

## Umbrella repair of giant omphalocele, a new technique

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### Abstract

**Introduction:** Although many techniques have been described for reconstruction of the giant omphalocele, we present a simple, effective and safe new technique.

**Materials and methods:** We have studied 11 neonates with giant omphalocele that were treated by a new technique, Umbrella repair, in Sarvar pediatric hospital of Mashhad, Iran. In this new technique we released the skin around the omphalocele membrane just near the junction and a purse string suture is placed at the edge of the skin with beads beneath each bite and graded tightening of the suture in order to push the omphalocele toward the abdominal cavity. Finally we compare the results.

**Results:** Among total 11 patients, mean age and weight at the time of operation were 2.18 days and 2150 grams respectively. Comparing the results between groups, we observed significant less operative time and number of surgeries in neonatal period among patients who were managed by umbrella repair. Post-operative complications, morbidity and mortality in umbrella repair group were also less than conventional methods.

**Conclusion:** Umbrella repair provide a rapid and safe method for management of giant omphalocele with acceptable results and low morbidity and mortality.

### Keywords

- Giant omphalocele
- Surgery complications
- Umbrella repair

## Introduction

Omphalocele is one of abdominal wall defects in which abdominal organs herniate into the umbilical cord.<sup>1</sup> The term giant omphalocele has been used to describe an omphalocele that cannot be repaired neither by fascial nor skin flap closure. In a patient with giant omphalocele, a part of the liver usually protrudes into the sac and a worse outcome is expected due to more frequent coexistent anomalies.<sup>2</sup> Management of giant omphalocele remains a challenge in pediatric surgery and several procedures have been suggested including conservative management by antiseptics, reconstructive surgery with skin flaps and grafts, stage repair with Silo or using tissue expanders or even prosthetic materials like Gore-tex patch.<sup>3-10</sup>

Considering the high prevalence of associated anomalies, complicated, prolonged or multiple stage procedures are risky in these cases with a high mortality rate. Most of the traditional treatments for giant omphalocele are associated with infectious complications, sepsis, respiratory insufficiency, hemodynamic compromise, dehiscence, and inability to close the abdomen.<sup>1,2</sup> Due to the above mentioned reasons, in this study we introduced a new technique called "Umbrella repair" for better management of this challenging condition.

## Materials and Methods

This new technique was first introduced in Sarvar pediatric hospital in 2005. All cases of giant omphalocele referred to the author during 2005–2015 were offered this new modified method and included in this study after taking informed consent. They were free to choose other methods under observation of other colleagues in the same department. The aim for doing this technique was to cover the giant omphalocele with the native skin without removing the omphalocele membrane as a natural barrier.

Expected advantages of our new technique are lower incidence of sepsis and dehiscence, prosthetic material is not used and the native barrier stays in place. Also short operating time, fast post operative recovery and less abdominal compartment syndrome are other positive aspects. The abdominal pressure can be adjusted during and after operation.

Skin folds created during the purse suture make the skin more stable and hard, like umbrella spokes. This may facilitate gradually spontaneous organ reduction after operation maintaining the natural lining of viscera in place. We compared all data including operative time, number of surgeries, post-operative complications and mortality among our series of 15 patients who were managed by conventional methods.

## Technique

It is simple, fast and easy to do. The skin around the omphalocele membrane is released just near the junction with the sac and keep the omphalocele membrane in place, undermining the skin as thick as possible, just over the fascia, leaving the abdominal wall fascia intact. The safe length of skin that can be detached is 5 to 6 centimeters.

Then a purse string suture is placed at the edge of the skin with 2-0 nylon or Prolene suture with beads beneath each bite to prevent skin necrosis **Figure 1**. The last step is gradual tightening of the suture in order to push the omphalocele toward the abdominal cavity, and covering the sac with native skin as much as possible being careful in order to prevent inadvertent increase of intra abdominal pressure.

At the beginning of operation we inserted a Foley catheter to drain the bladder and measured the intra-abdominal pressure at the end of operation after instillation of 10 cc normal saline. During the operation and at the time of skin repair we also monitored the intra abdominal pressure by checking free infusion of intravenous fluid and also by checking respiratory positive pressure during ventilation support. We considered slow intravenous infusion or peak inspiratory pressure more than 25 cm H<sub>2</sub>O as prone to abdominal compartment syndrome.

At the end of operation, all patients were transferred to NICU full paralyzed and under respiratory support with a fixed Foley for monitoring of the post-operative course. Intra-abdominal pressure higher than 20 was considered as abdominal compartment syndrome and demanded for loosening of skin flap **Figure 2**.

## Results

We operated on a total of eleven patients, with a mean age at the time of operation of 2.18±0.87 days and a mean weight between 2150±450.55 grams. Seven cases (63.6%) were male and 4 case (36.4%) were female.

Mean defect surface compare to total abdominal surface was 70.9±8.31%.

The most common complication in our study was abdominal compartment syndrome which was seen in 5 cases (45.5%). Purse string suture was loosened slightly to relieve the abdominal pressure. This method was effective in all cases and we tightened the sutures several days later. The remaining six patients did not have any complication after the first session of surgery.

Mean operative time was 32.54±11.6 minutes and mean number of operations during neonatal period was 1.1 (just one case needed reoperation due to partial flap necrosis)

Ventilation support after operation was maintained for  $7.63\pm 8.4$  days, minimum time of ventilation support after operation was 2 days and maximum time of ventilation support after operation was 32 days. Five patients had coexisting malformations including VSD in 4 cases (36.4%) and TOF in 1 case (9.1%). One case of mal-rotation was also diagnosed at the time of the second operation to correct the ventral hernia

at the age of one year. One death was due to sepsis in a very low birth weight neonate. Two deaths were due to major cardiac anomalies. The mortality rate of umbrella repair series at the time of study was 27.3%. Finally we compared our data with 15 giant omphalocele cases who were treated by conventional approaches such as conservative treatment, silo closure or other procedures. The results are shown in

**Table 1.**

**Table 1:** Comparison of results between umbrella repair and conventional approach in giant omphalocele

Index	Umbrella repair (n=11)	Conventional repair (n=15)	P Value
Sex (M/F rate)	7.4 (1.75)	8.7 (1.14)	0.726
Age (GA)	$2.18\pm 0.87$	$2.45\pm 1.09$	0.352
Weight	$2150\pm 450.5$	$2342\pm 822.6$	0.773
Abdominal wall defect %	$70.9\pm 8.31\%$	$64.8\pm 11.53\%$	0.124
Operative time	$32.54\pm 11.6$	$51.07\pm 23.2$	<0.05
Number of operations	$1.1\pm 0.3$	$1.62\pm 0.95$	<0.05
Ventilation support time	$7.63\pm 8.4$	$9.02\pm 7.2$	0.073
Postoperative Complications	45.5%	66.6%	0.249
Mortality	27.3%	33.3%	0.551

Secondary closure was performed in 6 patients to date (at the time of study) and mean age of patients at second operation was 9 months. The defect was repaired with Mersilene mesh in 2 cases and primary closure was possible in 4 children. A late complication seen in our patients during follow up was liver incarceration in the omphalocele sac. This patient presented with a hiatal hernia and at the second operation we saw a thick ring at the edge of the abdominal wall defect with liver prolapsing through it. Pathological studies on the ring specimen showed findings compatible with epidermal inclusion cyst.

### Discussion

The main goal in the treatment of infants with congenital abdominal wall defects is the reduction of the viscera and fascial closure. Sometimes this may not be possible due to the large size of the defect, loss of abdominal domain, risk of compartment syndrome, failure of venous return or respiratory function. On the other hand, associated anomalies may preclude surgery. In addition, delayed primary closure by silo or prosthetic materials may become complicated by infection and dehiscence which may require removal of the prosthesis. In order to confront these common problems, the defect closure becomes a real challenge. We must keep in mind that the priority is coverage of the exposed viscera.<sup>11</sup> In this study we decided to create a new method for giant omphalocele

management with fewer complications.

The main advantage of this method is keeping the natural visceral coverage (amniotic membrane) with gradual and controllable skin closure.

Expected advantages of our new technique supposed to be less sepsis and dehiscence considering prosthesis is not used and the native barrier is kept in place, short operating time, fast post-operative recovery time and less abdominal compartment syndrome as the abdominal pressure was adjustable during and after operation.

Skin folds that were created during the purse suture in this method make the skin more stable and hard enough, like umbrella spokes, and this may facilitate gradual spontaneous organ reduction after operation maintaining the natural lining of viscera in place.

Gross proposed that regional skin flaps-being the most elastic component of the abdominal wall - may allow delayed closure of fascia until the abdominal cavity expands sufficiently to accommodate the herniated viscera.<sup>2</sup> That is the reason why we used skin flaps to cover viscera including beads between purse string sutures to strengthen the flap.

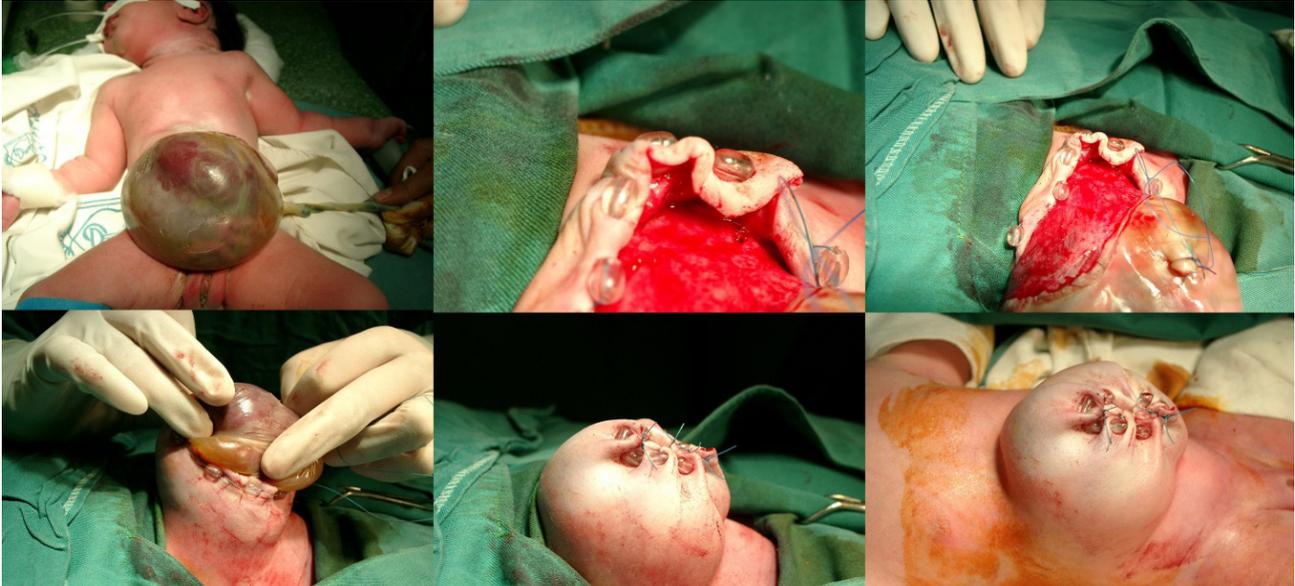
Compared to literature, the reported post-operative morbidity and mortality among our patients was acceptable.<sup>2-7</sup> Confronting the results between umbrella repair and conventional approaches, while both groups were almost equal in demographic

characteristics and size of defect, we observed significant less operative time and number of surgeries in the neonatal period, post-operative complications, morbidity and mortality in the umbrella repair group. However, the differences were not significant,

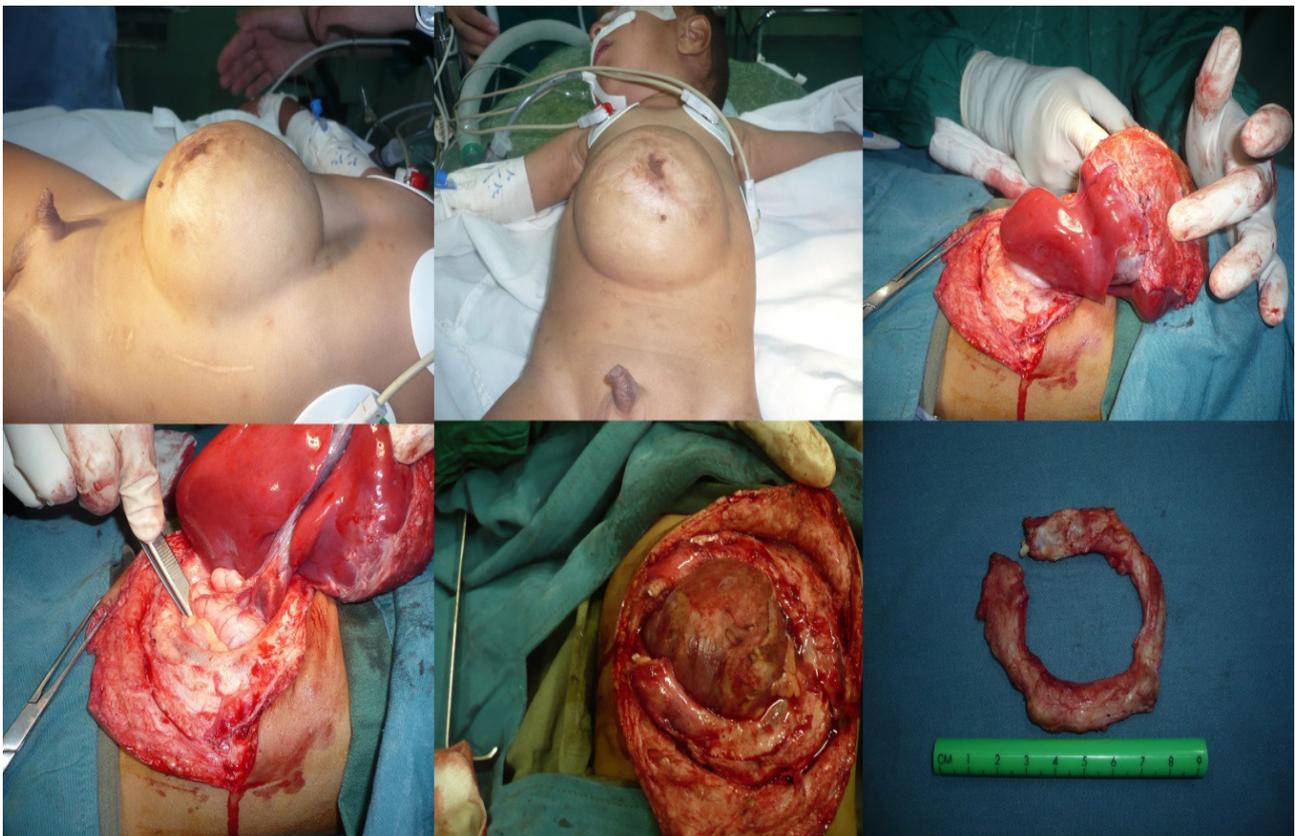
probably due to the small number of cases.

**Conclusion:** Umbrella repair provides a rapid and safe method for management of giant omphalocele with acceptable results and low morbidity and mortality.

**Figure 1:** different steps of our method, Umbrella repair of giant omphalocele



**Figure 2:** different steps of secondary abdominal wall repair in a patient with liver incarceration in abdominal wall defect



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