

Comparison Between Postpartum Lactate Concentration in the Umbilical Artery and Apgar Score

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ABSTRACT

Postpartum lactate concentration in the umbilical arteries was measured in 237 patients by means of the enzymatic method, using the lactic acid (LA) pack in the Du Pont Automatic Clinical Analyzer. Blood samples were taken immediately postpartum and Apgar scores were determined at one and five minutes, whereby the lactate level in the umbilical artery was found to be higher than the normal adult level (0.6-2.2 mmol/l). The lowest level was 1.1 mmol/l and the highest was 7.7 mmol/l, with a mean of 3.26 mmol/l, and a standard deviation of 1.36. It was also found that in 184 patients the lactate concentration was less than the mean and only one newborn had an Apgar score of less than 7 at five minutes. In 53 patients, the lactate concentration was more than the mean and 13 newborns had an Apgar score of less than 7 at five minutes. When comparing the frequency of low Apgar scores (less than 7) at five minutes in the two groups (above and below the mean), using the Z-score, there was a statistically significant difference ($P < 0.01$). Using the lactate level as a method of assessing the newborn in comparison with the Apgar score, the sensitivity was 92.86% and the specificity was 82.06%.

The most frequently used systems for the assessment of the newborn are Apgar score and umbilical cord blood gases. Normally, the foetus uses the aerobic pathway to generate energy and ATP; in case of inadequate foetal oxygenation, the anaerobic pathway of energy production is used and lactic acidosis is generated and the foetal pH falls. Lactate dehydrogenase is a key enzyme in anaerobic metabolism, lactate is synthesised from pyruvate in a reaction catalysed by this enzyme. Tissue hypoxia activates lactate dehydrogenase and lactate production increases in close relationship with the degree of oxygen deficiency.¹

The level of blood lactate has been considered to be

a good parameter for evaluating the presence and severity of foetal distress, since the lactate level rises rapidly in response to a variety of stimuli, such as catecholamine release, respiratory or metabolic alkalosis and particularly, hypoxemia.^{2,3}

Traditionally, Apgar score and cord blood gases have been used in delivery rooms to assess newborns. Measurement of postpartum umbilical artery lactate level by using the enzymatic method is a very simple, inexpensive and non-invasive method. The simplicity, availability and low costs make this method a valuable alternative for the assessment of newborns.

In this paper, we compare postpartum lactate concentration in the umbilical artery with Apgar score at five minutes.

METHODS

Patients were selected randomly from the delivery room at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Patients with high risk pregnancies, including multiple gestation and patients taking any medication during pregnancy were excluded. The only medications permitted during labor were intravenous fluids in the form of 5% dextrose in 0.9% normal saline at a rate of 125-150 cc/hour, analgesia in the form of pethidine 100 mg and promethazine hydrochloride 25 mg IM, (two doses only) and oxytocin, 1-2 mU/min, not exceeding 20 mU/min. All patients who entered the study were between 37 and 42 weeks gestation, which was determined by either a certain last menstrual period and/or an early ultrasound.

A total of 237 patients qualified to enter the study. Two to 5 mls of blood were taken from the umbilical artery immediately after delivery and placed in a tube containing sodium fluoride and potassium oxalate. The blood samples were centrifuged within 15 minutes of drawing and the analysis was performed on separated plasma. The lactate

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Table 1
Lactate concentration versus gestational age and Apgar scores

	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	\pm	<i>SD*</i>
Lactate concentration (mmol/l)	1.1	7.6	3.26	\pm	1.36
Gestation age (weeks)	37	42	38.62	\pm	0.74
Apgar score	3	10	8.31	\pm	1.39

*SD = Standard Deviation

was measured quantitatively in the plasma, using the LA pack in the Du Pont Automatic Clinical Analyzer (ACA). The enzymatic method selected for the ACA has a greater specificity than chemical oxidation procedures.^{4,5} The Z-score was used for statistical analysis.

RESULTS

A total of 237 patients entered the study. Table 1 shows the minimum and maximum values, mean and standard deviation of lactate concentration in the umbilical artery, gestational age in weeks and Apgar score at five minutes.

Patients were divided into two groups according to the level of postpartum lactate in the umbilical artery.

Group 1: 184 patients

Postpartum lactate concentration in the umbilical artery in this group was less than 3.26 mmol/l (which represents the mean), and only one newborn had an Apgar score of less than 7 at five minutes.

Group 2: 53 patients

Of this group in which the postpartum lactate concen-

tration in the umbilical artery was more than 3.26 mmol/l, 13 newborns had an Apgar score of less than 7 at five minutes.

When comparing the frequencies of occurrence of low Apgar scores at five minutes (<7) with the postpartum lactate concentration in the umbilical artery in both groups (Table 2) by means of the Z-score, it was found that there was a statistically significant difference of $p < 0.01$.

However, when using sensitivity and specificity, the following results were found:

$$\begin{aligned} \text{Sensitivity} &= \frac{\text{True +ve}}{(\text{True +ve}) + (\text{False -ve})} \times 100 \\ &= \frac{13}{13 + 1} \times 100 \\ &= 92.86\% \end{aligned}$$

$$\begin{aligned} \text{Specificity} &= \frac{\text{True -ve}}{(\text{True -ve}) + (\text{False +ve})} \times 100 \\ &= \frac{183}{183 + 40} \times 100 \\ &= 82.06\% \end{aligned}$$

Table 2
Comparison of Apgar score at 5 minutes with postpartum lactate concentration in the umbilical artery

Group 1		
Negative Test	False -ve	True -ve
LC < 3.26	AS (5) < 7	AS (5) > 7
184	1	183
Group 2		
Positive Test	True +ve	False +ve
LC < 3.26	AS (5) < 7	AS (5) > 7
53	13	40

AS (5) = Apgar score at five minutes

L = Lactate concentration in mmol/l

Z = 4.04, $p < 0.01$

DISCUSSION

At birth, Apgar score is used to assess neonatal condition and is frequently correlated with the data obtained by the foetal monitoring technique. It is described originally as the method for determining the condition of the neonate at birth, and it has gained prominence as a primary measure of the outcome of labor and delivery, including expected paediatric status, especially after it was found that the Apgar score can be correlated with cord blood gases.⁶ In this study, this was the reason why we elected to compare Apgar score with postpartum lactate concentration in the umbilical artery.

We chose to measure the lactate level, as in case of hypoxia, the foetus will use the anaerobic pathway to produce energy, which will lead to lactic acidosis.¹ The umbilical artery was chosen because it comes directly

from the foetus and reflects accurately its metabolism. Several studies have shown that there are many factors which alter lactate concentration in the umbilical artery.¹⁻⁵ We endeavored to avoid these factors by excluding high risk pregnant women and those taking medication other than the aforementioned ones.

Our study showed that the lactate concentration in the umbilical artery is higher than the normal adult lactate level (0.6-2.2 mmol/l), the mean being 3.26 mmol/l with a standard deviation of 1.36 mmol/l.

When comparing the frequency of low Apgar score at five minutes of those newborns with a lactate level in the umbilical artery which was above the mean, with those below the mean, it was found that the difference was statistically significant ($p < 0.01$).

CONCLUSION

When trying to use the lactate level in the umbilical artery as a method for assessment of the newborn, it was found that if the lactate level was below the mean ($N=184$), 183 newborns had an Apgar score of more than 7 at five minutes, but if it was above the mean, only 13 out of 53 neonates had an Apgar score of less than 7; this would indicate that factors other than acidosis might contribute to the rise in the level of lactate in the umbilical artery, we could conclude that if postpartum lactate concentration in the umbilical artery was used as a test for assessment of the newborn, the result would be fairly sensitive (sensitivity = 92.86%), but not specific (specificity = 82.06%).

Further studies are needed to compare cord blood gases with postpartum lactate concentration.

REFERENCES

1. Eguiluz A, Bernal AL, McPherson K, Parilla JJ, Abad L. The use of intrapartum fetal blood lactate measurements for the early diagnosis of fetal distress. *Am J Obstet Gynecol* 1983;147:949-54.
2. Du Pont Company. Test Methodology for the lactic acid pack in the Du Pont Automatic Clinical Analyzer (ACA) to quantitatively measure l-lactate in plasma, protein free blood filtrates, or spinal fluid. Wilmington: Du Pont Company, 1982.
3. Henry RJ, Cannon DC, Windleman JW. Clinical chemistry principles and techniques. New York: Harper and Row, 1974:1331-3.
4. Soothill PW, Nicolaides KH, Rodeck CH, Clewell WH, Lindridge J. Relationship of fetal hemoglobin and oxygen content to lactate concentration in Rh isoimmunized pregnancies. *Obstet Gynecol* 1987;69:268-71.
5. Cano A, Martinez P, Parilla JJ, Abad J. Effects of intravenous ritodrine on lactate and pyruvate levels: role of glycemia and anaerobiosis. *Obstet Gynecol* 1985;66:207-10.
6. Silverman F, Suidan J, Wasserman J, Antoine C, Young BK. The Apgar score: is it enough? *Obstet Gynecol* 1985;66:331-6.