Comparative evaluation of Bupivacaine and Ketamine as spinal anesthesia in albino rabbits

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Abstract

A comparative evaluation of bupivacaine and ketamine on albino rabbits was carried out. Intrathecal administration of these agents singly and in combination produces spinal anesthesia in rabbits. Different combinations of bupivacaine and ketamine do not produce any significant changes in duration of sensory and motor blockade. Ketamine is a less potent anesthetic agent compared to bupivacaine.

Key words : *Bupivacaine hydrochloride, ketamine hydrochloride, intrathecal, sensory and motor blockade.*

Introduction

More than thirty years ago Domino et al[1], first reported clinical use of ketamine. It is a commonly used intravenous anesthetic agent for short surgical procedures. Since then much more information regarding this agent has been acquired. It is now known that by antagonizing NMDA receptors in the central nervous system (CNS), it can act as an analgesic, an anti-inflammatory and an anticonvulsant. It also has local anesthetic and neuro-protective actions.[2,3] Animal studies by most investigators have found that ketamine induced motor block was variable and short lived.[4]

Present study was undertaken to assess the following:

1. Spinal anesthetic action of ketamine and compare it with that of bupivacaine (a standard spinal anesthetic agent).
2. Modifications in sensory and motor blockade when ketamine and bupivacaine are injected intrathecally in different percentage concentrations.

Material and methods

Permission of institutional "Ethics Committee" was obtained before starting the study.

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Inbred healthy albino rabbits of either sex weighing 2.2-2.8 kg were selected. They were maintained separately on standard diet and water ad-libitum. They were randomly divided into five groups, each composed of six animals. They were kept fasting overnight before experimentation, which was carried out between 10 am and 1 pm under strict aseptic precautions.

Preparation of the animal:

The back, anterior and posterior abdominal walls, flexor and extensor surfaces of both lower limbs was shaved. A towel was wrapped around. The animal was secured sideways by tying its hind limbs on a board leaving area of the spinal column exposed.

Under strict aseptic precautions a 26 gauze hypodermic needle attached to a tuberculin syringe was introduced at an angle of 45° into the intervertebral lumbar space above the line joining the anterior superior iliac spines, slightly off midline. The duramater was pierced as evidenced by appearance of CSF in the syringe. A volume of the drug under study was injected after withdrawing an equal volume of CSF. The volume of drug injected was kept constant on each occasion.

The following drugs were injected intra-thecally into various groups:

1. Group I: Bupivacaine 2 mg/kg body weight
2. Group II: Ketamine 20 mg/kg body weight

3. Group III: Bupivacaine 1 mg/kg + ketamine 10 mg/kg body weight (50% + 50%)
4. Group IV: Bupivacaine 1.5 mg/kg + ketamine 5 mg/kg body weight (75% + 25%)
5. Group V: Bupivacaine 0.5 mg/kg + ketamine 15 mg/kg body weight (25% + 75%)

Sensory loss was assessed by pinprick on clean shaven areas on extensor aspects of lower limbs and anterior and posterior aspects of the abdomen. Motor loss was assessed by loss and regain of righting reflex.

Bupivacaine (Anawin heavy 5 mg/ml: Neon laboratories) and ketamine (Anaket 50 mg/ml: Neon Laboratories), were obtained from Central Medical Stores of Pravara Medical Trust. Distilled water for injection was obtained from water distillation plant, Department of Pharmacology, Rural Medical College, Loni.

RESULT

Results are summarized in Tables 1 and 2.

TABLE 1 : Onset and Duration of Sensory Blockade

GP	Onset in Minutes	Duration in Minutes
I	2. 16 ±0.24	30.5 ± 1.38
II	4.41 ± 0.34	14.16+0.68
III	2.75± 0.25	21.83 ±1.67
IV	2. 18 ±0.16	27.5 ±1.60
V	3.79+ 0.46	18.83 ±0.89

Group I

Bupivacaine (2 mg/kg) produced sensory blockade after an average of 2.16 ± 0.24 minutes (mins) which lasted for 30.5 ± 1.38 mins; and motor blockade was produced after 5.36 ± 1.38 mins, which lasted for 41.66 ±3.72 mins

Group II

Ketamine (20 mg/kg), produced sensory blockade after 4.41 ± 0.34 mins, which lasted for 14.16 ± 0.68 mins; whereas motor blockade was produced after 7.2 ± 0.67 mins and lasted for 20.6 ±1.1 mins.

Table: 2 : Onset and Duration of Motor Blockade

GP	Onset in Minutes	Duration in Minutes
I	5.36 ± 01.38	41.66 + 03.72
II	7.20 ± 01.67	20.60 + 01.00
III	6.75 ± 00.46	28.16 ± 02.05
IV	6.18 ± 00.18	36.60 ± 01. 86
V	7. 10 ± 00.24	25.70 + 01.37

Group III

Bupivacaine (1 mg/kg) + Ketamine (10 mg/kg) produced sensory blockade after an average of 2.75 ± 0.25 mins which lasted for an average of 21.83 + 1.67 mins; whereas motor blockade was produced after 6.75 ± 0.46 mins and lasted for 28.16 ± 2.05 mins.

Group IV

Bupivacaine (1.5 mg/kg) + ketamine (5 mg/kg) produced sensory blockade after a period of 2.18 ± 0.16 mins which lasted for an average of 27.5 + 1.6 mins; whereas motor blockade was produced after an average period of 6.18±0.16 mins and lasted for 36.6 ± 1.86 mins.

Group V

Bupivacaine (0.5 mg/kg) + ketamine (15 mg/kg) produced sensory blockade after 3.79 ± 0.46 mins, which lasted for 18.83 ± 0.89 mins; whereas motor blockade was produced after 7.1 ± 0.24 mins and lasted for 25.7 ± 1.37 mins.

Discussion

Intrathecal administration of ketamine 20 mg/kg, alone, produced spinal anesthesia in all rabbits in Group II. Sensory blockade lasted for 14.66 ± 0.68 mins and motor blockade for 20.6 ± 1 min, and it was consistent.

Hiroki et al[5], studied conduction block in dogs. While studying the mechanism of intrathecal ketamine analgesia on intra-spinal evoked potential, they found dose dependant decrease in amplitude of Wave I and Wave II[2]. It indicated axonal block by ketamine in a dose of 1-5 mg/kg body weight[6].

In the present study, ketamine in the dose of 5-20 mg/kg body weight resulted in the loss of sensory and motor responses in all rabbits.

Compared to bupivacaine, ketamine is a less potent spinal anesthetic agent, and there are no significant modifications in the duration of sensory and motor blockade with different percentage combinations of bupivacaine and ketamine.

References

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