قسم: طب الحيوان.
كلية : الطب البيطرى ـ جامعة أسيوط.
رئيس القسم : أ.د/ ابراهيم سيد أحمد.

التغيرات في الاتزان الحمضي القاعدى والعناصر المتعادلة المترتبة على الفقد الكلي والجزئي للعاب في الاغنام

علي السباعي ، محمد عادل*

أجرى البحث على عدد ثمانية من الاغنام الذكور والاناث وقسمت الحيوانات الى مجموعتين كل مجموعة احتوت على أربعة أغنام. المجموعة الأولى أجريت لها عملية قطع احدى قنوات الغدة اللعابية والمجموعة الثانية أجريت لها عملية قطع قناتي الغدة اللعابية .

أجريت الفحوص الطبية اللازمة قبل ادخال الحيوانات في التجربة وأخذت عينات قبل اجراء العمليات كأساس للمقارنة للتغيرات بعد اجراء العمليات.

كانت متوسطات القراءات للمجموعة الأولى قبل العملية على النحو التالي :ـ

الاسي الهيدروجيني للدم ٧ر٣٢٧، ضغط ثاني أكسيد الكربون ٠٧ر٤٦مم/زئبق.

ضغط الأكسجين ٨٥ر٤٣مم/زئبق ، البيكربونات ٧٧ر٢٧ملمول /لتر.

إجمالي ثاني أكسيد الكربون ١٥ر٢٩ ملمول/لتر والزيادة القاعدية ٨ر٢ ملمول/لتر.

في حين كانت متوسطات المجموعة الثانية قبل العملية كما يلي :ـ

للاس الهيدروجيني ٤٥ر٧، ضغط ثاني أكسيد الكربون ٥٥ر٤٥مم زئبق ، ضغط الاكسجين ٨٧ر٤١ مم/زئبق ، البيكربونات ٩ر٢٨ ملمول /لتر واجمالي ثاني أكسيد الكربون ٤ر٣٠ ملمول /لتر والزيادة القاعدية ٢ر٣ ملمول/لتر.

حدثت تغيرات ملحوظه في قراءات الاتزان الحمضي القاعدى للحيوانات بالمجموعة الثانية وأدت الى وفاة جميع حيوانات المجموعه في اليوم التالي للتجربة . في حين أن التغيرات في المجموعه الأولى حدثت بصفة مؤقته في اليوم الثاني للعملية وعادت المعادلات الى طبيعتها بعد ذلك واستعادت الحيوانات طبيعتها.

كانت هناك تغيرات متوازنة في العناصر المعادله.

---

* : قسم الجراحة ـ كلية الطب البيطرى ـ جامعة أسيوط.

Dept. of Animal Medicine,
Faculty of Vet. Med., Assiut University,
Head of Dept. Prof. Dr. I.S. Abdallah.

ACID-BASE BALANCE AND ELECTROLYTES ALTERATION ASSOCIATED WITH PARTIAL AND COMPLETE SALIVARY DEPLETATION IN SHEEP

(With 5 Tables)

By
A. EL-SEBAIE and M.A. ALY*

(Received at 24/5/1986)

SUMMARY

Eight sheep were included in this investigation and divided into two groups. Group (I) composed of four animals and operated with unilateral parotid duct section. Group (II) also composed of four animals and operated with section of parotid ducts bilaterally. Blood and serum samples were collected for blood gasses and electrolytes assay. Preoperative mean values of group (I) for blood pH, Pc02, P02 HC03, TC02 and Base excess were 7.372, 46.07 mmHg, 43.85 mmHg, 27.77 mm01/L, 29.15 mmol/L and 2.8 mmol/L respectively, while the preoperative values for group (II) were 7.452, 45.55 mmHg, 41.87 mmHg, 28.9 mmol/L, 30.4 mmol/L and 3.2 mmol/L respectively. A marked alteration in Acid-Base values and electrolytes of group (II) were opserved after the first day of operation, and all animals of this group were died. Slight changes were observed on group (I) one day post-operation and the animals retained their normal values at the third post-operation.

INTRODUCTION

Salivary secretion in ruminants is supplied by three glands namely submaxillary, sublingual and parotid. The latter is resposible for the largest amount of salivary secretion. The secretion under control of automatic nervous system can be gargantuan (BARNETT and REID, 1961). It has been estimated that in 24- hours period an ox can secrete over 50 Kg. of saliva (BLACH, 1958) and a sheep produce 4 litre per day (McDOUGALL, 1948), which in addition to multipicity of other salts may contain about 300 g of Na Hco3 (BLACH, 1958 and WILLISON, 1963).

The composition of saliva has been extensively investigated in many domestic animals (GOATS, et al. 1956; PHILIPSON and MORGAN, 1959; SCHNEYER and YOUNG, 1972 and SOMMER, 1961). Saliva contains in addition to Na Hco3 a certain amount of mucin Na Cl and phosphates as well as smaller amounts of other minerals and it has been suggested that the level of urea formed in the liver and returned in part of saliva may be an important source of readily avilable nitrogen to ruminants (McDOUGALL, 1984 and DENTON, 1957). The function of bicarbonate is related to sustaning of the rumen at pH of about 7 and a denail, by the canulation of salivary flow ca seriously salivary flow can seriously upset the well-being of animal (DENTON, 1957).

* Dept. of Vet. Surgery, Fac. of Vet. Med., Assiut University.

The ill effect of such restriction are due, however, not so much to the denial of the volume of saliva as the reduction in the amount of bicarbonate which it contains for if that is replaced the animals suffer a lesser degree of discomfort.

Salivary loss can occur secondarily to a number of affections, including dysphagia, ptyalism, laceration, fistula and abscess of the salivary gland or duct. Excessive loss of digestive secretion usually is reflected in extracellular fluid and therefor results in alteration of acid-base and electrolyte values (DENTON, 1957 and SOMMER, 1961). SCHEUNERT and TRAUTMANN (1921), made the frist attemp to prepare perminant unilateral parotid fistulae in sheep, they concluded that the lack of the secretion of even one parotid gland caused a fatal unilateral faliure, and hence the long term study of secretion of the parotid gland in the sheep could not be successful (SOMMER, 1961).

Different surgical techniques of the parotid duct fistulae were described by (SCHEUNERT and TRAUTMANN, 1921; DENTON, 1957 and DOUGHERTY, 1981).

As it is well known that the saliva play an important role in the buffering mechanism of the body and in the maintenance of the acid-base balance, it is aimed in this experiment to study the extent of alteration in acid-base and serum electrolyte values and the influences of salivary deplitation in sheep.

MATERIAL and MEHTODS

Animals: 8 healthy, mature, native breed sheep (4 males and 4 females), body weight 20-40 Kg were used in this experiment.

Animals were subjected to carful clinical examination prior to experiment, and calssified into two groups.

Group I: Composed of 4 animals and used for unilateral duct section.

Group II: Composed of 4 animals and used for bilateral parotid duct section.

From each animal two blood samples were taken. The frist sample was used for acid-base status. The samples were collected anaerobically into syringe whose dead space had been previously filled with 1/100 U sodium heparin, and immediatly placed on ice-bath and processed within 45 minutes of collection. Blood PH and blood gases measurments were performed using Corning pH-blood gas analyzer Mol. 168. The analyzer directly measured at 37°C, blood pH, carbon dioxide tension (Pco2 mm/Hg), and oxygen tension (Po2 mm/Hg). Bicarbonate (Hco3 mmob/1), total carbone dioxide (Tco2 mmod/1) and base excess (B.E. mmol/L) were calculated automatically by the same apparatus.

The second blood samples were used for serum separatioh, used for Na, K(Corning-400 Flame Phlometer) and Chloride (Corning Chloride meter 925) determenation.

Blood samples were collected from each animal pre and 24, 48 hours post operation with exception in group II in which the sampling extend to the 5th day post operation.

Surgical Technique:

Pre-operation, clipping and shaving of the hair was done at lateral aspect of the chek from the lower eyelid dorsally to the ventral border of the mandible and the mouth commisure. The area was desinficted with tincture iodine and infilteration anaesthesia of 1/2% procaine-HCL

solution in an inverted L manner was applied in a dose of 5 cc. Skin incision 4 cm long was made vertical to the oral commisure and above the ventral border of the ramus of the mandible by 3-4 cm. The subcautenous tissues were dissected until we reach the vessels at the anterior border of the masseter muscle. The parotid duct was idenified and then transversly severed. The severed end toward the parotid gland was fixed to the skin by simple interrupted pattern using 2/0 silk. The skin was sutured by simple interrupted pattern using silk No. 0. Animals of group II were operated by the same technique on both sides. The skin sutured was removed after 7 days post-operation.

RESULTS

Group I: Unilateral section of the parotid duct, the animals showed in the frist day of operation slight reduction in appetite, but they appeared active, in the second day post-operation the ruminal motility was depressed in the third and fourth day, while retaind their normal values five days post-operation.

Group II: Bilateral section of the parotid duct. In this group clinical examination revealed a marked depression of appetite, dullness and reduced ruminal motility. Pulse and respiration were slightly elevated. In first and second day post-operation the animals were completly anorexic, unwilling to move and recumbant. All animals died at the 2nd day post-operation.

Mean values of acid-base balance and serum electrolytes were present in tables 1, 2, 3, 4 and 5 Fig. 1.

The mean values of acid-base balance of the frist group (pre-operative) for pH, Pco2, Po2, Hco3, Tco2, and base excess were 7,390,46,07 mm.Hg 43,85 mm.Hg 27,77 mmol/L, 29.15 mmol/L mmol/L and 2.8 mmol/L respectively.

Post-operative values for acid-base balance and electrolytes were present in table 1, 2, 3, 4 and 5.

The mean of pre-operative values of acid-base balance in group II for pH, Pco2, Po2, Hco3, Tco2 and base excess were 7.452, 45.55 mmHg, 41.87 mmHg, 28.9 mmol/L, 30.4 mmol/L and 3.2 mmol/L respectively.

Post operative values for acid-base balance and serum electrolytes were illusterated in tab. 1, 2, 3, 4 and 5.

DISCUSSION

Sodium, potassium and possibly calcium are the main cation in saliva and of particular osmotic importence, while chloride and bicarbonate are the major active anions.

Salivary losses through the parotid duct section causes a marked alteration in acid-base balance and serum electrolyte values. In the present study unilateral section of the parotid duct causes in 24 h. post-operative a less significant changes in blood pH (7.327) and slight drop in bicarbonte values 27.4 mmol/L. A maximum alteration in acid-base values were observed two-days post-operation in which the blood pH reaches its minimal value (7.295), bicarbonate 23.97 mmol/L and base excess (-1.3 mmol/L). This means a transit metabolic acidosis observed

in the animals with unilateral parotid duct section. It was probably due to Hco-3 and sodium losses in saliva during this period (post-operative), the physical activites of the operated animals was not significatly altered with the exception of a partial in appetence. During the first three days post-operation the values of Na, and chloride were slightly decreased (slight hypernatremia and hyperchloraemia) these values retained their intial values at the fourth day post-operation, as the hypochloremia favours bicarbonate resorption in the kidney and maintained the conctration of electrolytes in serum and consequently the acid-base values. Additionally with serum K depletion the capcity of renal tubules to reabsorp Hco-3 and plasma concentration is stabilized at the normal values.

In group II (bilateralisection of parotid duct) the healthy conditions were severely altered, pulse, respiration and temperature were elevated, complete loss of appitite, ruminal atony and scanty firm faces. All animals died on the fourth day. Resonable explanation for such deteruration in healthy condition of the animals due to the development of sever acidosis (pH 7.126) and base excess (15.42 mmol/L), in addition to marked reduction in bicarbonate values were also reduced specially serum sodium which reaches 60 mmol/L (marked hyponatraemia). Such observations were in agreement with the findings of (GINGERICH and MURDICK, 1975).

Alteration in the acid-base and serum electrolyte values reached to uncompensate capacity of the kidney and such point was fatal.t could be expected from this observations that the ruminant subject ot a variable degree of metabolic acidosis when salivary depletation was induced, and this agreed with PHILIPSON and MORGAN (1959).

From the surgical point of view the most reliable technique for depletion of parotid saliva is that where the duct is surgically severed and fixed to the skin. This method provided complete depletion of the saliva in group II. The fistula in this experement can be treated by changing the way of the severed duct into the mouth cavity. While in other techniques discribed by (SCHEUNERT and TRAUTMANN, 1921; DENTON, 1957 and DOUGHRTY, 1981) some saliva may pass around the cannula leading to incomplete collection, obstruction or withdrowal of the cannula.

As a conclusion it should be emphasised that bilateral lacerations, fistulae and abscess resulting from caseous lymphadenitis which is very common at the parotid reigon in sheep must be treated as quickly as possible before destruction of the parotid duct takes place.

REFERENCES

Balch, C. (1958): Brit. J. Nute. cited by Barnett and Reid 1961 "Reaction in the rumen" Edward, Arnold Ltd London.

Barnett, C. and Reid (1961): Reaction in the rumen. Edward, Arnold Ltd London.

Goats, D.A.; Denton, D.A. and Goding, J.R. (1956): Secretions by the parotid glands of sheep. J. Physiology. London. 131: 13-31.

Denton, D.A. (1957): The study of sheep with perminant unilateral parotid fistulae. Q.J.Exp. Physiol. 42: 72-95.

Dougherty, R.W. (1981): Experimental surgery in farm animal. the Iowa State Uni. Press. Amer. 1st ed 78-79.

Gingerich, D.A. and Murdick, P.W. (1975): Paradoxic acidurea in bovine metabolic acidosis. J.Am.Vet.Assoc. 166: 227-230.

McDougall, E.L. (1948): Studies on ruminant saliva, the compositon and output of sheep saliva. Biochmical, J. 43: 99-109.

Phillpdon, A.T. and Morgan, J.L. (1959): Bloat in cattle xv Bovine saliva, the chemical compostion of parotid, submaxillary and residual secretions. NzJ. Agric. Res. 2: 990-1001.

Schneyer, L.H. and Young, J.A. (1972): Salivary secretions of electrolytes. Physiol, Rev. 52: 720-777.

Scheunert, A. and Trautmann, A. (1921): Uber die secretion der parotis und mandibularis des schafes. Pflug. Arch. Ges. Physiol. 192: 30-80.

Sommer. M. (1961): Factors influencing the secretions of nitrogen in sheep saliva. Aust. J. Exp. Biol. Med. Sci. 39: 111-156.

Willson, A.D. (1963): The effect of diet on secretion of parotid saliva by sheep VI. Variation in the rate of salivary secretion. Aust. J. Agric. Res. 14: 680-689.

Table (1)

Blood gases and acid-base balance under the influence of unilateral parotid duct section (Group I)

Serial number	sampling time	pH	Pco2 mm.Hg	Po2 mm.Hg	Hco3 mmol/L	Tco2 mmol/L	B.E. mmol/L	Remarks
I	before	7.426	45.5	48.7	26.9	28.1	2.3	
	1 day	7.337	50.3	45.9	24.9	26.1	-0.5	
	2 day	7.301	50.8	46.7	20.1	22.0	-3.5	
	3 day	7.345	50.1	45.8	24.8	26.1	+1.3	
	4 day	7.348	53.6	42.8	26.3	28.1	+1.0	
	5 day	7.352	50.6	41.8	27.3	29.0	+3.2	
II	before	7.388	50.1	43.6	28.4	30.1	+3.3	
	1 day	7.321	53.3	40.1	26.3	28.0	2.1	
	2 day	7.310	58.8	40.6	25.1	26.4	-1.2	
	3 day	7.340	54.6	44.1	25.4	27.1	1.8	
	4 day	7.365	55.3	43.2	26.7	28.3	2.1	
	5 day	7.381	54.3	43.8	27.3	29	2.5	
III	before	7.339	42.8	39.8	27.8	29.1	3.1	
	1 day	7.313	45.1	39.6	26.3	28.2	3.8	
	2 day	7.271	45.6	39.9	20.1	21.5	-5.1	
	3 day	7.354	48.1	40.1	27.3	29.1	+2.1	
	4 day	7.381	48.7	43.5	26.8	28.1	2.3	
	5 day	7.354	47.3	45.0	27.3	29.2	2.4	
VI	before	7.409	45.9	43.3	28.0	29.4	2.8	
	1 day	7.339	49.85	41.7	27.5	27.5	1.5	
	2 day	7.295	49.9	41.5	24.4	26.0	-2.4	
	3 day	7.334	52.4	42.9	27.3	25.4	1.5	
	4 day	7.362	51.9	42.8	26.9	28.3	2.5	
	5 day	7.372	50.8	42.9	26.5	28.	3.1	

Table (2)

Mean values of blood gases and acid-base balance at before 1,2,3,4 and 5 days after unilateral section of parotid duct

	pH	Pco2 mm.Hg	Po2 mm.Hg	Hco3 mmol/L	Tco2 mmol/L	B.E. mmol/L	Remarks
before	7.327	46.07	43.85	27.77	29.15	2.8	
1 day	7.327	49.6	41.82	26.1	27.4	1.9	
2 day	7.295	51.1	42.17	22.4	23.97	-1.3	
3 day	7.343	51.3	43.22	26.2	26.92	1.5	
4 day	7.351	52.37	43.07	26.67	28.2	1.9	
5 day	7.366	50.7	43.37	27.6	28.7	+2.	

Table (3)

Blood gases and acid-base balance under the influence of bilateral section of parotid duct (Group II)

Serial number	sampling time	pH	Pco2 mm.Hg	Pc2 mm.Hg	Hco3 mmol/L	Tco2 mmol/L	B.E. mmol/L	Remarks
	Before	7.411	41.3	42.1	26.2	27.5	2.0	
I	24 H	7.076	36.3	47.0	10.6	11.7	-19.3	
	48 H	7.086	39.7	39.6	11.9	11.3	-18.0	died
	Before	7.514	42.0	42.5	33.8	35.1	+10.8	
II	24 H	7.208	35.6	39.3	14.1	15.2	-12.5	
	48 H	7.190	29.2	30.4	11.1	12.0	-15.6	died
	Before	7.485	48.6	41.3	28.3	29.9	+1.9	
III	24 H	7.180	54.9	48.6	13.9	15.0	-16.8	
	48 H	7.130	55.8	45.4	11.6	13.2	-16.9	died
	Before	7.398	50.3	41.6	27.3	29.1	+2.1	
VI	24 H	7.206	59.4	50.1	18.1	19.9	-8.7	
	48 H	7.101	60.3	35.1	16.3	18.0	-11.3	died

Table (4)

Mean values of blood gases and acid-base balance at before 24 H and 48 H after bilateral section of parotid duct

Mean values	pH	Pco2 mm.Hg	Po2 mm.Hg	Hco3 mmol/L	Tco2 mmol/L	B.E. mmol/L	Remarks
$\bar{X}$ Before op.	7.452	45.55	41.87	28.9	30.4	3.2	
$\bar{X}$ 24 H after	7.167	46.55	35.8	14.14	15.45	-14.02	died
$\bar{X}$ 48 H after	7.126	26.25	37.62	12.72	13.62	-15.42	died

Table (5)

Mean values of serum sodium, potassium and chloride under the influence of unilateral and bilateral parotid duct section

Mean	days	unilateral section			bilateral section		
		Na mmol/L	K mmol/L	Cl mmol/L	Na mmol/L	K mmol/L	Cl mmol/L
$\bar{X}$	before	138	5	105	135	5.5	110
	1 day	90	4.5	101	100	4.5	90
	2 day	100	4.2	90	90	4.5	90
	3 day	120	3.8	89	-	-	-
	4 day	130	3.7	80	-	-	-
	5 day	135	3.7	70	-	-	-