



# The Utilisation of the Small Bite Closure Technique in Emergency Laparotomy – A Pilot Study

Hazim A Eltyeb<sup>1\*</sup>; Dorothy Wintrip<sup>2</sup>; Amnah Khan<sup>2</sup>; Frederick Dowker<sup>2</sup>; D Light<sup>2</sup>

<sup>1</sup>Department of General Surgery, North East, Royal Victoria Infirmary, Newcastle-upon-Tyne, NE1 4LP, UK.

<sup>2</sup>Northumbria Healthcare NHS Foundation Trust, UK.

**\*Corresponding Author(s): Hazim A Eltyeb**

Department of General Surgery, North East, Royal Victoria Infirmary, Newcastle-upon-Tyne, NE1 4LP, UK.  
 Email: hazim.eltyeb1@nhs.net

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## Abstract

**Aims:** In this study, we investigate the effect of small bite closure compared to a cohort of mass closure in emergency abdominal surgery. Our primary outcomes are wound dehiscence and wound infection, and our secondary outcome is 30-day mortality.

**Methods:** A retrospective comparative cohort analysis was performed from the surgical database over five years, from 01/01/2017 to 31/12/2022. All cases of emergency laparotomy that fit the NELA inclusion criteria were included. Small bite closure was performed by a standardised technique with slowly absorbable sutures. A comparator cohort of cases closed with mass closure was used for comparison.

**Results:** 509 patients who had emergency operations and fulfilled the inclusion criteria were identified, 262 (51.5%) had small bite closure, and 247 (48.5%) received mass closure technique. The mean age was 66.5 years  $\pm$  16 SD ( $P = 0.981$ ). There were 285 females (56%) ( $P = .344$ ). The main approach for surgery was the open approach, with 291 (57.2%). All cases in both groups had a consultant surgeon present. There was no significant difference in the types of procedures performed. 218 (42.8%) cases were started as laparoscopic procedures and then converted to laparotomy, while 219 (57.2%) were straight to laparotomy.

Overall, there were 14 (2.8%) superficial wound dehiscence, with 8 cases (3%) in the small bites closure group and 6 cases (2%) in the mass closure group ( $P = .789$ ). There were ten deep dehiscence (2%) cases, with 4 (1.5%) in the small bite group and 6 (2%) in the mass closure group ( $P = .535$ ). 39 patients (7.7%) developed wound infection, with 16 (6%) in the small bites closure group and 23 (9%) in the mass closure group ( $P = 0.186$ ).

The mean post-operative stay was 9.9  $\pm$  21.2 days, with a mean of 10 days in the small bites closure and 14 days for the mass closure group ( $P = 0.587$ ).

There were 52 (10.2%) overall 30-day mortality, with 18 (7%) in the small bite group and 34 (14%) in the mass clo-



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sure group ( $P=0.0124$ ). Overall mortality was 105 (20.6%) in both groups, with 40 (15%) in the small bite group and 65 (26%) in the mass closure group ( $P = .002$ ).

**Conclusion:** Our study suggests that there is no difference in small bites closure compared to mass closure in emergency laparotomy; further research with further data on BMI, smoking, and incisional hernia needs to be investigated in future research.

## Introduction

Emergency laparotomy has a high mortality rate of up to 24% [1]. Complications can include wound complications such as incisional hernia, and SSIs (Surgical site infection) are not uncommon (up to 30%) [2]. Incidence of Surgical Site Infections (SSIs) varies in the literature; in the UK, SSIs represent the third most common health care related infections with a rate of (15.7%) [3]. This is related to many factors, generally the procedure or patient factors [4]. The operating surgeon controls some procedure-related factors, such as the type of incision, type and length of suture material, and closure technique [5,6]. Slowly absorbable suture material has reduced the wound infection rate compared to non absorbable sutures [7,8]. In 2015 the STITCH trial showed that the small bites technique had reduced incidences of wound-related complications such as incisional hernia and burst abdomen [9] however, this had only included patients undergoing elective surgery.

There is a robust body of evidence to support the technique of small bite fascial closure in elective abdominal surgery. This relates to reduced early fascial dehiscence and subsequent incisional hernia rate [10,11]. The technique of small bite closure is well described and is based on using slowly absorbable suture material.

Despite a slow uptake of the technique in the UK, in our institution, the method of small bite closure was adopted for elective surgery cases in 2015. As our team developed experience, the small bite technique was adopted in the emergency setting in 2017.

Currently, most of the literature relates to elective surgery. This may relate to the ease of randomisation in the elective setting compared to the emergency setting. There may also be hesitation in the surgical community to adopt this technique in emergency cases.

Our institution is based in the North East of England and covers a large geographical area with a population cohort of around 500000 people with a high volume of emergency laparotomies. Many general surgeons (colorectal and upper gastrointestinal surgeons) manage the acute abdomen. All cases were either performed or supervised by a consultant surgeon who was present in the operating room.

In this study, we investigate the effect of small bite closure compared to a cohort of mass closure in emergency abdominal surgery. Our primary outcomes are wound dehiscence and wound infection, and our secondary outcome is 30-day mortality.

## Methods

Cases were identified retrospectively from a prospectively maintained database in our institution over five years, from 01/01/2017 to 31/12/2022. All cases of adults (over 18 years old) involving an emergency laparotomy which fulfilled the

NELA (National Emergency Laparotomy Audit) inclusion criteria [12], emergency laparoscopic surgery conversions or emergency colorectal cases extraction sites were included. Patients who underwent emergency laparotomy for appendicectomy, hernia without bowel resection and trauma were excluded.

Demographic data and baseline characteristics were analysed and matched to two groups based on the type of abdominal fascia closure technique; Group A included patients who underwent the small bites closure technique, and Group B had patients who received fascial closure through the traditional mass closure technique. Data were compared between both groups. Statistical analyses were conducted using SPSS IBM V24. Fisher exact, Chi-square and Unpaired 't' tests were used to assess the statistical significance when appropriate.

## Description of the technique

Since 2017, we have adopted a standardised method of small bite closure in emergency cases. This was based on a slowly absorbable 2/0 suture (Polydioxanone) in a 4:1 suture-to-wound length ratio. The small bites technique was followed with a 5 mm width and length along the anterior fascia. The small bite technique was used to the surgeon's preference in emergency cases and was not established as mandatory. The mass closure group received abdominal fascial closure through standard conventional mass closure using a slowly absorbable suture of a large size "1" (Polydioxanone), continuous and total thickness with the use of two sutures which meet in the middle and are tied together.

## Results

509 patients who had emergency operations and fulfilled the inclusion criteria were identified, 262 (51.5%) had small bite closure, and 247 (48.5%) received mass closure technique. The overall mean age was 66.5 years  $\pm$  16 SD, the small bite closure group's mean age was 64.4  $\pm$  16.5 years, and the mass closure group was 68.7  $\pm$  15.2 years ( $P = 0.981$ ) (**Figure 1** shows the distribution of cases by age). There were 285 females (56%) and 224 (44%) males collectively ( $P=.344$ ). The main surgery approach was open with 291 (57.2%). All cases in both groups had a consultant surgeon present. Both groups were comparable in age, sex, and ASA (**Figure 2** shows the distribution of cases by ASA). There was no significant difference in the types of procedures performed. 218 (42.8%) cases were started as laparoscopic procedures and then converted to laparotomy, while 219 (57.2%) were straight to laparotomy. **Table 1** shows the demographics of both groups.

Overall, there were 14 (2.8%) superficial wound dehiscence, with 8 cases (3%) in the small bites closure group and 6 cases (2%) in the mass closure group ( $P = .789$ ). There were ten deep dehiscence (2%) cases, with 4 (1.5%) in the small bite group and 6 (2%) in the mass closure group ( $P=.535$ ). 39 patients (7.7%) developed wound infection, with 16 (6%) in the small bites closure group and 23 (9%) in the mass closure group ( $P. 0.186$ ).

The mean post-operative stay was 9.9  $\pm$  21.2 days, with a mean of 10 days in the small bites closure and 14 days for the mass closure group ( $P = 0.5874$ ).

There were 52 (10.2%) overall 30-day mortality, with 18 (7%) in the small bite group and 34 (14%) in the mass closure group ( $P=0.0124$ ). Overall mortality was 105 (20.6%) in both groups, with 40 (15%) in the small bite group and 65 (26%) in the mass closure group ( $P = .002$ ). **Table 2** shows a summary of the results.

**Table 1:** Patients' demographics.

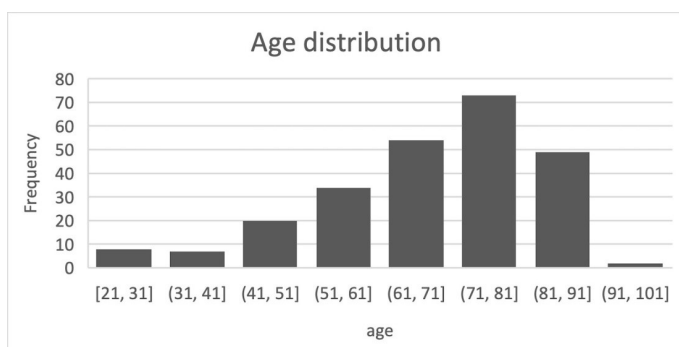
Variables	All patients	Small bites closure group	Mass closure group	P Value
Number	509	262	247	
Mean Age in years ± SD	66.5 ± 16	64.4 ± 16.5 (18-91)	68.7 ± 15.2 (21-99)	.981*
Gender				
Male	224 (44%)	110 (42%)	114 (46.2%)	.344**
Female	285 (56%)	152 (58%)	133 (53.8%)	
ASA †				
I	59 (11.6%)	47 (17.9%)	12 (4.9%)	
II	211 (41.5%)	123 (46.9%)	88 (35.6%)	
III	162 (31.8%)	71 (27.1%)	91 (36.8%)	
IV	73 (14.3%)	20 (7.6%)	53 (21.5%)	
V	4 (0.8%)	1 (0.4%)	3 (1.2%)	
Approach				
Open	291 (57.2%)	119 (45.4%)	172 (69.6%)	
Laparoscopic converted to open	218 (42.8%)	143 (54.6%)	75 (30.4%)	

\*Unpaired 't' test \*\*Chi-Square test † Median, ASA American Society of Anaesthesiologists classification.

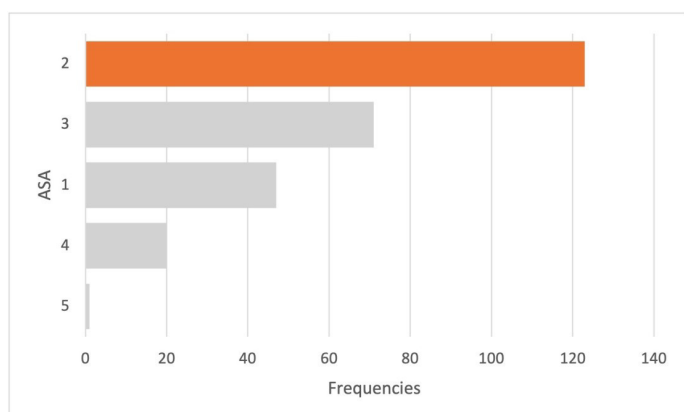
**Table 2:** Results.

Variables	All patients	Small bites closure group	Mass closure group	P Value
Number	509	262	247	
Superficial wound dehiscence	14 (2.8%)	8 (3%)	6 (2%)	0.789*
Deep dehiscence	10 (2%)	4 (1.5%)	6 (2%)	0.535*
Wound infections	39 (7.7%)	16 (6%)	23 (9%)	0.186*
Mean post operative stay10(days)	9.9 ± 21.2	10 (2 to 74)	14 (3 to 65)	0.5874**
30 day Mortality	52 (10.2%)	18 (7%)	34 (14%)	0.0124*
Overall mortality	105 (20.6%)	40 (15%)	65 (26%)	0.002*

\*Fisher's exact test \*\*Unpaired 't' test.



**Figure 1:** Age distribution in the included population.



**Figure 2:** ASA distribution in the included population.

### Discussion

Recently, there has been an established interest in reducing post-operative wound morbidity from midline laparotomy incisions. This is especially true with the subsequent development of incisional hernia with fascial closure techniques. The incidence of incisional hernia after laparotomy ranges from 10% to 69% in high risks cases [13,14]. In the past few years, there has been an accepted body of literature to establish the reduction in incisional hernia using a small bites fascial closure technique. EHS (European Hernia Society) guidelines 2015 recommended using the small bites closure technique in elective laparotomy incisions utilising a 4:1 suture-to-wound ratio and a slowly absorbable suture [15].

Despite this evidence, there is still reluctance in the broader surgical community to utilise this technique. Several studies have investigated surgeons' uptake of this technique [16]. Even in units aware of the technique, around 30% of elective laparotomy incisions were closed with the correct small bites' technique. A few reasons may be identified. Education must be recognised as a principal factor in disseminating good practice and a limitation in adopting the technique. Surgeons may also tend to dogma even when presented with evidence [17]. The same may be the case with small bites closure. This may also be related to apprehension by surgeons for the early complication of deep dehiscence, which conveys significant morbidity when it occurs [18].

In considering small bites' fascial closure, there is an awareness that most literature relates to elective surgery. This is true of the STITCH trial, which strongly advocated the uptake of this technique with robust data [9]. The use of small bites closure has been considered in the emergency setting. Wound and hernia morbidity following emergency laparotomy is considerable and directly affects patients' quality of life and return to activity, as well as a tremendously costly impact on the healthcare system [19,20]. The benefit of the small bites technique in reducing morbidity and mortality from these procedures must be considered.

In the emergency setting, our study shows comparably favourable results towards the small bite closure group with a rate of fascial dehiscence of 1.5% and 30-day mortality of 7% ( $p = 0.0124$ ) and lower overall mortality (7% Vs 14%), which was statistically significant ( $p = 0.002$ ). There was no significant trend for the development of fascial dehiscence in our study, although Tolstrup et al. identified male sex and medical comorbidities as substantial [21].

Limitations of this study included a lack of data which might impact the rate of wound complications such as obesity, smoking, nutritional, and steroid use; further plans are to organise more exhaustive research with a five-year follow-up for incisional hernia rate.

Tolstrup et al. [22] investigated the results of implementing small bites closure in emergency laparotomy cases and compared results to a matched historical cohort. They showed a reduced rate of fascial dehiscence (6.6% to 3.8%). They also showed a reduction in 30-day mortality (22.4% to 18.4%). A further analysis was performed, which showed a decrease in incisional hernia on follow-up (27% to 15%) [23].

## Conclusion

Our study suggests no difference in the long-term outcomes of using small bites closure compared to the mass closure technique in emergency laparotomy; further data on BMI, smoking, and incisional hernia needs to be investigated in future research.

**Conflicts of interest:** None.

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**Authors contribution:** All authors contributed to study design and data interpretation. The data set was processed and exported for analysis by DW and AK. Statistical analysis, data verification and writing of the report were carried out by HE and DL. All authors critically appraised and approved the final report.

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