IBOM MEDICAL JOURNAL
Vol.18 No.3 | July - September 2025 | Pages 479-484
www.ibommedicaljournal.org

Cosmetic outcomes and wound closure time in paediatric transverse laparotomy: A randomised comparison of mass and layered closure techniques

Ituen, MA[1], Akpanudo, EI[2], Eyo, CS[3], Ekot EA[4]*

[1,2]*Department of Surgery, Faculty of Clinical Sciences, University of Uyo, Nigeria.*
[3]*Department of Anesthesia, Faculty of Clinical Sciences, University of Uyo, Nigeria.*
[4]*Paediatric Surgery, Addenbrookes Hospital, Hills Road, Cambridge CB2 0QQ, United Kingdom.*

Abstract

Background: Optimal abdominal wall closure in children should ideally balance efficiency with long-term cosmetic outcomes. This study compared wound closure time and scar appearance following mass versus layered closure in paediatric transverse laparotomies.
Methods: This single-centre, randomised clinical trial was conducted at the University of Uyo Teaching Hospital, Nigeria, between December 2021 and December 2023. Children aged ≤5 years undergoing transverse laparotomy were randomly assigned to either mass or layered closure techniques. Closure was performed using Polyglactin 910 sutures by senior surgical trainees following standardised protocols. The primary outcomes were wound closure time and cosmetic appearance, assessed using the Stony Brook Scar Evaluation Scale (SBSES) at 3 and 6 months postoperatively. Data were analysed with SPSS version 23.0, using appropriate statistical tests, with significance set at $p < 0.05$.
Results: A total of 111 children were enrolled: 56 in the mass closure group and 55 in the layered group. Mean wound closure time was significantly shorter in the mass closure group (18.6 ± 3.4 minutes) than in the layered group (32.8 ± 3.8 minutes; $p < 0.001$). Cosmetic outcomes were comparable between groups at both 3 and 6 months (mean SBSES score: 4.2 vs. 4.1; $p = 0.58$). Wound contamination and postoperative complications were significantly associated with poorer scar scores, regardless of closure technique.
Conclusion: Mass closure offers a time-saving advantage without compromising scar appearance, making it a practical and cosmetically acceptable technique for paediatric abdominal wall closure in resource-limited settings.

Keywords: Paediatric surgery, Laparotomy, Cosmesis, Mass closure, Layered closure, Nigeria

Introduction

Optimal abdominal wall closure is a critical aspect of laparotomy in children, influencing both short-term healing and long-term cosmetic outcomes.[1] The commonly adopted closure methods are mass closure and layered closure. The choice between them is often based on surgeon preference, institutional practice, or perceived outcomes, rather than high-quality evidence in paediatric populations.

Cosmesis is a particularly important consideration in paediatric surgery, where visible scars may persist for a lifetime and impact psychosocial development.[2] Despite this, few studies have specifically evaluated the cosmetic outcomes of abdominal wall closure in children.

Beyond cosmetic appearance, operative efficiency is also a key consideration. In paediatric patients, prolonged anaesthesia is associated with greater physiological risk, and operating theatre time is often limited. Mass closure is generally considered

Corresponding Author:
Dr. Monday A. Ituen
Pediatric Surgery Unit, Department of Surgery, Faculty of Clinical Sciences, University of Uyo, Nigeria.

ima.ituen24@gmail.com

DOI: 10.61386/imj.v18i3.706

more time-efficient,[3,4] yet its relative speed and cosmetic results in children undergoing transverse laparotomy remain underexplored.

While the existing literature provides some insight into closure techniques, most of the studies are based on adult populations, often in high-resource settings, and rarely prioritise cosmetic outcome as a primary endpoint. This study addresses these gaps by evaluating both operative time and scar appearance following transverse laparotomy in a paediatric population within a resource-constrained setting. We hyothesised that there would be no difference between the two intervention groups for evaluated endpoints

Materials and methods

Study Design and Setting

This was a single-centre, hospital-based randomised clinical trial conducted at the University of Uyo Teaching Hospital (UUTH), a 500-bed tertiary referral centre located in Uyo, the capital city of Akwa Ibom State, South-South Nigeria. The paediatric wards have a dedicated capacity of 150 beds. The Paediatric Surgical Unit provides specialised care in general paediatric surgery, neonatal surgery, and paediatric urology. It performs over 100 paediatric laparotomies annually and is staffed by consultant paediatric surgeons, specialist registrars, and paediatric nurses. The study spanned a 24-month period from December 2021 to December 2023, during which patient recruitment occurred over the first 12 months, followed by a one-year observation period to complete follow-up for the final participants.

Study Population and Inclusion Criteria

The study population comprised children aged 0 to 5 years, who underwent laparotomy through a transverse abdominal incision. Exclusion criteria included previous laparotomy, the presence of congenital or acquired anterior abdominal wall defects, and contaminated, or dirty wounds classified as Class III and IV by the Centre for Disease Control and Prevention (CDC) Surgical Wound Classification.[5] Children whose parents or guardians declined consent were also excluded.

Randomisation and Surgical Procedure

Eligible participants were randomly assigned to one of two groups: Group A (mass closure) or Group B (layered closure). All closures were performed using Polyglactin 910 (Vicryl™) sutures, with suture size chosen based on patient age and body size. Surgeries were performed by senior registrars under consultant supervision, using standard aseptic technique.

In the mass closure group, the abdomen was closed en-mass with a continuous suture incorporating all layers except subcutaneous tissue and skin. In the layered closure group, the abdomen was closed in anatomical layers using interrupted sutures. Subcutaneous tissue and skin were closed similarly in both groups.

This was a single blind study. Although the surgeons were aware of the assigned closure technique, the patients and outcome assessors were blinded to group allocation. The assessors were plastic surgeons who were not part of the investigative team.

Outcome Measures

The primary outcomes for this study were:

- Wound closure time, defined as the time (in minutes) taken to complete abdominal wall closure, measured intraoperatively with a stopwatch. Timing began at the start of fascial closure and ended at the completion of skin closure.
- Cosmetic outcome, assessed using the Stony Brook Scar Evaluation Scale at 3 and 6 months postoperatively. The scale scores scar characteristics including width, height, colour, and overall appearance. Scores range from 0 to 5, with higher scores indicating better cosmetic results.

Sample Size Consideration

This study represents a secondary analysis of a previously conducted randomised trial powered to assess differences in wound complication rates. The sample size of 111 participants was not specifically calculated to detect differences in wound closure time or cosmetic outcomes. As such, findings related to these endpoints should be interpreted as exploratory, though based on prospectively collected data.

Data Collection and Follow-Up

Wound closure time was measured intraoperatively by an independent observer not involved in the surgery. Scar assessments were conducted at 3 and 6 months during routine outpatient follow-up using a standardised scoring form.

Statistical Analysis

Data were analysed using SPSS version 23.0. Continuous variables, which included wound closure time and scar scores, were summarised as means and standard deviations and compared using the Student's t-test for normally distributed data, or the Mann-Whitney U test where data was non-normally distributed. Categorical variables were summarised as frequencies and percentages and assessed for associations using the Chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

Pilot Study

Prior to the main study, a pilot was conducted to assess inter-observer reliability in the use of the Stony Brook Scar Evaluation Scale (SBSES) for cosmetic outcome assessment. Two trained assessors independently reviewed anonymised postoperative scar photographs from 10 children who had undergone transverse laparotomies. Inter-observer agreement was evaluated using Cohen's kappa statistic for individual scale components and the intraclass correlation coefficient (ICC) for overall SBSES scores. A minimum ICC threshold of 0.8 was considered acceptable. Where initial discrepancies arose, additional training and consensus discussions were undertaken to improve scoring consistency. Following this, both assessors proceeded to evaluate scars in the main study. Final scoring discrepancies in the main study were resolved by consensus between assessors. Data from the pilot study were not included in the final analysis.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee of the University of Uyo Teaching Hospital (UUTH/AD/S/96/VOL.XIV/575). Written informed consent was obtained from the parents or legal guardians of all participants before enrolling. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Confidentiality of participants' information was strictly maintained, and data were anonymised during analysis and reporting. No financial incentives were offered, and participation was entirely voluntary, with the option to withdraw at any stage without consequence to the patient's care.

Results

A total of 111 paediatric patients who fulfilled the eligibility criteria were recruited and included in the analysis. Of these, 56 children (50.5%) had mass closure, while 55 (49.5%) had layered closure. Patient ages ranged from 2 days to 5 years, with a median of 7 months (interquartile range: 4–36 months). Infants aged between 1 and 12 months accounted for the largest proportion at 49 (44.1%), and 71 (64.0%) of the participants were males.

There were no statistically significant differences between the two study groups in terms of baseline socio-demographic and clinical characteristics, as shown in Table 1.

Table 1: Baseline socio-demographic and clinical characteristics of children undergoing laparotomy, by closure technique.

Characteristic	Mass Closure (n = 56)	Layered closure (n = 55)	p value	x^2
Age Group				
<1month	13 (23.2%)	10 (18.2%)	0.81	0.43
1-12 months	24 (42.9%)	25 (45.5%)		
>12 months	19 (33.9%)	20 (36.4%)		
Sex				
Male	39 (69.6%)	32 (58.2%)	0.21	1.58
Female	17 (30.4%)	23 (41.8%)		
Type of Surgery				
Emergency	50 (89.3%)	44 (80.0%)	0.17	1.84
Elective	6 (10.7%)	11 (20.0%)		
Wound Class				
Type 1	29 (51.8%)	29 (52.7%)	0.92	0.009
Type II	27 (48.2%)	26 (47.3%)		
Note: x^2 is the Chi-square test statistic				

Cosmetic Outcome

A total of 103 patients (92.8%) had good scar outcomes, while 8 patients (7.2%) were rated as having poor scars. While wound closure technique and nature of surgery were not significantly associated with scar quality, both wound class and the presence of postoperative complications showed strong associations with cosmetic outcome($p = 0.002$ and <0.001 respectively). All poor scars occurred in patients with clean-contaminated wounds, and every patient who developed a wound complication also had a poor

Table 2: Association Between Selected Clinical Factors and Cosmetic Outcome of Wounds

Factor	Good scar (n, %)	Poor scar (n, %)	Total	p value
Wound Closure				
Mass Closure	52 (50.5)	4 (50.0)	56 (50.5)	0.999
Layered Closure	51 (49.5)	4 (50.0)	55 (49.5)	
Type of Surgery				
Elective	86 (83.5)	8 (100.0)	94 (84.7)	0.606
Emergency	17 (16.5)	0 (0.0)	17 (15.3)	
Wound Class				
Type I	58 (56.3)	0 (0.0)	58 (52.3)	0.002+
Type II	45 (43.7)	8 (100.0)	53 (47.7)	
Complication				
Yes	3 (2.91)	8 (100.0)	11 (9.9)	< 0.001+
No	100 (97.09)	0 (0.0)	100 (90.1)	

Note: *p*-values derived using Fisher's exact test. + Statistically significant.

Table 3: Cosmetic scores at 3 and 6 months

Time Point	Mass Closure (mean ± SD)	Layered Closure (mean ± SD)	p value
3 months	4.2 ± 0.7	4.1 ± 0.8	0.58
6 months	4.4 ± 0.6	4.4 ± 0.6	0.91
Note SD = Standard Deviation			

scar. The cosmetic outcomes are presented in Table 2.

At the 3-month follow-up, the mean Stony Brook Scar Evaluation Scale (SBSES) score was 4.2 ± 0.7 in the mass closure group and 4.1 ± 0.8 in the layered group (p = 0.58). At both the 3- and 6-month follow-up periods, there were no statistically significant differences in mean SBSES scores between the groups (Table 3). No adverse cosmetic outcomes such as hypertrophic scars or keloids were reported in either group during the follow-up period.

Wound Closure Time

The mean wound closure time was significantly shorter in the mass closure group compared to the layered closure group, as shown in Figure 1.

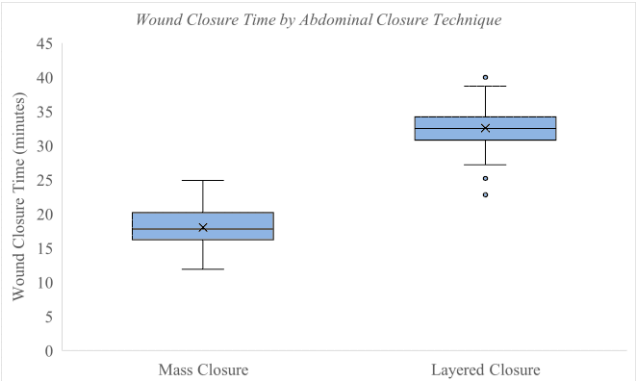

Figure 1. Box plot showing wound closure times in minutes for mass closure (mean = 18.6, SD = 3.4) and layered closure (mean = 32.8, SD = 3.8). The box represents the interquartile range; the line within the box indicates the median; the "×" marks the mean; and outliers are shown as individual dots. There was a statistically significant difference in wound closure time between the two techniques (t = 20.8730, p < 0.001).

Discussion

This study evaluated wound closure time and cosmetic outcomes following mass versus layered closure techniques in paediatric transverse laparotomy. While both closure methods yielded comparable scar appearance based on the Stony Brook Scar Evaluation Scale (SBSES) at 3 and 6 months, mass closure was associated with a significantly shorter closure duration.

A key strength of this study is its randomised design, which minimised selection bias and allowed for balanced comparison between the two techniques. The use of a validated cosmetic assessment tool (the Stony Brook Scar Evaluation Scale) enhanced the objectivity of outcome measurement.[6,7] Inter-observer reliability was established through pilot exercise and consensus scoring, and independent outcome assessors were blinded to group allocation, reducing the risk of measurement bias.

However, this study has a few limitations which should be acknowledged. First, it was conducted at a single centre, which may affect the generalisability of the findings to other settings with different surgical protocols or patient demographics. Second, although the SBSES is a validated instrument applied by trained assessors, cosmetic evaluation remains inherently subjective and may not fully reflect patient or caregiver perceptions. Third, the follow-up period of six months may be insufficient to capture long-term scar maturation. Lastly, while the sample size was sufficient for the primary outcome, it may not have detected smaller differences in cosmetic results.

The cosmetic outcomes observed in this study were similar between groups at both the three- and six-month follow-up points. Mean SBSES scores did not differ significantly between the mass and layered closure groups, suggesting that both techniques could produce satisfactory aesthetic results when performed using standardised techniques and suture materials. There is limited literature on cosmetic outcomes following abdominal wall closure in children. Only a few

paediatric studies have assessed cosmetic outcomes of abdominal wall closure using objective tools like the SBSES. Tandon et al.,[8] compared three skin closure techniques in children and reported inferior scar scores with tissue adhesives compared to suture alone and adhesive tape. However, their study excluded emergency surgeries. Similarly, Varghese et al.[9] and Fleisher et al.[10] focused on skin closure and suture materials, reporting superior cosmetic results with absorbable sutures over non-absorbable staples. In contrast, Cromi et al.[11] found no significant differences in scar appearance between stapled wounds and those closed with subcuticular sutures. However, these studies primarily involved adult women undergoing caesarean sections and did not examine deeper fascial or full abdominal wall closure. The comparable cosmetic outcomes observed in our study may be attributed to the use of uniform suture material (Polyglactin 910) and consistent suturing protocols across both groups.

Scar formation is influenced by several modifiable intraoperative factors, including incision design, aseptic technique, haemostasis, tissue handling, and tension control.[12] In our study, clean-contaminated wounds showed significantly more poor cosmetic outcomes. This is likely due to the effects of subclinical infection, sustained inflammation, or delayed healing. Previous studies have linked prolonged inflammation from wound colonisation or infection to poor scarring, including incisional dehiscence and hypertrophic changes.[13,14] Similarly, we observed that patients who developed any postoperative complication were more likely to have suboptimal scar outcomes, consistent with prior reports.[12,13]

In terms of efficiency, the mean wound closure time was significantly shorter in the mass closure group, with an average reduction of approximately 14 minutes compared to layered closure. This is consistent with findings from other surgical series, which reported mass closure to be significantly faster especially when using a continuous suture.[3,15,16] In paediatric surgery, where minimising anaesthesia time is important for safety, this reduction may offer additional clinical value. Studies from our region have reported inefficiencies in operating theatre time management, reinforcing the relevance of time-efficient surgical techniques in improving workflow and optimising surgical service delivery in resource-constrained settings.[17]

In Conclusion, this study demonstrated that mass closure and layered closure techniques yielded comparable cosmetic outcomes in paediatric transverse laparotomy. However, mass closure was associated with significantly shorter wound closure time. These findings suggest that mass closure offers an operative time advantage without compromising aesthetic results, supporting its use as an efficient and cosmetically acceptable technique in paediatric abdominal wall closure. We recommend that all patients who have undergone laparotomy should be routinely followed up for at least six months to monitor scar evolution and detect delayed complications. Considering time-efficient wound closure techniques that maintain quality may be useful in resource-constrained settings, where surgical volume, limited theatre space, high costs, and workforce shortages are major constraints.

Ethics Approval: This study was reviewed and approved by the Health Research Ethics Committee of the University of Uyo Teaching Hospital (UUTH/AD/S/96/VOL.XIV/575).

Conflicts of Interest: None declared.

References

1. Rifai AE, Zaghal A. Special considerations in pediatric abdominal surgeries. In: IntechOpen eBooks. 2021. https://doi.org/10.5772/intechopen.96189.
2. Imren C, IJsselstijn H, Vermeulen MJ, Wijnen RHM, Rietman AB, Keyzer-Dekker CMG. Scar perception in School-Aged children after major surgery in infancy. Journal of Pediatric Surgery. 2024; 59(11): 161659. https://doi.org/10.1016/j.jpedsurg.2024.07.044.
3. Chalya PL, Massinde AN, Kihunrwa A, Mabula JB. Abdominal fascia closure following elective midline laparotomy: a surgical experience at a tertiary care hospital in Tanzania. BMC Research Notes. 2015; 8(1). https://doi.org/10.1186/s13104-015-1243-4
4. Hasan KM, Islam S, Huq MdAU, Huque MM, Karim SMdR, Azam MS, et al. Outcomes of Layered versus Mass Closure in Transverse Incision during Emergency Laparotomy in Children. Journal of Biosciences and

Medicines. 2020;08(08): 180–193. https://doi.org/10.4236/jbm.2020.88016.
5. Onyekwelu I, Yakkanti R, Protzer L, Pinkston CM, Tucker C, Seligson D. Surgical wound classification and surgical site infections in the orthopaedic patient. JAAOS Global Research and Reviews. 2017;1(3):e022. https://doi.org/10.5435/jaaosglobal-d-17-00022
6. Singer AJ, Arora B, Dagum A, Valentine S, Hollander JE. Development and validation of a novel SCAR evaluation scale. Plastic & Reconstructive Surgery. 2007;120(7): 1892–1897. https://doi.org/10.1097/01.prs.0000287275.15511.10.
7. Kate C a. T, Koese HJH, Hop MJ, Rietman AB, Wijnen RMH, Vermeulen MJ, et al. Psychometric Performance of the Stony Brook Scar Evaluation Scale and SCAR-Q Questionnaire in Dutch Children after Pediatric Surgery. International Journal of Environmental Research and Public Health. 2023;21(1): 57. https://doi.org/10.3390/ijerph21010057.
8. Tandon S, Ensor ND, Pacilli M, Laird AJ, Bortagaray JI, Stunden RJ, et al. Tissue adhesive, adhesive tape, and sutures for skin closure of paediatric surgical wounds: prospective randomized clinical trial. British Journal of Surgery. 2022;109(11): 1087–1095. https://doi.org/10.1093/bjs/znac254.
9. Varghese F, Gamalial J, Kurien JS. Skin stapler versus sutures in abdominal wound closure. International Surgery Journal. 2017;4(9): 3062. https://doi.org/10.18203/2349-2902.isj20173888.
10. Fleisher J, Khalifeh A, Pettker C, Berghella V, Dabbish N, Mackeen AD. Patient satisfaction and cosmetic outcome in a randomized study of cesarean skin closure. The Journal of Maternal-Fetal & Neonatal Medicine. 2018;32(22): 3830–3835. https://doi.org/10.1080/14767058.2018.1474870.
11. Cromi A, Ghezzi F, Gottardi A, Cherubino M, Uccella S, Valdatta L. Cosmetic outcomes of various skin closure methods following cesarean delivery: a randomized trial. American Journal of Obstetrics and Gynecology. 2010;203(1): 36.e1-36.e8. https://doi.org/10.1016/j.ajog.2010.02.001.
12. Hong N, Sheng B, Yu P. Early postoperative interventions in the prevention and management of thyroidectomy scars. Frontiers in Physiology. 2024;15. https://doi.org/10.3389/fphys.2024.1341287.
13. Commander S, Chamata E, Cox J, Dickey R, Lee E. Update on postsurgical scar management. Seminars in Plastic Surgery. 2016;30(03): 122–128. https://doi.org/10.1055/s-0036-1584824.
14. Landers K, Hwang M, Cottrill E. A narrative review of scars after surgery: what to expect. Annals of Thyroid. 2023;8: 9. https://doi.org/10.21037/aot-22-16.
15. Deshmukh SN, Maske AN. Mass closure versus layered closure of midline laparotomy incisions: a prospective comparative study. International Surgery Journal. 2018;5(2): 584. https://doi.org/10.18203/2349-2902.isj20180357.
16. Bhavikatti GS, Ghv RG. Comparative study of mass closure and layered closure techniques in midline and paramedian laparotomies. Academia Journal of Surgery. 2019;2(1). https://doi.org/10.21276/ajs.2019.2.1.12.
17. Akpanudo E, Ituen MA, Iyanam VE. Operating theatre time utilisation and elective surgery cancellations: A one-month review in a Nigerian teaching hospital. Orapuh Journal. 2024 Dec 18; 5(7), e1165. https://doi.org/10.4314/orapj.v5i7.65