

Outcomes of common general surgery procedures for patients discharged over weekends at a tertiary care hospital in Saudi Arabia

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BACKGROUND: Hospitals usually reduce staffing levels and services over weekends. This raises the question of whether patients discharged over a weekend may be inadequately prepared and possibly at higher risk of adverse events post-discharge.

OBJECTIVES: To assess the outcomes of common general surgery procedures for patients discharged over weekends, and to identify the key predictors of early readmission.

DESIGN: Retrospective cohort study.

SETTING: A tertiary care center.

PATIENTS AND METHODS: Patients discharged from general surgery services during the one-year period between January and December 2016 after cholecystectomy, appendectomy, or hernia repairs were included. Patient demographic information, comorbidities, and complications as well as admission and follow-up details were collected from electronic medical records.

MAIN OUTCOME MEASURES: Outcomes following weekend discharge, and the predictors of early readmission.

SAMPLE SIZE: 743 patients.

RESULTS: The operations performed: 361 patients (48.6%) underwent a cholecystectomy, 288 (38.8%) an appendectomy, and 94 (12.6%) hernia repairs. A significantly lower number of patients were discharged over the weekend (n=125) compared to those discharged on weekdays (n=618). Patients discharged during the weekend were younger, less likely to have chronic diseases, and had a significantly shorter average length of stay (LOS) (median 2 days, IQR: 1, 4 vs. median 3 days, IQR: 1, 5, $P=.002$). Overall, the 30-day readmission rate was 3.2% (n=24), and weekend discharge (OR=2.25, 95% CI 0.52–9.70) or any other variable did not predict readmission in 30 days. However, 14-day post-discharge follow-up visits were significantly lower in the weekend discharge subgroup (83.1% vs. 91.2%, $P=.006$).

CONCLUSION: Weekend discharge was not associated with higher readmission rates. Physicians may consider discharging post-operative patients over a weekend without an increased risk to the patient. Day of discharge, length of stay and increased patient age are not predictors of early readmission.

LIMITATIONS: Single-center study and retrospective.

CONFLICT OF INTEREST: None.

During weekends, hospitals are not usually as well-staffed as during the week and may have limited access to diagnostic and therapeutic interventions. Previous research has shown adverse health outcomes for patients undergoing surgery over the weekend.¹⁻⁴ Furthermore, several studies showed worse outcomes, including higher mortality rates, for patients admitted over the weekend.⁵⁻⁷ Outcomes related to surgical services over a weekend might reflect system-based deficiencies that may be detrimental to surgical care.

The timing of discharge can be a predictor of outcomes, including readmission and mortality rates, but previous studies investigating the timing of discharge have shown inconsistent results. For instance, a study on an intensive care unit found that patients discharged during working hours or weekdays have a lower mortality rate and better outcomes compared to patients discharged over weekends or after working hours.⁸ Flythe et al revealed that patients on maintenance dialysis had a 35% rate of readmission within 30 days of discharge and weekend discharge was a predictive factor.⁹

In contrast, a study conducted in California showed that discharge of patients over weekends after major surgery was not associated with increased early readmission rates.¹⁰ A second study by Cloyd et al. reported similar readmission rates among patients with heart failure and pneumonia discharged over the weekend, despite a shorter length of stay (LOS) in hospital and lower availability of outpatient resources.¹¹ This raises the issue that LOS might be increased by avoiding discharges on the weekend. Previous studies showed that discharging fewer patients over a weekend compared to being discharged on a weekday, resulted in unnecessary increases in the LOS.^{12,13}

In the field of general surgery, studies assessing differences in patient outcomes between weekend versus weekday discharges are rare. Studies on this issue will contribute to improving the quality of care and reducing healthcare costs. This knowledge is critical because procedures such as appendectomies, cholecystectomies and hernia repairs are common and performed on a daily basis.¹⁴ In this study, we tested the hypothesis that patients discharged over a weekend have worse outcomes compared to patients discharged on a weekday. The aim of the study was to reduce the knowledge deficit related to the outcomes of common general surgery procedures for patients discharged over weekends, and to identify the key predictors of early readmission.

PATIENTS AND METHODS

This retrospective study included all adult patients who

underwent an appendectomy, a cholecystectomy or a hernia repair procedure during the one-year period between January and December 2016 at King Abdulaziz Medical City, National Guard Health Affairs, Riyadh, Saudi Arabia. The study was approved by King Abdullah International Medical Research Center. Excluded were age 14 years or younger, pregnancy, and patients transferred to another inpatient facility, and in-hospital mortality.

Subjects were recruited to the study based on the date of admission, and followed-up for 30 days post-discharge. Data extracted from the electronic medical records (EMR) system included baseline demographics (age, sex and smoking status), comorbidities (diabetes mellitus, hypertension and dyslipidemia, coronary artery diseases and asthma/chronic obstructive pulmonary disease), admission and follow-up details. The authors of this study collected this data and followed up patients through the EMR system. Details about admission and discharge included the date and day of admission and discharge, admission type (elective or unplanned), length of stay (LOS), complications, the discharge team, and post-discharge follow-up.

Patients were divided into two groups according to the day of discharge. The first group (n=618) was the weekday discharge subgroup (defined as Sunday through Thursday), and the second group (n=125), the weekend discharge subgroup (defined as Friday and Saturday). Hospital readmission and emergency department (ED) visits were defined as the first unplanned inpatient hospitalization or ED visit for any reason 30 days after discharge from general surgery services. Details on readmission and ED visits included the primary diagnosis, number of days post-primary discharge, LOS, major complaint and the number of ED visits.

All statistical analyses were performed using IBM SPSS version 20 (<https://www.ibm.com/products/spss-statistics>). Categorical variables were represented by frequency and percentage, and continuous variables by mean and standard deviation, and median and interquartile ranges. Baseline patient characteristics of the weekday and weekend discharge subgroups were compared using Pearson's chi-squared tests and Fisher's exact tests for binary or categorical variables and t-tests and Mann-Whitney tests for continuous variables. To assess the association of weekend discharge with 30-day readmission rates, 30-day ED visits and 14-day post-discharge follow-up, Pearson's chi-squared tests and Fisher's exact tests were used. Univariate and multivariable logistic regression were used to identify significant predictors of 30-day readmission with control for potential confounders including age, gender, length

of stay, presence of complication, and admission type. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated. $P < .05$ was considered to indicate statistical significance.

RESULTS

Of the 743 cases included between January and December 2016, 361 (48.6%) had a cholecystectomy, 288 (38.8%) an appendectomy and 94 (12.6%) a hernia repair. Significantly fewer patients were discharged over the weekend (n=125) compared to those discharged on weekdays (n=618) (**Figure 1**). Compared with patients discharged on weekdays, patients discharged on weekends were younger (median 30 vs. 37 years, respectively; $P < .001$), less likely to have chronic diseases, such as diabetes (11.2% vs. 20%, $P = .021$) and hypertension (11.2% vs. 21.1%, $P = .011$) (**Table 1**). Patients discharged over a weekend had a significantly shorter average LOS [(median 2 days, IQR: 1, 4) vs. (median 3 days, IQR: 1, 5), $P = .002$]. In addition, some of the patients (8.2%, n=61) had complications during admission (**Table 2**). The most common complications were intra-abdominal collection (1.9%, n=14) followed by atelectasis (1.2%, n=9) and wound infection (0.6%, n=5).

There were no statistically significant differences for patients being discharged on a weekend or a weekday in terms of either 30-day readmission rates (1.6% vs. 3.6%, $P = .26$) or 30-day ED visits (14.9% vs. 10.5%, $P = .19$) (**Table 3**). Most of the patients had an outpatient follow-up visit with a clinician in the first two weeks after discharge (89.6%, n=666); however, the number was significantly lower among patients discharged over a weekend (83.1% vs. 91.2%, $P = .006$).

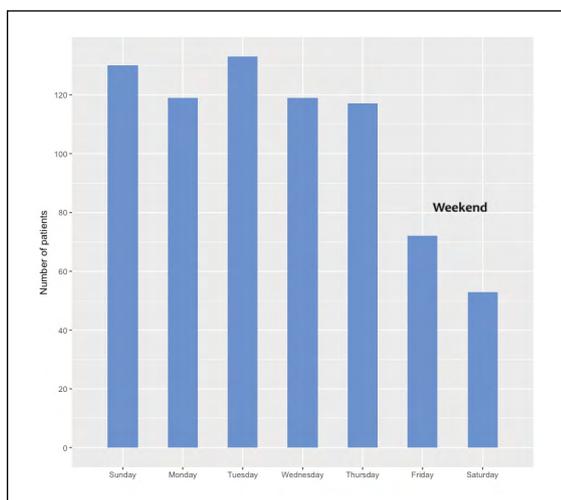


Figure 1. Number of discharged cases by day of the week.

Table 1. Demographic and baseline characteristics of 743 patients discharged on weekends and weekdays.

Variables	Weekday discharge (n=618)	Weekend discharge (n=125)	P value
Age (median, IQR) (y)	37 (26, 53)	30 (24, 43)	<.001
Sex (%)			
Male	288 (46.6)	58 (46.4)	.97
Female	330 (53.4)	67 (53.6)	
Smoking (%)			
Yes	79 (13.7)	17 (14.4)	.84
No	498 (86.3)	101 (85.6)	
Diabetes mellitus (%)			
Yes	123 (20)	14 (11.2)	.02
No	493 (80)	111 (88.8)	
Hypertension (%)			
Yes	130 (21.1)	14 (11.2)	.01
No	485 (78.9)	111 (88.8)	
Dyslipidemia (%)			
Yes	77 (12.5)	9 (7.2)	.09
No	539 (87.5)	116 (92.8)	
Coronary artery disease (%)			
Yes	31 (5)	3 (2.4)	.21
No	586 (95)	122 (97.6)	
Asthma/COPD (%)			
Yes	59 (9.6)	13 (10.4)	.77
No	558 (90.4)	112 (89.6)	
Admission type (%)			
Elective	154 (24.9)	20 (16)	.03
Unplanned	464 (75.1)	105 (84)	
Type of surgery			
Laparoscopic	590 (95.6)	120 (96)	.85
Open	27 (4.4)	5 (4)	
Complications during admission (%)			
Yes	56 (9.1)	5 (4)	.06
No	560 (90.9)	119 (96)	
Length of stay (Median, IQR) (days)	3 (1, 5)	2 (1, 4)	.002

IQR - interquartile range, COPD - chronic obstructive pulmonary disease.

Table 2. Postoperative complications.

Complication	Number of patients (%)
Intra-abdominal collection	14 (1.9)
Atelectasis	9 (1.2)
Wound infection	5 (0.6)
Postoperative pyrexia	5 (0.6)
Arrhythmia	5 (0.6)
Acute kidney injury	3 (0.4)
Wound hematoma	3 (0.4)
Pneumonia	2 (0.3)
Urinary retention	2 (0.3)
Unspecified complications	13 (1.7)

The reasons for unplanned readmission were various. Twenty-four (3.2%) of the discharged patients were readmitted within 30 days. Hepatobiliary-related reasons including common bile duct stones and bilioma were the most common causes of readmission followed by intra-abdominal collection and pancreatitis. Almost two-thirds of the patients (n=15) were readmitted within the first two weeks, with a median LOS of 6 days (IQR: 5, 9).

Univariate logistic regression analysis showed that being discharged over a weekend was not associated with a higher 30-day readmission rate (OR=2.25, 95% CI 0.52–9.70) (Table 4). However, increased age (OR=1.01, 95% CI 1.01–1.04) and LOS (OR=1.06, 95% CI 1.01–1.11) were all significantly associated with the need for readmission. In the multivariable logistic regression analysis, after controlling for age, LOS and time of discharge, age and LOS showed weak associations with readmission.

Table 3. Analysis of outcomes associated with weekend discharges.

Variables	Weekday discharge (n=618)	Weekend discharge (n=125)	P value
30-day readmission (%)			
Yes	22 (3.6)	2 (1.6)	.26
No	596 (96.4)	122 (98.4)	
30-day Emergency department visits (%)			
Yes	92 (14.9)	13 (10.5)	.19
No	526 (85.1)	111 (89.5)	
14-day follow-up (%)			
Yes	563 (91.2)	103 (83.1)	.006
No	54 (8.8)	21 (16.9)	

DISCUSSION

Contrary to our hypothesis, weekend discharge following an appendectomy, a cholecystectomy or a hernia repair procedure was not associated with either a higher 30-day readmission rate or number of 30-day ED visits. Similarly, previous studies showed that weekend discharge for patients undergoing a major surgery or discharged from a general medicine department was not associated with higher readmission rates or ED visits.^{10,15} Our results support the relative safety of discharging this category of post-operative patients during the weekend, indicating that routine delay of discharge until Sunday is not justified.

The results of the present study revealed an early readmission rate of 3.2%. Similarly, prior research showed that the 30-day readmission rate after procedures such as cholecystectomy, appendectomy and hernia repair ranged from 2.4% to 8%.¹⁶⁻²⁰ Factors such as admission type, co-morbidities, or the discharging team were not found to be predictive of 30-day readmission. Contrary

Table 4. Logistic regression analysis of variables predicting 30-day readmission.

Predictors	Univariate			Multivariable		
	P value	Odds ratio	95% CI	P value	Odds ratio	95% CI
Weekend discharge	.28	2.3	.52 (9.70)	.4	1.9	.43 (8.22)
Age	.04	1.01	1.01 (1.04)	.22	1.0	.96 (1.01)
Length of stay	.02	1.1	1.01 (1.11)	.3	1.0	.87 (1.04)

-2 log-likelihood: 206.146, Hosmer and Lemeshow P=.140

to our hypothesis, patients discharged by a non-primary team did not experience more adverse events, specifically higher readmission rates, which may indicate the effectiveness of the discharging physicians and the current system. However, further studies are required to investigate this subject.

The findings of this study demonstrate that patients who were discharged over weekends have significantly lower early follow-up rates. The period immediately following hospital discharge is critical, and patient follow-up with physicians is required to promote a successful recovery. Field et al²¹ identified several factors associated with fewer follow-up visits including younger age, longer LOS and surgery during the index hospitalization. The lower number of outpatient follow-up consultations in the current study could be attributed to the higher demands placed on the discharging physicians during weekends. Consequently, physicians might forget to schedule a follow-up appointment or fail to inform patients of the importance of the follow-up. We recommend that physicians who discharge patients during the weekend encourage early follow-up to improve the uniformity of care.

Compared to patients discharged on weekdays, the current study indicated that patients discharged over weekends had a shorter LOS. Previous research showed that a lower frequency of patients discharged over the weekend was associated with an increase in LOS.²²⁻²⁴ Various factors may lead physicians to delay discharge to weekdays, including insufficient access to diagnostic or therapeutic interventions, waiting for a skilled nursing facility placement or unavailable post-discharge service scheduling.^{22,23} All these reasons may reflect inefficiencies in the healthcare system during weekends, which lead to unnecessary hospital days and more stress for the patients and their families.

Patients discharged on weekends tended to be younger in age and less likely to have chronic diseases such as diabetes mellitus, hypertension, dyslipidemia, coronary artery diseases and asthma/COPD, which is supported by a previous study on general medicine patients discharged during the weekend.¹⁵ The characteristics of these patients could also explain the shorter

LOS in patients discharged over weekends, since this category of patient usually does not need further medical intervention. Furthermore, it is easier to manage young, healthy post-operative patients by on-call physicians, without the need to consult or wait for the primary team. However, outcomes of weekend and weekday discharges are similar regardless of patient characteristics and LOS. With sufficient staffing and knowledge about the case, on-call physicians may discharge older and co-morbid patients on weekends without the fear of worse outcomes.

This study has several inherent limitations. First, our findings are derived from one tertiary care center in Saudi Arabia, which may not be generalizable to other hospitals. The results of this study may underestimate the rate of readmission, since there is no unified record system to detect other hospital readmissions. Future studies should be designed using a multi-centric approach to detect possible differences in outcomes of weekend discharge compared with those of the present study. However, the strengths of the present study include investigating various outcomes related to weekend discharge, including readmission, ED visits, post-discharge follow-up as well as investigating predictors of early readmission following post-operative discharge.

In conclusion, for general surgery services, patients discharged during the weekend were younger in age, less likely to have chronic diseases, and had significantly shorter LOS. Although a lower proportion of patients are discharged during a weekend, the rate of hospital readmission is not higher than that for patients discharged on a weekday. In hospitals with adequate health care staffing, appropriate organization of care protocols and established discharge systems, physicians may consider discharging post-cholecystectomy, appendectomy and hernia repair patients over a weekend without an increased risk to the patient. The practice of surgery should be equally good every day. In this study, day of discharge, LOS, increased patient age and other variables are not predictors of early readmission. These findings may be useful in the development of healthcare quality improvement programs to optimize protocols and reduce costs.

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