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MONITORING FOETO-PLACENTAL FUNCTION IN NIGERIA BY ESTIMATION OF URINARY OESTRIOL

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Summary

Oestriol levels were measured over the third trimester of pregnancy in a group of sixty-one women. Levels increased from a mean of 13.7 mg/24 hr at 27 weeks to 32.6 mg/24 hr at term. Lowest values were recorded from preganacies resulting in babies of under 2.5 kg at birth while the highest values were found in three twin pregnancies. Higher oestriol levels were obtained in this study than in a previous study in Nigeria (Coker & Sanyaolu, 1972).

Résumé

Les niveaux d'oestriol ont été mesuré pendant le troisième trimestre de grossesse dans un groupe de soixante-et-un femmes. Les niveaux se sont élevés d'un moyen de 13.7 mg/24 hr à 27 semaines à 32.6 mg/24 hr à la fin. Les niveaux les plus médiocres ont été enrégistrés dans les grossesses qui ont produit des bébés de moins de 2.5 kg à la naissance tandis que les plus élevés ont été enrégistrés dans trois grossesses qui ont produit des jumeaux. Des niveaux d'oestriol qui ont été enrégistrés dans cette étude sont plus élevés que ceux d'une étude précédante faite au Nigéria (Coker & Sanyaolu, 1972).

Introduction

Urinary oestriol measurement is the most commonly employed method of monitoring foeto-placental well-being. Excreted oestriol is the metabolic end-point of a pathway which begins in the foetal adrenal with the production of dehydroepiandrosterone sulphate. This is converted to oestrogen in the placenta thus reflecting the condition of both compartments in the foeto-placental unit. The oestrogens produced in the placenta are conjugated in the maternal liver and finally excreted in the maternal urine in this form.

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Patients and methods

A group of sixty-one women attending the antenatal clinic of Ife State Hospital was studied. From these patients a total of 180 third-trimester samples were analysed for urinary oestriol.

An aliquot of one thousandth of the 24-hr urine volume was taken for oestrogen estimation using the Kober colorimetric method after Brown, Bull Brock & Greenwood (1957). Urinary creatinine was analysed in all urine specimens to indicate completeness of collection.

Birth weights, placental weights and apgar score were recorded by the labour ward staff at delivery. Results were analysed retrospectively and the study population divided into groups. Normal data were obtained from patients who delivered babies of 2.5 kg and over. Data from other groups of potentially higher risk were obtained with birth weight less than 2.5 kg, placental weight below 0.4 kg and apgar score less than 7.

Results

The data obtained from the normal group are shown in Fig. 1. The small standard deviations obtained at 28 and 37 weeks were due to the small sample size at these times. Mean urinary oestriol levels increased from 13.7 mg/24 hr at 27

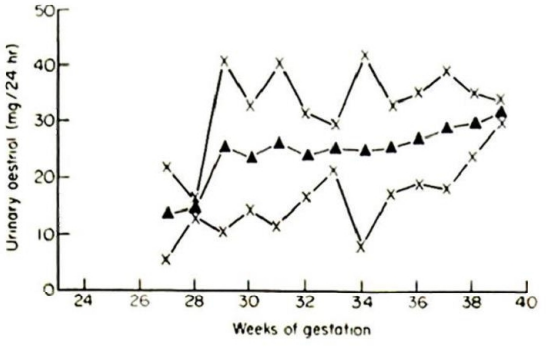

FIG. 1. Urinary oestriol excretion during pregnancy. ▲, Mean; ×, standard deviations, upper and lower limits.

weeks to 32.6 mg/hr at 39 weeks. A sharp increase in mean oestriol levels occurred between 28 and 30 weeks' gestation.

Results obtained from subjects with normal birth weights following the WHO definition (2.5 kg) and normal placental weights (0.4 kg) are shown in Fig. 2. These all fell within the normal

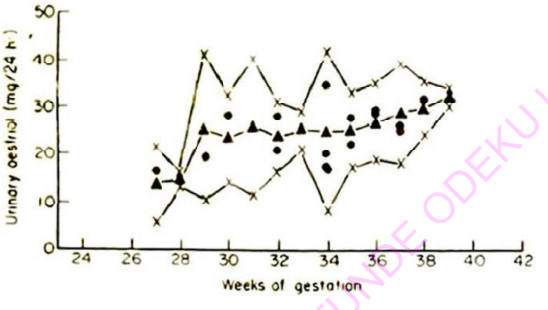

FIG. 2. Distribution of oestriol in twelve patients with normal birthweights (≥2500g) and normal placenta weights (≥400g). ▲, Mean; ×, standard deviation, upper and lower limits; , Results from patients with normal birthweights and normal placental weights.

range. The distribution of oestriol values obtained for four subjects with low birth weights are shown in Fig. 3, with the majority of these falling below the range of normality. Of these four patients, two developed pre-eclampsia and two were anaemic. They delivered at term. Patients with placental weights less than 0.4 kg (Fig. 4) are all below the normal mean but within the normal range; results from a twin pregnancy in which individual placental weights were less than 0.4 kg were above the normal range, as would be expected due to the combined foeto-placental effort producing oestrogen levels equivalent to those of a healthy singleton pregnancy.

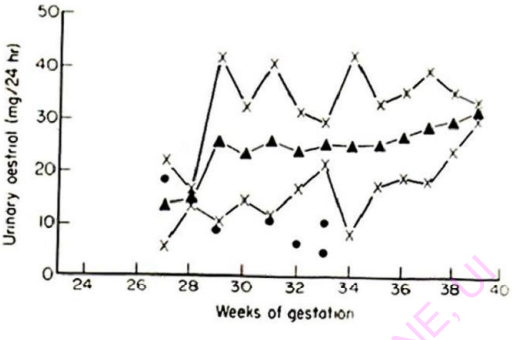

FIG. 3. Distribution of oestriol values in four patients with low birthweights (≤2500g). ▲, Mean; ×, standard deviations; upper and lower limits; , results from patients with low birthweights.

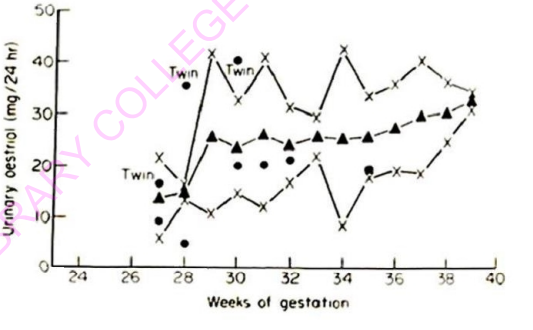

FIG. 4. Distribution of oestriol in five patients with low placental weights (400g). ▲, Mean; ×, standard deviations, upper and lower limits; , results from patients with low placental weights.

Figure 5 shows the results for six pregnancies resulting in babies with low apgar score. No obvious relationship appears to exist between these two parameters.

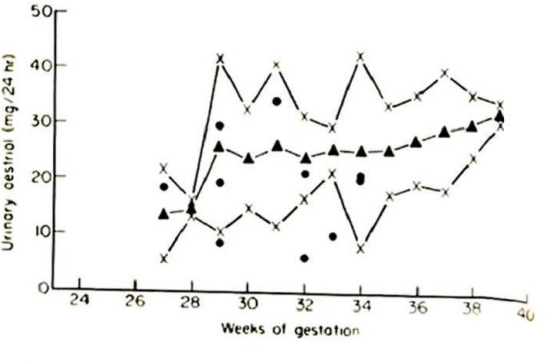

FIG. 5. Distribution of oestriol in six patients with low apgar scores (≤7). ▲, Mean; ×, standard deviation, upper and lower limits; , results from patients with low apgar scores.

Three patients with twin pregnancies were encountered in the study (Fig. 6). Most of the

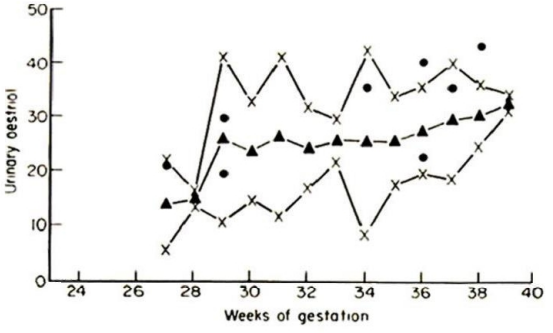

FIG. 6. Distribution of oestriol in three patients with twin pregnancies. ▲, Mean; ×, standard deviation, upper and lower limits. , results from patients with twin pregnancies.

values were above the normal mean but one value at 36 weeks appeared dangerously low.

A group of four multi-gravid patients aged over 35 years gave normal oestriol levels (Fig. 7).

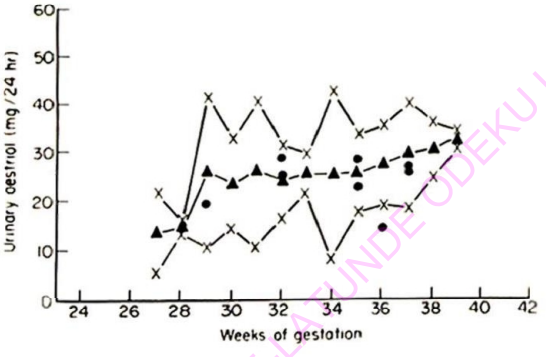

FIG. 7. Distribution of oestriol in four elderly patients (>35 years) ▲, Mean; ×, standard deviations, upper and lower limits; , results from elderly patients (>35 years).

A comparison was made between results obtained in the present study and previous studies on Caucasian women utilizing similar methodology (Figs 8-9). Figure 8 shows the results obtained in Nigeria to be slightly higher than those obtained from a study in Edinburgh (Kellar *et al.*, 1959), and the mean results shown in Fig. 9 are in good agreement with values obtained by Brown (1956, 1959) and Lenters (1958). Although the pattern of steadily increasing oestriol values obtained by the European groups contrasted with the sharp increase in oestriol values at 28–30 weeks in the subjects of present study.

FIG. 8. Comparison of the graph from this study with the Edinburgh oestriol excretion curve. △, Edinburgh oestriol excretion curve obtained by Keller *et al.* (1959); ○, Standard deviations, upper and lower limits. Curve from this study: ▲, mean; × standard deviations, upper and lower limits.

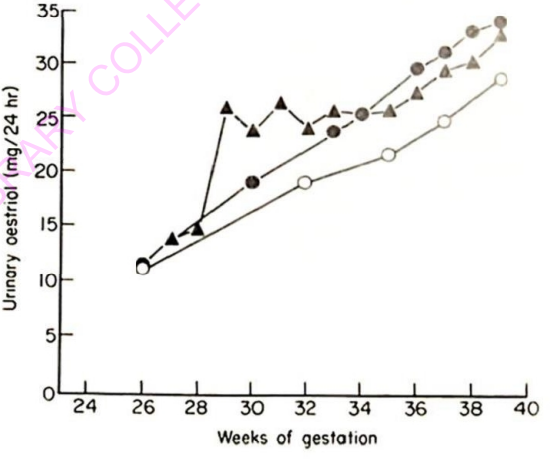

FIG. 9. Mean oestriol excretion levels. ▲, Present study; ●, Lenters (1958); ○, Brown (1955, 1959)

Discussion

This study of urinary oestriol levels in pregnancy in Nigerian women produced a series of results comparable to previous studies utilizing similar methodology conducted in Europe approximately 20 years ago. This is in contrast to a previous study conducted in Nigeria (Coker & Sanyaolu, 1972), in which much lower mean results were obtained; 6.1 mg/24 hr at 27 weeks to 25 mg/24 hr at 39 weeks against 13.7 mg/24 hr at 27 weeks to 32.6 mg/24 hr at 39 weeks in the present study.

It is possible to speculate upon reasons for these differences, amongst which could be:

incomplete 24-hr urine collection — all our patients were hospitalized and total 24 hr urine collected.

A feature of the oestriol excretion curve found in this study is the sudden increase in oestriol levels from 28 to 30 weeks of gestation. This could be a reflection of a more rapidly maturing foetal adrenal in African populations which in turn may be linked to the low incidence of respiratory distress syndrome in African newborns (Olowe & Akinkugbe, 1978) due perhaps to higher corticosteroid levels from the foetal compartment enhancing early lung maturity.

The oestriol excretion patterns observed in the present study demonstrated the low oestriol levels associated with high-risk pregnancies, in particular where poor foetal growth results in low birth weight.

Three patients with twin pregnancies were encountered in the study; these tended to have higher oestriol values than normal singleton pregnancies, in keeping with the high combined foeto-placental weight. In view of the fact that twin pregnancies are a common occurence in Nigeria (Nylander, 1974) early recognition of these pregnancies would be necessary and normal data available for oestriol levels if foeto-placental monitoring by urinary oestriol determination was to prove of value in such cases.

The Kober method employed here, although superseded in both Europe and America, is suitable in Nigeria because of its cheapness and reliability, requiring only basic equipment which could be provided in many centres throughout the country. This would represent a major breakthrough in obstetrical care and undoubtedly improve the perinatal mortality rate and reduce the number of term *in utero* deaths.

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