, while those of the other digits took 7 weeks (range 3–20 weeks; SD 7.1 weeks) to return to hockey ($P = 0.32$). For metacarpal fractures, those of the thumb took a mean of 12 weeks (range 10–14 weeks; SD 2.8 weeks) to return to hockey, while those of the other digits took 7 weeks (range 5–9 weeks; SD 1.7 weeks) to return to hockey ($P = 0.06$). The highest rate of persisting symptoms 2 years postinjury was seen in clavicle (100%) and the lowest rate in the finger phalanx (38%). Only 13% of all upper limb fractures had persisting symptoms at 2 years, which impaired field hockey ability.

Complete follow-up was achieved for the lower limb cohort. Of these, all returned to field hockey, and 50% returned to the same level or higher. Both the lower limb patients were noted to have persisting symptoms 2 year postinjury, though only the ankle patient had persisting symptoms which impaired her ability to play hockey.

Upper limb injuries returned to activity significantly quicker than lower limb injuries ($P < 0.05$), but there was no significant difference in return rates between the two groups ($P = 1.00$).

Discussion

We believe this study provides the first comprehensive overview of the epidemiology, management and outcome of field hockey-related fractures in a known general population.

Table 3: Fracture follow-up data

Type	Follow-up (%)	Return to hockey (%)	Return to same level or higher (%)	Time to hockey (weeks)	Persisting symptoms (%)	Persisting symptoms affecting hockey (%)
Total cohort	18 (95)	16 (89)	14 (78)	10.8	9 (50)	3 (17)
Upper limb	16 (94)	14 (88)*	13 (81)	9.2**	7 (44)	2 (13)
Finger phalanx	8 (100)	7 (88)	7 (88)	8.4	3 (38)	1 (13)
Metacarpal	7 (100)	6 (86)	5 (71)	8.5	3 (43)	1 (14)
Clavicle	1 (100)	1 (100)	1 (100)	19.0	1 (100)	0
Distal ulna	0	-	-	-	-	-
Lower limb	2 (100)	2 (100)*	1 (50)	22.0**	2 (100)	1 (50)
Ankle	1 (100)	1 (100)	0	26.0	1 (100)	1 (100)
Patella	1 (100)	1 (100)	1 (100)	18.0	1 (100)	0

Statistical comparisons: *Upper limb versus lower limb return rates (P=1.00), **Upper limb versus lower limb return time (P<0.05)

The study reported an incidence of field hockey-related fractures of 0.04/1000 population. This is in keeping with previous studies within the same population which noted an incidence of 0.05/1000 population.[9] In contrast to reports from other sports,[15-17] we found an even gender distribution among our fracture cohort. This is reflective of the significant female participation in the sport.[2,3,9] We recorded a unimodal distribution of these injuries with a mean age of 24.7 years for our cohort. This is in keeping with previous reports which noted a mean age of 25 years for their cohort,[9] reflective of the young age group of participation in this sport in our region.[2,3] The SD for our age range was 10 years. this is indicative of the injuries being predominantly recorded in patients aged 15–35 years and is similar to previous reports of sport-related fractures.[9,15-17]

We found a significantly greater upper limb to lower limb ratio in this cohort, compared to reports from other sports.[7-9,15,16] Similar findings have been noted by previous reports on field hockey fracture epidemiology.[9] This high incidence of upper limb fractures is reflective of the upper limb involvement of the sport, with significant potential for injury from both the hockey stick and the hockey ball.[5] This provides clear guidance regarding focus for injury prevention strategies in the sport.[4]

Regarding fracture types, we found finger phalanx fractures to have an incidence of 0.02/1000 population and metacarpal fractures to have an incidence of 0.01/1000 population. This reflects a similar incidence to previous studies, with field hockey noted to be the sixth most common cause of sport-related finger phalanx fractures and the fifth most common cause of sport-related metacarpal fractures.[7] Regarding the mechanism of injury, we found that stick and ball contact provided the highest cause of fracture, again in keeping with the common modes of injury reported by previous studies.[5] Such information provides valuable direction for the planning of injury prevention equipment in the sport.[13]

We recorded a return to field hockey rate of 89% for our whole cohort, with a return to the same level or higher in 78% and a mean duration of return to field hockey of 11 weeks. In comparison to previous studies on other sports, this represents a reduction in return time to the sport (13–15 weeks).[15,17] This is likely a reflection of the high proportion of upper limb injuries within our cohort, which have been well documented to take a shorter time to return to sport compared to lower limb injuries.[15-17]

Regarding our survival analyses, we found that the operatively-managed fractures had prolonged return times compared to the conservatively-managed fractures, though with comparable return rates. Similar findings have been reported in previous studies, with operatively-managed fractures being recorded to take three times longer to return to the sport than conservatively-managed fractures.[15] Such prolonged return times are often a consequence of the more severe injuries requiring surgical intervention, as well as the effects of postoperative rehabilitation restrictions. Conversely, we found that patients over 30 years of age had lower return rates than those under 30 years, although with similar return times. This again is in keeping with previous studies, who found that patients over 30 years of age had a 3–5 times increased chance of no return compared those <30 years.[15,16] It would appear advancing age is a key factor in deciding to stop sport postinjury.

Regarding the distribution of fractures among the different play positions, we found these were distributed evenly through all four positions. To note, goalkeepers have previously been recorded to have the highest rate of injuries.[4] However, they also have been recorded to have lower rates of hand fractures than other players due to the use of gloves.[6] The study results are reflective of this, with goalkeepers having lower rates of hand fractures than the other positions, but having higher rates of other fractures; this then results in a similar overall fracture incidence among the positions. This shows the benefit of protective handwear against such injuries and should be considered in future injury prevention programs.[6,13]

There are several limitations to our study. The first involves the limited number of patients: this reflects the frequency of participation in this sport in our region; given our study covered a 1-year period, we feel the cohort provides a sufficient representation of the fracture patterns in this sport within our region. The second limitation relates to the follow-up process. While clinical review could have provided

more reliable information, the authors have successfully performed a number of similar studies using preformed telephone questionnaires.[15,16] A further limitation relates to the retrospective follow-up data. While prospective follow-up data would have been preferred, the standard clinical follow-up for the majority of the fracture types in the study was not sufficient to allow for this.

Conclusions

We present the first comprehensive study into the epidemiology, management, and outcome of field hockey-related fractures in a known general UK population. While field hockey related fractures represent a limited portion of all sport-related fractures, they comprise a significant proportion of all field hockey-related injuries, resulting in one of the longest return times to the sport. Accurate knowledge of their epidemiology, management, and the outcome is vital to medical staff managing field hockey teams, to allow optimization of these injuries. Future injury prevention programs are likely to reduce the incidence of such injuries, particularly the use of protective handwear.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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