COMPARATIVE EVALUATION OF BUPIVACAINE PLAIN VERSUS BUPIVACAINE WITH FENTANYL IN SPINAL ANAESTHESIA IN GERIATRIC PATIENTS

Dr. M. S. Khanna[1] Dr. Ikwinder KJP Singh[2]

SUMMARY

We evaluated the risks and benefits of the administration of fentanyl during spinal anaesthesia in the elderly. Forty patients (65 years and above) undergoing hip replacement or DHS were studied. Pre-operatively, cognitive function (minimental state examination [MMSE]), associated pathology, medications, and treatment were evaluated. Patients had spinal anaesthesia with 12.5 mg bupivacaine plus saline (SS; n = 20) or 25 *m*g fentanyl (FN; n = 20). The number of ailments and drugs per patient were 2.6 and 2.9; 2.2 and 2.1, respectively; 30% - 35% of disorders were untreated, 15% - 25% were symptomatic, and 25% were adequately treated. Groups were comparable regarding demographic data and characteristics of the spinal block. Group FN had more pruritis ($p < 0.02$) and lower SaO_2 ($p < 0.007$), but prevalence of side effects was similar. Pain intensity (visual analog scale [VAS]), at the time of analgesia request (TAR) was lower in group FN ($p < 0.01$). MMSE at hospital discharge was no different from pre-operative values. Our results show that 25 *m*g fentanyl during spinal anaesthesia to elderly patients premedicated with benzodiazepines for sedation, does not alter characteristics of motor block; prolongs the sensory block; improves intraoperative analgesia; produces postoperative pain relief; preserves the congnitive function, but induces pruritus and decreases O_2 desaturation. The prolongation of sensory block, the decrease in postoperative pain intensity and the preservation of cognitive function would justify the use of spinal fentanyl in the elderly.

Keywords : Spinal anaesthesia, Drugs: Bupivacaine, Fentanyl, Geriatric patients

Introduction

Intrathecal opioids are synergistic with local anaesthetics and intensify the sensory block without increasing the sympathetic block.

The combination makes it possible to achieve spinal anaesthesia with otherwise inadequate doses of local anaesthetic as intrathecal opoids offer hemodynamic stability. As interathecal morphine is assiciated with higher incidence of side effects, use of newer opioids like fentanyl are combined with local analesthetics which have milder side effects.

Since only a few studies of intrathecal fentanyl are available in our country, we assessed the risk and benefits of intrathecal administration of fentanyl in geriatric patients. Geriatric patients show an increased reponsiveness to analgesics[1]. The reported enhanced sensitivity to systemic opioids seems to be related to pharmacokinetic or pharmacodynamic factors and/or physiological changes that occur in the central nervous system during the process of aging[2,3,4].

1. MS,DA,MNAMS,Professor and Head
2. Postgraduate Student
Department of Anaesthesiology and Intensive Care,
Government Medical College, Amritsar- 143 001
Correspond to :
Dr. Ikwinder KJP Singh,
21-Adarsh Nagar, Phagwara – 144 402 (Pb)-India.

Regional anaesthesia is well tolerated by geriatric patients undergoing orthopaedic surgery, producing less postoperative confusion and delirium than general anaesthesia[5]. In the nongeriatric population, the association of fentanyl and local anaesthetics improves the sensory block induced by the spinal administration of local anaesthetics in the intra and postoperative period. The advantages and risks of this procedure have not been fully examined in the elderly[6,7] although Varrassi et al[8] have reported respiratory depression after the administration of 50 mg, of spinal fentanyl.

On the basis, of the routine use of spinal anaesthesia for orthopaedic surgery and the presumed increased "sensitivity" to opioids in the geriatric population, we designed a protocol to evaluate a) the characteristics of the spinal block and incidence of side effects induced by bupivacaine plus fentanyl and b) the consequences of the administration of spinal fentanyl on mental function in the immediate postoperative period.

Methods

Forty patients aged 60 yr or older, scheduled for total hip replacement or DHS under spinal anaesthesia were evaluated in a prospective, randomized, double blind

protocol. Individual informed consents were obtained. Prior to inclusion in the study, all potential patients underwent a rigorous physical and psychological examination, minimental state examination test [MMSE][9] to exclude those with severe psychiatric disorders, depression and/or dementia which could interfere with the comprehension of the protocol. Patients suitable and willing were visited again the night before surgery and ASA physical status, associated pathologies (unrelated to the surgical problem), adequacy of treatment and drugs consumed were recorded and the information stored in a database (Table I).

Table I : Pre-operative assessment

Associated Pathology (a)	Drugs (b)	Adequacy of treatment
01 Respiratory	01 Respiratory	1 Asymptomatic, treated
02 Cardiovascular	02 Cardiovascular	2 Symptomatic, treated
03 Neurological	03 Endocrine	3 No treatment
04 Psychiatric	04 CNS	4 No symptoms
05 Muscle-bone	05 Analgesic-antiinflammatory	
06 Endocrine	06 Other	
07 Digestive		
08 Kidney		
09 Genitourinary		
10 Neoplasia		
11 Infections		
12 Other		

Factors (a) and (b) were subdivided into items reflecting common pathologies and drugs

CNS = Central Nervous System

All patients were premedicated with 5 mg of oral diazepam the night before surgery. In the operating room, routine monitoring was used, and the patients received a slow infusion of 500 mL of lactated Ringer's solution over a period of 30 min. With the patient in left lateral position, spinal anaesthesia was administered at L_3-L_4 through a 23 gauge spinal needle. Patients were randomly distributed in two groups who received spinal anaesthesia in a final volume of 3.0 mL: 12.5 mg of hyperbaric bupivacaine plus saline (Group SS, n = 20) or the same dose of the local anaesthetic plus 25 mg of fentanyl (Group FN, n = 20). The anaesthesiologist who administered the drugs and the patient were blinded as to the combination used. The following variables were recorded: latency and upper level of sensory block (pin prick): onset and degree of motor blockade (Bromage scale, 1-4); intraoperative discomfort with the following scores: 0 no distress; 1 slight (need of a single dose of an anxiolytic drug); 2 moderate (need of two doses); and 3 intense (more than two doses). Intraoperative vitals signs were recorded after every 10 minutes. Midazolam at 1 mg increments was used for intraoperative sedation and no other drugs were administered intraoperatively.

During surgery, blood loss, blood replacement, and urine output were recorded. The following side effects were also recorded: respiratory depression (estimated as a decrease in SaO_2 less than 90%), hypotension (when mean arterial pressure (MAP) decreased to less than 20% of baseline values obtained prior to anaesthesia) and nausea, vomiting, and/or itching.

In the recovery room, vital signs were recorded every 20 mins for six hours then hourly upto 12 hours from start of anaesthesia. At the time of analgesia request (TAR), pain intensity was assessed by a visual analog scale graded 1-100 mm (VAS). Duration of motor and sensory blocks were also recorded. The MMSE test was performed at the TAR. Complications like, bradycardia, hypotension, respiratory depression, nausea and vomiting, itching were recorded.

All the observations were recorded and all the results were analysed statistically and compared using the student's 't' test. P-value <0.05 was considered significant.

Results

Groups were comparable regarding demographic variables, type and duration of surgery (Table 2). Incidence of associated pathologies/patient was 2.6 and 2.9 for each group with a prevalence of cardiovascular (51% and 59% for Groups SS and FN), muscle-bone (30% and 11%, $p < 0.02$, x^2 test), and ophthalmological (32% and 30%) disorders. Similarly, the number of drugs taken was 2.3 in each group; in both, the most commonly consumed drugs were analgesic-antiinflammatory (40% and 52%), cardiovascular (36% and 52%). When individual pathologies were evaluated in relation to treatment, 32% and 26% (Groups SS and FN, respectively) of the disorders did not receive treatment; 16% (Group SS) and 22% (Group FN) were symptomatic regardless of therapy, and in 28% (Group SS) and 30% (Group FN) the medication was appropriate (patients asymptomatic). Regarding preoperative cognitive function, values of MMSE were within normal limits for the geriatric population (25.3 ± 0.7 and 25.8 ± 0.6 for groups SS and FN, respectively).

There was no statistically significant difference regarding latency of sensory/motor and duration of motor

block but there was significant difference in the duration of sensory block and degree of discomfort between two groups (Table 3), the latter was evaluated according to a simple score system graded 0-3 (see Methods). The results show that the block was satisfactory (adequate sensory/ motor block and zero discomfort) in 12 (saline) and 16 patients (fentanyl). The rest of the patients had an acceptable block, but presented different degrees of discomfort; in Group SS, four patients had a degree of discomfort of 3, two patients had a degree of discomfort of 2 and another two a degree of 1, while in Group FN, two patients had a score of 2, two had a score of 1. None of the patients required the administration of intravenous analgesics prior to completion of surgery.

Table 2 : Patient Characteristics

	GROUP	
	SS	**FN**
N	20	20
Age (yrs)	67.80±2.21	67.95±2.48
Weight (kg)	66.5±1.8	70.6±1.8
Height (cm)	148.8±1.8	150.6±1.8
No. pathologies/patient	2.5±0.1	2.4±0.2
No drugs/patient	2.2±0.2	2.1±0.3
Surgery		
Type THR/DHS	12 /8	11/9
Duration (min)	140.75±8.03	141.65±8.54

Table 3 : Characteristics of the spinal block

	Group		p-value
	SS	**FN**	
Sensory			
Latency (min)	13.58±0.73	12.73±0.36	
Level (at surgery)	T-7	T-8	
TAR (min)	191.90±4.01	219.65±7.02	<0.01
Level at TAR	L-3	L-3	
Motor			
Latency (min)	5.8±0.41	5.7±0.62	
Duration (min)	160.9±5.5	163.75±2.9	
Discomfort			
Incidence (n)	8	4	
Degree (0-3)	2.25±0.89	1.50±0.58	<0.05

On arrival to the operating room, MAP, heart rate, and SaO_2 were comparable in both groups. All of these variables showed a significant decrease ($p < 0.001$) after the spinal block was established; the decrease in MAP and heart rate was approximately 20% in both groups. Hypotension was treated with mephenteramine (3 mg boluses) and the slow administration of lactated Ringer's solution. Pre and post-blockade values for SaO_2 were 94.2% ± 1.24% and 93.35% ± 2.01% in Group SS, and 93.35% ± 1.46% and 90.90% ± 2.15% in Group FN ($p = 0.007$). Thus, fentanyl significantly decreased SaO_2 in these patients. Incidence of side effects was more frequent in Group FN. When the effects were analyzed individually, pruritis and respiratory depression were significantly more recurrent in Group FN ($p = 0.02$) (Table 4). Pruritis was localized in the upper abdomen, thorax, and face; of the four patients with pruritis, three required the administration of intramuscular droperidol.

Blood loss (750 ± 51 and 800 ± 87 ml, Groups SS and FN, respectively), blood replacement (252 ± 82 and 335 ± 124 mL, Groups SS and FN, respectively) and diuresis (345 ± 20 and 310 ± 40 mL, groups SS and FN, respectively) were comparable in both groups.

Table 4 : Prevalence of side effects

	Group	
	SS	**FN**
Prevalence, n (%)		
Hypotension	8 (40%)	10 (50%)
RD	2 (10%)	4 (20%)
Pruritis	-	4 (20%)
Nausea and vomiting	2 (10%)	1 (5%)

Table 5: Pain intensity and cognitive function at the time of analgesia request (TAR)

Group	TAR (min)	VAS (mm)	MMSE
SS	191.90±4.46	66.50±4.01	25.45±1.23
FN	219.65±7.02	34.00±4.47	25.00±1.34
p-value	<0.001	<0.001	>0.05

In the recovery room, the TAR was significantly increased in group FN (Table 5) and, pain intensity at the TAR was significantly lower in Group FN when evaluated by VAS ($p = 0.001$). Cognitive function (MMSE test), evaluated in the recovery room at the TAR and again the day before discharge from the hospital, did not show significative differences from pre-operative values.

Discussion

The present study shows that, in elderly patients, adding 25 mg of fentanyl to bupivacaine during spinal anaesthesia does not alter the latency of sensory and motor block/duration of motor block but prolongs the duration of sensory block, reduces intraoperative discomfort and decreases the pain intensity in postoperative period. Our findings agree with those of Liu et al[6], Singh et al[12], Dahlgren et al[13], Nigiam et al[14], Singh et al[15], Belzarena et al[16], Bendavid et al[17] as all concluded that fentanyl do not alter onset of sensory or motor block but prolongs duration of sensory block without prolonging recovery of motor block. In addition, we did not find significant differences in the upper sensory level of the block at any time point measured[16,17].

Regarding side effects, when they were individually analyzed, pruritis and respiratory depression (decrease in SaO_2) were more prevalent in patients recieiving fentanyl. Our patients were premedicated with diazepam and received midazolam for intraperative sedation; consequently, the decrease in SaO_2 observed in Group FN cannot be attributed to the effect of fentanyl, but rather to the interaction of fentanyl and benzodiazepines on respiration. Thus, patients in the saline group who received similar doses of benzodiazepines but no spinal fentanyl did not show a decrease in SaO_2 after the block. In addition, Varrassi et al[8] demonstrated that the administration of 25 mg of spinal fentanyl during spinal anaesthesia in elderly nonpremedicated patients did not alter respiratory rate, minute ventilation, $EtCO_2$, respiratory drive, respiratory timing, or the ventilatory response to CO_2. Consequently, the decrease in SaO_2 observed in the present investigation seems to be related to the association of fentanyl and benzodiazepines, and should caution against the use of this combination in elderly patients. Unfortunately, the limitations of our experimental protocol do not allow us to establish which respiratory variables were altered in group FN, but only illustrate a decrease in SaO_2 which would be a late response of respiratory depression. The low incidence of nausea and vomiting in our patients supports the results obtained by other investigators in elderly patients[18].

Inspite of the intravenous administration of 500 mL of lactated Ringer's solution, the spinal block induced a comparable decrease in MAP in both groups, supporting the finding that prehydration does not regularly preclude hypotension induced by sympathetic blockade during spinal anaesthesia[19]. The results also show that in geriatric patients, 25 mg of spinal fentanyl do not alter the cardiovascular response to the spinal block.

In the recovery room, duration of sensory block was prolonged in patients receiving fentanyl; also patients receiving fentanyl requested analgesia with lower VAS scores than those in the saline group. This finding could be related to the steep (and coinciding) dissipation of the effects of bupivacaine and probably reflects a residual analgesic effect of fentanyl that surfaced when the sensory block induced by bupivacaine vanished.

Regarding cognitive function evaluated by the MMSE, we did not find significant changes in the mental status of our patients, demonstrating that in geriatric nondemented patients, orthopedic surgery under regional anaesthesia does not alter cognitive function.

Conclusion

Our results show that the administration of 25 mg of fentanyl during spinal anaesthesia to elderly patients, receiving pre and intraoperative benzodiazepines for sedation; a) does not alter the characteristics of motor block, b) prolongs the sensory block, c) improves intraoperative analgesia, d) produces postoperative pain relief, e) preserves the congnitive function. However, caution should be used when benzodiazepines are given concomitantly.

In view of the above facts the use of 25mg spinal fentanyl is recommended in elderly patients inspite of mild pruritis. However caution should be taken when benzodiazepines are used concomitantly because this can lead to fall in oxygen saturation and respiratory depression.

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Election to the Governing Council ISA – 2003 will be held at the conference venue of ISA-GOLDCON 2002, on 30/12/2002 at Coimbatore. The vacancies open for the year – 2003 are:

(a)	President ——————	- (one post)
(b)	Vice-President ——————	- (one post)
(c)	Governing Council Members —	- (3 posts)
(d)	Honorary Secretary ———	- (one post)
(e)	Honorary Treasurer ———-	- (one post)

The rules and regulations regarding the election to the Governing Council of ISA are as per the constitution. Nomination in the proper format may be forwarded to the Society office by registered post or in person, **on or before 30th November 2002.**

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Election to the Governing Council – 2003 will be held on 30 December 2002 at ISA-GOLDCON – 2002, Coimbatore, during the Annual General Body Meeting. All eligible members who are interested to vote, are requested to bring their ISA-Photo Identity Card, issued from ISA office. The members without ID Card will not be permitted to vote.

Those members who do not have an ISA identity card (photo fixed) are requested to apply with: 1) The details of their membership 2)Blood group 3)Telephone number and 4)A fee of Rs.75/- only, to the **Secretary ISA (National).**

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