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Research Article

Outcome of Staged versus Primary Repair in Neonatal Abdominal Wall Defects

Farah Mushtaq[1], Dr. Binish Naeem[2], Dr. Muhammad Asad Khan[3*], Ahsan Ali Ghauri[4], Dr. Muhammad Adeel[5]

[1]Pediatric Surgery Department, Children Hospital and Institute of Child Health Sciences, Lahore.
[2]Consultant Pediatric Surgeon, YCDO EXECUTIVE Hospital Mother and Child Care Multan.
[3*]Medical Officer Paediatric Surgery, the Children's Hospital Lahore.
[4]Assistant Professor Paediatric Surgery, Nawaz Shareef Medical College and Aziz Bhatti Teaching Hospital, Gujrat.
[5]Senior registrar General Surgery, Al Nafees Medical College and Hospital, Islamabad.

Email: [1]farahmsq@gmail.com, [2]drbinish23@gmail.com, [3*]masadkhan0381@gmail.com, [4]drahsanalighauri@gmail.com, [5]Dradeel393@gmail.com

Corresponding Author: Dr. Muhammad Asad Khan
Medical Officer Paediatric Surgery, the Children's Hospital Lahore.

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ABSTRACT

Background: Notable examples of congenital surgical defects that are accompanied by significant morbidity and mortality are neonatal abdominal wall defects, mainly gastroschisis and omphalocele. Depending on the size of the defect, bowel condition, related anomalies and the stability of the neonate, surgery treatment can be conducted using primary repair or staged repair. The benefits of primary repair are that it could offer early closure, and the benefit of staged repair is that it could reduce abdominal compartment pressure in the select neonates.

Objective: To compare the results of the staged and primary repair among the neonates who present with abdominal wall defects.

Methodology: This comparative study was carried out on in Paediatric Surgery department of The Children's Hospital Lahore from June 2024 to June 2025, including 150 newborns with congenital abdominal wall defects, such as gastroschisis and omphalocele. The WHO formula of sample size will be used with a confidence level of 95 percent, and a margin of error of 5 percent. Informed parental consent will be sought; PAD was frequently observed among patients with LMS coronary artery disease undergoing PCI. Routine PAD screening may help identify high-risk patients and guide comprehensive vascular management and the enrolment of the eligible neonates will be done. The patients will be divided into two groups, Group A which will be receiving primary repair and Group B which will be receiving staged repair. The first management will be Resuscitation, temperature control, fluid replacement, nasogastric decomposition, antibiotics, and bowel protection. A comparison of postoperative outcomes including sepsis, wound infection, ventilatory support, feeding recovery, hospital stay, reoperation, and mortality will be compared.

Results: The postoperative complications, ventilatory support need, sepsis, feeding tolerance, length of stay and mortality, in both groups will be compared to evaluate the outcomes.

Conclusion: This study will be used to make a choice between the more effective and safer surgical procedure to be used in neonatal abdominal wall defects. The outcomes are that primary repair is more effective in the stable neonates, but that the staged repair is necessary in the complicated cases. Neonatal intensive care support, early diagnosis, good resuscitation, proper planning of surgical procedures and neonatal intensive care can help in improving survival, reduce complications, and improve postoperative recovery in the affected neonates.

Keywords: Neonate, Abdominal wall defect, Gastroschisis, Omphalocele, Primary repair, Staged repair, Surgical outcome, Mortality.

INTRODUCTION

Neonatal abdominal wall defects are important congenital surgical pathologies in which the abdominal organs have protruded outside of the abdominal cavity due to failure of normal development of the anterior abdominal wall. The two most common gastroschisis and omphalocele [1]. Although the two conditions are similar in terms of the fact that in both conditions, there is the herniation of the abdominal contents, the two conditions differ in embryology, anatomy, related anomalies, treatment and prognosis. These deficiencies should be identified at early stages, neonatal

resuscitation, exposure of the viscera, loss of heat and fluid and an early surgery intervention to improve survival and reduce the number of complications [2].

Gastroschisis is usually characterized by a complete-thickness abdominal wall defect; most frequently, on the right side of the umbilicus. The bowel during pregnancy is in contact with the amniotic fluid and on birth this contact is with the external world 3. As a result, bowel enema, inflammation, matting, thickening or intestinal dysfunction can be experienced by the neonates with gastroschisis. Bowel related complications like atresia, perforation, volvulus, ischemia and delayed feeding are also not common4. These babies frequently need extended parenteral nutrition, ventilatory, and close observation of sepsis and electrolyte imbalance 5.

Omphalocele on the other is a midline defect, in which the abdominal organs are herniated into a sac by the peritoneum and amnion. Bowel, liver or other viscera may be contained in the sac depending on the size of the defect that the sac may contain 6. Omphalocele is generally linked with congenital anomalies, such as cardiac defects, chromosomal anomalies and syndromic anomalies. These associated abnormalities have a tremendous effect on the choice of treatment and survival 7. In minor defects, it is possible to simply close the defect but in large omphaloceles, it is possible to stage or not to close the defect due to the small abdominal capacity and the fact that the respiratory system may be compromised.

There are two major kinds of surgical treatment of defects of the abdominal wall, namely, primary and staged repair. Primary repair entails the herniated content lowered into the abdominal cavity followed by the abdominal wall being sealed during the initial surgery. The surgery is normally requested in such cases that the bowel is in good condition, the defect is minor and the viscose can be moved without causing extreme tension in the abdominal cavity 8. The benefits of primary repair are early discharge, a reduced exposure of the bowel, a reduced exposure of the open defect and possibly a lower risk of infections. Nevertheless, forced primary closure can increase the intra-abdominal pressure, millwork ventilation, decrease venous return, impair bowel perfusion and develop abdominal compartment syndrome.

Most of the instances where staged repair is chosen are as follows; when the primary repair is unsafe due to large defect, bowel hernia, liver hernia, sepsis potentiality or inadequate neonatal stability 9. Staged repair the gradual aspirin of the abdominal contents either with the assistance of silo or some other temporary cover up before sealing. So doing, a gradual loading of viscera is facilitated and chances of sudden increase in intra-abdominal pressure are minimized 10. However, the staged repair can be attributed to the increased length of hospitalization, increased need of the intensive care, delayed feeding, and increased exposure to the hospital-acquired infection.

The survival of the neonates with abdominal wall defects depends on several factors which include the type and size of the abdominal wall defects, gestational age, birth weight, bowel status, whether the neonatal intensive care is available or the postoperative complications. The most suitable one can be ascertained by the plight of the patient and the resources available in the institution as compared to staged versus primary repair 11. The aim of the study will be to compare the outcome of the staged repair and the primary repair of the neonatal abdominal wall defects with special reference being made to the complications, recovery of feeding, length of stay in the hospital and survival 12.

Objective

The study will compare the outcomes of staged repair and primary repair in case of abdominal wall defects in neonates. The outcomes will be assessed based on postoperative complications, sepsis, ventilatory support, time to start oral feeding, length of hospital stay, and mortality, as to which is the safer and effective surgical procedure.

METHODOLOGY

This comparative study was carried out on in Pediatric Surgery department of The Children's Hospital Lahore from June 2024 to June 2025, including 150 neonates presenting with defects of the abdominal wall which are congenital such as gastroschisis and omphalocele, will be compared and analyzed. The WHO sample size formula will be used to calculate the sample size of 150 patients based on the expected outcome proportions in previous studies, a 95% confidence level and a 5% margin of error. Parents/guardians will be enlightened and give informed consent and after that recruit eligible neonates. The patients will be separated into two groups, depending on the surgical procedure that is used. Group A will consist of the neonates that will be receiving primary

repair, and Group B will consist of the neonates that will be receiving staged repair. Early care will entail the neonatal resuscitation, maintenance of body temperature, treatment of fluid and electrolyte imbalance, nasogastric decompression, intravenous antibiotics and covering exposed bowel with sterile warm saline dressings. The consultant paediatrics surgeon will decide how the surgery is to be performed, depending on the size of the defect, bowel status, the capacity of the abdominal cavity, and any other related anomalies and overall neonatal stability. When tension of abdominal contents can be decreased, and the closure can be achieved without tension the main repair will be done. To be selected to undergo staged repair will be large defects, oedematous bowel or limited abdominal capacity. The outcome of the postoperative period such as wound infection, sepsis, ventilatory support, feeding recovery, abdominal compartment syndrome and length of stay in hospital, re-operation and mortality will be documented on a structured proforma. The results of the staged and primary repair groups will be compared, to determine which surgical procedure is safer and more effective in repairing the neonatal abdominal wall defects.

Inclusion Criteria and Exclusion Criteria
Inclusion Criteria
Neonates of either sex diagnosed with congenital abdominal wall defects, such as gastroschisis or omphalocele, presenting during the study period, and undergoing either primary or staged surgical repair following informed parental consent, will be included in the study.

Exclusion Criteria
The study will not include neonates with severe lethal congenital anomalies, major chromosomal abnormalities, extreme prematurity and birth weight below the viability limit, those who are unfit to undergo surgery or those whose parents do not provide informed consent or abandon the patient against medical advice.

Data Collection Procedure
The parent or guardian will provide written informed consent, and the hospital ethical review committee will give consent to the data collection. The enrolment of all neonates meeting the inclusion criteria will be done through the paediatrics surgery or neonatal intensive care unit. The initial demographic data will include the age, sex, birth weight and gestational age, mode of birth and place of birth. The clinical data such as the type of defect of the abdominal wall, the size of the defect, the condition of bowel, the presence of related anomalies and preoperative stabilization will be documented on a structured proforma. Nature of repair, length of surgery, need of silo during surgery and complications during the surgery will also be recorded. Postoperative follow up will include the monitoring of sepsis, wound infection, respiratory support, feeding tolerance, time to full oral feeds, length of stay, reoperation and mortality. The review of the hospital records, operative notes, lab results, and daily progress charts will be reviewed and inputted into the study proforma that will be subject to final analysis.

Data Analysis
The data will be inputted and analyzed in SPSS version 26. All quantitative variables that will be presented in the form of the mean and standard deviation will be age, birth weight, gestational age, time to oral feeding, period of ventilatory support and length of hospital stay. As frequency and percentage, qualitative variables like gender, type of abdominal wall defect, type of repair, postoperative complications, sepsis, wound infection, and mortality will be presented. Primary repair and staged repair groups will be compared on the outcomes. Chi-square test or Fisher exact test will be used to analyse qualitative variables and independent sample t-test will be used to analyse quantitative variables. A p-value of ≤ 0.05 will be considered statistically significant.

RESULTS
150 neonates with abdominal wall defects were studied. Of these, 90 neonates were treated with primary repair while 60 neonates were treated with staged repair. Gastroschisis was the most common defect followed by omphalocele. There were slightly more male than female neonates and most of those patients were seen within 24 hours of birth. Staged repair patients had more postoperative complications than patients who underwent primary repair, most notably in neonates with large defect, bowel enema, and/or decreased abdominal domain. For complex cases, in which primary closure was deemed unsafe, staged repair was used more frequently. The staged repair group had a higher mortality, primarily related to sepsis, respiratory complications, and related congenital abnormalities. In summary,

there appeared to be better outcomes for neonates who had smaller defects, viable bowel, and were carefully selected for primary repair, while staged repair remained a valuable option in those with more complex defects in the abdominal wall in whom primary repair was not safely possible.

Table 1: Demographic Characteristics of Neonates (n = 150)

Demographic Variable	Primary Repair Group N=90	Staged Repair Group N=60	Total N=150
Male	51 (56.7%)	35 (58.3%)	86 (57.3%)
Female	39 (43.3%)	25 (41.7%)	64 (42.7%)
Term Neonates	63 (70.0%)	37 (61.7%)	100 (66.7%)
Preterm Neonates	27 (30.0%)	23 (38.3%)	50 (33.3%)
Birth Weight ≥2.5 Kg	59 (65.6%)	33 (55.0%)	92 (61.3%)
Birth Weight <2.5 Kg	31 (34.4%)	27 (45.0%)	58 (38.7%)
Presented Within 24 Hours	71 (78.9%)	42 (70.0%)	113 (75.3%)
Presented After 24 Hours	19 (21.1%)	18 (30.0%)	37 (24.7%)

Demographic data for the 150 neonates with abdominal wall defects are given in Table 1. The male neonates were slightly more prevalent than the females. Most neonates were born full term, with a birth weight of 2.5 kg or more and presented within 24 hours of birth. Neonates who were clinically stable were more likely to have primary repair.

Table 2: Distribution of Abdominal Wall Defects (N = 150)

Type Of Defect	Primary Repair Group N=90	Staged Repair Group N=60	Total N=150
Gastroschisis	57 (63.3%)	36 (60.0%)	93 (62.0%)
Omphalocele	33 (36.7%)	24 (40.0%)	57 (38.0%)
Small Defect	54 (60.0%)	17 (28.3%)	71 (47.3%)
Large Defect	36 (40.0%)	43 (71.7%)	79 (52.7%)
Bowel Edema Present	29 (32.2%)	44 (73.3%)	73 (48.7%)
Bowel Edema Absent	61 (67.8%)	16 (26.7%)	77 (51.3%)

Table 2 indicates that gastroschisis was the highest frequency abdominal wall defect, with omphalocele as the next most common. The small defects were more likely to be treated with primary repair, while the large defects and bowel edema were more likely to be treated with staged repair. These results suggest that only more complicated surgical presentations were treated with staged repair.

Table 3: Postoperative Complications

Complication	Primary Repair Group N=90	Staged Repair Group N=60	Total N=150
Wound Infection	11 (12.2%)	13 (21.7%)	24 (16.0%)
Sepsis	14 (15.6%)	21 (35.0%)	35 (23.3%)
Ventilatory Support Required	18 (20.0%)	29 (48.3%)	47 (31.3%)
Abdominal Compartment Syndrome	5 (5.6%)	7 (11.7%)	12 (8.0%)
Reoperation Required	6 (6.7%)	10 (16.7%)	16 (10.7%)
No Complication	36 (40.0%)	11 (18.3%)	47 (31.3%)

As shown in table 3, there were more postoperative complications in the staged repair group than in the primary repair group. Patients who had staged repair were more likely to have a wound infection, require ventilatory support, have abdominal compartment syndrome, and

be reoperated. The opposite was true for the primary repair patients, however, as a larger percentage had uncomplicated postoperative recovery.

Table 4: Feeding Recovery and Hospital Stay

Outcome Variable	Primary Repair Group N=90	Staged Repair Group N=60	Total N=150
Oral Feeding Started Within 5 Days	55 (61.1%)	21 (35.0%)	76 (50.7%)
Oral Feeding Started After 5 Days	35 (38.9%)	39 (65.0%)	74 (49.3%)
Full Oral Feeds Achieved Within 10 Days	53 (58.9%)	18 (30.0%)	71 (47.3%)
Full Oral Feeds Achieved After 10 Days	37 (41.1%)	42 (70.0%)	79 (52.7%)
Hospital Stay ≤14 Days	58 (64.4%)	17 (28.3%)	75 (50.0%)
Hospital Stay >14 Days	32 (35.6%)	43 (71.7%)	75 (50.0%)

Neonates who were treated with primary repair had earlier oral feeding, quicker progress to full feeds and shorter hospital stay than staged repair (Table 4). These were more severe and complex cases as evidenced by the higher rate of delayed feedings and prolonged hospitalization in the staged repair group.

Table 5: Outcome of Neonates

Outcome	Primary Repair Group N=90	Staged Repair Group N=60	Total N=150
Survived	81 (90.0%)	47 (78.3%)	128 (85.3%)
Expired	9 (10.0%)	13 (21.7%)	22 (14.7%)
Discharged Without Complication	57 (63.3%)	24 (40.0%)	81 (54.0%)
Discharged With Follow-Up Advice	24 (26.7%)	23 (38.3%)	47 (31.3%)
Left Against Medical Advice	3 (3.3%)	5 (8.3%)	8 (5.3%)

Table 5 indicates that the primary repair group had higher rates of survival compared with the staged repair group, which had more mortality. Increased number of neonates treated in primary repair were discharged without complications. The clinical complexity of the staged repair patients made them more likely to require follow-up care or to have poor outcomes.

DISCUSSION

The abdominal wall defects in neonatal patients are severe congenital abdominal wall defects, which require early diagnosis, careful stabilization, and timely operative care 13. In the present study, the outcome of staged repair and primary repair were compared in the background of 250 neonates with defects of the abdominal wall, gastroschisis and omphalocele 14. The findings revealed that primary repair was associated with improved postoperative recovery in the sample of stable neonates compared to staged repair which was mostly applied in more complicated cases with large defects, bowel enema or limited capacity of abdominal cavity 15.

In this study, gastroschisis was more dominant than the omphalocele. The fact that most of the neonates presented during the first 24 hours of life is significant because by being presented within the first 24 hours of life, the risk of dehydration, hypothermia, bowel contamination, and sepsis are decreased. The number of male neonates was a little higher than that of females. A greater percentage of term neonates, and neonates with birth weights of 2.5 kg were repaired at the primary level, indicating that a better neonatal outcome was associated with early discharge 16.

Primary repair had positive results in the form of reduced complications, quicker recovery to feeding, and reduced length of stay. This could be since primary repair was done in the neonates with smaller defects, healthier bowel and enough abdominal capacity 17. Exposure to early bowel contents, the loss of fluids and heat is reduced, and the possibility of infection may be lowered 18. In the current study, the sepsis,

wound infection, ventilatory support, abdominal compartment syndrome, and reoperation were less common in the primary repair group in the case study. Moreover, more of the neonates could achieve oral feeding in five days and could achieve the oral feeds within ten days after the primary repair 19.

Staged repair was attributed to the augmented complication and prolonged recovery period. That, however, does not necessarily mean that staged repair is not superior in all patients 20. It is typically used in infants with large intra-abdominal wall defects, oedematous bowel, poor abdominal domain or unstable general condition 21. In these situations, forced primary closure can result in an increased intra-abdominal pressure, impaired ventilation, reduced venous return, and impaired bowel perfusion. Thus, staged repair is still a significant and less risky option in cases of complexities where the primary closure is not possible 22 .

Deaths were higher in the staged repair group, and it was mainly due to sepsis, respiratory complications, related abnormalities and slow recovery. The main repair team was more successful in survival and discharge without any complication. Overall, the findings of the research suggest that primary repair is more effective in selective neonates, and staged repair is needed in the high-risk neonates 23. The factors that are involved in improving the final outcomes include proper patient selection, early referral, neonatal intensive care, infection control and experienced surgical decision-making.

CONCLUSION

Primary repair has been found to have superior results in a selected group of stable neonates with defects of the abdominal wall including less postoperative complications, earlier recovery of feeding, shorter hospital stays and higher survival rate. Repair, which were staged more frequently, were necessitated by large defects, bowel enema, poor abdominal capacity, or unstable clinical condition of the neonate. Staged repair was not a very safe or effective option, but nonetheless, a safe and necessary alternative when primary closure was not possible. The patient selection, early presentation, proper resuscitation, neonatal intensive care support, and timely surgical intervention are critical in enhancing survival and decreasing morbidity in neonates with abdominal wall defects.

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