Experimental and clinical uses of Novocain in the induction of epidural analgesia in donkeys
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Abstract

Sixteen adult donkeys of both sexes (6 females and 10 males) weighting 90-110 kg. were used in this study to determine the ideal dose of epidural administration of Novocain for experimental and clinical uses in many surgical applications. Novocain was used epidurally in different concentrations (1, 2, 3, and 4%) at different doses: 0.1, 0.2, 0.3, 0.4 ml /kg BW. The result of dose setting revealed that, Novocain in the 2% concentration at the dose of 0.3 ml /kg B.W induced, effective, save and good caudal epidural analgesia, the loss of sensation extended to the scrotal sac and the duration of action was (28.3±1.7) min after injection which allowed to perform surgical intervention at the caudal region of the body. Many surgical interventions were applied clinically by this technique at this dose. We concluded that 2% Novocain at the dose of 0.3 ml /kg B.W was efficient for inducing effective, good and save epidural analgesia that, could be used for surgical operations such as castration.

Introduction

Epidural analgesia is a regional anesthetic technique commonly used in large and small animals. It is a useful tool for the equine practitioner (1). This technique allows surgery to be performed without the risk and cost of general anesthesia (2). It is often used by the veterinary practitioners for a variety of obstetrical and surgical procedures in farm animals. It is useful for tail amputation, perennial surgery, and cesarean section (3). Also epidural block with lignocaine and bupivacaine can provide analgesia for major surgery of hind limbs and pelvis, this technique is performed by sterile injection of local analgesic agent as procaine (Novocain) through the space between first and second coccygeal vertebrae in equine (4). Procaine (Novocain), is the first local anesthetic be synthesized, as crystal powder without smell, water soluble, and temporarily prevents the sense organs from initiating afferent impulse (5,6,7). Other local anesthetic drugs such as lidocaine and bupivacaine are used epidurally (8, 9, 10,11 and 16). In recent years, studies have shown the adoption of sedative and analgesic agents such as, xylazine, medetomidine, bupivacaine/ xylazine mixture for use as epidural analgesic (12, 13, and 14). The purpose of this study was to determine the ideal dose of Novocain for experimental and clinical use of epidural analgesia.

Materials and Methods

Sixteen adults donkeys of local breed from both sexes and their average weight was 90-110 kg. The animals were 7 apparently healthy donkeys from the farm animals of the college of veterinary medicine and 9 clinical cases. The experiment was designed as follows:

Group (1) For setting the ideal dose for the induction of epidural analgesia seven animals were treated with epidural Novocain in different concentrations (1,2,3,4%) at different doses (0.1,0.2,0.3,0.4 ml /kg B.W). The site of injection between the first and second coccygeal vertebrae was prepared aseptically which has been determined by elevating the tail up and down. A hypodermic needle G 18 was then placed at the space between vertebrae. Correct needle placement was confirmed by noting negative pressure and minimal resistance to injection. The syringe containing the appropriate anesthetic solution was then attached to the needle and the drug was administered slowly over 30 seconds (5,13). The onset of action
and duration of analgesia were recorded. The degree of analgesia determined by the needle pricks was graded into the following: (-) presence of sensation, (+) mild loss of sensation, (++) moderate loss of sensation, (+++) complete loss of sensation. The needle pricks were applied at the base of tail, around vulva and anus, perineum, scrotum and hind limbs.

**Group(2)** The effective dose of Novocain obtained from group1 experiment was applied clinically on nine cases that were brought to the private clinic. The site of injection and treatment were as in group1.

**Results**

The anesthetics solution was prepared under aseptic conditions in disposable syringes as no color change or precipitation resulted after dilution. The results of experimental group showed that the ideal dose of 2% Novocain was 0.3ml/kg B.W which induced good and save epidural analgesia. The administration of Novocain in concentration of 1% has no clear effects at the caudal region, only there were slight analgesic effects that were limited to the perineum region at (15±0.8) min of injection. In animals that were treated with 4% Novocain the caudal and anterior epidural analgesia were obtained at (4.0±0.7)min of injection but this analgesia was associated with severe weakness, incoordination of hind limbs(ataxia), urination, salivation, muscle tremor and recumbency. On the other hand the administration of 3% Novocain at the dose 0.3ml/kg B.W induced epidural analgesia at the caudal region except scrotum, the onset of action was (8.3±0.5)min and the duration of analgesia at the tail, vulva and anus, perineum and hind limb were 33.3±7.6, 30.0±8.6, 36.6±7.6 and 11±2.9min, respectively (Table1). As compared to the 2% Novocain at the dose 0.3ml/kg B.W the onset of action was (7.9±0.5) min. and the analgesia induced by this concentration at this dose was good and save and the duration of analgesia at the tail, vulva and anus, perineum, scrotum and hind limb were 46±2.9, 40±5.0, 36.6±6.1 28.3±1.7 and 18.3±7.6 min, respectively. This analgesia was significantly different from the animals treated with 3% Novocain at same dose. The optimal dose of 2% Novocain at the dose 0.3 ml/kg B.W was applied clinically on 9 cases suffering from different sorts of surgical problems(Table 2). This dose induced effective scores of analgesia that was acceptable for accomplishing different surgical procedures such as castration.

**Table (1) A comparison of epidural analgesia produced by Novocain in concentration 2% and 3% at the dose 0.3 ml/kg B.W, (n=7).**

<table>
<thead>
<tr>
<th>Concentration and dose of the anesthetic</th>
<th>Onset of action</th>
<th>Duration of analgesia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tail</td>
<td>Vulva and anus</td>
</tr>
<tr>
<td>2% Novocain0.3 ml/kg.B.W(G-1)</td>
<td>7.9±0.5</td>
<td>46.±2.9</td>
</tr>
<tr>
<td>3% Novocain0.3 ml/kg.B.W(G-2)</td>
<td>8.3±0.5</td>
<td>33.3±7.6</td>
</tr>
</tbody>
</table>

*Data significantly different (Data G-1 as compared to G-2) at (p<0.05).*
Table (2) The application of epidural analgesia of 2% Novocain at 9 cases underwent different sorts of surgical interventions

<table>
<thead>
<tr>
<th>Number of treated animals</th>
<th>Breed</th>
<th>Sex</th>
<th>Type of surgical procedures</th>
<th>Duration of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>local</td>
<td>F</td>
<td>Rectal and vaginal prolapsed</td>
<td>17 min.</td>
</tr>
<tr>
<td>2</td>
<td>local</td>
<td>F</td>
<td>Perineum neoplasm</td>
<td>17 min.</td>
</tr>
<tr>
<td>3</td>
<td>local</td>
<td>M</td>
<td>Castration</td>
<td>20 min</td>
</tr>
<tr>
<td>2</td>
<td>local</td>
<td>F</td>
<td>Amputation of tail</td>
<td>15 min</td>
</tr>
</tbody>
</table>

Discussion

The option of epidural injection is the correct decision in many difficult conditions, but this technique require more knowledge and more experience. In our study the results showed that , the ideal dose of Novocain in concentration 2% was 0.3ml/kg B.W, this dose was adequate for inducing caudal epidural analgesia .The spread of anesthetic solution within the epidural space is known to be influenced by variety a factors including age, obesity, pregnancy and body posture (11,14), therefore aged , obese and pregnant donkeys were not included in this study. A number of side effects are associated with epidural administration of Novocain such as salivation, recumbency, urination and the signs of sweating which indicated analgesia at the affected area and it may be due to the effect of analgesic agent on the sweet glands. This agrees with (7). On the other hand , the duration of analgesia was less than that produced by xylazine alone or combined with lignocaine (8,15). The administration of 1% Novocain produced weak analgesic effect and this may be due to the slight effect of this concentration on the nervous system. While administration of 4% Novocain has been stormy effect on the animals, as restlessness, muscle tremor, shivering, inability to stand, this may be serious effect on the nervous system so that this dose is out of use. In our investigation the epidural analgesia that was induced by 2% Novocain at the dose 0.3ml /kg B.W was significantly different at the tail, scrotum and hind limbs (46.0±2.9, 28.3±1.7, 18.3±7.6, respectively) as compared to the group 1 that treated at the same dose but different concentration .We can come to conclusion that the 2% Novocain at the dose of 0.3ml /kg B.W was allowed to perform many surgical procedures with minimal resistance and with less complications.

References


دراسة تجريبية وسريرية للتسكين فوق الجافي للنوفوكائين
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الخلاصة

ستة عشر حمارا بالغا من كلا الجنسين(6 أثري و10 ذكور) تراحت أوزنها بين 95-110 كغم استخدمت في هذه الدراسة لتحديد الجرعة المثلى للاستخدام فوق الجافي للنوفوكائين للاستعمالات الجراحية والسريرية في العديد من التطبيقات الجراحية. تم استخدام النوفوكائين بتركيز 2% فوق الجافي بتراكيز مختلفة (1.3, 3.4) وجرعات مختلفة (0.1, 0.2, 0.3, 0.4 مل/كغم وزن الجسم). أثبتت النتائج تثبيت الجرعات المثلى أن النوفوكائين بتركيز 2% وجرعة 0.3 مل/كغم. وزن الجسم الحي فعالة وأمنة وجودة لأحداث التسكس فوق الجافي للمنطقة الكلفية وان فقدان الإحساس امتاز كبيرا في أدنى تركيز 10 و20، حيث أن فجوة فعل هذا المخدر كانت (28.3±1.7) دقيقة من الحقن والذي يسمح بأجراء التدخلات الجراحية للمنطقة الكلفية للجسم. العديد من التدخلات الجراحية طُبقت سريريا بهذه التقنية وبالجرعة المقررة، نستطيع أن النوفوكائين بتركيز 2% وجرعة 0.3 مل/كغم وزن الجسم الحي فعالة وأمنة وجودة لأحداث التسكس فوق الجافي للمنطقة الكلفية ومكن استخدامها للحالات السريرية مثل الاختلاس .