

Comparison of post-operative mortality between early and late weekdays surgery

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ABSTRACT

Objective: To compare the mortality rates between surgeries done on early weekdays (Monday to Thursday) to those conducted on late weekdays and weekends (Friday to Sunday).

Methodology: This case control study was conducted at the Department of Surgery in Pakistan Institute of Medical Sciences Islamabad. Hospital record of all adult patients who had undergone surgery over a period of one year from June 2017 to May 2018 was obtained and divided according to the day of surgery into weekdays surgery group and weekend surgery group for analysis.

Results: A total of 772,997 patients presented in the OPD and 441,321 patients presented in the Emergency and Accident (EAC) department in one year with a male to female ratio of 1.63. Day to day breakdown revealed that more patients presented on Mondays and Saturdays. A total of 2,832 surgeries were performed in one year, out of which 62.46% (n=1,769) were performed on weekdays and 37.54% (n=1,063) were performed on weekends. Higher risk surgeries and surgeries with more operative complexity were performed on weekends as compared to weekdays however in both groups most of the surgeries fall in Intermediate risk. More deaths were seen on weekdays as compared to weekends in General surgery wards and ICU (statistically insignificant P=0.1446) however day of surgery caused no difference in mortality on Neurosurgery and other departments.

Conclusion: No significant difference was observed in mortality based on surgeries performed on early or late weekdays.

Keywords: Mortality, Post operative, Weekend, Weekdays

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Introduction

The health care delivery system is unique in the sense that it provides cover to society on a 24/7 basis even during wartime. However, Fraser et al¹ studied the effect of convenience or preferably called physician convenience as a factor on patient outcome. Later MacFarlane A² in England and Wales and Mangold W³ in Arkansas USA found an effect related to the day of the week on patient outcomes. These two studies found evidence that there is a significant effect of the day of surgery on the outcome of the procedure in terms of

complications and mortality. In England and Wales, a week cycle was observed, where birth rates were more concentrated during early weekdays and relatively less numerous on weekends. Though the number of birth rates was relatively less on late weekdays or weekends, a higher newborn mortality rate was observed on weekends.² A similar trend was observed in Arkansas USA with higher neonatal mortality on weekends and it was reported that there was a 27% higher mortality rate on Sundays than that of weekly average mortality. Aiken et al⁴ in the USA studied how staffing levels affect patient outcomes and found that surgical patients experience

higher risk adjusted 30 day mortality and failure-to-rescue rates related to staffing levels which aggravate on week ends.³ In similar research, Needleman J. et al⁵ examined all cases of in hospital mortality and found that weekend admissions have an association with higher complication rate and in hospital mortality, if compared to patients admitted on early weekdays. They proposed relatively less access to diagnostic and interventional procedures to be contingent upon the day of admission.⁶

A meta-analysis on the databases from 1966 to 2013 was carried out to find if there is a weekend effect in hospitalized patients, revealed that patients admitted on weekends had a higher mortality rate irrespective of differences in staffing and procedure rates in the media spotlight.⁷ However, soon it was challenged^{8,9,10} and disputed. A study published in BJS concluded that there was no difference in short and long term mortality among the surgeries performed on early weekdays, middle weekdays, or during the week end.⁹ However, some thought that this challenge to a common sense notion was a methodological bias in reporting.¹¹ This article effectively eliminated a notion where Dr. Foster unit hospital had concluded in a study and effectively proved that claims in variation in hospital mortality standardized ratios from Dr. Foster unit reflects the difference in the quality of care and are less than credible.¹¹ An analysis by Nick Freemantle¹² et al reveals that weekend admissions after robust adjustment for case mix, carries a higher 30 day mortality risk compared to mid-week admissions however, those patients who were already admitted to the hospital before the weekend, revealed a reduced rate of mortality.¹²

Among these factors, weekend effect was particularly in media spotlight leading the UK Government to implement a series of changes to ensure a 24/7 hospital care across NHS.^{6, 11, 12, 13} It is because of this reason that we were intrigued to study the phenomenon of the weekend effect in our own set up as a representative of data in a developing country, like Pakistan.

Annually 321.5 million surgical operations are required to address the burden of disease of a global population of 6.9 billion in 2010¹⁴, with variations noticed as seen in Central Latin America where minimum surgery requirement is 3,383 procedures per 100,000 population and in West Africa with a need of 6,495 procedures per 100000 population.¹⁴ In order to meet this demand total surgeries performed globally in 2014 estimated to be about 312.9 million which is 38.2% higher than that

reported in 2004.¹⁵ In a developing country like Pakistan, the rate of surgical procedures is low, with almost 411 surgeries performed per 100000 people annually.¹⁶ The rate of mortality is reportedly high in Pakistan with 55/100000 per person mortality in cases of trauma and acute abdomen and an even higher maternal mortality ratio estimated at 8.9/1000 deliveries.¹⁶

With an increased number of surgical cases, common sense dictates that morbidity and mortality are going to increase. It is therefore imperative to study the influence of the weekend effect, to help policymakers to look into it.

Methodology

This case control study was carried out at the Departments of Surgery and allied, Pakistan Institute of Medical Sciences, Islamabad, Pakistan after obtaining approval from the Ethical review board and Research Board of PIMS, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan. The study looked into the records of patients presenting in the adult age group at the PIMS during a period of 1 year from June 2017 to May 2018. Data was collected retrospectively using non probability purposive sampling technique. All adult age patients requiring surgical operations during this time period were included in the study.

The variables studied were age, sex, date of admission, date of discharge, day of admission, day of surgery and length of hospital stay. The procedures were categorized as high risk, medium and low risk, depending upon the Graham Comorbidity Index and operative Complexity was defined by taking into consideration the British United Provident Association (BUPA) schedule of procedures, because no such data is available in the local literature. The procedures were defined as high, low and intermediate risk depending upon the predefined strata of risk. The high risk procedures were defined as the procedures with pre-defined risk of Peri-operative Mortality Rate (POMR) of more than 10%. The low risk procedures were defined as less than 1% risk of POMR and moderate risk 1-9.9% risk of POMR. The results were entered into SPSS version 21 and statistical analysis was done using means and frequencies.

Results

A total of 772,997 patients presented in OPD at Pakistan Institute of Medical Sciences, out of which 53,253 patients (6.9%) presented in Surgery OPD. A total of

Table I: Diagnosis and procedure category amongst patients presenting on weekdays and weekends.

Demographic details	Monday to Thursday	Friday to Sunday	P values
AGE (mean)	41	47.4	P=0.009557 (sig)
Gender			
Male	1080(61.09%)	628(59.1%)	
Female	689(38.91%)	435(40.9%)	
Co-Morbidity Chalon Score			
0	1596(90.22%)	989(93.03%)	P=0.00745 (not significant)
1	136(7.69%)	58(5.46%)	
2	30(1.7%)	14(1.32%)	
3	7(0.39%)	2(0.19%)	
Diagnosis			
Cancer	89(5.04%)	39(3.68%)	P=0.00078 Significant
Trauma/injury	526(29.73%)	25(23.6%)	
Other	1154(65.23%)	773(72.72%)	
Procedure			
category	1117(63.14%)	599(56.35%)	P=<0.00001 Significant
Git/abdominal	332(18.77%)	140(13.17%)	
Skin/soft tissue	49(2.77%)	18(1.69%)	
Vascular	271(15.31%)	306(28.79%)	
Other			
Risk Category			
<1	1304(73.71%)	758(71.31%)	P=0.000219 (Significant)
1-9.9	294 (16.62%)	226(21.26%)	
>10	70(3.96%)	72(6.77%)	
MISSING	101(5.71%)	7(0.66%)	
Operative complexity			
Minor	526(29.74%)	316(29.73%)	P=0.022 (Significant)
Intermediate	786(44.43%)	499(46.94)	
Major	362(20.45%)	174(16.37%)	
Complex major	95(5.37%)	74(6.96%)	

441,321 patients presented in the Emergency and Accident Centre (EAC). The ratio of OPD attendance to Emergency attendance was 1.75. In the EAC 81.72% (360,626) patients were new admissions while 18.28% (80,695) were already registered patients.

In EAC, during one year 248,297 patients presented on week days (Monday to Thursday) while 193,024 patients presented on weekends (Friday to Sunday). In day to day breakdown, more patients were presenting on Mondays (63,904) and Saturdays in most of the weeks (74,932). Male patients accounted for 62% (273,626) while 38% (167,695) were female patients. The male to female ratio was 1.63. Sex distribution according to days of the week showed there were more male patients on weekdays as compared to weekends (61.09% versus 59.1%; P=0.885) however in both categories male patients were more than female patients. On weekends patients were more likely to be from the older age group than on weekdays (mean age 41 on weekdays versus 47.4 on weekends; P=0.00957).

The total number of surgeries performed in one year were 2,832 out of which 1,769 (62.46%) were done on weekdays with a mean of 442 per weekday per year and 1,063 (37.54%) on weekends with a mean of 354 per weekend day per year. Diagnosis of patients is broadly classified into Cancers, Trauma, and Others (including infectious diseases, hernias, vascular diseases etc). Cancer patients were operated more on weekdays than weekends. Also, there were more trauma cases from Monday to Thursday. The majority of the patients in both groups belonged to the 'other' category. There was a significant difference in diagnosis and procedure category amongst patients presenting on weekdays and weekends as shown in Table I. Commonest discipline of procedure in both weekdays and weekends was gastrointestinal and abdominal followed by skin and soft tissue category in Weekdays group and 'other' category in a weekend group.

Most patients undergoing surgery had risk category <1 with 1,304 (73.71%) of weekday procedures and 758 (71.31%) of weekend procedures falling in this category. Higher risk surgeries were performed on weekends as compared to weekdays (P=0.00219). Operative complexity was significantly higher on weekends as compared to weekdays (P=0.022) however highest number of procedures fall under the Intermediate category [786 (44.43%) for weekdays and 499 (46.94%)] for weekends). Charleston Comorbidity Index revealed no significant difference among both groups (p=0.00745).

Mortality was higher on Wednesdays (n=37) followed by Mondays (n=33) in ICU settings as shown in figure 2. No significant difference was observed on mortality by day of surgery in Neurosurgery and other departments.

Discussion

Ahmed et al found that in Northern Pakistan the rate of surgery in rural areas is 124/100 000 patients per year which is way below US where the incidence of surgery is 8253/100 000 patients per year.¹⁷ In rural areas of Pakistan, it is reported that the annual incidence of trauma-related surgeries is 1531 per 100000, acute abdomen constitutes slightly less incidence with 1364 per 10000 persons and maternal morbidity related surgeries accounted for the highest incidence with 16462 per 100000 persons.¹⁶ Most of the patients sought specialist surgical help quite late in the course of disease and male predominance was noticed in trauma and acute abdomen categories.¹⁶

Ramsay et al reported that there were 81,446 ER general surgery admissions under National Health Services hospitals in a year in Scotland.¹⁸ They observed that mean age of patients was 53 years which is more than the median age found in our study, and there were more female patients than male (55% versus 45%)¹⁸ as opposed to our study which revealed larger population visiting emergency was male, both on weekends and weekdays. The incidence of surgery in these patients was about 25% (n=20,292) of the total admissions recorded in NHS.¹⁸ In our study annual cases of surgery, both elective and emergency, in our

hospital were reported to be 2,832 while the total patients presenting in Surgical OPD was above fifty thousand.

In our study diagnoses of Trauma and Cancers were exceeded by 'other' category including acute abdominal cases and infective etiologies etc. According to a survey

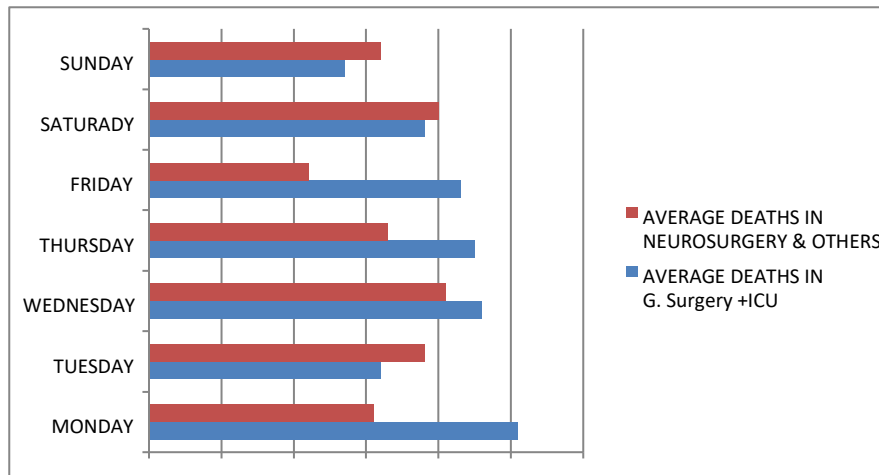


Figure 1. Comparison between mortality in git, vascular, skin, soft tissue, abdominal & thoracic related procedures and ICU care v/s mortality in general surgery, neurosurgery and other related procedures

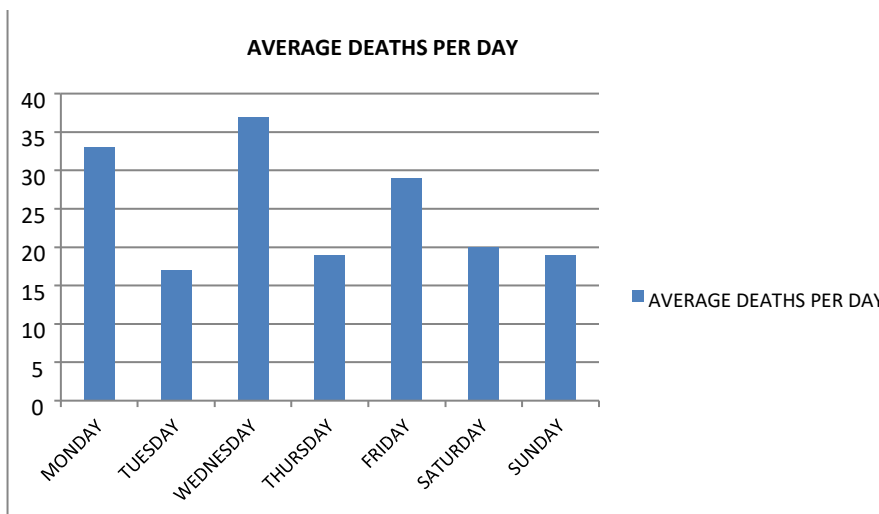


Figure 2. ICU deaths based on the day of surgery/admission

More deaths were noticed in patients undergoing surgery on weekdays than on weekends in General Surgery wards and ICU (43.5 versus 36.3) as shown in figure1 however the difference is not statistically significant (P=0.1446).

conducted in Northern Pakistan, obstetric cases contributed as the highest incidence diagnosis observed in the surgical and allied Emergency department, followed by trauma and acute abdominal cases.¹⁶ In Scotland, the record of NHS shows that the most common diagnoses in General Surgery emergencies was non-specific abdominal pain in 20.2% of the patients, followed by Cholecystitis in 7.2% patients, Constipation in 3.4% cases and Pancreatitis, Diverticular disease and Appendicitis each accounting for 3.1% of the total number of patients presenting in Emergency.¹⁸ Out of a total of 1,196 cases of Emergency department analyzed by researchers, GIT diseases were found to constitute almost 15.5% cases which were the most prevalent category in the Emergency department in Kerala Institute of Medical Sciences, India.¹⁹

This claim was refuted by Ozgediz who observed that in the surgical global burden of disease, 38% contribution is from trauma followed by malignancies (19%)²⁰ and other surgical cases. He also reports that higher morbidity in surgical disability adjusted life years was found in South East Asia.²⁰ According to NHS data from Scotland¹⁸ most, commonly performed procedures were abdominal surgeries, (Appendectomy accounted for 13.1%) which is consistent with the findings of our study where GIT/Abdominal procedures were most frequently performed on both weekdays and weekends.

In a study conducted in Japan, it was found that higher co-morbidity based on the Charlson comorbidity index causes an increase in post operative mortality and complications.²¹ However, in our study co-morbidity had no significant impact on the postoperative mortality. In a study conducted at Taiwan²² similar findings to our study were reported and revealed that there was no significant increase in mortality due to co-morbidity however the increase in complications was noticed. Minto et al reports²³ that globally there is a risk of permanent disability or death in 0.4-0.8% patients after surgical procedures are performed and this population holds a large proportion of high risk individuals.

In this study, we could not find a statistically significant difference in the mortality between patients admitted on weekdays and weekends. In a study conducted on NHS Trusts in England, it is reported that there was increased Mortality in patients admitted on weekends (OR 1.11, P<0.0001)²⁴ due to fewer surgeons and lower staffing, with overall mortality rates ranging from 1.6% to 8.0%. Similar findings were reported in researches conducted in

England, USA, by Agrawal et al and in a meta analysis conducted from 1966 to 2013 which revealed a higher incidence of mortality on weekends.^{2,3,6,7} A systematic review and meta-analysis carried on 4,027 citations revealed that there was a graded increase in the mortality of patients who underwent emergency surgeries as the weekdays passed and weekend approached, with lowest mortality on Monday (OR=1) followed by OR=1.04 on Tuesday, OR=1.08 on Wednesday, OR=1.12 on Thursday and OR= 1.24 on Friday.²⁴ There was also increased mortality after being admitted on weekends compared with weekdays.²⁵

Conclusion

In this study, most surgeries comprised of GIT cases, were from low risk category and intermediate operative complexity. There was no statistically significant difference observed in post-operative mortality among surgeries performed on early weekdays and late weekdays and weekends.

This study can help in improving outcomes of surgical procedures by developing a schedule for high risk, intermediate risk, and low risk surgeries divided into early or late weekdays so that maximum efficacy is shown while performing surgical procedures.

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