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

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).

| Post internship surgical exposure | Department |
|-----------------------------------|------------|
|                                   | Surgery (%) | ObGyn (%) |
| 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 | Department |
|---------------------------------------------------|------------|
| 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 1: Early surgical exposure and knowledge source on abdominal closure |
|--------------------------------------------------------------------------|
| Post internship surgical exposure                                       | Department |
|                                                                         | Surgery (%) | ObGyn (%) |
| 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         |

| Table 2: Fascial closure, technique and choice of suture depending on wound class |
|----------------------------------------|--------|--------|
| Choice of suture                       | Surg (%) | ObGyn (%) |
| Clean wound                            |         |         |
| Absorbable                             | 43      | 98     |
| Non absorbable                         | 50      | 1      |
| No preference                          | 7       | 1      |
| Clean contaminated                      |         |         |
| Absorbable                             | 30      | 94     |
| Non absorbable                         | 59      | 4      |
| No preference                          | 11      | 2      |
| Contaminated                           |         |         |
| Absorbable                             | 22      | 89     |
| Non absorbable                         | 69      | 8      |
| No preference                          | 9       | 3      |
| Dirty                                  |         |         |
| Absorbable                             | 7       | 72     |
| Non absorbable                         | 90      | 21     |
| No preference                          | 3       | 7      |

| Table 3: Subcutaneous layer and skin closure |
|---------------------------------------------|--------|--------|
| Closure of subcutaneous layer               | Surg (%) | ObGyn (%) |
| Closes fat layer                           |         |         |
| Yes                                        | 69      | 67     |
| No                                         | 31      | 33     |
| Approx. adipose layer thickness considered for closure |        |        |
| Size not a consideration                    |         |        |
| <1 cm                                      | 32      | 34     |
| 1–3 cm                                     | 23      | 19     |
| >3 cm                                      | 24      | 23     |
| Use of subcutaneous drains                 |         |        |
| Yes                                        | 9       | 11     |
| No                                         | 91      | 89     |

| Skin closure by wound category             | Department |
|--------------------------------------------|------------|
| Clean contaminated                         |            |
| Yes                                        | 100        | 100     |
| No                                         | 0          | 0       |
| Contaminated                               |            |
| Yes                                        | 54         | 65      |
| No                                         | 46         | 35      |
| Dirty                                      |            |
| Yes                                        | 11         | 49      |
| No                                         | 89         | 51      |
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 dexon. 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 polydioxanone (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.

| Suture bites from fascia edge | Proportion Surgery (%) | ObGyn (%) |
|-----------------------------|------------------------|----------|
| Distance (mm)               |                        |          |
| <5                          | 17                     | 17       |
| 5                           | 34                     | 31       |
| 10                          | 40                     | 40       |
| 15                          | 3                      | 3        |
| 20                          | 6                      | 9        |

| In-between bites             | Proportion Surgery (%) | ObGyn (%) |
|------------------------------|------------------------|----------|
| Distance (mm)                |                        |          |
| <5                           | 12                     | 9        |
| 5                            | 18                     | 3        |
| 10                           | 55                     | 73       |
| 15                           | 3                      | 6        |
| 20                           | 12                     | 9        |

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

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.

References
1. Patnaik V, Singla R, Bansal V. Surgical incisions—their anatomical basis Part IV—abdomen. J Anat Soc India. 2001;50(2):170–8.
2. Murtaza B, Khan N, Sharif M, et al. Modified midline abdominal wound closure technique in complicated/high risk laparotomies. J Coll Physicians Surg Pakistan. 2010;20(1):37–41.
3. Knaebel H-P, Koch M, Sauerland S, et al. Interrupted or continuous slowly absorbable sutures—Design of a multi-centre randomised trial to evaluate abdominal closure techniques INSECT-trial [ISRCTN24023541]. BMC Surg. 2005; 5:3.
4. Fortelny RH. Abdominal wall closure in elective midline laparotomy: The current recommendations. Front Surg. 2018; 5:34.
5. Krukowski Z, Matheson N. “Button-hole” incisional hernia: A late complication of abdominal wound closure with continuous non-absorbable sutures. Br J Surg. 1987; 74:824–5.
6. Millbourn, Daniel. Closure of midline abdominal incisions with small stitches: studies on wound complications and health economy. Diss. Umeå universitet, 2012.
7. Poole G. Mechanical factors in abdominal wound closure: The prevention of fascial dehiscence. Surgery. 1985;97(6):631–40.
8. Sharp W, Belden T, King, et al. Suture resistance to infection. Surgery. 1982; 91:61–3.
9. RodeheaverT, Powell T, Thacker J, et al. Mechanical performance of monofilament synthetic absorbable sutures. Am J Surg. 1987; 154:544–7.
10. Williams Z, Williams S, Easley H, et al. An evaluation of abdominal wall closure in general surgical and gynecological residents. Hernia. 2017; 21(6):873–7
11. Komba, Charles Onesphor. "Practices of abdominal fascial closure and related complications following elective midline laparotomy at Muhibbili national hospital." PhD diss., Muhibbili University of Health and Allied Sciences, 2012.
12. Israelsson L, Millbourn D. Closing midline abdominal incisions. Langenbecks Arch Surg. 2012;397(8):1201–7.