

# Technique of Midline Abdominal Incision Closure Among Surgical Trainees

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## Abstract

**Background:** Technique of anterior abdominal wall closure (AAWC) determines wound-related surgical complications. Residents in obstetrics and gynecology and surgery departments perform most midline abdominal wall closure; data is lacking on how it is being done. This study identifies abdominal wall closure techniques used. **Methods:** A descriptive study was carried out from October 2015 to May 2016. **Results:** 71 (35 surgical, 36 ObGyn) residents completed a self-administered questionnaire. Knowledge of midline abdominal closure was acquired from medical officers (58.6%) or consultants before residency (28.6%). Absorbable suture was preferred for clean wounds by 75% of residents; 70% used size 1 suture for fascial closure. Most residents (95.7%) closed fascia in clean wound by continuous suturing. Interrupted suturing was preferred in contaminated and dirty wounds. Half of the

residents in both groups would close skin in contaminated wounds, while 16% of surgery and 9.4% ObGyn will close skin in dirty wounds. **Conclusion:** Inconsistencies exist in anterior abdominal wall closure between groups of residents despite presence of clear guidelines. It is important to harmonize training on AAWC at the tertiary hospital.

**Keywords:** Abdominal closure, Midline incision, Wound complications

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## Introduction

Proper technique and choice of suture material are surgeon dependent and are crucial for secure closure (1–3). Simple continuous suturing is most widely used because tension is distributed evenly along the suture line, it has less knots and uses less suture material, and is quicker than the interrupted closure (4). Non-absorbable sutures, such as nylon and polypropylene, although having high tensile strength and durability, have increased chances of stitch sinus formation and suture-related pain and buttonhole hernia (4, 5). Absorbable sutures avoid those limitations but have a short half-life and less tensile strength (4).

The fascia layer contributes to tensile strength of the abdominal wall. It is the most important layer to close preferably with a fine, e.g. 2/0, long-term absorbable monofilament suture. Bites should be taken at 5–8 mm from the edge and 4–5 mm between bites as this has shown to be the best technique for fascial closure (5). Data are scarce on technique of midline abdominal incision closure among residents globally. This

knowledge may lead to improvement in teaching correct technique and in reinforcing what is being done correctly. This may reduce abdominal wound complications such as burst abdomen, chronic pain and incisional hernias.

Long-term complication such as incisional hernia may occur in 5–15% of midline abdominal closures and its repair may cost up to one billion dollars annually in the USA (6). We undertook this study to describe the abdominal wall closure technique used by residents in the surgical and obstetrics and gynecology (ObGyn) departments and to identify self-reported complications of midline abdominal incision closures.

## Methods

This study was conducted in the departments of surgery and obstetrics and gynecology from October 2015 to May 2016, targeting all residents from the two departments in clinical years of training. Ninety-four residents were eligible participants for this study. Upon approval from the University of Nairobi/Kenyatta National Hospital-ERC (Ref Number: KNH-ERC/A/156), data were

collected using a pre-designed self-administered questionnaire. These data focused on demographic data, year of residency, source of information on abdominal wall closure, choice of suture material and technique of midline abdominal wall closure. Data entry and analysis used SPSS version 20.

## Results

Seventy-one (76%) residents in clinical years in the two departments returned a duly filled self-administered questionnaire.

Most respondents had post internship surgical exposure of between 1 and 2 years, working in either the surgery or obstetrics and gynecology units before joining residency (Table 1). Knowledge of how to close the abdomen was largely acquired during internship and residency where they learned from medical officers and senior fellow residents respectively (Table 1).

Table 1: Early surgical exposure and knowledge source on abdominal closure

	Department	
	Surgery (%)	ObGyn (%)
Post internship surgical exposure		
1 year	20	33
2 years	33	33
3 years	17	16
4 years	14	12
5 years	14	5
More than 5 years	2	3
Source of knowledge on correct abdominal closure practice		
Taught by medical officer during internship	58	63
Taught by consultant during internship	8	7
Taught by consultant during residency	2	2
Taught by fellow resident during residency	30	27
Watching videos online	2	1

In both groups, most respondents said they closed the fat layer; a third of these said their decision was not influenced by fat layer thickness (Table 2). Most said they did not use subcutaneous drains (Table 3). In both groups the trend was towards not closing the skin for higher wound classes, but it was observed that more ObGyn residents closed the skin for contaminated and dirty wounds than did surgery residents (Table 3). When closing the fascia layer, most residents from the two departments took bites that were between 5 and 10 mm from the wound edge and between one bite to the next (Table 4).

Table 2: Fascial closure, technique and choice of suture depending on wound class

Choice of suture	Department	
	Surg (%)	ObGyn (%)
<i>Clean wound</i>		
Absorbable	43	98
Non absorbable	50	1
No preference	7	1
<i>Clean contaminated</i>		
Absorbable	30	94
Non absorbable	59	4
No preference	11	2
<i>Contaminated</i>		
Absorbable	22	89
Non absorbable	69	8
No preference	9	3
<i>Dirty</i>		
Absorbable	7	72
Non-absorbable	90	21
No preference	3	7
Technique		
<i>Clean wound</i>		
Continuous	94	98
Interrupted	2	2
No preference	4	0
<i>Clean contaminated</i>	90	98
Continuous	7	1
Interrupted	3	1
No preference		
<i>Contaminated</i>		
Continuous	84	71
Interrupted	12	20
No preference	4	9
<i>Dirty</i>		
Continuous	85	62
Interrupted	19	36
No preference	6	2

Table 3: Subcutaneous layer and skin closure

Closure of subcutaneous layer	Department	
	Surg (%)	ObGyn (%)
<i>Closes fat layer</i>		
Yes	69	67
No	31	33
<i>Approx. adipose layer thickness considered for closure</i>		
Size not a consideration	32	34
<1 cm	21	24
1–3 cm	23	19
>3 cm	24	23
<i>Use of subcutaneous drains</i>		
Yes	9	11
No	91	89
Skin closure by wound category		
<i>Clean contaminated</i>		
Yes	100	100
No	0	0
<i>Contaminated</i>		
Yes	54	65
No	46	35
<i>Dirty</i>		
Yes	11	49
No	89	51

Table 4: Distance between suture bites from fascia edge and in-between bites

Distance (mm)	Proportion	
	Surgery (%)	ObGyn (%)
<i>Suture bites from fascia edge</i>		
<5	17	17
5	34	31
10	40	40
15	3	3
20	6	9
<i>In-between bites</i>		
<5	12	9
5	18	3
10	55	73
15	3	6
20	12	9

**Discussion**

In Kenya, internship period and first few years of residency represent a critical period of learning the principles and practice of surgery, including principles of laparotomy wound closure. While many factors beyond the surgeon’s control are responsible for wound breakdown, learning proper technique and suture choice early are vital for secure closure (6,7).

Most residents use continuous suturing for the fascia layer regardless of wound class. Most ObGyn residents used absorbable suture across all the wound classes; surgery residents were more likely to use non-absorbable suture for contaminated and dirty wounds. The most commonly used non-absorbable suture is nylon while the most used absorbable suture is vicryl, with PDS coming in second. Nylon and polypropylene have been used for 40 years now but have been associated with increased incidence of stitch sinus formation and suture-related pain and buttonhole hernia (4,5). However, this suture has great tensile strength and is relatively immune to infection (4,8). Due to these complications, the use of absorbable sutures gradually became popular. The absorbable sutures commonly used are polygalactin 910 (vicryl®) and dixon. These sutures have a half-life of 15–90 days and most of their tensile strength is lost by day 21. These sutures are braided, hence can act as a nidus to harbor bacteria, leading to infection and wound failure (4). Absorbable monofilament sutures are currently routinely used for fascial approximation due to their longer half-life and relative immunity towards infection. Such types are polydioxone (PDS®) and polyglyconate (maxon®); they have a half-life of 180days and maintain their tensile strength for up to 4weeks. PDS has a tensile strength 16% more than that of vicryl (4,9). A study in Ontario, Canada reported that 39–44% of surgeons used vicryl, 24–26% used PDS and 14–

16% used polypropylene (10). A similar study from Tanzania reported totally opposite results. Among general surgeons, 57% preferred using polypropylene, 15% vicryl and 27% PDS. Among gynecologists, 61% preferred using vicryl, 25% polypropylene and 14% used PDS (11). The incidence of incisional hernia was comparable when PDS and a non-absorbable were used; however, in a meta-analysis done by Hodgson, other complications were lower with the use of PDS (10).

Most respondents across the two groups use a bite distance of 10 mm from wound edge and between bites. They also mainly use suture size number 1 or 2. Millbourn and Israelsson in separate studies have shown that monofilament long-term absorbable suture size 2/0 suffices in reducing wound-related complications especially incisional hernia and wound dehiscence. In addition, bite distance of 5–8 mm from wound edge and 4–5 mm between stitches giving a suture: wound ratio of at least 4:1 is associated with less wound complications (6,12). This would require a shift in practice in our setting; however, with more awareness some residents are practicing the small bites and 4:1 suture to wound length ratio.

Most residents in the two departments close the fat layer, with a third of those that do so closing the layer regardless of thickness. Anatomically, the rectus sheath (fascia) offers the greatest tensile strength to a laparotomy wound and it is this layer that has the greatest impact to wound-related complications post laparotomy (4,12). Although theoretically closure of subcutaneous layer would be expected to result in less wound complications and result in better cosmesis, the available evidence shows that fat closure results in more inflammatory changes due to more suture material in the wound, and has no effect on prevention of wound complication (6).

For class III and IV wounds, surgery residents reported a tendency to leave the skin open. This was less so among the ObGyn residents. Current recommendation is that class III (contaminated) and IV (dirty) wounds should not be closed and should be left open to heal by secondary intention, with the possibility of delayed primary closure, depending on the state of the wound bed as it progresses.

## Conclusion

In Kenya, abdominal closure knowledge and skills are passed down among peers from senior to junior colleagues during residency. There appears to be no consensus among the residents on the suture type to be used for closure of the different classes of wounds. Both surgery and ObGyn residents show inconsistencies in the technique of anterior abdominal wall closure despite presence of clear guidelines on the same. It is therefore important to harmonize training on AAWC for both groups.

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