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Role of Cross Sectional Imaging in Repair of Neonatal Hypoplastic Aortic Arch

By Rabin Gerrah, MD; Dianna Bardo, MD; Rachel Sunstrom, PAC; Rich Reed, PAC; Stephen Langley, MD

Introduction

Hypoplastic Aortic Arch (HAA) is a common diagnosis in Congenital Heart Diseases. Altogether, aortic malformations account for 15-20% of all congenital cardiovascular diseases.[1] HAA may occur as an isolated lesion or in conjunction with other congenital cardiac anomalies. Hypoplasia might entail single or multiple segments of the aorta and, hence, the wide range of surgical options. The surgical treatment for HAA has evolved with advances in surgical techniques and improved imaging modalities. As a general rule, the anomalies of the distal arch and descending aorta are approached via left thoracotomy and the ascending and proximal portion of the arch are approached through midsternotomy. Different guidelines regarding when to use each approach based on anatomic landmarks or morphologic characteristics have been described.[2] A management dilemma rises when the common hypoplasia of the distal arch is extended towards the transverse arch. In some instances, the presence of aortic arch hypoplasia has been ignored in the setting of severe isthmus stenosis or a coarctation with the hypothesis that reestablishing flow in the aorta after relief of obstruction will stimulate the aorta to grow and the hypoplasia will resolve.[3,4] Instead, in many institutions any extension of hypoplasia proximal to the distal arch is considered Complex Arch Disease and repaired through a midsternotomy approach. The major differences between the two approaches are the need for cardiopulmonary bypass (CPB) to reconstruct the aorta and cerebral perfusion techniques or deep hypothermic circulatory arrest in the midline approach versus no CPB in the thoracotomy approach. Achieving the same outcome with no CPB would exclude the complications associated with the use of it, and would be a preferred approach, if feasible.

Echocardiography, has become the gold standard for imaging and diagnosis in Congenital Heart Disease (CHD). It is used primarily for surgical decision-making regarding the approach for repair of HAA. This diagnostic modality has limitations, such as lack of appropriate acoustic windows in specific body habitus or posterior structures, and limited spatial resolution. Recently, cross sectional imaging (CSI) including: computerized tomography (CT) and Magnetic resonance imaging (MRI), have become a strong modality in diagnosis of CHD. The different variations of HAA are repaired based on surgeons' experience and preference and to-date, no standard morphological or anatomical definitions or numeric parameters exist to define the exact type of pathology and the appropriate repair-type based on these definitions.

In repair of HAA, whatever type of surgical repair is undertaken, it needs to provide a definitive treatment with exclusion of the hypoplastic portion of the aorta while ensuring the patient undergoes the lowest risk procedure possible. It has not been studied whether or not CSI adds additional information to existing echocardiographic studies and whether or not these additional images may impact surgical decision-making. It is known, however, that 3-dimensional reconstruction achieved uniquely by CSI is the most realistic imaging modality, and provides a simulation for direct visualization of the cardiac anatomy or preoperative planning.

We hypothesize that better definition of the aortic arch by CSI will identify more patients with complex HAA who are still amenable to the lower risk thoracotomy approach, rather than the midsternotomy approach. Based on our findings we propose a management algorithm.

Patients and Methods

This study was approved by Institutional Review Board of Oregon Health and Science University. Computerized database was used to identify the study population. All patients diagnosed with HAA in the neonatal period by echocardiography who underwent surgery from May 2008 to March 2013 at our institution were initially selected for inclusion in the study.

Echocardiographic description of arch anomaly included both descriptive and quantitative information on arch segments as well as cardiac chambers and function. Whenever two measurements from the same patient varied more than 10%, they were considered as inaccurate, and were excluded for use in surgical management.

CSI with 3-dimensional reconstruction was obtained in HAA cases considered complex cases or when the data from echocardiogram regarding the arch anatomy was inconclusive. Two-dimensional images from CSI were used for measurements of length, diameter and distance of the structures from each. For the purpose of standardization and comparison between the different modalities, the aortic arch standard

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segmentation definition was used: Segment 1 being the section between the brachiocephalic artery and the left common carotid artery; Segment 2, the section between the left common carotid artery; and Segment 3, between the left subclavian artery and the isthmus (Figure 1). Each segment was defined as normal or hypoplastic in either imaging method. Since the definition of a HAA is controversial,[5] we used a combination of the three definitions and parameters assumed to be the most predictive. These criteria included: less than 50% ratio of the diameter of the transverse arch to the descending aorta,[5] size of the arch in mm less than the patient's weight in kg +[16] or aortic arch diameter Z-score is less than - 2.0. [7]

We excluded patients with Hypoplastic Left Heart Syndrome (HLHS) or other single ventricle physiology and patients with interrupted aortic arch, right sided aortic arch and bovine arch.

All cases were presented in cardiology and in a cardiac surgery forum for surgical decision making. Whenever the anatomy of the arch was complex or in cases with questionable imaging quality of echocardiography, a repeat echo was performed or CSI was obtained and these patients were discussed again for final surgical planning purposes.

Surgical Techniques

The surgical plan was made for either a midsternotomy or left thoracotomy approach after reviewing all patients' data and images if their quality was satisfactory. In all patients, blood pressure was monitored proximal and distal to the repaired area before and after surgery to evaluate for any pressure gradient or residual narrowing at repair site. Near infrared spectroscopy were monitored to assess the adequate cerebral blood flow. In the midsternotomy approach, the surgery was performed on CPB and the repair was completed using a patch material on the lesser curvature of the aorta to augment the aorta during a period of selective cerebral perfusion, as described previously.[5]

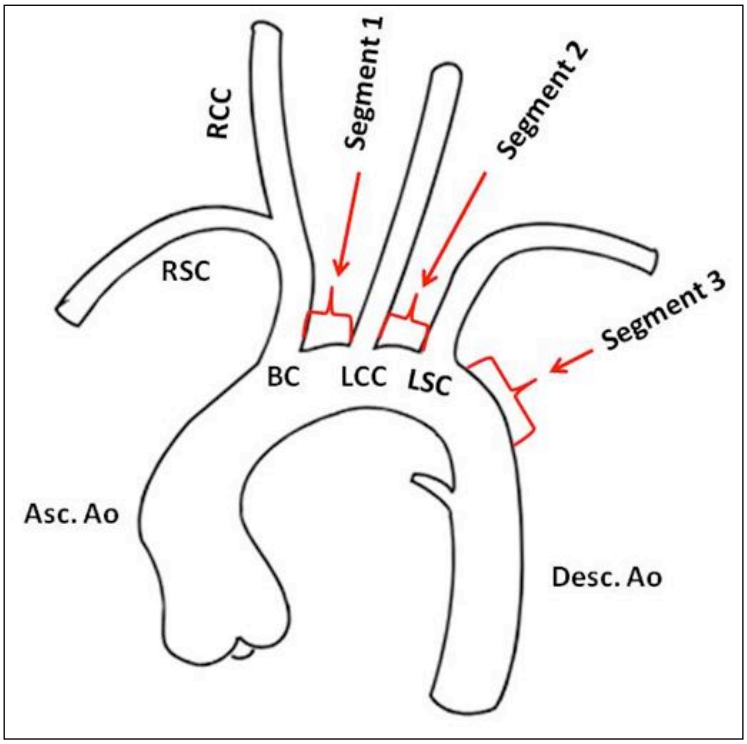

Figure 1. Segmentation of the aortic arch. Asc Ao= Ascending aorta, BC= Brachiocephalic, Desc Ao= Descending aorta, LCC= Left common carotid, LSC= Left subclavian, RCC= Right common carotid, RSC= Right subclavian.

For the thoracotomy approach, the procedure was performed as described for classic repair of extended end-to-end anastomosis.

Statistical Analysis

Results are presented as mean ± standard deviation or median and range for continuous measurements. Due to a small number of samples in each group, non-parametric statistics as Mann-Whitney test and one way analysis of variance were used to compare the groups. In all measurements, a *p*-value of less than 0.05 was considered as significant.

Results

Twenty-six patients were enrolled in the study. The median age was 11 days (range 3-28 days) and weight was 3.3 kg (range 2.1-4.4 kg). Patients were grouped based on type of anatomy and repair. Group 1 (16 patients) had discrete hypoplasia of the third segment and underwent repair by resection of the isthmus and extended end-to-end anastomosis via thoracotomy. Group 2 (4 patients) had complex arch anatomy of the arch and septal defects. These patients underwent complex arch repair and closure of septal defects using CPB through midsternotomy. Group 3 (6 patients) had a complex anatomy of arch with hypoplasia of Segment 3 and hypoplasia and/or dysplasia of Segment 2 (Figure 2). The surgical approach in these patients was left thoracotomy and extended end-to-end anastomosis. Patients' characteristics are summarized in Table 1.

All patients were diagnosed initially by echocardiography. Echocardiographic data for each group was recorded in Table 2.

CSI was performed in 50% of total study population as additional diagnostic imaging. The 13 CSI studies were performed on the following patients: 4 of 12 (25%) in Group 1, 3 (75%) in Group 2 and 6 (100%) in Group 3. The type of CSI was either CT (9 patients) or MRI (4 patients).

The CSI was used to determine the diameter and the length of each segment and to visualize the entire aortic arch in a 3-dimensional reconstruction.

The decision-making for type of surgery was based on anatomy initially seen by echocardiography. The decision for an extended end-to-end repair was straight forward for patients in Group 1, with only hypoplasia of segment.[3] Group 2 had intra-cardiac lesions necessitating complete repair which was performed in one stage through a sternotomy. The group of main interest was Group 3,

Table 1
Patients' Characteristics

Variable	Group 1 (n=16)	Group 2 (n=4)	Group 3 (n=6)	*P* Value
Age (days) (All 13.6±8.6)	12.2±8.6	16.6±11.2	14.5±6.6	0.1
Weight (kg) (All 3.3±0.6)	3.2±0.7	3.0±0.5	3.6±0.3	0.3
BSA (m2) (All 0.20±0.02)	0.20±0.03	0.20±0.02	0.21±0.01	0.3
CSI (n) {CT/MRI}	{2/2}	{3/0}	{4/2}	0.1
Length of hospital stay (days) (All 10.4±9.2)	9.1±6.3	16.8±14.6	8.3±7.1	0.2
Mean follow-up period (days)	942±490	1102±492	610±461	0.3

BSA: Body surface area; CSI; Cross-sectional imaging;
CT: Computerized tomography;MRI: Magnetic resonance image

with complex anatomy of the arch in which a midsternotomy approach for repair was proposed initially. After further evaluation with CSI, the anatomy looked more favorable and the patients underwent repair via a thoracotomy approach.

The measurements of length and diameter were not statistically different between echocardiography and CSI (Table 3), however, the data obtained from echocardiography was incomplete or omitted due to variability as described in methods.

Group 3 was further analyzed to identify parameters affecting the surgical planning. Arch anatomy analyzed by CSI data in Group 3 provided the following measurements: Segment 1, 4.9±0.9 mm, Segment 2, 3.7±0.7 mm, and Segment 3, 2.7±0.4mm. In all these patients, the diameter of the first segment was similar to the descending aorta diameter (4.9±1.1mm vs. 5.0±0.9mm, p=0.9) and the length of this segment was similar to its diameter. In these patients, an extended end-to-end anastomosis repair via thoracotomy was performed rather than arch reconstruction on CPB (as was initially planned based on echocardiogram).

It appeared that numeric values of Segments 1 and 2 were the main parameters determining the type of surgical approach. These parameters were accurately achievable only from CSI. In presence of hypoplastic or short Segment 1 of aortic arch, a midsternotomy approach was necessary; however, when the Segment 1 had a diameter and length similar to descending aorta, a left thoracotomy approach with extended end-to-end anastomosis was possible regardless of the anatomy of Segments 2 and 3 of the aortic arch. Presence of these determining factors quantified by CSI, created a common language and standardized the decision-making process.

We hypothesized that for an extended end-to-end anastomosis using our previously described technique, a normal ascending aorta and an appropriate size and unrestricted flow through the first branch of aorta are necessary. These conditions enable safe clamp placement and performance of extended-end-to-end anastomosis.

Using this surgical strategy, there was no patient with a residual narrowing. All patients had a gradient of less than 10 mmHg determined

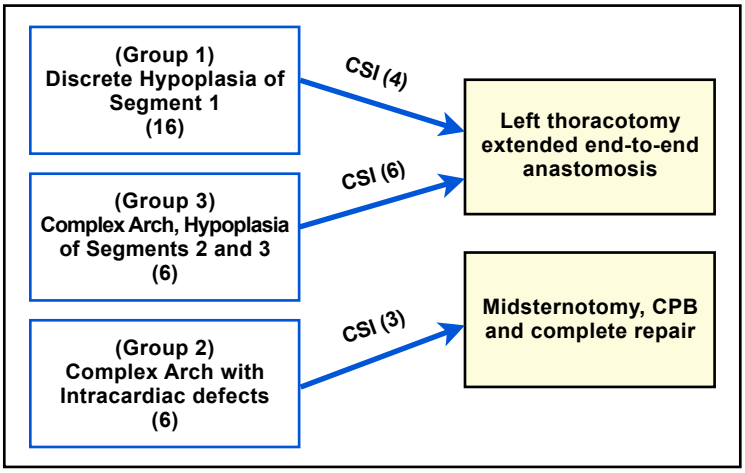

Figure 2. Distribution of patients in the study groups, number of cross sectional imaging studies and the surgical procedures. CPB= Cardiopulmonary bypass, CSI= Cross sectional imaging.

"Echocardiography, has become the gold standard for imaging and diagnosis in Congenital Heart Disease (CHD). It is used primarily for surgical decision making regarding the approach for repair of HAA. This diagnostic modality has limitations such as lack of appropriate acoustic windows in specific body habitus or posterior structures, and limited spatial resolution. Recently, cross sectional imaging (CSI) including: computerized tomography (CT) and Magnetic resonance imaging (MRI), have become a strong modality in diagnosis of CHD."

with blood pressure recordings. One patient in Group 1 had a gradient of 11 mmHg after completing the repair.

The average length of hospital stay was not different between the groups, 10.42±9.2 days in the entire group: 9.1±6.3 days in Group 1, 16.8±14.6 days in Group 2, and 8.3±7.1 days in Group 3, p=0.2.

There were 3 readmissions, 2 in Group 1, 1 in Group 2 and none in Group 3. All readmissions were non-cardiac related. There was no peri-operative mortality, and no patient needed re-intervention in the follow-up period in all groups.

The mean follow-up was similar between the groups. No patient was lost to follow-up at the time of the report of this study. The endpoints for follow-up were death, diagnosis of re-coarctation, need for procedure either surgical or percutaneous for relief of aortic narrowing. During this follow-up period none of these endpoints were observed.

Based on this observation, we propose a treatment algorithm for patients with HAA utilizing CSI with proper indications (Figure 3).

Discussion

HAA is a common consideration in congenital cardiac surgery. It is known that growth of a blood vessel or a cardiac chamber is dependent on the blood flow through it. A common condition proving this theory is hypoplasia of the aortic isthmus and coarctation, which occur as a result of an increase in pulmonary blood flow and decreased aortic flow.[8,9] This pathologic process, along with other unknown factors, can affect different segments of the aortic arch. According to the definitions of arch hypoplasia of Moulaert and associates,[10] there are three types of hypoplasia: Type I, hypoplasia of the distal arch (82%); Type II, hypoplasia of the entire arch (13%); and Type III, absence of the proximal arch (5%). All these pathologies require surgical repair, usually performed in the neonatal period. Conventionally, pathologies of the

distal arch and descending aorta are approached through left thoracotomy, whereas more proximal pathology is addressed by midsternotomy. These two approaches bear significant differences in risk, prognosis and outcome. While the former is performed with a beating heart, the latter is carried out with CPB with different perfusion techniques, including deep hypothermic circulatory arrest or selective cerebral perfusion, all with inherent risk of major morbidity or mortality. It is not clear what subtype of patients with HAA is still amenable for the thoracotomy approach. Furthermore, no quantifiable anatomic variables have been defined yet to determine the type of approach.

In this study we determined whether further delineation of the arch anatomy by means of additional modality will affect the decision regarding the approach, possibly shifting more patients toward the lower risk off - CPB, thoracotomy approach. In addition, we attempted to identify and quantify anatomic factors influencing the type of approach.

In clinical settings, besides feasibility of repair, complete relief of the stenosis in the aorta is of utmost importance. In any approach, the surgery needs to resolve the narrowing, leaving no residual hypoplastic segment as such a narrowing has been found to be associated with early mortality, late mortality and hypertension.[11-13, 6] In a long-term follow-up study, after conventional repair of the coarctation in patients with moderate hypoplasia of the arch, one third kept a small proximal arch.[4] The extended end-to-end anastomosis-type repair for hypoplastic distal arch has been criticized as being inadequate when an additional proximal hypoplasia of the arch is seen by echocardiography. In our study, no patient had any significant gradient after the surgery, and no intervention was required in the follow-up period. This satisfactory outcome might be explained by appropriate patient selection for this type of repair using objective measurements of arch segments accurately obtained from CSI. The extended end-to-end anastomosis repair provides a large anastomosis less prone to narrowing should any anastomotic imperfection or tissue growth occur and it has proved to address the hypoplasia of the transverse arch with low early mortality.[14]

Table 2
Echocardiographic Characteristics

		Group 1 (16)	Group 2 (4)	Group 3 (6)
Anatomic description		Discrete hypoplasia of distal arch and/ or discrete coarctation of aorta. Proximal and distal arch, ascending, and descending aorta: within normal limits.	Hypoplasia of distal arch involving Segment 2 and coarctation of aorta, presence of large ventricular (and atrial) septal defect/s.	Hypoplastic aortic arch, complex hypoplasia involving proximal arch and coarctation, long hypoplastic segment and/or torturous segment of aortic arch.
Adequate quantification of arch segments (patients)	Segment 1	14/16 (87%)	2/4 (50%)	2/6 (33%)
	Segment 2	16/16 (100%)	3/4 (75%)	2/6 (33%)
	Segment 3	16/16 (100%)	3/4 (75%)	4/6 (66%)
Accurate branching pattern description (patients)	9.1±6.3	16/16 (100%)	3/4 (75%)	2/6 (33%)

In this study, CSI was used to accurately define the HAA. While no studies have compared the different imaging modalities in the context of HAA, echocardiography, despite being the only modality in most cases, was found to be less sensitive in diagnosing Isthmic Hypoplasia.[15] In a study reviewing the multimodality imaging for assessment of congenital heart disease, MRI and CT have been considered superior to echo in imaging of extra-cardiac vasculature.[16]

Routinely, most congenital cardiac anomalies are diagnosed solely by echocardiography. It is non-invasive, available and easy to interpret; however, it affords limitations including spatial resolution, lack of appropriate acoustic windows and user dependency in interpretation. Specifically, echocardiography lacks the 3-dimensional orientation of arch branches, which is valuable for surgical planning, including cannulation and perfusion during CPB. The 3-dimensional reconstruction is a realistic view elucidating accurate anatomy as seen in the surgical field. Despite these benefits of CSI, it is used only in a fraction of the patients due its availability, exposure to radiation and contrast material. However, advances in CSI technology with sophisticated image reconstruction and processing have made this

Table 3
Arch Characteristics by CSI and Echocardiography in Group 3

	Segment 1, length (mm)	Segment 1, diameter (mm)	Segment 2, diameter (mm)	Segment 3, diameter (mm)
Echocardiography	4.6±0.1*	5.0±0.2*	3.8±1.0	2.8±0.3
CSI	4.8±0.4	4.9±0.9	3.7±0.7	2.7±0.4
P Value	0.2	0.1	0.4	0.5

*Incomplete data, the measurement varied in different studies or the image quality was insufficient for accurate measurement.
CSI: Cross-sectional imaging.

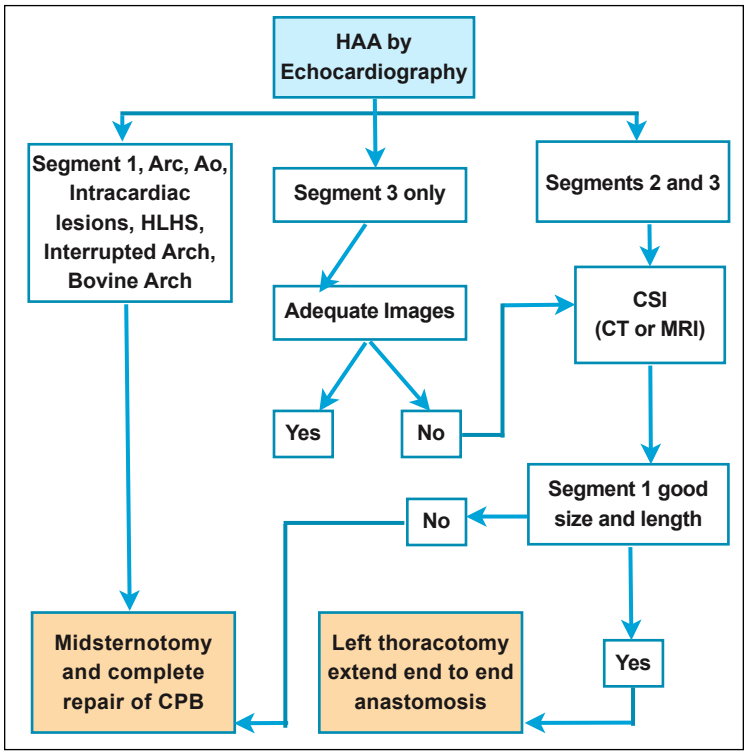

Figure 3. Proposed surgical management algorithm for Hypoplastic Aortic Arch. Asc Ao = Ascending Aorta, CPB = Cardiopulmonary bypass, CSI = Cross-sectional imaging, CT = Computerized tomography, HAA = Hypoplastic Aortic Arch, HLHS = Hypoplastic Left Heart Syndrome, MRI = Magnetic resonance imaging.

modality more accurate and accessible even for the neonates.

In our patients, the complex pathology of the second segment of arch did not exclusively affect the surgical technique. The CSI in this group provided objective measurements and, therefore, changed the management plan. A 3-D arch image provided a real life representation of the aorta where the surgeon could visualize the surgery with all parameters available. The concept of thoracotomy was accepted when the surgeon could virtually plan the surgery using these images to imagine clamp location, incision lines, resection extension and anastomosis lines and location. This imaginary surgery based on 3-D images from CSI would not be possible by 2-D images obtained from echocardiography and, in these complex cases, the decision would be midsternotomy as a default approach rather than a thoracotomy.

This study is limited by the small number of patients and short follow-up. No death and no re-coarctation was recorded in these series of patients and, therefore, we assume it is possibly an optimal approach saving midsternotomy and CPB in some cases. However, it is possible that minor narrowings without clinical significance may develop during this follow-up period, and they would be diagnosed only by follow-up CSI, that would be hard to justify in routine follow-up. It is also not clear whether the long-term results will be as optimal as the short-term results. The satisfactory immediate results in all these patients seems to support this decision making process. We propose this management algorithm as a baseline and an initial paradigm. Larger studies and further experience are needed to optimize it and to prove its validity as a general guideline.

In conclusion, in HAA, whenever the exact anatomy of the arch is not perfectly described by echocardiography, a CSI is recommended for surgical planning. The information obtained by CSI, can provide quantifiable parameters to identify patients who can benefit from a thoracotomy approach rather than a midsternotomy approach.

This study was conducted at Oregon Health and Science University, Portland, Oregon, while the author was working at this institution.

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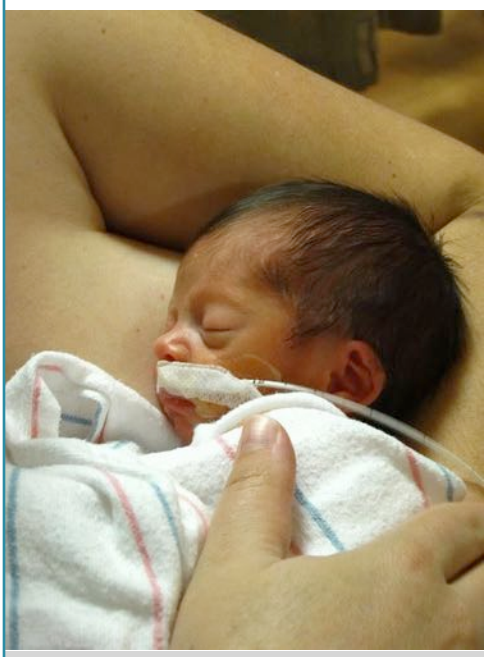

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A Case of a Newborn with Absent Sternum

By Crystal N. Le, MD; Jane O'Donnell, MD; Mallory Boutin, MPH; Richard S. Song, MD

Introduction

Absent Sternum is a rare, unexpected finding on a newborn examination, and it is important to evaluate for associated syndromes. Here we discuss a case presentation and the workup for differential diagnosis.

Case Presentation

The one-year old female patient was born at 40 3/7 weeks gestation to a 34-year-old mother, G3PO, who received unremarkable prenatal care. Prenatal labs were normal except for a 32 week ultrasound showing size < dates by 1 week (in 15th percentile). Mother has normal TORCH titers and no history of teratogen exposure. She presented in labor with failure to progress and delivered via repeat C-section. Infant's Apgar scores were 7 at 1 minute of life and 9 at 5 minutes of life. The significant findings on initial examination consisted of: chest wall deformity with no palpable bony sternum or manubrium, tachypnea with midline retractions, but clear breath sounds bilaterally, regular heart rate and rhythms with visible impulse at midline of chest, midline raphae extending from umbilicus to the position of the apparent absent xyphoid. The rest of the physical exam is unremarkable without any other dysmorphic features or vascular lesions. A chest X-ray was taken to further evaluate the physical findings (Figure 1) and showed floating clavicles without sternal ossification center.

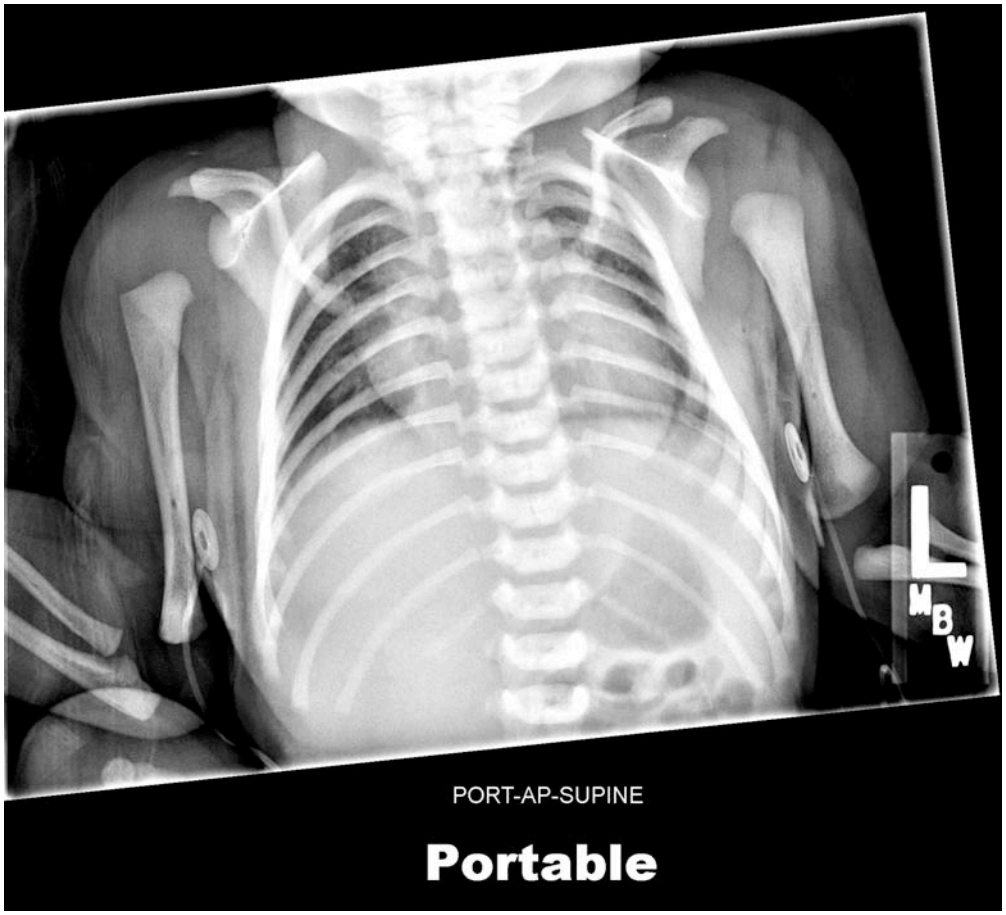

Figure 1. CXR Absent Sternum.

During the hospital course, evaluation with chest CT confirmed absent sternum and manubrium with intact diaphragm (Figure 2 showed 3D reconstruction). Cardiac echocardiogram was unremarkable except for a small secundum Atrial Septal Defect (ASD). Ultrasound of the brain was normal. Kidney ultrasound indicated right-sided Grade 1 hydronephrosis. Ophthalmology exam was normal without optic disc hypoplasia or media opacity. The remainder of hospital course was uneventful. Despite the chest wall deformity, the infant remained stable in room air without any respiratory distress. She was discharged home at Day of Life 4 after genetics and surgery consultations.

Patient developed a 2 cm-wide strawberry hemangioma on the left thigh at three months of life. At four months old, the patient underwent sternotomy, thymectomy, and primary closure of complete sternal cleft. An incidental finding during surgery included a Congenital Defect of the Pericardium. There were no complications after surgery and the patient was discharged home five days post-operatively.

Discussion

Sternal formation begins after the fifth week of gestation with migration of paired lateral plates of mesoderm toward the midline and progressively undergoes fusion in the cephalocaudal direction.[1] Failure of this fusion leads to sternal cleft or complete sternal absence.

Isolated Absent Sternum is extremely rare, with an unknown incidence, but is a potentially life threatening congenital midline defect. The literature has described this anomaly with associated developmental anomalies of other midline visceral structures. Proximal sternal clefts are seen with vascular dysplasia such as Sternal Malformation-Vascular Dysplasia Spectrum (SM-VDS) and PHACES Syndrome (posterior fossa malformations, hemangiomas, arterial lesions/AV malformation, cardiac and eye disease, sternal defect and superumbilical raphae).[2-4] Distal sternal defects are also seen in Pentalogy of Cantrell (omphalocele, ectopia cordis, anterior diaphragmatic defect, pericardial defect with sternal cleft and congenital heart malformation).[2] Our

"Absent Sternum is a rare, unexpected finding on a newborn examination, and it is important to evaluate for associated syndromes. Here we discuss a case presentation and the workup for differential diagnosis."

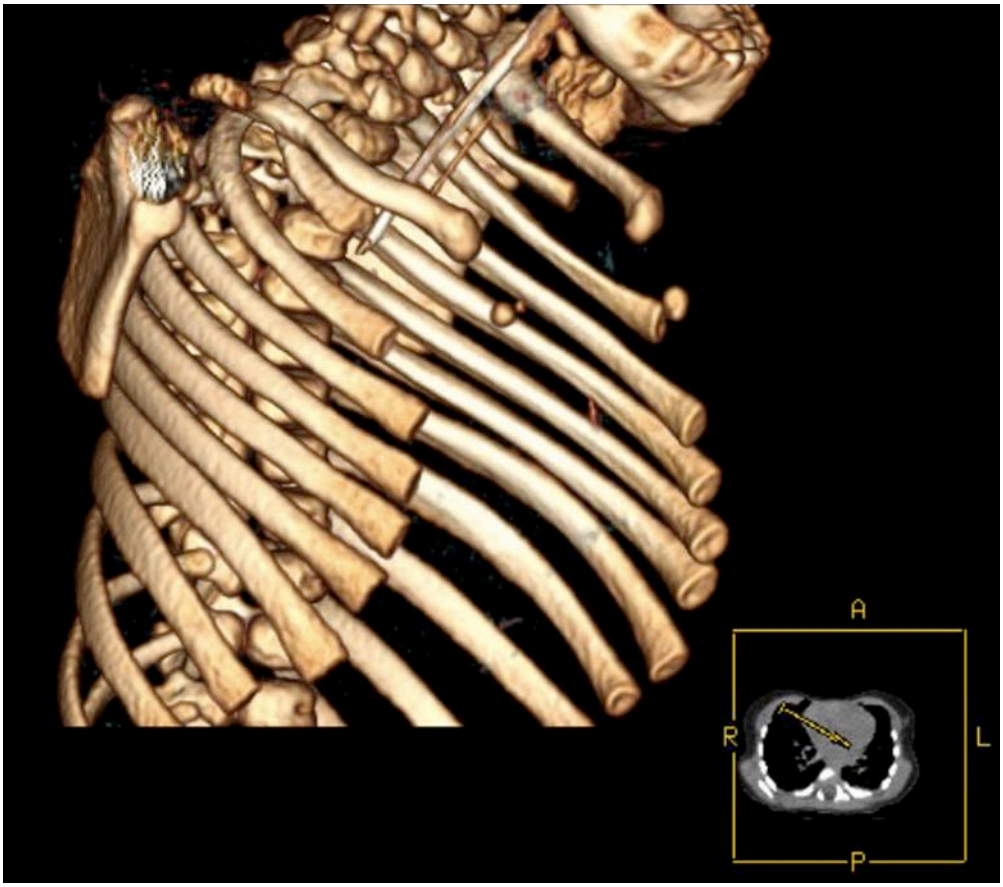

Figure 2. 3D CT Absent Sternum.

case did not identify a clear associated syndrome described above despite isolated complete absence of sternum, supraumbilical raphe, incidental absent pericardium without significant cardiac defect, and late development of hemangiomas.

In all cases of Absent Sternum, a complete evaluation is needed with close physical examination, imaging modalities (CT, Echocardiogram, brain MRI and/or ultrasound of brain and abdomen), as well as multidisciplinary consultations with genetics, cardiology, ophthalmology, hematology and surgery. Future genomic advancement might help pinpoint an associated gene locus.

"In all cases of Absent Sternum, a complete evaluation is needed ...."

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Perinatal Loss and Bereavement: Grief (Part 2)

By Marylouise Martin, MSN, RNC-NIC

Members of the NPA write a regular column in *Neonatology Today*.

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As William Shakespeare has opined, "Everyone can master a grief but he that has it" (Much Ado About Nothing, Act III, Scene 2) and "To weep is to make less the depth of grief" (Henry VI, Part II, Act II, Sarkis 2012, para 7). To lose a child is one of the most stressful and devastating events parents, siblings and families can experience and causes intense grief (Avelin et al. 2013, Endo, Yonemoto and Yamada, 2015). Grief has been defined as the emotional response to loss; loss defined as the absence of a person or possession; mourning the outward social expression of loss and bereavement includes grief, loss and mourning (National Perinatal Association, 2013, Klass, 2015). Although the sense of loss and pain is universal, the expression of that grief varies among cultures, among families, and even among individuals who grieve.

Anthropological studies on dying, death and grief suggest that there is no one grief theory that applies to everyone. Western cultural concepts such as "dying" and "grief" originated from the context of the American culture. They are based on American beliefs and the way Americans think, categorize and understand. People from other cultures understand and classify their own beliefs differently about the origins of events, the nature of the person, the way to behave, the meaning of losses and much more (Andrews, 2013, Morgan and Laungani, 2002, Purnell, 2013). What people believe, feel and do when they have experienced a loss varies enormously from culture to culture. For example, in impoverished families of northeastern Brazil, most infant and child deaths are seen as inevitable, and also as a function of the individual child's will to live. Therefore, infants and children are not typically mourned for more than a few days. The dead children are still counted as part of the nuclear family, and mothers expect to eventually join these children in heaven (Rosenblatt 1993, Morgan and Laungani, 2002, National Perinatal Association 2013).

"Grief has been defined as the emotional response to loss; loss defined as the absence of a person or possession; mourning the outward social express of loss and bereavement includes grief, loss and mourning (National Perinatal Association, 2013, Klass, 2015). Although the sense of loss and pain is universal, the expression of that grief varies among cultures, among families, and even among individuals who grieve."

In Bali, it is believed that if one is not calm, the gods will not listen to one's prayers. If one expresses emotional distress, then one is more vulnerable to sorcery and evil spirits. Therefore, a bereaved family who has suffered the death of a child will work hard, with the support of family and friends who laugh, joke, tease and distract, to take death lightly (Rosenblatt 1993, p. 15). This is referred to as "muted grief" (Rosenblatt, 1993).

Another type of grief, which we as Americans would likely see as "excessive grief," can be seen in the Egyptian culture. For example, the loss of an infant may cause "years of muted depression, constant suffering and remaining in bereavement. Such a consequence is culturally normal. The social support given to the Egyptian bereaved actively encourages suffering and dwelling on pain and gravity of the loss" (Rosenblatt, 1993, p. 15). This process may go on for seven years or more (Morgan and Laungani, 2002).

"In the ancient Chinese culture, children must be 18 years or older to be accepted as adults. If a child dies before he or she reaches adulthood, parents will not plan formal ceremonies" (Yu-Ling and Hsia, 2004, 76-77). In the Chinese culture it is believed that children should not die before their parents (Yu-Ling and Hsia, 2004, p. 77). "The cultural belief is that letting gray hair (parents) arrange a funeral for black hair (children) will add more sin to the dead person" (Yu-Ling and Hsia, L (2004, p. 77). The Chinese, as well as other cultures, will internalize their grief, which can result in "somatization" (Rosenblatt 1993). When grief is internalized in this manner, it may result in the expression of physical ailments such as pain, weakness, discomfort, gastrointestinal issues and more (Rosenblatt 1993, Klass, 2015).

"Because the way grief is manifested varies vastly from culture to culture, it is important that the healthcare provider have, at least, a basic knowledge of the culture and cultural practices related to grief in the population s/he is serving."

In many cultures grief, especially due to the loss of a child, may be expressed as anger and aggression as a part of the mourning process. This is referred to as "violent grief" (Rosenblatt, 1993). In some cases retribution may even be sought, a practice seen in the Kuali of New Guinea.

Because the way grief is manifested varies vastly from culture to culture, it is important that the healthcare provider have, at least, a basic knowledge of the culture and cultural practices related to grief in the population s/he is serving. It is also important to bear in mind that culture is never stagnant, but is dynamic and each person has an individual take on their own culture. Cultural expressions can be impacted by education, socioeconomic factors, ethnic affiliations, and acculturation (Herbert, 1998, Kenner, Press, and Ryan 2015). When working with a primary client, it is important to assess that person's cultural orientation: for example, "languages spoken, religion professed, and generation of immigration" and what role each family member plays as well as roles within the community, all of which can impact the grief manifestations of the family suffering a perinatal loss ((Herbert, 1998, p. 77). Once again, it is also important to know one's own culture and grief response.

Practitioners will be more effective if they are flexible, creative and sensitive to cultural beliefs/practices. A family-centered, integrated, culturally-driven plan of care can provide support for families experiencing grief for either an anticipated or unanticipated perinatal loss (Kenner, Press, and Ryan 2015, p.522). This should be the gold standard in providing care to the bereaved family.

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Medical News, Products & Information

Compiled and Reviewed by Tony Carlson, Senior Editor

Extracting Value from Chaos: The Promise of Health Information Technology

INDIANAPOLIS -- Expectations for health information technology abound. A paper from the Regenstrief Institute takes a sweeping look at a variety of categories of health IT including: electronic medical records, health information exchange, telemedicine, patient portals and personal health records, mobile devices, wearable sensors and monitors, and social media. The authors evaluate current use of these technologies, detail their potential and discuss barriers that must be overcome to fulfill their promise of improving health.

"The Promise of Information and Communication Technology in Healthcare: Extracting Value from the Chaos" by Regenstrief Institute investigator Burke Mamlin, MD, and former institute president William Tierney, MD, is published in the January 2016 issue of The American Journal of Medical Sciences.

"When it comes to predicting the future of medicine and health IT, there is no crystal ball. We need to make informed observations based on where we are now and infer the possibilities," said Dr. Mamlin, a Regenstrief Institute investigator and IU School of Medicine Associate Professor of Clinical Medicine. "We can't assume someone else will make the right decisions with health IT. It's going to take everyone's involvement, including providers and patients, to raise expectations and drive the needed changes. This isn't a passive process."

"Getting to a desirable future where health IT is appropriately employed to benefit human health isn't a technical problem -- the technologies already exist. It's a health policy and a sociology problem," said Dr. Tierney. "How do I, as a physician, maintain the same degree of connectedness with my patient when there's a computer in the exam room or if I am seeing a patient via a video connection or answering questions via e-mail or social media? How does the healthcare system that employs me get paid for my time? The rules of engagement are changing." Dr. Tierney currently serves as Population Health Department Chair at the Dell Medical School at the University of Texas at Austin and is a Regenstrief Institute affiliated scientist.

In addition to laying out current status, highlighting the promise and discussing how to get there for various aspects of health IT, the authors discuss security issues and policy implications. "There is no health care without management, and there is no management without information," they write.

"Too often, health IT designed to emulate paper processes becomes a distraction to care. The promise of health IT is for it to become a valuable part of the healthcare team, a participant in the conversation and not simply a passive tool," Dr. Mamlin said. "And we as physicians must understand its potential and become active participants in its development or the potential."

More than three-quarters of U.S. hospitals and half of outpatient practices have installed electronic health record systems. "We have come a long way in health IT and communication over the past 15 years and should acknowledge that progress," said Dr. Tierney. "It is propelling us to the future."

As healthcare IT becomes more pervasive, and as technology (Internet access and smart phones, at the very least) becomes part of everyday life for a growing percentage of physicians and patients, both stakeholders are becoming more comfortable with the greater amounts of data available and more demanding of its use in support of health according to Drs. Mamlin and Tierney.

Now is the time for action, they say, for a rational and well-funded national agenda for healthcare IT spearheaded by the federal government. Drs. Mamlin and Tierney conclude "only then can health care, an information business, maximize the benefits realizable by leveraging existing and rapidly developing information and communication technology. Only then can we extract value from the chaos."

Using Steroids Before Late Preterm Delivery Reduces Neonatal Respiratory Problems

Newswise — A multicenter clinical trial led by researchers at Columbia University Medical Center (CUMC) and NewYork-Presbyterian has found that the use of corticosteroids in mothers at risk for late preterm delivery significantly reduced the incidence of severe respiratory complications in their babies.

“Our study demonstrates that administering a medication that is commonly used to prevent complications in babies born before 34 weeks of gestation can also reduce the risk of many serious complications in babies delivered just a few weeks before term,” said Cynthia Gyamfi-Bannerman, MD, MSc, the Ellen Jacobson Levine and Eugene Jacobson Associate Professor of Women’s Health (in Obstetrics and Gynecology) at CUMC, obstetrician and maternal-fetal medicine specialist at NewYork-Presbyterian, and lead investigator of the study. “This will transform the way we care for mothers at risk for late preterm delivery.”

The study was published February 4th, in *New England Journal of Medicine*.

Since the early 1990s, corticosteroids have been widely used in mothers at risk of delivering before 34 weeks of gestation. This treatment accelerates the development of the baby’s lungs, so that once born, the baby is better able to clear fluid and absorb oxygen. At the time, researchers believed that corticosteroids were unnecessary for later preterm births because 99% of babies born after 34 to 35 weeks survive. However, it is now clear that infants born during the ‘late’ preterm period (between 34 and 36 weeks) have increased neonatal and childhood respiratory complications compared with newborns born at term (37 weeks or later).
The new study enrolled more than 2,800 pregnant women deemed at high risk of delivery during the late preterm period (34-36 weeks of gestation). The women were randomized to receive two injections of the steroid betamethasone or a placebo, given 24 hours apart.

The study found that babies whose mothers received betamethasone had a significantly lower rate of severe respiratory complications shortly after birth compared with those whose mothers were given a placebo. In particular, neonates from the treatment group had significantly lower rates of bronchopulmonary dysplasia, a lung condition of newborns that increases the risk of chronic lung disease during childhood.

The study also found that babies in the treatment group were significantly less likely to require a long-term stay in the hospital’s Neonatal Intensive or Intermediate Care Unit or need respiratory treatments such as surfactant.

Approximately 8%, or more than 300,000 babies, are born in the late preterm period each year. Of those, roughly 12 percent need persistent respiratory support or have other serious complications requiring prolonged stays in a special care nursery.

"While survival among late preterm infants is comparable to that of babies born at term, the rate of respiratory problems and other serious complications in this group is not comparable and remains unacceptably high," said Dr. Gyamfi-Bannerman. "Expanding the use of a well-studied, safe medication to improve lung development before birth offers a means of preventing many of these complications."

Neonates with severe respiratory problems are at higher risk for long-term complications, such as chronic lung disease and neurodevelopmental problems, throughout infancy and childhood. The investigators plan to conduct further studies to determine if giving corticosteroids to mothers at risk for late preterm delivery ameliorates their children's risk of long-term health problems.

The study is titled Antenatal Late Preterm Steroids (ALPS): a Randomized Trial to Reduce Neonatal Respiratory Morbidity. Authors of the paper include: Cynthia Gyamfi-Bannerman, MD, MSc (CUMC); Elizabeth A. Thom, PhD (the George Washington University Biostatistics Center, Washington, DC); Sean C. Blackwell, MD (the University of Texas Health Science Center at Houston–Children's Memorial Hermann Hospital); Alan T.N. Tita, MD, PhD (University of Alabama at Birmingham, Birmingham); Uma M. Reddy, MD, MPH (the Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, MD); George R. Saade, MD (University of Texas Medical Branch, Galveston); Dwight J. Rouse, MD (Brown University, Providence, RI); David S. McKenna, MD (The Ohio State University, Columbus); Erin A.S. Clark, MD (University of Utah Health Sciences Center, Salt Lake City); John M. Thorp, Jr., MD (University of North Carolina at Chapel Hill); Edward K. Chien, MD, MBA (MetroHealth Medical Center-Case Western Reserve University, Cleveland, OH); Alan M. Peaceman, MD (Northwestern University, Chicago); Ronald S. Gibbs, MD (University of Colorado School of Medicine, Anschutz Medical Campus, Aurora); Geeta K. Swamy, MD (Duke University, Durham, NC); Mary E. Norton, MD (Stanford University, Stanford, CA); Brian M. Casey, MD (University of Texas Southwestern, Dallas); Steve N. Caritis, MD (University of Pittsburgh, Pittsburgh); Jorge E. Tolosa, MD, MSCE (Oregon Health & Sciences University, Portland); Yoram Sorokin, MD (Wayne State University, Detroit); J. Peter VanDorsten, MD (Medical University of South Carolina, Charleston); and Lucky Jain, MD, MBA (Emory University, Atlanta, GA) for the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network.

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The researchers declare no conflicts of interest.

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Prior Surgical Abortion Linked to Subsequent Preterm Birth

Newswise — Surgical methods used in a common form of abortion or to clear the womb after a spontaneous miscarriage appear to significantly increase the risk of a later preterm birth, say researchers at Thomas Jefferson University who analyzed 36 studies that enrolled more than 1 million women.

The additional risk is small —0.7% — when compared to women who have not had the surgery, or who may have used medical means to clear their uterus. "But, when considered in the light of hundreds of thousands of women who have had such surgery, this is an unnecessary risk to take," says the study's senior author, Vincenzo Berghella, MD, Director of Maternal Fetal Medicine at Thomas Jefferson University Hospital, and Professor of Obstetrics and Gynecology at Sidney Kimmel Medical College at Thomas Jefferson University.

"This is not a study that suggests abortions per se are risky and shouldn't be done. What we are saying is that women should be given a choice between a surgical and a medical procedure, and should also be informed about the potential risk to subsequent pregnancy," Dr. Berghella says.

Dr. Berghella added that due to the limitations of some of the studies included in this meta-analysis, "it is difficult to definitively recommend that surgical abortion should be avoided and that medical methods should be preferentially offered."

Their study, published in the *American Journal of Obstetrics & Gynecology,* was a meta-analysis aimed at determining if any link existed between surgical or medical means to clear the uterus and subsequent pregnancies that do not achieve full terms. One reason to conduct the study is that the incidence of preterm births has been rising, and falling, in parallel to popularity of abortion, the vast majority of which, until late, have been surgical.

Surgical evacuation of the uterus mechanically stretches the cervix, and does so quickly, Dr. Berghella says. "In normal birth, dilation of the cervix occurs slowly over a period of many hours. Mechanically stretching the cervix, however, may result in permanent physical injury to the cervix." Resulting scar tissue, for example, could increase the probability of faulty

placental implantation in the womb, and could increase risk for infectious diseases, he adds.

In contrast, medical abortions involve use of one or two drugs — misoprostol and mifepristone, known as RU-486 — designed to mirror the process of a spontaneous abortion. Mifepristone, which is approved in the U.S. for aborting pregnancies up to 49 weeks, softens the uterus over time and misoprostol induces contractions. The combination is said to be effective in terminating 95% of pregnancies, and in finishing spontaneous abortions where some of the tissue supporting the pregnancy needs to be removed.

Abortions are increasingly being conducted using the medical approach, which requires several days to conduct and likely two visits to a provider, Dr. Berghella says.

Included in the meta-analysis were 31 studies that reported prior abortions in women who later delivered another child, and five studies that focused on women, who later became pregnant, who spontaneously aborted a prior pregnancy but needed either surgery or medicine to complete the miscarriage.

The goal was to look at women who subsequently delivered a child before the 37th week of pregnancy. "The issue is important because preterm birth is the number one cause of perinatal mortality in many countries, including the U.S.," Dr. Berghella says.

Researchers found:

- Considering all 1,047,683 women enrolled in the 36 studies, women with a history of uterine evacuation had a significantly higher risk of preterm birth (5.7%) compared to a control group of women who did not have either a surgical or medical procedure (5%); had babies that were of low birth weight (7.3% versus 5.9%), and infants that were small for their gestational age (10.2% versus 9.0 %).
- Of the 31 studies that reported prior abortions, 28 included 913,297 women who had surgery, and three included 10,253 women given medical abortions. Women with prior surgical abortion had a significantly higher risk of preterm birth (5.4 percent versus 4.4% for the control population), low birth weight babies (7.3% versus 5.9%), and small gestational age infants (10.2% versus 9%).
- In the three studies that looked at medical abortions, the risk of preterm birth was the same as in the control group.
- In the five studies of 124,133 women that looked at spontaneous miscarriages, those women who had a surgical procedure to clear the uterus had a higher risk of subsequent preterm births compared to the control group (9.4% versus 8.6%).

"These data — the most comprehensive look at the issue to date — find that prior surgical uterine evacuation may be an independent risk factor for preterm birth," says Berghella. "The findings warrant caution in the use of these surgical techniques, and should encourage the development of safer surgery as well as use of medical methods."

No financial support was received for this study.

Co-authors include: Gabriele Saccone, MD, of the School of Medicine at the University of Naples, Italy, and Lisa Perriera, MD, of Thomas Jefferson's Department of Obstetrics and Gynecology, of the Sidney Kimmel Medical College.

The authors report no conflict of interest.

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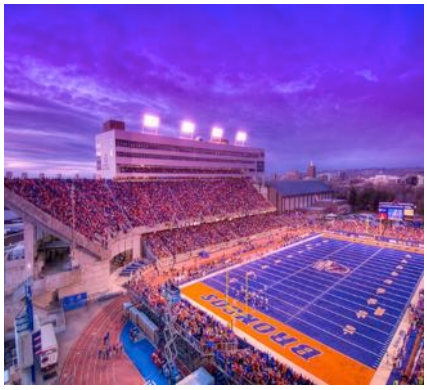

stlukesonline.org

Neonatal Nurse Practitioner, St. Luke's Children's Hospital - Idaho!

Boise, Idaho

St. Luke's Children's Hospital in Boise seeks an NNP to assist with coverage in our NICU's. The Neonatology team is comprised on 10 BC Neonatologists and 10 NNP's. The Children's Hospital provides a full complement of Pediatric Subspecialty services with the exception of ECMO & complex congenital heart surgery. The level IV Boise NICU is a modern 61-bed unit with 900 admissions annually providing advanced technology support (HFV, iNO, therapeutic hypothermia, non-invasive ventilation), semi-private rooms and a priority of family-centered care. The program is supported by a skilled Obstetrical department including 5 full-time MFM specialists. At this facility NNP's provide daily rounding support and in-house night coverage along with a Neonatologist. In addition, the team provides coverage at our 12-bed, Level IIb NICU in Meridian, ID 0 just 10 miles from Boise. NNP's provide weekend coverage and home call at this facility.

Known as the "City of Trees," Boise is Idaho's capital city—both a cultural center and a playground for those who love the outdoors. A vibrant downtown area affords fine dining, theatre, music, and college and semi-professional sports. Whole Foods, Trader Joe's, The Boise Co-op, and seasonal farmers markets are within a mile of the hospital. The Greenbelt follows the beautiful Boise River corridor for more than 30 miles, and the Boise foothills are home to miles of hiking and biking trails.

Twin Falls, Idaho

St. Luke's Children's Hospital seeks an experienced NNP to join the team in our Twin Falls location! This position currently covers nights with opportunity for future daytime coverage. The ideal candidate for this position is an experienced NNP with strong teaching skills and a desire to educate front-line staff to the higher skill set that a Level II NICU demands. Built in 2011, this state-of-the art 18-bed Level IIIa NICU with 250 admissions annually, and excellent growth potential. While based in Twin Falls, this position rotates regularly through the NICU at St. Luke's Children's in Boise. This provides opportunity to maintain a higher acuity skillset and consistency across the Health System NICUs. Additionally, as part of this larger practice group, coverage for time off and conferences is well-supported.

Twin Falls is located in an area of Idaho referred to as the Magic Valley. It has a population of 44,000 and is the fastest growing city in south central Idaho. It is located in the heart of a rich agricultural area of the state along the mighty Snake River. Housing is affordable, and recreational opportunities abound, with rafting, hiking, skiing, and fishing easily accessible in the immediate area. South central Idaho has a mild, 4-season, high-desert climate. Summers are hot with low humidity, great for outdoor activities. In winter, the valley is largely protected from the cold arctic fronts by the mountains to the north, with occasional snow within the city. Sun Valley, Idaho is just an hour away with excellent skiing in the winter and abundant outdoor recreation in the summer.

St Luke's Children's

To learn more please contact:
schechir@slhs.org or 208.493.0354

NEONATOLOGY TODAY

News and Information for BC/BE Neonatologists and Perinatologists

About Neonatology Today

Neonatology Today (NT) is the leading monthly publication that goes to over 4,000 BC/BE neonatologists, Perinatologists, Fellows, NNPs, and their NICU teams. Neonatology Today provides timely news and information regarding the care of newborns, and the diagnosis and treatment of premature and/or sick infants. In addition, NT publishes special issues, directories, meeting agendas and meeting dailies around key meetings.

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