Can practice on a model, video review with structured objective and subjective feedback improve residents' midline laparotomy fascia closure?

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Introduction

Traditionally, the closure of the fascial layer of laparotomy incisions is taught in the operative setting without specific simulation training, using 1 cm tissue bites placed 1 cm apart [1]. However, several trials including the STITCH trial [2,3] suggest that smaller bites may lead to fewer incisional hernias and better outcomes, emphasizing a 4:1 suture-to-wound length ratio. Postoperative fascia dehiscence and hernia can lead to increased mortality, readmissions, and costs.

Aim: enhance surgical residents' techniques of midline laparotomy fascia closure. Hypothesis: simulated training module, complemented by constructive feedback, will help consistently achieve 4:1 suture-to-wound ratio.

Methods

We first assessed the current technique, then trained residents using a simulated abdominal wall model, and evaluated the operative technique after training.

- Pre-intervention data was collected during laparotomy closures, capturing laparotomy length, suture length, and the suture-to-wound ratio with the goal of at least 4:1. This anonymized data was catalogued by the resident year.
- Residents underwent didactic education on abdominal wall closure and hands-on training with our simulation model. *M*easurements were taken on the non-visible, visceral side of the fascia model. Objective measures on a model included the bite depth, the distance between bites (travel), the suture tension, the knot quality, and the suture-to-wound ratio, with a goal of at least 2.9:1 on a model (the analogue of 4:1 ratio on our model). T-test was used to compare the suture-to-wound ratio with ideal.
- *A subjective evaluation of the videotaped closures was performed based on a modified Operative Performance Rating System, specifically general criteria for open ventral hernia repair, that included instrument handling and needle orientation, respect to tissue, time and motion, operation flow and overall performance, with grading on a 1 to 5 scale. Objective and subjective feedback was provided to the residents (ongoing).*

- Post-intervention clinical measurements of suture-to-wound were obtained in a similar way.

Results

Anonymous pre-intervention 26 measurements of residents' fascia closures revealed an average suture-to-wound ratio of 2.7:1 (ranging from 0.8:1 to 5.6:1), significantly lower than the goal of 4:1 (p=0.025). Only 19% of residents were able to achieve a suture-to-wound ratio of at least 4:1.

After the training, during a simulation on a model, a higher percentage of residents (31%) achieved the appropriate suture-to-wound ratio. However, there was a high variability in the bite depth of individual residents. Every resident had 6%-84% of very small bites (1-3 mm). Additionally, 0%-65% of the bites were too large (9-14 mm). Post-intervention 15 clinical measurements from residents showed that the mean ratio increased to 4:1 and more residents (45% vs 19% pre-intervention) were able to reach a suture-to-wound ratio of at least 4:1. The most significant improvement was observed among PGY2 residents (current PGY3).

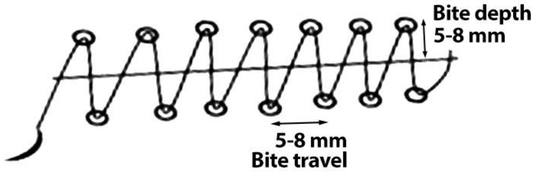


Figure 1: Small incremental bites.

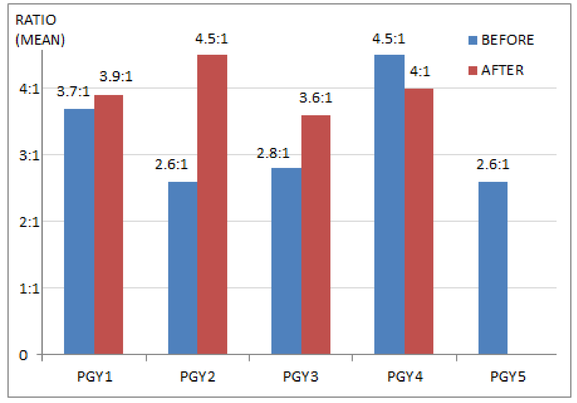


Figure 2: Improvement in suture-to-wound ratio among the residents of different levels.

Conclusions

1. Training on a simulated fascia **helped the residents achieve the goal of 4:1 suture-to-wound ratio** better than traditional teaching in the operating room. 45% of residents vs. initial 19%, achieved at least the 4:1 ratio. The mean ratio increased from 2.7:1 to 4.0:1.
2. Variability and a significant number of small bites on the model might be related to skiving.
3. The ability to perform detailed measurements on a model can reveal individual pitfalls and help create strategies to avoid them.
4. The next step is to evaluate whether objective and subjective feedback for residents can improve suture-to-wound ratio in clinical settings.

References

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