



ORIGINAL RESEARCH PAPER

Anaesthesiology

EFFICACY OF PREOPERATIVE INCENTIVE SPIROMETRY ON FENTANYL-INDUCED COUGH DURING INDUCTION OF GENERAL ANAESTHESIA & POSTOPERATIVE PULMONARY COMPLICATIONS: A PROSPECTIVE CONTROLLED STUDY

KEY WORDS: fentanyl-induced cough, preoperative incentive spirometry, bolus.

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ABSTRACT

Background: Incentive spirometry creates forceful inspiration, while stretching pulmonary receptors. The aim of our study is to evaluate the efficacy of preoperative incentive spirometry on fentanyl-induced cough during induction of GA & postoperative pulmonary complications.

Methods: 100 patients were allocated into group IS & group C: depending on whether they have received preoperative incentive spirometry before fentanyl administration or not. Patients in the group IS performed incentive spirometry 10 times just before an intravenous bolus of 2µg/kg fentanyl. Incidence & severity of coughs after fentanyl injection and postoperative pulmonary complications were recorded.

Results & Conclusion: Patients in the group IS had a significantly lower incidence & severity of FIC than in group C (5% vs 31%); (mild 5 vs 21; moderate 0 vs 8; severe 0 vs 2) (P<0.05). We have concluded that Preoperative incentive spirometry significantly reduces the incidence and severity of FIC and pulmonary complications.

INTRODUCTION:

Fentanyl, a synthetic opioid, due to its rapid onset, short duration of action, intense analgesia, ease of titrability, cardiovascular stability and low histamine release, is often used as a premedication drug during the induction of general anesthesia [2]. However, intravenous bolus administration of fentanyl often evokes cough, which is usually benign, transient and self-limited but frequency can reach up to 65%, even severe FIC can lead to upper airway obstruction that might require immediate intervention and even more FIC is undesirable during anesthesia induction, especially in patients suffering from coexisting diseases including increased intracranial pressure, cerebral aneurysm, brain trauma, brain hernia, dissecting aortic aneurysm, open eye injury, reactive airway disease or pneumothorax [1-5]. Therefore, effective measures to prevent FIC are clinically important. The mechanism of FIC is still unclear. However, in previous studies various pharmacological interventions have been conducted to reduce the incidence of FIC using readily available anesthetic adjuncts such as NMDA receptor antagonists, benzodiazepines, lidocaine, propofol, α2 agonists, dilution, priming and slow injection of fentanyl, inhalation of selective β2-adrenergic bronchodilators, huffing maneuver prior to induction etc. [6-9]

The postoperative pulmonary complications increase the hospital stay as well as morbidity and mortality in patients. [10] Postoperative hypoxemia, impaired mucociliary clearance results in decreased cough effectiveness, increases the risk of postoperative pulmonary complications like, hypoxemia, atelectasis, aspiration of gastric contents, thromboembolism, pneumonia and respiratory failure. incidence 2–39% [28]. Incentive spirometry involves voluntary, slow, deep and sustained inhalation and exhalation of air through a spirometer, which helps to recruit alveoli, increase lung expansion, strengthen the cough reflex, and clear the airway [13].

So, the aim of the present study was to investigate the efficacy of preoperative spirometry to suppress or prevent fentanyl induced cough (FIC) during induction of general anaesthesia & postoperative pulmonary complications.

MATERIAL AND METHODS : After approval from the Institutional Ethical Committee and informed written consent from patients, the present study was carried out in the Department of Anaesthesiology, Gandhi Medical College & associated hospitals (Hamidia and Sultania), Bhopal over a period of 6 months. It was randomized, prospective and controlled study. 100 patients of ASA

class I/II, age 18-50 years, both sex (M & F), scheduled for elective surgery under general anesthesia were randomly (computer generated) divided into 2 groups (n = 50);
 Group C: Patients who have received i/v fentanyl bolus without preoperative incentive spirometry (control group);
 Group IS: Patients who have received i/v fentanyl bolus with preoperative incentive spirometry.

The patients having history of recent URTI, asthma or COPD, smoking patients on bronchodilator or steroid therapy or ACEI, smokers, drug or opioid abuse, cardiac disease, or had known hypersensitivity to fentanyl and laparoscopic procedure or combined thoracic incision or on ventilator support and non-cooperative patients were not included in the study. Pre-anesthetic checkup and routine tests were done in all patients. After arriving into operation room i/v venous access was obtained and monitoring of ECG, noninvasive blood pressure, and pulse oximeter applied. Baseline systolic and diastolic blood pressure, mean arterial pressure (MAP), oxygen saturation (SpO2) and heart rate (HR) were recorded. No premedication was allowed. Patients in group IS were instructed to perform incentive Spirometry preoperatively, which was done 10 times with an inspiratory interval of 3 sec. The patients were required to lift the two balls in the spirometer until achieving an inspired volume of 900 ml for 1 second. A 2µg/kg i/v fentanyl bolus was given over a period of 2 sec and flushed with normal saline. No any other IV medication was given prior to the fentanyl bolus. The occurrence and intensity of cough within 2 min after the fentanyl bolus (since the cough generally happens within this period of time), were observed and recorded by an observer who was blinded to the study groups. The severity of FIC was graded depending on the number of coughs, as follows: mild = 1–2, moderate = 3–4 and severe ≥ 5. Any changes in BP, HR, ECG or chest rigidity were recorded (just after, and 1, 3, and 5 min after the fentanyl bolus). Postoperative pulmonary complications recorded as secondary outcomes. After that assessment anesthesia was induced with propofol 2-2.5mg/kg followed by i/v succinylcholine (1-2mg/kg) to facilitate tracheal intubation.

STATISTICAL ANALYSIS :

Patient's characteristics and study parameters were analysed using SPSS software (version 16.0, SPSS, New York, USA). Variables are expressed as means ± SD, percent and number. The differences between the study group data was performed using the Student's t-test for parametric data and Chi-square test for nonparametric data. The incidence and severity of FIC were compared using

Fisher's exact test and the Mann-Whitney U test, respectively. The level of significance was a P value < 0.05.

OBSERVATION :

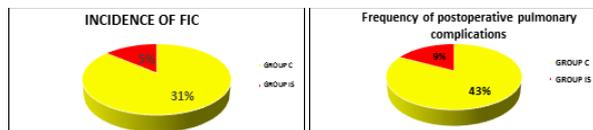
Table -1:demographic Data

PARAMETER	GROUP 1	GROUP 2	P VALUE
AGE	36.78±13.08	38.2±11.89	0.73
Weight(kg)	55.8±9.45	59.43±7.23	0.82
SEX (M/F)	52/48	56/44	0.31
ASA (I/II)	68/32	63/37	0.47

TABLE 3: Change in Hemodynamic Variables

PARAMETER	GROUP C		GROUP IS		P VALUE	
	HR	MAP	HR	MAP	HR	MAP
Baseline	84.21 ± 14.98	93.55 ±8.76	87.27 ± 16.43	95.57 ±8.76	0.74	0.34
Just after bolus fentanyl	83.89 ± 15.78	92.65 ±13.76	84.89 ± 15.57	93.67 ± 12.44	0.60	0.21
1 min.	81.78 ± 17.67	91.67 ±16.44	84.98 ± 17.78	92.89 ±16.56	0.69	0.36
3 min.	82.78 ±17.56	90.98 ±13.87	85.45 ± 16.84	92.67 ±15.46	0.89	0.41
5 min.	83.12 ± 15.64	90.56 ±12.89	85.12 ± 17.35	91.67 ± 15.67	0.76	0.39

GRAPH 1: Showing incidence of FIC and Postoperative Pulmonary Complications



RESULTS:

All 100 patients completed the study and data from all patients were recorded and analyzed. Demographic data in both groups was statistically insignificant and comparable [Table 1]. There was a statistically significant difference (P < 0.05) for frequency and intensity of FIC between two groups, in which 31% patients in control group had FIC after fentanyl bolus as compare to group IS(5%). Cough severity was also lower in group IS than in group C (mild- 5/21); moderate- 0/8; severe 0/2, P <0.05) [Table 2]. Also, there was a statistically significant difference for frequency of postoperative pulmonary complications (43% vs 9%). The hemodynamic values (HR, MAP) were also similar and there was no significant difference between two groups [Table 3].

DISCUSSION:

FIC is usually benign, but sometimes leads to an undesirable response like bronchospasm, aspiration of gastric contents, difficult ventilation or postoperative nausea and vomiting [3,12]. In previous studies like Pandey et al. [7] and Agarwal et al. [5], patients coughed following 2-3µg/kg fentanyl given intravenously through a peripheral venous line. So, fentanyl induced cough seems to be a dose-dependent effect. Therefore, in the present study, we chose a medium dose of fentanyl (2 µg/kg), a dose which is commonly used in daily practice. The mechanisms involved in the production of fentanyl-induced cough are not clear. Fentanyl has been shown to inhibit central sympathetic outflow, causing vagal predominance, inducing cough and reflex bronchoconstriction, and it has also been shown to evoke cough by stimulating irritant receptors in tracheal smooth muscle [5,15]. A pulmonary chemoreflex mediated by J receptors located in the alveolar wall is thought to be the basic phenomenon of cough. Fentanyl magnifies the excitability of rapidly adapting receptors to cause cough, and enhanced histamine release in the airways might be related to fentanyl induced increased cough sensitivity. In this study, the observed incidence of FIC was similar to previously reported rates (13–64%). Lin et al. [14] observed a higher incidence of FIC (65%) after an IV bolus of fentanyl. The incidence of FIC may depend on many factors preceding fentanyl administration; like the dose, concentration, route and rate of injection etc.

Preoperative incentive spirometry is routinely used to prevent and treat postoperative pulmonary complications in patients with respiratory comorbidities. Incentive spirometry imitates natural sighing and encourages the patient to take a slow, deep and long

TABLE 2: Incidence and Severity of FIC and postoperative pulmonary complications

PARAMETER	GROUP C	GROUP IS	P VALUE
Incidence of cough (%)	31	5	<0.001
Severity of cough			<0.001
Mild	21	5	
Moderate	8	0	
Severe	2	0	
postoperative pulmonary complications	43%	9%	<0.001

breath. The recruitment of alveoli and improved gas exchange eventually reduces the risk and severity of pulmonary complications. Kundra et al. [11] observed that lung functions were better preserved in patients performing preoperative incentive spirometry in patients undergoing laparoscopic cholecystectomy. Patients in incentive spirometer group were under observation of physiotherapist which may be the major factor of increasing pulmonary volumes, by maintaining accuracy of doing exercise with incentive spirometer, as well as patient's interest and compliance to treatment, which was not present in control group patients; that was may be a limitation of our study.

CONCLUSION:

On conclusion, both the incidence and severity of FIC and postoperative pulmonary complications can be effectively attenuated by preoperative incentive spirometry.

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