Large Antecubital Vein Versus Small Vein on Dorsum of Hand for Propofol Injection Pain: A Comparative Study

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Abstract

Objective: To determine the mean difference in pain scores between large antecubital vein compared to small vein on hand dorsum for propofol injection pain in patients undergoing general anaesthesia surgery.

Methods: A randomized control trial was conducted at Department of Anaesthesiology, Abbasi Shaheed Hospital, Karachi from May 2018 to November 2018. All patients aged 18-60 years of either gender undergoing scheduled elective surgery under general anaesthesia having ASA status I or II were consecutively enrolled. Group A was offered propofol through antecubital vein and group B was given injection propofol through small vein on the dorsum of the hand. The 2% lidocaine 1 ml admixture in 1% propofol 19 ml was administered to patients through large antecubital vein and small dorsal vein at hand. Anesthesia induction was carried out as routine and as per procedure. All patients were explained the use of VAS (Visual Analogue Scale) and were asked to report the intensity of the pain immediately after the injection propofol.

Results: Of 120 patients, the overall mean age and BMI of the patients was 40.92 ± 10.03 years and 27.11 ± 5.05 kg/m^2 respectively. An insignificantly higher mean difference of age (p= 0.052) and body mass index (BMI) (p= 0.901) were observed in small vein group as compared to the antecubital group. There were 64 (53.3%) males and 56 (46.7%) females. There were 43 (35.80%) smokers, 52 (43.3%) hypertension (HTN), and 29 (24.2%) diabetes mellitus patients. The mean difference of pain was significantly lower in antecubital vein group as compared to the small vein group, i.e. 2.48 ± 0.77 vs 5.67 ± 0.75 respectively (p<0.001).

Conclusion: A significant difference in mean pain scores was observed between large antecubital vein versus small vein on hand dorsum for propofol injection pain among patients undergoing surgery for general anaesthesia. We recommend using larger veins for propofol bolus while inducing general anaesthesia patients.

Keywords: Veins, pain, propofol, injections

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Introduct ion

For general anaesthesia induction and sedation, propofol is a drug of choice mainly due to its rapid onset, limited time of action and simple titration. It has little hemodynamic improvement if doses are given gradually and are measured[1]. Hypersensitivity reaction with propofol is very rare and the incidence of pain recorded on propofol injection is 26-70 percent[2]. Because propofol is used widely in clinical settings the injection discomfort cannot be ignored. Unfortunately, in reducing the pain absolutely, none of the treatment was considered successful. In many hospital settings propofol's everyday uses warrant its painless use. The mechanisms proposed for pain are local mediator release and/or the immediate painful effect of propofol on nerve endings[3].

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Propofol was considered superior to other steps, such as shift in propofol temperature, intravenous catheter or injection speed, via a large antecubital vein[4].

Propofol lidocaine admixture, ketamine pretreatment, antidepressants, anti-inflammatory antisteroids, magnesium sulfate, ondansetron, ramosetron, and many of the medications were extensively studied. Pharmacological treatments were tested on different drugs with pretreatment of lidocaine with venous occlusion[5-6].

The rationale of the study is that the data is scarce on this topic locally and anesthetists are using different modalities to alleviate the pain on propofol injections. Therefore, the present study is designed to assess the effectiveness of different sites of injection and the better of the two was used in subsequent patients in future.

Patients and Methods

This randomized controlled trial was conducted from May 2018 to November 2018 at Department of Anaesthesiology, Abbasi Shaheed Hospital, Karachi. The Abbasi Shaheed Hospital is among Pakistan's most prestigious hospitals. Located in one of the most populous neighborhoods in Karachi, it is also the third largest public sector hospital that comes under the umbrella of the City Government of Karachi. It has the strength of 850 beds and a total of 18 operation theatres for various departments.

Ethically all the patients were made clear about the purpose, procedure, risk, and benefits of the study and confidentiality was ensured. Signed informed consent was also obtained from all study participants after explaining the pros and cons of the study.

All patients age 18 to 60 years of either gender having ASA physical status I & II underwent scheduled elective surgery under general anesthesia were included. Non-probability consecutive sampling technique was applied. Whereas those who were obese, history of lidocaine / propofol allergy, taking some analgesics, and pregnant women were excluded.

Open Epi sample size calculator was used for the purpose of sample size estimation. In previously published study VAS score of patients in antecubital vein group was 2.63 ± 1.80 while VAS score of patients in small vein on dorsum of hand was 5.95 ± 2.79. In addition, significance level was taken as 01% and power of the test as 90%. The required sample size came out to be 150 however in order to generalize our results on population we took the sample of 120 (60 per group).

Pain scores were assessed using visual analogue scale of 0-10. Visual analogue score was used immediately after propofol injection to assess the pain score.

Post informed consents patients were randomly divided into two groups through sealed opaque envelop method. Envelop distribution was performed with the help of randomized number list which will generate by applying formulation method in Microsoft Excel 2016. Group A was offered propofol through antecubital vein and group B was given injection propofol through small vein on the dorsum of the hand. A 20-gauge intravenous catheter was inserted in respective veins by anesthesia staff having more than one-year experience. The use of visual analog scale was demonstrated to all the patients. Pain level was noted after the propofol injection was administered. The 2 percent lidocaine 1 ml admixture in 1 percent propofol 19 ml was administered to patients through large antecubital vein and small dorsal vein at hand. Anesthesia induction was carried on as routine as per procedure. Data like age, gender, place of residence, ASA status, and pain intensity was noted.

Statistical analysis was performed using SPSS version 22. Age, height, weight, body mass index, family income and pain score were computed as mean ± standard deviation while gender, educational status, residential status, ASA status, smoking status, HTN, DM, were computed as frequencies and percentages. Two groups were compared with re-

spect to pain score using independent t-test. Significance level was set at 0.05.

Results

Of 120 patients, the overall mean age of the patients was 40.92 ± 10.03 years. The mean age was insignificantly higher in small vein group as compared to the antecubital group (p= 0.052). The mean weight of the patients was 60.10 ± 5.13 kg. The mean weight was insignificantly higher in antecubital group as compared to the small vein group (p=0.887). The mean height of the patients was 1.54 ± 0.06m. The mean height was insignificantly higher in antecubital group as compared to the small vein group (p=0.845). The mean BMI of the patients was 27.11 ± 5.05 kg/m^2. The mean BMI was insignificantly higher in small vein group as compared to the antecubital group (p=0.901).

There were 64 (53.3%) males and 56 (46.7%) females. There were 20 (16.7%) patients with <15,000 rupees monthly family income, 60 (50%) had in between 15,000 to 30,000 rupees monthly family income and 40 (33.3%) patients with >30,000 rupees monthly family income. ASA status I was observed in 57 (47.5%) patients whereas ASA status II in 63 (52.5%) patients. There were 43 (35.80%) smokers, 52 (43.3%) HTN, and 29 (24.2%) diabetic patients. Educational status of majority of the patients was intermediate or less (n=63, 53%), followed by graduate or more (n=43, 35.8%) whereas secondary or less in 14 (11.7%) patients. Residential status of 46 (38.3%) patients was rural while 74 (61.7%) patients had urban residential status.

The mean difference of pain was significantly lower in antecubital vein group as compared to the small vein group, i.e. 2.48 ± 0.77 vs 5.67 ± 0.75 respectively (p-value <0.001). (Table 2)

A significant mean difference of pain scores and groups when stratified according to age, gender, educational status, monthly income, residential status, smoking, HTN, and DM of the patients. (Table 3)

Discussion

This study was conducted with the aim to find out a mean difference in pain scores between large antecubital vein compared to small vein on hand dorsum for propofol injection pain in patients undergoing general anaesthesia surgery. For this purpose, all patients age 18-60 years of either gender undergoing scheduled elective surgery under general anaesthesia having ASA status I or II were consecutively enrolled.

The pain during injection cannot be dismissed as propofol is frequently used in healthcare settings[2]. Pain mechanisms are the release and/or the immediate painful effect of propofol on nerve endings by local mediators[4-5].

Table 1. Demographic characteristics of the patients (n=120)

	Total	Antecubital Vein	Small Vein	p-value	95% CI
Age years	40.92±10.03	39.15±10.09	42.71±9.74	0.052	-7.13 to 0.34
Weight kg	60.10±5.13	60.16±5.17	60.03±5.11	0.887	-1.72 to 1.99
Height m	1.54±0.06	1.54±0.06	1.53±0.03	0.845	-0.02 to 0.03
BMI kg/m^2	27.11±5.05	27.04±5.07	27.16±5.01	0.901	-1.95 to 1.72

Table 2. Mean difference of pain with respect to group (n=120)

Group	Mean ± SD	p-value	95% CI
Antecubital Vein	2.48 ± 0.77	<0.001	-3.45 to -2.91
Small Vein	5.67 ± 0.75		

Table 3. Comparison of mean pain difference to group and general characteristics (n=120)

Variables	Group	Mean±SD	p-value	95% CI
Male	Antecubital Vein	2.63±0.84	<0.001	-3.09 to -2.34
	Small Vein	5.34±0.62		
Female	Antecubital Vein	2.28±0.12	<0.001	-4.06 to -3.31
	Small Vein	5.96±0.75		
Smokers	Antecubital Vein	2.67±0.76	<0.001	-3.31 to -2.40
	Small Vein	5.53±0.69		
Non-smokers	Antecubital Vein	2.36±0.76	<0.001	-3.72 to -3.03
	Small Vein	5.73±0.78		
	Small Vein	5.59±0.79		

Independent t-test applied, p-value <0.05 considered significant

In the current study, the mean difference of pain was significantly lower in antecubital vein group as compared to the small vein group, i.e. 2.48 ± 0.77 vs. 5.67 ± 0.75, respectively. Similar findings were observed in previous studies as well. In a study conducted by Narejo et al, it was reported that severity of pain was considerably lower in antecubital vein than that of small vein on dorsum of hand[7]. Similar findings were reported in a meta-analysis by Jalota et al[8].

Since these theories of propofol mediated pain, different researchers have postulated various approaches for alleviating this issue. Propofol injection through large antecubital vein was considered a better option than other non-pharmaceutical procedures, such as changes in propofol temperature, a large intravenous catheter and speed of injection[9].

Different drug pharmacologic treatments, lidocain pretreatment with venous occlusion have been tested[10]. Admixture of propofol-lidocaine[11-12], Ketamine pretreatment[13], antidepressants[14], magnesium sulfide[15], ondansetron[15,16], ramosetron, and many other medications have been thoroughly studied[17]. In 20% vs 71% of patients, the efficacy of large antecubitally vein and small vein in the dorsal hand were evaluated to severe pain, which means that 80% and 29%, respectively, for large antecubitally vein and smaller vein were successful[18].

Propofol reduces cerebral blood flow, intracranial pressure, and cerebral metabolic rate while maintaining dynamic and static self-regulation[19] and vascular responsiveness to CO_2[20]. Such beneficial effects on cerebral physiology make propofol an almost perfect hypnotic for anesthesia during neurosurgery. There is conflicting evidence of propofol's neuroprotective effects during ischaemia-reperfusion injury[21]. However, its function has been developed in multimodal neuroprotection[22].

Propofol has both pro- and anticonvulsive activity. On one side, during or shortly after the start or end of propofol anaesthesia, a number of reports of convulsions and exciting events such as myoclonus and tremor have been reported[23]. Such events could be the product of the subcortical region's preferential depression. On the other hand, the function of propofol has been well known as an effective treatment of epileptic status[24,25].

Some investigators suggest that the lipid solvent for propofol activates the plasma kallikrein-kinin system and produces bradykinin, which in turn causes local vein vasodilation and hyper-permeability. This modification of the peripheral vein may increase the contact between the aqueous phase propofol and free nerve endings of the vessel resulting in pain[26]. Others investigators believe that propofol as a member of phenol group can have direct irritant effect on local vein by stimulating nociceptors and free nerve endings giving rise to an immediate sensation of pain[27,28]. Based on these assumptions of propofol induced pain pathway, different investigators postulated different interventions to alleviate this problem. The injection of propofol through large antecubital vein was considered as a superior method than any other non-pharmacological measures like changing the temperature of propofol, large intravenous catheter and speed of injection[8].

Among the all above interventions, propofol-lidocaine admixture is well known to be the best simple method[7]. Lidocaine is a local anesthetic. It reduces the pain by two possible mechanisms, direct effect of local anesthetic on vascular smooth muscle and modifying the pH of propofol. As lidocaine is a weak base solution when it dissolves with lipid it decreases the pH of the mixture. Thus, more propofol in lipid phase cause less pain on injection[29]. Injection of propofol through large vein is another effective way in reducing pain. The vein diameter, flow rate, and endothelial structure might account for the reduction in pain. The injection of propofol through a large antecubital vein, minimize the extent to which a high concentration of propofol comes into contact with the sensitive endothelial wall. Furthermore, propofol will move faster from the injection site when more blood will be available to dissipate the bolus. Additionally, the composition of

nociceptors along the endothelial wall might differ between the smaller veins of the hand and the larger antecubital veins. A meta-analysis showed that among the non-pharmacological and pharmacological interventions for the most effective method was the use of large antecubital vein followed by pretreatment with lidocaine combined with venous occlusion[8].

Propofol is a popular drug used for induction of anesthesia and sedation in intensive care, emergency room and for endoscopic procedures. Propofol injection pain was ranked seventh among the most important thirty-three low-morbidity clinical anesthesia problems[28]. Unfortunately; despite its popularity pain on its injection is still unresolved issue because exact mechanism of this pain is not clear so far. This limitation in understanding the cause of propofol injection pain necessitates many investigators to address the issue.

Thus, use of large antecubital vein for propofol injection is associated with significantly less pain when compared with smaller veins at back of the hand. It is recommended larger veins for propofol bolus could be use while inducing general anesthesia patients.

The finding of the study could be highlighted in the light of limitation the study failed to analyze data on certain important variables like clinical and laboratory characteristics. Despite of these limitations, this study has reported current finding from a large public sector hospital of metropolitan city Karachi. Further studies are recommended on larger sample size to preclude the finding of this study.

Conclusion

A significant difference in mean pain scores was observed between large antecubital vein versus small vein on hand dorsum for propofol injection pain among patients undergoing surgery for general anaesthesia. We recommend using larger veins for propofol bolus while inducing general anaesthesia patients.

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