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SUBCUTANEOUS TRAMADOL INFILTRATION AT THE WOUND SITE VERSUS INTRAVENOUS ADMINISTRATION AFTER INGUINAL HERNIA OPERATIONS

[*1]Dr. Mohammed Niyazi Gheni, [2]Dr. Luqman Mohammed Azeez, [3]Dr. Janan Wadea Hurmiz Zora

[1]M.B.Ch.B, F.I.B.M.S., F.K.B.M.S-GI & HPB Surgery, Rizgary Teaching Hospital /Erbile- Trainer in Arabic Board of General Surgery.
[2]M.B.Ch.B-FICMS/ Rizgary Teaching Hospital-Erbil, Iraq.
[3]M.B.Ch.B., F.I.B.M.S. "General Surgery", F.K.B.M.S "Digestive Surgery/ Rizgary Teaching Hospital-Erbil, Iraq.

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***Corresponding Author: Dr. Mohammed Niyazi Gheni**
M.B.Ch.B, F.I.B.M.S., F.K.B.M.S-GI & HPB Surgery, Rizgary Teaching Hospital /Erbile- Trainer in Arabic Board of General Surgery.
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ABSTRACT

Background and Objectives: One of the most dreaded and likely most common pain disorders is postoperative pain, which is frequently still not appropriately addressed. Our goal is to evaluate the analgesic efficacy and side effects of intravenous tramadol against local wound infiltration in adult patients following open inguinal hernia surgeries. **Patients And Methods:** Fifty adult male patients were randomly assigned to two groups; SC group (n=25) received tramadol 2 mg/kg titrated with NaCl 0.9% for a total of 20 mL, as a local wound infiltration prior to skin closure and IV group (n=25) received tramadol 2 mg/kg plus NaCl 0.9% to a volume of 50 mL was infused slowly within 15 minutes prior to skin closure. Postoperatively; pain severity, time to first analgesic requirement, analgesic consumption, and incidence of nausea &vomiting were recorded. **Results:** Over the course of the investigation, the IV group's VAS ratings were higher. The results showed that these scores were extremely significant at 3 hours and up to 24 hours (p = 0.00). Only one case (4.0%) in the SC group and four cases (16.0%) in the IV group needed diclofenac. Over the course of the trial, nausea and vomiting were less common in the SC group (p value = 0.00). **Conclusions:** In comparison to intravenous administration following open inguinal hernia procedures, subcutaneous wound infiltration of tramadol results in fewer cases of nausea and vomiting and a lower consumption of postoperative analgesics.

KEYWORDS: Inguinal Hernia, Intravenous administration, Subcutaneous Infiltration, Tramadol, Wound site.

INTRODUCTION

Postoperative pain after inguinal hernia repair negatively impacts recovery, with pain control affecting functional recovery speed. Subcutaneous wound-site infiltration of tramadol differs from intravenous administration, providing anesthesia in a non-opioid manner. Post-operative analgesia can be administered via intravenous (IV) tramadol or subcutaneous wound-site infiltration of tramadol. Both methods are equally effective but differ in pharmacokinetic profile and safety. Cross-reference to pharmacokinetics is justified for this comparison.[1,2]

Postoperative pain is a significant risk factor for chronic inguinal pain after inguinal hernia repair. Controlling postoperative pain is crucial for optimal rehabilitation of patients undergoing groin surgery. It is especially important during the early hours after surgery, when pain levels are at their peak, as severe pain can lead to chronic inguinal pain. Therefore, all measures must be taken to eliminate postoperative pain.[3]

Because tramadol is a centrally acting opioid, its pharmacology for parenteral administration of tramadol is poorly documented. The main objective of this study was to compare postoperative analgesia following subcutaneous infiltration of tramadol 2 mg/kg at the suture line with tramadol 2 mg/kg given intravenously (IV) on immediate postoperative pain and recovery in patients undergoing inguinal hernia repair. The hypothesis was that tramadol would exert an analgesic

effect at wound sites where tissue damage occurred after surgery when compared to intravenous administration. Tramadol after 8–12 hours sedative effect is expected following surgical wound infiltration. The goal of the study was to evaluate the effect of wound-site infiltration.[4]

Tramadol is a centrally acting atypical opioid analgesic that acts as a μ-opioid agonist and inhibits serotinin and norepinephrine reuptake.[5] Tramadol is an analgesic agent that binds and activates μ-opioid receptors, weakly inhibiting norepinephrine and serotonin re-uptake. It is subject to significant liver metabolism, resulting in a systemic bioavailability of approximately 70%. Tramadol is marketed as parenteral formulation in 73 countries, with doses of 50 mg or 100 mg administered 4-6 hours apart. The intravenous route is the most widely adopted for parenteral tramadol.[6]

Wound infiltration techniques provide effective regional analgesia with minimal systemic exposure, making them beneficial in medical settings. When combined with tramadol, this method enhances the overall analgesic effect and provides longer-lasting support during the recovery phase. Local infiltration during hernia repair reduces incision-related pain, allowing patients to resume normal activities more quickly. Regional infiltration may reduce the need for rescue analgesics, such as tramadol, in the early postoperative period, particularly during the first 0 to 6 hours after wound-site infiltration adjustment. However, this method does not alter the effectiveness of clinical outcomes achieved in the subsequent hours following the infiltration process.[7]

Postoperative pain after inguinal hernia repair is continuous and can be managed effectively. Tramadol, an analgesic with fewer side effects, can help return to preoperative activity. Subcutaneous infiltration at the surgical wound site prolongs the interval before supplementary analgesics are needed, preventing local wound dependency.[8]

Inguinal hernia repair and groin surgery are common procedures worldwide, affecting both adults and children. Postoperative pain control allows for quicker return to preoperative activity, facilitating early ambulation, which is crucial for uneventful meniscus healing.[9,10]

Tramadol is a promising alternative to conventional analgesics due to its fewer adverse effects and lower abuse potential. Oral administration at moderate doses can provide postoperative comfort, especially in reconstruction surgery with anadductor tenotomy. Parenteral administration is often preferred due to its fast effect and systemic side, making it a popular choice for large volumes in practice.[11] The current study aimed to compare the therapeutic effects and possible complications of intravenous versus local wound infiltration of tramadol following open inguinal hernia operations.

PATIENTS AND METHODS

A comparative prospective study was carried out in the surgical units of both Erbil Teaching Hospital and Rizgari Teaching Hospital. All adult male patients of the American Society of Anesthesiologists physical status I–II, who underwent inguinal hernia repair under general anesthesia, during the period from September 2019 till March 2020, were enrolled in the study. Exclusion criteria; were patients with definitive liver disease (eg, acute and chronic hepatitis, cirrhosis, hemochromatosis); renal impairment (acute and chronic renal failure, glomerulonephritis); history of opium addiction and allergy to tramadol; history of seizure disorder; or administration of monoamine oxidase inhibitors, naloxone, cimetidine, carbamazepine, and ondansetron, and patients refusing general anesthesia were excluded from the study. The operations done by more than one surgeon and the type of the operations selected according to the surgeons preference. Patients were allocated randomly into one of two groups.

- **Subcutaneous group (SC)** (n=25): received subcutaneous wound infiltration contained tramadol 2 mg/kg titrated with NaCl 0.9% for a total of 20 mL. The infiltration started from the external oblique aponeurosis up to the skin prior to skin closure.
- **Intravenous group (IV)** (n=25): tramadol 2 mg/kg plus NaCl 0.9% to a volume of 50 mL was infused slowly within 15 minutes prior to skin closure.

We used Tramadol Hexal AG (Bach No. 8M1031) in both group.

Intravenous administration performed by the anesthesiologist while subcutaneous wound infiltration with tramadol done by the surgeon or by assistant.

Postoperative assessment of the intensity of pain as measured by a 10- mm visual analog scale (VAS) (Figure 1), and complications such as nausea and vomiting were recorded at time of receiving the patients in the ward (Regarded as zero time), after 30 minutes, hourly for six hours then at 12 hour and 24 hour postoperatively. Diclofenac 75mg/dose was administered intramuscular if pain intensity was greater than 4 and intravenous metoclopramide 10 mg/dose was prescribed if nausea and vomiting were present.

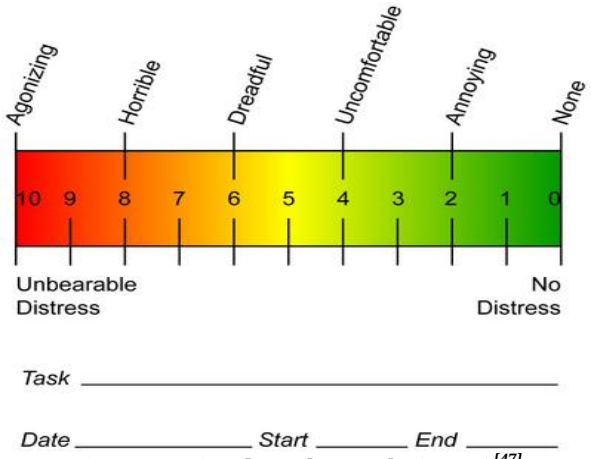

Figure 1: Visual *Analog Scale (V A S)*[47]

Data Management and Statistical Analysis

1. The data were collected and entered into SPSS version 17.0 to generate the general characteristics of the study. Parametric tests (T-test) were used for comparison between the results of the two groups. P value less than 0.05 was considered significant.
2. Each entry was double checked to avoid any possible mistakes.
3. Graphs and tables were drawn to summarize & present the results.

RESULTS

Fifty patients were included in the study, including 25 in SC group and 25 in IV group. Two patients in SC group & 3 patients in IV group initially assigned were excluded due to incomplete data collection. The age of patients in SC group ranged between 18-71 (mean 35.96) years and weight 42-104 (mean 68.48) Kg (figure 2), while in IV group age ranged between 18-69 (mean 39.67) years and weight between 48-90 (mean 65.32) Kg (Figure 3).

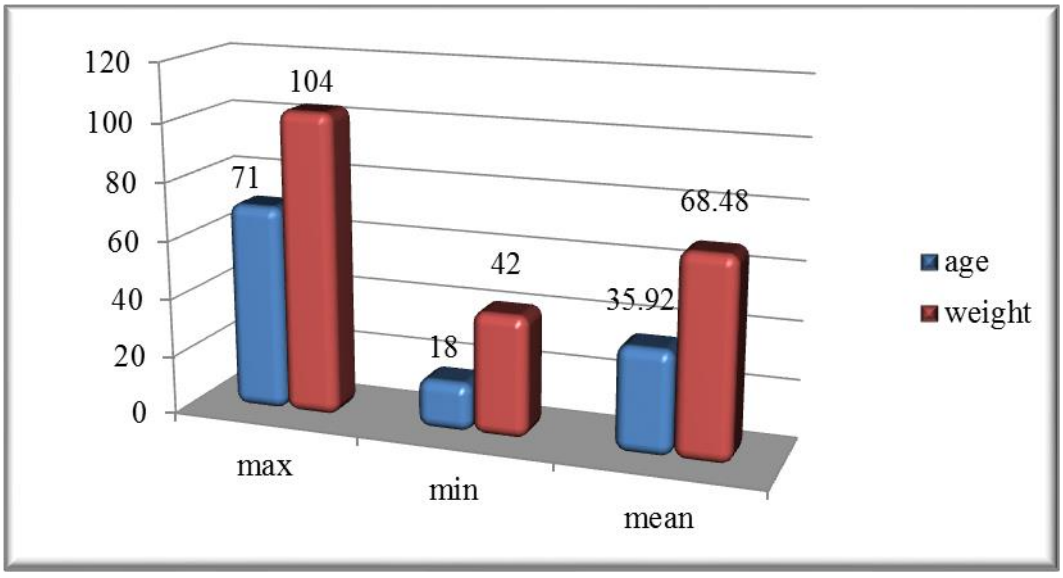

Figure (2): Age and weight of subcutaneous group.

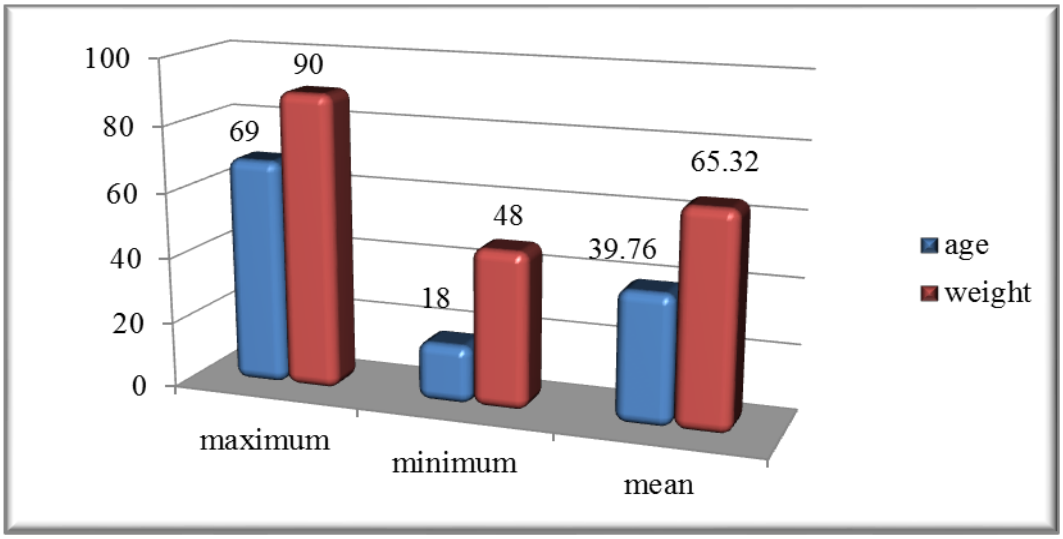

Figure (3): Age and weight of intravenous group.

The mean differences in VAS, in each group during the study period are recorded. The VAS score at zero time was 0.28 ±0.61 in the SC group and 0.6 ± 0.5 in the IV group. The VAS score was reported to be higher in the IV group throughout the study. These scores were found to be highly significant at 3hr & up ward till 24hr (p = 0.00). (Table 1 & Figure 4).

Table (1): Comparison of the changes in the VAS scores during the study.

VAS Parameter	SC±SD	IV±SD	P value	Mean difference	95% C.I
zero time	0.28 ± 0.61	0.6 ± 0.5	**0.04**	-0.32	-0.63; -0.00
30 mint	0.8 ± 0.70	1.12 ± 0.52	**0.07**	-0.32	-0.67; -0.03
1hr	1.20 ± 0.81	1.20 ± 0.91	1.0	0.00	-0.49; 0.49
2hr	0.96 ± 0.88	1.12 ± 0.66	0.47	-0.16	0.60; 0.28
3hr	0.96 ± 0.53	1.36 ± 0.48	**0.00**	-0.40	-0.69; -0.10
4hr	1.04 ± 0.35	1.36 ± 0.56	**0.02**	-0.32	-0.58; -0.05
5hr	1.12 ± 0.33	1.56 ± 0.50	**0.00**	-0.44	-0.68; -0.19
6hr	1.20 ± 0.40	1.68 ± 0.55	**0.00**	-0.48	-0.75; -0.20
12hr	1.28 ± 0.45	1.68 ± 0.55	**0.00**	-0.40	-0.68; -0.11
24hr	1.28 ± 0.45	1.68 ± 0.55	**0.00**	-0.40	-0.68; -0.11
*Independent t-test for two means					

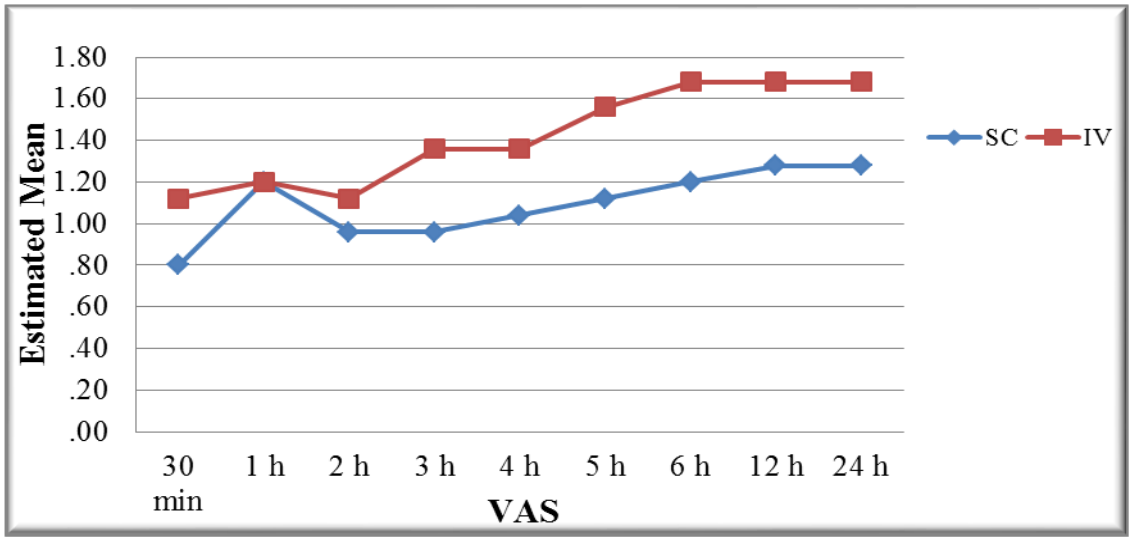

Figure (4): Mean pain severity (VAS) in each group (repeated measures analysis with comparing factor; IV = intravenous administration; SC = subcutaneous wound infiltration; VAS = visual analog scale.

Only 1(4.0%) case in SC group & 1(4.0%) case in IV group were required diclofenac in the first 1-7 hr, and 3(12.0%) cases in IV group between 8-16hr. it was not significant from statistical point of view (p=0.20) as shown in (Table 2).

Table (2): Diclofenac requirement in both groups.

Route of giving tramadol	Time of given Diclofenac		Total
	Between 1-7hr	Between 8-16hr	
SC	**1**	**0**	**1**
	4.0%	**0.0%**	**4.0%**
IV	**1**	**3**	**4**
	4.0%	**12.0%**	**16.0%**
Total	**2**	**3**	**5**
	4.0%	**6.0%**	**10.0%**

Considering groups, nausea and vomiting were frequently reported during the first hours of recovery; the complications, however, were less frequent 6 hours after the operations. Nausea and vomiting occurred less frequently in the SC group throughout the study period, statically was highly significant (p= 0.00), as shown in (Table 3).

Table 3: The incidence of nausea & vomiting in both groups.

Time	Subcutaneous	Intravenous	P value*
at zero time	0(0%)	1(4%)	0.31
30mint	0(0%)	1(4%)	0.31
1hr	0(0%)	4(16%)	0.03
2hr	0(0%)	1(4%)	0.31
3hr	0(4%)	1(4%)	0.31
4hr	1(4%)	1(4%)	1.0
5hr	0(0%)	1(4%)	0.31
6hr	1(4%)	0(0%)	0.31
12hr	0(0%)	0(0%)	
24hr	0(0%)	0(0%)	
Total	2(8%)	10(40%)	0.008

DISCUSSION

Of all the pain syndromes, postoperative pain is one of the most dreaded and most likely to occur, but it is frequently still not well addressed. Despite being the standard for treating acute pain, opioids are nevertheless feared by patients, nurses, and doctors.[12] After major surgery, postoperative discomfort increases hospital stays, postoperative morbidity, and recovery time.[13] Additionally, the most prevalent patient issue is postoperative discomfort. The degree of early postoperative pain and postoperative complications, particularly infectious complications, are positively correlated, according to a growing body of research. [14]. Greater rates of postoperative complications and greater degrees of postoperative pain are linked to more involved and involved surgical procedures.[14,15] Even yet, several studies have shown that local anesthetic injections into surgical incisions are helpful.[16-18] Due to the possibility of central nervous system and cardiovascular system toxicity, the effects of an unintentional local anesthetic injection might be fatal.[19] The great prevalence of negative consequences, however, encourages research for substitutes. Recent research has demonstrated that localized usage of these medications can resolve the related issues.[20,21] According to clinical research, tramadol produces a local anesthetic effect with no sedation or cardiovascular damage.[22-24]

Following inguinal hernia procedures, we showed in this study that subcutaneous wound infiltration with tramadol is linked to a decreased incidence of nausea and vomiting, a decreased requirement for diclofenac (even no diclofenac within the first 24 hours in 90% of cases), and a drop in VAS ratings. Using analgesics like tramadol during surgery has been shown in several trials to reduce the requirement for analgesics after the procedure.[25–27] when major abdominal surgery, Bayoumi et al.[28], and Martinez et al.[29], saw a significant reduction in morphine intake when tramadol was administered. Due to its capacity to reduce the need for postoperative analgesia, tramadol has been suggested by Costa et al.[22] and Jendi and Talathi study[30] as a potential substitute for lidocaine in small procedures. Gebremedhin et al.[31] discovered that postoperative analgesia was sustained and the requirement for further opioids was significantly decreased after subcutaneous wound infiltration with tramadol.

In our study, the group that got tramadol subcutaneous wound infiltration had a lower postoperative desire for analgesia. This observation indicates that tramadol infiltration into subcutaneous wounds is more effective, maybe as a result of its simultaneous systemic and local actions. After coronary artery bypass surgery, Martinez et al.[29] were unable to find any appreciable variations in VAS, morphine intake, or antiemetic need after administering oral slow-release tramadol (150 mg every 12 hours). When compared to the use of a single medicine provided by a single approach, Weber et al.[32] randomized experiment has demonstrated that multimodal analgesia is linked with greater pain relief and lower opioid intake.

CONCLUSION

Tramadol infusion into the subcutaneous incision causes less nausea and vomiting and less postoperative analgesic use than intravenous treatment following open inguinal hernia surgeries.

Recommendations

After all open inguinal hernia surgeries on adult patients, we advise applying subcutaneous tramadol wound infiltration.

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