



Dedicated emergency theatres improve service delivery and surgeons' job satisfaction

Douglas A. Stupart, David A. Watters, Glenn D. Guest, Vanessa Cuthbert and Shannon Ryan

Department of Surgery, Geelong Hospital and Deakin University, Geelong, Victoria, Australia

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Correspondence

Mr Douglas A. Stupart, Department of Surgery, Geelong Hospital, Ryrie Street, Geelong, Vic. 3220, Australia.
Email: douglasstupart@yahoo.co.uk

D. A. Stupart MBChB, FRACS; **D. A. Watters** ChM, FRACS; **G. D. Guest** MSc, FRACS; **V. Cuthbert** BN; **S. Ryan** BN.

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Abstract

Background: There are well-described benefits to separating emergency and elective surgery. Geelong Hospital lacked the resources to implement a separate acute surgical unit, but instituted daily dedicated emergency general surgery operating sessions, managed by an on-site consultant. This study aims to assess the impact of this on service delivery and surgeons' job satisfaction.

Methods: From 1 February 2011, daily half-day operating lists were allocated for general surgical emergencies. Patients treated on these lists were studied prospectively until 31 December 2011. Theatre waiting times and hospital stay were compared with the previous year. A quality-of-life questionnaire was administered to participating surgeons before the project commenced and after 6 months.

Results: A total of 966 patients underwent surgery during an emergency general surgery admission in the control period, and 984 underwent surgery during the study period. The median time from arrival in the emergency department (ED) to surgery was reduced from 19 (18–21) h in the control group to 18 (17–19) h in the study group ($P = 0.033$). The time from booking surgery to operation was reduced from 4.8 (4.3–5.4) h to 3.9 (3.5–4.3) h ($P < 0.0001$). For patients undergoing emergency laparotomy, the time from booking to surgery was reduced from 3.1 (2.2–4.1) to 2.4 (1.8–2.9) h, and hospital stay was reduced from 13 (11–15) to 10 (9–12) days ($P = 0.0089$). The surgeons' responses to the questionnaires showed improvement in job satisfaction ($P < 0.0001$).

Conclusion: This intervention has improved service delivery for emergency surgery patients, and improved the participating surgeons' job satisfaction.

Introduction

The Association of Surgeons of Great Britain and Ireland¹ and the Royal Australasian College of Surgeons² have both advocated the provision of dedicated emergency surgery theatre space. This is in response to concerns that in many hospitals, emergency surgery was neither planned nor given adequate resources. Emergency surgical patients are therefore made to compete for care with elective patients, to the disservice of both groups. Emergency operations are often delayed until the end of elective surgery lists and performed after hours, in many cases by more junior staff. Conversely, unplanned emergency operations can lead to elective cases being cancelled. This has the potential to lead to suboptimal care of both emergency and elective surgical patients, as well as having a negative impact on the job satisfaction of surgeons.

Parasyn *et al.*³ and Von Conrady *et al.*⁴ reported benefits from creating acute surgical units at tertiary metropolitan hospitals in Australia. In this model of service, emergency surgical cases were managed by a separate acute surgical unit, with arrangements made for routine patient handover at the end of each on-call period. This model of care, although appealing, may not be applicable to smaller regional hospitals.

The Geelong Hospital is a regional hospital with 426 acute beds in Victoria, Australia. All surgical specialty services are provided, except neurosurgery, and the hospital is a regional trauma centre. The general surgery emergency on call service is delivered by 15 surgeons, most of whom have subspecialist private practices.

We implemented a model of emergency surgical care in which daily (Monday–Friday) dedicated emergency general surgery operating sessions were made available, and managed by an on-site

consultant surgeon. This surgeon was responsible for deciding which cases could be booked on the list, and their order (according to urgency). The surgeons were also responsible for treating emergency general surgery patients or delegating that care to a more junior colleague at their discretion. The emergency general surgery operating sessions could be made available to other specialties at the discretion of the supervising surgeon according to urgency and the availability of other operating time.

Resources were not available to fund a dedicated emergency surgical unit, and there was strong cultural resistance from some of the involved surgeons to the concept of routine handover of patients (a potential problem of implementation identified by Parasyn *et al.*³).

The purpose of this study was to assess the impact of this intervention on patient care and surgeons' job satisfaction.

Methods

Patients undergoing emergency General Surgery at Geelong Hospital between 1 February 2011 and 31 December 2011 were studied prospectively. Patients were included if they were admitted to hospital via the emergency department (ED) and underwent surgery during that admission. Patients who had planned admissions were not included in this study, even if they required an unplanned emergency operation during their hospital stay. A similar cohort of patients who were admitted between 1 February 2010 and 31 December 2011 were studied retrospectively as an historical control group.

Data were collected for diagnosis and type of operation, time from arrival at the ED to operation, time from booking theatre to operation, time of surgery and hospital stay.

A questionnaire asking about levels of job satisfaction relating to the emergency workload was given to all 15 surgeons who were allocated these sessions before the emergency operating sessions were introduced, and again after 6 months.

Statistical analysis

The times from ED to theatre, from booking to theatre and hospital stay, were not normally distributed, so the figures are presented as median (95% confidence interval for median) and were compared using the Mann–Whitney *U*-test. Job satisfaction questionnaire results were also compared using the Mann–Whitney method. Categorical data were compared using the chi-squared test.

Results

Nine hundred and sixty-six patients underwent emergency general surgical procedures in the control period, and 984 in the study period. The types of operations performed are listed in Table 1. They were similar between the two groups ($P = 0.40$).

The emergency general surgery operating sessions were utilized for a total of 836 h out of a total of 868 allocated (96%) hours. The theatre lists were used for general surgical emergencies for 617/868 (71%) allocated hours, and for emergencies managed by other specialties for 219/868 (25%) of the allocated hours.

For all cases operated on, the median time from arrival in the ED to surgery was reduced from 19 (18–21) h in the control group to 18

Table 1 Types of operation performed

Operation performed	Control group	Study group
Appendectomy (open or laparoscopic)	305 (32%)	321 (33%)
Laparotomy	160 (17%)	144 (15%)
Incision and drainage of abscess	131 (14%)	157 (16%)
Cholecystectomy (open or laparoscopic)	96 (9.9%)	101 (10%)
Endoscopic procedures	104 (11%)	88 (8.9%)
Hernia operations	42 (4.3%)	59 (6.0%)
Diagnostic laparoscopy ± drainage of cysts of collections	29 (3.0%)	24 (2.4%)
Debridement ± suturing of wound	25 (2.6%)	26 (2.6%)
Minor anorectal procedures (excluding abscess drainage)	15 (1.6%)	16 (1.6%)
Other	59 (6.1%)	48 (4.9%)
Total	966	984

(17–19) h in the study group ($P = 0.033$). The time from booking surgery to operation was reduced from 4.8 (4.3–5.4) h to 3.9 (3.5–4.3) h ($P < 0.0001$).

The times from ED to surgery and from booking surgery to operation for the four most commonly performed types of operations are summarized in Table 2. There was a significant improvement in the times from ED to surgery, and from booking surgery to operation in patients undergoing laparotomy. There was also an improvement in the time from booking theatre to surgery for patients undergoing abscess drainage. There was no change in these times for patients undergoing cholecystectomy or appendectomy.

There was no difference in hospital stay between the two groups overall (3 (3.0–4.0) days in the control group versus 3 (3.0–3.0) in the study group, $P = 0.13$). In patients undergoing laparotomy, however, hospital stay was reduced from 13 (11–15) days to 10 (9–12) days ($P = 0.0086$).

There was a significant increase in the proportion of operations performed between 8.00 and 18.00 hours. During the control period, 592/969 (61%) of cases were commenced between 8.00 and 18.00 hours versus 658/984 (67%) in the study period ($P = 0.029$). Among the cases commenced between 18.00 and 8.00 hours, 21/377 (5.6%) were commenced after midnight in the control period, versus 17/326 (5.2%) in the study period ($P = 0.52$).

Thirteen surgeons completed the work satisfaction questionnaire before the start of the study period, and 15 completed it 6 months post-implementation. Overall, there was an improvement in their levels of satisfaction with their work ($P = 0.0012$). In response to the question 'will the new model of emergency surgery care lead to better work life balance for staff?' prior to implementation, 7/13 (53%) surgeons agreed, 2/13 (15%) disagreed and 4/13 (31%) were unsure. Six months after implementation, 7/15 (47%) strongly agreed, 8/15 (53%) agreed, none disagreed and none were unsure ($P = 0.005$).

Discussion

In our institution, the introduction of a dedicated emergency surgery operating lists was associated with a small, but statistically significant reduction in waiting times for surgery overall, a reduction in after-hours operating and improved job satisfaction for the partici-

Table 2 Times from emergency department (ED) to surgery and time from booking theatre to surgery are in hours

Operation	Control	Study	P-value
Appendicectomy			
Time from ED to surgery	12.0 (11.0–13.0)	13.0 (11.0–14.0)	0.85
Time from booking theatre to surgery	3.6 (3.2–4.2)	3.5 (2.9–4.2)	0.56
Hospital stay	2.0 (2.0–2.0)	2.0 (2.0–2.0)	0.25
Laparotomy			
Time from ED to surgery	26.5 (19.0–56.0)	18.5 (13.0–27.2)	0.0083*
Time from booking theatre to surgery	3.1 (2.2–4.1)	2.3 (1.8–2.9)	0.016*
Hospital stay	13.0 (11.0–15.0)	10.0 (9.0–12.0)	0.0089*
Incision and drainage of abscess			
Time from ED to surgery	11.0 (9.9–16.0)	12.0 (9.8–15.2)	0.47
Time from booking theatre to surgery	5.8 (4.6–6.5)	4.2 (3.1–5.1)	0.011*
Hospital stay	1.0 (1.0–2.0)	2.0 (1.0–2.0)	0.71
Laparoscopic cholecystectomy			
Time from ED to surgery	38.0 (30.0–45.9)	33.0 (26.0–44.4)	0.57
Time from booking theatre to surgery	7.4 (5.3–13.7)	6.1 (4.8–8.2)	0.24
Hospital stay	4.0 (3.0–4.9)	5.0 (3.0–5.7)	0.41
Emergency operations overall			
Time from ED to surgery	19 (18–21)	18 (17–19)	0.033*
Time from booking theatre to surgery	4.8 (4.3–5.4)	3.9 (3.5–4.3)	<0.0001*
Hospital stay	3.0 (3.0–4.0)	3.0 (3.0–3.0)	1.3

Hospital stay is in days. Asterisks indicate a statistically significant difference.

pating surgeons. There was a significant (approximately 30%) reduction in waiting times for patients undergoing emergency laparotomy, and this was associated with a reduction in median hospital stay of 3 days.

A number of different models for managing the competing demands of emergency and elective surgery have been advocated. The Association of Surgeons of Great Britain and Ireland, Royal Australasian College of Surgeons and the Garling report (on the NSW public hospital system) have all recommended separating the resources available for emergency and elective surgery.^{1,2,5} A number of authors have reported on varying levels of separation of these two streams within their institution. These models have ranged from simply allocating dedicated emergency surgery theatre sessions^{6–9} as we did, through to instituting completely separate emergency surgical units.^{3–5}

Lovett and Katchburian⁶ reported an audit of two 3-week periods before and after instituting a dedicated half day emergency theatre in a district general hospital in the UK. They reported a reduction in the number of operations performed after hours, and particularly in the number that were commenced after 22.00 hours. They noted that the grade of surgeon performing the procedures was unchanged. They concluded that in an institution where a 24-h emergency theatre could not be provided, even a half day emergency surgery theatre can improve the emergency surgery service. Similarly, Corner *et al.* reported that implementing a regular morning emergency theatre list reduced the percentage of operations performed after midnight from 32% to 11%.⁸

Barlow *et al.* studied the impact of a half day (afternoon) operating session in a district general hospital in the UK.⁷ They prospectively compared the 6-month period prior to introduction of these operating sessions with the 12 months following their introduction. They noted a significant reduction in late night (after midnight) operating but did not observe any change in the level of consultant involvement in the cases (13% before, and 19% after

implementation). They expressed concern that in their institution, the emergency theatre was significantly underutilized, with only 37% of the total available theatre time. They concluded that an emergency operating theatre is effective in reducing after-hours operations, but that it may be a costly approach. They further stated it may be more difficult to achieve direct consultant supervision during the daytime when surgeons often have other commitments, and that high levels of supervision are only obtainable when 'the emergency operating session becomes a "fixed commitment" in the consultant contract'. Trompetas *et al.* specifically addressed the question of whether morning or afternoon half day lists impacted differently on the emergency laparotomy workload.¹⁰ This study was a retrospective audit comparing two district general hospitals, one of which had implemented a morning emergency theatre, and the other an afternoon theatre. There was no difference between the two groups, but they noted that the lists appeared to be underutilized, and that some of the more complex laparotomies were delayed until a consultant was available. Like Corner *et al.*,⁸ they noted that these lists were not part of the consultants' 'job plan', and that they may have other commitments. None of the above studies reported on waiting times to theatre or levels of staff satisfaction.

Sorelli *et al.* reported on the impact of appointing a dedicated emergency surgeon (in order to address the problem of conflicting elective and emergency commitments described earlier).¹⁰ They found that implementing this consultant led model of emergency surgical care was effective in reducing after-hours operating, and improving the level of consultant supervision of emergency operations. They also found an improvement in the number of early discharges from hospital, and a reduction in the number of patients who waited in the ED for more than 4 h, although no impact on waiting times to theatre were reported.

Parasyn *et al.*³ and Von Conrady *et al.*⁴ described the introduction of separate emergency surgery units at two Australian tertiary

hospitals. There were some differences between the two models adopted, but both shared the following features. Emergency surgery patients were managed in a separate unit from elective patients; they were consultant-led; there were clear arrangements for comprehensive handover from consultant to consultant at the end of each on-call period; theatre time was allocated specifically for emergency surgery. Both groups reported a reduction in after-hours operating. Von Conrady *et al.* also reported an improvement in the time taken from referral to review by a surgeon in the ED (although no changes in waiting times to theatre were reported). Parasyun *et al.* demonstrated improvements in theatre utilization and in staff morale.

In keeping with the above studies, we demonstrated a significant reduction in after-hours operating. We did not demonstrate any reduction in late night (after midnight) operating, but the frequency of after midnight operating in our institution was already low (5.6% of cases) even before this model of care was implemented.

In our institution, all general surgical emergency operations are performed by or under the direct supervision of a specialist general surgeon. This was true during the control and study periods, so any improvements between the control and study groups cannot be ascribed to changes in levels of supervision.

Two previous studies have shown that instituting a form of acute surgical unit was associated with improved patient outcomes. Earley *et al.* studied the outcomes of patients undergoing appendicectomy by an in-house dedicated trauma/emergency surgeon compared with those operated on by a general surgeon taking his on-call from home.¹¹ They demonstrated that the presence of an in-house acute care surgeon led to a reduction in the time taken from the ED to theatre and was associated with better outcomes as measured by complication rate and hospital stay. Pepingco *et al.* recently reported an improvement in conversion rates and post-operative infection rates in patients with cholecystitis.¹² They also noted improvements in the time to definitive treatment, and the proportion of patients undergoing surgery on their index admission. In this study, we could not demonstrate any changes in waiting times for appendicectomy or cholecystectomy. In the case of appendicectomy, this may be due to the great variability between consultants in how extensively these patients are investigated or observed in hospital. In the case of cholecystectomy, this is at least partly because of the differences in the timing of surgery between patients with cholecystitis, biliary colic and gallstone pancreatitis. We have found in our institution that if the patients with acute cholecystitis are considered separately, the time taken to surgery was decreased after implementation of the emergency general surgery operating sessions.¹³

At Middlemore Hospital in New Zealand (reported Poole *et al.*¹⁴), there were concerns that routine handover of patients at the end of the on-call periods was time-intensive and inhibited continuity of care. For this reason, they instituted a system similar to the one reported here in which the patients stayed under the care of the admitting surgeon, but were operated on by a surgeon allocated to the dedicated emergency theatre. They found this system to be safe and efficient.

Our institution did not have the resources to justify employing a full-time emergency surgeon or instituting a dedicated emergency surgery unit with its own beds and staff. We attempted to address the problem of surgeons' conflicting elective and emergency surgery

commitments by assigning the emergency surgery theatre lists as operating sessions, to which the surgeons had a full (paid) commitment. We found the emergency operating sessions to be well utilized.

This study has obvious limitations. It is not possible completely to control for any changes that may occur from year to year within an institution (e.g. in the middle-grade staff). The same consultant general surgeons were employed over the two time periods. The types of operations performed in the two time periods were similar, so changes in case mix are unlikely to have influenced the results. There may be bias in that staff knew their performance was being audited during the study period. The enthusiasm of the staff performing the study may also have biased the results of the questionnaires. It does not appear possible, however, to perform a perfectly controlled study on this topic, and certainly blinding of the participants to exclude these biases could not be achieved. A further weakness of this study is that we did not examine complication rates or other measures of clinical outcome other than hospital stay.

The main difficulty we had in implementing this system was ensuring that good communication occurred between the surgeon responsible for the list and the other theatre staff. Using this system, the order of patients is not finalized until shortly before commencement of the theatre session in order to accommodate unexpected emergencies. This requires a change in the culture in the theatre (where many individuals are used to a system in which priority is determined by the time that the case is booked rather than purely by urgency). There were also significant concerns raised by other surgical specialists about whether this system would unfairly limit their access to theatre, and that there was a potential for general surgeons to abuse these lists by using them for urgent elective cases. It was essential for this system to be implemented that emergency cases from specialties other than general surgery could be operated on in these sessions, and that cases were selected fairly according to urgency. Despite the initial concerns, we have found that access to theatre for specialties other than general surgery has been improved by reducing the competition by general surgical emergencies for access to other theatre sessions.

We have continued to implement emergency general surgery operating sessions beyond the study period, and this has been achieved without extra funding. A further change we have implemented since the study period has been to assign one surgical registrar to emergencies (seeing patients in the ED and assisting in the emergency theatre are his only responsibilities). This has further streamlined our delivery of emergency surgical care.

We conclude that in a regional hospital in which a separate emergency surgery unit is not feasible or warranted, instituting regular consultant-led emergency operating session can improve service delivery and improve surgeons' job satisfaction. This model of care is not unique, but we found it useful in our setting, and believe that it may be applicable to a number of moderate to large institutions with a significant emergency surgery commitment. There does not appear to be a universally accepted or applicable model for emergency surgery service delivery, and it should be individualized for the needs and resources of the particular institution.

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