Emergency general surgery in a public hospital in Malaysia

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ABSTRACT

Introduction: Patients undergoing emergency general surgery (EGS) are at risk for death and complications. Information on the burden of EGS is critical for developing strategies to improve the outcomes.

Methods: In this retrospective cohort study, medical records of all general surgical operations in a public hospital were reviewed for the period 1st January 2017 to 31st December 2017. Data on patient demographics, operative workload, case mix, time of surgery and outcomes were analysed.

Results: Of the 2960 general surgical operations that were performed in 2017, 1720 (58.1%) of the procedures were performed as emergencies. The mean age for the patients undergoing emergency general surgical procedures was 37.9 years (Standard Deviation, ±21.0), with male preponderance (57.5%). Appendicitis was the most frequent diagnosis for the emergency procedures (43%) followed by infections of the skin and soft tissues (31.6%). Disorders of the colon and rectum ranked as the third most common condition, accounting for 6.7% of the emergency procedures. Majority of emergency surgery (59.3%) took place after office hours and on weekends. Post-operative deaths and admissions to critical care facilities increased during EGS when compared to elective surgery, p<0.01.

Conclusions : EGS constitutes a major part of the workload of general surgeons and it is associated significant risk for death and post-operative complications. The burden of EGS must be recognised and patient care systems must evolve to make surgery safe and efficient.

KEYWORDS:
General Surgery, Emergency Surgery, Out of hours, Outcomes

INTRODUCTION

Patients undergoing emergency general surgical (EGS) are generally acutely ill and distinctively at risk for death and complications. It has been reported that those who undergo an emergency operations are up to eight times more likely to die postoperatively compared with patients who undergo the same procedures electively.[1,2] In addition, it has been reported that approximately half of all patients undergoing EGS procedures will develop postoperative complications.[3] Optimal management of emergency surgeries remains a major challenge.[4] The availability of accurate and meaningful information is key to developing strategies to make EGS safe and efficient.

Malaysia, classified by the World Bank as an upper middle-income country, has a dual healthcare system. In Malaysia, the public and the private healthcare sectors, and the two systems exhibit a major disparity in the distribution of expertise and resources. It is reported that the public sector caters for the bulk of the population (~65%) but is served by just 45% of all registered doctors and even fewer specialists (25-30%).[5] There is also a significant variation in surgical practice; with public hospitals performing the bulk of the emergency surgeries while the private hospitals mainly cater for elective procedures. There is pressure on public hospitals to deliver high-quality care despite the limited resources. The 'general surgeons' in the public hospitals play a critical role in the management of a diverse range of surgical conditions. They are the bastions of EGS, and the 'on-call' surgeons manages all the EGS besides meeting the demands of daily routines, including elective surgeries. Typically, the workload of the 'on-call' system is demanding on the general surgeons. The Royal College of Surgeons of England has recommended that, wherever possible, elective surgical services should be separated from emergency services.[6] In Canada and the United States of America, EGS is increasingly recognised as a distinct surgical specialty. In these high resource countries, with the implementation of acute care surgical (ACS) services, surgeons are beginning to have protected time for emergency on-call work.[7]

In considering new approaches to manage EGS in Malaysia, it is important to have a clear understanding of not only the workload and the disease profile but also logistic issues. The aim of this study was to describe the burden of EGS in a public tertiary care facility in Malaysia, with reference to operative workload, disease pattern and the time of the surgery.

MATERIALS AND METHODS

Design and Setting

This study was conducted at Hospital Tuanku Ja'afar (HTJS), Seremban, Negeri Sembilan, Malaysia. HTJS is a tertiary care referral government facility, with more than 1000 beds. The general surgical services of this hospital are managed by general surgeons, many of whom have differentiated into

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upper gastrointestinal, colorectal, and breast and endocrine surgeons. The hospital practices an 'on-call' system, and the on-call surgeon provides a 24-hour coverage for all general surgical emergencies in addition to the daily routines. A dedicated 24-hour operation theatre is allocated for all general surgical emergencies. In this retrospective cohort study, all patients who underwent emergent procedures by general surgeons at HTJS for the period 1st January 2017 to 31st December 2017 were included.

EGS was defined as emergency, unplanned surgical intervention for diseases within the realm of general surgery. Elective surgery was defined as surgical intervention that are planned or booked in advance for a routine admission to hospital. Surgery performed 'out of hours' in this study refers to emergency surgical procedures undertaken outside the normal working hours (08:00 to 18:00 hours), during the weekends and public holidays. EGS cases during this period were also studied as a comparator group. Surgeries performed for trauma were excluded from the study. The American Society of Anesthesiologists (ASA) criteria was used to assess the physical status of patients for the surgery, and the co-morbidities identified included hypertension, diabetes mellitus, chronic obstructive pulmonary disease, bronchial asthma, acute coronary syndrome and cerebrovascular accident. The outcomes that were determined included length of stay, admission to critical facilities and mortality within 30 days of surgery.

Data Collection

Data was obtained from the Computerised Operating Theatre Documentation System (COTDS) of the HTJS.[8] The COTDS is a web-based system that records all surgical operations that take place in all Ministry of Health Hospitals. The system uses a nationally agreed coding for diagnosis and operative procedures to ensure accuracy and consistency. Data extracted from the COTDS included demographic details of patient, e.g., age, gender and the ASA physical status at the time of operation, and details of the operative procedures such as date of operation, preoperative and postoperative diagnosis, surgical procedures performed, particulars of the surgeons, time of procedure, and nature of surgery (elective or emergency surgery). Information of admission and outcome of the patients was obtained from the Patient Management System (PMS). All data that was collected were kept anonymous.

Statistical Analysis

Continuous data were reported as a population mean (±standard deviation, SD) or as a population median followed by the interquartile range (IQR) if data were non-normally distributed. Categorical data were reported as the number of occurrences and the corresponding sample percentage. Unadjusted differences in demographic and case-mix characteristics between patients undergoing EGS versus elective general surgery were calculated using appropriate descriptive statistics, including one-way analyses of variance (normal continuous data), Kruskal-Wallis non-parametric one-way analyses of variance (non-normal continuous data), and Chi-square test (categorical data). All statistical analyses were performed using Statistical Software: IBM SPSS Statistics (Version 25). This study was approved by the Ethical Review Committee of the Ministry of Health Malaysia, Project ID NMRR-18-796-39921 (IIR).

RESULTS

Burden of the Emergency Surgical Procedures

A total of 2960 general surgical procedures were performed at HTJS during the study period. Emergency surgeries accounted for a majority of the surgical procedures (1720, 58.1%). The demographic characteristics of patients who underwent emergency surgeries as compared to elective surgery are shown in Table I. There was male preponderance (57.5%) in emergency procedures, while there was female preponderance in elective surgery (51.1%). The mean age for episodes in EGS was 37.9 years (±21.0), while that for elective surgery was 46.1 years (±20.1). The patients undergoing emergency procedures were younger than those undergoing elective procedures and this difference was statistically significant ($p<0.01$). The age group, 39 years and below, accounted for majority of the episodes in emergency procedures (56.7%). On the other hand, the majority (64.8%) of the episodes for elective procedures occurred in patients 40 years and above. Interestingly, patients undergoing elective surgery had significant more co-existing medical illnesses as compared with emergencies. The relation between the number of comorbidities and the status of surgery was significant, $p<0.01$. Two or more comorbidities were noted in 300 (17.4 %) cases in the patients undergoing emergency surgery as compared to 263 (21.2 %) in elective surgery. However, patients undergoing emergency surgery were more at risk for surgery as compared to elective surgery. The relationship between ASA status and status of surgery was significant, $p<0.01$. (Table 1)

Timing of Emergency General Surgery

A significant number of emergency surgical procedures (1020, 59.3%) were performed out of working hours. It was also noted that during weekdays (Mondays to Fridays), more than half of the emergency procedures (51.6%) took place out of hours. The single dedicated operation theatre was only able to cope with 612 (60.0%) of EGS performed out of working hours and additional operation theatres were used for the other operations.

Surgical Disorders in Emergency General Surgeries

Table II shows the common surgical disorders performed as EGS and the common age groups. Appendicitis was identified as the most frequent surgical disorder (43%), decreasing in frequency with advancing age, ranging from 35.3% in those below 20 years of age to 4.6% in those more than 60 years. The second most common surgical disorder in EGS was infections of skin and soft tissue, and these included abscesses, carbuncles and necrotising fasciitis, accounting for 31.6% of the episodes. The median age for patients with infections of skin and soft tissue was 44 years (±18.9). Disorders of the colon and rectum were the third commonest surgical condition, and they accounted for 6.7% of the emergencies, and the frequency increasing with age. Other surgical disorders performed as EGS included urology (5.3%), small bowel (4.1%), hernia (3.2%), biliary (2.5%) and peptic ulcer (1.9%) disorders.

Table I: Patient characteristics in emergency and elective general surgery

Total Episodes (n=2960)	Elective (n=1240)		Emergency (n=1720)		
	n	%	N	%	p-value*
Gender, n (%)					<0.01
Female	634	51.1	731	42.5	
Male	606	48.9	989	57.5	
Age groups, y, n (%)					<0.01
0-19	139	11.2	370	21.5	
20-39	298	24.0	605	35.2	
40-59	436	35.2	416	24.2	
60-79	349	28.1	290	16.9	
≥80	18	1.5	39	2.2	
Number of Comorbidities, n (%)					<0.01
0	679	54.8	1084	63.0	
1	298	24.0	336	19.5	
2	205	16.5	226	13.2	
>2	58	4.7	74	4.3	
ASA status, n (%)					<0.01
Class I	524	42.3	918	53.4	
Class II	716	57.7	536	31.2	
Class III	0	0.0	194	11.3	
Class IV	0	0.0	72	4.1	

*Two-sided p<0.05 considered statistically significant; taken from Pearson $\chi 2$ tests for categorical variables, one-way ANOVA for continuous age, and Kruskal-Wallis one-way ANOVA for non-normally distributed continuous duration of stay. ANOVA, Analysis of variance.

Table II: Frequency of surgical disorders in emergency general surgery

	Age group (years)									
	ALL		<20		20-39		40-59		≥60	
Diagnostic category	n	%A	n	%B	n	%B	n	%B	n	%B
Appendicitis	740	43.0	261	35.3	357	48.2	88	11.9	34	4.6
Infective disorders of skin/soft tissue	543	31.6	60	11.0	174	32.0	201	37.0	108	20.0
Colorectal disorders	116	6.7	3	2.6	13	11.2	39	33.6	61	52.6
Urological disorders	92	5.3	25	27.2	17	18.5	18	19.6	32	34.8
Small Bowel disorders	71	4.1	18	25.4	13	18.3	19	26.8	21	29.6
Complications of hernias	55	3.2	2	3.6	11	20.0	16	29.1	26	47.3
Biliary disorders	43	2.5	0	0.0	6	14.0	17	39.5	20	46.5
Complications of peptic Ulcer	32	1.9	0	0.0	9	28.1	8	25.0	15	46.9
Vascular disorders	26	1.5	1	3.8	4	15.4	9	34.6	12	46.2
Breast Disorders	1	0.1	0	0.0	1	100.0	0	0.0	0	0.0
Thoracic Disorders	1	0.1	0	0.0	0	0.0	1	100.0	0	0.0
Total	1720	100.0	370	21.5	605	35.2	416	24.2	329	19.1

A: Percentage in total of disorders; B: Percentage in the same disorder.

Table III: Outcomes associated with elective and emergency general surgery

Outcomes	Elective surgery		Emergency surgery		P value
Duration of stay, days, median (IQR)	2 (IQR: 0-4)		3 (IQR: 2-6)		<0.01
HDU admission, n (%)	14	1.1	86	5.0	<0.01
ICU admission, n (%)	15	1.2	69	4.0	<0.01
30-day mortality	0	0.0	86	5.0	<0.01
Total out of hours, n (%)	0	0.0	1020	59.3	<0.01
Out of hours (Monday to Friday only), n (%)	0	0.0	526	51.6	

Outcomes of Emergency General Surgery

Table III compares the outcomes of EGS with elective surgery. The median length of stay for EGS is significantly longer than that of elective surgery, p<0.01. The table also shows a significant difference in the utilisation of critical facilities such as high dependency unit (HDU) and intensive care unit (ICU) between EGS and elective surgery, p<0.01. There were 86 mortalities in the EGS, whereas there no mortality in elective surgery.

DISCUSSION

This study identified EGS as a significant component (58 %) of the workload of general surgeons. In many low-and middle-income countries (LMICs), at least 60 percent of the surgical operations performed are for emergencies.[9] It has been reported that the prevalence of EGS has surpassed that of other highly studied public health problems, including newly diagnosed cancers and new onset diabetes.[10] Emergencies account for more than 80% of deaths in general surgery, and complication rates for emergencies exceed those of a similar elective operation by five-fold.[11,12] In Malaysia, a report on the perioperative deaths identified emergency surgery as a significant risk factor accounting for 85% of all perioperative deaths.[11] EGS carries a significant burden of risk and in our cohort of patients who underwent EGS, we noted a mortality rate of 5%. Patients undergoing EGS also experienced longer length of stay and increase in the utilisation of critical facilities such as HDU and ICU when compared to patients for elective surgery.

Deaths and post-operative complications in EGS most commonly occur in the patients who were categorised as 'high-risk'. These groups of patients would consist of mainly older patients, with co-existing medical illness and who have advanced surgical conditions. Successive National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reports have also shown that most deaths occur in older patients, who undergo major surgeries, and who have severe co-existing disease.[13,14] Unlike developed countries which experience a larger geriatric population in EGS, our patients were relatively young with a mean age of 37.9 years (±21.0). The discrepancy in the age distribution may be attributed to differences in surgical pathology of the patients. Patients who were 60 years and above accounted for 19.1% of the emergency surgical episodes. With the rapidly changing patient demographics in Malaysia, especially the aging population, the surgical risk associated with emergency surgeries is expected to increase significantly. We used the ASA physical status classification system to stratify patients' risk of surgery. Nearly 47% of the episodes were recorded to have ASA II and above and there was a strong association of age with ill health. The ASA grading system helps define the physical status of the patient; unfortunately, it does not indicate the acute physiological status of the patient. We hope in future more, an effective 'risk stratification' tools will be used to help us accurately identify the subgroup of patients who will be at 'high-risk' surgery. This will facilitate objective triaging and clinical decision making.

Data on the range and complexities of the surgical disorders are useful information because they have serious implications in the planning and development of EGS services. The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) in a three-year retrospective study of 198 hospitals revealed appendectomy (67.51%), colorectal resection (19.71%) and cholecystectomy (12.77%) being the most commonly performed emergency surgical procedures.[15] In our study, appendectomy was also identified as the most frequent procedure, accounting for 43% of the EGS. Most patients who underwent this procedure were below the age group of 39 years, but no age group of patients were exempted. Since appendectomy is a common general surgical emergency procedure, there has been a suggestion for it to be used as a surrogate marker to evaluate quality in surgical management.[16] Infections of the skin and soft tissues ranked the second most common surgical disorder, contributing to nearly 32% of the episodes in EGS. The term "skin and soft-tissue infections" describes a wide heterogeneity of clinical conditions ranging from cutaneous abscess to severe life-threatening necrotising fasciitis. Because of its aggressive character of the necrotising soft tissue infections it is important for us to differentiate that from non-necrotising infection.[17] The prevalence of necrotising fasciitis was common in our study because of poor glycaemic control of our diabetic patients. Effective management of patients with severe soft tissue infections involves prompt recognition, resuscitation, and timely surgical debridement. Delay in diagnosis and treatment of these infections increases the risk of mortality. Diseases of the colon and rectum was the third most common diagnostic group and it accounted for 6.7% of the emergency surgical episodes. In the report on perioperative deaths in Malaysia, diseases of the colon and rectum ranked as the second most important diagnosis of perioperative mortality next to trauma.[11] Most patients in the perioperative review presented with obstruction or perforation of the colon and rectum. Patients presented late, often with faecal peritonitis and advanced sepsis.

At HTJS, common urological conditions are managed by the general surgeons. Urological emergency accounted for 5.3 % of the emergency procedures. Many of the conditions can be attributed to Malaysia's ageing population and increase in benign prostatic hyperplasia, a common cause of acute urinary retention. Other common surgical emergencies include disorders of the small bowel (4.1 %), mainly due to adhesions, hernias (3.2%), biliary (2.5 %) and complications of peptic ulcer (1.9%).

The spectrum of surgical conditions in EGS managed by general surgeons in Malaysia is wide and varied. In recent years, general surgeons in Malaysia have increasingly advanced their practice into upper gastrointestinal, colorectal, hepatobiliary, and breast and endocrine fields of surgery. Despite the differentiation, they are required to play a pivotal role in the management of surgical emergencies. The results of this study indicate that if 'general surgeons' continue their 'on-call' roles and manage EGS, they must develop competency in managing a diverse range of general surgical emergencies regardless of their expertise in subspecialty.

The NCEPOD has highlighted that out of hours surgery is inefficient and contributes to increased perioperative

morbidity and mortality.[14] Although HTJS offers a dedicated 24-hour emergency theatre for general surgery, the number of surgeries conducted out of hours in this study was substantial (59.3 %). The allocation of a single dedicated operation theatre in HTJS for EGS is inadequate. The level of care at out of hours is of a lower standard because personnel may be less experienced and there may be inadequate support for critical care. The delay in time of arriving to the surgery department or to operating theatre and further delay either in optimising or availability of operating theatre and personnel may increase chances of morbidity and mortality. The NCEPOD comments that many of out of hours could potentially be managed during working hours. Better planning and resource allocation may improve access to emergency theatres during normal working hours and avoid unnecessary out of hours surgery.[14]

CONCLUSIONS

This study has shown that patients undergoing EGS constitutes a major part of the workload of the general surgeons in the public hospitals in Malaysia. EGS is associated with increased risks for death and post-operative complications. The current workforce planning and allocation of hospital resources for EGS may be inconsistent with the demands. It is imperative that we review our patient care systems in Malaysia and make EGS safe and efficient.

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REFERENCES

1. Havens JM, Peetz AB, Do WS, Cooper Z, Kelly E, Askari R, et al. The excess morbidity and mortality of emergency general surgery. J Trauma Acute Care Surg 2015; 78: 306-11.
2. Havens JM, Olufajo OA, Cooper ZR, Haider AH, Shah AA, Salim A. Defining rates and risk factors for readmissions following emergency general surgery. JAMA Surg 2016; 151(4): 330-6.
3. Kassin MT, Owen RM, Perez SD, Leeds I, Cox JC, Schnier K, et al. Risk factors for 30-day hospital readmission among general surgery patients. J. Am. Coll. Surg 2012; 215: 322-30.
4. Coccolini F, Kluger Y, Ansaloni L, Moore EE, Coimbra R, Fraga GP, et al. WSES worldwide emergency general surgery formation and evaluation project. World J of Emerg Surg 2018; 13(1): 13.
5. Quek DK. The Malaysian healthcare system: a review. Paper presented at: Intensive Workshop on Health Systems in Transition; 2009 Apr 29-30; Kuala Lumpur.
6. Scott JW, Olufajo OA, Brat GA, Rose JA, Zogg CK, Haider AH, et al. Use of national burden to define operative emergency general surgery. JAMA Surg 2016; 151(6): e160480.
7. Emergency surgery standards for unscheduled surgical care; Royal College of Surgeons of England: 2011
8. Quality and Standards Unit, Medical Development Division, Ministry of Health Malaysia, July 1999 Computerised Operating Theatre Documentation System. MOH – Quality Manual Perioperative Mortality Review MOH/P/PAK/21.99(QAP)
9. Mccord C, Ozgediz D, Beard JH, Debas HT. General surgical emergencies. In: Debas HT, Donkor P, Gawande A, Jamison DT, Kruk ME, Mock CN, editors. Essential surgery: disease control priorities, vol. 1. 3rd ed. Washington, DC: World Bank; 2016. p. 1-30.
10. Becher RD, Davis KA, Rotondo MF, Coimbra R. Ongoing evolution of emergency general surgery as a surgical subspecialty. J Am Coll Surg 2018; 226(2): 194-200.
11. Kandasami P, Inbasegaran K, Lim WL. Perioperative death in Malaysia: the transition phase from a developing nation to a developed one. Med J Malaysia 2003; 58(3): 413-9.
12. Sørensen LT, Malaki A, Wille-Jørgensen P, Kallehave F, Kjærgaard J, Hemmingsen U, et al. Risk factors for mortality and postoperative complications after gastrointestinal surgery. J Gastrointest Surg 2007; 11(7): 903-10.
13. Campling EA, Devlin HB, Lunn JN. The report of the National Confidential Enquiry into. Perioperative Deaths 1989. NCEPOD, London 1990.
14. National Confidential Enquiry into Patient Outcome and Death. Who Operates When? The 2003 Report of the National Confidential Enquiry into Perioperative Deaths. NCEPOD. London, 2003)
15. Ingraham AM, Cohen ME, Bilimoria KY, Raval MV, Ko CY, Nathens AB, et al. Comparison of 30-day outcomes after emergency general surgery procedures: potential for targeted improvement. Surgery 2010; 148(2): 217-38.
16. Gomes CA, Sartelli M, Di Saverio S, Ansaloni L, Catena F, Coccolini F, et al. Acute appendicitis: proposal of a new comprehensive grading system based on clinical, imaging and laparoscopic findings. World J Emerg Surg 2015; 10: 60.
17. Sartelli M, Guirao X, Hardcastle TC, Kluger Y, Boermeester MA, Raşa K, et al. 2018 WSES/SIS-E consensus conference: recommendations for the management of skin and soft-tissue infections. World J Emerg Surg 2018; 13(1): 58.