

CONTINUOUS SEGMENTAL SUBARACHNOID ANALGESIA IN DONKEYS

By

A.S. SALEH

(Received at 23/6/1993)

التخدير الجزئي المستمر بالحقن في الفراغ تحت العنكبوتى في الحمير

أحمد صالح

لقد أجريت هذه الدراسة على ١٨ حماراً سليماً مظهرياً حيث تم وصف طريقة إدخال القسطره. وقد قسمت الحيوانات إلى ثلاث مجموعات متساويه حسب نوع المخدر المستخدم حيث استخدم الكيتامين فى المجموعه الأولى ، البوبوفاكايين فى المجموعه الثانيه وخليط من العقارين فى المجموعه الثالثه. تم تسجيل وقت بداية تأثير المخدر وأستمرارية التخدير وكذا الجزء الذى تم تخديره. هذا وقد أتضح من الدراسه أن استخدام خليط من الكيتامين والبوبوفاكايين يعطى مدة تخدير أطول بالمقارنه بأستخدام أى من العقارين منفرداً.

SUMMARY

The present study was carried out on eighteen nonmedicated clinically healthy donkeys. The technique for catheterization of the subarachnoid space at the Lumbosacral intervertebral foramen was described. According to the type of the anaesthetic used, the animals were divided into three equal groups each of six donkeys. Duration and anaesthetized area were determined in each group after administering a fixed initial and fractional dose of ketamine, bupivacaine 0.5% and a mixture of ketamine and bupivacaine in the 1st, 2nd and 3rd group respectively. It was found in the 1st group that the onset of analgesic effect started 2-3 minutes after the end of injection. The onset of analgesic effect in the 2nd and 3rd groups was observed immediately after the end of injection. The anaesthetized area was nearly the same in all groups. The total analgesic period in 1st group was 78 minutes. In 2nd group, it was 150 minutes while in 3rd group, it was in an average of 212 minutes. Throughout this study, it could be concluded that the use of a mixture of ketamine and bupivacaine gave the longest duration of analgesia in comparison with the other two groups.

INTRODUCTION

The application of segmental subarachnoid analgesia in cows given 5% procaine hydrochloride solution was described by SKARDA and MUIR (1981 A & B). In conscious horses, SKARDA and MUIR (1983 A & B) performed a catheter technique for production of continuous epidural and subarachnoid anaesthesia. SKARDA *et al.* (1985) in a more advanced study recorded the analgesic threshold spinal fluid concentration of mepivacaine in horses and procaine in cows after subarachnoid catheterization.

Although, Ketamine hydrochloride is an effective anaesthetic agent in veterinary practice given either intravenously or intramuscularly. It has been proved to be also effective when administered epidurally (KAWANA *et al.*, 1987). The capacity of ketamine to induce spinal anesthesia was studied in primates by TSAI *et al.* (1988).

There is no available literatures about catheterization of the subarachnoid space in donkeys as well as the uses of ketamine either alone or in combination with local analgesic. The purpose of this study is to catheterize the subarachnoid

SEGMENTAL SUBACHNOID & DONKEYS

space and to determine the efficiency of this technique for induction of continuous segmental analgesia in donkeys.

MATERIAL AND METHODS

Experimental animals:

Eighteen nonmedicated clinically healthy donkeys of both sexes, weighing from 60 to 85 kg and aged between 1-8 years were used in this study. They were divided randomly into three equal groups.

Equipment:

Tuohy unidirectional spinal needle 1.3 mm. diameter and 90 mm. long (curved tip cannula, VYGON, Aachen, Germany). Epidural catheter 90 cm long, 0.6 X 1.0 mm diameter, closed distally and with side openings (Art. No. 186-101, VYGON, Aachen, Germany).

Anaesthetic agents:

1- Ketamine hydrochloride 100 mg/ml (Ketavet, Parke, Davis, Munchen) was used for subarachnoid injection in the first group. An initial dose of 1 ml for each animal was injected. Another 0.5 ml was given immediately upon return of sensation.

2- Bupivacaine hydrochloride 0.5% (marcaine, Astra, Sweden) was used in the second group for subarachnoid injection. The same initial and fractional dose as in the first group were used.

3- Mixture of ketamine hydrochloride 100 mg/ml and bupivacaine hydrochloride 0.5% was used in the third group. An initial dose of 1 ml of anaesthetic solution (0.5 ml ketamine + 0.5 ml bupivacaine) was given to each animal. Half this dose was injected after return of skin sensation.

Site of injection:

The site of injection was between the last lumbar vertebra (L6) and the sacrum (S1).

Technique:

Each animal was controlled by twitch and secured in a stanchion. The lumbosacral area was clipped, surgically scrubbed and disinfected. With the thumb and middle finger, the sacral tuberosities were palpated and with the index finger, the depression leading to the lumbosacral foramen was felt.

The needle with stylet was inserted along the median plane at the lumbosacral intervertebral space. The tip of the needle

was directed 5°- 10° perpendicular to the spinal cord and slowly advanced with the bevel pointed cranially until the subarachnoid space was identified by free flow of clear cerebrospinal fluid from the hub after removal of the stylet.

The epidural catheter was introduced into the needle and advanced cranially until its tip was positioned between the last thoracic and first lumbar vertebra. The needle was withdrawn over stationary catheter and a stopcock was attached to the catheter free end. Fixation of the catheter was done by means of a broad leucoplast strip to the previously shaved skin at the lumbosacral region.

The anaesthetic solution was administered very slowly (0.5 ml/minute) as mentioned by *SHORT (1987)*. The period from the beginning of injection to the onset of analgesia was assessed using superficial and deep muscular pin pricks stimulation of the flank region as well as cranial and caudal to it. The duration of analgesia was also determined.

RESULTS

Subarachnoid injection of 1 ml ketamine hydrochloride 100 mg/ml at thoraco-Lumbar junction produced bilateral analgesia in all donkeys without any effect on the motor function of the pelvic limbs. The onset of analgesic effect began 2-3 minutes after the end of injection. The area of the last four ribs till the cranial half of both gluteal and lateral aspect of the thigh were desensitized. The period of analgesia after an initial dose of 1 ml ketamine ranged 30-47 minutes (40 maintained by fractional bolus of 0.5 ml ketamine for further 33-58 minutes. The analgesic period became totally in an average of 78 minutes (52-112 minutes).

In the second group, injection of 1 ml bupivacaine hydrochloride 0.5% in subarachnoid space at thoraco-Lumbar junction induced bilateral analgesia in 5 donkeys without any effect on the motor function of the pelvic limbs. Only one donkey in this group required some support to remain in standing position and the analgesia was unilateral. The onset of analgesic effect began just after the end of bupivacaine injection. The anaesthetized area was typically as in the first group. The duration of analgesia after first injection (1 ml bupivacaine 0.5%) was 80 minutes (65-90 minutes). It was found that injection of 0.5 ml bupivacaine HCl 0.5% after return of skin sensation prolonged the duration of analgesia for another 70 minutes. In this group the total duration of analgesia was about 2.5 hours.

SEGMENTAL SUBACHNOID & DONKEYS

Injection of 1 ml of anaesthetic solution (0.5 ml bupivacaine HCL 0.5% + 0.5 ml ketamine HCL) intrathecally through an implanted catheter in the third group induced rapid bilateral blockade in all animals. The analgesic effect started immediately following subarachnoid injection. The anaesthetized area was extended from the last 5th or 6th rib to the cranial third of both the gluteal region and the lateral aspect of the thigh. In two donkeys recumbency occurred after 10 minutes from the end of injection in spite of presence of sensation distal to stifle joint. The analgesic period in this group after the first injection lasted for 90-120 minutes (112 minutes). Prolongation of this period for further 100 minutes was induced by fractional injection of 0.5 ml anaesthetic solution just after return of sensation. In this group of animals the total analgesic period was in an average of 212 minutes.

DISCUSSION

In the present study subarachnoid catheterization through the lumbosacral space for administering anaesthetic solutions in donkeys is described. This technique can be performed to produce continuous cranial thoracolumbar segmental subarachnoid analgesia of the abdominal wall without interfering with motor function of the pelvic limbs. The interarcual space between the last lumbar and the sacrum is a reliable site for subarachnoid catheter implantation. ALI *et al.* (1990) mentioned that this site is larger than that of the first intercaudal space used by GREEN and COOPER (1984). Moreover, the spinal cord in equines terminates at level of the middle of the sacrum (BERGE and WESTHUS, 1966).

A small dose (1.0 ml) of anaesthetic solutions were injected through the catheter using a rate of injection of approximately 0.5 ml/minute. Slow injection rate allows a more even distribution of the drug within the subarachnoid space and complete desensitization of adjacent spinal nerves before they emerge from the dura mater covering the spinal cord.

In this study, analgesia of the flank was satisfactory in all donkeys. The onset of analgesic effect varied from 2-5 minutes. In the first group where ketamine was used alone its effect started 2-3 minutes from the end of injection. In the second and third groups analgesic effect started immediately after the end of injection (within 2 minutes). Bupivacaine is of high lipid solubility so faster absorption from cerebrospinal fluid and in turn enhanced the onset of anaesthesia (COUSINS and MATHER, 1984). It may thus be

possible that in third group the addition of bupivacaine to ketamine reduced the time of onset by synergistic action with local anaesthetic.

In all groups, there were satisfactory and uniform bilateral anaesthesia. The anaesthetized area was extended from the last 4th or 5th rib to the cranial third of both gluteal region and the lateral aspect of the thigh. The duration of analgesic effect in the 1st and 2nd groups was 40 and 80 minutes respectively which was augmented when a mixture of ketamine and bupivacaine was used. The mean value in this group of animals being 112 minutes. The analgesia can be maintained by fractional bolus of half initial doses of anaesthetic regimen.

Throughout the present study, unilateral block was produced in only one animal in second group. It is speculated in this case that the tip of the catheter was placed between the trabecula and spinal root nerves on one side, restricting deposition of the local anaesthetic to this side (SKARDA and MUIR, 1981 A). On the other hand Hall (1974) attributed unilateral block to the existence of an inconsistent septum dividing the spinal subarachnoid space along the midline of the dorsal surface of the cord.

This investigation documented that the use of a mixture of ketamine and bupivacaine gave safe and good uniform bilateral anaesthesia for the longest period in comparison with the other groups.

REFERENCES

- Ali, M.A.; Saleh, A.S.; Seleim, S.M. and Ahmed, I.H. (1990): Epidural catheterization and analgesia in donkeys. *Assiut Vet. Med. J.*, 23(45): 184-190.
- Berge, E. and Westhus, M. (1966): *Veterinary operative surgery*. 2nd ed., Medical Book Company, Copenhagen, Denmark.
- Cousins, M.J. and Mather, E. (1984): Intrathecal and epidural administration of opioids. *Anesthesiology*, 61: 276-310.
- Green, E.M. and Cooper, R.C. (1984): Continuous caudal epidural anaesthesia in the horse. *J.A.V.M.A.*, 184: 971-4.
- Hall, L.W. (1974): *Wright's Veterinary Anaesthesia and Analgesia*. 7th ed. London, Bailliere, Tindall.
- Kawana, Y.; Sato, H.; Shimada, H.; Fujita, N.; Ueda, Y.; Hayashi, A. and Araki, Y. (1987): Epidural ketamine for postoperative pain relief after gynecologic operations: A

SEGMENTAL SUBACHNOID & DONKEYS

- double-blind study and comparison with epidural morphine. *Anesth. Analg.* 66: 735-8.
- Short, C.E. (1987): Principles and Practice of Veterinary Anaesthesia.. 1sted., Williams & Wilkins. Baltimore, U.S.A.
- Skarda, R.T. and Muir, W.W. (1981A): Segmental thoraco-Lumbar subarachnoid analgesia in cows. *Am. J. Vet. Res.*, 42:632-8.
- Skarda, R.T. and Muir, W.W. (1981B): Effects of segmental subarachnoid analgesia on arterial blood pressure, gas tensions, and pH in adult conscious cows. *Am. J. Vet. Res.*, 42:1747-1750.
- Skarda, R.T. and Muir, W.W. (1983A): Segmental epidural and subarachnoid analgesia in conscious horses: A comparative study. *Am. J. Vet. Res.*, 44:1870-6.
- Skarda, R.T. and Muir, W.W. (1983B): Continuous caudal epidural and subarachnoid anaesthesia in mares: A comparative study. *Am. J. Vet. Res.*, 44:2290-8.
- Skarda, R.T.; Muir, W.W. and Ibrahim, A.L. (1985): Spinal fluid concentration of mepivacaine in horses and procaine in cows after thoracolumbar subarachnoid analgesia. *Am. J. Vet. Res.*, 46:1020-4.
- Tsai, S.K.; Mok, M.S.; Hung, H.L. and Lippman, M. (1988). Analgesic effect of intrathecal ketamine in primates. *Anesth. Analg.*, 67: S1-S266.