Pre-NELA vs NELA – has anything changed, or is it just an audit exercise?

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ABSTRACT

BACKGROUND Following evidence suggestive of high mortality following emergency laparotomies, the National Emergency Laparotomy Audit (NELA) was set up, highlighting key standards in emergency service provision. Our aim was to compare our NHS trust's adherence to these recommendations immediately prior to, and following, the launch of NELA, and to compare patient outcome.

METHODS This was a retrospective study of patients who underwent an emergency laparotomy over the course of 6 months – 3 months either side of the initiation of NELA.

RESULTS There were 44 patients before the initiation of NELA (pre-NELA, PN group) and 55 in the first 3 months of NELA (N group). We saw a significant increase in the proportion of patients whose decision to operate was made by the consultant: 75.0% in the PN group vs 100% in N group (subsequent data presented in this order) ($P < 0.001$). The presence of a consultant surgeon (75.0% vs 83.6%, $P = 0.321$) and anaesthetist (100.0% vs 90.9%, $P = 0.064$) in theatres were comparable in both groups. Risk stratification based on Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (P-POSSUM) score showed no difference in high-risk patients in both groups (47.7% vs 36.4%, $P = 0.306$). With the NELA initiative, however, significantly more patients were admitted directly from theatres to the critical care unit, when compared with the pre-NELA period (9.1% vs 27.3%, $P = 0.038$). This also reflected a significant reduction in unexpected escalation to a higher level of care during this period (10.0% vs 0%, $P = 0.036$). Significantly more patients had uneventful recovery in the NELA period (52.3% vs 76.4%, $P = 0.018$), although there was no difference in 30-day mortality between the groups (2.3% vs 7.3%, $P = 0.378$).

CONCLUSIONS This study demonstrated a greater degree of consultant involvement in the decision to operate during NELA. More high-risk patients have been identified preoperatively with diligent risk assessment and, hence, have been proactively admitted to critical care units following laparotomy, which may account for the significant reduction in unexpected escalation to level 2 or level 3 care and thus in overall better patient outcomes.

KEYWORDS

Emergency laparotomy – Surgical outcome – National audit – NELA

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Introduction

Emergencies make up over one-third of all surgical hospital admissions in the country, with over 30,000 emergency laparotomies being performed each year in England and Wales alone.^{1,2} Current evidence reports high mortality rates associated with emergency laparotomies – up to about 15% at 30 days being the national average.³ This is eight times higher when compared with elective admissions, with figures highly variable between trusts across the country, depending on the tertiary status.^{4,5} Several sources, including National Confidential Enquiry into Patient Outcomes and Deaths (NCEPOD) reports, have recorded inconsistent standards of care for these emergency cases.⁶

Following the above evidence, and in line with the call for new national audit topic proposals from the Healthcare

Quality Improvement Partnership, the National Emergency Laparotomy Audit (NELA) was set up: ‘The aim of the audit is to enable the improvement of the quality of care for patients undergoing emergency laparotomy through the provision of high quality comparative data from all providers of emergency laparotomy.’⁷

NELA was established on 1 January 2014, and highlights key standards in emergency service provision to collect comparative information on organisation of care across the country.⁷ We hypothesise that the initiation of NELA at our local unit has likely generated awareness among members of clinical staff, thereby affecting changes in practice in line with the audit guidelines. The aim of this study was to compare our trust's adherence to NELA's recommendations immediately prior to and following its inception, so as to analyse any differences in clinical practice and patient outcome.

Methods

We undertook a retrospective review of patients who underwent an emergency laparotomy over the course of 6 months – 3 months either side of the initiation date of NELA. Patients were identified using the trust's operating room management information system. Clinical data were collected from medical and intraoperative records. Corresponding to NELA's selection criteria,⁸ our study included all patients above the age of 18 years who were undergoing an expedited, urgent or emergency (as per NCEPOD definitions)⁹ open abdominal procedures primarily involving the stomach, small or large bowel or rectum, for pathology including – but not limited to – perforation, ischaemia, abdominal abscess, bleeding or obstruction. Pathology primarily involving the liver, gall bladder and biliary tree, pancreas, spleen, kidneys, renal or urinary tract or the appendix were excluded. NELA's patient selection criteria are non-exhaustive; where cases were equivocal, the authors consulted the trust the NELA project lead for guidance.

The outcome measures were categorised into pre-, intra- and postoperative management of the patient: level of consultant involvement, availability of preoperative computed tomography (CT) and a serum lactate, time of operation

(day or night), postoperative location, intra- and postoperative complications, unexpected escalation to high dependency or intensive care, return to theatres, length of hospital stay and 30-day mortality rate.

Statistical Analysis

Categorical variables were expressed as percentages and continuous variables as mean $\pm$ standard deviation. Statistical associations between the categorical variables were assessed using Fisher's exact test or Chi-square test, as appropriate. Student t-test or analysis of variance was used to compare continuous variables. Mann-Whitney U test or other non-parametric tests were used where the data were not normally distributed. A *P* value of < 0.05 was considered statistically significant. All statistical analysis was carried out using SPSS for Windows version 19.0 (SPSS Inc., Chicago, IL, USA). The local research and development department lead confirmed this study as a service evaluation, so research ethics committee approval was not required.

Results

Between 1 October 2013 and 31 March 2014, 140 emergency laparotomies were performed in our unit at a district general

Table 1 Patient demographics and preoperative work-up

Factor	Group		<i>P</i> value
	Pre-NELA (<i>n</i> = 44)	NELA (<i>n</i> = 55)	
Age, mean $\pm$ SD (years)	66.9 $\pm$ 13.2	63.9 $\pm$ 17.0	0.339
Female gender, <i>n</i> (%)	26 (59.1)	33 (60.0)	1.000
ASA grade, <i>n</i> (%):			
I	0	5 (9.1)	0.064
II	17 (38.6)	17 (30.9)	0.523
III	16 (36.4)	21 (38.2)	1.000
IV	11 (25.0)	11 (20.0)	0.629
V	0	1 (1.8)	1.000
<i>Preoperative assessment</i>			
Most senior grade involvement for decision to operate <i>n</i> (%):			
Consultant	33 (75.0)	55 (100)	< 0.001
SAS grade	9 (20.5)	0	< 0.001
ST	2 (4.5)	0	0.195
Preoperative CT performed, <i>n</i> (%)	34 (77.3)	45 (81.8)	0.621
<i>Preoperative P-POSSUM:</i>			
Mortality:			
% range	0.7–80.6	1.1–87.9	0.233
Mean $\pm$ SD	12.2 $\pm$ 16.5	16.7 $\pm$ 20.0	
Morbidity:			
% range	17.5–99.4,	25.5–99.6,	0.109
Mean $\pm$ SD	62.8 $\pm$ 26.4	70.7 $\pm$ 22.3	
ASA = American Society of Anaesthesiologists, CT = computed tomography, NELA = National Emergency Laparotomy Audit, P-POSSUM = Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity, SD = standard deviation, SAS = specialty and associate specialist, ST = specialty trainee			

hospital. After applying the selection criteria, 99 cases were included in the current study: 44 between 1 October 2013 and 31 December 2013 (PN group), 55 between 1 January 2014 and 31 March 2014 (N group).

Demographics

Patient demographics are summarised in Table 1. There was no difference in age (66.9 ± 13.2 vs 63.9 ± 17.0 years; $P = 0.339$) between the PN and N groups. Female gender was predominant, with no difference between the two groups (59.1% PN group vs 60.0% N group were females; $P = 1.000$). There was no difference in American Society of Anesthesiologists grade between the two groups.

Preoperative factors

There appeared to be a significant improvement regarding consultant surgeon involvement in the decision for a laparotomy: 75.0% (PN) vs 100% (N) ($P < 0.001$). Conversely, the proportions of patients whose decision for surgery was documented as being made by specialty and associate specialists grade were reduced from 20.5% (PN) to 0% (N) ($P < 0.001$) and those made by a specialty trainee registrar from 4.5% (PN) to 0% (N) ($P = 0.195$).

There was no difference between the two groups in terms of patient review by the surgeon at the time of making decision for laparotomy, availability of preoperative lactate levels and performing CT before decision for laparotomy.

Overall, there was poor documentation of risk stratification in the patient notes and in the consent forms. Documented P-POSSUM risk stratification scores were absent in all but one cases reviewed; risk scores for all other patients were retrospectively calculated.¹⁰ The mean predicted mortality and morbidity were: 12.2% (PN) vs 16.7% (N); $P = 0.233$ and 62.8% (PN) vs 70.7% (N); $P = 0.109$, respectively (Table 1).

Intraoperative factors

There was no difference between the two groups when comparing the time of day during which the procedure was carried out. The majority were daytime operations (8am to 8pm): 79.5% (PN) vs 76.4% (N) ($P = 0.809$). Similarly, there was no difference between the two groups when comparing the presence of consultant surgeon: 75.0% (PN) vs 83.6% (N) ($P = 0.321$), or that of consultant anaesthetist: 100% (PN) vs 90.9% (N) ($P = 0.064$) in theatres.

There were four Hartmann's procedures performed in the PN group, 15 in the N group ($P = 0.038$). This was the only statistically significant difference observed in terms of the types of procedures performed in the two groups. Other common procedures performed included adhesiolysis, colectomy and small bowel resection. The most common operative findings were adhesions, abscess formation, perforation, bowel ischaemia and localised malignancy. Histopathology results of the two groups were compared, which showed no significant differences.

Most patients did not have significant peritoneal contamination in both groups: 77.3% (PN) vs 63.6% ($P = 0.188$). In the subgroup of patients with evidence of peritoneal contamination, localised contamination to a single quadrant was

seen in 6.8% of the PN group and 23.6% of the N group ($P = 0.029$; Table 2).

Postoperative factors

Postoperative risk stratification was undertaken with retrospectively calculated P-POSSUM scores. There was no statistically significant difference between the groups in terms of P-POSSUM predicted morbidity and mortality. Mean mortality rates were 12.3% (PN) vs 13.3% (N) ($P = 0.760$), while mean morbidity rates were 62.2% (PN) vs 68.5% (N) ($P = 0.205$). Patients were considered to be at high risk if their predicted P-POSSUM mortality was greater than 10%.⁷ There was no difference between the two groups in terms of high risk patients: 47.7% (PN) vs 36.4% (N) ($P = 0.306$).

Following surgery, 9.1% in the PN group were directly admitted from theatres to level 2 or level 3 care; this increased to 27.3% in the N group ($P = 0.038$); 10% of the PN group had an unexpected escalation of care; this was reduced to 0% in the N group, which was statistically significant ($P = 0.036$). There was no difference between the two groups in terms of unexpected return to operating theatres: 6.8% (PN) vs 7.3% (N) ($P = 1.000$).

More than three-quarters (78.2%) of the patients in the N group had uneventful recovery with no complications, whereas only 52.3% in the PN group had a similar outcome ($P = 0.018$). The 30-day mortality rate was comparable between the two groups: 2.3% (PN) vs 7.3% (N) ($P = 0.378$; Table 3).

Discussion

NELA was set up with the intention of collecting organised and comparative information on emergency service provision across the country; its standards have also become a marker of performance among hospital trusts. Its initiation is a stepping stone that ultimately serves to identify individuals' preoperative risks, as well as giving the patient the best survival chance following emergency operation by optimising care pre-, intra- and postoperatively. Our hypothesis was that, with its inception, NELA's standards would be disseminated among the surgical team and would affect clinical practice and thus patient outcome. However, it could also be simply another audit exercise, with little role to induce change in clinical practice. To our knowledge, our study is the first to compare the immediate effect on emergency surgery service provision since NELA was adopted by the 178 NHS trusts across the country.

Early consultant input allows prioritisation of the sickest patients to benefit from experienced decision making.⁷ Our study suggests that, following the initiation of NELA at our local unit, there has been an increase in the degree of consultant involvement in the decision for an emergency laparotomy, as documented in patients' notes. It could be possible that as NELA was set up, surgical team members become increasingly conscientious and diligent in documenting discussions with consultants before sending patients to theatres. This was one of the limitations of our retrospective study in ascertaining whether the PN group truly had less consultant input or whether there was simply improved documentation

Table 2 Intraoperative factors

Factor	Group		P value
	Pre-NELA (n = 44)	NELA (n = 55)	
Intraoperative care			
Time of day, n (%):			
8.01am–8pm	35 (79.5)	42 (76.4)	0.809
8.01pm–8am	9 (20.5)	13 (23.6)	
Most senior grade of surgeon, n (%):			
Consultant	33 (75.0)	46 (83.6)	0.321
SAS	9 (20.5)	6 (10.9)	0.260
ST	2 (4.5)	3 (5.5)	1.000
Most senior grade of anaesthetist, n (%):			
Consultant	44 (100)	50 (90.9)	0.064
Clinical Fellow	0	1 (1.8)	1.000
ST	0	4 (7.3)	0.127
Operative procedures, n:			
Abdominal hernia repair	3	2	0.653
Abscess drainage	3	4	1.000
Adhesiolysis	19	15	0.136
Appendicectomy	4	2	0.402
Cholecystectomy	1	1	1.000
Colectomy	8	8	0.784
Enterotomy	0	1	1.000
Gastric surgery	3	2	0.653
Haemostasis only	0	2	0.501
Hartmann's	4	15	0.038
Joint case,			
Gynaecology	1	4	0.378
Urology	1	1	1.000
Laparostomy formation	0	2	0.501
Peptic ulcer repair	3	0	0.084
Small bowel resection	16	16	0.519
Splenectomy	0	1	1.000
Stoma formation	3	4	1.000
Strictureplasty	1	0	0.444
Washout only	0	1	1.000
Peritoneal contamination			
Type, n (%):			
None/reactive fluid only	34 (77.3)	35 (63.6)	0.188
Bile	1 (2.3)	1 (1.8)	1.000
Blood	2 (4.5)	3 (5.5)	1.000
Pus	6 (13.6)	13 (23.6)	0.304
Small bowel contents	1 (2.3)	3 (5.5)	0.627
Extent, n (%):			
None	34 (77.3)	37 (67.3)	0.369
Localised (single quadrant)	3 (6.8)	13 (23.6)	0.029
Generalised	7 (15.9)	5 (9.1)	0.361
NELA = National Emergency Laparotomy Audit, SAS = specialty and associate specialist, ST = specialty trainee			

Table 3 Postoperative Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (P-POSSUM) scores

Factor	Group		P value
	Pre-NELA (n = 44)	NELA (n = 55)	
Postoperative P-POSSUM			
Mortality:			0.760
% range	0.7–66.6,	0.9–60.7,	
Mean ± SD	12.3 ± 16.5	13.3 ± 15.9	
Morbidity:			0.205
% range	17.5–98.8,	22.6–98.3,	
Mean ± SD	62.2 ± 26.8	68.5 ± 22.4	
Postoperative care			
Postoperative location, n (%):			
Ward	26 (59.1)	30 (54.5)	0.687
High-Dependency Unit	4 (9.1)	15 (27.3)	0.038
Intensive Therapy Unit	14 (31.8)	10 (18.2)	0.157
Unexpected return to theatres, n (%):			
Yes	3 (6.8)	4 (7.3)	1.000
No	41 (93.2)	51 (92.7)	
Unexpected escalation to higher level of care, n (%):			
Yes	4 (10.0)	0	0.036
No	40 (90.0)	55 (100.0)	
Postoperative complications, n:			
Uneventful recoveries	23 (52.3)	42 (78.2)	0.018
Complications			
Cardiac	6	1	0.042
Failure	2	1	
Arrhythmia	2	0	
Acute coronary syndrome	2	0	
Collection: drained	1	4	0.378
Ileus	6	1	0.042
Respiratory	8	4	0.126
Failure	3	3	
Hospital-acquired pneumonia	5	1	
Sepsis	3	5	0.729
Urinary tract infection	2	1	0.583
Wound	8	4	0.126
Dehiscence	2	0	
Infection, deep	3	1	
Infection, superficial	3	1	
Venous thromboembolic event	0	2	0.729
30-day mortality, n (%):			
Alive	43 (97.7)	51 (92.7)	0.378
Deceased	1 (2.3)	4 (7.3)	
NELA = National Emergency Laparotomy Audit, SD = standard deviation			

following NELA. Nonetheless, good medical practice involves documentation of any key communication between team members and with the patient, as outlined in General Medical

Council guidance.¹¹ In emergency situations, where there is often time constraint, accurate documentation may be overlooked.¹² Anecdotally, we also noted that several entries

Table 4 Comparing our results with national data

	Our data (%)	National data (%)
Consultant surgeon review (not necessarily < 12 hours of admission)	100	50–79
Computed tomography report before surgery	81.8	50–79
Preoperative risk documentation	1.8	0–49
Consultant surgeon present in theatre	83.6	80–100
Consultant anaesthetist present in theatre	90.9	80–100
Direct postoperative admission to critical care	45.5	0–49

regarding consultant involvement were made retrospectively in the medical notes of patients in the NELA group.

Another important lesson learnt from this study was the improved outcomes, both in fewer cases of unexpected escalation of care and lower complication rates in the NELA group. Examining the postoperative P-POSSUM scores, both groups had a similar proportion of patients identified as being high risk. A predicted mortality risk exceeding 10% on NELA prompts patient to be directly admitted to a critical care unit following surgery.⁷ We believe that a major contributor to the improved outcomes was that more patients in the NELA group were being ‘proactively’ admitted to a critical care unit following theatre, instead of escalating the level of care only after patients had developed complications on a general surgical ward. This was the case despite minimal documentation on risk stratification. A key confounding factor, however, was the way in which patients were booked for emergency laparotomy during the study period. During the early stages following initiation of NELA, this process consisted of submitting a handwritten form to the theatre coordinator, so P-POSSUM scores were not routinely calculated. The fact that there was improved critical care involvement was a reflection of improved risk stratification. Anecdotally, this was achieved largely by direct consultations with the critical care team on a case-by-case basis. We therefore stress the importance of liaising with the critical care team regarding the postoperative care of patients undergoing emergency laparotomy. We also predict that with the advent of a new online booking system which automatically calculates patients’ P-POSSUM scores, subsequent improvement in objective risk documentation can be expected.

The first patient report of NELA was published in June 2015, featuring performances of all hospital trusts across the UK since the inception of NELA. When comparing with national data (Table 4), our study was limited by the sample size, as we primarily intended to look at immediate changes following the inception of NELA over a short time period. Current NELA standards state that ‘a consultant surgeon should review patients who may require emergency bowel surgery within 12 hours of hospital admission’.⁷ However, it was noted by the authors anecdotally that while a consultant reviewed all patients in the NELA group, not all were within 12 hours of admission. This subgroup of patients who had an

apparent delay in consultant review was largely made up of inpatients being admitted for a non-surgical condition (for example, community acquired pneumonia or orthopaedic procedures). While being treated, the patient then developed an acute abdomen; yet when these patients undergo an emergency procedure, NELA’s data collection process would only consider their initial admission date and time, thereby creating a potential source of bias.

Conclusions

This study demonstrated a greater degree of consultant involvement in the decision for an emergency laparotomy following initiation of NELA. More high-risk patients might have been identified preoperatively and proactively admitted to critical care units directly from theatre, which may be associated with the reduction in the numbers of unexpected escalation of care and postoperative complications. NELA has driven the need for better risk assessment of patients prior to emergency laparotomy and the importance of higher-level monitoring for these sick patients in the immediate postoperative period. However, there is need for more research to analyse whether this change in clinical practice has persisted over the length of NELA and following completion of NELA.

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