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Emergency general surgery and trauma: Outcomes from the first consultant-led service in Singapore

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ABSTRACT

Introduction: There is a significant burden on public health systems from emergency surgical and trauma (ESAT) patients. In Western countries, the response has been to separate acute and elective surgery with the creation of a new sub-specialty: acute care surgery. Dedicated acute units have shown improvements in efficiency and clinical outcomes for patients. The aim of this study was to assess the results of the first such unit in Singapore.

Materials and methods: A retrospective analysis was performed of a 12-month period of acute admissions between May 2014 and April 2015, with comparison of 6-months before and after the creation of the ESAT service. The ESAT service was a consultant led dedicated team managing all daily acute and trauma patients. Demographic, efficiency and clinical outcome key performance indicators were compared.

Results: There were 2527 acute admissions split between the two time periods. The ESAT service (N = 1279) managed soft tissue infections (257, 20%), appendicitis (199, 16%) and biliary disease (175, 14%) most commonly. The most common of the 573 procedures performed were incision and drainage (242, 42%), appendicectomy (188, 33%) and laparotomy (84, 16%). Clinical outcome during the ESAT service included reduction in overall mean length of stay (4.5d to 3.5d, $P < 0.01$) and mortality (24/1248 (1.9%) to 11/1279 (0.9%), $P = 0.03$). Efficiency gains in theatre booking time, ED surgical review and overall costs were also noted.

Conclusion: The creation of an ESAT service has led to improved efficiency of care with no worsening of clinical outcomes for acute general surgical and trauma patients.

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Introduction

Emergency general surgical patients represent a significant global public health burden that until recently has not been well described [1,2]. Coupled with the 'identity crisis' in Trauma surgery secondary to higher rates of blunt trauma, fewer operative cases, incorporation of new technologies into management decisions and declining interest from trainee surgeons, it has led to the birth of a new sub-specialty Acute Care Surgery (ACS) [3–7]. This landmark accomplishment has been followed with great research interest as well as creation of similar programmes and units outside of North America [8–10].

In Singapore, as in much of Asia similar pressures on healthcare delivery exist though change has been slower to arrive. Traditional

models of care are faced with the expectation of meeting high standards for elective targets whilst burdened by the increasing workload that emergency surgery and trauma (ESAT) patients provide. Furthermore the day to day ability to provide senior support and supervision of complex ESAT patients whilst encumbered by elective and scope lists as well as large clinics is a reality most general surgeons do encounter.

Khoo Teck Puat hospital (KTPH) commenced the first ACS service in Singapore in November 2014 [11]. The unit intended to separate acute and elective work streams within the department whilst providing dedicated consultant-led management of all ESAT care. The aim of the current study is to assess the impact of this change within the department.

Materials and methods

KTPH is a busy acute public hospital based in the north of Singapore and manages approximately 2800 acute GS and trauma admissions every year. A 12-month retrospective review was performed comprising two distinct time periods: May–October

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Table 1
Baseline Characteristics and discharge diagnoses of all patients.

| Variable | Pre-ESAT (n = 1248) | ESAT (n = 1279) | P |
|-----------------------------------|---------------------|-----------------|-------|
| Age | 50 (19) | 51 (19) | 0.67 |
| Sex (M:F) | 786:462 | 852:469 | 0.40 |
| Acute appendicitis | 192 (15) | 199 (16) | 0.95 |
| Biliary disease/Pancreatitis | 192 (15) | 175 (14) | 0.25 |
| Diverticular disease | 65 (5) | 75 (6) | 0.53 |
| Soft tissue infection | 221 (18) | 257 (20) | 0.14 |
| Trauma | 98 (8) | 78 (6) | 0.1 |
| Bowel obstruction | 99 (8) | 131 (10) | 0.05 |
| Gastro-intestinal bleed | 64 (5) | 63 (5) | 0.88 |
| Gastritis/Colitis/Gastroenteritis | 82 (7) | 126 (10) | 0.003 |
| Gynaecology | 12 (1) | 14 (1) | 0.89 |
| Hernia | 22 (2) | 33 (3) | 0.20 |
| Non-specific abdominal pain | 108 (9) | 55 (4) | <0.01 |
| Other | 93 (7) | 73 (6) | 0.09 |

Data are number of patients (%).

Other refers to small numbers of patients from a spectrum of disorders grouped together.

2014 before ESAT began and December 2014–May 2015 which was a 6-month period after the service started. Data was collected from existing hospital databases and filtered by discharge discipline, emergency admission type and time period. Individual case files were retrieved if the data was not available in the hospital systems for complete accuracy. The study population consists of every emergency general surgical patient admitted during the 12 month period. Referrals from other inpatient services were not included in this study. The study was funded by the National Medical Research Council (NMRC) centre with hospital ethical approval obtained from the National Healthcare Group (NHG).

Models of care

Prior to the inception of the ESAT service, acute GS admissions followed a typical on call model for each 24-h period. The consultant on call would typically be involved with elective cases, scopes and clinics during the daytime and provided senior cover from home after hours.

The ESAT service is a single-consultant led service Monday-Friday 07:30–16:00 with the team managing all acute GS and trauma admissions. For the time span of the data obtained the principle author (SM) was the consultant in charge of the service. The consultant is present to review all patients each morning and also participate in a mid-afternoon handover to discuss new patients that have been admitted so far. After hours and on weekends the standard on-call roster would continue. Each

morning a handover meeting between the ESAT consultant and the on-call team would occur to discuss each of the patients admitted after hours and the majority of the patients would then be taken over by the ESAT team. If the condition of the patient required further sub-specialty input then the appropriate team (Upper GI, colorectal, hepato-biliary, endocrine, breast) would be contacted to take over management. That proportion of acute patients not transferred to the ESAT team were still included in the analysis for completion. There is no dedicated operating theatre at present.

Data collected

Retrospective review identified all demographic patient characteristics (age, sex) as well as discharge diagnosis and procedure performed. Other data points included priority (P) status of the operation: P1 refers to operation to be performed within 60 min, P2 within 4 h, P3 within 12 h. The admission time in ED and time of review by GS was recorded. Operation notes were reviewed to assess the presence of a consultant in OT as well as the time of the day the case was performed. The length of stay (LOS) was identified as well as the days in intensive care (ICU). The hospital bill size was identified. Re-admissions within 30 days were identified as patients returning with conditions or complications relating to the original diagnosis. Surgical complications were identified through the case records and classified according to Clavien-Dindo [12]. Specifically Clavien grade III–V were reported. All mortalities during both time periods were identified.

Statistics

Data were compared between the two groups: pre and post ESAT time frames. Differences were assessed utilising Student's *t*-test for continuous (p-value for equal/unequal variances) and χ^2 /Fishers Exact test for categorical data with dispersion represented as standard deviation (SD). Analyses were performed using SPSS Statistics for Windows, Version 22.0. (Armonk, NY: IBM Corp.)

Results

The 12 month cohort included 2527 patients of which 1279 were managed after the start of the ESAT service. Baseline characteristics for these two groups are shown in Table 1. No significant differences in age or sex distribution were observed however there were more soft tissue infection and bowel

Table 2
Emergency procedures performed.

| Variable | Pre-ESAT (n = 568) | ESAT (n = 573) | P |
|---|--------------------|----------------|------|
| Appendectomy | 176 (31) | 188 (33) | 0.55 |
| Incision and Drainage/Wound debridement | 208 (37) | 242 (42) | 0.06 |
| Cholecystectomy | 41 (7) | 28 (5) | 0.13 |
| Hernia | 16 (3) | 17 (3) | 0.98 |
| Laparotomy | 94 (19) | 84 (16) | |
| Adhesiolysis | 8 (1) | 6 (1) | 0.78 |
| Bowel resection | 32 (6) | 30 (5) | 0.87 |
| Exploratory and Trauma Laparotomy | 33 (6) | 30 (5) | 0.77 |
| Peptic Ulcer | 16 (3) | 14 (3) | 0.83 |
| Gastric resection | 2 (0.4) | 1 (0.2) | 0.50 |
| Other | 2 (0.4) | 3 (0.5) | 0.50 |
| Thoracotomy | 1 (0.2) | 0 | 0.5 |
| Minor | 33 (6) | 14 (2.4) | 0.01 |

Data are number of patients (%).

Other refers to conditions with small numbers that have been grouped together.

Minor includes procedures such as examination under anaesthesia for perianal disease, tracheostomy and skin lump excisions or repair of lacerations.

**P* < 0.05.

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