

***Lactate and S100 protein* …. 132**

**Original Article**

**Lactate and S100 protein as early biochemical indicators of birth neonatal asphyxia caused by intrauterine umbilical cord strangulation: a medicolegal view**

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## ABSTRACT

**Background**: From a forensic pathologist’s perspective, there are several aspects of the perinatal postmortem that are particularly important if the baby was born alive or dead. If the infant is delivered alive and dies a few hours or days later, access to the obstetric and neonatal notes is required to achieve a correct interpretation and conclusion in situations of perinatal morbidities occurring in hospitals. After prenatal hypoxia, hypoxic ischemic encephalopathy (HIE) is a common cause of neonatal morbidity and long-term neurological disability. It has many causes including intrauterine strangulation by umbilical cord (nuchal cord). Failure of early diagnosis of neonatal asphyxia and its treatment is considered a medicolegal negligence against the doctors. **Aim**: The present study aimed to use cord blood lactate & S100 protein levels as early markers of neonatal hypoxia caused by nuchal cord to minimize the risk of medicolegal liabilities against the doctors and hospitals. **Methods**: This is a comparative cross-sectional study carried out 30 hypoxic neonates due to intrauterine cord strangulation. Lactate & S100 protein levels in the cord blood were evaluated. As a control group, 30 apparently healthy neonates were compared in age, sex, and body weight. **Results**: Lactate & S100 protein levels in cord blood were a higher significant difference in HIE neonates than control group. **In conclusion**: lactate & S100 protein levels in cord blood could be used as an early marker for diagnosis of neonatal HIE.

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**Key words**: Hypoxic, ischemic, encephalopathy, Nuchal cord, Lactate, S100 protein.

## INTRODUCTION

With a reported prevalence of 100-250/1000 live births in the poor countries, birth asphyxia is a major cause of infant illness and mortality (Lawn et al., 2009). Birth asphyxia is the world's main cause of premature neonatal death, accounting for 23% of all neonatal deaths. Every year, between 4 and 9 million babies are born, of which 1.2 million die and a similar number acquire serious neuro-disabilities such as cerebral palsy, epilepsy, and developmental delay (Manandhar and Basnet, 2019).

A typical umbilical anomaly in men is the umbilical cord around the neck, known as the nuchal cord. It has been found in 23-37 percent of human pregnancies, with the rate increasing as the pregnancy progresses. (Clapp et al., 2003). Nuchal cords can be single or multiple in number, as well as tight or loose. The placental end of the [Type A] cord crosses over the umbilical end, entangling the neck in an unlocked pattern, whereas the cord in the [Type B] pattern cannot be undone and ends up as a real knot. The placental end crosses under the umbilical end, entangling the neck in a locked pattern (Collins, 2002).

Multi-organ damage and cardiovascular failure were major outcomes of perinatal hypoxia. Postnatal neurological impairment may be caused by myocardial injury, right ventricular dysfunction, abnormal circulatory transition, and defective autoregulation. As a result, adequate monitoring and specific therapy are required following an asphyxial insult (Kluckow, 2011).

When tissue perfusion is poor and hypoxia is present, lactate is produced invariably. If the clinical reduction of oxygen and substrate delivery occurs, the aerobic metabolism through Krebs cycle cannot be persisted and tissues must rely on anaerobic metabolism to supply their energy needs. This causes an increase in blood lactate results in its accumulation and reflects tissue hypoxia (Jin et al., 2013). Once produced prenatally, the placenta excretes it. During neonatal period liver and kidneys control its excretion. Lactate analysis, when compared to pH, offers equivalent or greater predictive characteristics in identifying short-term newborn morbidity (Borruto et al., 2008).

The S-100 protein is a calcium binding protein detected in astroglial cells in excessive quantities. In neuronal development, outgrowth, and death, it regulates calcium-dependent signalling. In many CNS disorders, it is thought to be an indication of glial activation and/or death (Sedaghat and Notopoulos, 2008).

According to studies, there is a link between the severity of neuronal injury and the concentration of S100, which has sparked a renewed interest in S100 in asphyxiated babies. However, just a few papers have examined  brain injury biomarkers in umbilical cord blood samples taken at birth (Wirds et al., 2003; Gazzolo et al., 2009; Michetti et al., 2012).

Pregnant women are concerned about the possibility of developing a nuchal chord. The level of concern varies depending on their education, but in general, moms believe that the nuchal cord is to blame for the newborn's poor growth. As a result, moms who have a newborn with a nuchal cord and delayed development blame midwives and obstetricians and seek legal dispute, claiming everything from compensation to an occupational ban (Kong et al., 2015).

For this medicolegal aspect, the current study was designed to use cord blood lactate &

S100 protein levels as early markers of neonatal hypoxia caused by nuchal cord to reduce the risk of medicolegal negligence & liability against the doctors.

1. **CONFLICTS OF INTEREST**:

The authors of the study declared that there are no conflicts of interest.

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**الملخص العربي**

**اللاكتات وبروتين اس100 كمؤشر بيوكيميائي مبكر لاختناق الأطفال حديثي الولادة عن طريق خنق الحبل السري داخل الرحم:**

**وجهة نظر طبية قانونية**

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**مقدمة البحث**: من وجهة نظر إختصاصي الطب الشرعي ، هناك العديد من الجوانب ذات أهمية عن الوفاة خاصة في الفترة المحيطة بالولادة إذا ولد الطفل حياً أو ميتاً. في حالات التقاضي بشأن أمراض الفترة المحيطة بالولادة التي تحدث في المستشفيات ، من الضروري الوصول إلى ملاحظات التوليد وحديثي الولادة إذا ولد الطفل على قيد الحياة وتوفي بعد بضع ساعات أو أيام للوصول إلى تفسير واستنتاج صحيحين. ولقد يعد اعتلال الدماغ الإقفاري بنقص الأكسجين ما قبل الولادة سببًا هاما لأمراض الأطفال حديثي الولادة والإعاقة العصبية طويلة الأمد. و له العديد من الأسباب بما في ذلك الخنق داخل الرحم بواسطة الحبل السري. ويعتبر عدم التشخيص المبكر للاختناق الوليدي وعلاجه إهمالاً طبياً قانونياً تجاه الأطباء. **الهدف من البحث**: هدفت الدراسة الحالية إلى استخدام قياس مستويات بروتين اس 100واللاكتات داخل دم الحبل السري و كدلائل مبكرة لنقص الأكسجين فى الاطفال حديثي الولادة الناجم عن الحبل القفوي لتقليل مخاطر المسؤوليات الطبية القانونية ضد الأطباء والمستشفيات. .**طريقة** **البحث :** وتم اجراء هذه الدراسة على ثلاثون من الاطفال حديثي الولادة الذين يعانون من نقص الأكسجة بسبب خنق الحبل السري لقياس مستويات بروتين اس 100 واللاكتات في دم الحبل السري. تمت مقارنة هؤلاء مع ثلاثين حديثي الولادة الذين يتمتعون بصحة جيدة على ما يبدو متطابقين في العمر والجنس ووزن الجسم كمجموعة ضابطة. **النتائج:** وقد وجدت هذه الدراسه انه يوجد ارتفاع ذو دلالة احصائية في مستوي بروتين اس 100 و اللاكتات داخل دم الحبل السري فى حديثي الولادة الذين يعانون من نقص الاكسجين نتيجة خنق الحبل السري بالمقارنة مع المجموعة الضابطة. **الخلاصة**: خلصت هذه الدراسة إلي أنه من الممكن استخدام نسبة بروتين اس 100 و اللاكتات داخل دم الحبل السري كمؤشر حيوي مبكر لتشخيص الاعتلال الدماغي لنقص الاكسجين في حديثي الولادة. **التوصيات**: في ضوء نتائج الدراسة الحالية ، نوصي باستخدام بروتين اس 100 واللاكتات في دم الحبل السري كعلامات مبكرة للاختناق الوليدي الناجم عن الحبل القفوي لأنها بسيطة وغير جراحية ورخيصة. كذلك ، ينبغي إجراء مزيد من الدراسات حول مؤشر حيوي مفيد آخر للكشف المبكر عن الاختناق الوليدي.