RESEARCH ARTICLE

The Effect of Intravenous Lidocaine Infusion on Post-Operative Pain after Percutaneous Nephro Lithotomy: A Randomized Clinical Trial

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Background: Percutaneous Nephro Lithotomy (PCNL) is an efficient treatment for complicated, large and staghorn calculi. Optimal pain control has long been a concern for the surgeons and the anesthesiologist. The pivotal aim of this study is to evaluate the effects of intravenous lidocaine infusion on pain levels, sedation score, foley catheter tolerance and level of nausea and vomiting in patients undergoing the procedure.

Methods: In a randomized parallel group double blind clinical trial, 60 patients with ASA physical class I candidate for PCNL were enrolled in the study. During the operation, group A patients received 1mg/kg/hr infusion of intravenous lidocaine infusion while group B patients received normal saline infusion as placebo.

Results: Patients receiving lidocaine infusion had better foley catheter tolerance compared to the placebo group. Similarly VAS pain scores in the PACU were 2.5 ± 1.7 in group A versus 3.7 ± 1.2 in group B was observed to be higher in the placebo group leading to significant difference. (p= 0.03) One hour after surgery 4 (23%) and 26 (87%) of the patients in group A were drowsy and alert, while the results in group B were 13 (77%) and 6 (20%) respectively.

Conclusion: The results of our study demonstrates significant difference in sedation score (15 minutes and one hour after surgery) and foley catheter tolerance in patients who received lidocaine infusion through PCNL surgery. In addition, patients receiving lidocaine infusion convey better pain scores after surgery.

Keywords: acute pain; lidocaine; post-operative; percutaneous nephrostomy

Percutaneous Nephro Lithotomy (PCNL) is an efficient treatment for complicated, large and stag horn calculi [1-3]. Various approaches for management of anesthesia through the procedure have been proposed. General anesthesia is more favorably performed due to safe and secured airway in the prone position while making the surgeon comfortable for higher punctures and long surgery duration if needed [2]. However the use of regional anesthesia has also been proposed with its own advantages and drawbacks. Despite the advantages offered by general anesthesia postoperative complications such as pain, nausea and vomiting is inevitable [3,11-12].

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For optimal pain management various modalities such as regional analgesia and drugs have been introduced [3]. However each alternative has its own side effects, such as respiratory depression, nausea and vomiting in opioids and hypotension and infection in regional analgesia. Therefore, there has been major effort to minimize opioid consumption, while conceiving the means of pain control.

Lidocaine, an amino-amide type local anesthetic, has anti-inflammatory and analgesics effects through sodium channel blockade, NMDA receptors and inhibition of G-protein receptors [4-5]. It also has antiarrhythmic properties. Advantages of perioperative lidocaine infusion have been shown in previous studies. Reduction of opioids requirements and pain scores have been reported in both open and laparoscopic abdominal surgeries. Moreover some studies have reported faster bowel function return as a merit of lidocaine usage [6-10].

The aim of this study was to evaluate pain levels, sedation score, foley catheter tolerance and level of nausea and vomiting in patients who received perioperative lidocaine infusion in PCNL procedure.

Methods

With the approval of the proposal by the research

committees of the anesthesia department, the faculty of medicine, and the medical ethics committee of the university, the study was registered in the Iranian registry of clinical trials (IRCT) with the registration code of IRCT2017011732017N1.

In this randomized double blind clinical trial, 60 patients who were candidate for PCNL were randomly allocated by sealed envelopes to groups (A) and (B). The inclusion criteria of the study were patients with ASA class I and aged 20 to 60 years. Patients with ASA class II and more, with sensitivity to lidocaine, history of renal surgery, those with substance abuse and addiction, mood and anxiety disorders, withdrawal symptoms, surgery more than 3 hours and major bleeding during the procedure were excluded from the study. Randomization was carried out by simple randomization of 1-60 to 2 different treatments. After confirming eligibility for patients and entrance of patients to the operating room, a sealed envelope was opened and patient's treatment category (A versus B) was identified. All patients were prescribed normal saline 5cc per kg for hydration when entering the operating room. Under standard patient monitoring (ECG monitoring, pulse oximetrey and noninvasive blood pressure monitoring), 0.05 mg/kg of midazolam and 3µg/kg of fentanyl were prescribed as premedication. For induction of anesthesia, 1 mg/kg of lidocaine, 5 mg/kg of thiopental sodium and 0.5 mg/kg of atracurium and for maintenance, an infusion of 100-200 µg/kg/min of propofol was administered. PCNL was performed according to the standard prone position with fluoroscopic guidance as described before (REF) as summarized below. The patients underwent cystoscopy and a 5F ureteral catheter was inserted up to renal pelvis and fixed to foley catheter, then the patient was turned to the prone position. An additional dose of 50 µg of IV fentanyl every hour was injected for the patients. Puncture was made by an 18 G shiba needle under fluoroscopic guidance, tract was dilated using one-shot amplatz dilators and 30F apmplatz sheat was inserted. Lithotripsy was performed using preamatic lithotripters. Participants in group A received 1mg/kg/hr infusion of lidocaine throughout the surgery, whereas group B received normal saline infusion as placebo. At the end of the surgery and after the patients were in a supine position 0.04mg /kg neostigmine and 0.02 mg/kg atropine was administered. The primary endpoint interest were visual analogue Richmond sedation scale assessed 15 minutes and 1 hour after surgery. Secondary endpoints included visual analogue pain score, foley catheter tolerance and anesthesia complications especially nausea, vomiting and chills. After the patient was removed to the post anesthetic care unit (PACU) vital signs and sedation score, evaluated by Richmond Sedation Scale, were recorded every 10 and 15 minutes, respectively. After the patients gained consciousness pain score was evaluated using VAS score. All the evaluations were conveyed by an anesthesiologist blinded to the study. As for pain management with a score more than 3, 20 milligrams of pethidine was administered. Foley catheter tolerance was assessed after the operation from 0 to severe score. (0 means no complaints, mild score for those who did not complain but had disturbance after questioning, patients with complaints of voiding discomfort and dysuria were deemed to moderate score and severe for those with aggressive hand and foot movements, loud voices and trying to take the foley off.)

Data analysis

The descriptive data were featured along with their standard deviations and/or frequencies (percent). Chi-square analysis was performed to compare the qualitative variables, where T-test and Mann-Whitney U test were used to do so for the quantitative variables. P value lower than 0.05 was considered meaningful. All data were analyzed with the Statistical Package for Social Science (SPSS) for windows, version 22.0 (Chicago, IL, USA).

Results

Demographic and intraoperative values are displayed in (Table 1). Patient's flow diagram has been illustrated in (Figure 1). Sedation score after the surgery for both groups was measured and recorded in the first 15 minutes and 1hour after surgery, displaying a significant statistical difference. (P value≤0.001) (Table 2)

Regarding complications after surgery, nausea and vomiting in both groups did not show any statistical significance. (p=0.424 and 0.671, respectively) As for chills no difference was seen between groups (Table 3).

Patients receiving lidocaine infusion had better foley catheter tolerance compared to the placebo group. Similarly pain scores in the PACU was observed to be higher in the placebo group leading to significant difference. (p= 0.03)

Systolic and diastolic blood pressures were higher in group A whereas heart rate was higher in group B. Although hemodynamic values in each group revealed significant difference, no statistically difference was demonstrated comparing the trends between groups.

Table1- Demographic and intraoperative Values

		lidocaine group (n=30)	Placebo group (n=30)	P value
Age		33.2(9.66)	32.77(10.78)	0.8
Sex	Male	21 (70%)	15(50%)	0.187
	Female	9 (30%)	15 (50%)	
Surgery duration		101.33(11.7)	155.83(11.37)	0.1
Anesthesia duration		155.66(9.16)	154.83(10.21)	0.7
Stone location	Right	27(90%)	22(73.3%)	
	Left	3(10%)	8(26.7%)	0.9

Table1- Demographic and intraoperative Values (Continued)

	lidocaine group (n=30)	Placebo group (n=30)	P value
Stone size	2.75(0.66)	2.73(0.73)	0.9
Type of foley catheter			
Double-j	28(93.3%)	27(90%)	
sound ulter	2(6.7%)	3(10%)	0.6

Values are expressed as mean (SD) or N (%)

Figure 1- Flow diagram of patients

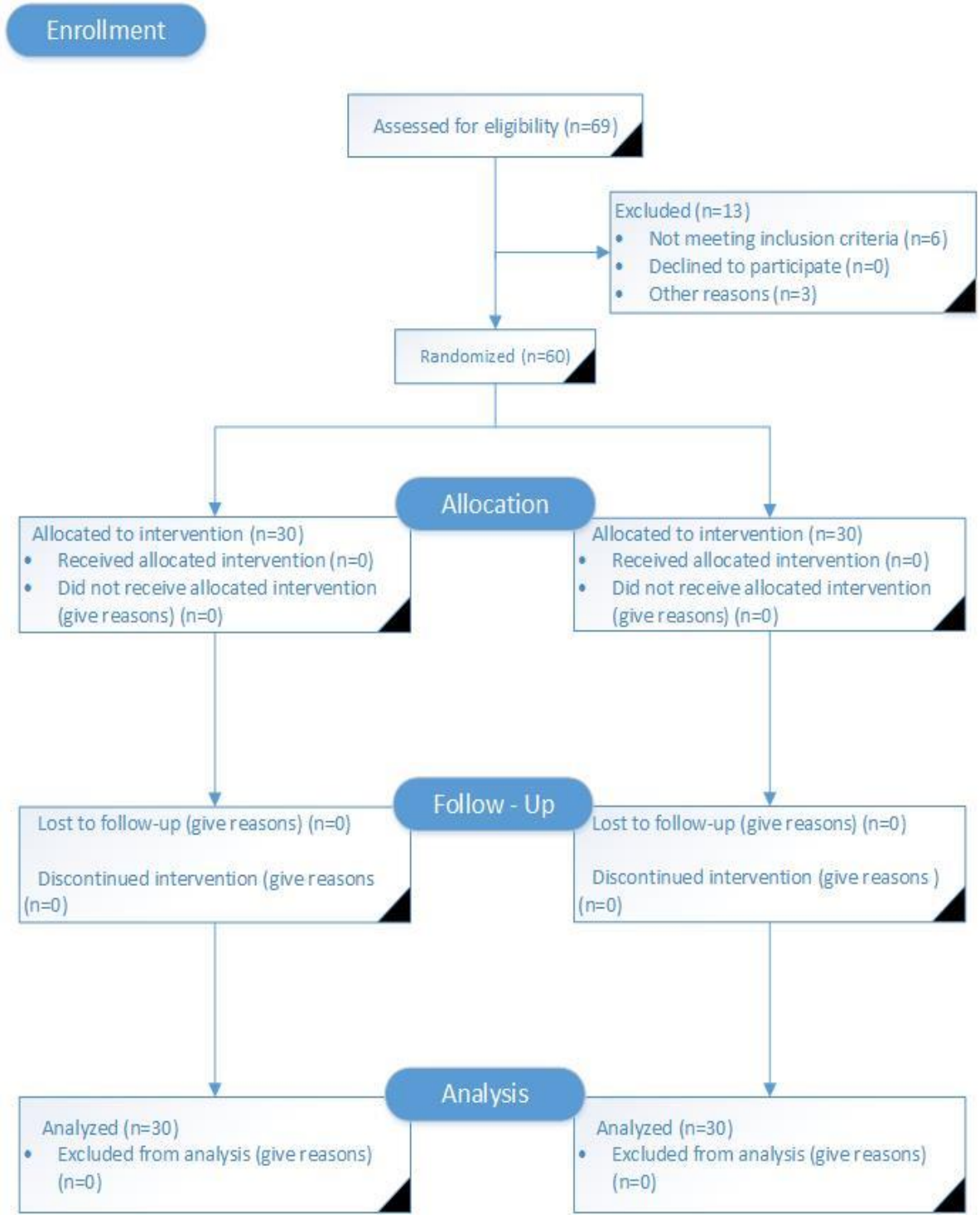

Table 2- Sedation score in the first 15 minutes and hour after surgery in groups

Sedation Score	Lidocaine Group(n=30)		Placebo Group(n=30)		P value	
	First 15 min	First hour	First 15 min	First hour	First 15 min	First hour
Light sedation	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Drowsy	7 (23.3%)	4 (13.3%)	2 (6.7%)	0 (0%)		
Alert & calm	21 (70%)	26 (87.7%)	11 (36.7%)	23 (76.7%)	<0.001	<0.001
Restless	2 (6.7%)	0 (0%)	15 (50%)	6 (20%)		
Agitated	0 (0%)	0 (0%)	2 (6.7%)	1 (3.3%)		
Very agitated	0 (0%)	0 (0%)	0 (0%)	0 (0%)		

Table 3- Post-operative complications in groups

Complications	Lidocaine group(n=30)	Placebo Group (n=30)	P value
Nausea, n (%)	5 (16.7%)	2 (6.7%)	0.424
Vomiting, n (%)	4 (13.3%)	2 (6.7%)	0.671
Chills, n (%)	27 (90%)	27 (90%)	1
Pain in PACU, mean ±SD	2.5 ± 1.7	3.7 ± 1.2	0.003
Foley catheter tolerance, n (%)			
zero	22 (73.3%)	13 (43.3%)	0.035
light	6 (20%)	11 (36.7%)	
moderate	2 (6.7%)	6 (20%)	
severe	0 (0%)	0 (0%)	

Discussion

The results of our study demonstrate significant difference in sedation score (15 minutes and one hour after surgery) and foley catheter tolerance in patients who received lidocaine infusion through PCNL surgery. In addition, patients receiving lidocaine infusion convey better pain scores after surgery.

Pain after surgery is a major concern due to complications and delayed recovery. Pain after PCNL is due to dilation of capsule and parenchyma tract [11,25]. There has been considerable debate through various methods of post-operative pain relief to elicit a feasible safe and well tolerated method or drug. The advantages offered by opioids are well appreciated, however their side effects should also be considered.

Lidocaine is a local anesthetic with analgesic and anti-inflammatory properties [4]. It retains analgesic properties by sodium channel blockade and G-protein receptors inhibition. Lidocaine might play a promising role in the control of postoperative pain cuased by inflammatory response in the body and decreased cytokine plasma levels [6]. Lidocaine also has subtle opioid like effects, which contributes to reduced opioid requirements after surgery [10].

There has been considerable debate through the effectiveness of lidocaine infusion on postoperative pain. In laparoscopic bariatric surgery, improvement in pain and recovery scores and lower incidence of nausea were seen after lidocaine infusion [3]. These results and the results of our study are parallel, in our study post-operative pain score and sedation score were of better results when receiving IV lidocaine. In concordance with our study Khan et al also reported lidocaine infusion intraoperative decreased pain 48 and 72 hours after surgery [13]. Accordingly postoperative pain in 24 hours was less in abdominal surgery with the therapeutic effect of lidocaine infusion. In 45 clinical trials lidocaine infusion reduced pain in 1-4 and 24 hours after laparoscopic and open abdominal surgery [10,14-16]. Inversely reduction of pain was not detected 48 hours after surgery [10], however opioids requirement after surgery were lower in patients receiving lidocaine. Alternatively a study on perioperative lidocaine infusion in major laparoscopic renal surgery failed to conclude reduced post-operative pain in these groups [17]. In another study on breast cancer surgery IV lidocaine did not influence post-operative pain 2 – 72 hours after surgery, however chronic pain was reduced during 3-6 months [18].

Many studies have emphasized on trivial adverse of effects of therapeutic doses of IV lidocaine and its analgesic and anti-inflammatory properties. Our results did not demonstrate any complications due to lidocaine infusion. Previous studies have also showed lower incidence of post-operative nausea and vomiting with intraoperative lidocaine infusion as well as no difference was demonstrated in nausea and vomiting in patients receiving IV lidocaine infusion in open and laparoscopy abdominal surgery [13,19]. This was in agreement to our findings. Moreover our study delineates less pethidine consumption in patients receiving lidocaine infusion than their counterparts.

Regarding hemodynamic parameters, no difference was seen between groups, inconsistent with our study Zengin et

al also found the same results [20-21]. However in laparoscopy cholecystectomy researches reported lower blood pressure and heart rate in patients receiving IV lidocaine. Additionally, in our study we observed no adverse side effects from lidocaine infusion.

However our study had some limitations. No data were collected regarding patients follow up and need for analgesic drugs in the ward. We failed to measure lidocaine concentration level and finally postoperative ileus reduction and bowel movements were not evaluated in our study [22-26].

Clinical implementation of lidocaine infusion with trivial adverse effects as an adjuvant to maintenance of anesthetic technique and strategy is of utmost importance, to offer therapeutic benefits or replace existing partly effective treatments. It could also be further deducted that intravenous lidocaine significantly reduces post-operative pain in most surgeries. Future research to elicit the beneficial effects and to determine this conclusion is needed.

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