

Functional echocardiographic assessment in congenital diaphragmatic hernia newborns: not only a right ventricle matter.

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Objectives: To characterize patterns of preoperative and postoperative ventricular function in infants with congenital diaphragmatic hernia (CDH).

Methods: Infants treated for CDH at a tertiary center during 2017-2018 were included in this prospective, observational study. Echocardiography was performed in the first 12 hours of life, 7 days following surgery, and 30 days of life. Parameters analyzed included measurements of aortic VTI and cardiac output (CO) and measurements of right ventricle (RV) and left ventricle (LV) systolic and diastolic function, including LV myocardial strain (LVMS). Data obtained at 12h of life were compared with a control group of healthy newborns. Data are presented as median and interquartile range (IQR).

Results: Eight patients were included; 7/8 survived to hospital discharge. Lung-to-heart ratio was 52.5% (38, 55). Half required ECMO with a duration of 8.5 days (7.5, 9.5) and an ICU stay of 61 days (38, 82). At birth, CHD newborns had worse CO compared to controls, with both RV and LV systolic and diastolic dysfunction (Table 1). After surgery, CDH newborns had significant improvements in aortic VTI and CO; RV systolic function showed significant TAPSE and diastolic function improvement; and LV systolic function increased, including overall volume augmentation. Though trans-mitral flow improved, overall LV diastolic function worsened (Table 1). LVMS analysis showed improvement after surgery, specifically in the apical segments, but did not show any significant changes in mid-ventricular GCS.

Conclusions: CDH patients showed reduced cardiac output and global RV dysfunction at birth compared with healthy controls, with clear improvement in overall RV function after surgery. Patients with CHD have abnormal LV diastolic function 1 month after surgery. The abnormally low LV volumes at birth might conceal underlying diastolic dysfunction, which is then unmasked post-surgery.

Values: Median(IQR)	Control(n=16)	CDH 12h(n=5)	p-value*	CDH 1month(n=7)	p-value**
Aortic VTI	11 (10, 12)	7.7 (5.8, 8.2)	0.004	14 (11, 14)	0.011
Cardiac output	0.6 (0.4, 0.6)	0.3 (0.1, 0.5)	0.064	0.7 (0.6, 0.8)	0.006
FAC	55 (48, 63)	47 (35, 48)	0.050	33 (28, 42)	0.230
TAPSE	9 (7, 10)	5.5 (6.5, 7)	0.079	8 (6, 10)	0.006
PW E Tric	53 (42, 57)	38 (32, 43)	0.029	64 (50, 73)	0.054
PW A Tric	64 (49, 68)	46 (45, 49)	0.050	65 (56, 77)	0.006
ED RV area	2.7 (2.5, 3.0)	1.7 (1.4, 2.5)	0.039	3.2 (2.7, 3.6)	0.073
ES RV area	1.6 (1.3, 2.0)	1.1 (0.8, 1.5)	0.099	2.1 (1.5, 2.5)	0.037
LVEF	66 (63, 71)	75 (70, 83)	0.211	75 (68, 78)	0.667
Septal S'	4 (4, 5)	3.5 (3.3, 3.8)	0.148	4.2 (4.0, 5.4)	0.029
MAPSE	5.5 (5, 6)	3.3 (2.5, 4.8)	0.046	4.5 (3.5, 6)	0.164
SAPSE	5 (5, 6.8)	3 (2.5, 3)	0.01	5 (4, 5)	0.006
Ejection Time	195 (185, 210)	156 (150, 171)	0.009	180 (156, 185)	0.230
PW E Transmitral	59 (49, 63)	46 (41, 48)	0.064	82 (72, 89)	0.014
PW A Transmitral	52 (48, 61)	47 (31, 55)	0.290	79 (72, 105)	0.011
Septal E'	5 (4, 6)	3.7 (3.4, 4.4)	0.099	4.7 (4.3, 6.2)	0.230
Septal A'	6 (5, 7)	5.7 (4.3, 6.7)	0.617	8.1 (6.5, 8.4)	0.042
E/E'	9.5 (6.9, 12)	8.2 (8, 9.4)	0.712	14 (9, 16)	0.048
ED LV Volume	4 (3, 5)	1.7 (1.6, 2.5)	<0.001	4.5 (3.2, 4.8)	0.005
ES LV Volume	1.5 (1, 2)	1.1 (0.7, 1.3)	0.208	1.9 (1.8, 3.0)	0.048
Strain Apical Septal	-	-28 (-31, -23)	-	-37 (-39, -36)	0.036
Strain Apex	-	-27 (-30, -24)	-	-34 (-34, -34)	0.036
Strain Apical Lateral	-	-27 (-28, -25)	-	-32 (-32, -30)	0.036