Pulmonary Artery Pressure Changes in Neonates

Thesis

Submitted for the Partial Fulfillment of Master Degree
in Pediatrics

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2017

سورة البقرة الآية: ٣٢

Acknowledgment

First and foremost, I feel always indebted to **ALLAH**, *the Most Kind and Most Merciful.*

I'd like to express my respectful thanks and profound gratitude to **Prof. Alyaa Amal Kotby,** *Professor of Pediatrics, Head of the Pediatrics Department - Faculty of Medicine- Ain Shams University for her keen guidance, kind supervision, valuable advice and continuous encouragement, which made possible the completion of this work.*

I am also delighted to express my deepest gratitude and thanks to **Dr. Omneya Ibrahim Youssef,** *Assistant Professor of Pediatrics, Faculty of Medicine, Ain Shams University, for her kind care, continuous supervision, valuable instructions, constant help and great assistance throughout this work.*

I am deeply thankful to **Dr. Ghada Ahmad Saleh,** *Lecturer of Pediatrics, Faculty of Medicine, Ain Shams University, for her help and active participation.*

I would like to express my hearty thanks to all my family for their support till this work was completed.

Last but not least my sincere thanks and appreciation to all patients participated in this study.

Dina Abdo

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List of Abbreviations

Abb.	Full term
2D	*2 dimensional*
3D	*3 dimensional*
ASD	*Atrial septal defect*
AV	*Aortic valve*
AVSD	*Atrioventricular septal defect*
BSA	*Body surface area*
CHD	*Congenital heart disease*
ECMO	*Extra corporeal membrane oxygenation*
EPSPAP	*Estimated peak systolic pulmonary artery pressure*
HFOV	*High frequency oscillatory ventilation*
HFJV	*High frequency jet ventilation*
IVH	*Intarventricular hemorrhage*
LA	*Left atrium*
LV	*Left ventricle*
MAP	*Main pulmonary artery*
MAS	*Meconium aspiration syndrome*
NO	*Nitric oxide*
PAAT	*Pulmonary artery acceleration time*
PAP	*Pulmonary artery pressure*
PASP	*Pulmonary artery systolic pressure*
PDA	*Patent ductus arteriosus*
PFO	*Patent foramen oval*
PPHN	*Perisitent pulmonary hypertension*
PVR	*Pulmonary vascular resistence*
RA	*Right atrium*
RDS	*Respiratory distress syndrome*
RV	*Right ventricle*
RVEF	*Right ventricular ejection fraction*
RVESP	*Right ventricular end systolic pressure*

List of Abbreviations (Cont...)

Abb.	Full term
RVSP	*Right ventricular systolic pressure*
SSRIs	*Selective serotonin reuptake inhibitors*
SVC	*Superior vena cava*
TR	*Tricuspid regurgitation*
TRJV	*Tricuspid regurgitation jet velocity*
TRV max	*Tricuspid regurge maximum velocity*
TT	*Transient tachypnea*
TTE	*Transthorathic echocardiography*
VSD	*Ventricular septal defect*

INTRODUCTION

Directly after birth, major changes in the respiratory and cardiovascular systems are required for postnatal survival ***(Van Vonderen et al., 2014)***.

A dramatic reduction in pulmonary arterial pressure and resistance occurs with an increase in oxygen tension and blood flow ***(Gao and Raj, 2010).***

Studies suggest a gradual drop in pulmonary artery systolic pressure (PASP) with increasing age, but the wide-range of variation and the small sample sizes cannot permit adequate appraisal of the rate of decline. Patent ductus arteriosus (PDA) and tricuspid regurgitation (TR) are frequently found in neonates, and echocardiographic measurements of the Doppler flow velocity across the PDA and the tricuspid regurgitant jet velocity have been shown to yield accurate values for PASP ***(Hu et al., 2014)***.

Half of congenital heart defects permit blood flow from a left sided chamber or blood vessel through a communication to the right side of the heart. These conditions are called left-to-right shunts. The patients are acyanotic but have increased pulmonary blood flow. The four most common left-to-right shunts are ventricular septal defect (VSD), patent ductus arteriosus (PDA), atrial septal defect (ASD), and atrio-ventricular septal defect (AVSD) ***(Johnson and Moller, 2014)***.

Echocardiography has revolutionized the practice of pediatric cardiology. The addition of Doppler and color flow mapping also gives physiological information about flow and pressures and enables the pediatric cardiologist to refer patients for surgical treatment without cardiac catheterization, especially in neonate and infants ***(Awasthy and Radhakrishnan, 2013)***.

Aim of the Work

The aim of this study is to evaluate changes in pulmonary artery pressure during the neonatal period in full term newborns with congenital heart diseases with left to right shunts (VSD, ASD, PDA, AVSD) in comparison to healthy newborns.

Chapter 1

THE FETAL CIRCULATION

Because the fetal lungs are not inflated, and the fetus obtains oxygen and carbon dioxide gas exchange through the placenta, there must be some level of mixing and redirection of blood flow involving the ductus arteriosus, the ductus venosus, foramen ovale, the umbilical vessels and placenta ***(Hines, 2013).***

Inspite that blood flow in the placental vasculature is governed by the same physiological forces of shear, pressure and resistance as in other organs, it is also uniquely specialized on the maternal and fetal sides. At the materno-fetal interface, the independent utero-placental and umbilico-placental circulations must coordinate sufficiently to supply the fetus with the nutrients and substrates it needs to grow and develop ***(Thornburg and Samantha, 2013).***

The fetal heart differs from the extra-uterine heart in both structure and function. The fetal heart represents two circulations, which effectively run in parallel, with two 'shunts' connecting them, i.e. the ductus arteriosus and foramen ovale. In ex-utero life, the two circulations are referred to as pulmonary and systemic; however, in the fetus this distinction is somewhat euphemistic, and it may be more accurate to discuss right and left circulations ***(Godfrey et al., 2012).***

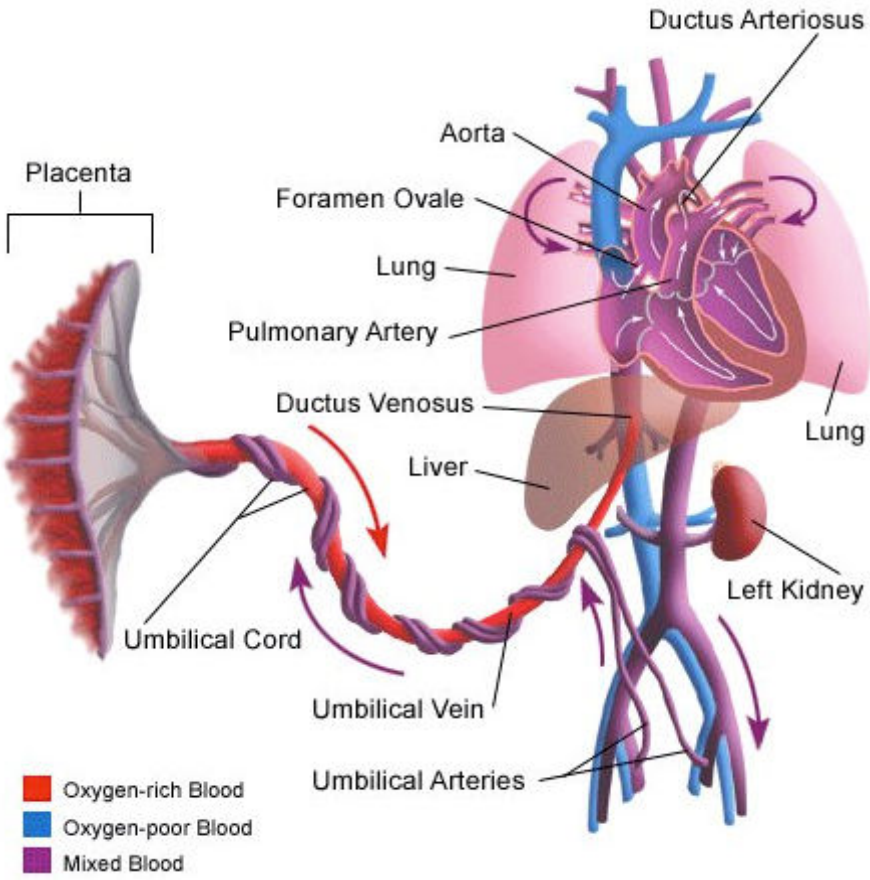

Figure (1): A simplified scheme of the fetal circulation. The shading indicates the oxygen saturation of the blood*: http://study.com/academy/lesson/fetal-blood-circulation-diagram-lesson-quiz.html).*

Embryology:

By the third week of gestation, passive diffusion of oxygen into the developing embryo becomes insufficient to support metabolism, blood has formed, and the primitive heart tube has begun beating; by the end of the 4th week, active circulation begins. Distinct components of the pulmonary and systemic circulation emerge from folding and twisting of the