

J. Perinat. Med.  
4 (1976) 95

## Estrogens, lactation and oral glucose tolerance test in the early puerperium

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The early puerperium affords a convenient opportunity to perform an oral glucose tolerance test (OGTT) in hospitalized patients not previously recognized as "prediabetic", but having an oversized or congenitally malformed baby, or an unexplained stillbirth. However, in previous studies, this test appeared unreliable because of a high proportion of abnormal curves unrelated to the known risk factors for diabetes [2, 4, 5].

Other factors responsible for this high proportion of "false positives" were not elucidated [2].

The aim of present study was to estimate "normal" plasma glucose response in the early puerperium, taking into account the possible influence of lactation or of the modalities of its suppression particularly by hormonal treatments.

### 1 Material and methods

The present study was performed on 98 females from three obstetric hospitals in Paris\*. All were para 3. None had a family or personal history of diabetes. All had normal deliveries. They were free from obstetrical pathology (concerning the three pregnancies): No congenitally malformed babies, terms at least equal to 38 weeks, no stillbirths, birth weights less than 4.5 kg, no previous spontaneous abortion, no hydramnios, no history of hypertension in pregnancy or toxemia.

Hôpitals Cochin, Pitie-Salpetriere, Hotel Dieu.

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### Curriculum Vitae

Didier JOB: Born in Paris in 1945.

MD graduation in 1971.  
PhD of Mathematics and Statistics in 1973. Full time epidemiologist since 1971.

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On the fifth day of the puerperium, 51 females were breast feeding and 47 were not breast feeding. Among the latter, none exhibited a medical contraindication to breast feeding, so that breast feeding was only a function of personal choice. In 27 females, lactation was suppressed by compression and diuretics and in the remaining 20 non breast feeding women, by estrogens (Dienoestrol 3 × 5 mg/day given from the first day of the puerperium until the fifth day).

OGTT were performed on fasted overnight subjects, at 8.00 a.m. on the fifth day after delivery. Blood sugar levels (BS) were determined in the fasting state and 30, 60, 120 and 180 minutes following an oral glucose load of 50 g. Glucose was determined on plasma taken from the antecubital vein by the Auto-Analyzer (version of HOFFMAN's ferricyanide method).

Statistical analysis was carried out according to SCHWARTZ [7]. OGTTs were compared using the t test of Student. However, as blood sugar levels had a distribution of log normal type statistical significances were tested after logarithmic transformation which normalized the distributions and equalized the variances.

## 2 Results

The main characteristics of the group under study are given Tab. I.

Tab. I. General characteristics of the group under study (n = 98)

	Mean	s.e.m.	
Age (years)	29.3	0.5	
Body weight before pregnancy (kg)	57.2	1.0	
Body weight at time of examination (kg)	60.0	0.8	
Height (cm)	159.2	0.6	
Systolic blood pressure (mmHg)	111.6	0.8	
Diastolic blood pressure (mmHg)	68.1	0.7	
Birth weight of the present baby (kg)	3.27	0.1	
Terms (weeks)	40.0	0.2	
	0 mn	81.9	1.0
Observed glucose values during the OGTT (mg/100 ml)	30 mn	109.9	1.6
	60 mn	116.1	2.7
	120 mn	96.4	2.2
	180 mn	75.2	1.1
Peak time (mn)		52.6	2.4

Conditions of lactation suppression were a function of the usual routines of each hospital but not of the medical characteristics of the women. It was verified that demographic (age, socio-professional level)

and ponderal (history of obesity, body weight before pregnancy and after delivery, weight gain during pregnancy) characteristics, and also maternal blood pressure at the time of examination, birth weight and term of the present baby, were not significantly different between the various services. Percentages of breast or non breast feeding women were not significantly different in the three hospitals. Similarly, no systematical difference was found between the groups of breast feeding women and those who did not breast feed, whether they were given estrogen, or not. Lastly, in breast feeding women, the OGTT did not differ significantly in the three hospitals.

Results of the OGTT are checked in Tabs. I, II, III and in Fig. 1. Among the 98 examined women, 81 had a normal OGTT (83%) and 17 (17%) an abnormal OGTT on the basis of  $G_0 < 110$  mg/100 ml,  $G_{120} < 120$  mg/100 ml and  $G_{60} < 160$  mg/100 ml. However, these percentages differed strikingly with the conditions of lactation. Tab. II shows that OGTT were not significantly different in breast feeding and non breast feeding women not given estrogen. Among the 78 women, not given estrogen 7 (9%) had an abnormal OGTT.

However, Tab. III shows that glucose levels were consistently higher in women given estrogen compared to women not given estrogen. Among the 20 patients estrogen receiving, 10 (50%) had an abnormal OGIT. These two percentages differ highly significantly ( $\chi^2$  after Yates correction: 15.9;  $p < 0.001$ ).

Tab. II. Comparison of OGTT in breast feeding women (BFW) and in non-breast feeding, non estrogen treated women (NBFNOW)

		Blood Sugar (mg/100 ml)					Peak time (mn)
		Fasting	30 mn	60 mn	120 mn	180 mn	
BFW (51)	Mean	80.0	106.4	112.0	91.9	73.5	49
	s.e.m.	1.5	2.0	3.6	3.1	1.5	3
	range	60-105	80-145	80-195	60-145	60-100	30-120
NBFNOW (27)	Mean	84.6	111.1	108.0	93.4	73.3	46
	s.e.m.	2.0	3.1	5.9	3.2	1.9	4
	range	65-105	80-140	70-180	65-130	60-100	30-120
P		NS	NS	NS	NS	NS	NS

NS = not significant

Tab. III. Comparison of the OGTT in 20 women receiving estrogens as lactation suppressor and 78 women not receiving estrogens.

		Blood Sugar (mg/100 ml)					Peak time mn
		Fasting	30 mn	60 mn	120 mn	180 mn	
No Estrog. (78)	Mean	82.0	108.1	109.7	92.3	73.4	48
	s.e.m.	1.2	1.8	2.7	2.2	1.2	2.2
	range	60-105	80-145	70-195	60-145	60-100	30-120
Estrog. (20)	Mean	83.1	116.5	138.3	110.2	77.1	66
	s.e.m.	1.9	3.6	6.6	4.8	4.8	5.7
	range	65-110	90-160	100-210	80-150	65-105	30-120
	P	NS	< 0.05	< 0.001	< 0.001	NS	< 0.001

NS = not significant

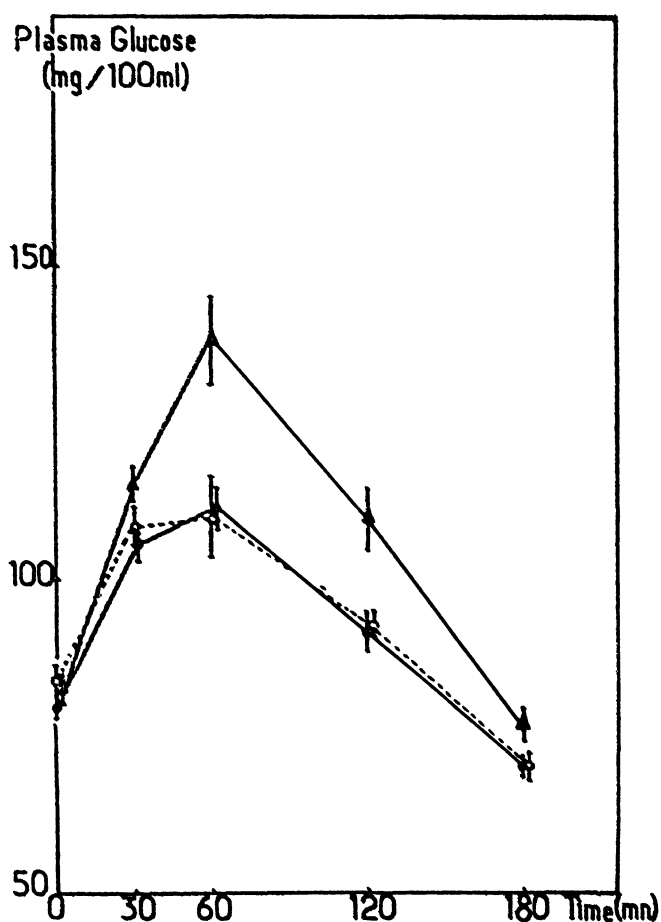


Fig. 1. Results of the OGTT according to the conditions of lactation.

—●— breast feeding women  
 - - -○- - - non breast feeding non estrogen given women  
 —▲— women given estrogen  
 Mean values  $\pm$  s.e.m.

### 3 Discussion

Diagnosis of latent diabetes in the early puerperium is rendered difficult by the lack of data on "normal" values during this period. Taking "normal" values observed in non-pregnant women as a basis for comparison, previous studies of BENJAMIN [2], BURT et al. [4], LOVE and al. [5] demonstrated a high proportion (about 50%) of abnormal OGTT in the early puerperium among groups of women free from any known risk factors of diabetes. Nevertheless, in the studies of BURT and al. and LOVE and al. the conditions of lactation or of its suppression were not considered. Among the 60 women studied by BENJAMIN, 50 received hormonal treatment as lactation suppressor and 10 only were breast feeding. Percentages of abnormal OGTT were 58% among the non breast feeding (always hormonal treatment given) and 30% among the breast feeding women. In fact, the percentage of abnormal OGTT in breast feeding women was estimated with much imprecision because of the low number of patients included in this group.

In the present study, only 9% of non estrogen given women had an abnormal OGTT according to the same criteria. This yields a specificity of 91% which can be considered as good, and was found similar to that of 0-120 min OGTT performed on normal non-pregnant women of the same age class systematically examined in another study [6] (427 women, fasting blood glucose value = 93 mg%

$\pm 0.4 - 2$  hrs Blood Glucose value =  $92 \text{ mg\%} \pm 1.0$ ). However, 50% of the estrogens given women had an abnormal OGTT.

The effect of estrogens on OGTT seems to depend on physiological status and mode of drug prescription [1, 3, 8]. The present study demonstrates a substantial hyperglycemic effect of Dienestrol under the particular hormonal status of early puerperium. Direct comparison with the above cited studies is difficult since only Dienoestrol was

used here. Nevertheless, it is at least very likely that the high percentages of "false positive" OGTT previously reported in the early puerperium were due to an hyperglycemic effect of hormonal treatments given as lactation suppressors.

Thus, the OGTT in the early puerperium could be valuable for the diagnosis of latent diabetes, provided that no hormonal treatment is given to stop lactation. Further studies are needed to test its sensitivity.

### Summary

An oral glucose tolerance test (OGTT) was performed on 98 women free from any known risk factor of diabetes on the fifth day of the puerperium.

Results show that OGTT is greatly influenced by the conditions of lactation. A high proportion of abnormal curves (50%) is found among the group of women receiving estrogens as lactation suppressors at the time of the test.

**Keywords:** estrogens, glucose tolerance, puerperium

However, in breast feeding women or in non breast feeding women not given estrogen, the proportion of abnormal curves is less than 10%.

It is concluded that the unexplained previously reported lack of specificity of the OGTT in the early puerperium could be related to hormonal treatment for lactation suppression.

### Zusammenfassung

#### Östrogene, Laktation und oraler Glukose-Toleranz-Test im Frühwochenbett

Bei 98 Frauen, bei denen keinerlei bekannte Risikofaktoren hinsichtlich eines Diabetes bekannt waren, wurde am 5. Wochenbettstag ein oraler Glukose-Toleranz-Test (OGTT) durchgeführt. Die Ergebnisse zeigen, daß der OGTT erheblich von den Stillbedingungen beeinflusst wird. Ein hoher Prozentsatz von abnormalen Kurvenverläufen (50%) findet man in jener Gruppe von Frauen, die Östrogene zur Verhinderung des Milcheinschusses zum

Zeitpunkt der Testdurchführung bekommen hatten. Bei normal stillenden Müttern und Frauen, die nicht stillten und keine Östrogene erhalten hatten, lag die Rate an abnormalen Testergebnissen bei weniger als 10%.

Es wird der Schluß gezogen, daß der hürzlich mitgeteilte unerklärliche Mangel an Spezifität des OGTT im Frühwochenbett auf die Zufuhr von Hormonen zur Verhinderung des Milcheinschusses zurückgeführt werden kann.

**Schlüsselwörter:** Glukose-Toleranz-Test, Östrogene, Wochenbett.

### Résumé

Oestrogènes, lactation et épreuve d'hyperglycémie provoquée par voie orale dans la période puerpérale.

Une épreuve d'hyperglycémie provoquée par voie orale a été pratiquée chez 98 femmes exemptes de tout risque de diabète connu, le cinquième jour après l'accouchement.

Les résultats montrent que la tolérance aux hydrates de carbone est influencée de manière importante par les conditions de la lactation. Ainsi, une proportion élevée (50%) de courbes anormales est retrouvée dans le groupe de femmes traitées par oestrogènes pour stopper la lactation.

**Mots clés:** Oestrogènes, période puerpérale, tolérance au glucose.

Au contraire, dans le groupe des femmes allaitant ou dont la lactation avait été stoppée par compression et diurétiques, la proportion de courbes anormales est inférieure à 10%.

En conclusion, le manque de spécificité des tests de tolérance aux hydrates de carbone durant la période puerpérale rapporté antérieurement dans la littérature, et jusqu'à présent non expliqué, pourrait résulter de l'usage des oestrogènes pour stopper la lactation.

This work was supported by the Institut National de la Santé et de la Recherche Médicale. We are indebted to

Pr. C. TCHOBROUTSKY M.D., Paris, for her review of this paper.

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Received January 23, 1976. Accepted February 2, 1976

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