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Comparison of Pre-emptive Tramadol versus Diclofenac in Postoperative Pain Management after Laparoscopic Cholecystectomy

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ABSTRACT

Effective Pre-emptive analgesia is essential to improve pain control and reduce opioid consumption. Non-opioid analgesics such as diclofenac and tramadol are commonly used, but their comparative efficacy remains an area of interest. **Objective:** To compare mean postoperative pain intensity and time to 1st analgesic requirement between diclofenac and tramadol groups as Pre-emptive analgesics among patients undergoing laparoscopic cholecystectomy. **Methods:** This quasi-experimental study was conducted at Department of Anaesthesia, Mayo Hospital, Lahore, over period of six months. Quasi experimental study. 50 patients scheduled for elective laparoscopic cholecystectomy were included and randomized into two groups using lottery technique. Group D (diclofenac sodium 100mg), and Group T (oral tramadol 100mg), respective drug was given two hours before surgery.Postoperatively, NRS score were assessed at 8th hour, and time to first analgesic request was recorded.Data were analyzed using SPSS version 26.0, p-value ≤ 0.05 considered statistically significant. **Results:** Postoperatively, mean NRS score at 8th hour was significantly lower in Group T (3.56 ± 1.32) compared to Group D(4.52 ± 1.22)(p=0.01). Mean time to first analgesic request was significantly longer in Group T (104.04 ± 12.02 minutes) than in Group D (91.64 ± 8.51 minutes) (p<0.001). **Conclusions:** Preoperative administration of oral tramadol provides superior postoperative analgesia compared to diclofenac sodium, as evidenced by lower pain scores at the 8th postoperative hour and longer time to first analgesic request. Tramadol may be more effective option for pain control in patients undergoing elective laparoscopic cholecystectomy.

INTRODUCTION

Pain is unpleasant sensory/emotional experience associated with tissue damage [1]. Postoperative pain arises due to inflammation resulting from tissue trauma [2]. This pain can trigger cascade of biochemical and physiological stress responses, potentially leading to complications such as hyperventilation, reduced alveolar ventilation, impaired wound healing, sleep disturbances, and transition of acute pain into chronic pain [3]. These complications ultimately impact patient's surgical outcomes and overall satisfaction with medical care [4]. Effective postoperative pain management is essential component of patient recovery and involves combination of pharmacological and non-pharmacological approaches [5]. The use of minimally invasive surgical techniques, early initiation of physiotherapy, and early ambulation can accelerate recovery, which can be further enhanced through effective pain control. Pre-emptive analgesia, administration of analgesic treatment before surgery, aims to prevent central sensitization triggered by surgical incisions and inflammatory responses during and after surgery [6]. Clinical studies have shown the benefits of Pre-emptive analgesia using local anesthetics, opioids, and NSAIDs. Diclofenac, widely used NSAID, exerts its Pre-emptive analgesic effects by inhibiting prostaglandin synthesis through suppression of COX-1 and COX-2 enzymes [7]. In contrast, tramadol, a synthetic opioid, has

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safer profile compared to traditional μ-opioid receptor agonists. It functions through dual mechanism: weak μ-opioid receptor agonism and inhibition of serotonin and norepinephrine reuptake, thereby enhancing inhibitory effects on pain transmission [8, 9]. It was found that Pre-emptive administration of tramadol provided superior postoperative analgesia compared to diclofenac. Patients in tramadol group had lowest total analgesic consumption, longest time to first analgesic request, and significantly lower pain scores at multiple postoperative time points [10].

Therefore, this study aimed to assess the Pre-emptive use of diclofenac sodium and tramadol for postoperative pain management, aiming for effective yet safer alternative to traditional opioid-based analgesia.

METHODS

This quasi-experimental study was done at Anesthesia Department of Mayo Hospital, Lahore, over period of six months (July 2024 to January 2025) following approval of synopsis from CPSP (REF No. CPSP/REU/ANS-2021-066-2663). 50 patients were enrolled, with 25 in each group, based on sample size calculation using OpenEpi for "comparison of two means," considering time to first analgesic request in diclofenac group as 103.01 ± 23.53 minutes and in tramadol group as 144.05 ± 14.72 minutes, with 95% confidence level and 80% study power.[10] Non-probability consecutive sampling was used for patient selection. Patients of both genders, aged 18 to 60 years, with American Society of Anesthesiologists status I or II, scheduled for elective laparoscopic cholecystectomy were included. Patients who refused participation, had allergies or contraindications to study drugs, pregnant or lactating females, or were already on analgesics for any reason were excluded. Informed consent was obtained from patients after explaining the study's purpose, importance, and risks, and participants were assured of their right to withdraw at any time. Patients were randomized into two groups using lottery technique. Preoperative assessment was performed, and all eligible patients were instructed on using Numerical Rating Scale (NRS) for pain assessment. On the morning of surgery, two hours before procedure, patients received either 100 mg of oral diclofenac sodium (Group D) or 100 mg of oral tramadol (Group T) in extended-release formulation, administered by anesthetist not involved in the study. On the day of surgery, patients were shifted to operation theatre and routine General anesthesia protocols were followed with continuous vital monitoring. Intraoperatively, all patients received intravenous paracetamol (1 gram) and dexamethasone (8 mg). Patients were extubated after meeting the reversal criteria and transferred to Post-Anesthesia Care Unit, where they were observed for two hours before being shifted to the ward upon meeting the modified Aldrete discharge criteria. Postoperatively, study outcomes NRS score at 8th hour post operatively and time to first analgesic request (when NRS >3) was recorded. Relevant data were documented in the study proforma. Intravenous nalbuphine diluted in 10 ml of normal saline was administered as rescue analgesic at a dose of 0.07 mg/kg (maximum 10mg) when patient reported NRS >4. Data were collected and analyzed using SPSS version 26.0. The normality of numerical data was assessed using the Shapiro-Wilk test and Kolmogorov-Smirnov test, confirming a normal distribution ($p > 0.05$). Numerical variables, including age, NRS score, duration of surgery, and time to first analgesic request, were expressed as mean ± standard deviation, while categorical variables such as ASA status and gender were presented as frequencies and percentages. Stratification for effect modifiers, including age and gender, was performed, and post-stratification independent sample t-tests were applied for outcomes, considering a p-value of ≤0.05 as statistically significant.

RESULTS

As shown in table 1, mean age of patients in Group D (Diclofenac) and Group T (Tramadol) was 36.6 ± 10.24 years and 38.1 ± 10.98 years, respectively (p=0.606). Regarding gender distribution, in Group D, 8 (32%) patients were male, and 17 (68%) were female, whereas in Group T, 9 (36%) patients were male, and 16 (64%) were female (p=0.765). In terms of ASA status, 17 (68%) patients in Group D and 19 (76%) patients in Group T were categorized as ASA I, while 8 (32%) in Group D and 6 (24%) in Group T were classified as ASA II (p=0.529). Mean duration of surgery in Group D was 68 ± 12.87 minutes, while in Group T, it was 70 ± 13.40 minutes (p=0.522).

Table 1: Comparison of Variables among Groups (n=50)

Variables		Group D (Diclofenac) Mean ± SD/ Frequency (%)	Group T (Tramadol) Mean ± SD/ Frequency (%)	p-Value
Age (Years)		36.6 ± 10.24	38.1 ± 10.98	0.606
Gender	Male	8 (32%)	9 (36%)	0.765
	Female	17 (68%)	16 (64%)	
ASA Status	I	17 (68%)	19 (76%)	0.529
	II	8 (32%)	6 (24%)	
Duration of Surgery (Minutes)		68 ± 12.87	70 ± 13.40	0.522

As shown in table 2, mean NRS score at 8th postoperative hour was 4.52 ± 1.22 in Group D (Diclofenac) and 3.56 ± 1.32 in Group T (Tramadol), showing statistically significant reduction in group T (p=0.01). The mean time to first analgesia was also less (91.64 ± 8.51 minutes) in Group D as compared to group T (104.04 ± 12.02 minutes), and this difference was noted to be significant (p<0.001).

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Table 2: Comparison of Study outcomes among Study Groups (n=50)

Outcomes	Group D (Diclofenac) Mean ± SD	Group T (Tramadol) Mean ± SD	p-Value
NRS Score (at 8th hour post-operatively)	4.52 ± 1.22	3.56 ± 1.32	0.01*
Time to 1st Analgesia (Minutes)	91.64 ± 8.51 min	104.04 ± 12.02 min	<0.001*

*Statistically significant at p≤0.05.

As shown in table 3, when stratified by age, time to first analgesia was significantly longer in Group T compared to Group D in both age groups. In patients aged <40 years, mean time to first analgesia was 91.41±7.73 minutes in Group D and 104.06 ± 12.69 minutes in Group T (p=0.002). Similarly, in patients aged ≥40 years, it was 92.12 ± 10.54 minutes in Group D and 104.00 ± 11.62 minutes in Group T (p=0.03). For pain scores at 8th postoperative hour, significant difference was found in patients aged <40 years, where the mean NRS score was 4.52 ± 1.32 in Group D and 3.40±1.45 in Group T (p=0.02). However, in patients aged ≥40 years, difference in pain scores between Group D (4.50 ± 1.06) and Group T (3.80 ± 1.13) was not statistically significant (p=0.20).

Table 3: Data Stratification with Respect to Age

Age Group	Outcome	Group	N	Mean ± SD	p-Value
<40 Years	Time To 1st Analgesic	D	17	91.41 ± 7.73 min	0.002*
		T	15	104.06 ± 12.69 min	
≥40 Years	Time To 1st Analgesic	D	8	92.12 ± 10.54 min	0.03*
		T	10	104.00 ± 11.62 min	
<40 Years	Pain Score at 8Hours	D	17	4.52 ± 1.32	0.02*
		T	15	3.40 ± 1.45	
≥40 Years	Pain Score at 8Hours	D	8	4.50 ± 1.06	0.20
		T	10	3.80 ± 1.13	

*Statistically significant at p≤0.05.

As shown in table 4, when stratified by gender, time to first analgesia was significantly longer in females receiving Tramadol (106.50 ± 11.90 minutes) compared to those in the Diclofenac group (90.29 ± 9.13 minutes) (p<0.001). However, in males, there was no statistically significant difference between the Diclofenac (94.50 ± 6.63 minutes) and Tramadol (99.66 ± 11.59 minutes) groups (p=0.286). For pain scores at the 8th postoperative hour, the difference was significant in females, with a mean NRS score of 4.58 ± 1.28 in Group D and 3.56 ± 1.41 in Group T (p=0.036). However, in males, the difference was not statistically significant (4.37 ± 1.19 in Group D vs. 3.55 ± 1.23 in Group T, p=0.185)

Table 4: Data stratification with Respect to Gender

Gender	Outcome	Group	N	Mean ± SD	p-Value
Male	Time To 1st Analgesic	D	8	94.50 ± 6.63	0.286
		T	9	99.66 ± 11.59	
Female	Time To 1st Analgesic	D	17	90.29 ± 9.13	<0.001*
		T	16	106.50 ± 11.90	
Male	Pain Score at 8Hours	D	8	4.37 ± 1.187	0.185
		T	9	3.55 ± 1.23	
Female	Pain Score at 8Hours	D	17	4.58 ± 1.277	0.036*
		T	16	3.56 ±1.41	

*Statistically significant at p≤0.05.

DISCUSSION

The mean age of patients in Group D (Diclofenac) and Group T (Tramadol) was 36.6 ± 10.24 years and 38.1 ± 10.98 years, respectively (p=0.606).Previous studies have reported varying mean ages for patients undergoing laparoscopic cholecystectomy, with some indicating higher mean age of 46.3 ± 15.8 years while others found lower mean age of 34.3 years. These differences are likely due to variations in study populations and age group distributions [11, 12]. Regarding gender distribution, in both groups there were female predominance.Previous studies have also consistently observed female predominance in LC patients, with large-scale analyses reporting 73.4% female representation, while smaller studies have reported up to 87% female patients [13, 14].The comparison of tramadol and diclofenac as Pre-emptive analgesics in laparoscopic cholecystectomy reveals significant differences in efficacy.Supporting current findings, it was observed by Zaman M *et al.*, that tramadol showed better pain relief as compared to diclofenac after laparoscopic cholecystectomy, with significant reductions in pain scores at various time intervals postoperatively [15]. Further supported by local study, Iqbal MS *et al.*, indicated that patients receiving diclofenac had higher VAS scores at multiple time points compared to those receiving tramadol [16].However, in contrast, one study found no significant differences between tramadol and diclofenac in reducing post-operative pain [17]. Previous studies have shown that women are more likely to use NSAIDs and opioids than men following surgery due to higher reported pain scores [18]. Additionally, analgesic use tends to increase with age, with older patients exhibiting higher prevalence of opioid use. Younger patients experience more significant decrease in analgesic use post-surgery compared to older patients, who maintain higher usage. Moreover, interaction between age and sex reveals that older women are more likely to receive analgesics than older men, particularly in emergency departments [19, 20]. This study has found that younger patients (<40 years) receiving tramadol had longer time to first analgesic request and lower pain scores, whereas in patients ≥40 years, pain scores did not differ significantly. Similarly, females in tramadol group experienced superior analgesia, while in males, the differences between tramadol and diclofenac were not significant. It was also highlight in literature multifactorial

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nature of postoperative pain management, emphasizing importance of individualized analgesic strategies based on patient demographics and clinical factors.

CONCLUSIONS

Preoperative administration of oral tramadol provides superior postoperative analgesia compared to diclofenac sodium, as evidenced by lower pain scores at 8th postoperative hour and longer time to first analgesic request. Tramadol may be more effective option for pain control in patients undergoing elective laparoscopic cholecystectomy.

Authors Contribution

Conceptualization: AN
Methodology: AN, ZI, FA, MR, SY, SH
Formal analysis: SY, SH
Writing, review and editing: FA, MR, SY, SH
All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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