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Research Article

Abdominal Wall Defects: Current Practices and Outcomes in the Developing World: Tripoli Medical Center as a Model

Mohammed Jubail[1], Enas Meselati[2] and Abdulraouf Lamoshi[3]*

[1]*Pediatric Surgery Department, Tripoli Medical Center, Tripoli, Libya*

[2]*Cuyahoga Community College, Parma, OH, USA*

[3]*Pediatric Surgery Department, Oishei Children's Hospital, Buffalo, NY, USA*

***Corresponding Author**: Abdulraouf Lamoshi, Clinical Research Fellow, Department of Pediatric Surgery Oishei Children's Hospital, Buffalo, NY, USA.

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Abstract

Introduction: Abdominal wall defects (AWD) are a common problem that can become difficult to manage, especially when the defect is large and resources are limited (silo and TPN).

Methods: Retrospectively, 85 medical records of patients who have been admitted to TMC over a decade (2005 - 2015) were studied. The defects have been categorized into three groups: omphalocele minor, omphalocele major and gastroschisis. The aim is compare the outcomes within these three groups between developed and developing nations.

Results: Out of 85 neonates with abdominal wall defects, 50 are males and 35 are females. 58 patients had omphalocele minor, 16 omphalocele major and 11 with gastroschisis. Associated congenital anomalies are reported in 45% of omphalocele groups (1 and 2) and in 27% of gastroschisis group. Post-operative morbidity rate among the omphalocele groups (1 and 2) is 27.37%, and 54.54% among gastroschisis group. Mortality rate among the group one is 3.45%, group two 12.5%, and group three 27.27%. The mortality rate among the two patients who received devices was 50%.

Conclusion: Omphalocele can be treated effectively in the developing world; however, gastroschisis cases need more sophisticated supportive measures to reach the reported rates.

Keywords: *Abdominal Wall Defects (AWD); Omphalocele; Gastroschisis*

Introduction

Though abdominal wall defects (AWD) (Omphalocele and gastroschisis) are less common congenital anomalies, the rates of congenital abdominal wall defects have been rising over the last two decades [1]. Omphalocele affects up to 2.5 in 10,000 newborns, where approximately 6 in 10,000 newborns are suffering from gastroschisis [2]. Omphalocele's survival rates mainly rely on the severity of the associated anomalies, and the mortality rate of omphalocele is 35% but may reach 100% in the presence of a serious associated abnormalities and genetic defects [3]. In general, gastroschisis' survival rate is about 90%; however, the preoperative mortality rate can reach up to 17% [4]. The fatality could result from sepsis, gastrointestinal anomalies (such as bowel necrosis, atresia, severe dilation or thickening of the intestine), nutritional related complications, premature delivery, and surgical difficulty in repairing the defect [5]. On the other hand, the postoperative survival rate is 94% with a relatively long hospital stay [6].

In our developing world, especially Libya, the resources are severely lacking in personal expertise, devices (e.g. silo), and nutritional support (e.g. TPN), which has a direct impact on the short and long-term outcomes of these patients [7].

Aim of the Study

This study aims to assess the current practices to manage abdominal wall defects and their outcomes in the shade of the other variables at Tripoli Medical Center, one of the two centers providing pediatric surgery services to approximately 4 million Libyans. It will also compare the findings with the standard practice and outcomes in the literature from developed countries. We hypothesize that lacking some resources such as TPN and silo have a negative impact on the mortality and morbidity of AWD. Based on the results of this work, the required adjustments can be realized, emphasized, and hopefully implemented.

Materials and Methods

This study was approved by the Tripoli Medical Center Institutional Review Board. This work is designed to be a retrospective study of the medical records of 85 abdominal-wall defect patients whom were admitted to the pediatric surgery service at TMC between 2005 and 2015. The collected data will include: demographics, associated anomalies, type of defects, the type and time of the intervention, devices used, length of hospital stay, and the outcomes. At Tripoli Medical Center, a major congenital heart disease is defined by its impact on a child's life.

In this study, abdominal wall defects have been categorized as follows, omphalocele minor if the diameter of the defect is 4 cm or less, omphalocele major if the diameter is more than 4 cm, and gastroschisis if there is no sac covering the abdominal content. This study explored the association between different abdominal wall defects and other congenital anomalies, such as heart diseases, urological and gastrointestinal abnormalities, and Beckwith-weidmann syndrome.

Statistical analysis such as central tendency measures, univariate and multivariate analysis, analysis of variance, and T-test are used to assess the main features of the disease and the relationship between the variables under the study. Noting that a P-value of 0.05 or less will be considered statically significant.

The main focus of this study is to explore a series of questions; whether there is a difference or not between the mortality and morbidity of primary and secondary closure approaches of AWD. Also, if there is a difference in mortality and morbidity rate between minor and major defects after a primary repair. Another question we are exploring is the difference between conservative treatment and surgical closure outcomes. Moreover, we want to report the secondary devices used (mesh, blood bags, IVF bag), and the differences in their outcomes.

Results

Demographically: 85 neonates have been admitted to TMC-NICU over 10 years with a diagnosis of abdominal wall defects. 50 males and 35 females. Overall morbidity rate was 18.82% (16/85) with 8.24% (7/85) mortality. Fifty-eight (68.24%) patients had omphalocele minor, 16 (18.82%) omphalocele major and 11 (12.94%) with gastroschisis. The average age at the surgery is 2.91 (1- 4.8) days, average NICU stay was 6.31 (3 - 15.8) days, and the average hospital stay was 10.54 (5.7 - 28.9) days. More than 70.88% received primary repair, 15% received secondary repair using different devices, 10.59% treated conservatively, and 3.53% died before the surgery. About 45% of omphalocele groups (1 and 2) and 27% of gastroschisis group were associated with other congenital anomalies. Short term post-operative morbidity rate among the omphalocele group was 13.51% (10/74) and 54.54% (6/11) among gastroschisis group. Nine patients received conservative treatment (8 omphalocele- minor and 1 omphalocele-major), all of which were discharged home. Three patients (two gastroschisis and one omphalocele (OEIS)) had devices (blood bag, IVF bag, and mesh), the gastroschisis patients died and omphalocele patient was discharged home.

Omphalocele minor accounts for 58 patients, forms 68.24% of the cohort. Demographically: 34 males and 24 females, and mean age of the patients at presentation is 2.7 days (1 - 12). Patients spent an average of 4.48 days in the NICU (0 - 12) and 8.93 days (1 - 36) in the hospital. Mortality rate was 3.45%. Of these patients, 67.24% (39/58) did not have any associated pathologies, table 1 demonstrates the associated anomalies, worth noting 5.17% had major cardiac defects, and 1.72% have Beckwith-Wiedemann syndrome. In terms of approach, 84.48% (49/85) had primary repair (Figure 1A and 1B), 1.72% died before surgery who had also diaphragmatic hernia, 13.79% (8/58) treated conservatively, 87.93% had no co-surgeries, two patients (3.45%) had diverticulectomy, and 1.72% had Ladd's procedure. As for complications, 6.9% had sepsis, and 1.72% developed wound infection. Finally, 96.55% had been discharged home and only 3.45% (2/58) died. The mortality rate was recorded in the patients who had also associated anomalies; Beckwith-Wiedemann syndrome and congenital diaphragmatic hernia ($P < 0.05$).

Associated Pathologies	Omphalocele Minor	Omphalocele Major	Gastroschisis
Minor Cardiac Defect	18.97	18.75%	9.09%
Major Cardiac Defect	5.17%	18.75%	9.09%
Gastrointestinal Defects	3.45%	12.5	9.09 %
Urological Disorder	1.72%	6.25%	0
Diaphragmatic Hernia	1.72%	0	0
Beckwith-Wiedemann syndrome	1.72%	6.25%	0

Table 1: *Associated anomalies to AWD.*

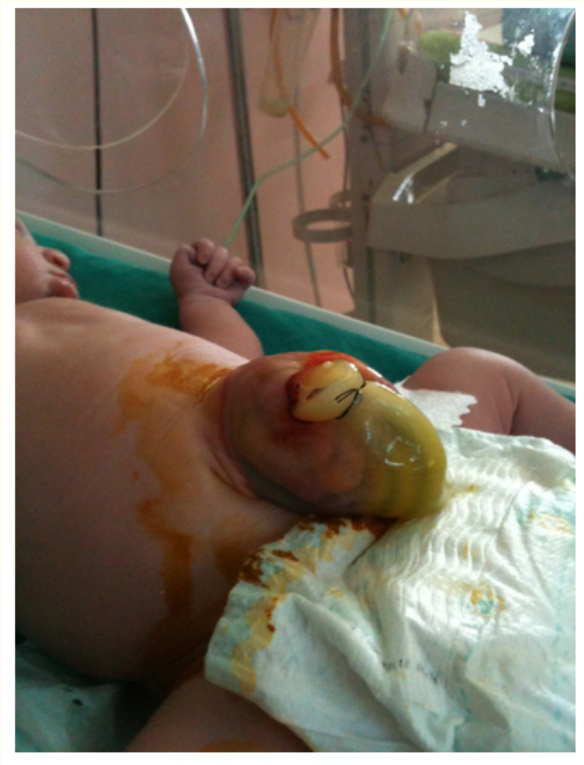

Figure 1A: *Omphalocele minor before the surgery.*

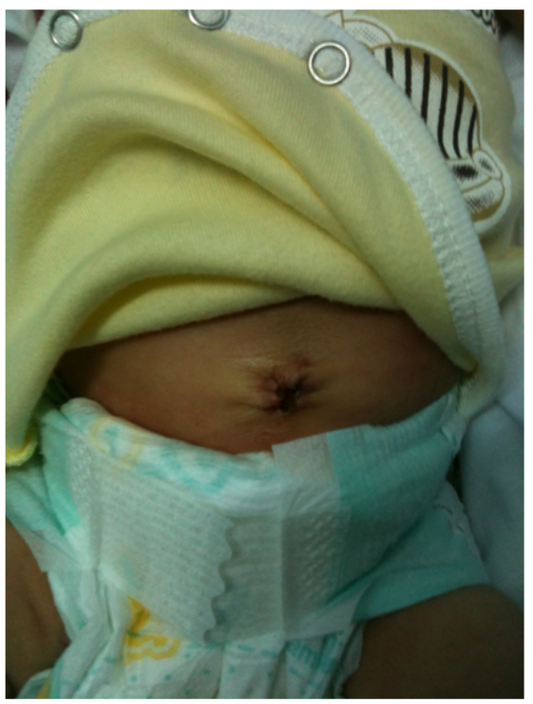

Figure 1B: *Omphalocele minor after the surgery.*

Omphalocele major accounts for 16 patients, forms 18.82 % of the cohort. Demographically: 9 males and 7 females, and mean age at presentation is 1.44 days (1 - 17). Patients spent 9.63 days in the NICU (3 - 33), and 12.44 days (4 - 33) in the hospital. Omphalocele minor. Mortality rate was 12.5%. Of these patients, 56.25% (9/16) did not have any associated pathologies, table 1 demonstrates the associated anomalies worth noting that 18.75% had major cardiac defect, and 6.25% have Beckwith-Wiedemann syndrome. In terms of therapeutic approach, 6.25% (1/16) had primary repair, 75% (12/16) had secondary repair, 6.25% treated conservatively (Figure 2), 12.5% died before surgery, 25% had co-surgeries, 6.26 % had wedge resection, 6.26% had colostomy, 6.25% urinary bladder repair, and 6.25% had Ladd's procedure. As for complications, 18.75% had sepsis. Lastly, 87.5% had been discharged home and 12.5% (2/16) died. The mortality rate was recorded in two cases associated with other congenital anomalies ($P < 0.05$) before the surgery.

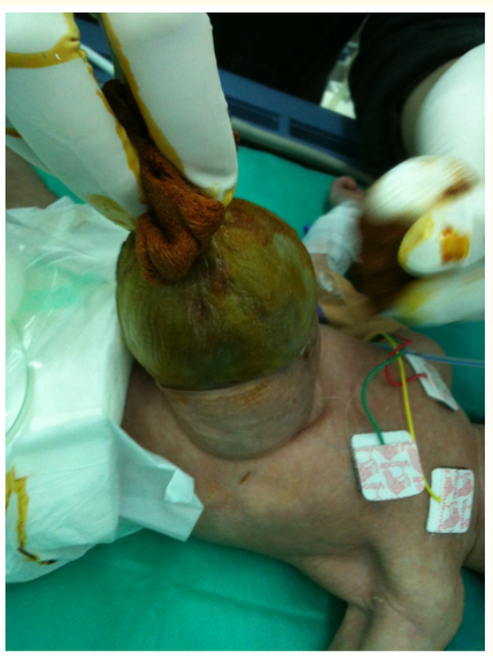

Figure 2: *Omphalocele major with conservative approach.*

Gastroschisis accounts for 11 patients, forms 12.94 % of the entire group. Demographically: 7 males and 4 females, and the mean age of 3.09 days (1-20) at presentation. Patients spent 11.09 days on average in the NICU (1-36), and 16.27 days (1-36). Mortality rate was 27.27%. Table 1 demonstrates the associated anomalies worth noting 9% gastrointestinal anomalies. As for the therapeutic approach, 90.91% (10/11) had primary repair (Figure 3A and 3B), 9.09% (1/11) had secondary repair with blood bag who was 31 ex-weeker and 950 grams with small bowel atresia, died 10 days after the surgery, 9.09% had co-surgeries (wedge resection). When it comes to complications, 36.36% had sepsis, and 9.09% had respiratory distress, and 9.09% had ileus. At the end, 72.73% had been discharged home and 27.27% (3/11) died. All patients who had delayed or closure under pressure died. The mortality rate was higher among those patients who needed nutritional support for a long time, and silo as transient measure for the closure ($P < 0.05$).

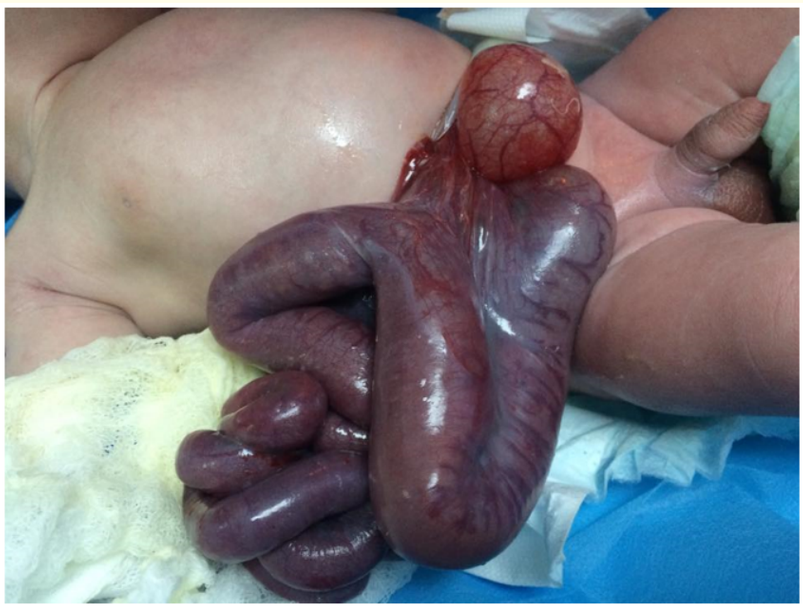

Figure 3A: *Gastroschisis before the surgery.*

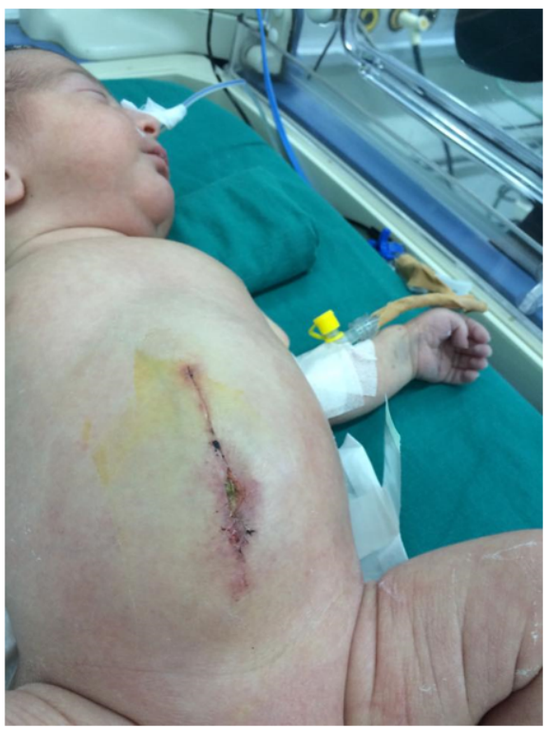

Figure 3B: *Gastroschisis after the surgery.*

Discussion and Conclusion

In conclusion, the mortality rates among our omphalocele groups are less than the reported rates (5.4% vs. 21.5%) [8]. Contrary, the mortality and morbidity rates were significantly higher among gastroschisis group (27.27% vs. 11.8%) [8]. This conclusion should shed light on the remarkable magnitude of using silo and TPN on the short-term prognosis of the abdominal wall defects in neonates [5]. It is worth noting that associated anomalies are similar to the reported rates in all groups.

Our explanation for this conclusion is based on the lack of supporting measures, especially silo and TPN. Silo is crucial to keeping the bowels moist and giving the abdominal wall the opportunity to grow [9]. TPN plays a pivotal support during both pre-operative and post-operative periods [5]. Gastroschisis patients with difficulty achieving preliminary repair need silo for about 10 days [10] and TPN at the same time and for up to 3 - 4 weeks [11]. This would allow the bowels to regain function with improved fascial closure rates, fewer ventilator days, and less complications, compared to the attempts of early primary repair of the large defect [12]. The lack of silo pushed us to do premature repair, which can lead to intra-abdominal compartment syndrome; therefore, the patient can end up with multi-organ failure and death [13]. Lack of TPN, especially during the average 2 weeks of post-operative time needed for bowel recovery, can cause malnutrition, poor wound healing, decrease in immunity, and high risk of sepsis and death [10].

On the other hand, the low mortality rate among the omphalocele group (5.41%, 4/74) can be rationalized by the high percentage of the omphalocele minor, including hernia of the cord, and not including the long-term fatality rate. Another important point is the double time spent in the hospital by omphalocele major (about 10 days) in comparison to the omphalocele minor (about 4 days). The longer hospital stay of omphalocele major allows the abdominal wall to grow while bowels are covered with the sac before surgery. This again demonstrates the significance of having the abdominal content inside the abdomen with a suitable cover (the amniotic sac or silo) [13].

One interesting omphalocele major was an OEIS complex case (combination of defects including omphalocele, exstrophy of the cloaca, imperforate anus, and spinal defects) for whom the repair of the defect was done on the first day of life with ileostomy and mesh repair. The case has showed smooth post-operative course and was sent home after 20 days on full enteral feed (Figure 4A-4C). Unlike the recommended approach [14] for the small abdominal wall defect, 8 patients received conservative treatment with a need for surgical intervention in the future.

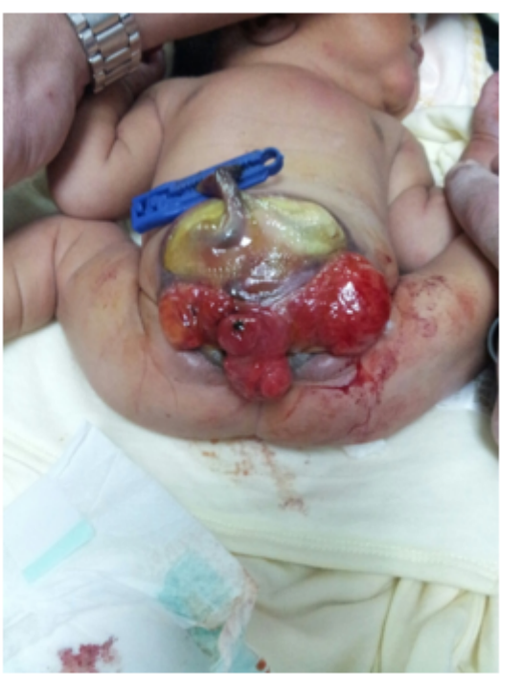

Figure 4A: *OEIS complex before the surgery.*

Figure 4B: *OEIS complex Intra-operatively with using mesh.*

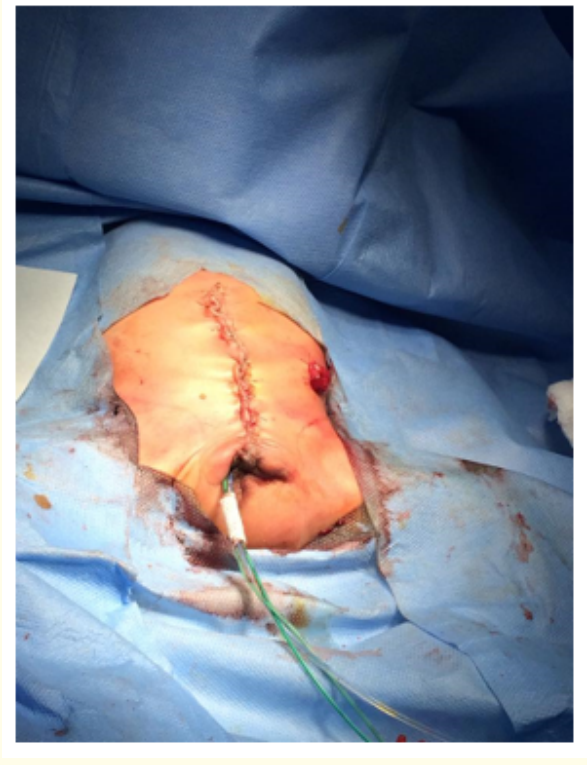

Figure 4C: *OEIS complex after the surgery.*

Contrary to previous studies [8,15], this study shows that mortality rate among gastroschisis patients is higher than omphalocele fatality rate (27.27% vs. 5.4%, respectively). This observation can be attributed to the absence of silo and TPN where a recent study from a Jamaican perspective established a similar observation [16]. The study revealed a mortality rate of about 79% for gastroschisis patients and attributed it to the lack of TPN, prematurity, and sepsis and they recommend that to improve these outcomes nutrient should be optimized [16]. Hence, we can infer that the impacts of not having TPN and silo in gastroschisis cases exceeds that of associated congenital anomalies in omphalocele patients.

The main advantage of this study that it is one of a few studies that explore the practice and outcomes in developing countries with limited resources. Second, it emphasizes the importance of silo and TPN.

This study has a number of disadvantages such as a relatively small sample size, being retrospective, and the limited number of patients who received devices to close the large defects. Also, there is no clear documentation and measurement to the potential intra and post-operative complications, such as intra-abdominal pressure, renal and liver functions. Moreover, we did not distinguish between the hernia of the cord (< 1.5 cm) and the omphalocele minor (between > 1.5 cm and < 4 cm). Regarding patients who received devices, due to lack of the standard devices (silo and mesh), few patients received different modified types with dissatisfied results, but it is difficult to draw statistically significant results due to small sample size. However, it is clear that using standard measures can yield better outcomes.

We recommend future studies to be prospective, larger scale and obtain more detailed documentation of the short and long term post-operative complications.

Disclosure

I agree for further communication with Herald Scholarly Open Access.

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