Medicine 2015.

IUGR

prof. Damir Roje

IUGR

- intrauterine growth restriction
- intrauterine growth retardation

Two basics of fetal growth

- growth potential :
  - genetics
  - envioronmental factors (viruses, radioation, epigenetics)
- growth support:
  - transplacental nutrients transport
  - hormons (growth hormone, fetal insulin)

The dynamics of fetal growth

- in the first half of pregnancy, placenta is growing significantly faster than fetus
  (20 weeks ⇨ 3x heavier)
- in the second half of pregnancy, fetus is growing faster, and the term baby is 7x heavier than placenta

The dynamics of fetal growth

- in the first half of pregnancy qualitative componet of fetal growth dominates over quantitative
- potential to built (quantitative growth) is assigned to the placenta
- in the second half of pregnancy, the fetus "compensates" the quantity
- Physiological deceleration of fetal growth ⇨ after 38 weeks

The dynamics of fetal growth

- first 16. weeks ⇨ hyperplastic fetal growth
- 16. – 24 weeks ⇨ combination of hyperplastic (decelerating) & hypertrophic type of growth (accelerating)
- after 24. weeks hypertrophic type of fetal growth dominates

The dynamics of fetal growth

- ~ 26 weeks - fetus begins to secrete its own insulin
  (the active form - an inactive form is proven in the first quarter)
- until then, its growth is predominantly genetically determined
- since then, its growth mostly depends on the supply of glucose and insulin dependent metabolism

Cararach V, Carmona F (1998) Macrosomia: Etiology and Pathogenesis. In: Kurjak A (ed) Textbook of Perinatal Medicine. The Parthenon Publishing Group, London New York, pp 1281-9

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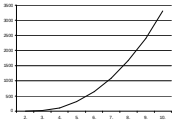
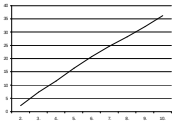
  - 22. weeks = 500g
  - 25. weeks = 800g
  - 28. weeks = 1200g
  - 30. weeks = 1500g
  - 32. tweeks = 2000g

Normal fetal growth

months	weight (g)	crown- rump (cm)
2.	1	2,3
3.	14	7,4
4.	105	11,6
5.	310	16,4
6.	640	20,8
7.	1080	24,7
8.	1670	28,3
9.	2400	32,1
10.	3300	36,2



weight



lenght

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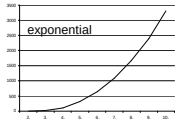
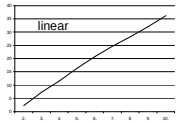


weight



lenght

FETAL GROWTH EVALUATION

BIRTH WEIGHT (*per se*)

- extremely low birth weight (500-999 g)
- very low birth weight (1000-1499 g)
- low birth weight (1500-2499 g)
- normal birth weight (2500-3999 g)
- macrosomia (<4000 s. 4500g)

small / BIG?

Normal fetal growth (physiological)

- estimated fetal weight, or measured birth weight compared with the population average
- **Percentile values** / tables / curves - distribution in the newborns population
- In regard to the three main factors determining fetal growth:
  - gestational age
  - infant's gender
  - mothers parity

Percentile tables – population in Split

tjedan	PRVOROTKE MUŠKO – PORODNE TEŽINE (g) n	centile 5.	10.	25.	50.	75.	90.	95.	PRVOROTKE ŽENSKO– PORODNE TEŽINE (g) n	centile 5.	10.	25.	50.	75.	90.	95.
22.	3	550	550	55	600	600	600	600	8	350	350	475	550	625	650	650
23.	25	550	550	600	610	650	700	710	19	350	500	550	600	650	700	700
24.	23	550	560	600	800	900	900	900	33	500	500	600	700	750	850	900
25.	12	700	750	750	825	925	950	1100	20	600	650	700	750	800	875	900
26.	34	750	820	900	975	1070	1250	1550	33	650	860	700	860	950	1200	1300
27.	28	720	850	1075	1100	1275	1400	1850	33	750	800	900	980	1100	1300	1350
28.	45	1050	1050	1100	1200	1350	1450	1950	40	750	850	1050	1200	1300	1460	1480
29.	39	1050	1150	1250	1350	1600	1875	2150	38	900	1050	1250	1400	1590	1850	2000
30.	56	1100	1150	1430	1550	1750	2190	2500	40	1000	1050	1250	1500	1850	2050	2275
31.	71	1150	1200	1550	1750	1950	2400	2550	54	1100	1300	1500	1600	1850	2100	2350
32.	113	1430	1600	1750	1900	2070	2550	2650	89	1200	1300	1600	1800	2150	2350	2450
33.	136	1350	1540	1850	2200	2450	2800	3100	128	1200	1350	1645	2100	2265	2500	2660
34.	139	1500	1600	2000	2320	2600	3000	3100	124	1300	1500	1900	2250	2600	2800	3000
35.	251	1800	2050	2350	2600	2900	3150	3300	212	1350	1700	2000	2370	2750	3050	3250
36.	512	2050	2200	2550	2850	3150	3450	3600	400	1815	2150	2450	2725	3000	3250	3425
37.	150	2350	2500	2800	3050	3400	3650	3800	132	2100	2300	2550	2900	3240	3450	3700
38.	355	2600	2750	3000	3250	3600	3900	4150	282	2480	2650	2900	3200	3400	3650	3800
39.	688	2850	3000	3250	3550	3800	4100	4250	615	2600	2800	3050	3250	3550	3800	4000
40.	817	2900	3100	3300	3600	3930	4200	4300	838	2800	3000	3200	3450	3700	4000	4100
41.	426	3000	3150	3400	3700	4000	4300	4500	446	3000	3150	3300	3570	3800	4050	4300
42.	120	3025	3150	3470	3870	4175	4500	4700	91	3100	3200	3400	3650	3950	4200	4650

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22.	3	550	550	550	650	650	650	650	6	400	400	400	650	700	700	700
23.	18	500	500	600	650	700	750	800	15	530	530	550	600	650	700	700
24.	27	500	500	600	710	850	850	1060	20	500	550	675	765	850	875	900
25.	12	700	700	800	800	1035	1090	1100	20	600	625	700	850	950	1000	1150
26.	14	700	800	900	1100	1100	1150	1375	12	500	600	775	1000	1030	1060	1200
27.	27	800	900	1050	1100	1200	1350	1450	26	700	700	900	1150	1250	1250	1350
28.	52	1050	1070	1100	1250	1380	1500	1700	41	900	1050	1100	1200	1350	1650	1700
29.	37	1100	1150	1250	1400	1550	1800	2300	43	1000	1100	1250	1400	1550	1800	2000
30.	60	1115	1185	1320	1530	1750	2125	2500	56	1000	1100	1395	1450	1700	1980	2200
31.	82	1400	1420	1600	1785	2000	2200	2500	80	1180	1200	1415	1650	1900	2135	2285
32.	107	1400	1580	1820	2030	2200	2350	2530	130	1300	1400	1650	1875	2100	2315	2850
33.	161	1550	1650	2000	2280	2500	2700	3100	163	1350	1500	1800	2100	2450	2720	2800
34.	146	1850	1950	2150	2420	2700	2950	3100	135	1400	1650	1960	2250	2600	2900	3100
35.	258	1930	2200	2400	2700	2950	3250	3650	235	1500	1820	2140	2550	2800	3000	3300
36.	510	2100	2250	2650	2900	3150	3540	3700	435	2000	2200	2450	2800	3100	3400	3800
37.	179	2400	2600	2900	3150	3500	3900	4050	145	2200	2550	2800	3075	3300	3600	4000
38.	379	2600	2800	3100	3350	3750	4000	4200	354	2650	2750	3000	3250	3600	3850	4000
39.	887	2800	3000	3300	3600	3900	4250	4400	865	2700	2900	3150	3400	3750	4000	4150
40.	1011	3000	3200	3450	3750	4050	4350	4550	1038	2850	3000	3300	3600	3850	4150	4350
41.	436	3050	3200	3550	3850	4150	4400	4550	424	3000	3150	3400	3650	3900	4200	4350
42.	94	3150	3250	3600	3950	4250	4550	4750	109	3100	3250	3550	3800	4150	4500	4700

Roje D i sur. Porodne težine i duljine novorođenčadi u Splitu, Opravdanost razvijanja vlastitih referentnih vrijednosti za ocjenjivanje fetalnog rasta. Gynaecol Perinatol 2005;14:66-74.

Normal / altered fetal growth

- 10. – 90. centile – normal – **expacted growth**
- <10. centile = hypotrophy – Small for gestational age (SGA)
- >90. centile = hipertrofy – Large for gestational age (LGA)

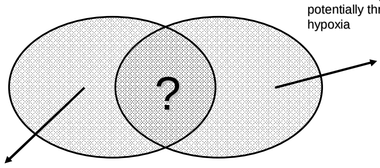
- SGA – the smallest 10% of the population

- LGA – the biggest 10% od the population

SGA

- Intrauterine growth restriction / retardation (IUGR)
- IUGR : SGA

small due to placental insufficiency; potentially threatened by hypoxia

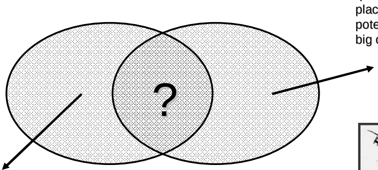


small due to reduced genetic potential; in fact, it is a healthy child

LGA

- LGA – hypertrophy
- Macrosomia

large due to "positive" placental insufficiency; potentially endangered big child



large up to genetic potential; in fact it is a healthy (big) kid

SGA - IUGR

- conditions associated with SGA / IUGR:
- chromosomopathy
- genetic syndromes
- viral infection of the first part of pregnancy
- preeclampsia
- disturbed placentation and inadequately developed placenta

LGA

- conditions associated with LGA:
  - DM
  - hydrops fetus

OBESE / undernourished

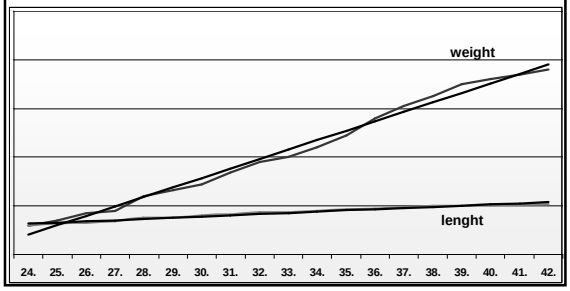
/

birth weight
:
birth lenght

symmetrically : asymmetrically

skinny — **obese**

DYNAMICS OF FETAL WEIGHT AND LENGTH
(through pregnancy)



PONDERAL INDEKS (g/cm^3)
Rohrer's index

$$\mathbf{PI} = 100 \times \frac{\text{birth weight (g)}}{\text{birth lenght}^3 \text{ (cm)}}$$

The question of all questions related to IUGR!

What is actually important?

- the size (weight /lenght) (what we can not control / change)

or !?!

- possible fetal distress (hypoxia) (what we can not control / change too , but we can *take the baby out* if the situation gets out of control

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+ SGA = IUGR

SGA

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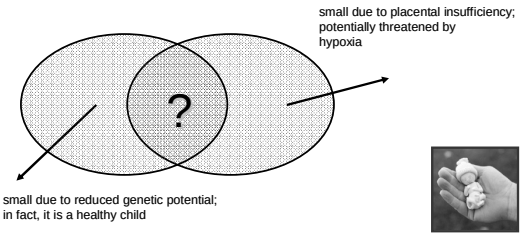
- IUGR : SGA



HOW TO KNOW IF IT IS IUGR OR JUST A SGA ?

SGA
normal growth ~ IUGR ~ ponderal index
LGA

Is it intrauterine undernouritioned?

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SGA

or !?!

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+ SGA = IUGR

The important question:

Is the fetus at risk ?
How does the fetus feel?

Ultrasound biometry only provides an answer to the question: "How does the fetus look ?"

morphology vs. physiology

Is the fetus at risk ?
How does the fetus feel?

Ultrasound biometry only provides an answer to the question: "How does the fetus look ?"

(dys) morphology vs. (patho) physiology

US:
- fetal growth
– EFW-
- Symetricity
– nutritional placental insuficiency

US, doppler, CTG, &/or ?
– respiratory placental insuficiency

Is the fetus at risk ?
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Ultrasound biometry only provides an answer to the question: "How does the fetus look ?"

(dys) morphology vs. (patho) physiology

Is the fetus at risk ?
How does the fetus feel?

How can we know if the fetus is in hypoxia & are there any compensatory mechanisms activated?

Placental respiratory insuficiency:

1. **compensated stage**
2. **sub (de)compensated stage**
3. **decompensated stage**

Fetal hypoxia distress patophysiology ?

FETAL SIZE:

- - Nutritional allways developes before respiratiry placental insufficiency (if it is the cause of IUGR-a)

ULTRASOUNG _ GOLD STANDARD

- - Pregnant women feels less and different fetal movement
- - Fetus is resting / saving oxygen /slowing it's metobolism

CTG

- oscilations ⇩, accelerations ⇩; later ⇨ deceleration (spontaneous or DIP II.) Sign of hypoxia of the brain and heart

DOPPLER

- Brain sparing effect - centralization - a. umbilicalis and a. cerebri media
- more blood (O2) to brain, heart and suprarenal glands & less blood (O2) to all other organs and rest of the body (legs, hands, …)

AMNIOSOCPY: green / meconial amniotic fluid – (Intestine spasms in relative hypoxia during brain sparing effect (expacted reacion of any muscle to hypoxia)

ULTRASOUND AMNIOTIC FLUID - olygohydramnios

- Kidney is extremely stupid! Whenever (for any reasons) is the blood flow to kidney reduced, it decreases the production of urine. Kidney always „thinks" that the organism is in hypovolemia, and concentrates the urine reducing diuresis.

BIOPHYSICAL PROFILE - "cumulative score"

So, what it is IUGR?

Thank you!