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Comparative Efficacy of Gabapentin and Diclofenac Sodium for Post-Operative Pain Relief in Patients Undergoing Major Abdominal Surgeries

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ABSTRACT

OBJECTIVE: To evaluate the efficacy of gabapentin versus diclofenac sodium for post-surgery pain relief in patients undergoing major abdominal surgeries.

METHODOLOGY: This randomized controlled trial was performed at the Department of Anaesthesia, Quaid-e-Azam Medical College/Bahawal Victoria Hospital, Bahawalpur, from August 2022 to February 2023. The consecutive sampling technique was adopted. Two hundred and forty patients aged 18–60 years, undergoing elective major abdominal surgery, were randomized to receive oral gabapentin 600 mg or diclofenac sodium 100 mg one hour before induction. Pain intensity was assessed using the Visual Analogue Scale (VAS) postoperatively, and efficacy was defined as VAS ≤ 3 without rescue analgesia (tramadol 1 mg/kg IV). Data were analyzed in SPSS v26.0.

RESULTS: In a total of 240 patients, 142 (59.2%) were male. The median age was 38.2 years (IQR 29.3–49.8), and BMI 25.6 kg/m² (IQR 23.4–28.2). Diabetes mellitus and hypertension were present in 115 (47.9%) and 94 (39.2%) patients, respectively. Effective postoperative pain relief was achieved in 70 (58.3%) patients receiving gabapentin, versus 54 (45.0%) receiving diclofenac (p=0.039). The median time to first analgesic demand was longer with gabapentin (p=0.004). Rescue analgesia was required in 45 (37.5%) patients, compared with 69 (57.5%) patients (p=0.002).

CONCLUSION: Among patients undergoing major abdominal surgery, gabapentin demonstrated superior postoperative analgesic efficacy compared with diclofenac sodium.

KEYWORDS: Gabapentin, diclofenac sodium, post-operative pain, rescue analgesia, surgery.

TRIAL REGISTRATION: NCT07267182 (clinicaltrials.gov)

INTRODUCTION

Acute post-surgery pain is a commonly encountered entity in healthcare settings[1]. Opioids have been considered the mainstay of post-surgery pain management, but these are not free from adverse effects[2]. Other widely used and relatively safe analgesics include non-steroidal anti-inflammatory drugs (NSAIDs), but are also associated with side effects like gastrointestinal (GI) bleeding and cardiovascular related issues[3]. Contemporary literature reflects that sub-optimal acute post-surgery pain increases the odds of morbidity, linked with poor quality of life, prolonged recovery time, extended opioid utilization, and higher healthcare cost[4,5].

Gabapentin has successfully been used for managing neuropathic pain related to postherpetic neuralgia, post-poliomyelitis neuropathy, reflex sympathetic dystrophy and diabetic neuropathy[6,7]. Gabapentin has been shown to reduce post-operative narcotic consumption and pain[8]. Oral diclofenac sodium is an effective analgesic agent but has gastrointestinal and cardiovascular side effects. NSAIDs, opioid analgesics and local and regional anesthesia have been used as preventive interventions, but their role in post-operative pain management remains inconclusive[9]. Gabapentin is relatively new drug for post-surgery pain management whose side effects are well tolerated. Little is known about the comparative efficacy of gabapentin and diclofenac sodium in managing post-operative pain.

This study was planned to compare the efficacy of gabapentin and diclofenac sodium for post-operative pain relief in patients undergoing major abdominal surgeries.

METHODOLOGY

This open-label, randomized controlled trial (NCT07267182 at clinicaltrials.gov) was conducted at the Department of Anaesthesia, Quaid-e-Azam Medical College/Bahawal Victoria Hospital, Bahawalpur, Pakistan, from August 2022 to February 2023, after obtaining approval from the institutional ethical review committee (letter number 1110, dated 29-6-2021). Written informed consent was obtained from all patients. The sample size was calculated using G*Power version 3.1.9.7. The calculation was based on the ability to detect a 15% difference in mean postoperative pain scores (VAS) between groups, with a 95% confidence level and 80% power. The required minimum sample size was 216 patients (108 per group). Inclusion criteria were patients aged between 18 and 60 years of either gender who were scheduled to undergo elective major abdominal surgery under general anesthesia. Only those classified as American Society of Anesthesiologists (ASA) physical status I or II were included. Patients with known allergy or contraindication to gabapentin, diclofenac sodium, or a history of peptic ulcer disease, GI bleeding, hepatic or renal dysfunction, or who were pregnant or lactating were excluded. Those with neurological or psychiatric disorders affecting pain perception, or those who had received opioids, anticonvulsants, antidepressants, or NSAIDs within 24 hours before surgery, were also excluded. Patients with uncontrolled hypertension, ischemic heart disease, or diabetes mellitus, and those who experienced intraoperative complications necessitating a change in anesthetic plan or postoperative mechanical ventilation were not included. For this study, 240 patients were recruited through consecutive sampling. Randomization was performed using a computer-generated random number sequence. Allocation concealment was ensured using sequentially numbered, sealed, opaque envelopes prepared by an independent staff member. The envelope was opened immediately before administration of the study medication, after enrollment. The participants and the attending anesthesiologist administering the intervention were aware of the allocation (open-label design), but the postoperative pain assessor remained blinded to the group

assignment. Patients in the Gabapentin group received a single oral dose of gabapentin (600 mg) 1 hour before surgery. In comparison, those in the Diclofenac group received a single oral dose of diclofenac sodium (100 mg) 1 hour before surgery.

All patients underwent elective open major abdominal surgeries under general anesthesia. During surgery, standard monitoring and surgical techniques were maintained. The time interval between recovery from anesthesia and the first request for analgesia was recorded. Patients were considered to have effective pain relief ("Yes") if their VAS score remained ≤3 throughout the monitoring period without requiring rescue analgesia. Patients who reported VAS >3 at any time point or required rescue analgesia (tramadol 1 mg/kg IV) were categorized as having ineffective pain relief ("No"). VAS at 0 hour was recorded at PACU/recovery room arrival after extubation and once the patient was awake and able to communicate pain. Subsequent VAS measurements were recorded at 2, 4, 6, 8 and 12 hours postoperatively. Operative time was recorded as the interval from skin incision to skin closure. Anesthesia duration was recorded separately from induction to transfer to recovery. Intraoperative anesthesia and analgesia were standardized for both groups according to a predefined departmental protocol. Induction and maintenance agents were uniform, and intraoperative opioid administration and adjunct analgesics were administered using the same criteria in both groups. No additional long-acting analgesic premedication was given beyond the assigned study drug.

Data analysis was performed using IBM SPSS Statistics, version 26.0. Quantitative data that were non-normally distributed (as assessed by the Shapiro–Wilk test) were presented as medians with interquartile ranges (IQR) and compared using the Mann–Whitney U test. Categorical variables were presented as frequencies and percentages, and compared using the Chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

In a total of 240 patients, there were 142 (59.2 %) males and 98 (40.8 %) females. The median age of participants was 38.2 years (IQR 29.3–49.8). The median BMI was 25.6 kg/m² (IQR 23.4–28.2). ASA physical status was II among 121 (50.4%) patients. In terms of comorbidities, diabetes mellitus and hypertension were present in 115 (47.9%) and 94 (39.2%) patients, respectively. At baseline, the median mean arterial pressure was 88.7 mmHg (IQR 83.4–94.6), and the median heart rate was 85.1 beats/min (IQR 78.2–92.5). The median duration of surgery was 45.6 minutes (IQR 31.2–64.9). **Table I** compares baseline demographic, clinical, and hemodynamic characteristics between the study groups.

Table I: Comparison of characteristics of patients

Characteristics		Total (N=240)	Gabapentin (n=120)	Diclofenac Sodium (n=120)	P-value
Gender	Male	142 (59.2%)	69 (57.5%)	73 (60.8)	0.599
	Female	98 (40.8%)	51 (42.5%)	47 (39.2%)	
Age groups (years)	18-40	169 (70.4%)	83 (69.2%)	86 (71.7%)	0.671
	41-60	71 (29.6%)	37 (30.8%)	34 (28.3%)	
Age (years), median (IQR)		38.2 (29.3-49.8)	37.5 (28.6-48.7)	39.0 (30.2-50.6)	0.416
BMI (kg/m^2), median (IQR)		25.6 (23.4-28.2)	25.5 (23.3-28.4)	25.7 (23.6-28.1)	0.879
ASA physical status	I	119 (49.6%)	61 (50.8%)	58 (48.3%)	0.699
	II	121 (50.4%)	59 (49.2%)	62 (51.7%)	
Diabetes mellitus		115 (47.9%)	58 (48.3%)	57 (47.5%)	0.897
Hypertension		94 (39.2%)	46 (38.3%)	48 (40.0%)	0.791
History of smoking		48 (20.0%)	26 (21.7%)	22 (18.3%)	0.519
Mean arterial pressure (mmHg), median (IQR)		88.7 (83.4-94.6)	88.3 (82.9-93.8)	89.2 (84.1-95.3)	0.492
Heart rate (beats/min), median (IQR)		85.1 (78.2-92.5)	84.7 (77.9-91.8)	85.8 (78.6-93.1)	0.361
SpO_2 (%), median (IQR)		98.4 (97.1-99.2)	98.3 (97.0-99.1)	98.5 (97.2-99.3)	0.802
Duration of anesthesia (minutes)	≤45	142 (59.2%)	69 (57.5%)	73 (60.8%)	0.599
	>45	98 (40.8%)	51 (42.5%)	47 (39.2%)	
Duration of surgery (minutes)	≤30	115 (47.9%)	58 (48.3%)	57 (47.5%)	0.897
	>30	125 (52.1%)	62 (51.2%)	63 (52.5%)	
Duration of surgery (minutes), median (IQR)		45.6 (31.2-64.9)	46.3 (32.5-66.1)	44.8 (30.8-63.5)	0.537

Effective postoperative pain relief was achieved in 70 (58.3%) patients in the gabapentin group compared with 54 (45.0%) in the diclofenac group (p=0.039); details are shown in **Figure 1**.

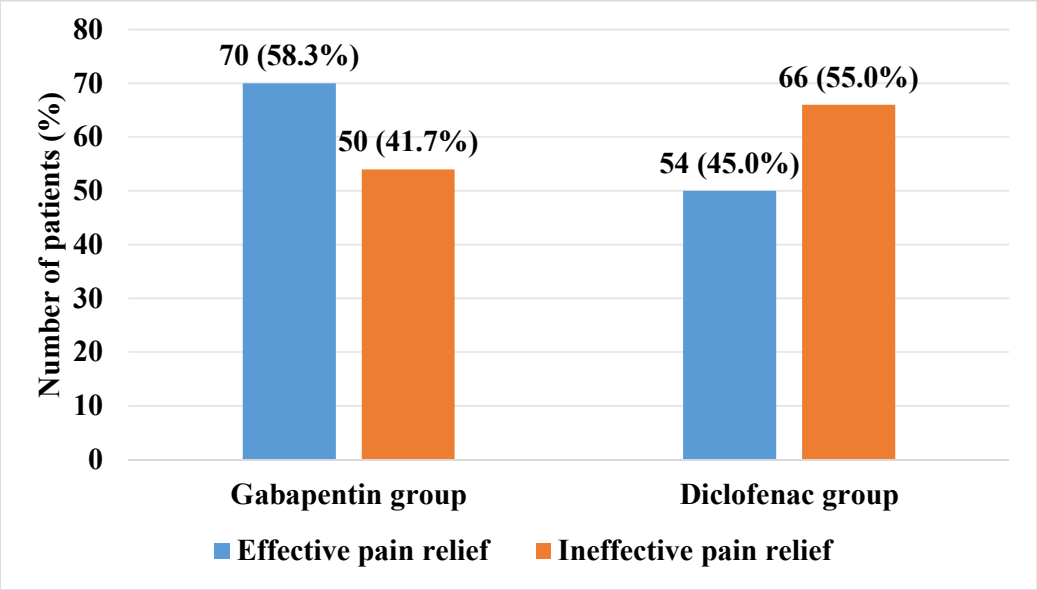

Figure 1: Comparison of post-operative pain control (N=240)

The median VAS score at 0 hour was 4.7 (IQR 3.9–5.6) in the gabapentin group and 4.9 (IQR 4.0–5.8) in the diclofenac group (p=0.382). At 2 hours, the median VAS was significantly lower in the gabapentin group at 3.8 (IQR 3.0–4.9) compared with 4.5 (IQR 3.7–5.4) in the diclofenac group (p=0.028). This difference persisted at subsequent intervals, at 4 hours (p=0.017), 6 hours (p=0.011), 8 hours (p=0.009), and 12 hours (p=0.021) (**Table II**). The median time to first analgesic demand was significantly longer in the gabapentin group at 7.6 hours (IQR 6.1–9.2) compared with 5.8 hours (IQR 4.6–7.3) in the diclofenac sodium group (p=0.004). Rescue analgesia was required in 45 (37.5%) patients receiving gabapentin, and 69 (57.5%) receiving diclofenac sodium (p=0.002).

Table II: Comparison of outcomes (N=240)

Outcome parameters		Gabapentin (n=120)	Diclofenac Sodium (n=120)	P-value
Visual analog scale (for post-operative pain assessment), median (IQR)	At 0-hour	4.7 (3.9-5.6)	4.9 (4.0-5.8)	0.382
	At 2-hour	3.8 (3.0-4.9)	4.5 (3.7-5.4)	0.028
	At 4-hour	3.2 (2.5-4.3)	4.0 (3.1-5.2)	0.017
	At 6-hour	3.5 (2.7-4.6)	4.4 (3.4-5.6)	0.011
	At 8-hour	3.8 (2.9-4.9)	4.6 (3.6-5.7)	0.009
	At 12-hour	4.0 (3.0-5.2)	4.9 (3.9-5.8)	0.021
Time to first analgesic demand (hour)		7.6 (6.1-9.2)	5.8 (4.6-7.3)	0.004
Rescue analgesia required		45 (37.5%)	69 (57.5%)	0.002

When efficacy was stratified by demographic, clinical, and hemodynamic characteristics, no significant associations were found (**Table III**).

Table III: Comparison of efficacy with respect to characteristics of patients among study groups (N=124)

Characteristics		Gabapentin (n=70)	Diclofenac Sodium (n=54)	P-value
Gender	Male	40 (57.1%)	32 (59.3%)	0.813
	Female	30 (42.9%)	22 (40.7%)	
Age groups (years)	18-40	49 (70.0%)	39 (72.2%)	0.787
	41-60	21 (30.0%)	15 (27.8%)	
Age (years), median (IQR)		37.5 (28.6-48.7)	39.0 (30.2-50.6)	0.416
BMI (kg/m^2), median (IQR)		25.5 (23.3-28.4)	25.7 (23.6-28.1)	0.879
ASA physical status	I	36 (51.4%)	28 (51.9%)	0.923
	II	34 (48.6%)	26 (48.1%)	
Diabetes mellitus		33 (47.1%)	25 (46.3%)	0.925
Hypertension		27 (38.6%)	20 (37.0%)	0.861
History of smoking		15 (21.4%)	10 (18.5%)	0.689
Mean arterial pressure (mmHg), median (IQR)		88.3 (82.9-93.8)	89.2 (84.1-95.3)	0.492
Heart rate (beats/min), median (IQR)		84.7 (77.9-91.8)	85.8 (78.6-93.1)	0.361
SpO_2 (%), median (IQR)		98.3 (97.0-99.1)	98.5 (97.2-99.3)	0.802
Duration of anesthesia (minutes)	≤45	40 (57.1%)	32 (48.1%)	0.813
	>45	30 (42.9%)	22 (40.7%)	
Duration of surgery (minutes)	≤30	34 (48.6%)	26 (48.1%)	0.963
	>30	36 (51.4%)	28 (51.9%)	
Duration of surgery (minutes), median (IQR)		46.3 (32.5-66.1)	44.8 (30.8-63.5)	0.537

DISCUSSION

This research demonstrated that preoperative administration of oral gabapentin 600 mg significantly improved postoperative pain control compared with diclofenac sodium 100 mg in patients undergoing major abdominal surgery. A higher proportion of patients in the gabapentin group achieved effective analgesia, defined as sustained VAS ≤ 3 without rescue analgesia (58.3% versus 45.0%, p=0.039). Pain intensity measured by VAS was consistently lower at all postoperative intervals from 2 to 12 hours, the median time to first analgesic demand was longer (7.6 hours versus 5.8 hours, p=0.004), and fewer patients required rescue analgesia (37.5 % versus 57.5 %, p=0.002). These findings indicate that gabapentin provided more sustained and effective postoperative analgesia than diclofenac sodium. Hussain S et al.,[10] observed significantly lower postoperative pain scores in the gabapentin (600 mg) group compared with diclofenac sodium (100 mg), consistent with the present findings. Hussain S et al.,[10] reported mean pain scores of 9.0±4.0 in the gabapentin group compared with 15.3±2.0 in the diclofenac group, reinforcing the sustained analgesic effect of gabapentin over 12 hours. The trend of lower postoperative VAS scores across all recorded intervals in the current study corroborates Moghadam YA 2012[11], who compared gabapentin and diclofenac in tonsillectomy patients. These findings suggest that gabapentin's mechanism of modulating central sensitization via voltage-gated calcium channels plays a consistent role across diverse abdominal procedures in which somatic and visceral pain coexist.

Ghai A 2011,[12] evaluated 900 mg gabapentin in women undergoing abdominal hysterectomy and documented an extended analgesic-free duration compared to placebo and diclofenac. Likewise, Dauri M et al.,[13] exhibited that gabapentin extended the time to rescue analgesia while minimizing post-surgery opioid requirement. The prolonged pain-free interval observed in the present research may support the hypothesis that gabapentin modulates central hyper-excitability rather than simply attenuating peripheral inflammation, which may explain its sustained effects compared to diclofenac sodium, which acts primarily through prostaglandin inhibition[14,15]. Pandey CK 2014[16], showed no differences in the occurrence of myalgia but documented significantly lower fentanyl utilization in the gabapentin and pregabalin groups when comapring against diclofenac. These findings across a diverse set of patients undergoing various types of surgical procedures reflect the role of gabapentin in minimizing central sensitization and postoperative hyperalgesia. Abrishami R 2024[17], comparing pre-emptive oxycodone, diclofenac, and gabapentin in patients undergoing tibia fracture surgery, found comparable pain scores overall, except at 6 hours, when gabapentin markedly reduced pain intensity (p=0.001). These findings, in terms of isolated time-point differences, contrast with the present research's observations, which showed persistent improvement in VAS scores. These disparities may be stemming from procedural differences, as orthopedic surgeries induce more localized nociceptive pain.

In contrast, visceral surgical pain following abdominal surgeries may be more responsive to central modulation by gabapentin[18]. Cao and coworkers[19] confirmed that pre-emptive gabapentin significantly reduced VAS scores post-surgery. Cao L 2024[19], also observed that gabapentin 300 mg and 600 mg produced similar analgesia, while higher doses were observed to have a higher incidence of dizziness/sedation.

Pre-emptive administration of gabapentin provided prolonged pain relief and reduced overall analgesic requirements without compromising hemodynamic stability[20,21]. Incorporating gabapentin into multimodal analgesic protocols may reduce dependence on opioids and NSAIDs[22,23]. Given its favorable safety profile, gabapentin offers a cost-effective, easily administered oral option that can enhance postoperative recovery in abdominal surgery patients[24,25].

A single-centre study setting with a relatively modest sample size may limit the generalizability of these findings. The study assessed pain for only 12 hours postoperatively; longer follow-up could provide insight into late pain recovery patterns and delayed analgesic needs. Adverse effects such as sedation, dizziness, or nausea were not systematically recorded, limiting evaluation of the tolerability profile. Future multicenter, large-scale randomized trials with standardized operative stratification, extended follow-up, and systematic safety assessment are warranted to establish definitive recommendations.

CONCLUSION

Among patients undergoing major abdominal surgery, gabapentin demonstrated superior postoperative analgesic efficacy compared with diclofenac sodium. The incorporation of gabapentin integration into perioperative analgesic regimens can improve pain control, minimize reliance on opioids and NSAIDs, and contribute to safer, more effective postoperative recovery strategies.

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AUTHOR CONTRIBUTION

Noreen S: Data collection, drafting, responsible for data's integrity, approved for publication.
Khan A: Conception and design, proof reading, critical revisions, approved for publication.
Ahmed QA: Data collection, drafting, proof reading, critical revisions, approved for publication.
Pervaiz M: Data collection, proof reading, critical revisions, approved for publication.
Awan SA: Data collection, literature review, drafting, proof reading, approved for publication.
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