

제26차 대한당뇨병학회 춘계학술대회

11 May, 2013
ICC, Jeju, Korea

What are the appropriate screening and diagnostic methods for gestational diabetes in Korean women?

서울의대

분당서울대학교병원

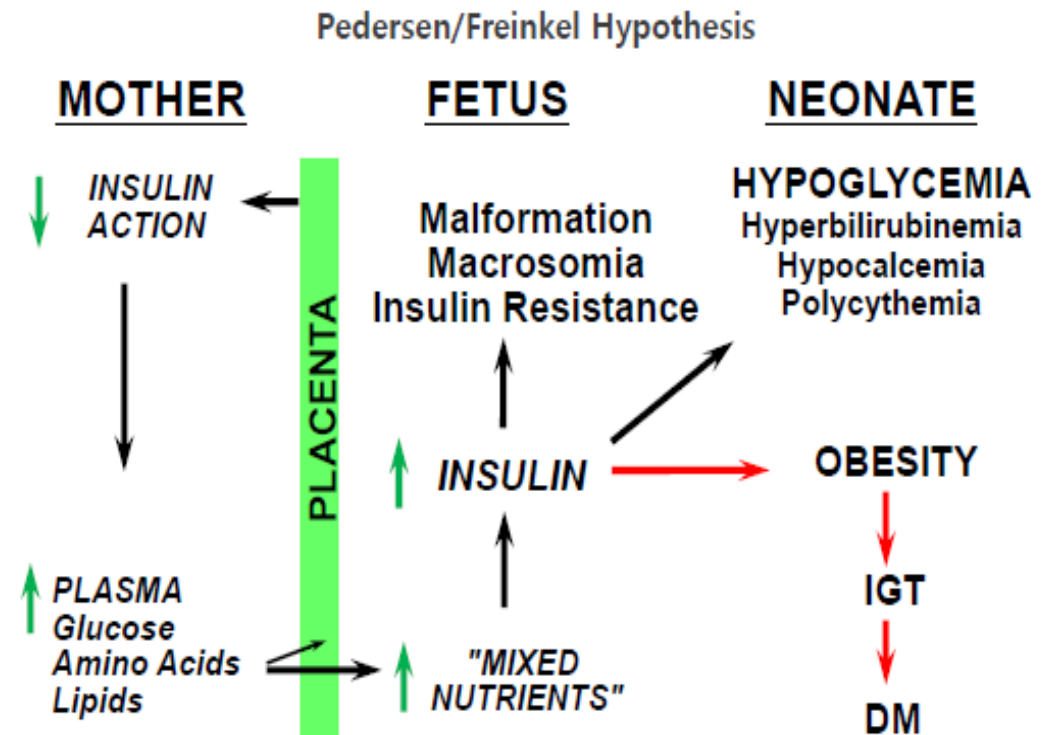
내과 장학철



임신성 당뇨병

- Gestational diabetes mellitus is defined as glucose intolerance of variable severity with onset or first recognition during the present pregnancy.
- Incidence: 5% in Korean Women
- Maternal hyperglycemia → Adverse pregnancy outcome

Diabetic Fetopathy



Diagnosis of Overt Diabetes Mellitus in Pregnancy: Threshold Values

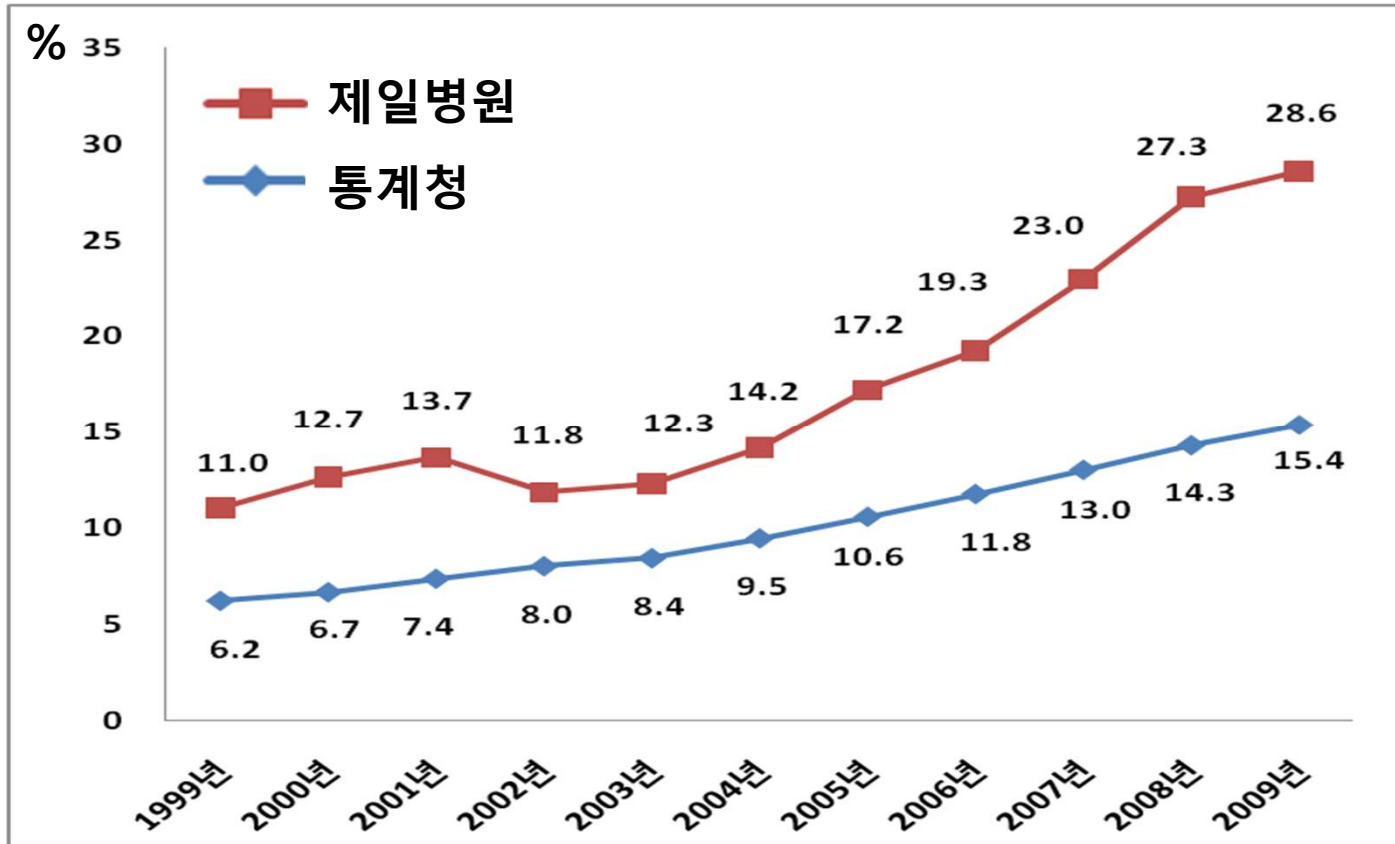
Diagnosis of Overt Diabetes Mellitus in Pregnancy	
Measure of glycemia	Consensus threshold
FPG	≥ 7.0 mmol/l (126 mg/dl)
A1C	$\geq 6.5\%$ (DCCT/UKPDS standardized)
Random plasma glucose (RPG)	≥ 11.1 mmol/l (200 mg/dl) confirmed*
*Confirm RPG with FPG or A1C	

The incidence of GDM is increasing in Korea

Year	Delivery(n)	GDM(n)	Incidence(%)
2002	8,627	344	4.0
2003	9,464	338	3.6
2004	8,972	250	2.8
2005	8,112	172	2.1
2006	7,725	222	2.9
2007	7,730	325	4.2
2008	7,112	329	4.6
2009	6,352	333	5.2
2010	6,694	303	4.5
2011	6,542	356	5.4
Total	77,330	2,972	3.8

김문영, 제일병원

연도별 고령 산모 비율(%)



고령 산모가 늘어나면서 임신 중 당뇨병으로 병원을 찾는 사람이 매년 27%씩 증가 (국민건강보험공단, 2012.10.9)

김문영, 제일병원

임산부의 날, MBN News



고령 산모가 늘어나면서 임신 중 당뇨병으로 병원을 찾는 사람이 매년 27%씩 증가 (국민건강보험공단, 2012.10.9)

Contents

- Current diagnostic approach for GDM
- Detection and diagnosis of GDM in Korea
- Case presentation

Current Screening and Diagnostic Test for GDM

➤ Two step approach

- 50 g glucose challenge test
 - ❖ Cutoff -130, 135, 140 mg/dL
- 100 g glucose tolerance test
 - ❖ NDDG criteria
 - ❖ Carpenter-Coustan criteria

➤ One step approach

- WHO
- IADPSG

Glucose Thresholds for the Diagnosis of GDM

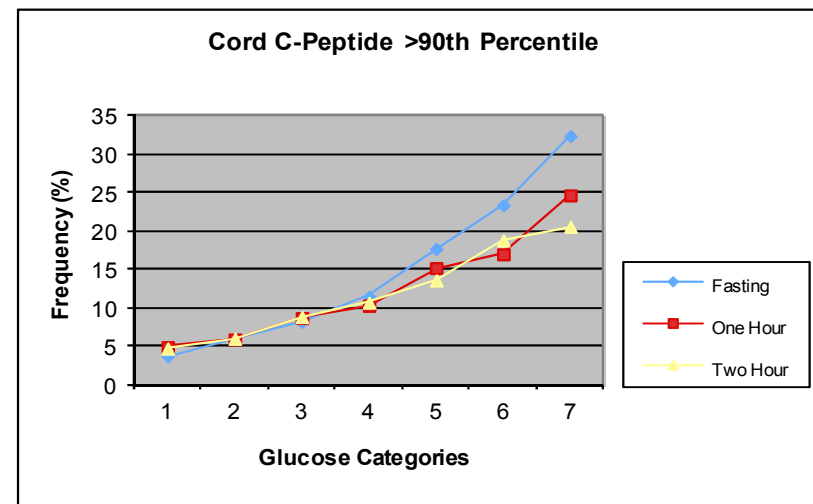
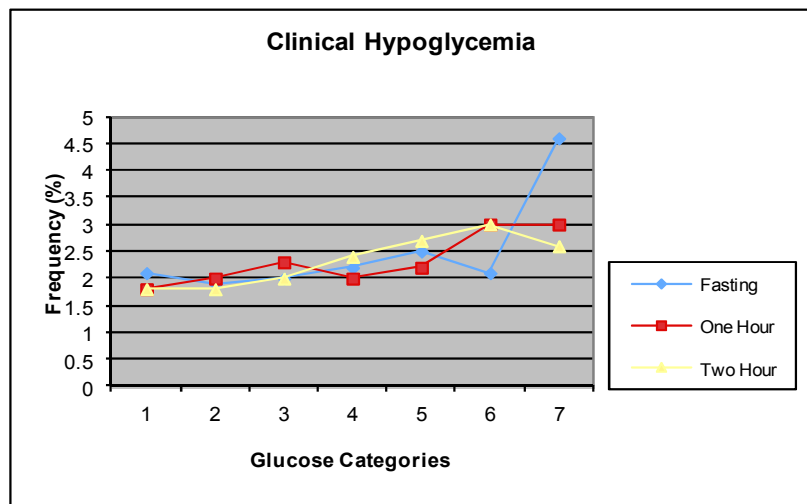
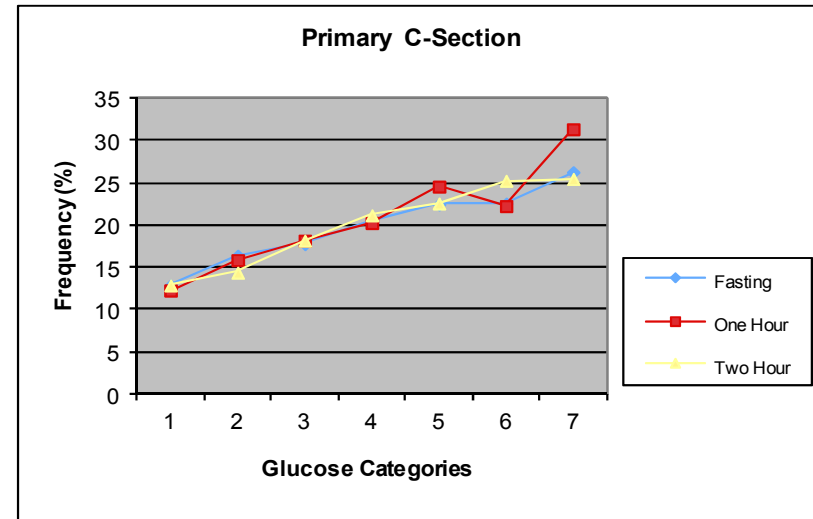
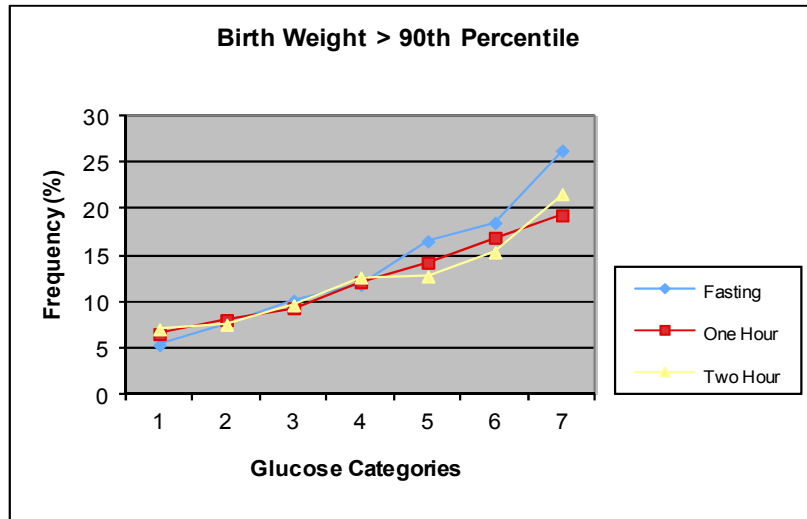
Criteria	Fasting, mg/dL	1-h, mg/dL	2-h, mg/dL	3-h, mg/dL
NDDG (100 g)	105	190	165	145
C-C (100 g)	95	180	155	140
WHO (75 g)	110		140	
IADPSG (75 g)	92	180	153	

C-C = Carpenter & Coustan; NDDG = National Diabetes Data Group; WHO = World Health Organization; IADPSG = International Association of Diabetes and Pregnancy Study Groups

HAPO Study

- Observational study
- Glucose tolerance status using 75 g OGTT at 24 to 32 weeks during pregnancy in 25,505 pregnant women from 15 centers in 9 countries
- Increasing maternal glucose levels were related to increased infant birth weight, body fat, and cord C-peptide > 90th percentile, and increased primary cesarean delivery rates.
- In addition, these women also had increased risks for premature delivery, preeclampsia, shoulder dystocia or birth injury, and hyperbilirubinemia.

HAPO study: Associations btw Maternal Glucose & 1° Outcomes



Plasma Glucose Concentrations at Specified OR

Glucose	Odds Ratio		
mg/dl*	1.5	1.75	2.0
FPG	90	92	95
1-Hr PG	167	180	191
2-Hr PG	142	153	162

*Mean of threshold values for birthweight, cord serum C-peptide, % body fat >90th percentile

Frequencies of Outcomes: Glucose Values < or \geq Threshold

Outcome	% All Values < Threshold	% Any \geq 92/180/153 (5.1/10.0/8.5)
Birthweight >90 th percentile	8.3	16.2
Cord C-peptide >90 th percentile	6.7	17.5
% Body fat >90 th percentile	8.5	16.6
Preeclampsia	4.5	9.1
Preterm birth (<37 weeks)	6.4	9.4
Shoulder dystocia/birth injury	1.3	1.8
Primary Cesarean section	16.8	24.4

Adopting IADPSG criteria

➤ Patients

- Fasting state, wait time of 2 hours
- Increasing women with GDM
- Considerable inconvenience (SMBG, Education, US, etc.)

➤ Providers

- Additional clinical resources & services
- Workload would increase approximately 30 percent
- 1 million more clinic visits & prenatal testing in U.S.

Adopting IADPSG criteria

➤ Health Care Systems

- Additional outpatient visits and testing
- Increased time spent on labor and delivery suites due to more frequent inductions & cesarean deliveries.
- Direct medical and patient time costs would be higher
- Annual cost in the U.S. for the care of GDM x 3

Does treatment modify the health outcomes of mothers with GDM and their offspring?

- Very few studies
- NICHD RCT*: treatment of GDM reduced the risk for macrosomia, hypertensive disorders of pregnancy, and shoulder dystocia.
- Treatment of GDM did not increase the risk of cesarean delivery.
- Results were not consistent among studies for maternal weight gain and risk for induction of labor.
- Lack of evidence: treatment of GDM on birth trauma, BMI at delivery, and long-term maternal outcomes including T2DM, obesity, and hypertension.

*Landon MB et al. NEJM 361:1339-48, 2009

Does treatment modify the health outcomes of mothers with GDM and their offspring?

- A 50 percent reduction in macrosomia in infants born to mothers who received treatment for GDM.
- No sufficient data available to conclude whether treatment of GDM modifies neonatal morbidities such as prematurity, admission to neonatal intensive care units, or mortality.

Treatment of mild GDM Reduces Adverse Outcome*

Outcome	NICHD RCT		P
	Not treated	Treated	
BW >90 th percentile	14.5	7.1	<0.001
C-peptide >95 th percentile	22.8	17.7	0.07
NICU admission	11.6	9.0	0.19
Shoulder Dystocia	4.0	1.5	0.02
Preeclampsia	5.5	2.5	0.02

*Landon MB et al. NEJM 361:1339-48, 2009

* FPG <95 mg/dl, a 1-hr value between 180 and 199 and a 2-hr value between 155 and 199 were eligible

What are the harms of increased diagnosis of GDM?

- Patients' short-term stress and anxiety
- Over-diagnosis of GDM may lead to the “medicalization of pregnancy”.
- Considerable variability in the 2-hour glucose tolerance test
- Anti-diabetic medication –hypoglycemia
- Higher induction of labor rates in women with GDM
- Cesarean rates may be higher in women given the diagnosis of GDM.



NATIONAL INSTITUTES OF HEALTH CONSENSUS DEVELOPMENT CONFERENCE

Several criteria need to be fulfilled for adopting IADPSG recommendation:

- There should be evidence that the additional women who are identified by the one-step approach have an increased frequency of maternal and/or perinatal morbidities.
- There should be evidence that these morbidities can be decreased by intervention.
- There should be evidence that the benefits of the decrease in morbidities outweigh the harms incurred (including maternal, perinatal, and societal).

NIH, March 4–6, 2013

KDA 임신성 당뇨병 진료지침

- 진단기준

1. 첫 번째 산전 방문 검사 시 다음 중 하나 이상을 만족하면 기왕의 당뇨병이 있는 것으로 진단한다. [E]

1-1. 공복 혈장 혈당 ≥ 126 mg/dL

1-2. 무작위 혈장 혈당 ≥ 200 mg/dL

1-3. 당화혈색소 $\geq 6.5\%$

2. 임신 24-28주 사이에 시행한 2시간 75 g 경구당부하검사 결과 다음 중 하나 이상을 만족하는 경우 임신성 당뇨병으로 진단할 수 있다. [E]

2-1. 공복 혈장 혈당 ≥ 92 mg/dL

2-2. 당부하 1시간 후 혈장 혈당 ≥ 180 mg/dL

2-3. 당부하 2시간 후 혈장 혈당 ≥ 153 mg/dL

3. 기존의 2단계 접근법으로 100 g 경구당부하검사를 시행한 경우는 다음 기준 중 두 가지 이상을 만족하는 경우 임신성 당뇨병으로 진단한다. [E]

3-1. 공복 혈장 혈당 ≥ 95 mg/dL

3-2. 당부하 1시간 후 혈장 혈당 ≥ 180 mg/dL

3-3. 당부하 2시간 후 혈장 혈당 ≥ 155 mg/dL

3-4. 당부하 3시간 후 혈장 혈당 ≥ 140 mg/dL

임신성 당뇨병 소연구회 (KDPSG)

- 회장: 관동의대 제일병원 김문영
- 간사: 최성희, 한성희
- Pregnancy outcome in women with gestational diabetes mellitus by IADPSG criteria (다기관연구: 2013/3-)
- Determine whether the additional women categorized as having diabetes by the IADPSG criteria, who would be considered normal in the C-C criteria, are increased risk for adverse pregnancy outcome.

Case Presentation

Case 1

- 여자 / 36세
- 외부 병원에서 임신성 당뇨병으로 진단받고 내분비 내과를 방문.
- GCT: 157 mg/dL
- 100 g OGTT: **112-155-160-139** mg/dL (**capillary**)
- V/S : SBP 123 mmHg, DBP 78 mmHg, PR 102/min
- 신장 163 cm, 현재 체중 65 kg (임신전 60 kg)
- 산과력: 0-0-0-0
 - 현재 임신 26 주
- 당뇨병 가족력: 없음

질문

- 진단은 ?
 - GDM ?
- 어떤 검사가 필요할까?

Case 1

- 100 g OGTT (27 wks)
89-174-114-101 mg/dL
- Assessment
 - NGT
- Recommendation: Regular diet & exercise

Case Presentation

Case 2

- 34세 임신부
- 이전 특이 병력 없던 34세 산모가 외부 병원에서 시행한 혈당 검사에서 이상 소견을 보여 내분비 내과를 방문.
- **Outside glucose test : 107 mg/dL**
- V/S : SBP 117 mmHg, DBP 71 mmHg, PR 94/min
- 신장 156 cm, 현재 체중 61 kg (BMI 25.1)
- 산과력: 2-0-1-1
 - 1st baby: male, 2.6 kg, 37 weeks
- 현재 임신 13 주
- 가족력: 아버지 - 당뇨병
- 임신 전 체중 : 61 kg

질문

- 진단은 ?
 - IFG
 - GDM
- 어떤 검사가 필요할까?

Case 2

- Lab test
 - **FPG 77 mg/dL, A1C 5.5%**
 - C-peptide 1.3 ng/ml, insulin 12.1 uIU/ml
 - Lipid Panel 222 - 162 - 60 - 144 mg/dL
 - BUN 10 mg/dL, Cr 0.55 mg/dL
 - Ca 9.1 mg/dL, P 3.9 mg/dL, Uric acid 4.0 mg/dL
 - AST/ ALT 21/26 IU/L
- Assessment
 - NGT
- Recommendation: Screening test for GDM at 24-28 wks

Case Presentation

Case 3

- 29세 임신부, 임신 28주
- 임신성 당뇨병으로 진단받아 의뢰됨
- 50 g GCT: 246
- 100 g OGTT: 146-272-264-not done (Capillary)
- 산과력: 0-0-0-0
- 당뇨병 가족력: 아버지
- V/S SBP, 110; DBP, 64 mmHg; PR(/min) 96
- 신장: 160.3 cm, 임신전 몸무게: 63 kg, 현재 체중 75 kg

질문

- 진단은 ?
 - GDM
 - Overt diabetes in pregnancy
- 어떤 검사가 필요할까?

Case 3

- Lab test
 - **FPG 132 mg/dL, A1C 6.7%**
- Assessment
 - GDM B1
 - Overt diabetes in pregnancy
- GDM education and insulin therapy



감사합니다.

Pregnancy outcome in Korean women stratified by GCT and OGTT

	Screen negative (n=2120)	Screen positive, Normal OGTT (n=545)	GDM by C- C criteria† (n=37)	GDM by NDDG criteria (n=74)	P-value
Preterm delivery (<37wk)	71(3.3%)	20(3.7%)	3(8.1%)	7(9.5%)*	<0.05
Total C-section	642(30.3%)	201(36.9%)*	18(48.6%)*	41(55.4%)*	<0.001
Preeclampsia	9 (0.4%)	11 (2.0%)*	2 (5.4%)*	6 (8.1%)*	<0.001
Gestational age at delivery (week)	39.5±1.5	39.4±1.4*	39.0±1.5*	38.8±1.4*	<0.01
Apgar score (1 min)	8.5±1.0	8.5±1.0	8.4±0.9	8.4±0.9	0.42
Apgar score (5 min)	9.7±0.7	9.7±0.7	9.6±0.7	9.6±0.7	0.73
Birth weight (g)	3301±450	3360±435*	3379±461	3464±532*	<0.001
LGA infant	287(13.5%)	88(16.1%)	10(27.0%)*	25(33.8%)*	<0.0001
Macrosomia (>4,000 g)	106(5.0%)	29(5.3%)	2(5.4%)	10(13.5%)*	.<0.05

* P<0.05 compared with women with screen negative

†C-C criteria: Carpenter-Coustan Criteria

(당뇨병28:122,2004)