APPENDIX 1: GUIDE ON HOW TO MAKE THE NEOPRENE SILOS

Making a Neoprene Binder to Support and Compress a Giant Omphalocele:

A Guide

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1. MATERIALS

Neoprene is an effective material to use for supporting and compressing a giant omphalocele as it includes a combination of structure and stretch. Using a neoprene that includes a loop Velcro side allows for extensive adjustability without needing to repeatedly sew Velcro in different locations. We have used the sheets of 1/16" or 1.6mm thick neoprene with pile material on one side (that hook Velcro can attach to).

2. TIME OF INVOLVEMENT

Early referral to the occupational therapist is very helpful. Awareness to expect the baby's arrival before delivery and information around expected day of delivery allows time to ensure materials are available and to prepare to make the binder. Team should contact the occupational therapist when the baby has arrived in the NICU to allow for measurements as soon as the baby is adequately stable.

3. INFANT MEASUREMENTS

The following measurements need to be taken on the infant (Supplementary Figure 1 and Supplementary Table 1):

1. Circumference of the infant's torso both proximal and distal to the omphalocele ("a" and "b")

2. Length of the infant's torso from nipple line to anterior superior iliac crest, provided this is greater than the opening of the abdominal wall defect ("c").

3. Circumference of the neck of the omphalocele ("d").

4. Height of the omphalocele when the entire sac has been confined to the circumference of the omphalocele's neck ("e").

Please note that in practice these measurements have been taken immediately after the omphalocele was wrapped with a length of umbilical cord that was kept intact, then wrapped with sterile gauze while keeping the profile relatively cylindrical with a circumference consistent with the abdominal opening.

SUPPLEMENTARY TABLE 1. Summary of measurements**:**

"a" to "e" – measurements on neonate and omphalocele

"u" to "z" – measurements of the neoprene binding

Label	***Measurements***	***Relationship***
a	Circumference of the infant's torso proximal to the omphalocele	
b	Circumference of the infant's torso distal to the omphalocele	
c	Length of the infant's torso from nipple line to anterior superior iliac crest	
d	Circumference of the neck of the omphalocele	

e	Height of the omphalocele when the entire sac has been confined to the circumference of the omphalocele's neck	
r	Diameter of hole in torso band (piece 1)	
s	Width of compression band (piece 4) = 20% wider than the diameter of the hole in the torso wrap r	s = 1.2r
t	Length of the compression band (piece 4) = 4.5 times the height of the omphalocele (e)	t = 4.5e
u	Length of piece 2 = width of half of the omphalocele	u = d/2
v	Length of piece 3 = width of half of the omphalocele plus 20-30%	v = 1.2u-1.3u
x	height of silo pieces 2 and 3 = height of the contained omphalocele	x =e
y	Torso wrap length (piece 1) = the largest torso circumference plus approximately 10-15% additional length	If a>b → y= 1.15a If b>a → y= 1.15b
w	width of torso wrap (piece 1) = length of the infant's torso	w = c
z	hole in the torso wrap (piece 1) = slightly larger than the neck of the omphalocele.	z = ~1.05d

4. CUTTING THE NEOPRENE TO SIZE.

The neoprene needs to be cut to accommodate the infant's measurements. Please refer to Supplementary Table 1, Figure 1 and Supplementary Figures 1-6 for more details on how to build it. The final product can be seen in Supplementary Figure 3A and 3B. In total 4 pieces needs to be made.

The torso wrap (Piece 1) (Figure 1) needs to be cut to the length ("y") of the largest torso circumference ("a" or "b") plus approximately 10-15% additional length. It needs to be cut to a width ("w") that is the same as the measurement of the length of the infant's torso ("c"). A hole needs to be cut in the torso wrap ("z") which is slightly larger than the neck of the omphalocele ("d"). The hole should be offset to one side so that the wrap will close on a lateral ventral aspect rather over a dorsal aspect, which could cause a point of pressure, and make adjustments to the wrap more challenging. Please note that to slightly reduce heat retention and support infant mobility the width of the portion of the wrap that will cover the back (and especially the shoulder blades) has been shaped to maintain the stability of the wrap (*) while reducing the amount of material. It was useful to start with a slightly larger piece of material and trim down the excess after a trial on the infant.

The first piece of the silo (Piece 2) (Figure 1) is cut to a size "x" in height which is the height of the contained omphalocele "e", and "u" in length which is the width of half of the omphalocele circumference "d"/2. Beveled edges have been cut on both sides of this piece (along the direction of the height of the omphalocele) to reduce any ridges as the second half of the silo overlaps the first.

The second piece of the silo (Piece 3) (Figure 1) is cut to the height "x" which is the height of the contained omphalocele "e", by a width "v" that is approximately 20-30 % more than the width "u" of silo piece number 2 to allow for some overlap of the two pieces.

The compression strap (Piece 4) (Figure 1) is cut to a width ("s") that is approximately 20% wider than the diameter of the hole in the torso wrap and a length ("t") of approximately 4.5 times the height of the contained omphalocele. Small wedges can be cut as shown in Supplementary Figure 4 to create a curvature to the portion of the compression strap that is in contact with the omphalocele. In practice, this has been helpful to prevent the compression strap from sliding out of place as the infants moves or is handled.

5. SEWING THE PIECES TOGETHER.

These pieces need to be sewn together (Supplementary Figure 2-6). Zig zag stitch used on a standard sewing machine with the stretch of the neoprene used to facilitate flat straight lines while sewing, creates a 3-dimensional product as displayed in the images below (Supplementary Figure 2-6). See below for steps by step instruction used to fabricate the binder and corresponding photos of the sewing process.

The first (smaller) silo piece (piece 2) is sewn to the inner circumference of the hole cut into the torso wrap (piece 1) (Supplementary Figure 2). Care is taken to create tight contact between inner rubber cores of the two pieces. The pieces are positioned flat on the sewing machine. Having the soft nylon lining facing up and the pile facing down can make visualization of the seam

and maintenance of a tight seam easier. Some stretching of the hole in the torso wrap is needed to sew the two together effectively and has not been found to create any bunching or irregularities in the seams.

Silo piece 3 is sewn in a similar manner to silo piece 2 (Supplementary Figure 3A and 3B). Starting from either side of the seam attaching silo piece 2 to the torso wrap, ensure that at least 1 cm of overlap is left unsewn creating overlap that prevents the possibility of velcro attachment to the sterile gauze wrap covering the omphalocele (Supplementary Figure 3A). The seam should only be the size of the circumference of the hole cut in the torso wrap with no overlap. When sewing piece 3 into place there should also be at least 1 cm of overlap on the other side that is unsewn. (See the result of sewing the two silo pieces to the torso wrap in Supplementary Figure 3B).

Sewing flat darts in the compression strap creates curvature to accommodate the expected bulge of the omphalocele from the silo with even, gentle pressure (Supplementary Figure 4). This also increases the stability of the compression over the silo and prevents the compression strap from sliding up or down over the omphalocele. The location, length, width, and number of these darts should be determined by the clinician based on the degree of bulge. In our experience a minimum of two darts at each edge of the compression strap was needed. These were created by cutting a narrow triangle into the compression strap (i.e. a 10-20 degree angle 1-2 cm in length). Double pointed ovals can also be cut in the middle of the compression strap on either side of the silo and sewn to increase the amount of curvature (Supplementary Figure 4).

Hook closures around the circumference of the silo, for the torso wrap and for the compression strap, all allow for adjustability so that compression can be increased or backed off based on infant tolerance and stability (Supplementary Figure 5).

6. ADJUSTING AND PROGRESSING THE OMPHALOCELE COMPRESSION.

Use of a neoprene binder that provides support and slow compression to the omphalocele has allowed for parents to hold their infants on the second day of life after the binder has been fabricated and fit. In addition, the neoprene has enough rigidity that the omphalocele did not need any additional vertical support. In the early days it is helpful to frequently check in on fit and function of the binder to revise and progress as tolerated. Twice daily checks by caregivers for skin integrity, dressing changes etc. are beneficial to ensure any issues are attended to promptly.

The medical team will need to decide the most appropriate plan for progressing each infant. Strategies we have used include adding a double layer of 2x2 gauze inside the silo at each shift (creating a stack) as tolerated by the baby and then cutting down the silo approximately when the stack has built to .5 to 1 cm in compressed height (Figure 3A-D). Making the adjustments in this manner allowed for room to easily back off on pressure if the infant showed signs they were experiencing too much pressure (i.e. edema, discoloration, tachycardia or tachypnea).

7. ADDITION OF SHOULDER STRAPS.

As the infants becomes more active and the omphalocele is reduced, we found it helpful to add shoulder straps and a crotch-strap to maintain position of the binding over the omphalocele. Straps can be made of the same materials and either sewn into place or attached with Velcro. Attention should be paid to avoid overlapping material in areas where the infants will put pressure on. Supplementary Figure 6 shows an example of shoulder and crotch straps in place.

8. SUPPLEMENTARY FIGURES

Supplementary Figure 1 – Omphalocele and infants need to be measured to build the neoprene device. a: circumference of the infant's torso proximal to the omphalocele; c: length of the infant's torso from nipple line to anterior superior iliac crest; d: circumference of the neck of the omphalocele; e: height of the omphalocele when the entire sac has been confined to the circumference of the omphalocele's neck. Measurement of the circumference of the infant torso distal to the omphalocele ("b") is not shown in this picture.

Supplementary Figure 2 – Initial assembly of the omphalocele. The smaller of the silos pieces (piece 2) is sewn to the inner circumference of the hole cut into the torso wrap (pieces 1).

Supplementary Figure 3 – Finishing the torso wrap. A. Sewing pieces 1 and 3 – note that suture lines of pieces 2 and 3 do not overlap to avoid pressure points; B. Complete torso wrap and omphalocele silo.

Supplementary Figure 4 – Sewing compression wrap. Darts have been cut and sewed together to allow for curvature of the compression wrap (Piece 4) over the omphalocele.

Supplementary Figure 5 – Bottom left: complete torso wrap and silo; Top left: finished compression strap; Right: fully assembled neoprene binder. Pieces 1, 2, 3 and 4 are marked.

Supplementary Figure 6 – Shoulder and crotch straps are added when the omphalocele is reduced enough in the abdominal cavity that the silos move over the torso. These extra straps also maintained the silo centred when infants become more active.