



British Association of
Perinatal Medicine



Role of Functional Echocardiography in NICU

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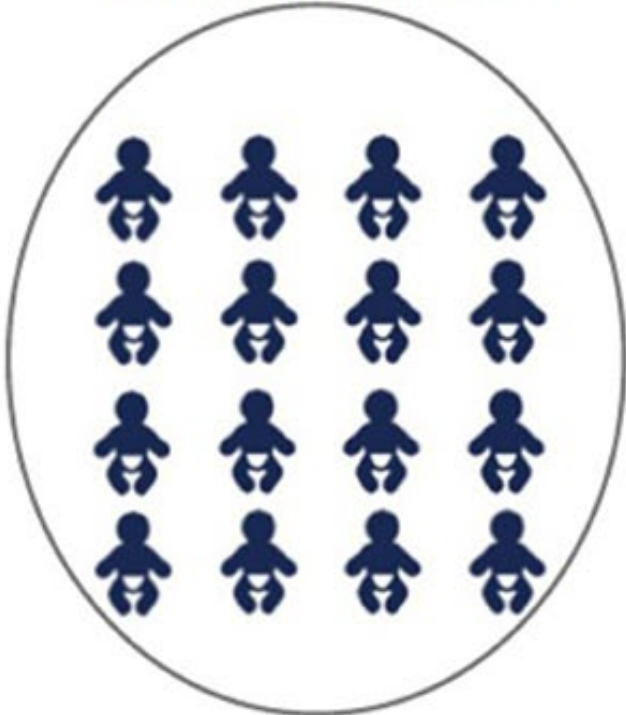
British Association of
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NeoFOCUS-UK 2024



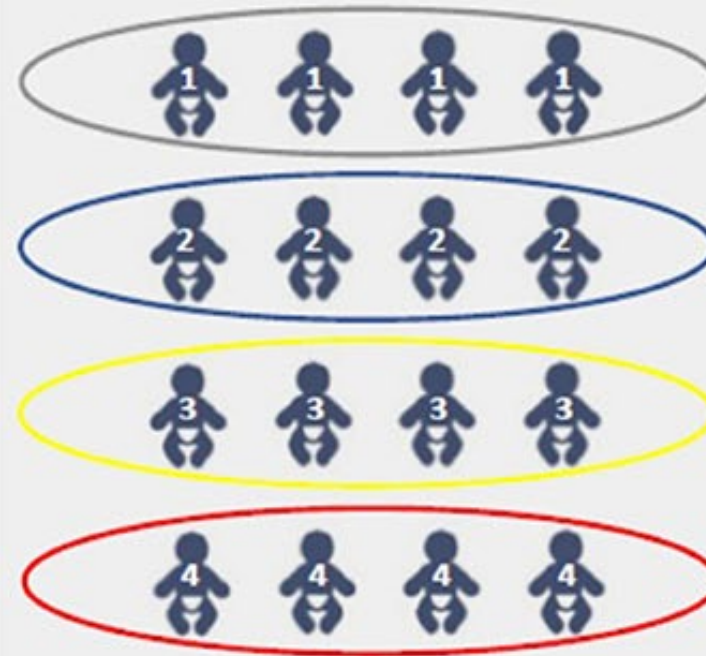
Personalised haemodynamic management

EMPIRICAL NEONATOLOGY



- All preterm infants same treatment protocol
- All preterm newborns same dose/kg bodyweight

PRECISION NEONATOLOGY



- Treatment is stratified to specific patient characteristics
- Drug dosing based on gestational age, post-natal age, gender or co-medication

INDIVIDUALIZED NEONATOLOGY



- Treatment specified to the individual infant
- Drug dosing based on genotype, MIPD (model informed precision dosing), continuous effect registration

Potential role of functional echo

- Assessment of hypotension/'shock'
- Hypoxaemic respiratory failure/PPHN
- PDA diagnosis and management
- Management of BPD-PH

When to intervene?

What drug to use?

How to escalate/wean/stop treatment?



REVIEW ARTICLE OPEN

Introduction to neonatologist-performed echocardiography

Alan M. Groves¹, Yogen Singh², Eugene Dempsey³, Zoltan Molnar⁴, Topun Austin⁵, Aff El-Khuffash^{6,7} and Willem P. de Boode⁸ on behalf of the European Special Interest Group 'Neonatologist Performed Echocardiography' (NPE)

Cardiac ultrasound techniques are increasingly used in the neonatal intensive care unit to guide cardiorespiratory care of the sick newborn. This is the first in a series of eight review articles discussing the current status of "neonatologist-performed echocardiography" (NPE). The aim of this introductory review is to discuss four key elements of NPE. Indications for scanning are summarized to give the neonatologist with echocardiography skills a clear scope of practice. The fundamental physics of ultrasound are explained to allow for image optimization and avoid erroneous conclusions from artifacts. To ensure patient safety during echocardiography recommendations are given to prevent cardiorespiratory instability, hypothermia, infection, and skin lesions. A structured approach to echocardiography, with the same standard views acquired in the same sequence at each scan, is suggested in order to ensure that the neonatologist confirms normal structural anatomy or acquires the necessary images for a pediatric cardiologist to do so when reviewing the scan.

Pediatric Research (2018) 84:S1–S12; <https://doi.org/10.1038/s41390-018-0076-y>



Case

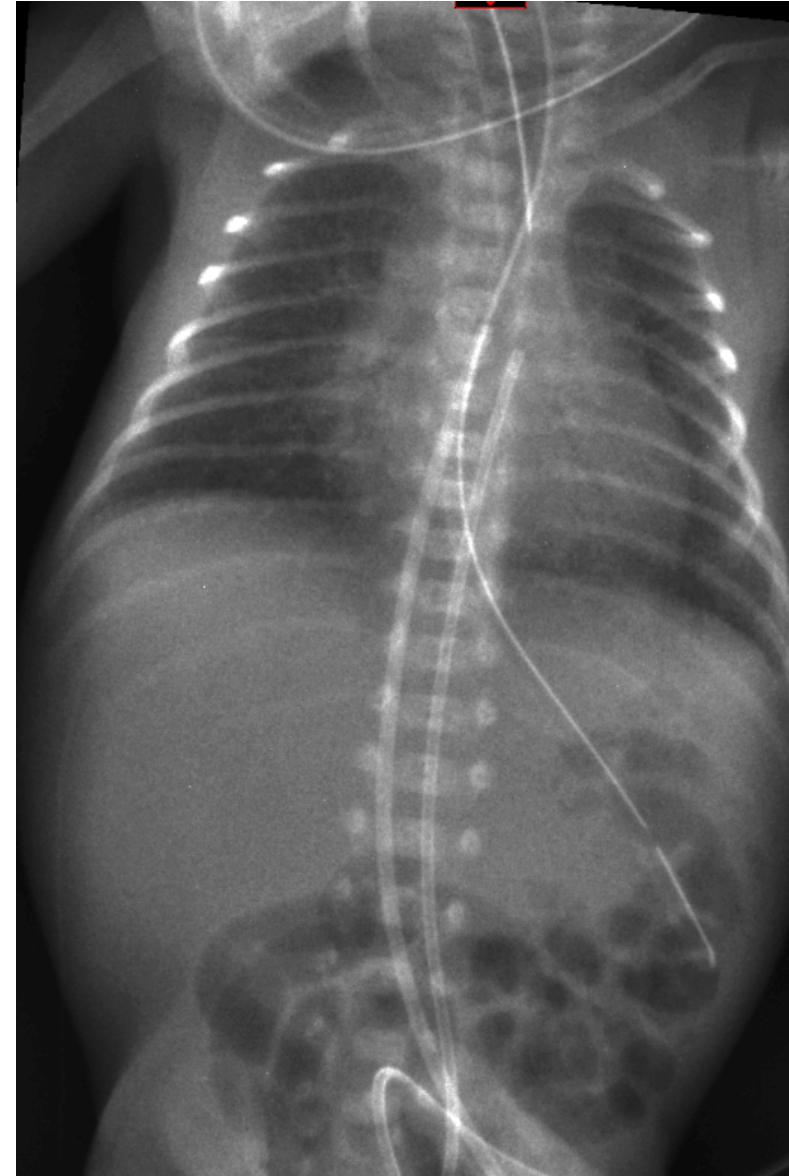
29 weeks, 990 g
PPROM 72h with anhydramnios
AN steroids
Cord prolapse → Em CS

Delayed cord clamping
Intubated 8 mins, surfactant

VG-PS ventilation,
requiring high PIP → HFOV

Hypotension (BP 37/24) (? volume)

FiO2 1.0 (? PPHN ?iNO)

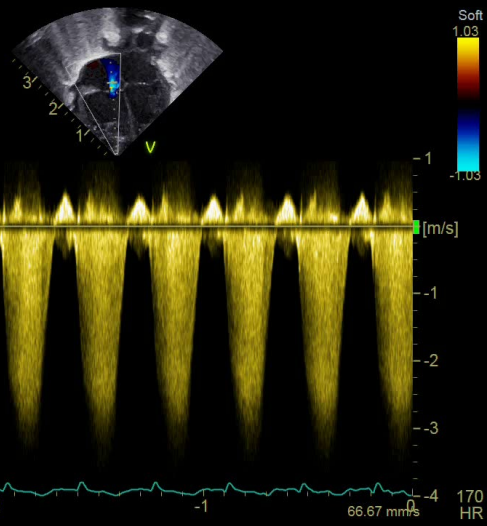
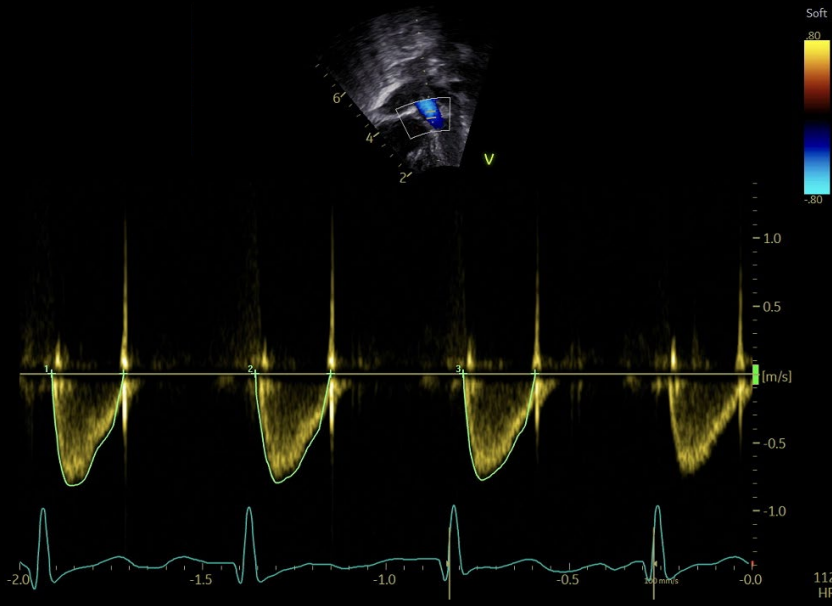
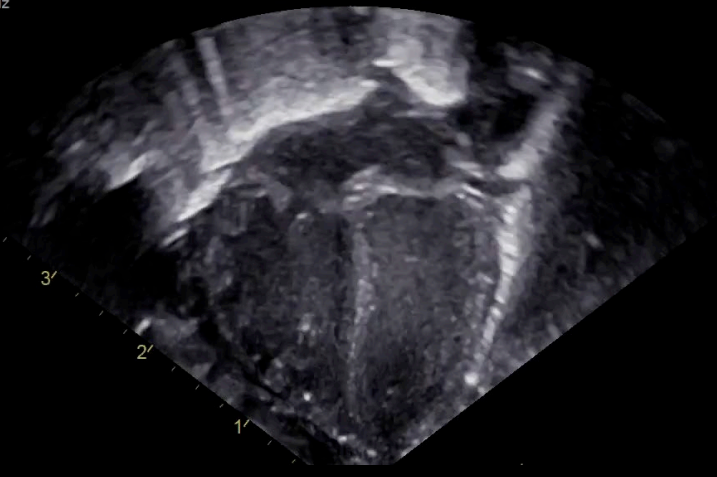


09:23:00
17
Freqs: 3.5 MHz/6.9 MHz
FPS: 87.4

CIU 08/04/2019 13:53:00
FPS: 109
f: 12.0 MHz
P: 0 dB

Soft
Av

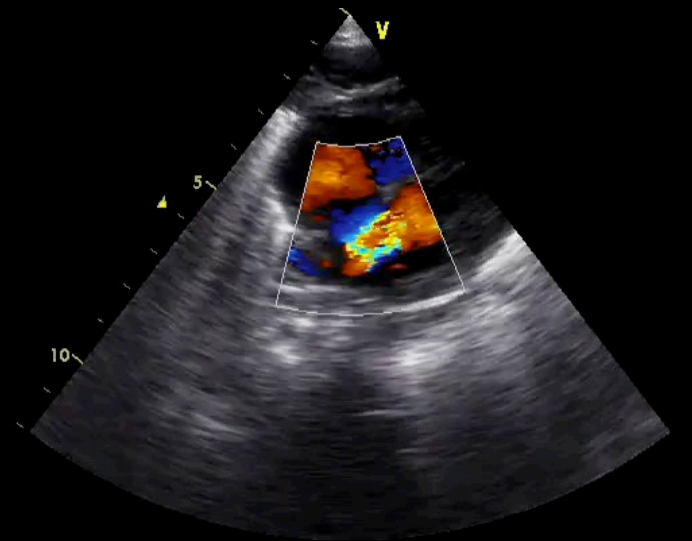
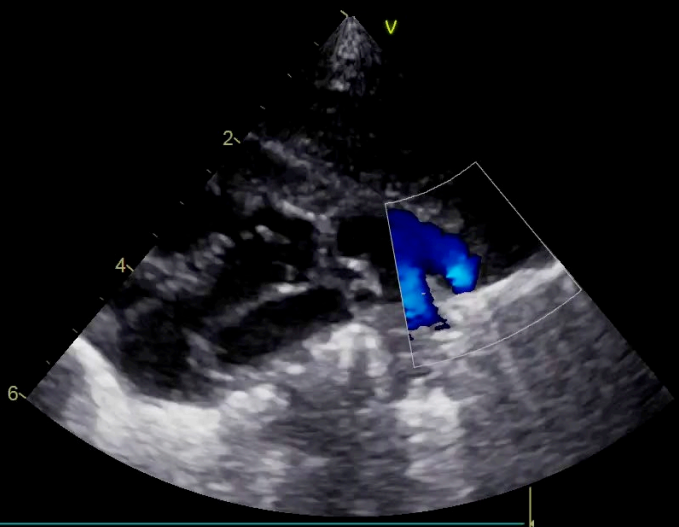
Soft
80
-80



09/01/2021 21:50:30
HD
FPS: 47
f: 3.3 MHz
P: 0 dB

Soft
1.17
09:46:14

Soft
.57
-.57



Well-filled LV

Poor bi-ventricular function

Low LV output (110 ml/kg/min)

Pulmonary hypertension (sPAP ~55)

R to L ductal flow

L to R atrial flow

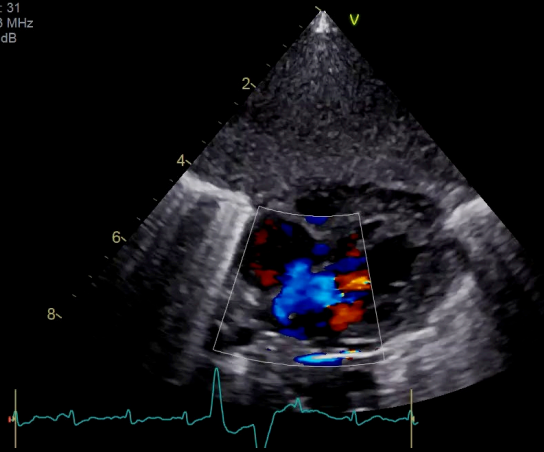
Not for volume expansion
(no evidence of hypovolaemia)

Inotrope (not vasopressor)
→ low dose adrenaline

Not for iNO
(contra-indicated in LV dysfunction)

Re-echo 12 hours later – improved
LV function → iNO

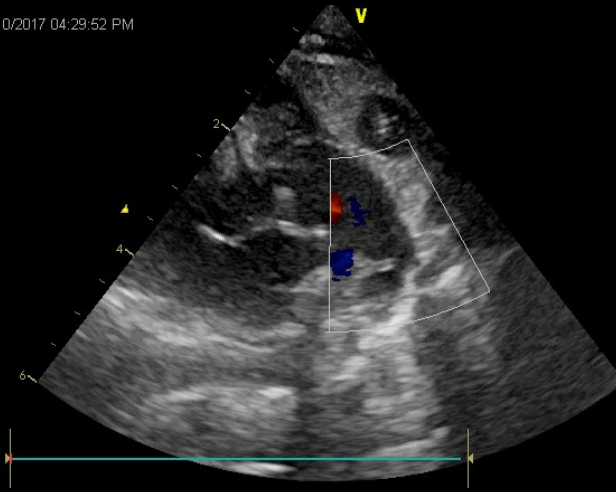
03/06/2023 10:41:30
HD
FPS: 31
f: 3.3 MHz
P: 0 dB



R to L atrial flow

Soft
35
-35

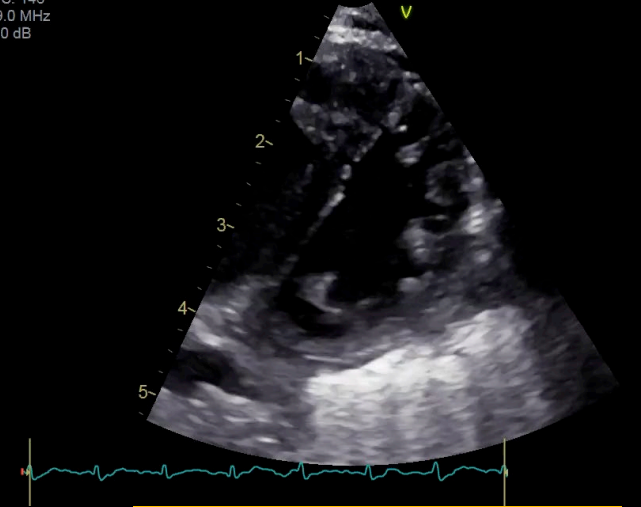
19/10/2017 04:29:52 PM



Restrictive ductus

Soft
80
-80

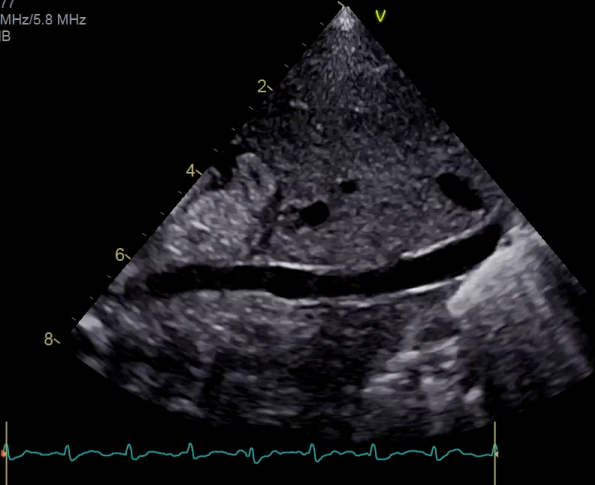
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HD
FPS: 146
f: 9.0 MHz
P: 0 dB



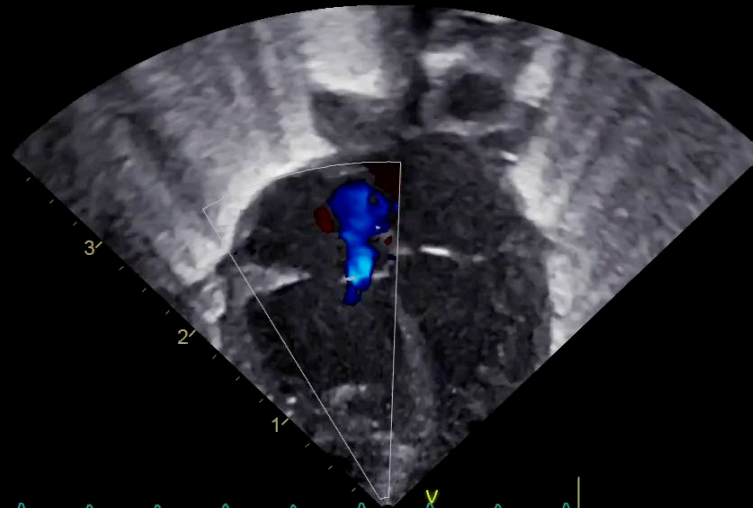
Flat interventricular septum

152
HR

03/06/2023 10:42:31
HD
FPS: 77
f: 2.9 MHz/5.8 MHz
P: 0 dB



Dilated IVC

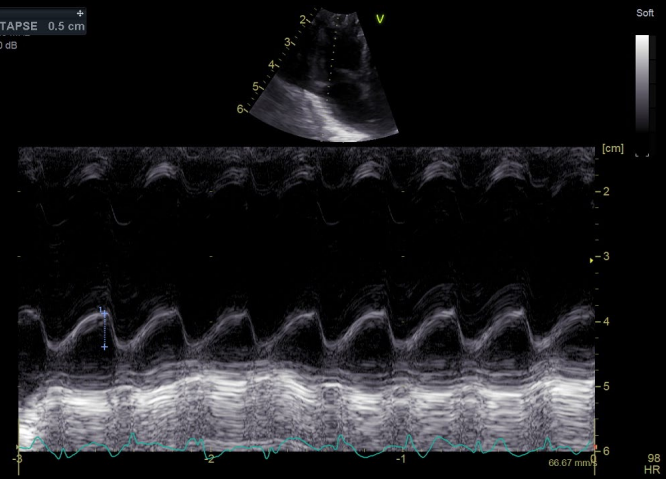


Severe TR

Soft
1.03
-1.03

1 TAPSE 0.5 cm
P: 0 dB

171
HR



RV systolic dysfunction

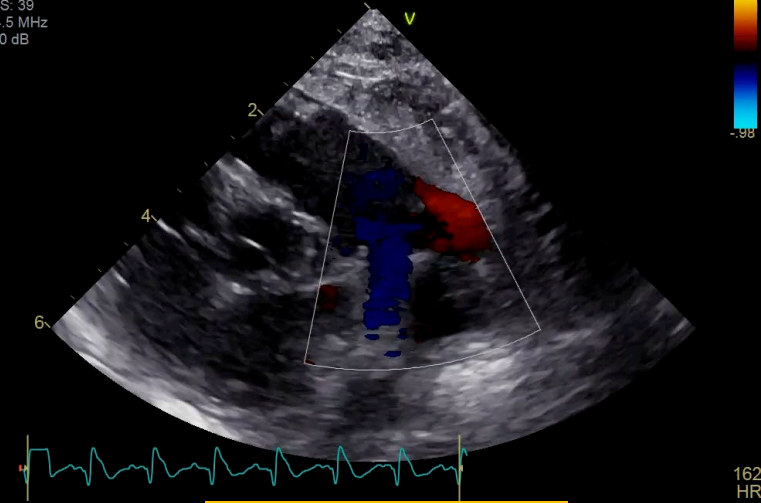
98
HR

Optimise pulmonary vasodilation

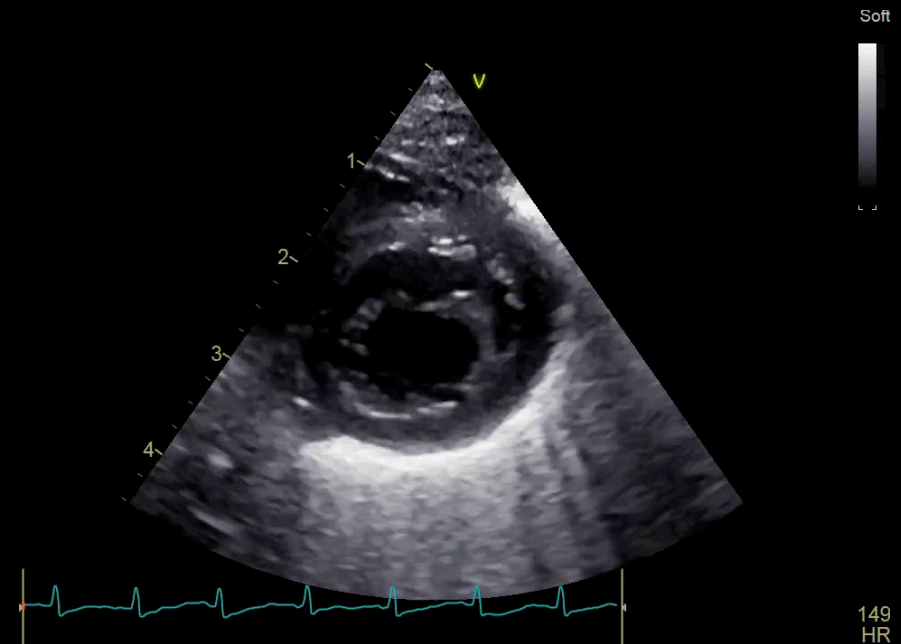
Milrinone/vasopressin

Start prostin to maximise ductal patency

07/06/2023 14:10:18
HD
FPS: 39
f: 4.5 MHz
P: 0 dB

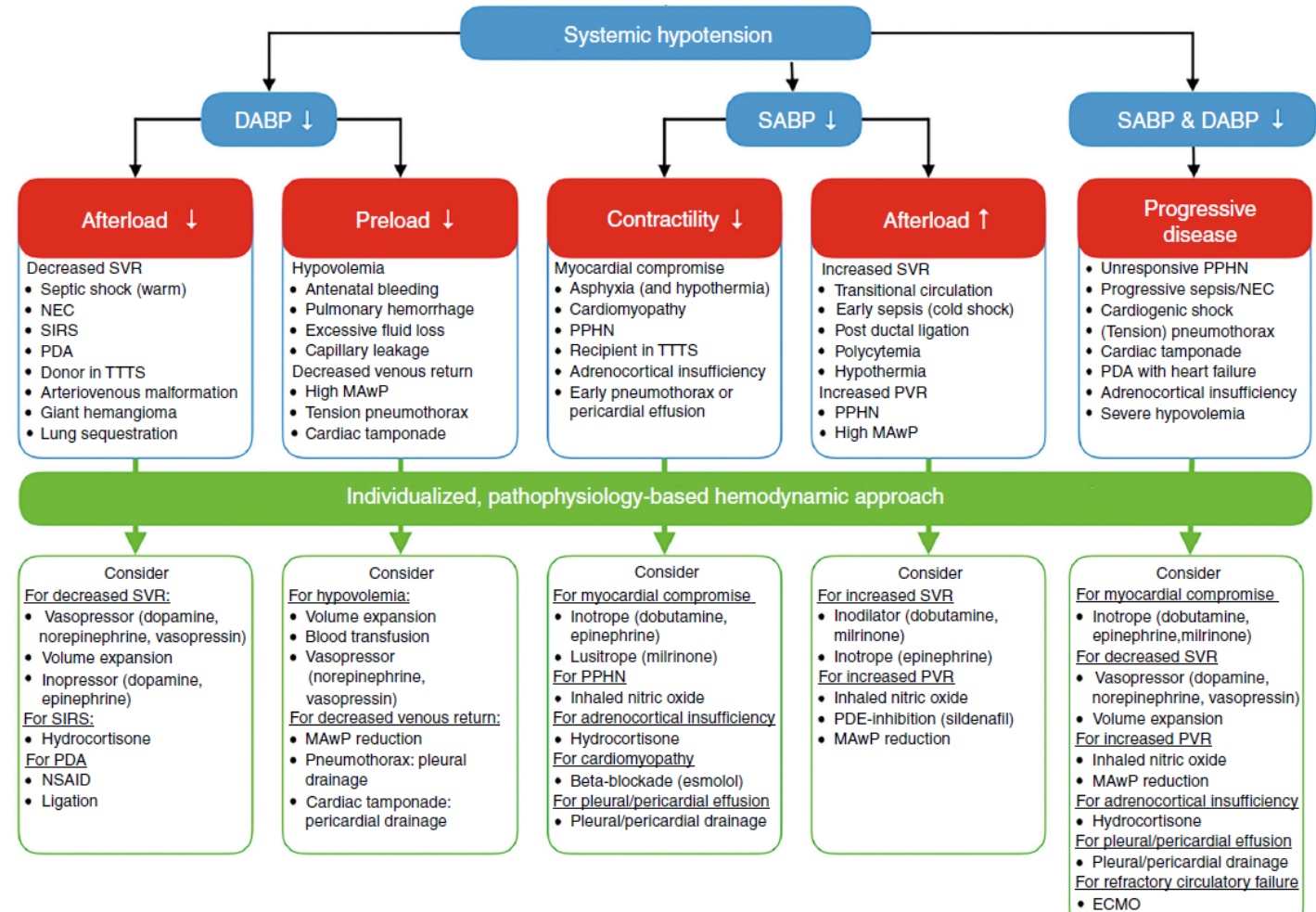
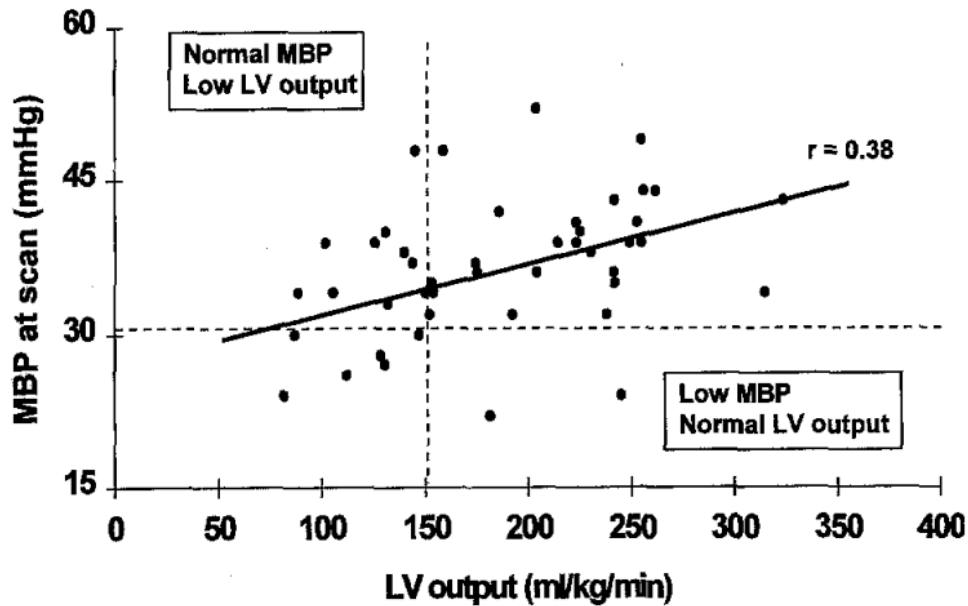


Non-restrictive PDA

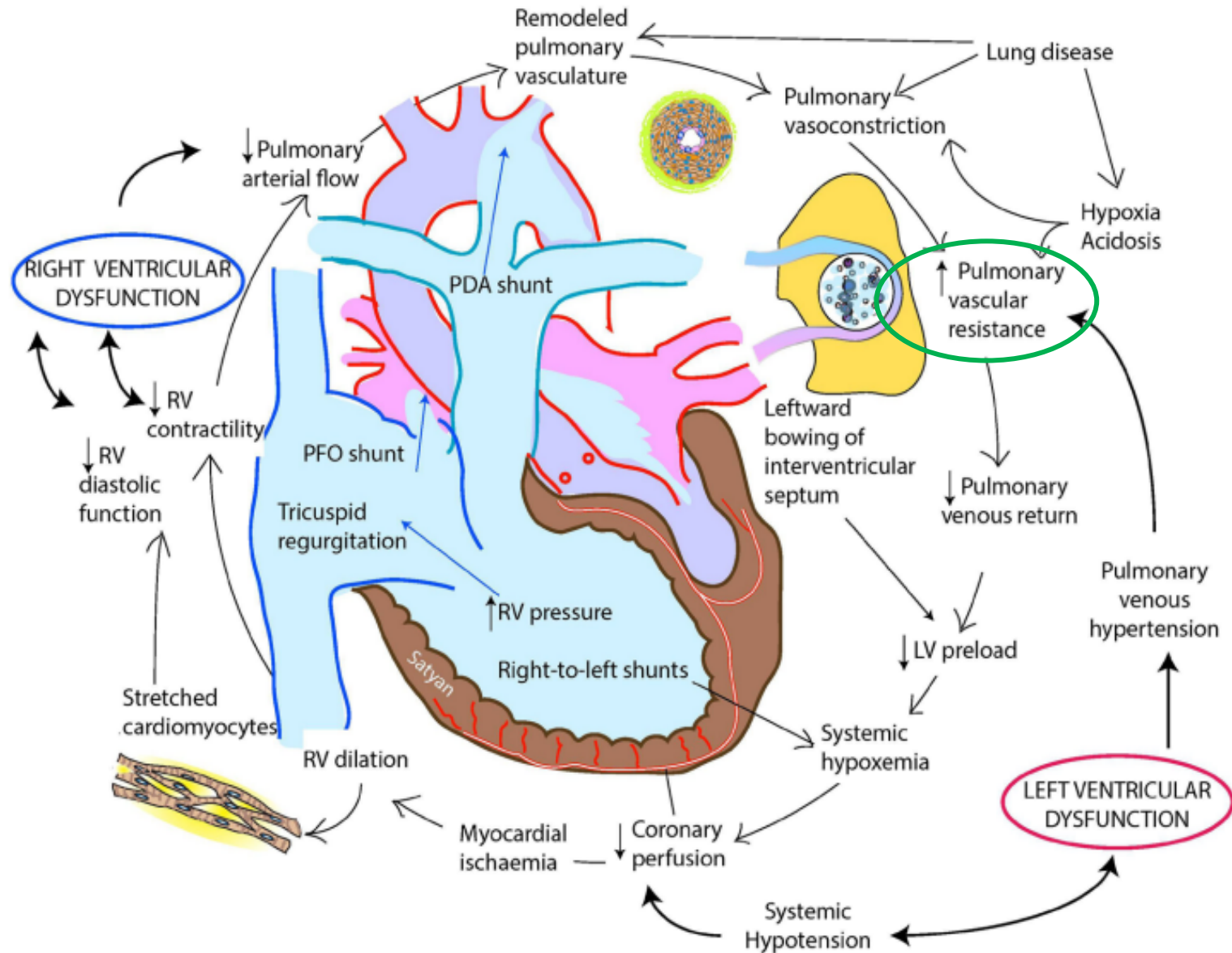


Normal IVS

Hypotension/shock



Neonatal Pulmonary Hypertension



What is the problem?

Measurement of BP and treatment of hypotension is too simplistic an approach

Most neonatal cardiorespiratory disorders have complex underlying haemodynamics

'Blind' treatment according to a pre-specified protocol is illogical and potentially harmful

Population-based management is unlikely to be effective given variation in clinical/physiological phenotype

What does functional echo offer the neonatologist?

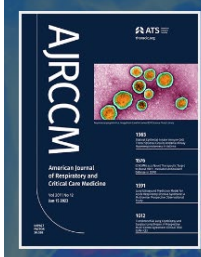
Comprehensive echo assessment provides meaningful information about cardiac function and haemodynamics (instead of just relying on BP)

Choice of treatment based on the specific underlying haemodynamic pathophysiology ('precision medicine')

Ability to assess response to treatment and manage appropriately

Potential of improved short-term and long-term outcomes

Standardised assessment in specific conditions (e.g. threshold for PDA treatment; BPD-PH)

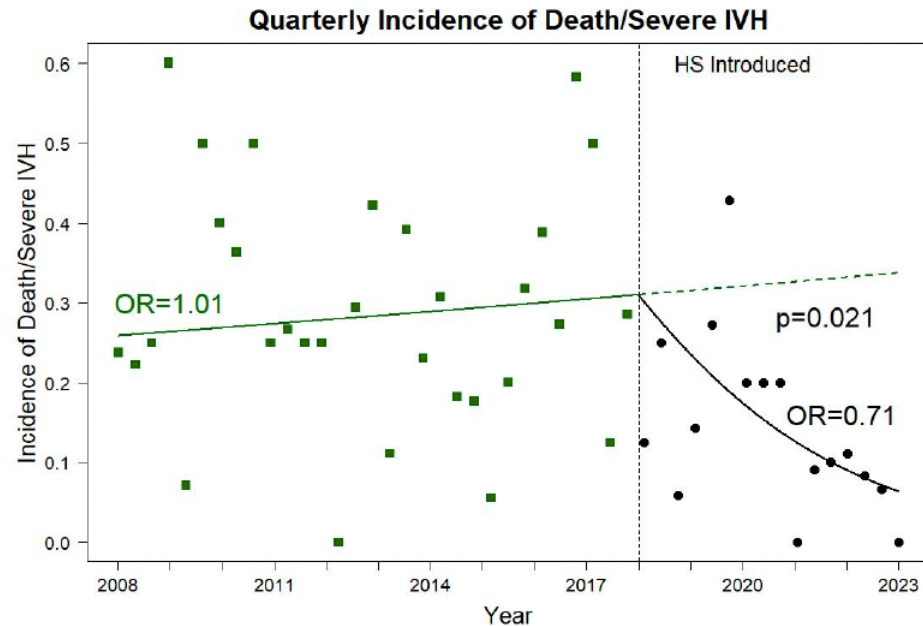


American Journal of Respiratory and Critical Care Medicine

Publishes the most innovative research, highest quality reviews, clinical trials, guidelines, and statements in pulmonary, critical care, and sleep-related fields

Impact of Early Hemodynamic Screening on Extremely Preterm Outcomes in a High-Performance Center

Regan E Giesinger¹, Danielle R Rios¹, Trassanee Chatmethakul^{1,2}, Adrienne R Bischoff¹, Jeremy A Sandgren¹, Alison Cunningham³, Madeline Beauchene³, Amy H Stanford¹, Jonathan M Klein¹, Patrick Ten Eyck⁴, Patrick J McNamara^{1,5}

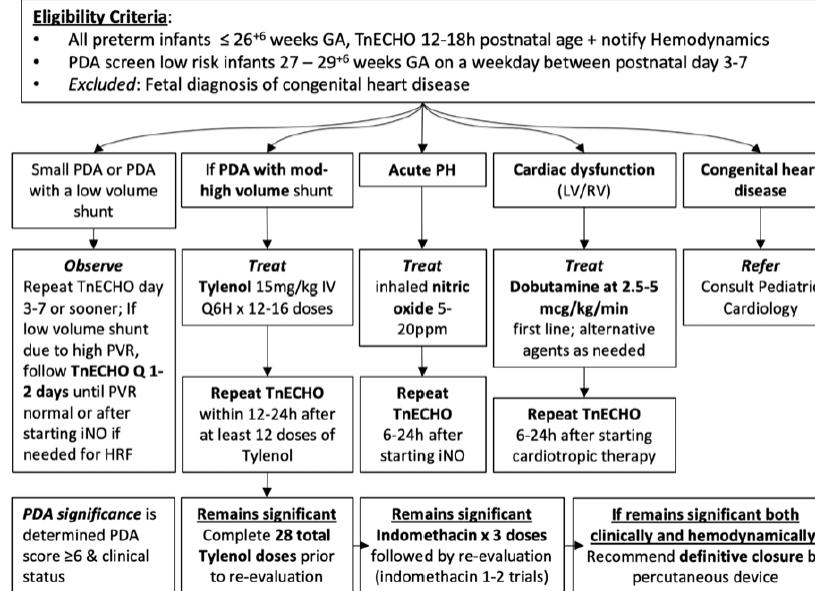


Before-and-after study

2 cohorts (2010-2017) vs (2018-2022)

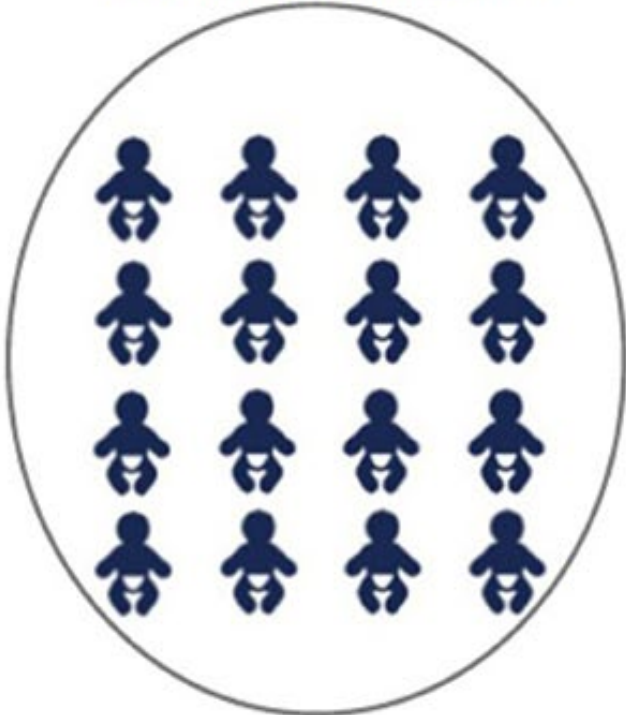
Impact of TNE 'screening' at 12-18h of 22-26w infants

Guidelines for Hemodynamic Screening and Management of Extreme Preterm Neonates



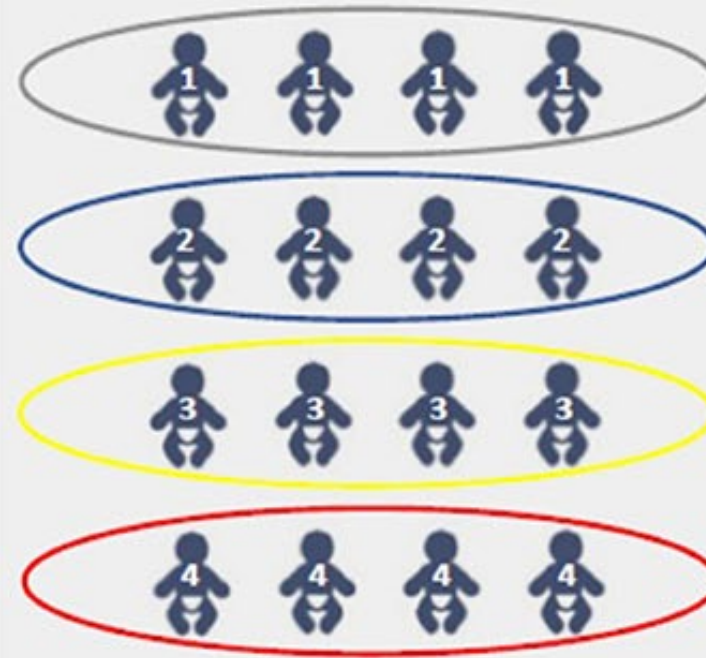
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