

Prevalence of pulmonary arterial hypertension on echocardiography in newborns with maternal risk factors

Abstract

Persistent pulmonary hypertension of newborn (PPHN) is suspected when the newborn has persistent desaturation and validated pulmonary hypertension and is associated with various risk factors both maternal and neonatal. The outcome of newborns with PPHN is always guarded even in good NICUs. This study was aimed at detection of PAH among newborns with maternal risk factors for PPHN. Twin delivery and newborns born through Caesarean section had higher prevalence of PAH but no significant association was found.

Keywords: persistent pulmonary hypertension of newborn, pulmonary hypertension, NICUs, PAH

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Introduction

PAH is a disease fairly common in neonatal period but relatively under diagnosed and often mismanaged. Various risk factors are associated with development of PAH and identification of these risk factors with early detection of PAH with proper management can decrease morbidity and mortality.

Persistent Pulmonary Hypertension of Newborn (PPHN), considered an extreme form of PAH, can be defined as a failure of normal fall in pulmonary vascular resistance (PVR) at or shortly after birth, leading to shunting of unoxygenated blood into the systemic circulation across foramen ovale or ductus arteriosus.¹ PPHN physiology mimics the fetal circulation in which PVR exceeds SVR and right to left hemodynamic shunting occurs through foramen ovale and/or ductus Arteriosus.¹

There are many studies which have found various risk factors associated with PPHN²⁻⁴ which have been identified retrospectively. However there is paucity of data about the newborns who have one or more risk factors for PPHN and have some degrees of PAH not significant enough to cause hypoxemia and desaturation.

Maternal risk factors associated with PPHN

Various maternal risk factors are associated with development of pulmonary arterial hypertension in newborns as shown by various studies.

Materials and methods

This analysis is from a larger study in which both maternal and neonatal risk factors were considered and the status of Pulmonary artery pressures was also seen at six weeks of post natal life. In this study we analysed only maternal risk factors and studied the prevalence of PAH in neonates with these risk factors.

After obtaining informed consent from parents or guardian a detailed history of mother and newborn was taken. After history, detailed examination of the newborn was done to identify high

risk newborn. Newborn with maternal or neonatal risk factor or both was taken up for the study. Initial echocardiography was done after 48hours of birth for newborns of this hospital and at first presentation for out born patients (age more than 48hours of life). Repeat echocardiography was done for patients who showed clinical deterioration or no improvement during hospital stay.

Design: Prospective observational study.

Sample size: a total 400 newborns with risk factors (either maternal or neonatal) were screened.

Inclusion criteria

Risk factors in mother

- Asthma
- Diabetes mellitus
- Urinary tract infection
- Maternal drug intake (like Selective Serotonin Reuptake Inhibitors)
- Caesarean section
- Twin delivery
- Pregnancy induced hypertension (PIH)
- Oligohydroamnios

Exclusion criteria

- Congenital heart disease.
- Pulmonary vein stenosis.

Echocardiography criteria for diagnosis of PAH

Tricuspid regurgitation Jet: The jet of blood leaking through the tricuspid valve was interrogated with Doppler. The peak velocity of the tricuspid regurgitation (TR) jet is a direct indicator of the right

ventricular pressure (and therefore PAP) plus right atrial pressure (assumed) was taken as Pulmonary artery pressure.

PAH- Pulmonary artery systolic pressure {(Right ventricular systolic pressure (RVSP)+Right Atrial Pressure (RA)} >50% of systolic blood pressure (SBP). We had assumed RA pressure as 5mm of Hg.

Mild-25-40mm of Hg

Moderate-40-60mm of Hg

Severe->60mm of Hg

Patent ductus arteriosus (PDA)/Patent foramen ovale (PFO) flow:

Pure right-to-left flow indicates that pulmonary artery pressure is higher than aortic pressure throughout the cardiac cycle and newborn has PPHN.

Inter ventricular septum (IVS) flattening: In the absence of TR jet, systolic ventricular septal flattening was considered to diagnose PAH which indicates the right ventricular pressures is more than left ventricular systolic pressure.

Data analysis: Statistical analysis was done, using the statistical package for social science (SPSS 23) for Windows Software. Continuous variables were expressed as means, standard deviation (SD), confidence intervals (95%CI), frequency and range. P value <0.05 was taken as significant. The univariate analysis was done for computing factor association separately.

Results

In our study out of 400cases (which included both neonatal and maternal risk factors) screened 264 newborns (66%) were delivered by LSCS. The number was large as it was the commonest risk factor and also most of the newborns with one or other risk factor were born through LSCS, which sometimes become an indication for doing it. Only 2 cases of UTI were screened since we have taken mothers with symptomatic bacteremia with positive urine cultures as risk factor for PAH. Thirteen newborns of pregnancy induced hypertension were screened. There were 40cases (10%) of twins and 2cases were having history of maternal drug intake and a total of 11 mothers (2.8%) were having Oligohydroamnios. There were no cases of asthma in the mother during the study period.

Among neonates with one or other maternal risk factor, most cases screened were of LSCS but only 18 newborns (6.8%) developed PAH which was not significant (p=0.108). Another risk factor showing association with PAH was twin delivery that too was found to be non-significant with a p value of 0.071. No cases of oligohydroamnios developed PAH.

Association of maternal risk factors with PAH

There is lack of data on children with PAH, majority of studies done had retrospectively analysed risk factors in cases of PPHN which is a severe form of PAH. The idea of the study was to screen neonates for PAH only, a stage before PPHN and follow up them prospectively. Since there is lack of studies on PAH we have kept our discussion on studies on PPHN.

LSCS

Caesarean section delivery was higher (50%-63.5%) among

patients with PPHN as shown in various studies^{3,5,6,7,9,10} in both developed and developing countries. In a study by Rocha et al from Portugal the percentage of deliveries by LSCS was 65.3%. Similarly it was 61.3% in another study by Hernandez Diaz et al.³ from Massachusetts (as shown in Table 1). Also study by Winovitch et al.¹¹ from USA found that among PPHN patients (n=125), 26(20.8%) cases were of elective Caesarean deliveries while 53(42.4%) cases were delivered by caesarean section after failed trial of labour.¹¹ Likewise from developing country like Egypt a study published by Bakheet et al.⁷ found that half of the deliveries among PPHN patients were LSCS.⁷

In our study out of 400cases screened we found 264 were of caesarean section delivery (66%) as it was the commonest risk factor encountered and 18(6.8%) neonates had developed PAH. If we analyse retrospectively all 54 PAH cases, 18(33.3%) neonates were delivered through LSCS which was non significant. This observation is different from other studies which had a higher prevalence of LSCS among PPHN cases.

Twin delivery

In a retrospective study by Hernandez Diaz et al.³ 12 (3.2%) cases were of multiple deliveries among 377 PPHN.³ In our study 9 out of 40 cases of twin deliveries (22.5%) had developed PAH & one case developed PPHN.

Pregnancy induced hypertension

Study by Razzaq et al.⁶ found that 3.6% of PPHN patients have history of PIH in the mother. Similar result was found in other studies^{3,6,7} while prospectively in our study we found that one out of 13 neonates (7.7%) with the history of pregnancy induced hypertension in mother had PAH at first screening.

Diabetes mellitus, SSRI, UTI

In our study we did not find any case of PAH with Diabetes as a risk factor as we had taken only cases of overt diabetes mellitus as a maternal risk factor for PAH and excluded gestational diabetes. Other studies by Bakheet et al.⁷ Hernandez Diaz et al.³ Razzaq et al.⁶ showed diabetes (IDM) as a risk factor for PPHN with a prevalence of 25.9%, 9.8%, 5.1% DM in PPHN cases respectively.^{7,3,6} Similarly we did not find any case of PAH with history of drug intake (e.g.SSRI) and UTI in the mothers but study by Hernandez Diaz et al.³ showed that 3.75% & 9.0% cases respectively had such history in the mother of PPHN cases.³

Oligohydroamnios

In our study 11cases of Oligohydroamnios were screened as a risk factor for PAH but not a single case developed PAH. Study by Kumar et al on 61preterm infants having PPHN found 18% cases had Oligohydroamnios in the mother.⁸

Asthma

In our study we did not find a single case of asthmatic mother as a risk factor for PAH. Study by Hernandez et al found 61(16.2%) mothers having asthma out of 377 cases of PPHN.³

The association of PAH with various maternal risk factors did not show any strong association. Caesarean delivery can be a cause and effect of PAH as children with various other risk factors (neonatal) were likely to be born by caesarean delivery.

The study was aimed to detect pulmonary hypertension in high risk newborns, so that preventive measures (minimum handling/sedation/drugs) can be started before the newborn lands up in overt PPHN (denaturation/distress) which has a poor prognosis even in good tertiary centers. Though no significant association was found but sample size is not adequate to arrive at any conclusive conclusion. We recommend a larger study with a bigger sample size to screen newborn with maternal risk factors to be done.

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None.

Conflict of interest

Author declares that there is no conflict of interest.

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