

# Improving Outcomes of Emergency Bowel Surgery Using NELA Model

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## ABSTRACT

**Objective:** To find outcomes of emergency bowel surgery and review the processes involved in the care of these patients on the same template used in National Emergency Laparotomy Audit (NELA).

**Study Design:** An audit.

**Place and Duration of Study:** Surgery Department, The Aga Khan University Hospital, Karachi, from December 2013 to November 2014.

**Methodology:** Patients undergone emergency bowel surgery during the review period were included. Demographic data, type of admission, ASA grade, urgency of surgery, P-POSSUM score, indication of surgery, length of stay and outcome was recorded. Data was then compared with the data published by NELA team in their first report. P-value for categorical variables was calculated using Chi-square tests.

**Results:** Although the patients were younger with nearly same spectrum of disease, the mortality rate was significantly more than reported in NELA (24% versus 11%,  $p=0.004$ ). Comparison showed that care at AKUH was significantly lacking in terms of proper preoperative risk assessment and documentation, case booking to operating room timing, intraoperative goal directed fluid therapy using cardiac output monitoring, postoperative intensive care for highest risk patients and review of elderly patients by MCOP specialist.

**Conclusion:** This study helped in understanding the deficiencies in the care of patients undergoing emergency bowel surgery and alarmingly poor outcomes in a very systematic manner. In view of results of this study, it is planned to do interventions in the deficient areas to improve care given to these patients and their outcomes with the limited resources of a developing country.

**Key Words:** Emergency laparotomy. Outcome. Bowel surgery. NELA model.

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## INTRODUCTION

Emergency laparotomy have a high rate of complication than same procedures done in elective setting.<sup>1,2</sup> Outcome depends on structural factors in the area and process factors.<sup>3</sup> The process factors can vary in care of different patient in a single institute resulting in different outcomes. More than 30,000 emergency laparotomies are performed every year in England alone.<sup>4,5</sup> 30-day death rate after emergency bowel surgery is reported to be 15% consistently in reports all around the world, which is 5 times higher than any other type of surgery including elective bowel surgery.<sup>6,7</sup> Modifiable factors in these patients, which can alter the outcome of emergency bowel surgery, are: timely diagnosis, preoperative resuscitation, prompt intervention and perioperative care. These factors vary in different centers all around the world, and can significantly impact the outcome.

National Emergency Laparotomy Audit (NELA), funded by NHS England and Welsh Government, was commissioned

in 2011, aimed to collect and publish high-quality comparative information from hospitals in England and Wales. It is a prospective ongoing audit and publishes its report annually. In 2015, it published its first annual report online, which includes patients undergoing emergency bowel surgery in 193 hospitals all over England and Wales from November 2013 to October 2014.<sup>8</sup> In the first report, NELA team has documented some policies which are being followed in high performance centres of NHS, and has labeled these key to their better outcomes.

This study was planned to audit the outcomes of the patients who underwent emergency bowel surgery at AKUH, Karachi during the same period as in first report by NELA and compare these with the same report to see the differences in the two audits. The aim was to find the areas where improvements can be made.

## METHODOLOGY

Permission from NELA team was obtained to use the proforma and Inclusion/exclusion criteria as being used by NELA. Exemption for this audit (3849-Sur-ERC-15) was obtained from Ethical Review Committee of Aga Khan University Karachi. Proformas were filled by the investigators after retrospectively reviewing the medical records of patients who underwent emergency bowel

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surgery at AKUH from 1st December 2013 to 30th November 2014. Patients undergoing emergency laparoscopic cholecystectomy, appendectomy, abdominal sepsis due to perforated appendix or emergency hernia repair without bowel resection anastomosis were excluded from the study.

Data was retrospectively collected with the help of Health Information Management System. Files of patients and computerized booking in operating room was used to record exact time of booking the case. Anesthesia preoperative evaluation form was used to record preoperative risk stratification. Preoperative and postoperative P-POSSUM score for predicted morbidity and mortality was calculated using online calculator ([www.riskprediction.org.uk](http://www.riskprediction.org.uk)).<sup>9</sup>

Data was analysed in SPSS. Mean  $\pm$  SD and medians with interquartile ranges were calculated for continuous data, where appropriate, Frequencies with percentages were calculated for categorical variables. Significance calculated by p-value using Chi-square test. P-value  $<0.05$  was considered statistically significant. These variables and outcomes were then compared with the charts in the first report of the national emergency laparotomy audit to find out the compliance of AKUH for each variable, example as in Figure 1.

## RESULTS

The total number of files extracted were 89. Fifteen were excluded as those patients had non-obstructing, irreducible hernias, where bowel was not resected. The files included in the first analysis were 74; and after excluding the penetrating trauma patients, the number decreased to 50 in the final analysis. The 193 NHS hospitals had a total of 20,183 patients in that period ranging from  $<10$  patients to 351 patients per institute. So AKUH was 153rd out of 194 institutes with respect to number of patients per year.

Mean age of patients was  $53.72 \pm 18.9$  years (Table I). Two-thirds patients were male. Fifty-eight percent population was in younger than 60 years of age. Seventy percent patients belonged to ASA II and ASA III groups. Urgency of surgery was  $<2$  hours in 30%. Eighty-nine percent patients underwent emergency laparotomy as a primary procedure, while 11% needed emergency laparotomy for treatment of a complication of a recent procedure. P-POSSUM predicted mortality risk was  $>10\%$  in 48% of patients and  $<10\%$  in 52% of patients.

Most frequent indication of emergency surgery was intestinal obstruction, followed by intestinal perforation. Most frequent primary procedures were stoma formations, followed by small bowel resections.

Mortality rate was 24% in the population as compared to 11% in NELA ( $p=0.004$ ) (Table II). This rate increased to

**Table I:** Baseline characteristics.

Characterisation n	NELA 20,183	AKUH 50	p-value
Gender			0.03
Female	10,375 (51%)	18 (36%)	
Male	9,808 (49%)	32 (64%)	
Age in years			0.007
18-39	2,188 (11%)	12 (24%)	
40-49	1,939 (10%)	8 (16%)	
50-59	2,707 (13%)	9 (18%)	
60-69	4,197 (20%)	6 (12%)	
70-79	5,084 (25%)	12 (24%)	
80-89	3,537 (18%)	3 (6%)	
$\geq 90$	531 (3%)	0	
Hospital admission type			0.02
Emergency	18,693 (93%)	42 (84%)	
Elective	1,490 (7%)	8 (16%)	
ASA grade			0.29
1	2,097 (10%)	1 (2%)	
2	6,793 (34%)	17 (34%)	
3	7,108 (35%)	18 (36%)	
4	3,747 (19%)	12 (24%)	
5	438 (2%)	2 (4%)	
Urgency of surgery			0.004
$<2$ hours	1,976 (14%)	15 (30%)	
2-6 hours	5,498 (39%)	13 (26%)	
$>6$ hours	6,460 (46%)	22 (44%)	
Procedure			1.00
Primary procedure	18,034 (89%)	45 (90%)	
Surgery for a complication of a recent procedure	2,149 (11%)	5 (10%)	
Preoperative predicted risk of death within 30 days of surgery (P-POSSUM)			0.54
$<5\%$	7,709 (38%)	15 (30%)	
5.0 - 9.9%	3,315 (16%)	11 (22%)	
10.0 - 24.9%	3,828 (19%)	8 (16%)	
25.0 - 49.9%	2,589 (13%)	9 (18%)	
$\geq 50\%$	2,742 (14%)	7 (14%)	
Indication for surgery			0.007
Intestinal obstruction	9,811 (49%)	23 (46%)	
Perforation	4,744 (24%)	9 (18%)	
Peritonitis	4,116 (20%)	1 (2%)	
Ischaemia	1,720 (9%)	4 (8%)	
Abdominal abscess	1,332 (7%)		
Sepsis: other	1,474 (7%)	1 (2%)	
Haemorrhage	819 (4%)	1 (2%)	
Colitis	748 (4%)		
Anastomotic leak Intestinal	618 (3%)	1 (2%)	
Fistula	326 (2%)	3 (6%)	
Abdominal wound dehiscence	116 (0.6%)	1 (2%)	
Abdominal compartment syndrome	55 (0.3%)		
Other	1,809 (9%)	6 (12%)	
Surgical Approach			0.06
Open	17,573 (87%)	50 (100%)	
Laparoscopic	1,208 (6%)		
Laparoscopic converted to open	1,215 (6%)		
Laparoscopic-assisted	187 (1%)		
Primary operative procedure			0.014
Small bowel resection	3,420 (17%)	12 (24%)	
Adhesiolysis	3,379 (17%)	4 (8%)	
Colectomy: right	2,573 (13%)	4 (8%)	
Hartmann's procedure	2,562 (13%)	1 (2%)	
Stoma formation	1,148 (6%)	13 (26%)	
Peptic ulcer - suture or repair of perforation	1,138 (6%)	3 (6%)	
Colectomy: subtotal	1,113 (6%)		
Drainage of abscess/collection	588 (3%)		
Colectomy: left (including anterior resection)	578 (3%)	2 (4%)	
Washout only			
Repair of intestinal perforation	532 (3%)	5 (10%)	
Colorectal resection - other	454 (2%)		
Exploratory/relook laparotomy only	440 (2%)	1 (2%)	
Gastric surgery - other	408 (2%)	1 (2%)	
Intestinal bypass Haemostasis	327 (2%)	1 (2%)	
Peptic ulcer oversew of bleed	302 (2%)		
Not amenable to surgery	245 (1%)		
Enterotomy	210 (1%)		
Stoma revision	185 (1%)		
Abdominal wall closure	159 (1%)		
Laparotomy formation	161 (1%)	1 (2%)	
Resection of other intra-abdominal tumour(s)	121 ( $<1\%$ )		
Pancreatic necrosectomy	77 ( $<1\%$ )		
	63 ( $<1\%$ )	1 (2%)	

53% if age of patient was >70 years. Median length of stay was 8.5 days (IQR 5.75-15).

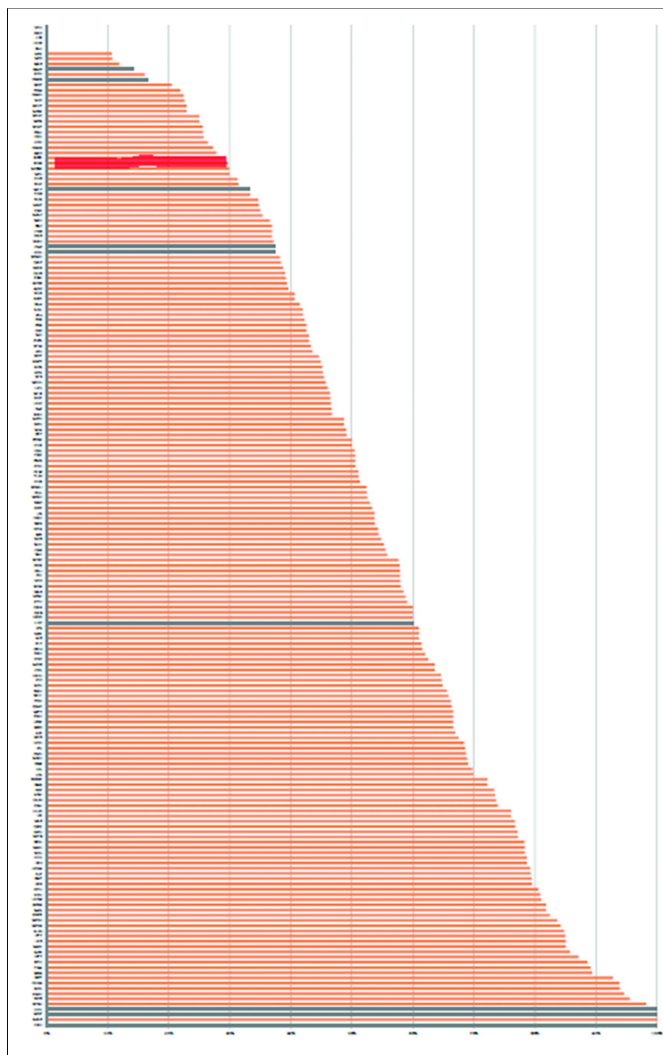
**Table II:** Outcome.

Variable	NELA	AKU	p-value
Length of stay Days (Median)	11.3 (6.5-20.4)	8.5 (5.75-15)	
Mortality			
Overall	(2254/20183) 11%	(12/50) 24%	0.004
<70 years	(662/11031) 6%	(4/35) 11.4%	0.18
>70 Years	(1592/9152) 17.4%	(8/15) 53%	<0.001

**Table III:** Postoperative predicted mortality versus actual mortality.

Post op predicted P-Possum mortality risk	No. of patients	Deaths	Actual mortality
<5%	16	0	0%
5.0-9.9%	5	2	40%
10-24.9%	14	4	28.5%
25-49.9%	8	3	37.5%
>50%	6	2	33%

\*One patient had on table death.



**Figure 1:** Proportion of patients with risk documented preoperatively. Red line shows position of AKUH among 193 NHS hospitals (30% documentation of risk, 156th position). Figure modified with permission from NELA team.

**Table IV:** Postoperative shifting and outcome.

Post op predicted P-Possum mortality risk	No. of patients	Shifted post op to	Mortality
<5%	16	Ward → 2 SCU → 14 ICU → 0	None
5.0-9.9%	5	SCU → 5	2
10-24.9%	14	SCU → 9 ICU → 5	1 1
25-49.9%	8	SCU → 4 ICU → 4	2 2
>50%	6	SCU → 1 ICU → 5	1 3

\*\*Out of 6 patients who eventually died, shifted in SCU postoperatively, 2 were made DNR in SCU (due to disseminated malignancy and mesenteric ischemia) while 4 were intubated and shifted to ICU and expired in ICU.

## DISCUSSION

Pakistan is a developing country with poor emergency health care system. Only 44% public secondary and 25% private secondary hospitals have designated emergency rooms.<sup>10</sup> The Aga Khan University Hospital (AKUH) is a JCI accredited, 600 bedded tertiary care hospital, providing 24-hour emergency surgery facility in Karachi. General surgery department has a team of residents and an attending consultant-on-call every day. The hospital has two designated emergency operating theaters, functional 24-hour a day with a dedicated team of anesthetists. There is a dedicated Surgical ICU with seven fully equipped beds to provide intensive care under supervision of an intensivist.

This audit showed that although the population was younger than NELA population and risk for mortality is similar of NELA population, the mortality rate was more than twice. Further analysis of mortality patients was done which showed that mortality rate was greater in high risk group than anticipated (Table III), while it was same or even lower than predicted in higher risk group. This poor outcome in relatively lower risk patients lead to the evaluation of AKUH for standard practices which are being followed in NHS high performance hospitals.

First practice is review of patients by consultant surgeon within 12 hours of their admission. This variable could not be measured at AKUH because of retrospective nature of audit and the time seen by consultant was missing in 84% of the files. Second practice is reporting of preoperative CT scan by consultant radiologist before surgery. At AKUH preoperative CT scan was done in 82% of patients, out of which 66% were reported preoperatively by a consultant radiologist (103rd position, range 95%-3%). Third practice is preoperative risk stratification. At AKUH, 80% patients were seen preoperatively by consultant anesthetist. Preoperative risk labeling was one only in 30% (156th position, range 100%-11%). There was no objectivity in this risk stratification.

Fourth practice is booking to operating room, time should be the same as documented at the time of booking of case. At AKUH, it was same in 80% of cases (127th position, Range 100%-48%). Fifth practice is direct supervision of surgery by a consultant surgeon. At AKU 100% of surgeries were directly supervised by the consultant surgeon (first position, range 100-36%). Sixth practice is provision of goal directed fluid therapy intraoperatively using cardiac output monitoring in high risk patients. At AKU, this was not done in any of the patients using cardiac output (176th position). In 60% patient, central venous line and arterial line were used, and in 40% of patients intraoperative monitoring was non-invasive.

Seventh practice is provision of intensive care postoperatively to highest risk patients (predicted mortality  $\geq 10\%$  and age  $\geq 70$  years). Twenty-eight percent of all patients undergoing emergency bowel surgery were shifted to ICU postoperatively (176th position, range 96-23%). Fifty percent of patients with predicted mortality  $\geq 10\%$  were shifted directly to ICU postoperatively (178th position, range 100-52%). While only 53.3% of patients aged more than 70 years were shifted to ICU postoperatively. The eighth variable was postoperative review of patients aged  $\geq 70$  years by MCOP physician. None of the patients was seen by a geriatric specialist at AKU postoperatively (151st position, range 100-0%).

This study identified a number of variables where there were deficiencies as compared to NHS hospitals. Although the patients are younger and spectrum and severity of disease similar to those reported in NELA, there is very high mortality in this population. The practices which were being practiced by the high performance centres of NHS were deficient at AKUH.

Preoperative evaluation by a consultant surgeon within 12 hours of admission is important for early decision making.<sup>12,13</sup> Delay in review can result in delayed diagnosis or intervention in some patients.<sup>14,15</sup> Being JCIA accredited hospital, the policy at AKU is consultant review within 24 hours of admission.

To improve outcomes, it is now a consensus among General Surgery, Anesthesia and ICU departments to change the practices. All CT scans will be reported by consultant radiologist preoperatively, after making some changes in radiology oncall system and hospital has provided home access to PACS to the radiology consultants. Now, it is mandatory to calculate mortality risk using P-POSSUM score and documenting it preoperatively. This information will help in shared decision-making for families and physicians. Compliance of booking-to-OR-time will be improved by operating room coordinators by making separate queue for emergency bowel surgery patients and giving them preference on routine add on patients.

There is an agreement with intensivists to daily review all these patients in HDU until they are stabilized. This will help in improving outcome of these high risk patients and to predict the need of ventilator support rather than providing it when the patient has crashed. Internal medicine department had been requested to nominate a specific internist with interest in geriatrics to help us.

There is a plan to reaudit emergency laparotomy result prospectively and see the effect of these changes. Although this study was evaluating the data which was prospectively recorded, yet it had some artifacts of retrospective study which will be covered in the next audit. The model provided by NELA is a simple and applicable model to every hospital providing emergency surgical care and that every hospital should audit its outcomes upon this model and find its way forward towards improving outcomes.

## CONCLUSION

This study helped in understanding the deficiencies in the care of patients undergoing emergency bowel surgery and alarmingly poor outcomes in a very systematic manner. In view of results of this study, it is planned to carry out interventions in the deficient areas to improve care given to these patients and their outcomes with the limited resources of a developing country.

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