

Burden of Surgery in Saudi Arabia, an Experience of a Tertiary Academic Hospital: A Longitudinal Descriptive Study

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ABSTRACT

Introduction: Surgery has a significant positive impact on human life. In fact, major disability and mortality can be prevented by providing appropriate surgical interventions. Since Lancet published the report about global burden of disease (GBD), increasing attention has been paid to surgical care and its importance in the post-2015 development plan of the World Health Organization. Surgical diseases account for about 11%–25% of the GBD, and 234 million surgeries are performed annually worldwide. Thus, our study aimed to assess the burden of surgery among hospitalized patients, which is an important step toward providing a better surgical care.

Method: This longitudinal descriptive study was conducted from January 2004 until the end of 2019 at King Abdulaziz University Hospital in Jeddah, Saudi Arabia. We included all admitted patients who underwent major surgeries, except for caesarean sections and other obstetric surgeries. Data about variables, including total number of patient admission, operation per patient, and operation per procedure, were assessed for the evaluation of the total burden of surgery (TBS) among the admitted patients.

Results: During the observation period, there were 642,810 admitted patients, and the mean annual number of admissions was 40,175. The daily rate of major surgical procedure was 22.70 and a total of 13,2578. The TBS among all admitted patients was 21%, and the burden of surgery among all emergency admissions was 31%. Meanwhile, the burden of surgery among all elective admissions was 19 %.

Conclusion: Surgery is considered important burden among patients admitted to our institution. Further studies must be conducted to achieve better surgery care in the region and health care resource planning.

Key words: Surgery, Global Burden of disease, Burden of surgery, Essential surgery

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INTRODUCTION

Surgery has a significant positive effect on human life. In fact, major disability and mortality can be prevented by providing appropriate surgical interventions. Several fatal conditions, including congenital diseases, malignancies, and serious injuries, can be effectively managed with surgery [1-4]. Notably, there has been an epidemiological shift of disease pattern toward a new pattern that is correlated to prolonged life expectancy and that requires surgical interventions. In addition, the rapid global motorization of the transportation system resulted in injuries that caused significant burden related to surgical services in most countries worldwide [3,5,6].

Since Lancet has published the report about the global burden of disease (GBD), increasing attention has been paid to surgical care and its importance in the post-2015 development plan of the World Health Organization (WHO). Surgical disease accounts for about 11%–25% of the GBD, and 234 million surgeries are performed annually world [7]. In the study of Rose J et al., major surgery was required in 28% of all admitted patients in the USA, with a total of 10 million major surgeries performed in 2010 [8]. However, accessibility to a safe surgery is extremely poor in most low- and middle-income countries (LMICs). Moreover, about 30% of the global population does not have access to surgery. According to the Lancet commission on global surgery in 2015, 143 million additional surgical procedures are required annually to cover the GDB. In total, 5000 surgical procedures per 100,000 populations are targeted annually to improve surgical services worldwide [7].

A growing body of evidence refuted the perception that surgery is extremely expensive and is beneficial only to a portion of the population [9]. From a public health standpoint, surgery has a large public burden, and it is a highly successful treatment and is considered cost-effective. In 2015, a resolution passed by the World Health Assembly has strengthened emergency and essential surgical care and the use of anaesthesia. This resolution is an important component of universal health coverage and is considered an essential part in achieving the Post-2015 United Nations Development Agenda [7,10].

Only few local studies have examined the burden of surgical diseases [11]. Thus, the current study aimed to assess the burden of surgery among hospitalized patients, which is an important step toward providing a better surgical care.

METHOD

Setting

The study was conducted at King Abdulaziz University Hospital (KAUH), a teaching hospital of King Abdulaziz University in Jeddah from January 2004 until the end of 2019. KAUH is a major tertiary care and teaching centre, with an 800-bed capacity, in the western region of Saudi Arabia. Jeddah is a major metropolitan city on the Red Sea coast, with a population of approximately 2,867,446 individuals in 2020. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed in reporting our methods and results. The study protocol was approved by the Unit of Biomedical Ethics of King Abdulaziz University and the Academic Affairs of King Abdulaziz University Hospital.

Study design

This was a longitudinal descriptive study that evaluated the burden of surgery among hospitalized patients in our institution. In addition, the number of emergency and elective surgeries during the observation period was assessed.

Study participants

All admitted patients were included in the study, and the number of major surgeries performed at KAUH during the observation period was assessed. Outpatient surgeries that meet the definition of major surgical procedures were included. However, obstetric interventions and caesarean sections, minor surgeries, and non-invasive procedures performed outside the operating room were excluded.

Data sources and measurement

From 2004 to 2019, we obtained data about the number of admission and major surgery from the hospital

information system (HIS). These data included the total number of admitted patients, elective and emergency major surgeries. Based on the data from the New Zealand's National Minimum Dataset, Hider et al. defined major surgery as any procedure requiring general or neuroaxial anaesthesia in an inpatient or day-surgery setting [12,13].

Study variables

The units of analysis are the number of "patient admission", "Major surgery per patient" and "Major surgical procedure". These variables represent the capability of each patient to seek admission on multiple occasions and to undergo multiple major surgical procedures during the study period. Then, we calculated the total burden of surgery (TBS) by dividing the total number of admitted patients who underwent a major surgery with the total number of admissions during the observation period. Emergency burden of surgery (ERBS) was calculated by dividing the total number of emergency patients who underwent a major surgery with the total number of emergency admissions during the period of observation. Meanwhile, elective burden of surgery (EBS) was calculated by dividing the total number of elective patients who underwent a major surgery with the total number of elective admissions during the observation period.

Statistical methods

A descriptive analysis of the findings was performed, and variables were presented as counts and frequency and percentages and mean (with SD) and median (with interquartile range) for continuous variables. Statistical analysis was conducted with SPSS (IBM, Armonk, NY) and Excel (Microsoft, Redmond, WA).

RESULTS

The current study showed that during the observation period, there were 642,810 admitted patients, with an annual mean number of 40,175.6. The primary category for admission was elective, with a total of 536,370 patients (83.4%; Table 1). In total, 136,200 patients underwent major surgery, with an annual mean of 8,512.5. (Table 2). The total number of major surgeries was 132,578, with an annual mean of 8,286.1. The primary category for major surgical procedure was elective, with a total of 106,208 procedures (80.1%; Table 3). The TBS among all admitted patients was 21.2 %, and the ERSB was 31.1%. Meanwhile, the EBS was 19.2% (Table 4).

Table 1: Total number of hospital admissions during the observation period from January 2004 until the end of 2019.

Hospital Admission			
Variables	Elective	Emergency	Total
Number of Patients	536,370	106,440	642,810
Mean ± SD	33,523.1 ± 5,635.0	6,652.5 ± 4,691.8	40,175.6 ± 4,456.7
Median (Q1-Q3)	32,256.0 (29,536.8-37,644.8)	4,468.5 (3,632.0-9,646.5)	40,077.0 (37,400.8-45,023.3)
Percentage (%)	83.4	16.6	

Table 2: Major Surgery per patient during the observation period from January 2004 until the end of 2019.

Major Surgery Per Patient			
Variables	Elective	Emergency	Total Number of Patients Who Underwent Surgery
Patients Who Underwent Major Surgery	102,886	33,111	136,200
Mean ± SD	6,430.4 ± 595.8	2,069.4 ± 525.9	8,512.5 ± 759.9
Median (Q1-Q3)	6,385.0 (6,234.3-6,740.0)	2,114.5 (1,963.0-2,371.5)	8,614.0 (8,051-9,090.5)
Percentage (%)	75.5	24.3	-

Table 3: Major surgery procedure during the observation period from January 2004 until the end of 2019.

Major Surgery Procedure			
Variables	Elective	Emergency	Total Number of Major Procedures
Procedures	106,208	26,370	132,578
Mean ± SD	6,638.0 ± 604.9	1,648.1 ± 680.9	8,286.1 ± 841.7
Median (Q1-Q3)	6,607.0 (6,403.5-6,969.0)	1,809.0 (1,227.5-1,961.8)	8,152.0 (7,873.8-9,049.5)
Percentage (%)	80.1	19.9	

Table 4: Burden of surgery among admitted patients during the observation period from January 2004 until the end of 2019.

Burden of Surgery Among Admitted Patients	
Elective Burden of Surgery (EBS)*	19.20%
Emergency Burden of Surgery (ERBS)**	31.10%
Total Burden of Surgery (TBS)***	21.20%
*Elective Burden of Surgery (EBS) = (Elective Patients Who Underwent Major Surgeries/Total Number of Elective Patients)*100	
**Emergency Burden of Surgery (ERBS)=(Emergency Patients Who Underwent Major Surgeries/Total Number of Emergency Patients)*100	
***Total Burden of Surgery (TBS)=(Total Number of Admitted Patients Who Underwent Major Surgeries/Total Number of Admitted Patients)*100	

DISCUSSION

The current study showed that surgical diseases is a significant burden among hospitalized patients in our institution. Moreover, about a quarter of admitted patients in our institution underwent a major surgery, and the value was within the range (approximately 11%–25%) in the report of the Lancet commission about global burden of surgery [7]. In addition, in the study of Rose J et al. 28% of all admitted patients in the USA require a major surgery. Unlike in a previous GBD study, the dichotomous assumption of surgery categorization was not considered in the current study. In fact, surgery was found to be involved in all disease subcategories in a GBD study conducted in 2010 [8].

Moreover, the study highlighted the magnitude of surgical load among emergency admissions. In the literature, there is a wide variability about the definition of ERSB due to the non-standardization of definitions and metrics [4,14]. However, the volume of emergency surgeries varied between LMICs and high-income countries (HICs). The emergency surgical load is heavier in LMICs than in HICs [15,16]. Generally, this result reflects a better access to surgical health care in HICs. However, this is beyond the scope of the current study [7,12,14]. Al-Mulhim, et al. has reported that the number of emergency surgical admission was higher than half of all surgical admissions in the author's institution. However, only one subset of surgical diseases was included during the short study period [11].

The current study showed the significant volume of surgeries in our institution. Le Brun *et al.* have assessed the volume of surgeries in LIMCs, and results showed a low surgical volume [15]. In fact, the total health expenditure per capita was the most important variable, and it was positively correlated to surgical rate. The mean annual number of operations per hospital in LIMCs was up to 3,215 [7,15]. The surgical volume in our institution was predominantly elective surgery, which is like that observed in HICs. However, the proportion of emergency admissions among the total admission was only 17%. The number of elective surgeries was more likely to be higher than that of emergency surgeries, and this tendency is worth evaluating. However, this is not included in the scope of the current study.

Caesarean sections and other obstetric emergencies were not included in the study. Obstetric care is considered a separate entity from surgery in the WHO Millennium development plan [4]. Meanwhile, the current study highlighted the burden of surgery, other than obstetric surgeries, to better focus on surgical care [3].

This study considered the importance of highlighting the burden of surgical diseases in the region among other health issues. Moreover, it covered a protracted period of 16 years, with a large sample size. Consequently, the study results can be used by future researchers in establishing a hypothesis for achieving a better surgical health care in the region.

The current study had several limitations. That is, the variables used in this study varied in different HISs. Therefore, we adopted a more conservative calculation, which might have an impact on the accuracy in estimating the burden of surgery. The outpatient's operative system in the hospital was not well developed. In fact, outpatient surgery admissions were recorded in the main hospital admission record system, and the same operative suite was used. However, we included all surgeries that meet the definition of major surgery, as stated in the Method section [12,13]. In addition, the quality of the collected data and the changes in health care policy during the study period were the other limitations of the study, which are like those of longitudinal and cross-sectional studies. Moreover, this might affect surgical case reporting in the data system of the hospital. Moreover, KAUH is a university hospital, which operates under multiple agreements with different health sectors. Thus, the results of this study must be cautiously generalized.

The non-standardized definition of surgery was an important limitation of our study. Rose, *et al.* have limited the definition to only inpatient procedures conducted in the operating room [8]. Meanwhile, Galukande *et al.* have adopted a more liberal definition of surgery [17]. That is, they defined surgery as any procedure that requires suture, incision, excision, manipulation, or other invasive procedures. Based on the information from the New Zealand's National Minimum Dataset, Rose *et al.* defined surgery as any procedure requiring general or neuroaxial anaesthesia in an inpatient or day-surgery setting

[12,13]. This created different unrelated metrics and measures that were used in comparing the current study from other studies, which is not an easy task.

CONCLUSION

Surgical disease is an important burden among the admitted patients in our institution. Thus, further studies must be conducted to achieve better surgery care in the region and health care resource planning.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Unit of Biomedical Ethics of King Abdulaziz University and the Academic Affairs at KAUH approved the study protocol. Informed written consent was obtained from all participants prior to the participation.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIALS

The data sets used and/or analysed during the current study are available from the corresponding author upon request.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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AUTHOR CONTRIBUTIONS

Yahya Almarhabi–Data collection, data analysis, editing of manuscript, drafting of manuscript, and literature review.

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