Should screening ultrasound of central nervous system and abdomen in infants >35th weeks of pregnancy be recommended?

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Research target

- **Evaluation of frequency of disorders occurrence in Central Nervous System and abdomen ultrasonography in population of physiological neonates**

Research method

- Preformed at I degree of neonatal care unit*
- Preformed on neonates born over 35 weeks of gestational age
- Indications had been widened
- Clinical state and indications was evaluated by neonatologist
- Ultrasound of CNU and abdomen was preformed by radiologist
- Both scans was preformed at all shorted neonates
- Scans preformed averagely over 48 h after birth
- Scans was preformed with LOGIQ 7 Ulrasonograph (GE Healthcare) with microconvex probe (8–11 MHz) and linear probe (8–12 MHz).

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Polish Neonatal Society Standards
Algorithm of imaging examinations

Neonate <32 weeks of gestation

- CNS damage risk factors
  - I USG to 3th day
    II USG 5th-7th day
    - Incorrect image – frequency of USG depend on abnormalities and clinical state
    - Normal image but ELBW, consider MR in 38-42 week postconceptional age
    - Indiscriminative image, preform MR, follow the evolution, define extent of damage, determine prognosis
- No CNS damage risk factors
  - USG to 7th day; if normal no further diagnostics

Neonate 32-35 weeks of gestation

- CNS damage risk factors
  - USG examination
    - Indiscriminative image or neurological symptoms, preform MR,
- No CNS damage risk factors
  - USG examination not required

Neonate >35 weeks of gestation
Apgar scale 0-3 points
Cord blood pH <7,0

- selective hypothermia
  - yes
    - after treatment USG with doppler next MR
  - no
    - Repeat USG, preform MR if neurological symptoms

Indication for ultrasound examination

GENERALLY ACCEPTED

- Gestation age <32 weeks
- Weight at birth <1500 gram
- TORH
- Apnea (APGAR <6 over 5')
- Intrautherine infection
- Congenital malformation
- Neurological symptoms
- Diabetic mother
- Haematocrit fall

ASSUMED IN RESEARCH

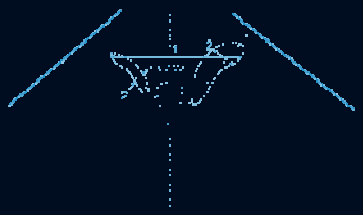
- Apgar scale at birth <8 points
- Resuscitation
- Respiratory and/or cardiovascular disorder
- Cord blood pH <7,2
- Perinatal injury
- Incorrect fetus alignment
- Early and late onset sepsis
- Hyperbilirubinemia/pathologic jaundice early and late
- Gestation age <38 weeks
- Weight at birth <10 pc and >90 pc
- Congenital malformation
- Incorrect prenatal USG and pregnancy disorders
- Jaundine

Central nervous system USG

- Standard preformed thru frontal fontanelle
- If needed preformed thru different acoustic windows
- Obtain min. 6 coronal sections thru:
  - lateral ventricle anterior horn
  - Monro foramen
  - dorsal part od third ventricle
  - quadrigeminal cystern
  - lateral ventricle dorsal horn
  - parietal and occipital lobe
- And 5 sagittal sections thru:
  - median plane (cerebellar falx)
  - thalamo-cadate fissure
  - body of lateral ventricle

Central nervous system USG protocol & norms

- During examination evaluated was
  - ventricular system
  - choroid plexus
  - subdural space
  - deep cerebral structures
  - cerebral hemispheres
  - cerebellum
  - Posterior cranial fossa

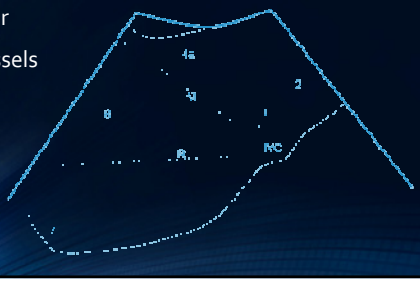


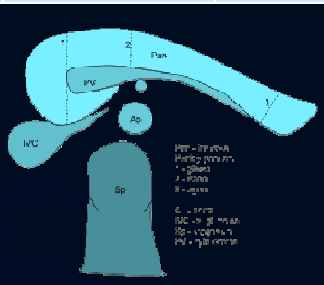
Structure	norm	probe
Lateral ventricle	To 5 mm	microconvex
Third ventricle	To 3 mm	microconvex
Corpus callosum	Length 4,2mm (+/-3,3mm)	microconvex
Cerebellum	Surface 31–62 mm²	microconvex
Subdural space	Width ~2-3,8 mm	linear

Abdominal caven USG

- During examination evaluated was
  - Liver
  - Gall bladder
  - Gall ducts
  - Pancreas
  - Splean
  - Adrenal gland
  - Kidneys
  - Urinary bladder
  - Abdominal vessels

structure	parameter	norm	echogenicity
Liver	ALL MCL	55-77 mm 50-7 2mm	Lower than kidney
Gall bladder	Length Width Wall thickness	25 mm 9 mm 2 mm	anecogrnic
Pancreas	Head Body Tail	10 mm (+/-4) 6 mm (+/-2) 10 mm (+/-4)	Lower than liver
Spleen	Length	To 60 mm	Lower or equal to liver
Kidneys	Length	L(cm)= 0,057 x A + 2,646 (+/- 1,529)	Cortex higher than liver Core lower than liver





Research material

- In period 01.01.2014 to 02.12.2014 - 501 newborns in unit
- 249 (49.1%) newborns with recognized indications to USG
- Retrospective data from patient documentation

Data analysis method

- Great variety of diagnosis
- USG diagnosis was divide in to 2 groups
- I group – minor diagnosis – observation only
  - Discreet changes in structure and dimensions
  - Echogenicity changes without other pathology
- II group – major diagnosis – high level diagnostics and/or treatment needed
  - IVH I-III°
  - Ischemic changes
  - Hydronephrosis
  - Vesicoureteral reflux
  - Doubled pelvilyceal system
  - Vascular chances
  - One septum pellucidum cyst has been counted separately because it was combined with other disorders

Results

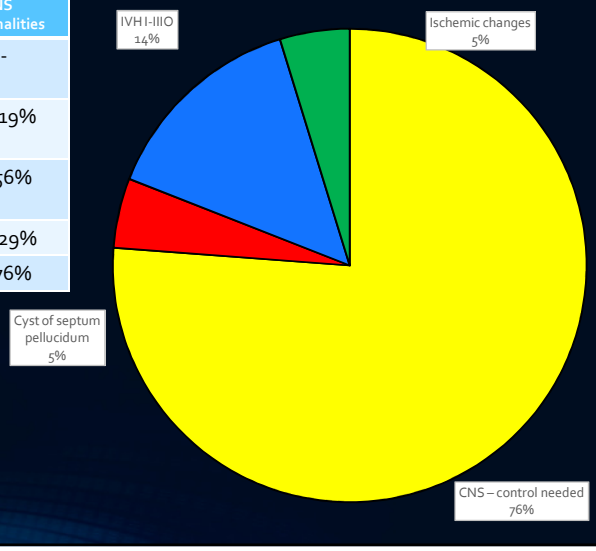
- 36 newborns with at least one diagnosis (7,19%)
- 15 newborns with at least one abnormality in CNS (2,99%)
- 21 newborns with at least one abnormality in abdomen (4,19%)
- 13 major patologys was found (2,59%)
- Often abnormalities was found in diferend system than indication to USG suggested
- Mainly asymptomatic

Numerical and percentage statement ultrasound abnormalities

	Numerical Value	Percentage from all newborns	Percentage from all indication	Percentage from all abnormalities
All newborns	501	-	-	-
All indications	246	49,10%	-	-
All abnormalities	36	7,19%	14,63%	-
Abnormalities in CNS	15	2,99%	6,10%	41,67%
Abnormalities in abdomen	21	4,19%	8,54%	8,54%
Major abnormalities	13	2,59%	5,28%	36,11%

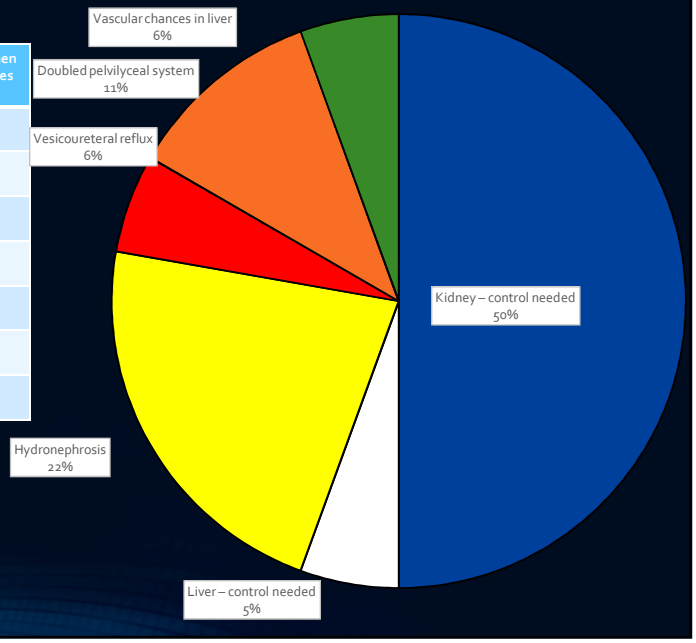
Numerical and percentage statement ultrasound abnormalities - CNS

	Numerical Value	% of all newborns	% of all indication	% of all abnormalities	% of CNS abnormalities
Singly count abnormalities	21	-	-	-	-
CNS – control needed	16	3,19%	6,50%	41,03%	76,19%
Cyst of septum pellucidum	1	0,20%	0,41%	2,56%	2,56%
IVH I-III^{O}	3	0,60%	1,22%	7,69%	14,29%
Ischemic changes	1	0,20%	0,41%	2,56%	4,76%



Numerical and percentage statement ultrasound abnormalities - abdomen

	Numerical Value	% of newborns	% of indication	% of abnormalities	% of abdomen abnormalities
Singly count abnormalities	18	-	-	-	-
Kidney – control needed	9	1,80%	3,66%	23,08%	50,00%
Liver – control needed	1	0,20%	0,41%	2,56%	5,56%
Hydronephrosis	4	0,80%	1,63%	10,26%	22,22%
Vesicoureteral reflux	1	0,20%	0,41%	2,56%	5,56%
Doubled pelvilyceal system	2	0,40%	0,81%	5,13%	11,11%
Vascular chances in liver	1	0,20%	0,41%	2,56%	5,56%



Encountered problems

- Different scans performers
- No consistent USG protocol
- Descriptions without accurate measurement results (slightly, in/out of norm)
- No information on the results of control and evolution of changes

Conclusions

- Screening ultrasound of Central Nervous System and abdominal cavity may not reasoned
- It may be reasoned to extend standard indications on neonates both near to estimated birth term and with mild adaptive ventilation disorders
- There is insufficient data to recommend extending indications to other clinical states – more studies needed

Conflict of interest

- There is no conflict of interest

Financial suport

- There is no financial suport

Thank you for your attention