Alkaline phosphatase is normally found in many parts of the body, including the bones, kidneys, liver, and intestines. The enzyme is also found in the blood serum and leukocytes. Higher levels of serum alkaline phosphatase are encountered in various bone and liver diseases and pregnancy. WACHSTEIN [17] in 1946, was the first to describe an increase in leukocyte alkaline phosphatase (LAP) in some types of myeloproliferative disorders. Marked increase of LAP activity has been observed in several pathologic conditions such as polycythemia vera [13], acute infectious processes [4, 6, 15], stress conditions [14], trauma and hemorrhage [16].

Higher levels of LAP activity were also found in newborn infants [8] and after adrenocortical hormone administration [14, 16]. Leukocyte alkaline phosphatase (LAP) in pregnancy increases until term [1, 2, 9, 11, 12] and decreases a few days before labor, returning to nonpregnant levels within 6 weeks post partum [9]. It was shown that LAP in pregnancy is not of placental origin but is under the influence of placental hormones and thus reflects placental function. The LAP score is probably determined by the balance of estrogen and progesterone secreted by the placenta [9].

In the immediate neonatal period the infant is still under the influence of maternal hormones, under the stress of labor, and other factors. The LAP of the newborn infant will reflect these influences.

The aim of the present study was to determine the LAP score of the newborn infant at delivery and during the first days of the puerperium and compare it with maternal LAP scores, and to evaluate the possibility of other factors such as the weight of the infant, influencing the infant’s LAP score.

1 Material and methods

LAP activity was studied in 60 women and their 61 infants (one pair of twins) at and after delivery. There were 58 deliveries at term and two in the 8th month. These included two cases of pre-eclampsia, one case of placenta previa, two cases of postmaturity, five cases of hypotonic uterine dysfunction, and two cases of post partum hemorrhage. Of the 61 infants, there were 33 females and 28 males. There was one case of Rh incompatibility and one case of congenital heart disease.

Peripheral blood smears were taken from the mothers at delivery — 60 cases, on the 1st day after delivery — 31 cases, on the 3rd day — 55 cases, and on the 5th day — 14 cases. Blood smears from the infants were taken at delivery from the umbilical cord and by heel prick in 61 cases, and subsequently only by heel prick: On the 1st day after delivery — 46 cases, on the 3rd day — 59 cases, and on the 5th day — 14 cases.

LAP scoring was done in all cases after fixation and staining of the blood films by the KAPLOW
method [5]. One hundred consecutive segmented 
and band form granulocytes were graded from 
0 to 4 according to the intensity and quantity of 
the precipitated dye within the cytoplasm, 
through pale pink to heavy granular precipitate. 
The sum of the grades represents the LAP score, 
and the possible range is from 0 to 400.

2 Results

Fig. 1 shows the maternal values of the LAP 
scores and averages at delivery and on the first, 
third and fifth day after delivery. The average 
of maternal LAP score decreases from 175 
at delivery to 87 on the fifth day (p < 0.01). 
Fig. 2 shows the newborn infants LAP scores on 
the same days. The average LAP scores at 
delivery is 149, decreasing to 87 on the fifth 
day after delivery (p < 0.01).

Fig. 3 compares the average LAP scores of 
maternal and newborn infants after delivery. It 
shows that the maternal LAP scores at delivery 
are usually higher than that of the newborn 
infant (p < 0.01), both decreasing during the 
following days reaching equal values on the 
fifth day.

Tab. I shows the LAP scores of the newborn at 
delivery as compared to those of the mothers. 
Most maternal and infants LAP scores, 50 of the 
60 cases — (83%) — at delivery were between
121 and 240. In 48 out of 60 cases, the LAP scores of the newborn infants were lower than those of the mothers. In only five cases was the infant’s LAP score higher than that of the mother.

Tab. II shows no significant difference in LAP scores of the newborn at delivery, between heel prick peripheral blood and umbilical blood (p < 0.01).

Tab. III shows the LAP score of the newborn at delivery in three groups according to the birth weight. It was found that the higher the birth weight, the lower the LAP score. The average LAP score in Group B is lower than in Group A (p < 0.025). The average LAP score in Group C is lower than in Group B. However, the small number of cases in Group C does not permit statistical evaluation. The difference between Groups C and A is significant (p < 0.025).

3 Discussion

We have confirmed the fact shown by others [7, 8, 18] that the maternal and newborn LAP scores are elevated at delivery, with the maternal values higher than those of the infants and both decrease after delivery [8, 9]. It is most probable that the LAP activity of the mother and of the fetus in utero is under the control of steroids produced by the placenta [10]. It is also possible that the stress of labor resulting in increased corticoid blood levels is an additional factor contributing to the elevation of the infants LAP score [16].

HALBRECHT and SHABTAY [3] suggested that the high LAP activity in the newborn is related to the infant’s metabolism and not to the placental hormones. The decrease of the maternal and infant LAP activity is explained by the delivery of the infant and the expulsion of the placenta.

The lower LAP activity in the newborn, as compared with that of the mother, could be explained by the lower hormonal levels in the fetus or possibly by a lower response of fetal granulocytes compared with the maternal granulocytes. Against this latter suggestion is the fact that on the 5th day after delivery the maternal and newborn LAP values are equal.
We have no explanation for our findings that LAP activity is inversely related to the weight of the newborn at delivery. OKELL [7], however, found that the LAP activity was directly related to the weight. HALBRECHT [3] did not find any correlation between LAP score and infants weight.

No correlation was found between the LAP score in the newborn and the sex, race, blood type or complication of labor [7, 8].

Summary

Leukocyte alkaline phosphatase (LAP) activity increases progressively during pregnancy, returning to non-pregnant levels 6 weeks post-partum. This enzymatic activity is under the influence of placental steroid hormones, thus reflecting placental function. LAP activity is thus a reflection of the dynamic relations between estrogenic, progestational and corticoid activity during pregnancy. LAP activity was studied in 60 women and in their 61 newborn infants at delivery and during the first five days of the puerperium. The KAPLOW cytochemical technique was employed.

The average maternal LAP score as well as the average newborn infant LAP score was considerably higher than the LAP score of the normal adult. The level of the enzyme in the maternal granulocytes was significantly higher than that of the newborn (Tab. I).

During the first five days after labor, there was progressive decrease in the LAP score in the maternal and the newborn blood; on the fifth day the LAP scores of both were only slightly above the normal adult score (Figs. 1, 2).

An inverse relation between the LAP score and the birth weight of the infant was found (Tab. III).

These results confirm the view that LAP activity in the fetus in utero, are dependent on placental steroid function. The lower LAP values in the newborn, as compared to those of the mother are probably dependent on the lower newborn hormone levels.

The significance of the relation between LAP scores and the infants birth weight is not clear.

Keywords: Newborn, leukocyte alkaline phosphatase, puerperium.

Zusammenfassung


Es wurde die LAP-Aktivität bei 60 Frauen und ihren 61 Neugeborenen bei der Entbindung und während der ersten 5 Tage des Wochenbettes bestimmt. Dabei wurde die cytochemische Methode von KAPLOW angewandt.


Während der ersten 5 Lebenstage fiel der LAP-Wert im mütterlichen und kindlichen Blut allmählich ab. Am 5. Tag lagen die LAP-Werte von beiden nur etwas über dem Normalwert bei Erwachsenen (Figs. 1, 2).

Es wurde eine umgekehrt proportionale Beziehung zwischen dem LAP-Wert und dem Geburtsgewicht des Kindes gefunden (Tab. III).

Die Ergebnisse bestätigen die Annahme, daß die LAP-Aktivität beim Fetus in utero von der plazentaren Steroidfunktion abhängt. Sind die LAP-Werte beim Neugeborenen verglichen mit denen bei der Mutter niedriger, hängen sie wahrscheinlich vom niedrigeren Hormonspiegel des Neugeborenen ab.

Die Signifikanz der Beziehung zwischen den LAP-Werten und dem Geburtsgewicht der Kinder ist nicht klar.

Schlüsselwörter: Alkalische Leukozytenphosphatase, Neugeborenes, Wochenbett.

Résumé

Phosphatase alcaline de leucocytes chez les nouveau-nés après la naissance et dans la période puerpérale. L'activité de la phosphatase alcaline de leucocytes (LAP) augmente progressivement durant la grossesse et atteint à nouveau son degré normal six semaines après la naissance. Cette activité enzymatique est soumise à l'influence des hormones stéroïdes placentaires, reflétant ainsi la fonction placentaire. L'activité LAP reflète donc les relations dynamiques entre l'activité des oestrogènes, des progestérones et des corticoides durant la grossesse.

L'activité LAP a été observée chez 60 femmes et chez leurs 61 nouveau-nés durant l'accouchement et les cinq premiers jours de la période puerpérale, avec recours à la technique cytochimique de KAPLOW.

Le score LAP moyen des mères ainsi que des nouveau-nés s'est révélé beaucoup plus élevé que chez l'adulte normal.

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Le niveau de l’enzyme était nettement supérieur dans les granulocytes maternels que chez le nouveau-né (Tab. I). Durant les 5 premiers jours suivant l’accouchement, on a pu observer une baisse progressive de la score LAP dans le sang maternal et du nouveau-né; le 7ème jour, il ne dépassait plus que légèrement dans les deux cas celui des adultes normaux (Figs. 1, 2).
Un rapport inverse a été enregistré entre le score LAP et le poids du nouveau-né à la naissance (Tab. III).

Mots-clés: Nouveau-né, période puerpérale, phosphatases alcalines de leucocytes.

Bibliography


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