قسم الجراحة
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غازات الدم والاتزان الحاضى القاعدى في الحمير
تحت تأثير أنواع مختلفة من المواد المخدّرة

تيسير سامي، على السباعى، محمد عادل

استخدمت هذه الدراسة عدد (9) حمير من الذكور والإناث قسمت إلى شمّلات مجموعات كل منها تحتوى على ثلاث حيوانات أُعطىت المجموعة الأولى مخدر مكون من الكورال هيدرات مع الكومبلين والثانية الكورال هيدرات مع النوفالجين والثالثة الكورال هيدرات مع نيفينتال الصوديوم.

وقد سجلت درجات الحرارة ومعدلات التنفس والتنفس قبل وبعد التخدير وكذلك الأعراض الأكلينيكية كمُن تحل في دراسة تكوينات الاتزان الحساسى والقاعدى وكذلك غازات الدم التي شملت درجة التراكيز الهيدروجيني (PH) وضغط ثاني أكسيد الكربون (م.م. - رقيق) وضغط الآكسجين (م.م. - زقوق) البيكرونات المتزنة (مل/لتر) وامتدال ثاني أكسيد الكربون (مل/لتر) بالإضافة إلى الزيادة القاعدية (مل/لتر).

ولقد وجد أن الحيوانات المخدّرة بخلط الكومبلين والكورال هيدرات أظهرت أحسن النتائج الإكلينيكية من ناحية سرعة مفعول المخدّر وعمق التخدير وذلك كان بدون مشاكل أثناء الحقن.

وكذلك كانت مدة التخدير أطول بالمقارنة بالأنواع الأخرى واستمرت لحوالي الساعات والنصف ولم أن استعمالهم كان مصطبغًا مرتبطًا بالتغيّر في الاتزان الحاضى القاعدى للدم عن استعمال مخلوط المركبات الأخرى.

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قسم الجراحة - كلية الطب البيطري - جامعة أسوان
BLOOD GASES AND ACID-BASE BALANCE UNDER THE INFLUENCES OF DIFFERENT ANAESTHETIC COMBINATIONS IN DONKEYS
(With 4 Tables & 1 Fig.)

By
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SUMMARY

Nine donkeys of both sex were used in this investigation. The animals were classified into 3 groups (each of 3 animals). Group I received a mixture of chloral hydrate and combelen. Group II received a combination of chloral hydrate and novalgin. Group III received chloral hydrate and thiopental sodium. Temperature, pulse and respiration rates before and after administration of the anaesthetics were recorded. Clinical signs were also demonstrated.

Blood samples were collected for blood gases and acid-base balance analysis. Blood pH, Pco (mm. Hg), Po (mm. Hg), Hco (mmol/L), Tco (mmol/L) and base excess (mmol/L) were measured using Corning pH - blood gas analyser 168.

Animal anaesthetized by the combined use of combelen and chloral hydrate showed clinically the best desired depth of anaesthesia as onset was rapid without injection discomfort. The anaesthetic period was longer and continued for about 11/2 hour. However their use was accompanied with greater alteration in acid-base values than in the other used anaesthetic combinations.

INTRODUCTION

In daily practice, the choice of a suitable intravenous anaesthetic combinations for donkeys remained up till now an unsolved problem especially when volatile anaesthetics are not available.

MILLENBRUCK and WALLINGA (1946) used a mixture of chloral hydrate, magnesium sulphate and pentobarbitone as a general anaesthetic for horses. They claimed that the mixture induced a state of deep general anaesthesia without excitation during induction and floundering was completely absent during recovery. TANTAWEY (1980) recommended the use of a mixture of combelen and chloral hydrate in the donkey as a general anaesthetic than the use of chloral hydrate alone.

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Moreover, the use of thiopentone sodium alone may cause apnoea in some animals and recovery is usually violent in nature, induction is also usually associated with excitement (WRIGHT and HALL, 1971). Novalgin is also recommended in veterinary practice and used in combination with anaesthetics as it is a potent sedative and analgesic. TEMIZER (1964) advised its use in combination with nembutal for safe anaesthesia and operation.

On the other hand, respiratory acidosis can develop during anaesthesia with the use of chloral hydrate, combelen and thiobental sodium (FRITSCH, 1965). The severity of acidema is proportional to the depth and length of anaesthesia. TEVIK, et al. (1968) reported a marked decrease in blood pH with marked elevation in the value of carbon dioxide tension under the influence of general anaesthesia with chloroform and halothane. However, the effect of intravenous anaesthesia on acid-base balance and blood gases in donkeys is not as well established.

The aims of the present study therefore aimed demonstration of the clinical effectiveness of some anaesthetic combinations in donkeys, and also to study the extent of changes in blood gases and acid-base balance parameters under their influence.

**MATERIAL and METHODS**

The study was carried out on 9 clinically healthy donkeys of different ages, sexes and body weights. The animals were divided into 3 groups (each of 3 donkeys) for comparison between the different anaesthetic combinations. Animals were fasted for about 18 hours before injection. In the first group, a mixture of combelen (Bayer) and chloral hydrate (10%) was administered intravenously in the dose of 0.023 mg/kg b.w. and 4 g/50 kg b.w. respectively. The second group received a mixture of novalgin (20%) and chloral hydrate (10%) intravenously in the dose of 1 ml/10 kg b.w. and 4 g/50 kg b.w. In the third group, a mixture of chloral hydrate (10%) and thiopental sodium was injected slowly intravenously in the dose of 4 g/50 kg b.w. and 10 mg/kg b.w. respectively. Different clinical parameters (temperature, pulse and respiration) were recorded 1/2 h. before injection and 1/2 h., 2 hrs., 4 hrs., 8 hrs. and 24 hrs. after administration. Clinical signs, onset, anaesthetic period and recovery were also demonstrated.

From each animal 1 ml sample of jugular blood was collected anaerobically into a syringe whose dead space had previously filled with 1/1000 sod. heparin. These samples were immediately placed on ice-bath and processed within 45 minutes of collection. Blood gases measurements were performed using Corning pH-blood gas analyser Model 168. The analyser directly measured at 37°C, blood pH, carbon-dioxide tension (Pco₂ mm. Hg), and oxygen tension (PO₂ mm. Hg). Bicarbonate (HCO₃ mmol/L.), total carbon dioxide (TCO₂ mmol/L.) and base excess (B.E. mmol/L.) were calculated automatically by the same apparatus. The pH, Pco₂ and PO₂ were adjusted for each animal rectal temperature using inbuilt correction equation.

**RESULTS**

The anaesthetic characteristics observed in response to the used anaesthetic combinations are mostly summarized in table 1. Clinically, it was found that animals in the first group—received a mixture of combelen and chloral hydrate—showed the best desired depth of anaesthesia as onset was rapid without injection discomfort and the anaesthetic period was longer and continued.
ACID-BASE BALANCE UNDER THE EFFECT OF ANAESTHESIA

for about 1 1/2 h. Although recovery was smooth, it continued for 3 hours. Animals in the second group could be placed in the second degree although muscle relaxation was better than those in animals of group I. The anaesthetic period was shorter and continued for only 1 hour. Moreover the combined use of chloral hydrate and thiopental sodium induced frequent discomfort with moderate excitation during induction. There was no complete muscle relaxation with occasional spontaneous movements after injection. The anaesthetic period continued for only 45 minutes and recovery was rapid.

The findings of blood gases and acid-base balance in groups I, II and III are presented in tables (2, 3 & 4) and in Fig. 1. The mean values of blood pH, PCO₂, PO₂, HCO₃⁻, TCO₂ and base-excess for the first group before administration of anaesthetics were 7.392, 40.4 mm. Hg, 41.23 mm. Hg, 23.96 mmol/L, 25.36 mmol/L and 1.1 mmol/L respectively. A marked alterations in blood gases and acid-base balance were observed after two hours from injection (Table 2).

The mean values of such parameters in group II before administration of anaesthetics were 7.379, 40.53 mm. Hg, 26.5 mm. Hg, 23.91 mmol/L, 25.1 mmol/L and -0.5 mmol/L respectively (Table 3).

In the third group, the mean values for blood pH, PCO₂, PO₂, HCO₃⁻, TCO₂ and base excess before giving the anaesthetics were 7.345, 46.9 mm. Hg, 31.95 mm. Hg, 26.20 mmol/L, 27.47 mmol/L and 1.2 mmol/L respectively. The effect of the administered drugs on the acid-base balance were presented in table 4.

DISCUSSION

From the clinical point of view, the combined use of combelen and chloral hydrate proved to induce a satisfactory period of anaesthetization in donkeys than the other used combinations, a fact which is in agreement with TANTAWY (1980). The recorded clinical manifestations resemble those reported by WRIGHT and HALL (1971).

The pronounced hypothermic action especially observed in group I is attributed to the used tranquilizer. It causes excessive loss of heat as a result of depression of the peripheral sympathetic system which gives rise to peripheral vasodilatation as manifested by EL-AMROUSI & SOLIMAN (1965) and KHAMIS (1968). However, the increased pulse and respiratory rates in groups I and II half an hour post-injection could be attributed to the compensatory mechanism of the cardiovascular and respiratory systems due to the respiratory acidosis (HASKINS, 1977). This was followed by decrease in their rates two hours post-administration as a result of the depression action of chloral hydrate on the central nervous system (WRIGHT & HALL, 1971). In group III, pulse and respiration rates showed no marked alterations in their values as the duration of the anaesthetic period was shorter in comparison with the other two groups.

The shorter anaesthetization period in group III with demonstration of the other undesirable clinical sign in table 1 are due to that these animals received neither a tranquilizer nor a muscle relaxant prior or in combination with the anaesthetic medicament. So, either the administration of premedicaments or the repeated injection of the barbiturate is essential for prolongation of the anaesthetic period for the desired operation time.

Generally, the respiratory system is highly affected by the acid-base balance of the blood. Also, respiratory acidosis is usually developed under the influence of general anaesthesia. In this investigation, blood gases and acid-base balance were severely affected one hour from administration of the anaesthetics (group I & II). In the first group, the blood pH dropped (7.295) and the base excess reached - 4.7 mmol/L, at the same time carbon dioxide tension was elevated to reach its maximum concentration (60.8 mm. Hg). Similar drop in blood pH values were also observed in group II half an hour from injection which reached 7.237, base excess was dropped to - 3.0 mmol/L and carbon dioxide tension was elevated to 55.2 mm. Hg. These alterations in acid-base balance and carbon dioxide tension are due to respiratory acidosis. Similar results were observed by GATES, et al. (1971).

The recorded marked elevation in carbon dioxide tension (53.23 mm. Hg) with the less changes in pH values and base excess half an hour post-injection in group I could be attributed to the compensatory mechanism of the respiratory system. The later was manifested clinically as a marked increase in the respiratory rate (Table 1). However, animals in this group retained their normal values of acid-base balance after 4 hours post-injection to be appeared clinically quite normal.

In the second group, the values of acid-base balance and blood gases did not severely affect half an hour from administration. This is also due to the compensatory mechanism of the respiratory system, where a marked polyynae was observed. Moreover, there was a marked reduction in the respiratory rate, dropped blood pH value (7.297) and decreased base excess value (- 3.0 mmol/L) 1 hour post-injection.

From the above mentioned observations, it could be concluded that although the combined use of chloral hydrate and combalen give a longer anaesthetic period than the use of chloral hydrate and novalgyn, yet their use is accompanied by greater alteration in acid-base values. Therefore, more attention should be paid to the animal during anaesthetization.

In the third group, there was no marked alterations in the clinical parameters and the acid-base values in spite of the recorded animal discomfort.

REFERENCES


ACID-BASE BALANCE UNDER THE EFFECT OF ANAESTHESIA


Table (1)
The anaesthetic characteristics in response to the used anaesthetic combinations

<table>
<thead>
<tr>
<th>Time</th>
<th>Group I (T)</th>
<th>Group II (P)</th>
<th>Group II (R)</th>
<th>Group III (T)</th>
<th>Group III (P)</th>
<th>Group III (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T</td>
<td>P</td>
<td>R</td>
<td>T</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>Before</td>
<td>37</td>
<td>50</td>
<td>13</td>
<td>37.5</td>
<td>48</td>
<td>16</td>
</tr>
<tr>
<td>After</td>
<td>36.3</td>
<td>92</td>
<td>26</td>
<td>37.5</td>
<td>42</td>
<td>28</td>
</tr>
<tr>
<td>1/2 h.</td>
<td>35.5</td>
<td>84</td>
<td>14</td>
<td>37.2</td>
<td>54</td>
<td>13</td>
</tr>
<tr>
<td>1 h.</td>
<td>35.2</td>
<td>76</td>
<td>16</td>
<td>37.5</td>
<td>49</td>
<td>13</td>
</tr>
<tr>
<td>2 h.</td>
<td>36.9</td>
<td>82</td>
<td>12</td>
<td>38.2</td>
<td>43</td>
<td>21</td>
</tr>
<tr>
<td>4 h.</td>
<td>37.8</td>
<td>68</td>
<td>12</td>
<td>38.2</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>8 h.</td>
<td>37.8</td>
<td>68</td>
<td>12</td>
<td>38.2</td>
<td>42</td>
<td>26</td>
</tr>
<tr>
<td>24 h.</td>
<td>37.8</td>
<td>68</td>
<td>12</td>
<td>38.2</td>
<td>42</td>
<td>26</td>
</tr>
</tbody>
</table>

Clinical signs

Onset | 3 minutes | 5 minutes | 3 minutes
Injection discomfort | absent | absent | frequent
Induction character | smooth | absent | moderate exciation
Muscle relaxation | very good | excellent | not complete
Anaesthetic period | 11/2 h. | 1 h. | 45 minutes
Spontaneous movement after inject. | absent | absent | occasional
Palperal reflex | absent | absent | sluggish
Recovery | after 3 hrs. smooth | after 2 hrs. smooth | hyperreflexia

T : temperature
P : pulse
R : respiration

Table (2)
Group I, mean values of Blood gases and Acid-base balance under the effect of combilen and chloral hydrate

<table>
<thead>
<tr>
<th>Time</th>
<th>pH</th>
<th>Pco mm. Hg</th>
<th>Po mm. Hg</th>
<th>Hco mmol/L</th>
<th>Tco mmol/L</th>
<th>B.E. mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>7.392</td>
<td>40.4</td>
<td>41.23</td>
<td>23.96</td>
<td>25.36</td>
<td>1.1</td>
</tr>
<tr>
<td>After</td>
<td>7.318</td>
<td>53.23</td>
<td>50.36</td>
<td>27.60</td>
<td>29.23</td>
<td>0.8</td>
</tr>
<tr>
<td>1 h.</td>
<td>7.259</td>
<td>50.80</td>
<td>53.30</td>
<td>21.60</td>
<td>22.90</td>
<td>-4.7</td>
</tr>
<tr>
<td>2 h.</td>
<td>7.345</td>
<td>45.66</td>
<td>34.33</td>
<td>23.4</td>
<td>23.8</td>
<td>-3.9</td>
</tr>
<tr>
<td>4 h.</td>
<td>7.346</td>
<td>41.6</td>
<td>35.84</td>
<td>23.1</td>
<td>24.9</td>
<td>-1.3</td>
</tr>
<tr>
<td>8 h.</td>
<td>7.401</td>
<td>36.0</td>
<td>39.46</td>
<td>21.4</td>
<td>23.6</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

Table (3)
Group II, Blood gases and Acid-base balance under the effect of novalgin and chloral hydrate

<table>
<thead>
<tr>
<th>Time</th>
<th>pH</th>
<th>Pco mm. Hg</th>
<th>Po mm. Hg</th>
<th>Hco mmol/L</th>
<th>Tco mmol/L</th>
<th>B.E. mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>7.379</td>
<td>40.53</td>
<td>26.5</td>
<td>23.91</td>
<td>25.1</td>
<td>-0.5</td>
</tr>
<tr>
<td>After</td>
<td>7.258</td>
<td>55.2</td>
<td>38.9</td>
<td>24.36</td>
<td>26.06</td>
<td>-3.5</td>
</tr>
<tr>
<td>1 h.</td>
<td>7.297</td>
<td>50.13</td>
<td>35.6</td>
<td>24.46</td>
<td>25.9</td>
<td>-3.5</td>
</tr>
<tr>
<td>2 h.</td>
<td>7.327</td>
<td>44.23</td>
<td>29.2</td>
<td>23.16</td>
<td>24.56</td>
<td>-2.1</td>
</tr>
<tr>
<td>4 h.</td>
<td>7.353</td>
<td>40.16</td>
<td>32.73</td>
<td>23.76</td>
<td>25.30</td>
<td>-1.5</td>
</tr>
<tr>
<td>8 h.</td>
<td>7.385</td>
<td>40.55</td>
<td>30.41</td>
<td>24.30</td>
<td>26.00</td>
<td>+1.5</td>
</tr>
</tbody>
</table>

Table (4)
Group III, Mean values of Blood gases and Acid-base balance under the effect of chloral hydrate and thionental sodium

<table>
<thead>
<tr>
<th>Time</th>
<th>pH</th>
<th>Pco mm. Hg</th>
<th>Po mm. Hg</th>
<th>Hco mmol/L</th>
<th>Tco mmol/L</th>
<th>B.E. mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>7.354</td>
<td>46.9</td>
<td>31.95</td>
<td>26.20</td>
<td>27.47</td>
<td>1.2</td>
</tr>
<tr>
<td>After</td>
<td>7.305</td>
<td>52.1</td>
<td>49.8</td>
<td>26.15</td>
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<td>-0.8</td>
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<td>1 h.</td>
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<td>50.5</td>
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<td>29.8</td>
<td>2.5</td>
</tr>
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<td>2 h.</td>
<td>7.351</td>
<td>45.8</td>
<td>38.7</td>
<td>27.63</td>
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<td>3.1</td>
</tr>
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<td>4 h.</td>
<td>7.381</td>
<td>46.8</td>
<td>37.1</td>
<td>26.5</td>
<td>28.0</td>
<td>1.3</td>
</tr>
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<td>8 h.</td>
<td>7.398</td>
<td>46.9</td>
<td>38.2</td>
<td>26.7</td>
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