ORIGINAL ARTICLE

Incidence and severity of catheter related bladder discomfort by using different inhalational anesthetic agents and comparing it with propofol

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ABSTRACT

Objectives: This study was conducted to evaluate the effect of halothane, isoflurane, sevoflurane and propofol on the incidence and severity of catheter related bladder discomfort (CBRD).

Study design: A prospective and randomized study.

Methodology: A total of 120 male patients, aged between 20-60 years, ASA physical status 1 and 2, undergoing percutaneous nephrolithotomy using urinary catheterization under general anesthesia were enrolled in the study. The patients were divided into 4 groups to receive either halothane (Group H), isoflurane (Group I), sevoflurane (Group S) or propofol (Group P) for maintenance of anesthesia. CBRD was assessed by a blinded anesthesiologist at 0 hour, 1 hour, 2 hours and 6 hours after surgery in post anesthesia care unit and graded no, mild, moderate or severe CRBD.

Results: There were no differences in patient demographics among the groups. In Group H the incidence of CRBD was significantly low at 1 hr, 2 hrs and 6 hrs, whereas severity of CRBD was significantly low at all points of time.

Conclusion-We conclude that the incidence and severity of CRBD is significantly less in inhalational (especially halothane) group as compared to propofol group.

Key words: Catheter related bladder dysfunction; Inhalational anesthetics; Propofol

Citation: Yadav G, Prashanth M, Singh RB, Jain G, Singh Y, Meena RK. Incidence and severity of catheter related bladder discomfort by using different inhalational anesthetic agents and comparing it with propofol. Anaesth Pain & Intensive Care 2015;19(4):452-456

INTRODUCTION

Surgical procedures where urinary catheter is left in-situ for perioperative drainage brings about catheter-related bladder discomfort (CRBD) and irritation during the postoperative period. The incidence rate is reported to be as high as 65% in previous literature.[1] The related pathology may involve an overactive bladder (OAB) which triggers involuntary detrusor contractions and presents as increased urinary frequency, urgency with or without urge incontinence, exacerbated postoperative pain and reduced quality of life.[1]

Various anti-muscarinic agents that suppress this activity are considered to be mainstay management in preventing CRBD.[2-5] Inhalational agents, used for induction and maintenance of anesthesia, are known to have an inhibitory action on the muscarinic receptors.[6] Flurane in primate model, has also been reported to decrease detrusor contraction pressure.[7] Propofol, used for induction of anesthesia, also alters the contractile activity of detrusor muscle.[8]

An online literature search does not reveal any information regarding the effect of inhalational anesthetic agents as well as propofol on CRBD. Therefore, we designed this study to determine the effect of different anesthetic inhalational agents and propofol on incidence and severity of CRBD.

METHODOLOGY

After approval from the institute's ethical committee and written informed consent from the patients this prospective, randomized study was conducted from July 2011 to June 2013. 120 male patients, aged 20-60 years, ASA physical status 1-2, undergoing elective percutaneous nephrolithotomy (PCNL) under general anesthesia were included. Patients with a history of bladder outflow obstruction, transurethral resection of prostate for benign prostate hyperplasia, elderly patients (age >60 year), overactive bladder (frequency; more than three times in the night or more than eight times in 24 hour), end-stage renal disease (urine output <500 ml per 24 hour), morbid obesity, disturbance of central nervous system, chemical substance abuse, chronic pain, chronic analgesic usage and cardiovascular, hepatic or any psychiatric disease were excluded.

Assuming that inhalational agent would reduce the incidence of CRBD by 20%, with a standard deviation of 25% estimated from initial pilot observations, with 80% power and 5% α error, we required 26 patients in each group. To make provision for dropouts if any, we enrolled 30 patients in each group. The study, therefore, consisted of 120 patients. The sample size was calculated using the power and sample size calculator of Department of Biostatics, Vanderbilt University, USA. Patients who could not be extubated at the end of the surgery or who were re-explored during the study period were considered as dropouts.

All patients were randomized (computer-generated random numbers and sealed opaque envelope technique) into four equal groups: Group H (n=30): anesthesia was maintained with halothane (0.75 - 2%), Group I (n=30): anesthesia was maintained with isoflurane (1.0 -2.5%), Group S (n=30): anesthesia was maintained with sevoflurane (2 - 4%) and Group P (n=30): anesthesia was maintained with propofol(100 μg/kg/min IV).

Patients were pre-medicated with oral lorazepam 0.04 mg/kg in night and 2 hours before surgery. Anesthesia was induced with inj. fentanyl 3 μg/kg IV and inj. thiopentone 3-5 mg/kg IV in all patients and maintained according to the groups. Tracheal intubation was facilitated by vecuronium bromide 0.1 mg/kg IV. Anesthesia was maintained using nitrous oxide, oxygen combination (70:30), intermittent boluses of inj. fentanyl and inj. vecuronium as and when required, and the studied medications according to group allocation. Urinary catheterization was done with 16F Foley's catheter and its balloon inflated with 10 ml distilled water after induction of anesthesia. K-Y jelly (a water base lubricating gel) was used to lubricate the catheter, which was later fixed in the suprapubic area with an adhesive tape without any traction and was always left to free drainage. Intraoperative monitoring consisted of five lead ECG, noninvasive blood pressure, ventilator frequency, pulse oximetry and end tidal carbon dioxide. At the end of surgery neuromuscular blockade was antagonized with a combination of neostigmine 0.05 mg/kg and glycopyrrolate 0.01mg/kg and patients were transferred to postoperative care unit (PACU). In PACU, all the patients received inj. fentanyl through IV PCA for their postoperative pain management.

Reduction in the incidence or severity of CRBD was considered as primary outcome, whereas secondary outcome was side effects if any. Another independent anesthesia registrar blinded to the group allocation observed the incidence and severity of CRBD, postoperative fentanyl requirement, and side-effects such as the level of sedation in PACU at 0, 1, 2 and 6 hrs. Patients, who could not be extubated after surgery or in whom trauma occurred during catheterization, were dropped from the study.

Severity of CRBD was recorded as;
None = patient did not complain of any CRBD even on inquiring;
Mild = reported by patients only on questioning;
Moderate = reported by the patients on their own (without questioning and not accompanied by any behavioral responses) and
Severe = reported by patients on their own along with behavioral responses.
Behavioral responses observed were flailing limb, strong vocal response and attempt to pull out the catheter.[1] Patients sedation was recorded on four point scale;
None = patients fully awake;
Mild = patient somnolent but responsive to verbal commands;
Moderate = patient somnolent and responsive to tactile stimulation, and
Severe = patients asleep and responsive to painful stimulation.

Incidence of CRBD between the groups was

compared by Chi-square test; whereas severity of CRBD (none, mild, moderate and severe) was analyzed by Fisher's exact test. SPSS 16.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. P < 0.05 was considered as significant.

RESULTS

All 120 patients completed the study. There was no difference regarding the demographic data in all the groups (Table 1).

Incidence of CRBD at 0 hour was comparable in all the groups. At 1 hour there was significantly low incidence of CRBD in Group H as compared to Group P ($p < 0.05$). At 2 and 6 hours, incidence of CRBD was significantly low in Group H when

Table 1: Demographic data

Physical variables	Group H	Group I	Group S	Group P
Age in years (Mean ± SD)	49.17 ± 15.77	48.00 ± 12.33	49.27 ± 14.52	50.53 ± 18.55
Weight (kg)	55.2 + 6.4	52.4 + 6.7	56.4 + 5.8	53.6 + 5.7
Height (cm)	159.3 + 8.1	157.4 + 7.2	157.9 + 7.5	158.3 + 8.5
Duration of anesthesia (min)	122 ± 43	128 ± 40	126 ± 41	126 ± 43
Post op fentanyl requirement (µm)	115 ± 10	120 ± 8	124 ± 10	128 ± 8

Table 2: Incidence of CRBD in both the groups at different time interval

Time interval	Group H		Group I		Group S		Group P	
	No.	%	No.	%	No.	%	No.	%
0 hr	11	36.7	12	40.0	14	46.7	12	40.0
1 hr	17	56.7*	23	76.7	22	73.3	25	83.3
2 hrs	19	63.3*†	26	86.7	25	83.3	27	90.0
6 hrs	20	66.7*†	27	90.0	26	86.7	29	96.7

No= Number of patients.
** =Significantly low incidence of CRBD in Gp H when compared with Gp P (p<0.05)*
† = Significantly low incidence of CRBD in Gp H when compared with Gp I (p<0.05)

Table 3: Severity of CRBD in both the groups at different time interval

Time interval	Severity	Group H		Group I		Group S		Group P	
		No.	%	No.	%	No.	%	No.	%
0 hr	Mild	7	63.6	4	33.3	7	50	2	16.6
	Moderate	3	27.2	6	50	5	35.7	4	33.3
	Severe	1	9.09*	2	16.6	2	14.3	6	50
1 hr	Mild	11	64.7	6	26.1	12	54.5	5	20
	Moderate	5	29.4	11	47.8	8	36.4	12	48
	Severe	1	5.8*†	6	26.1	2	9.09†*	8	32
2 hrs	Mild	12	63.2	9	34.6	12	48	6	22.2
	Moderate	7	36.8	11	42.3	10	40	13	48.2
	Severe	0	0*†	6	23.1	3	12*	8	29.6
6 hrs	Mild	11	55	10	37	13	50	8	27.5
	Moderate	8	40	12	44.4	9	34.6	10	34.5
	Severe	1	5*	5	18.5	4	15.4	11	37.9

No= Number of patients
** = Significantly low severity of CRBD when compared with Gp P*
†= Significantly low severity of CRBD when compared with Gp I

Table 4: Comparison of sedation among the groups

Sedation	Group H		Group I		Group S		Group	
	No.	%	No.	%	No.	%	No.	%
None	6	20	8	26.7	12	40	10	33.3
Mild	11	36.7	12	40	12	40	14	46.7
Moderate	13	43.3	10	33.3	6	20	6	20
Severe	0	0	0	0	0	0	0	0

** = Significantly high when compared with Gp I*
† = Significantly high when compared with Gp S
‡ = Significantly high when compared with Gp P

compared to Group I and Group P ($p < 0.05$) (Table 2).

Severity of CRBD at 0 hour was significantly low in Group H when compared to Group P ($p < 0.05$). At 1 hour severity was significantly low in Group H and Group S when compared to Group I & Group P ($p < 0.05$), but there was no difference between Group H and Group S ($p > 0.05$). At 2 hours severity of CRBD was significantly low in Group H when compared to Group I and Group P but not Group S. There was also significantly low value in Group S when compared to Group P ($p < 0.05$). At 6 hour time point the severity of CRBD was significantly low in Group H compared with Group P (Table 3).

Incidence of sedation was more in Group H, but it was statistically insignificant (Table 4).

DISCUSSION

Incidence and severity of CRBD is significantly less in inhalational (especially halothane) group compared to propofol group. Decrease in incidence and severity of CRBD by inhalational agents may be because of anti-muscarinic effect of halothane decreasing detrusor contraction pressure.[6,7] Minami K et al, who studied about the effect of halothane on muscarinic receptors, by studying over Xenopus oocytes, determined that halothane inhibits (2)R-induced cellular responses at clinically relevant concentrations.[6]

Ghoniem GM et al studied the effect of anesthesia on bladder function and urine dynamics by performing controlled comparisons of the effects of two anesthetics in a primate model, and observed that maximum detrusor contraction pressure was significantly lower under isoflurane than under ketamine anesthesia. Cystometric bladder capacity was significantly larger under isoflurane than under ketamine anesthesia. Cystometric reflex contractions with bladder filling occurred more frequently with ketamine (96%) than with isoflurane anesthesia (66%).[7]

In our study, isoflurane reduced the incidence and severity of CRBD to a lesser extent in comparison to halothane because isoflurane have main action on external urethral sphincter (EUS) and very less effect on bladder detrusor muscle; CRBD is contributed by contraction of both detrusor muscle and EUS. Isoflurane reduces the firing frequency of EUS, electromyographic activity, bursting activity during voiding and the amplitude of EUS and EMG tonic activity during bladder filling. It also prolongs the bladder intercontractile intervals; this can also explain increased severity of CRBD in isoflurane group as compared to halothane.[8]

In our studies incidence of CRBD is significantly more in propofol group, this can be explained by Canan Ceran et al study, who hypothesized that propofol depresses detrusor muscle contraction less as compared to ketamine, midazolam.[9]

Incidence of CRBD at 0 hr was comparable in all groups; this might be because of sedative effect of anesthetic agents. Higher incidence of sedation in halothane group can be explained by physiochemical properties of halothane.

LIMITATIONS

Some limitations of our study are that it could not be performed with a control group. Moreover, performing a dose-response study could have better delineated its optimal effect on CRBD and the corresponding increase in the side effects more profoundly. We have also not studied that how long the effect of halothane lasted on detrusor muscle. Further studies can also investigate on the effect of thiopentone on CRBD.

bladder discomfort by using different inhalational anesthetic agents

CONCLUSION

We conclude that inhalational agents (especially halothane) significantly reduce the incidence and severity of CRBD as compared to propofol infusion as maintenance agents during general anesthesia.

Acknowledgement: We would like to thank all our nursing and technical staff, without whom the study could not have been completed.

Conflict of interest: None declared by the authors.

Authors' contribution:

GY: Designing and drafting of the study
PM: Data collection and editing of the article
RBS: Drafting of the study
GJ: Data analysis and editing
YS: Data collection
RKM: Editing of the article

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