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Research Article

Chilly Feeling Verse Warm Feeling in Increasing Propofol Injection Pain in Pain-Free Bronchoscopy

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Abstract

Background: Patients will have a different feeling about the same temperature. This feeling will have some effect on the physiological reaction. The purpose of this research is to testify this question: Will chilly feeling enhance the pain induced by propofol injection?

Participants and Methods: One hundred and ninety-one patients with ASA physical status at I to II scheduled for pain-free Bronchoscopy underwent general anaesthesia were included in this research. The temperature of the operating room was set to 22°C and a 22 G vein cannula was inserted into a vein on the dorsum of the hand. Patients were allocated into 3 groups according to their feeling on the set temperature: Group W (patients reported with warm feeling), Group J (patients reported with just right) and Group C (Patients reported with chilly or cold feeling). After an average of three times of measurements, core temperature was recorded from ear temperature with a portable infrared thermometer. A temperature probe was patched in the centre of injecting hand, to get peripheral temperature. Propofol (1%) 2 mg/kg for inducing was injected by a pumper at a speed of 5 ml/min. Injection pains were recorded following 0 for no pain, 1 for mild pain, 2 for moderate pain or severe pain and 20 mg 0.5% lidocaine was injected for pain-relieving reinforcements. A nasal catheter oxygen supply at 2 L/min was maintained.

Results: (1) Total incidence of injection pains in all of the patients was 68% (130/191) including pain scale at 1 to 2 in our study; (2) Incidence of injection pain in group Chilly was significantly higher than that in Group Just and Group Warm ($p < 0.05$); (3) No significant difference was found among three groups in Central temperature; (4) Pain Intensity of injection in group Chilly was significantly severe than that in Group Just than Group Warm ($p < 0.05$).

Conclusion: Comparing to warm and just right feeling, Patients with normal core temperature but the chilly feeling will suffer more frequent and intense Propofol-induced injection pain during the induction procedure of general anaesthesia.

***Keywords**: Feelings; Chilly; Temperature; Propofol; Injection Pain*

Introduction

Induction with propofol intravenously for general anaesthesia and sedation is very popular for adults in China and beyond [1,2]. Propofol is also welcomed by most patients because of its rapid onset, short active duration and less severe side effects [3]. Despite these positive profiles, injection pain induced by propofol was very common in clinical practice in the past, with about 60% injection pains reported in some reports [4]; some of these pains can be very severe which caused the patients to get discouraged in having or getting injections [4]. This pain was related to many factors, including the injection sites [5], injecting speed [6], Carrier fluid injection speed [7,8], etc on. To reduce this injection pain, various methods had been adopted, including pretreatment with opiates [9], lidocaine [10,11], tramadol, ketamine [12] or ondansetron [13]. Different dilutions and different temperatures of propofol [14] were also tested by some researchers [4]. A review on propofol injection pains concluded that the two most efficacious methods to reduce injection pains were the following [4]: one is injection through the larger vein (Antecubital Vein or larger), and the other is pretreatment using 20 - 50 mg lidocaine in conjunction with venous occlusion. However, in that review, the author did not pay much attention to the temperature.

To reduce injection pain of propofol, a few researchers focused on the temperature of propofol solutions [14-16], while others paid some attention to the injection temperature [14]. Research that focused on local temperature showed that when propofol was injected by TCI in patients whose arms had been pre-warmed would suffer less intense injection pain [10]. According to this result, they concluded that a warm arm would have a larger vein than those whose arms were not warmed up, which could result in a less intense injection pain.

People might have a varied feeling even in the same temperature [17], ranged from 20°C to 24°C; this feeling will have some effect on some physiological reaction. Subcutaneous blood vessels will shrink after a chilly or cold feeling, which might make some contribution to making those veins smaller [18], while a warm feeling about the temperature will get impulse from the central nervous system for vasodilation to dilate blood vessels [19,20]. With this in mind, it suggested that if a cold or chilly feeling was presented by the patients, the intensity of propofol injection pain would be complained. However, few pieces of research were focusing on patients' feeling in the operating room.

Purpose of the Study

Therefore, our purpose of this studying was to test the hypothesis that even in the standard temperature, patients with a chilly feeling will suffer more propofol injection pains compared to those patients with a good or warm feeling. The first aim of this study was to compare the incidence of pain and pain severity on propofol injection; we also assessed pain incidence and severity between male and female patients.

Methods

With approval from the ethics committee of the Chenzhou No.1 People's Hospital (2017057), and all patients were provided with written information content. From April 1st to August 31st 2019 adult patients aged from 18 to 60 yrs with American Society of anesthesiology (ASA) physical status I to II underwent selective pain-free Bronchoscopy were enrolled in this research. Exclusion criteria include a history of allergy to propofol or soybean oil, a history of drug addiction or difficulty in communication, an experience of severe propofol injection pain or refusal to use propofol as an induction agent, and history of Raynaud syndrome or Peripheral angiitis. Difficult or Multiple catheter placements (N > 3), prolonged surgical procedures (over 3 hours) were also excluded.

All included patients were fasted (2h from water, and 6h from solid food) before being taken to a laminar flow operating room with its temperature set at 22°C and humidity at 55%. A 22G catheter needle (B. Braun, Melsungen, Germany) was placed into the vein on the back of a hand (Figure 1a male, figure 1b female), and a continued Ringer solution at room temperature at a speed of 100ml/h was infused. Patients were monitored with T8 Multi-parameter Patient Monitor (Mindray, Shenzhen, China) including electrocardiogram (ECG), pulse oximetry (SPO_2) and non-invasive artery blood pressure (NIBP). Patients were lying on the operating table covered with a thin cotton blanket at least 5 min before induction and a nasal catheter oxygen supply at 2 L/min was administered to the patients until loss of consciousness. Patients' feelings about the operating room were asked and recorded with three differences: Warm, Just right (not warm, not cold), and Chilly. Patients were marked and allocated to different groups according to their true feeling of the room temperature by a nurse anaesthetist. General anaesthesia was induced 2 min later by an anesthesiologist who did not know about patients' grouping. Propofol (10 mg/ml, Leweijin, Guorui, Sichuan, China, sn1612121) was injected by an infusion pump at a speed of 5ml/min with a total dosage of 2 mg/kg, no other drugs were administered before. Injection pain intensities were assessed with a three-point scale during the infusion: 0 for no pain (patients had no response); 1 for mild pain (patients reported mild pain); 2 for obvious pain (patients report ed moderate pain or severe pain). If a 2-degree pain was reported, a 4 ml 0.5% lidocaine (7b78JI, Dajiong, China) was injected in 30 seconds, 2 min pause of injection was taken, following with a 2 ml/min of propofol was infused by the infusion pump.

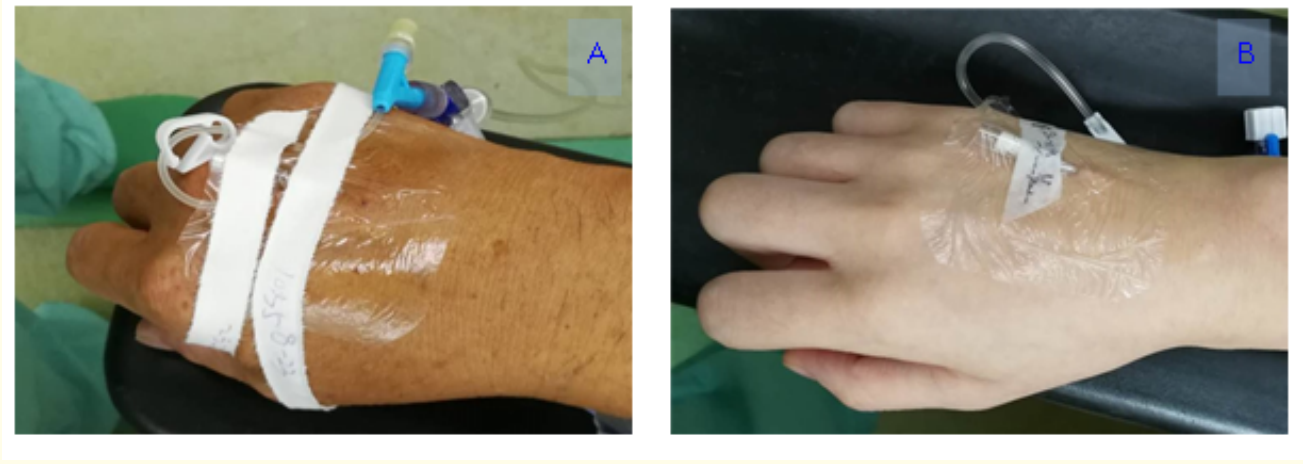

Figure 1: *Injection site of propofol. Propofol was infusion at 5 ml/min by an infurer via a 22G intravenous catheter. A: Male hand, B: Female hand.*

Sufentanil (0.5 ug /kg) was injected above 30 seconds when calculating inducing dosage of propofol through pump infusion, in conjunction with Cisatracurium (0.5 mg/kg) I.V. With Bispectral index (BIS) monitored, target ranges from 40 to 60, Anesthesia was maintained by propofol infusion at a speed of 0.5 - 1.5 ml/min and sevoflurane was inhaled at 1.5% - 3.5% with 2 L/min fresh flow (half O_2 and half air); sufentanil or cisatracurium was administered intravenously at 1/4 the induction dosages at demanding. Light guided laryngeal masks at Appropriate size were inserted for ventilation During the surgery. All the patients were transferred to Post Anesthesia Care Unit (PACU) after surgery and then dismissed to general wards with a steward scale of more than 4.

Statistics

SPSS for windows version 13.3 was chosen for statistical analysis. The sample size was based on a hypothesis that 60% incidence of propofol injection pain with no pretreatment and 30% incidence of propofol injection pain with positive pretreatments [4]. A minimum sample size of 54 was required to detect a significant difference with 90% power (Two sides, $\alpha = 0.05$). Data collection stopped when all groups have more than 56 patients enrolled. Measured data were presented as mean ± SD, counted data were presented as number (%). One-Way Analysis of Variance (ANOVA) was chosen for measurement data and Chi-square tests were chosen for enumeration data, respectively. $P < 0.05$ was considered as being significantly different.

Results

Totally 201 cases were enrolled in our research at first to avoid some exclusive cases, 8 patients were excluded for multi catheter placements and 2 patients were excluded for surgery time is more than 3 hours. Data from 191 patients were analyzed and 67 patients who reported chilly were allocated to Group Chilly, 56 patients feel warm were in Group warm and 68 patients feeling Just right were in group J, respectively. Subject enrollment and analysis are illustrated in figure 2. The Demographic characteristics of each group were shown in table 1. No significant difference was found among the three groups.

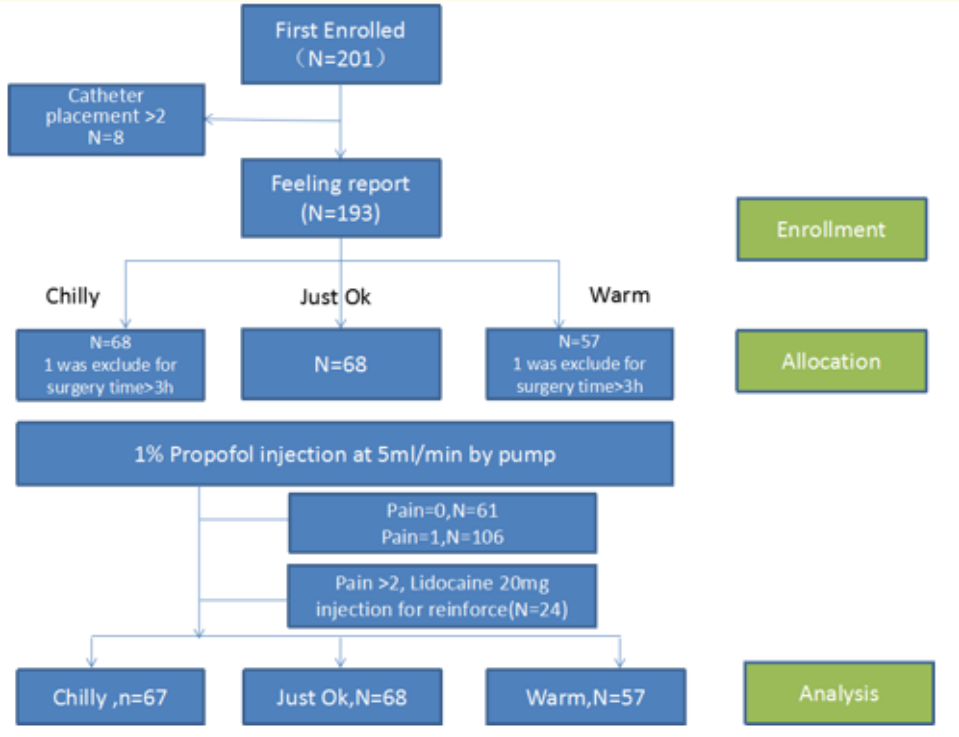

Figure 2: *Flow chart of this study.*

	Group Chilly (67)	Group Just (68)	Group Warm (56)	P value
Age (yr)	37 ± 10	38 ± 13	38 ± 11	0.67
Weight (kg)	53 ± 12	58 ± 13	56 ± 14	0.1
Gender (male/female)	19 (28.4)/48 (71.6)	29 (42.6)/39 (57.4)	22 (32.8)/35 (67.2)	0.23
ASA physical status (I/II)	30 (44.7)/37 (55.3)	29 (42.6)/39 (57.4)	18 (32.1)/38 (67.9)	0.86

Table 1: *Demographic information in three groups.*
Age and weight are presented as mean ± std. Gender and ASA were presented as numbers.
ASA: American Society of Anesthesiologists.

There was a significant difference among the three groups (Chi-square = 7.773, P = 0.021). The total incidence of propofol injection pain is 68.1% in our research. There are 57 (78%) patients in Group Chilly who suffered an injection pain, which is significantly higher than that in Group Warm (Chi-square = 6.9, P = 0.009); 22 patients got a pause of propofol infusion for the injection pain, which was significantly higher than those in group Just-right and group Warm (Chi-square = 20.5, P = 0.00), (Chi-square = 22.1, P = 0.00) (Figure 3A). There were no significant differences in the incidence and severity of Propofol injection pain between female and male patients (chi-square = 3.31, p = 0.069) (Figure 3B).

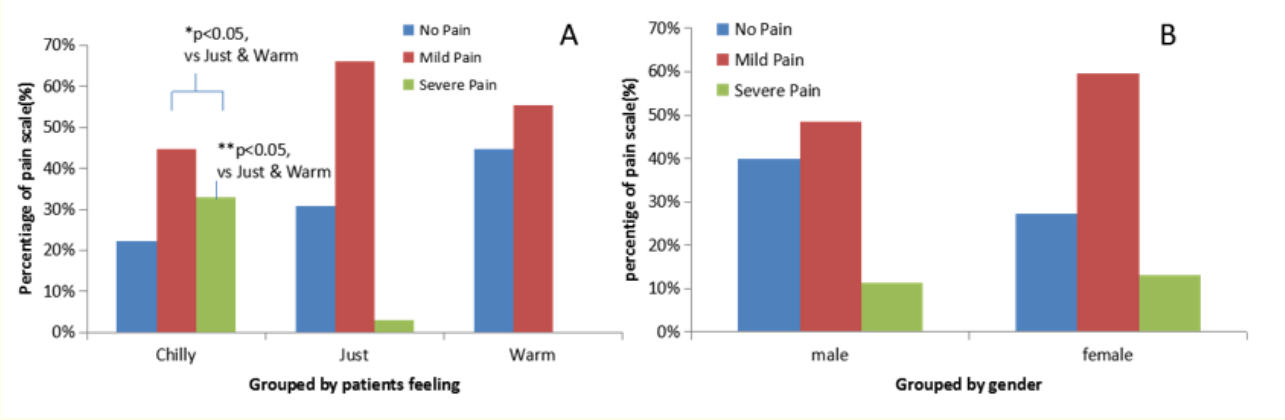

Figure 3: *Percentage of injection pain scale between different groups. A: Grouped by patients feeling, *: Showing that the total incidence of injection pain among three groups, while compare with group just and group warm feeling, incidence in group chilly is significantly higher, p < 0.05; **: Showing that the incidence of scale 2 injection pain in group chilly in significantly higher than that in group just and group warm. B: grouped by gender, total incidence of injection pain in female is higher than that in male, but difference is not significant, P > 0.05.*

Discussion

Our study focused on patients' feeling about the room temperature before propofol injection. Though during the whole period of this research, the room temperature was set at 22°C, our enrolled patients reported different feeling and they were allocated to three groups based on their feeling. To avoid severe injection pains, we only set 3 scales to assess injection pain, a moderate or more injection pain would get a pause of injection, as well as a reinforcement with an injection of 20 mg lidocaine [21,22]. With this plan, our patients did not suffer severe injection pains.

Reasons for propofol injection pain have not yet been very clear, and the pain is also hard to avoid completely. The total incidence of propofol injection pain is 68% in our research, which is close to other reports [21,22]. The reason for this high frequency of injection pain is probably we did not do any pre-treatments before propofol injection. These results implied that propofol injection pain is still very common in clinical practice [4], and more attention should be paid to this during general anaesthesia induction.

The main results of our research showed that patients suffered significantly more incidence of propofol injection pains if they had a chilly feeling in the operating room. The incidence will up to 78% if patients feel chilly. More severe pains can be found in group Chilly compare to group Just and group Warm ($P < 0.05$). Reports showed that on exposure to cold environments [17], skin blood flow decrease via vasoconstriction, this resulted in a less heat transfer from the core to the surface, which helped to maintain core temperature in the face of cold exposure [18], this vasoconstriction could be regarded as a reason for the increasing incidence of injection pain. On the contrary, during excise or heat exposure, the skin blood flow can be severalfold from 250 ml/min to 7 - 8 L/min [18,23]. The increased blood flow or the vasodilatation resulted in a decrease of propofol injection pain [10].

All the above suggested that keeping patients in a comfortable warm room before propofol injection was very important for the prevention of propofol injection pain; at least, an attempt to avoid a chilly or cold feeling should be tried. If a chilly or cold feeling was reported before propofol injection, a fast warm-up strategy [10] should be implemented or a lidocaine injection in conjunction with 2 min venous occlusion [4] was performed.

Injection pain was more common with female patients [24], which may be attributable to the smaller blood vessels in women [24]. Our secondary results showing that females were more vulnerable to propofol injection pain, but no significant differences were found in our study ($P < 0.05$), which may be caused by a small data size indicating a larger-sized study needed for clarification.

Limitation of the Study

There were some limitations in our study. First, because of instruments limitations, we cannot monitor patients' core temperatures and skin temperatures, which may explain why patients have different feelings at the same room temperature. The baseline of patients' temperatures or metabolic rates may contribute to their different feelings, but for the limitation of our types of equipment, we did not get those data. Second, a measurement of skin blood flow on hand dorsal veins with laser Doppler or venous occlusion plethysmography could be taken, which can analyze the relationship between the skin blood flow, skin temperature, feeling and propofol injection pain, which is not normal Nevertheless, our results did show that a cold feeling will increase and intensive the propofol injection pain.

Conclusion

In conclusion, Patients scheduled for general anaesthesia with propofol induction should be kept at a warmer room temperature to avoid a cold feeling; otherwise, they will suffer more propofol injection pain.

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Conflicts of Interest

There was no conflicting have to statement.

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