

Is There a Weekend Effect in the Management of Maxillofacial Trauma Patients?

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ABSTRACT

Background: Many previous studies have shown that patients admitted to the hospital at weekends have a longer delay than those on weekdays. It has been proposed that the equality of specialist services throughout the week could mitigate the 'weekend effect.' This study aimed to determine whether or not a weekend effect is observed in Oral and Maxillofacial surgery patients at a medical college and teaching hospital.

Methods: Our primary predictor variable was the day of admission. Our primary outcome of interest was the length of hospital stay from admission to operation. Descriptive analysis, correlation analysis, One way ANOVA, and post hoc comparison were performed for statistical analysis.

Results: Out of 1185, 1005 (84.8%) were male and 180 (15.2%) female, with a mean age of 30.3 (SD=14.1) years. There was a significantly higher admission on weekends, Friday, and Saturday, and the weekend admissions were associated with a longer delay from admission to operation. The night shift was also associated with a longer delay from admission to operation. The diagnosis based procedure had the most significant effect on delay from admission to operation. The patient's age and gender had no association with the primary outcome.

Conclusions: There is a delay in the definitive treatment of maxillofacial surgery patients admitted on weekends. These findings have implications for adequate staffing and resource allocation on the weekends based on admission volume.

Keywords: Evidence-based health care; length of stay; maxillofacial injuries

INTRODUCTION

Over the past decade, there has been a great interest in clinical settings with the so-called 'weekend effect' in hospital care.¹ This term refers to the perception that there is an increased risk of adverse outcomes and increased mortality in patients admitted into the hospital on weekends, compared to the other weekdays.² Reduced availability of specialist personnel, beds, operation theatre facilities and the reduced access to ancillary medical services, age, gender, and diagnosis at the time of admission and comorbidities, may also determine these patient's clinical outcomes.³

Studies have shown that this 'weekend effect' phenomenon is present in conditions or surgical procedures, which are time-sensitive, including general trauma and orthopaedic surgery.⁴ Our hypothesis is that weekend admissions are related to longer delay from admission to operation in maxillofacial trauma patients independent of age, gender, and diagnosis compared to weekday admissions.

METHODS

Following institutional review board (IRB) approval, we performed a retrospective analysis of all consecutive maxillofacial surgery patient's medical records, admitted under our unit for 18 months (January 2018-October 2019). Patients of all ages, with a diagnosis of soft tissue injury, maxillofacial fracture, and secondary corrective surgery for traumatic defects related to previous trauma, were included. Maxillofacial surgeries related to trauma require urgent care, usually within 48 hours of presentation, but are not emergency procedures. Exclusion criteria comprised of patients operated for other diagnoses not related to maxillofacial trauma, as the workup time for these elective cases are significantly different compared to the workup of maxillofacial trauma patients, which is managed on an urgent basis. Pregnant patients and patients with multiorgan injuries primarily managed by other departments were also excluded because of significant physiological differences, affecting the length of stay.

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De-identified data on demographic variables, diagnosis for admission, time and date of admission, and length of stay from admission to the operation were retrieved from the hospital's electronic health record system. Our primary outcome of interest was the length of stay from admission to operation recorded in days. We considered this length of stay from admission to operation as our primary outcome based on similar outcome measures reported in previous studies and the only length of stay outcome not affected by the length and type of operation.⁵ Our primary predictor variable was the day of admission, with Friday and Saturday considered weekends. Our secondary predictor variable was duty shift, categorized into day (6 AM- 6PM) and night (6 PM-6 AM). Age group, gender, and diagnosis were considered covariates.

The Sample size calculation was performed based on the primary outcome. At a significance level of .05 and 95% confidence interval and with an absolute error of 1 (error of 1 day more or less than the mean length of stay), the known standard deviation in published literature is three days for admission to operation time; hence, the calculation resulted in a sample size of 318.⁶ To compensate for the missing data and removal of the extreme statistical outliers during statistical analysis, a 20% reduction in sample size was assumed and compensated for, after which the minimum sample size of 800 was assumed. Convenient consecutive sampling was used from January 2018 to December 2020 to ensure an adequate sample size for inferential statistics. This study was provided ethical clearance by the IRB after review (reference number 2020-080). Data were analysed with Statistical Package for the Social Sciences (SPSS) software for macOS version 20. A descriptive summary was produced, and normality tests were performed with the Shapiro-Wilkes test to determine the accurate and robust statistical analysis suitable for the data type. Outlier analysis was performed, and extreme outliers were removed to clean the data using SPSS for MacOS version 24.

Frequency tables were drawn for the analysis of the weekday and day/night variations of admissions. A correlation matrix was drawn to see the association between all the variables, and Spearman's Rho was used as the coefficient of association as it is less sensitive to data distribution. Analysis of Variance with Welch's test was performed to investigate the interaction and effect of predictor variables on the primary outcome. Subgroup analysis was planned if the significant variation is observed within predictor variables. The significance level was set at 0.05, with a 95% confidence interval.

RESULTS

Table 1. Demographic and temporal characteristics of maxillofacial trauma.

Age	
Mean (SD)	30.3 (14.1)
Range	1.0 - 86.0
gender	
Female	180 (15.2%)
Male	1005 (84.8%)
Age group	
1-5 years	31 (2.6%)
6-15 years	72 (6.1%)
16-25 years	412 (34.8%)
26-35 years	328 (27.7%)
36-45 years	190 (16.0%)
46-55 years	83 (7.0%)
56 and above	69 (5.8%)
Day of Admission	
Sunday	195 (16.5%)
Monday	180 (15.2%)
Tuesday	163 (13.8%)
Wednesday	163 (13.8%)
Thursday	162 (13.7%)
Friday	160 (13.5%)
Saturday	162 (13.7%)
Duty shift	
Day	589 (49.7%)
Night	596 (50.3%)
Diagnosis/procedure	
Secondary corrective surgery for traumatic defects	191 (16.1%)
STI (Soft Tissue Injury)	564 (47.6%)
ORIF (Open Reduction and Internal Fixation)	430 (36.3%)
Admission to Operation	
Mean (SD)	1.5 (2.4)
Range	0.0 - 18.0

Our total sample size was n=1185 which is larger than calculated minimal sample size, and is always beneficial as it increases the power of study. There were no missing cases in any of the variables. The baseline demographic frequencies are detailed in table 1. Out of 1185, 930 (78.5%) were in the 16-45 years age group. There was no significant variation seen in the number of admissions based on weekday or weekend. The number of admissions

during day and night were almost equal. Maxillofacial fractures requiring Open reduction and internal fixation (ORIF) were the most common diagnoses, followed by soft tissue injury (STI) and secondary corrective surgery for traumatic defects. The median length of stay from the admission to the operation was one day with a range from 1-18 days.

To test our hypothesis, a correlation matrix was drawn to see the association between all the variables (Table 2). There was a weak association between age group and gender of patients. The diagnosis/procedure had a weak association with both the age and gender of the patients. The duty shift was associated with the age group, gender, and diagnosis/procedure. The day of admission was also associated with the type of procedure though the association was weak (based on p-value and rho-value, see table 2). Our primary outcome, time from admission to the operation, was associated with the day of admission, duty shift, and the diagnosis/type of procedure. There was no association between our

primary outcome and age or gender of the patients.

Since our primary outcome, admission to operation time, is not normally distributed, even after removal of extreme outliers, as confirmed by Shapiro-Wilk test, we performed non-parametric tests to analyse the variance. Mann Whitney U test for the duty shift variable, which has two levels, was performed, and the result was statistically significant (U=163727, p=0.033). Analysis of variance with a Welch's ANOVA reported a statistically significant variation based on the day of admission, F(6,513) = 3.73, p = .001 and Diagnosis/procedure F(2,545) = 54.4, p <0.001, thus our hypothesis was not rejected.

Games Howell Post hoc test (not assuming equal variance) was performed for subgroup analysis based on the admission day, which showed a significant variation with Saturday admissions compared to Sunday, Monday, Tuesday, and Thursday. Wednesday and Friday admissions were not associated with significant variation compared to Saturday admissions (Table 3).

Table 2. Correlation of predictor variables with the outcomes.

	Statistical results	Age group	Gender	Diagnosis/procedure	Day of admission	Day or Night
Gender	Spearman's Rho P-value	0.061 0.036*				
Diagnosis/procedure	Spearman's Rho P-value	0.054 0.063	0.076 0.009*			
Day of admission	Spearman's Rho P-value	0.014 0.636	0.011 0.709	0.140 <0.001**		
Day or night	Spearman's Rho P-value	0.059 0.041	0.073 0.012	0.337 <0.001**	0.128 0.016	
Admission to Operation	Spearman's Rho P-value	0.011 0.693	0.008 0.794	0.256 <0.001**	0.062 <0.001*	0.062 0.033*

Table 3. Post hoc comparison between the day of admission shows a significant variation on Saturday admissions compared to weekdays.

		Mon	Tue	Wed	Thu	Fri	Sat
Sun	Mean Difference P-value	0.123 0.995	0.157 0.983	0.550 0.270	0.072 1.000	0.587 0.223	1.109 0.002**
Mon	Mean Difference P-value		0.033 1.000	0.427 0.653	0.050 1.000	0.464 0.581	0.986 0.016**
Tue	Mean Difference P-value			0.393 0.751	0.084 1.000	0.430 0.682	0.952 0.026**
Wed	Mean Difference P-value				0.477 0.498	0.038 1.000	0.560 0.632
Thu	Mean Difference P-value					0.515 0.429	1.037 0.008**
Fri	Mean Difference P-value						0.522 0.719

DISCUSSION

Our study was designed to investigate the association between the day of admission in maxillofacial surgery with the length of stay outcomes from admission to operation to inform evidence-based personnel and resource allocation.

Results show that a significant proportion of maxillofacial trauma admissions take place during the night shift. The weekend admissions on Friday and Saturday were associated with a delay from admission to operation. The diagnosis and planned procedure in increasing order from soft tissue injury (STI), secondary corrective surgery for traumatic defects to ORIF were associated with higher admission to operation time. The weekend effect of delayed admission to operation time was independent of the duty shift and procedure type.

Patients admitted with maxillofacial injuries need specialist care from the initiation of the treatment, and human resources planning of specialists and staff is an important consideration to plan for appropriate allocation in a hospital.⁷ We observed a higher admission rate for ORIF and STI during the night hours than the day hours. Previous studies on diurnal admission patterns of road traffic accident-related trauma have reported higher admission rates at night or off-hours than during the daytime.^{8,9} This pattern has been explained by low luminance, headlight glare, low contrast clothing worn by pedestrians, and driver's slow reaction time during low visibility conditions.^{10,11} Some studies have shown an "off-hour effect" in the care of trauma patients and the admissions at night shift have a delay in initiation of treatment.^{8,9} Staffing, duty hours, and operating room availability based on off-hours volume of admission may mitigate the care pathway's variation and ultimately improve patient outcome and satisfaction.

Multiple studies have found that there were proportionally more admissions at the weekends than on weekdays, which was also observed in our study.^{5,12,13} The association of an increased number of facial injury-related admissions was also reported by other studies, which showed a significant number of weekend admissions were related to alcohol intoxication.^{14,15} The number of people with an illegal blood alcohol concentration (BAC) is significantly higher during weekends than during the workweek.^{16,17} Previous studies have shown that patients admitted to the hospital at weekends have worse outcomes and delayed length of stay than those on other days, also called the "weekend effect."^{11,12,18} A variation based on the day of admission was observed in our study, and we observed a delay in admission to

operation on weekends. This weekend effect observed in our study could be related to the reduced staffing and non-availability of operating rooms and personnel on weekends. The volume of admissions based staffing and availability of specialist services even on weekends could solve the disparity.

Though we excluded concomitant polytrauma from our study sample to reduce confounding, many other physiological and socioeconomic parameters could have affected the results of a non-random sample. Findings from observational studies are useful for policy forming and hypothesis generation. This study aims to provide useful data for adequate staffing and resource allocation, with implications for patient care and preparedness. There is a variation in the presentation of maxillofacial surgery patients based on the duty shift and weekdays. Although the diagnosis and planned operative procedure remains the primary predictor of admission to operation time, the weekend and night shift variation on the volume and type of maxillofacial injury patients dictate the staffing, training, and resource allocation in hospitals. Though current study's findings are from a single institution, these findings might be similar in other centres of the country and provide an insight into the situation and improve preparedness.

CONCLUSIONS

Findings of this study confirm that there is a delay in the definitive treatment of maxillofacial surgery patients admitted on weekends in a representative teaching hospital which receives proportionate number of maxillofacial injuries. These findings have implications for adequate staffing and resource allocation on the weekends based on admission volume.

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