

Comparative Evaluation of Bupivacaine and Ketamine as Spinal Anesthetic Agents in Albino Rabbits

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Abstract : Spinal anesthetic effect of ketamine was compared with that of bupivacaine - alone as well as combination of two drugs in varying doses. The time taken for onset of spinal anesthetic effect was faster with bupivacaine as compared to ketamine; whereas the duration of effect was longer with the former. Not much difference was observed when two drugs were administered in combination in varying doses.

INTRODUCTION

Domino et al¹, reported first clinical use of ketamine more than 30 years ago; ketamine is commonly used as intravenous anesthetic agent for short surgical procedures. Ketamine acts by antagonising NMDA receptors in CNS; several investigators have reported its analgesic, anti-inflammatory, anticonvulsant, local anesthetic and neuroprotective actions^{2,3}. The drug has no adverse effects on cardiovascular and respiratory systems. In animal studies, most investigators have found that ketamine - induced motor block was variable and short lived⁴.

The present study was undertaken to assess the spinal anesthetic action of ketamine and to compare it with bupivacaine, a standard spinal anesthetic agent. The present study also included assessment of any modifications in the duration of spinal anaesthesia with these two drugs.

MATERIALS AND METHODS

Animals : Inbred healthy albino rabbits of either sex weighing 2.2-2.8 kg. were selected for the study. They were maintained separately on standard diet and water ad-libitum. These animals were randomly divided into five groups consisting of 6 animals in each group. Animals were kept fasting overnight. Experiment was carried out between 10 a.m. - 1 p.m, taking strict aseptic precautions.

Preparation of the Animals : After shaving the part the rabbit was wrapped in a towel and secured sideways by tying hind limbs on the rabbit board, leaving the area of spinal column exposed. Intervertebral space immediately above the line joining anterior superior iliac spines, was prepared for the injection.

Methods : After taking aseptic precautions, hypodermic needle of 26 no. was introduced in the above mentioned lumbar space, slightly off the midline at 45 angle till the needle pierced dural membrane which was indicated by appearance of CSF flowing out of the needle. The needle was connected to the tuberculine syringe containing the drug under examination. An equal volume of CSF was allowed to flow freely. Then the drug under study was injected; the volumes of injection was kept constant every time.

Study Groups : Following drugs were injected intrathecally in various groups.

Group I - Bupivacaine 2 mg/kg; **Group II -** Ketamine 20 mg/kg; **Group III -** Bupivacaine 1 mg/kg + Ketamine 10 mg/kg (50% +

50%); **Group IV -** Bupivacaine 1.5 mg/kg + Ketamine 5 mg/kg (75% + 25%) and **Group V -** Bupivacaine 0.5 mg/kg + Ketamine 15 mg/kg (25% + 75%)

Sensory loss was assessed by pin prick method on cleanly shaven areas on the flexor and extensor aspects of lower limbs and anterior and posterior aspects of the abdomen. Motor loss was assessed by loss and regain of righting reflex. Duration of spinal anesthesia was measured by the time of initiating sensory loss till the regain of the righting reflex.

Drugs : Bupivacaine (Anawin heavy 5 mg/ml - Neon laboratories) and ketamine (Aneket 50 mg/ml - Neon laboratories) distilled water was used. The results were statistically evaluated by Student's "t" test.

RESULTS

Onset of Anaesthesia Effect : The onset of anaesthesia effect occurred within 2.16+0.24 min in group I, 3.41+0.34 min in group II, 2.74+0.25 min in group III, 2.18+0.16 min in group IV. In group V. Bupivacaine + Ketamine produced spinal anesthesia in 3.79+0.46 min.

Duration of Anaesthesia : Duration of anesthesia was 110+1.38 min in group I as compared to 50+0.68 min in group II p<0, 75+1.67 min in group III, 88+1.6 min in group IV and 65+0.89 min in group V respectively.

Table compares the time taken for onset of action and duration of action of ketamine and bupivacaine.

Table: Onset and Duration of Spinal Anaesthesia

Group	Onset in Minutes	Duration in Minutes
I	2.16+0.24	110+1.38
II	3.41+0.34	50+0.68
III	2.75+0.25	75+1.67
IV	2.18+0.16	88+1.6
V	3.79+0.46	65+0.89

Intergroup comparison, $p > 0.5$

Intergroup Comparison : In Group I where only Bupivacaine (2 mg/kg) was used, produced anesthesia of 110+1.38 min duration and in Group II (ketamine) produced anesthesia of 50+0.68 min only. As compared with Bupivacaine, Ketamine was less potent spinal anesthetic agent. There is no significant difference in duration of anesthesia effect with the varying dose combination of bupivacaine and ketamine.

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DISCUSSION

Intrathecal administration of ketamine 20 mg/kg alone produced spinal anaesthesia in all the rabbits in Group II, the duration of which was 50±0.68 minutes and it was consistent. Hiroki et al studied spinal conduction block in dogs. While studying the mechanism of intrathecal ketamine analgesia on intraspinal evoked potential they found dose dependent decrease in the amplitude of Wave I and II. It indicated axonal block by ketamine in dose of 1-5 mg/kg. In the present study ketamine in the doses of 5-20 mg/kg resulted in loss of sensory and motor responses in all the rabbits. As compared with bupivacaine, ketamine was less potent spinal anaesthetic agent with regard to the duration of the spinal anaesthesia is concerned ($p < 0.5$) and there was no significant modification in the duration of spinal anaesthesia with the different percentage combinations of bupivacaine and ketamine ($p > 0.5$).

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Check-List

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- (i) Copyright statement/declaration (not submitted or published elsewhere) signed by all the authors.
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Literature Review

Tobacco habit in northern India. Sandeep Kumar, Upendra Pandey, Nidhi Balal, *JIMA*.2006;104:19-24.

To study tobacco consumption practices in north-India population, a community-based, stratified sampling survey using validated interview schedule was performed in rural/urban areas of Lucknow, Uttar Pradesh. There were 432 tobacco users (385 men, 47 women, 276 urban, 156 rural) taken as subjects. Tobacco use practices i.e. chewing/smoking/rubbing/snuffing, fire control measures were all taken into consideration.

Single mode of tobacco use was reported by 277 subjects (64.1%) and the rest had a plethora of tobacco practices. Chewing was prevalent in 322 (74.5%), smoking in 256 (59.3%), rubbing in 32 (7.4%) and snuffing in 4 subjects (0.9%). Of the 10 preparations in the questionnaire, the "top 5" preferences ranked as tobacco-gutka, cigarette, bidi and khaini that remained unchanged between sexes, rural/urban people and age groups. Women significantly ($p < 0.00001$) preferred smokeless tobacco and perceived social barrier for smoking. Gutka consumption was significantly higher in youngsters (< 25 years, $p < 0.0001$). Most subjects (235, 54.3%) used tobacco 7.24 times/day. Majority (259;60%) users started consuming tobacco before 21 years. The commonest context of tobacco use was with any refreshment (337, 78.0%). Of the 322 tobacco chewers, about half the subjects (178;52.2%) rotated the quid in their mouth, 313 (97.2%) later spat it out, 9 (2.1%) swallowed it and 15 (4.7%) admitted to sleep with quid in mouth. Tobacco along with alcohol was consumed by 82 (19%) and with opium by 33 subjects (7.6%). Social barrier to tobacco use was perceived by 231 subjects (53.5%), especially by smokers. Majority users (355;82.2%) did not have negative feelings of embarrassment in using tobacco. Most users (351,81.4%) said they would welcome legislative control on tobacco use.

Detection of renal function decline in patients with diabetes and normal or elevated GFR by serial measurements of serum cystatin C concentration : results of a 4-year follow-up study. Perking, BA; Nelson, RG; Betsy, EP. *J. Am. Soc. Nephrol.* 2003;6:1404-1412.

The serum concentration of cystatin C has recently been proposed as an endogenous marker of renal function that is accurate even at the low concentrations found when GFR is normal or elevated. Cystatin C is a nonglycosylated basic pro-tease inhibitor that is produced at a constant rate by all nucleated cells. It is freely filtered by the renal glomerulus and primarily catabolized in the renal tubules. Furthermore, levels are reported to be independent of gender, age and body mass. Diurnal variation is insignificant, levels are not altered by inflammatory conditions, and the concentration is stable in stored serum. Thirty participants with type 2 diabetes in the Diabetic Renal Disease Study met these three eligibility criteria GFR > 20 ml/min per 1.73m² at baseline (based on cold iohalamate clearance), 4 year of follow-up and yearly measurements of iohalamate clearance and serum cystatin C. With the use of linear regression, each individual's trend in renal function over time, expressed as annual percentage change in iohalamate clearance, was determined. Serum cystatin C in mg/L was transformed to its reciprocal (100/cystatin C) and linear regression was used to determine each individual's trend over time, expressed as an annual percentage change. In paired comparisons of 100/cystatin C with iohalamate clearance at each examination, the two measures were numerically similar. More important, the trends in 100 cystatin C and iohalamate clearance were strongly correlated (Spearman $r = 0.77$). All 20 participants with negative trends in iohalamate clearance (declining renal function) also had negative trends for 100/cystatin C. Results were discordant for only three participants. In contrast, the trends for three commonly used creatinine-based estimates of GFR compared poorly with trends in iohalamate clearance (Spearman $r < 0.35$). Serial measures of serum cystatin C accurately detect trends in renal function in patients with normal or elevated GFR and provide means for studying early renal function decline in diabetes.

Compiled by Dr. .P.Chattree