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Effect of pre-eclampsia on plasma cholinesterase activity

Plasma cholinesterase (PCHE) activity was determined using a colorimetric method in 11 healthy non-pregnant women, 11 healthy pregnant women at term, and 11 pre-eclamptic pregnant women at term. The mean plasma cholinesterase activities for healthy non-pregnant women, healthy pregnant women and pre-eclamptic pregnant women were 438 ± 81 , 257 ± 25 and 173 ± 18 units \cdot ml⁻¹, respectively. Our data suggest that there is a significant reduction in plasma cholinesterase activity in pre-eclamptic pregnant women when compared to healthy non-pregnant ($p < 0.001$) and healthy pregnant women ($p < 0.001$).

There is a decrease in plasma cholinesterase activity during pregnancy.¹⁻³ However, previous studies have provided conflicting data regarding plasma cholinesterase activity in pre-eclamptic pregnancies.³⁻⁴ Hepatic dysfunction is known to cause a decrease in cholinesterase activity.^{5,6} Pre-eclamptic pregnancy is associated with significant hepatic dysfunction.^{7,8} Magnesium sulfate is frequently used to prevent and treat convulsions in pre-eclamptic pregnant patients. Data concerning the effect of magnesium on succinylcholine duration of action have been conflicting.⁹⁻¹² In pre-eclamptic patients, magnesium is known to cause prolongation of succinylcholine duration of action, whereas in healthy non-pregnant patients, magnesium has been shown to have no effect on succinylcholine duration of action. However, the prolongation of action of succinylcholine in the presence of magnesium in pre-eclamptic patients could be explained if there is a significant reduction in plasma

cholinesterase activity. Therefore, we studied plasma cholinesterase activity in pre-eclamptic pregnancy.

Methods

With the approval of our Institutional Human Protection Committee, we studied 11 healthy non-pregnant women (ages 20-34), eleven healthy pregnant women at term (ages 18-35), and 11 pre-eclamptic pregnant women at term (ages 18-40). Six ml of heparinized blood was collected from each patient and the plasma was separated for cholinesterase assay. All the blood samples were drawn at the time of admission before patients received any fluids or medications.

A colorimetric method was used in the determination of plasma cholinesterase activity.¹³ The reaction system consisted of sodium phosphate buffer containing dithiobis-nitrobenzoic acid (DTNB) and acetylthiocholine iodide. Dibucaine numbers were determined using a 0.1 mM concentration of the enzyme inhibitor in the final reaction medium. Readings were observed for 5 min at 410 nm in a Beckman Model 24 recording spectrophotometer at 24°C. Duplicate cholinesterase activities were measured for each patient plasma and mean of the two results was reported.

Plasma cholinesterase activity is expressed as units \cdot ml⁻¹ of plasma. One unit of plasma cholinesterase activity corresponds to the liberation of 1.0 micromol of thiocholine per minute under the conditions of enzyme assay. Data were analyzed for statistical significance by using a Student's t test (two tailed p-value) with a Bonferroni correction for three test groups.

Key words

PREGNANCY: normal; pre-eclampsia; ENZYME: plasma cholinesterase, PCHE.

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Presented at the 61st Congress of the International Anesthesia Research Society, March, 1987, Orlando, Florida.

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Results

The means and SD of plasma cholinesterase activity of all the patients (healthy non-pregnant, healthy pregnant at term and pre-eclamptic pregnant women at term) are shown in the Table. Plasma cholinesterase activity of healthy pregnant women was 41 per cent lower when compared to healthy non-pregnant women. There was a 60 per cent decrease in plasma cholinesterase activity in pre-eclamptic pregnant when compared to normal non-pregnant women, and 32 per cent decrease when compared to normal pregnant women. The dibucaine numbers (DN) of all the samples were in the normal range (78-90).

TABLE Plasma cholinesterase activity (Mean* \pm SD) in normal non-pregnant, normal pregnant at term and pre-eclamptic pregnant at term

Subjects	n	Units·ml ⁻¹
Healthy non-pregnant	11	438 \pm 81
Healthy pregnant	11	257 \pm 25
Pre-eclamptic pregnant	11	173 \pm 18

*Means differ significantly from one another ($p < 0.001$, two tailed t test with Bonferroni's correction).

Discussion

Plasma cholinesterase is a mucoprotein produced in the liver which is responsible for most of the recovery from muscle paralysis produced by succinylcholine. Plasma cholinesterase is also responsible for the hydrolysis of ester type local anaesthetics including procaine, chlorprocaine and tetracaine.

Data from several investigators agree that plasma cholinesterase activity declines during normal pregnancy. Tourtellotte and Odell reported in 1950 that there is a decrease in plasma cholinesterase activity in pre-eclamptic pregnancy when compared to normal pregnancy. However, Pritchard in 1955 reported that there is no significant difference in plasma cholinesterase activity between normal and pre-eclamptic pregnant patients. This disagreement could be due to the different techniques they used to measure plasma cholinesterase activity.

The mechanisms for a decrease in plasma cholinesterase activity in normal and pre-eclamptic pregnancies have not been elucidated. Various explanations including haemodilution, hepatic dysfunction, and hypoalbuminaemia were offered as possible mechanisms for the decrease in plasma cholinesterase activity in pregnancy. Viby-Mogensen reported in 1980 that it is possible to predict the duration of apnoea and time to 100 per cent twitch recovery following the administration of succinylcholine, utilizing correlation with plasma cholinesterase concentration.¹⁴ Prolongation of apnoea from succinylcholine was noted by investigators in the presence of low plasma cholinesterase activity in normal pregnancy.^{1,15} We recommend the use of a peripheral nerve stimulator when succinylcholine is administered to pre-eclamptic pregnant women, especially in multiple doses or in a continuous drip form.

In conclusion, our data confirm that both normal and pre-eclamptic pregnancies are associated with a significant decrease in plasma cholinesterase activity ($p < 0.001$). Our data also show that there is a significant decrease in plasma cholinesterase activity in pre-eclamptic pregnant women when compared with normal pregnant women ($p < 0.001$).

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Résumé

On a déterminé l'activité de la cholinestérase plasmatique chez 11 femmes en santé, 11 femmes en santé étant au terme de leur grossesse, et 11 femmes prééclampsiques étant au terme de leur grossesse, en utilisant une méthode colorimétrique. L'activité moyenne de la cholinestérase plasmatique pour les femmes en santé, les femmes enceintes en santé et les femmes enceintes prééclampsiques était de 438 ± 81 , 257 ± 25 et 173 ± 18 unités par ml, respectivement. Nos données laissent entendre que l'activité de la cholinestérase plasmatique est réduite de façon significative chez les femmes enceintes prééclampsiques en comparaison à celle des femmes en santé ($p < 0.001$) et à celle des femmes enceintes en santé ($p < 0.001$).