



Research Paper

Emergency laparotomy outcomes before and after the introduction of an acute surgical unit

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ABSTRACT

Introduction: Emergency laparotomy is associated with significant morbidity and mortality. This study compared emergency laparotomy outcomes in a traditional service to those after the introduction of an Acute Surgical Unit (ASU).

Methods: A retrospective cohort study was performed by reviewing the medical records of all individuals that had an emergency laparotomy in twelve-month periods before and after the introduction of an ASU. Outcomes included time to surgical review, operation duration, length of stay, complications and mortality. Morbidity and mortality were compared to that predicted by P-Possum scores.

Results: In the pre-ASU group there were 58 participants (26 males, 32 females) with a median age of 60 years (range 15–87) and median P-Possum predicted morbidity and mortality of 68% (18–98%) and 6% (1–66%) respectively. In the post-ASU group there were 109 participants (58 males, 53 females) with a median age of 63 years (range 11–100), and median P-Possum predicted morbidity and mortality of 82% (18–100%) and 12% (1–99%).

Operating time decreased post-ASU (median 1 hr 31 min pre vs 1 hr 15 min post $p = 0.030$) and there was a reduction in the incidence of post-operative fistula formation (5% vs 0% $p = 0.017$). There were no other significant differences in morbidity or mortality.

Conclusions: The post-ASU cohort had shorter operative duration and reduced incidence of complicating fistulas but no other significant difference in outcomes. Further studies may define the impact of an ASU on clinical decision making, service delivery, morbidity and mortality in patients that undergo emergency laparotomy.

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1. Introduction

Over the last decade the Acute Surgical Unit (ASU) has replaced the traditional on-call model for the provision of emergency general surgery in many hospitals. On-call models organised emergency surgery to fit in around the elective surgery workload. In contrast, the ASU model separates the provision of emergency and elective surgery with the aim of ensuring timely access to emergency general surgery. Other key features of the ASU model are that it provides a consultant led service with a comprehensive handover system and a dedicated emergency operating theatre [1,2]. Multiple studies have examined the ASU model. While findings have been heterogeneous, proposed potential benefits in particular units have

included reduced time from referral to surgical review, time to surgery, after hours operating, length of stay, complications and mortality as well as increased theatre utilisation and greater training opportunities in emergency surgery [2–18].

Emergency laparotomy is a common and costly emergency general surgery procedure. It is performed for multiple indications and is associated with significant peri-procedural morbidity [19]. Overall mortality is approximately 15% but varies substantially depending on the indication, patient specific factors and health-system factors [20]. Recognition of the prevalence and high-risk nature of this procedure has driven the implementation of numerous audits and studies around the world including the National Emergency Laparotomy Audit (NELA) in the United Kingdom. Saunders et al. in their first report of results from the NELA confirmed substantial variation in perioperative and intraoperative systems between hospitals and proposed systemic factors had the potential to influence outcomes [20]. The effect of the introduction of an ASU on outcomes following emergency laparotomy has not

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Table 1
Demographics.

	Pre-ASU n = 58	Post-ASU n = 109
% Female	55%	46%
Median age (range)	60 (15–87)	63 (11–100)

been established. This study aimed to compare outcomes in patients undergoing emergency laparotomy before and after the introduction of an acute surgical unit.

2. Materials and methods

A retrospective cohort study was performed by reviewing the medical records of all individuals that had an emergency laparotomy at Logan Hospital (Queensland, Australia) in twelve-month

Table 2
Laparotomy indications.

Indication	Pre-ASU	%	Post-ASU	%
Small bowel obstruction	16	27.59	30	27.52
Perforated viscus	11	18.97	26	23.85
Intraabdominal abscess/collection	10	17.24	8	7.34
Incarcerated/strangulated hernia	5	8.62	8	7.34
Ischaemic bowel	3	5.17	8	7.34
Haemorrhage	2	3.45	8	7.34
Large bowel obstruction	3	5.17	3	2.75
Anastomotic leak	3	5.17	2	1.83
Malignancy	2	3.45	0	0.00
Diverticulitis	1	1.72	1	0.92
Other	2	3.45	15	13.76
Total	58	100.00	109	100.00

Table 3
Perioperative risk profiles.

	Pre-ASU	Post-ASU	P value
	Median (Range)	Median (Range)	
P Possum predicted Morbidity (%)	68 (18–98)	82 (18–100)	0.005
P Possum predicted Mortality (%)	6 (1–66)	12 (1–99)	0.008
ASA grade			
1	7/58 (12%)	8/109 (7%)	0.181
2	23/58 (40%)	38/109 (35%)	
3	19/58 (33%)	40/109 (37%)	
4	9/58 (16%)	22/109 (20%)	
5	0/58 (0.0%)	1/109 (1%)	

Table 4
Service delivery.

	Pre-ASU	Post-ASU	P value
	Median (Range)	Median (Range)	
Referral to surgical review (hr:min)	1:41 (0:05–5:19)	1:12 (0:04–18:11)	0.611
Referral to theatre (hr:min)	12:08 (1:07–292:25)	17: 18 (1:01–288:47)	0.458
Duration (hr:min)	1:31 (0:27–6:32)	1:15 (0:18–4:48)	0.030
Duration after hours operating (hr:min) ^a	0:00 (0:00–6:32)	0:09 (0:00–4:48)	0.916
Length of stay (days)	9 (3–166)	8 (1–64)	0.413
% completed in business hours ^b	52%	46%	0.471

^a Defined as the length of the operation performed outside the hours of 0800–1700 in minutes.

^b Defined as the percentage of operations that were completed entirely between the hours of 0800–1700, i.e. for which the duration of after-hours operating = 0 min.

periods before and after the introduction of an ASU. The two periods (1st February 2012 to 31st January 2013 and 1st February 2014 to 31st January 2015) were separated by a twelve-month period to allow for transition. The ASU model replaced a traditional on-call service. The ASU was led by two consultant general surgeons that were both present during business hours, were free of elective responsibilities and had access to a dedicated emergency operating theatre. This was shared with the orthopaedic and obstetric and gynaecology teams. There was a rotating after-hours and weekend on-call roster in which all the consultants in the department participated (i.e. from both the elective teams and the ASU). In this ASU, patients operated on after-hours generally remained under the care of the operating consultant. The study was approved by the Metro South Human Research Ethics Council (reference number HREC/15/QPAH/65). Predicted rates of morbidity and mortality were estimated using P-Possum scores [21]. Measures of service delivery included time to surgical review, time to theatre, operation duration, the proportion of procedures completed in business hours and length of stay. Other outcomes measured were complications and thirty-day mortality. Statistical analyses were performed on IBM SPSS Statistics. Chi-square tests or Fisher's exact tests (for fewer than five events) were used for categorical variables. The Mann-Whitney U test was used for continuous variables. A *P*-value < .05 was considered significant.

3. Results

Table 1 outlines the demographics of the pre-ASU and post-ASU groups. There were more emergency laparotomies performed in the post-ASU group (58 versus 109). Table 2 compares the operative indications between the two groups. There was no statistically significant difference in ASA class, but the post-ASU group had a significantly higher median P-Possum predicted risk of morbidity and mortality compared to the pre-ASU group (Table 3).

Following the introduction of the ASU there was a statistically significant, sixteen-minute reduction in median operation duration

Table 5
Morbidity.

	Pre-ASU		Post-ASU		P value
	Number	%	Number	%	
Superficial surgical site infection	7/58	12%	11/109	10%	0.695
Deep surgical site infection	5/58	9%	4/109	4%	0.279
Wound dehiscence	2/58	3%	3/109	3%	1.000
Anastomotic leak	1/58	2%	1/109	1%	1.000
Intraabdominal haemorrhage	1/58	2%	2/109	2%	1.000
fistula	3/58	5%	0/109	0%	0.017
Pneumonia	9/58	16%	15/109	14%	0.758
Venous thromboembolism	4/58	7%	3/109	3%	0.238
Urinary tract infection	5/58	9%	9/109	8%	1.000
Readmission to hospital	1/58	2%	3/109	3%	1.000
Intensive Care	27/58	47%	43/109	39%	0.376
Total Parenteral Nutrition (TPN)	24/58	41%	30/109	28%	0.068
Repeat laparotomy	12/58	21%	17/109	16%	0.540

Note: It was decided that although ICU admission, TPN and repeat laparotomy do not necessarily represent a complication (being in some circumstances part of the surgical management plan), they are all unwanted from a patient perspective thus contributing to morbidity.

Table 6
Mortality.

	Pre-ASU		Post-ASU		P value
	Number	%	Number	%	
Mortality	6/58	10%	15/109	14%	0.526

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