10/17/18njm

INTRAUTERINE GROWTH RESTRICTION
CLINICAL MANAGEMENT PROTOCOL

1. DEFINITION

Intrauterine fetal growth restriction (IUGR) is a leading cause of perinatal morbidity and mortality. IUGR is defined as an ultrasound estimated fetal weight (EFW) of less than the 10th percentile for gestational age. Adverse consequences of IUGR usually do not develop until growth is less than the 3rd percentile, but sonographic weight estimates are variable enough that management decisions should be made when the EFW is reported as <10th percentile.

Some constitutionally small fetuses are actually growing normally when consideration is given to the size of their parents, or their ethnic group. IUGR may be identified, but is uncommon in our population. Small fetuses should be treated as if they have IUGR. The term "growth retardation" should not be used. The term "small for gestational age (SGA)" refers to infants, not fetuses, and should not be used.

2. DIAGNOSIS

a) The diagnosis of IUGR can be difficult to establish. A lag of more than 3 cm between fundal height and gestational age may identify patients at risk of IUGR, who should then have an ultrasound performed.

b) The ultrasound diagnosis of IUGR is defined as an estimated fetal weight less than the 10th percentile for gestational age. If the weight percentile is not reported, it should be sought from the radiologist or the worksheet on the PACS system, or a standard fetal weight curve can be consulted. Our current ultrasound machines use either the Williams or Hadlock curves, which are quite similar (see references). Customized growth curves, which correct for maternal height, weight, and ethnicity, are unfortunately not currently in widespread use in the United States.

c) Since fetal weight may vary by as much as $\pm$20% in the third trimester, please err on the side of caution for borderline cases.

d) Additional ultrasound parameters that may suggest the diagnosis of IUGR include an increased head to abdominal circumference ratio (HC/AC) and oligohydramnios (low amniotic fluid volume).

e) If late care, and unsure if the pregnancy is misdated (less farther along than dates), if time allows, repeat the growth ultrasound in 3 weeks to see if the fetus follows the same curve, suggesting misdating, or flattens out, suggesting IUGR. Monitor as below, as if IUGR, until the situation is clarified.

f) Most cases of late onset (after 28-32 weeks) fetal growth restriction in non

anomalous fetuses are associated with placental insufficiency, most often of unknown cause. Early onset (prior to 28 weeks) fetal growth restriction may be due to fetal aneuploidy or infection, and carries a worse prognosis. Laboratory investigation and amniocentesis may be appropriate.

3. ANTEPARTUM MANAGEMENT

1) Fetuses diagnosed as having IUGR should have an anatomic survey performed. Fetuses with an EFW <10th percentile should have reflex Doppler studies done. The clinically relevant Doppler parameters for this disorder include:

a. systolic to diastolic ratio of the umbilical artery (S/D-UA)
b. pulsatility index of the umbilical artery (PI-UA)
c. pulsatility index of the middle cerebral artery (PI-MCA)
d. ductus venosus waveform

Nomograms are available for the interpretation of these values (see attached). Abnormal Doppler indices include:

a. elevated S/D and/or PI of the UA
b. absent or reversed flow in the UA
c. decreased PI of the MCA
d. decreased cerebro-placental ratio (CPR = $\frac{\text{PI-MCA}}{\text{PI-UA}}$)
e. abnormal ductus venosus "a" wave or pulsatility index (PI)

The temporal sequence of deterioration of Doppler parameters in IUGR is usually:

1. Abnormal umbilical artery indices (diminished end diastolic flow)
2. Middle cerebral artery indices (increased end diastolic flow)
3. Absent or reversed end diastolic flow in the umbilical artery
4. Abnormal venous Dopplers: absent or reversed end diastolic flow in the ductus venosus, or pulsatile umbilical vein.
5. Oligohydramnios or abnormal fetal heart rate patterns are usually late events

2) Doppler studies should be repeated on a weekly basis until delivery. Abnormal Doppler indices may suggest delivery, depending on gestational age and clinical judgment.

3) Maternal Fetal Medicine consult should be considered when the diagnosis is made.

4) Non-stress testing (NST) should be carried out upon diagnosis, and then twice weekly until delivery

5) An amniotic fluid evaluation (single deepest pocket) should be obtained weekly

until delivery.

6) A biophysical profile (BPP) should be obtained weekly until delivery.

7) Smoking cessation has been shown to be beneficial for the growth restricted fetus. No other interventions (hospitalization for bedrest, oxygen therapy, nutritional supplements, aspirin, heparin, antihypertensive medication, etc.) have been demonstrated to have a favorable effect in established IUGR.

4. DELIVERY

1. The evidence is controversial as to the risks vs benefits of early delivery in fetuses with growth restriction. Early delivery may prevent intrauterine fetal demise or future neurodevelopmental problems. Very early preterm delivery of the growth restricted fetus is associated with the worst prognosis.

2. Administration of antenatal corticosteroids for fetal lung maturation is indicated in fetuses diagnosed with growth restriction prior to 34 weeks in case early delivery is indicated.

3. Growth restricted fetuses with abnormal Doppler velocimetry at less than 34 weeks should be discussed with Maternal Fetal Medicine.

4. Delivery of the late preterm or early term (34 to 37 weeks) growth restricted fetus may be deferred if Doppler velocimetry is normal and fetal surveillance is reassuring. Twice weekly surveillance should continue. Management should be individualized, but, if the fetal hemodynamics deteriorate, delivery may prevent an adverse outcome. Input from Maternal Fetal Medicine should be considered.

5. After 37 weeks, if both Dopplers and twice weekly fetal surveillance are consistently reassuring with no additional significant maternal/fetal risk factors, then, delivery may be postponed until 38-39 weeks.

6. Outpatient cervical ripening is probably not appropriate for the growth restricted fetus. Continuous electronic fetal monitoring should be instituted in active labor.

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Table 1

In Utero Fetal Weight Standards at US

Menstrual Week	Percentiles (g)				
	3rd	10th	50th	90th	97th
10	26	29	35	41	44
11	34	37	45	53	56
12	43	48	58	68	73
13	55	61	73	85	91
14	70	77	93	109	116
15	88	97	117	137	146
16	110	121	146	171	183
17	136	150	181	212	226
18	167	185	223	261	279
19	205	227	273	319	341
20	248	275	331	387	414
21	299	331	399	467	499
22	359	398	478	559	598
23	426	471	568	665	710
24	503	556	670	784	838
25	589	652	785	918	981
26	685	758	913	1,068	1,141
27	791	876	1,055	1,234	1,319
28	908	1,004	1,210	1,416	1,513
29	1,034	1,145	1,379	1,613	1,724
30	1,169	1,294	1,559	1,824	1,649
31	1,313	1,453	1,751	2,049	2,189
32	1,465	1,621	1,953	2,285	2,441
33	1,622	1,794	2,162	2,530	2,703
34	1,783	1,973	2,377	2,781	2,971
35	1,946	2,154	2,595	3,036	3,244
36	2,110	2,335	2,813	3,291	3,516
37	2,271	2,513	3,028	3,543	3,785
38	2,427	2,686	3,236	3,786	4,045
39	2,576	2,851	3,435	4,019	4,294
40	2,714	3,004	3,619	4,234	4,524

Hadlock FP, et al. In utero analysis of fetal growth: sonographic weight standards. Radiology 1991; 181:129-33.

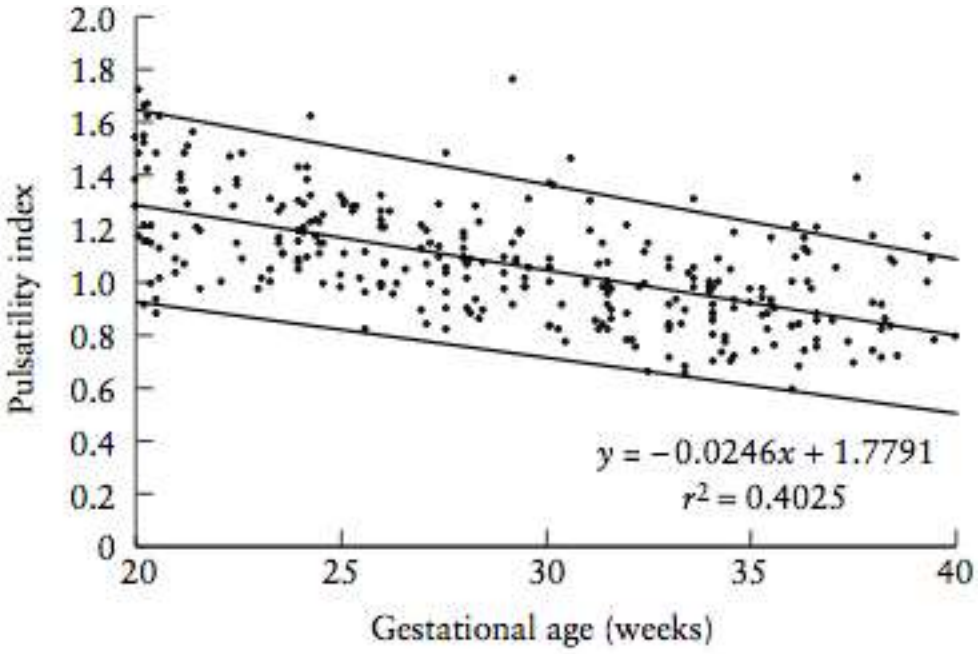

Figure 1 Graph showing the reference ranges (mean and 95% CI) of the umbilical artery pulsatility index.

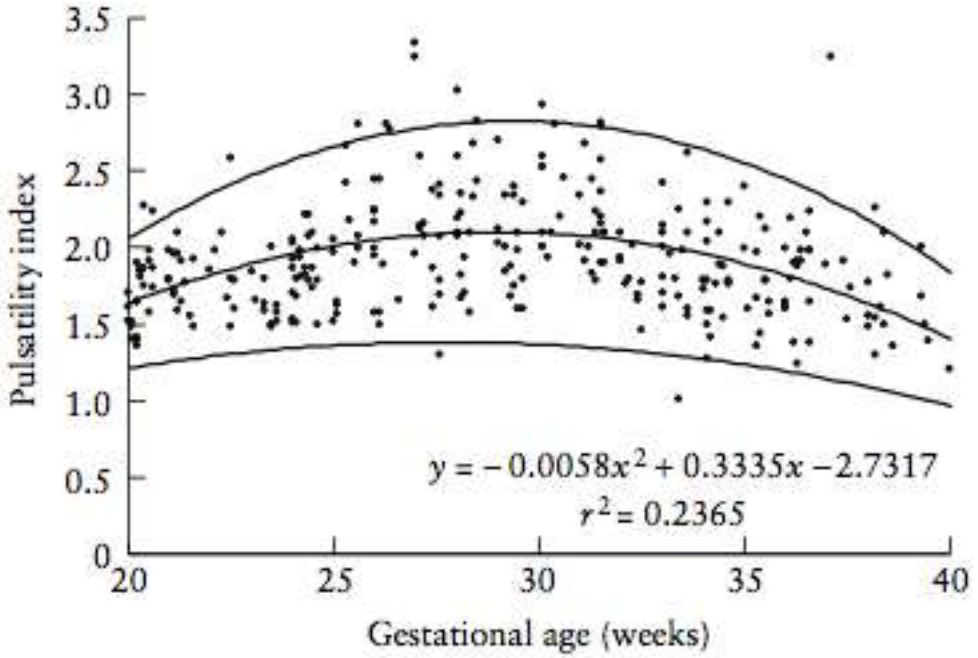

Figure 2 Graph showing the mean and 95% CI of the middle cerebral artery pulsatility index.

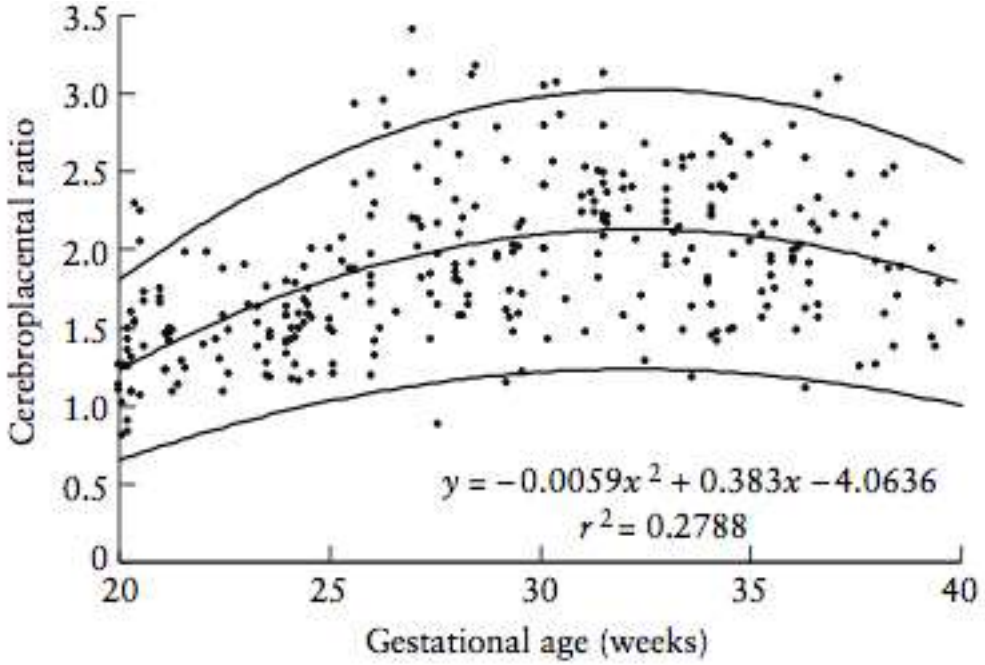

Figure 3 Graph showing the gestational reference range (mean and 95% CI) of the cerebroplacental ratio based on paired measurements of the middle cerebral and umbilical artery pulsatility index.