



Acidemia in the fetus: A review

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ABSTRACT

Introduction:

The acid-base balance plays an important role in maintaining the health of an organism. The concept of acid-base balance signifies the retention of H⁺ concentration homeostasis in body fluids. A slight deviation from the natural values causes severe changes in the rate of chemical reactions of cells, changes that can endanger the life of the organism.

Methods: Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) data bases for related studies from the inception of the data bases to September 2017 (with out time limitation) in English and Persian languages.

Discussion: Although one of the main causes of fetal acidemia is a decrease in placental-uterine perfusion, several studies have discussed the possible effects of other factors. One of these factors is oxytocin, which is widely used to induce or accelerate the process of labor during labor procedures. Studies on the effects of oxytocin on umbilical cord blood gases have reported controversial findings. Based on the results of See et al study, which was conducted to evaluate the effect of oxytocin administration on umbilical cord blood gases, the mean arterial blood pH was lower in oxytocin-treated patients in comparison with other subjects.

KEY WORDS: Acidemia, fetus, review

INTRODUCTION:

The acid-base balance plays an important role in maintaining the health of an organism. The concept of acid-base balance signifies the retention of H⁺ concentration homeostasis in body fluids. A slight deviation from the natural values causes severe changes in the rate of chemical reactions of cells, changes that can endanger the life of the organism. The accumulation of high H⁺ levels causes its binding to cellular proteins which, in turn, generates changes in electrical charge, shape and sometimes their function (1). Therefore, accurate control of the concentration of H⁺ is very important in the body. Acid- base hemostasis is naturally under the strict regulation of the CO₂ pressure in the body, which is managed through respiratory tract; additionally, the concentration of plasma bicarbonate is regulated by the renal excretion. PH determines the degree of a solution's being acid or base; additionally, PH of body fluids is determined by PCO₂ and bicarbonate concentration (2). Primary CO₂ disorders are symptoms of respiratory problems and bicarbonate disorders indicate metabolic problems. The sign (X) represents the concentration of X in the serum. PH

represents the negative logarithm of the concentration of H⁺ in the serum (3).

Methods:

Search strategy

Searches were conducted by two independent researchers in international (PubMed, Web of science, Scopus and Google scholar) and national (SID, Magiran) data bases for related studies from the inception of the data bases to September 2017 (without time limitation) in English and Persian languages. To ensure literature saturation, the reference lists of included studies or relevant reviews identified through the search were scanned. The specific search strategies were created by a Health Sciences Librarian with expertise in systematic review search using the MESH terms and free terms according to the PRESS standard. After the MEDLINE strategy was finalized, it was adapted to search in other data bases. Accordingly PROSPERO was searched for ongoing or recently related completed systematic reviews. The keywords used in the search strategy were "Acidemia, fetus" and Iran which were combined with Boolean operators including AND, OR, and NOT.

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Study selection

Results of the Literature review were exported to End note. Prior to the formal screening process, a calibration exercise was under taken to pilot and refine the screening. Formal screening process of titles and abstracts were conducted by two researchers according to the eligibility criteria, and consensus method was used for solving controversies among the two researchers. The full text was obtained for all titles those met the inclusion criteria. Additional information was retrieved from the study authors in order to resolve queries regarding the eligibility criteria. The reasons for the exclusion criteria were recorded. Neither of the review authors was blinded to the journal titles, the study authors or institutions.

Discussion:

Acid: A chemical that gives and releases H⁺. Acidemia and Alchemy represent real PH of blood if H⁺ is increased. PH decreases and the serum becomes acidic, and if H⁺ is reduced, PH is increased and the serum is alkalized. Acidosis is a pathophysiologic process that reduces the pH of the serum; on the other hand, alkaloids are the pathophysiologic process that increases the serum PH (4). Acidosis and alkalosis can be caused by metabolic or respiratory diseases. If the primary disorder is a change in serum HCO₃, the metabolic process is in progress and if the initial disruption is a change in PCO₂, the respiratory process is in progress. When there are two or more primary and acute abnormalities at the same time, there is a mixed disorder in the work (5). If the severity of the metabolic acidosis is higher, the pH of the serum is acidified and if the intensity of the alopecia is higher, the pH of the serum is alkaloid. Buffers: Buffers are compounds attached to H⁺ when its rate increases; these elements release themselves when the rate of H⁺ decreases; therefore, it reduces the H⁺ changes in the environment. In fact, buffering is the potential of a poorly dissociated acid and its anion in withstanding changes in pH in the presence of strong acid and base. In humans, the bicarbonate buffer system is the most important buffer system in ECF (6). Proteins and non-organic phosphates are ranked second. In ICF intracellular fluid, non-organic phosphate is probably the most important buffer; then, bicarbonate and intracellular proteins play the role of the buffer. Although intracellular PH is more important than its extracellular form, it is

difficult to measure intracellular PH, so the clinical efforts focusing on the measurement of extracellular pH and the categorization of diseases based on it are generally the focus of the bicarbonate buffer system (7).The study of umbilical cord blood gases is done to evaluate the oxygenation, acid-base and fetal response to labor stress. Mild acidosis is a physiological phenomenon and it does not endanger the baby; however, severe acidemia can be associated with an increase in neonatal mortality and neonatal nervous system development disorder (8).Intrauterine acid and base balance play an important role in determining the relationship between incidental and obstetric events (9). A complete analysis of blood gases provides important information regarding the type and cause of academia; additionally, arterial and venous sampling may provide more clear results (10)The arterial blood sample of the umbilical cord is more accurately indicative of the condition of the fetus, since arterial blood flows throughout the embryo's body and carry blood from the placenta to the fetus. Therefore, measurements of umbilical cord blood gases reflect the state of maternal acid-base performance and pair function. Hence, when the arterial blood is acidic, the vein may be normal (11).Although one of the main causes of fetal acidemia is a decrease in placental-uterine perfusion, several studies have discussed the possible effects of other factors. One of these factors is oxytocin, which is widely used to induce or accelerate the process of labor during labor procedures. Studies on the effects of oxytocin on umbilical cord blood gases have reported controversial findings. Based on the results of See et al study, which was conducted to evaluate the effect of oxytocin administration on umbilical cord blood gases, the mean arterial blood pH was lower in oxytocin-treated patients in comparison with other subjects (12). However, there was no significant difference between two groups, one taking and the other not taking oxytocin, in regard with trophic level of arterial blood pH (13).

According to the results of formerly conducted studies, no relationship was found between the arterial blood pH and fetal acidosis using a mother with high dose oxytocin. However, there is a significant relationship between maternal use of oxytocin and fetal acidosis (14).Relaxation drugs used in the lab are not significantly related to the amount of any of the blood gases in the umbilical artery; in other words, the use of sedative medicines has a negative effect on blood gases. No

umbilical stress has been observed and maternal Reynolds increased during labor, the secretion of cortisol and catecholamine, causing acidosis in the mother. As sedative medications reduce stress in the mother, the likelihood of metabolic acidosis decreases following their use in both the mother and fetus "(15). The results of Sosa et al. study, entitled "The relationship between pethidine used in the first stage of labor with the acid and fetus status", taking pethidine during the first stage of labor was associated with lower levels of pH and bicarbonate and higher levels of PCO₂ (16).

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