7. Fluid and electrolyte imbalance in gynaecological and obstetrical disorders

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William Osler had stated it is much more important to know what sort of a patient has a disease than what sort of a disease patient has. The above quote is very appropriate for establishing water and or electrolyte imbalance or acidosis or alkalosis in a patient. More so in obstetrical and gynaecological cases involving two lives—one of the mother and the other the foetus. In the field certain limitations may present handicaps to the veterinarian in assessing fluid and electrolyte requirement. The present paper enumerates the effect of electrolyte imbalance and its management in reproductive disorders, the electrolyte balance at gestation and variations in fluid and electrolyte loads at and after parturition.

Reproductive Disorders

Electrolytes at Oestrus:- The electrolyte and water loss at menstruation is quite less such that it could be ignored (Phillip et al, 1970) but the loss at oestrus in cattle may be of 50 ml. of water, 250 mmol of Na and 12.5 mmol of K, (Bhaskaran, 1982). It is significant to note that the oestrual mucus electrolyte content follows closely that of the blood. • The normally breeding animals have serum calcium of about 12 mgm% and in the mucus it is about 9.04 mgm%. Abnormally cycling animals showed increased potassium and decreased sodium levels in their oestrual discharge (Quay and Lamothy 1969) in contrast to the normally breeding animal which have a low potassium in their vaginal mucus (Olds and Vandemarks 1952). In the recent studies a wider ratio of Ca: P in anoestrus buffaloes and a narrow ratio in normally-cycling animals was observed, (4: 1 Vs 2 : 1) Quayam 1979.

pH of the cervical mucus: pH of the vaginal secretions varies with different phases of the cycle and pregnancy (McNutt at al. 1939). The wide variations in pH of the cervical mucus will affect the sperm movement. The pH iron concentration of the cervical mucus in different stages of oestrus cycle is as follows:

Oestrus: Cow (S.R. Pattabiraman et al. 1967) 8.03
Buffalo (K.S. Narasiman et al. 1980) 7.59
Gestation: Cow (Mc Nutt loc cit) 8.8

Other components of cervical mucus and blood: The protein and carbohydrate content of the cervical mucus if altered affects the sperm movement. The regular breeding animal have a high glucose content in the cervical mucus (25 mgm%) in contrast to open cows which have low glucose content (18 mgm%) (Thangaraj 1970). Variation in the blood components also affect the physiological processes including sexual activities, serum protein (less than 8 gm%) (Veerapandian, 1983) low energy level (less than 50 mgm%, Devanathan and Quayam 1984) and low Hb concentrations (less than 8mgm%, Devanathan and Quayam 1984) lead to sexual quiescence due to the lowered level of hypothalamic activity. (Howland et al., 1966).
GESTATION

Pregnancy changes the fluid and electrolyte balance appreciably. **Blood volume and Composition**: As pregnancy advances blood volume increases in ewes and cows due to an increase in plasma volume. Unlike human pregnancy, this increase in plasma volume is not associated with a decrease in haemoglobin concentrations in the blood. The phenomenon of “Physiologic anemia of pregnancy” observed in man does not occur in farm animals (Hafez 1980).

**Cardiovascular Dynamics**: The pregnant uterus depends on its circulation to perform various functions. In sheep, cardiac output increases during pregnancy and provides the gravid uterus with additional blood supply. The uterine blood flow, which amounts to 1-2% of the cardiac output in non-pregnant ewes, increases to 20% in pregnancy at term but does keep pace with the growth of the fetus, which extracts increasing amounts of oxygen from the maternal blood in the allotted to it. The quantity of blood in the uterus tends to increase in proportion to its contents and is related more to fetal than to placental weight (Barron, 1970).

**Blood pressure changes**: The blood pressure of the ewes, tends to fall during late gestation. An increasing cardiac output with a decrease in blood pressure indicates a decrease in peripheral resistance. Probably the uterus contains an area of low vascular resistance similar to an arteriovenous fistula. The uterus is a passive receiver of blood which could be well demonstrated by increasing or decreasing the blood pressure in the mother.

**Maternal Foetal Blood gas acid base metabolism**: The gaseous exchange in the placenta differs from that of the lungs in that, this is a fluid exchange. The following play a pivotal role in the exchange: Maternal and foetal oxyhaemoglobin dissociation curve, diffusion distance total surface area O₂ use in the placental tissue, maternal foetal blood flow rate. The dissociation curve at any given pH lies left of the maternal curve, i.e., at any given tension foetal blood contains more oxygen than the maternal blood. Likewise the foetal blood has a low affinity to CO₂ which favour the CO₂ transfer to the maternal blood.

**Changes in pH**: The foetal blood pH in the umbilical vein is in the order of 7.32 and in the umbilical arteries it is 7.26 and both are lower than that of maternal level resulting in the pH gradient of 0.05 pH units. (Joaison 1970).

**Maternal pulmonary function**: Maternal pulmonary function at pregnancy is principally an increased tidal volume of the lungs, and this mechanism is related to the effect of the progesterone on the respiratory centers of the brain (Goodland 1953).

**Maternal alkalosis and acidosis**: Maternal metabolic alkalosis induced by the infusion of bicarbonates results in the greater decrease of foetal oxygen saturation and content. This is again related to the increased oxygen affinity of the maternal haemoglobin. (Ralson 1974). Acute maternal metabolic acidosis due to the infusion of NH₄ Cl does not cause a foetal metabolic acidosis, emphasizing again the limited placental transfer of fixed acids (Blechner 1970).
Transfer of substances across the placenta:- The placental membrane controls the transfer of a wide range of substances, by several processes, such as rapid diffusion, active transport, simple diffusion, pino and phagocytosis. The mechanism of transport, between mother and the foetus is based on the physiological significances of the substances to be transferred.

<table>
<thead>
<tr>
<th>Mechanism of Transfer</th>
<th>Substances</th>
<th>Physiological role.</th>
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<tbody>
<tr>
<td>Rapid diffusion</td>
<td>Na, K, Mg, Ca,</td>
<td>Maintenance of biological homeostasis.</td>
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<tr>
<td></td>
<td>P, H₂O</td>
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<tr>
<td>Active transport</td>
<td>Aminoacids</td>
<td>Foetal nutrition.</td>
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<td></td>
<td>Sugar, vitamin</td>
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PARTURITION: The maternal response at normal labour to uterine contractions is by hyperventilation. This results in the increased O₂ tension and decreased CO₂ tension. This response could again be dampened by analgesia (Huch, 1974). This is again shown us a small but significant lowering in blood pH at uterus, due to building up of metabolic acidosis and lactate concentration. (Low, 1974). Similar pH changes in the clinically normal foetus at the normal parturition has also been recorded.

OBSTETRICAL DISORDERS

Foetal Asphyxia The circumstances leading to total asphyxia productive of brain damage, but brief enough to allow the foetal survival occur rarely in human being (Meyers 1968), but in animals foetal hypoxia always sets in, once the foetus is deprived of the umbilical blood flow either due to the compression of the cord or by its rupture. Even at 4 minutes hypoxia the foetus may be born alive but with irreparable damage to the CNS (Sloss and Dufty, 1980). The measure of the asphyxia of the foetus may be undertaken by ascertaining foetal blood pH. The dividing line seems to be 7.2 pH. The calves born in difficult births showed a distinct acidic pH with increased hyperkalaemia, indicating fatal oxygen depletion (Neduncheralathan et al, 1983).

Pueroal: The problems of the fluid balance to the dam, in obstetrical conditions are all concentrated in the postpartum or post operative period. At this period the dam does not differ much from a surgical patient. In the first 48 hours after birth or operation there is a relative increase in the retention of water due to the increased output of ADH. Therefore, about 5-10 litres of physiological fluids introduction is satisfactory during this period. If water loss is replenished the inevitable K depletion will accommodate itself or can best be done orally. Acid Base balance at this junction may better be left to the animal to be looked after. The crucial point to be remembered is that the labour lasting more than 24 hours water loss is inevitable including the serum potassium loss.

Shock: In other cases of obstetrical disorders shock due to haemo-concentration or due to the hypovolemic condition is most frequently met with. In such cases specific gravity of the blood is decreased (Less than 1.056) which require whole blood therapy or specific gravity
may be increased in which plasma therapy is indicated. The later can best be managed with Dextran solutions, or Polyvinylpyrrolidon solutions. These substitutes should be used with caution in patients with cardiac, renal and hepatic insufficiencies.

Peritonitis

A common condition of bovine obstetrics is peritonitis, as a post operative complications. Unlike in small animal or human practice, soilage of surgical wound, wound line infection failure of aseptic surgery lead to acute, diffuse peritonitis in large animals. In the treatment of peritonitis, the best approach is through the intra peritoneal infusion of fluid, electrolytes and antibiotics.

Procedure for administration: Correct site for the intraperitoneal infusions is the center of the hollow of the right flank about a hands breadth below the lumbar vertebrae. An 8 cm. needle with a stilet is passed with a jab in the poteriosuperior direction. The penetration of the peritoneum is indicated by a pain reaction by the animal. After pushing further 1/2 cm. the stilet is withdrawn the entry of air through the needle indicate the correctness of the site for the medicine to be administered. In the recent past, we have cured a quite number of animals through this technique (Pattabiraman at al., 1983).

At the outset I wish to stress that this paper is done with an intention to draw the attention to the variations in the fluid and electrolyte balance in Gynaecological disorders, their homeostasis between the mother and the foetus, and a little attention at and after parturition.

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