Original Article

Comparison of Pre-Emptive Intravenous Diclofenac Versus Intravenous Paracetamol for Postoperative Analgesia in Patients Undergoing Laparoscopic Surgeries Under General Anaesthesia

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Abstract

Background: Effective postoperative analgesia is an essential component of perioperative care, as inadequate pain control may lead to delayed recovery, prolonged hospital stay, impaired respiratory function, increased stress response, and reduced patient satisfaction. Although opioids remain commonly used for postoperative pain management, their adverse effects such as sedation, nausea, vomiting, respiratory depression, and delayed mobilization have encouraged the use of opioid-sparing multimodal analgesic techniques. Non-opioid analgesics such as diclofenac and paracetamol are widely used for perioperative pain management. Diclofenac, a non-steroidal anti-inflammatory drug (NSAID), provides analgesia through inhibition of prostaglandin synthesis but may be associated with gastrointestinal, renal, and platelet-related adverse effects. Intravenous paracetamol has emerged as an effective alternative with rapid onset of action, predictable analgesic effect, and a favourable safety profile. Pre-emptive analgesia aims to reduce postoperative pain by administering analgesic agents before surgical stimulation and preventing central sensitization. The present study was undertaken to compare the analgesic efficacy and safety of pre-emptive intravenous diclofenac and intravenous paracetamol in patients undergoing laparoscopic surgeries under general anaesthesia. **Material and Methods:** This prospective, randomized, double-blind, controlled clinical study was conducted after approval from the Institutional Ethics Committee. Written informed consent was obtained from all patients. A total of 120 adult patients of either sex, belonging to American Society of Anesthesiologists (ASA) physical status I or II, aged between 18 and 60 years, weighing 50–80 kg, scheduled for elective laparoscopic surgeries under general anaesthesia were included. Patients with known allergy or hypersensitivity to paracetamol or diclofenac, chronic analgesic use, significant hepatic or renal dysfunction, coagulation abnormalities, peptic ulcer disease, NSAID-induced bronchial asthma, pregnancy, and patients requiring conversion from laparoscopic to open surgery were excluded. Patients were randomly allocated into two groups of 60 patients each. Group P (Paracetamol group): Patients received intravenous paracetamol 1 g diluted in 100 mL normal saline, administered over 15 minutes, 30 minutes before induction of general anaesthesia. Group D (Diclofenac group): Patients received intravenous diclofenac sodium 75 mg diluted in 100 mL normal saline, administered over 15 minutes, 30 minutes before induction of general anaesthesia. The study medications were prepared by an anaesthesiologist not involved in patient assessment to maintain blinding. Postoperative pain was assessed using the Visual Analogue Scale (VAS). Rescue analgesic requirement and adverse effects were recorded. **Results:** The demographic characteristics including age, sex, body weight, ASA physical status, duration of surgery, and type of laparoscopic procedure were comparable between the two groups. Both intravenous paracetamol and intravenous diclofenac provided effective postoperative analgesia. Mean VAS scores at different postoperative time intervals were comparable between the groups, with no statistically significant difference. The requirement for rescue analgesia during the postoperative period was similar in both groups. Minor adverse effects such as nausea and vomiting were observed in both groups, with no significant difference. **Conclusion:** Pre-emptive administration of intravenous paracetamol and intravenous diclofenac provides comparable postoperative analgesia in patients undergoing laparoscopic surgeries under general anaesthesia. Intravenous paracetamol can be considered an effective alternative to diclofenac as a component of multimodal analgesia, particularly in patients where NSAIDs are contraindicated or require cautious use.

Keywords: Intravenous paracetamol; Diclofenac sodium; Pre-emptive analgesia; Laparoscopic surgery; Postoperative pain; General anaesthesia; Multimodal analgesia.

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Introduction

Postoperative pain continues to be one of the major concerns following surgical procedures despite significant advances in anaesthetic techniques and perioperative care. Inadequate pain relief after surgery may result in increased sympathetic stimulation, delayed mobilization, impaired pulmonary function, increased morbidity, and poor patient satisfaction. Effective analgesic strategies are therefore essential to

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improve recovery and facilitate early discharge.[1-3]

Laparoscopic surgery has become increasingly popular due to advantages such as reduced surgical trauma, smaller incisions, decreased postoperative morbidity, and faster recovery compared with open procedures. However, laparoscopic procedures are not completely pain-free. Postoperative pain occurs due to abdominal wall incisions, tissue manipulation, stretching of the peritoneum, carbon dioxide pneumoperitoneum, and inflammatory mediator release. Therefore, adequate perioperative analgesia remains important even after minimally invasive surgery.[4-6]

Opioids are commonly used for the management of moderate to severe postoperative pain. However, opioid-related adverse effects including sedation, respiratory depression, nausea, vomiting, urinary retention, and delayed recovery limit their use. The concept of multimodal analgesia, involving the use of different classes of analgesics acting through separate mechanisms, has gained importance to reduce opioid consumption and improve postoperative outcomes.[7-9]

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used as opioid-sparing agents because of their analgesic and anti-inflammatory effects. Diclofenac sodium is a potent NSAID that inhibits cyclooxygenase enzymes and decreases prostaglandin synthesis, thereby reducing inflammation and peripheral sensitization. Intravenous diclofenac provides effective postoperative analgesia; however, its use may be limited in patients with renal dysfunction, gastrointestinal disorders, bleeding tendencies, or NSAID hypersensitivity.[10-12]

Paracetamol (acetaminophen) is a centrally acting analgesic with minimal peripheral anti-inflammatory activity. Intravenous paracetamol has gained popularity in perioperative practice because of its rapid onset of action, good analgesic efficacy, opioid-sparing properties, and favourable safety profile. Unlike NSAIDs, it does not significantly affect platelet function or gastric mucosa, making it suitable for a wider range of patients.[13,14]

The principle of pre-emptive analgesia involves administration of analgesic medication before surgical stimulation with the aim of preventing central sensitization and reducing postoperative pain intensity. Administration of analgesics before induction of anaesthesia ensures adequate drug concentration before the onset of surgical nociceptive stimuli.[15]

Previous studies have compared intravenous paracetamol and diclofenac in different surgical populations. Hyllested et al. reported that paracetamol provides effective postoperative analgesia with fewer adverse effects compared with NSAIDs. Hiller et al. demonstrated comparable analgesic efficacy between paracetamol and diclofenac following tonsillectomy. Hynes et al. observed similar analgesic effects of intravenous paracetamol and diclofenac in postoperative orthopaedic patients. Durak et al. evaluated laparoscopic cholecystectomy patients and reported that both drugs provided satisfactory postoperative pain control.[16-18]

Although both drugs are frequently used in perioperative practice, comparative studies specifically evaluating their pre-emptive administration before induction of general anaesthesia in laparoscopic surgical patients remain limited. Hence, this study was designed to compare intravenous diclofenac and intravenous paracetamol for postoperative analgesia following laparoscopic surgeries.[19-21]

Aim of the Study: To compare the effectiveness of pre-emptive intravenous diclofenac and intravenous paracetamol for postoperative analgesia in patients undergoing laparoscopic surgeries under general anaesthesia.

Objectives

1. To compare postoperative pain intensity between patients receiving pre-emptive intravenous paracetamol and intravenous diclofenac using Visual Analogue Scale (VAS).
2. To assess the duration and quality of postoperative analgesia provided by both drugs.
3. To compare postoperative rescue analgesic requirements between the two groups.
4. To evaluate and compare adverse effects associated with intravenous paracetamol and intravenous diclofenac.

Materials and Methods

Study Design and Setting: This was a prospective, randomized, double-blind, comparative clinical study conducted in the Department of Anaesthesiology at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee.

The study was designed to compare the efficacy of pre-emptive intravenous paracetamol versus intravenous diclofenac for postoperative analgesia in patients undergoing elective laparoscopic surgeries under general anaesthesia.

The study duration was planned after obtaining ethical approval and included eligible patients scheduled for elective laparoscopic procedures.

Study Population: A total of 120 patients undergoing elective laparoscopic surgeries under general anaesthesia were included in the study.

Patients were randomly divided into two groups:

- Group P (n = 60): Received pre-emptive intravenous paracetamol.
- Group D (n = 60): Received pre-emptive intravenous diclofenac sodium.

Randomization was performed using a computer-generated random number sequence. Allocation concealment was maintained by preparing the study medications in identical infusion containers labelled only with the study code.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Patients aged between 18 and 60 years.
- Either sex.
- American Society of Anesthesiologists (ASA) physical status I and II.
- Body weight between 50 and 80 kg.
- Patients scheduled for elective laparoscopic surgeries under general anaesthesia.
- Duration of surgery expected to be less than 2 hours.
- Patients willing to provide written informed consent.

Exclusion Criteria

Patients were excluded if they had:

- Known allergy or hypersensitivity to paracetamol or

diclofenac.
- Chronic analgesic or opioid consumption.
- Significant hepatic dysfunction.
- Renal impairment.
- Bleeding disorders or coagulation abnormalities.
- Active peptic ulcer disease.
- NSAID-induced bronchial asthma.
- Pregnancy.
- Emergency surgical procedures.
- Conversion from laparoscopic to open surgery.
- Patients requiring prolonged postoperative ventilatory support.

Preoperative Evaluation

All patients underwent detailed preoperative evaluation including:
- Complete medical history.
- General physical examination.
- Airway assessment.
- ASA grading.
- Routine laboratory investigations including complete blood count, renal function tests, liver function tests, blood glucose, and coagulation profile wherever indicated.

Patients were instructed regarding the Visual Analogue Scale (VAS) for postoperative pain assessment.

A written informed consent was obtained from all participants before enrolment.

Randomization and Blinding

Patients were randomly assigned into two groups using computer-generated random numbers.

To maintain double blinding:
- The study drug was prepared by an anaesthesiologist not involved in intraoperative management or postoperative assessment.
- Both study medications were diluted in identical 100 mL infusion containers.
- The patient, anaesthesiologist assessing postoperative pain, and investigator recording outcomes were unaware of group allocation.

Study Drug Administration Protocol

Group P: Intravenous Paracetamol Group

Patients received:

Inj. Paracetamol 1 g diluted in 100 mL normal saline
- Administered intravenously over 15 minutes.
- Given 30 minutes before induction of general anaesthesia.

Group D: Intravenous Diclofenac Group

Patients received:

Inj. Diclofenac sodium 75 mg diluted in 100 mL normal saline
- Administered intravenously over 15 minutes.
- Given 30 minutes before induction of general anaesthesia.

The timing of administration was selected to achieve adequate plasma concentration before airway instrumentation and surgical stimulation, thereby providing pre-emptive analgesic effect.

Anaesthetic Technique: All patients were kept fasting according to standard fasting guidelines.

On arrival in the operating room, standard monitoring was initiated:
- Electrocardiography (ECG)
- Non-invasive blood pressure monitoring
- Pulse oximetry (SpO_2)
- End-tidal carbon dioxide monitoring after intubation

An intravenous cannula was secured, and routine pre-induction monitoring was performed.

After administration of the study medication, patients received general anaesthesia according to institutional protocol.

Induction of Anaesthesia

General anaesthesia was induced using:
- Intravenous induction agent (propofol/thiopentone as per institutional practice)
- Opioid supplementation (fentanyl or equivalent)
- Neuromuscular blocking agent for tracheal intubation

After adequate depth of anaesthesia, endotracheal intubation was performed.

Maintenance of Anaesthesia

Anaesthesia was maintained with:
- Oxygen-air mixture
- Inhalational anaesthetic agent
- Intermittent doses of neuromuscular blocking agents as required
- Controlled ventilation

For laparoscopic procedures, pneumoperitoneum was created using carbon dioxide, maintaining intra-abdominal pressure within recommended limits.

Intraoperative haemodynamic parameters including heart rate and blood pressure were recorded at regular intervals.

Reversal and Recovery

At completion of surgery:
- Residual neuromuscular blockade was reversed.
- Patients were extubated after fulfilling standard extubation criteria.
- Patients were transferred to the post-anaesthesia care unit (PACU).

Postoperative Pain Assessment

Postoperative analgesic efficacy was assessed using the Visual Analogue Scale (VAS).

VAS was explained to all patients preoperatively:
- 0 = No pain
- 10 = Worst imaginable pain

Pain assessment was performed at:

Time interval	Assessment
Immediately after extubation	VAS 0 hour
1 hour postoperatively	VAS 1 hour
2 hours postoperatively	VAS 2 hours
3 hours postoperatively	VAS 3 hours
4 hours postoperatively	VAS 4 hours
6 hours postoperatively	VAS 6 hours
12 hours postoperatively	VAS 12 hours
24 hours postoperatively	VAS 24 hours

Rescue Analgesia

Patients with: VAS score ≥4 were considered to have inadequate analgesia and received rescue analgesia.

Rescue analgesic protocol: Intravenous tramadol 1 mg/kg slowly

The following parameters were recorded:

- Time to first rescue analgesic requirement.
- Total rescue analgesic requirement during 24 hours.
- Number of patients requiring rescue medication.

Assessment of Postoperative Adverse Effects

Patients were monitored for adverse effects related to study drugs.

The following parameters were recorded: Gastrointestinal Effects

- Nausea
- Vomiting

Cardiovascular Effects

- Hypotension
- Bradycardia

Drug-related Effects

- Allergic reactions
- Injection site pain
- Phlebitis

Other Effects

- Sedation
- Dizziness

Postoperative nausea and vomiting were treated with:

Injection Ondansetron 4 mg intravenously when clinically indicated.

Outcome Measures

Primary Outcome

Comparison of postoperative pain intensity between paracetamol and diclofenac groups using VAS scores.

Secondary Outcomes

- Time to first rescue analgesic requirement.
- Total rescue analgesic consumption during first 24 hours.
- Incidence of postoperative nausea and vomiting.
- Other adverse effects related to study drugs.
- Haemodynamic stability during perioperative period.

Statistical Analysis: Data collected were entered into a spreadsheet and analysed using appropriate statistical software. Continuous variables including were expressed as mean ± standard deviation and analysed using the unpaired Student's t-test.

Categorical variables including were analysed using the Chi-square test.

A value of $p < 0.05$ was considered statistically significant. $p < 0.001$ was considered highly significant.

Results

A total of 120 patients undergoing elective laparoscopic surgeries under general anaesthesia were included in the study. Patients were randomly allocated into two groups of 60 each:

- Group P: Patients receiving pre-emptive intravenous paracetamol.
- Group D: Patients receiving pre-emptive intravenous diclofenac sodium.

All patients completed the study protocol, and no patient was excluded after randomization.

The demographic characteristics, including age, sex, body weight, ASA physical status, duration of surgery, and duration of anaesthesia, were comparable between both groups. No statistically significant difference was observed between the groups.

Table 1: Demographic Characteristics of Patients

Parameter	Group P (Paracetamol) n=60	Group D (Diclofenac) n=60	p-value	Significance
Age (years)	41.8 ± 10.2	42.5 ± 9.8	0.71	Not significant
Weight (kg)	67.4 ± 8.1	66.9 ± 7.9	0.74	Not significant
Male/Female	28/32	30/30	0.71	Not significant
ASA I/II	38/22	40/20	0.69	Not significant
Duration of surgery (min)	78.5 ± 18.4	80.2 ± 19.1	0.63	Not significant
Duration of anaesthesia (min)	96.2 ± 20.5	98.1 ± 21.4	0.62	Not significant

Values expressed as mean ± standard deviation.

Postoperative Pain Assessment

Postoperative pain intensity was assessed using Visual Analogue Scale (VAS) at predetermined time intervals.

The mean VAS scores gradually increased during the postoperative period in both groups. However, no statistically significant difference was observed between the paracetamol and diclofenac groups at any time interval.

Table 2: Comparison of Mean Postoperative VAS Scores Between Groups

Time after surgery	Group P (Paracetamol) Mean ± SD	Group D (Diclofenac) Mean ± SD	p-value	Significance
Immediate postoperative (0 hour)	1.0 ± 0.8	0.9 ± 0.7	0.48	Not significant
1 hour	1.2 ± 0.7	1.1 ± 0.8	0.54	Not significant
2 hours	1.7 ± 0.8	1.6 ± 0.8	0.51	Not significant
3 hours	2.2 ± 0.9	2.1 ± 0.9	0.59	Not significant
4 hours	2.7 ± 0.9	2.8 ± 0.8	0.56	Not significant
6 hours	3.1 ± 1.0	3.2 ± 0.9	0.58	Not significant
12 hours	3.5 ± 1.1	3.4 ± 1.0	0.62	Not significant
24 hours	3.2 ± 1.0	3.1 ± 1.1	0.71	Not significant

Rescue Analgesic Requirement

Patients received rescue analgesia when VAS score was ≥4.

The number of patients requiring rescue analgesia was comparable between both groups.

Table 3: Requirement of Rescue Analgesia during First 24 Hours

Requirement	Group P (n=60)	Group D (n=60)	p-value

Patients requiring rescue analgesia	16 (26.7%)	14 (23.3%)	0.68
Patients not requiring rescue analgesia	44 (73.3%)	46 (76.7%)	
Mean time to first rescue analgesia (hours)	6.8 ± 2.1	7.1 ± 2.3	0.47

The difference in rescue analgesic requirement between groups was statistically insignificant.

Total Rescue Analgesic Consumption

The mean total dose of rescue analgesic required during the first postoperative 24 hours was similar in both groups.

Table 4: Total Rescue Analgesic Requirement

Parameter	Group P	Group D	p-value
Mean tramadol requirement (mg)	62.5 ± 18.6	60.8 ± 17.9	0.64
Number of rescue doses	1.4 ± 0.5	1.3 ± 0.5	0.55

Postoperative Adverse Effects: The incidence of adverse effects was low in both groups. Nausea and vomiting were the most commonly observed complications.

No serious adverse events such as allergic reactions, renal complications, gastrointestinal bleeding, or significant haemodynamic instability were observed.

Table 5: Comparison of Adverse Effects

Adverse effect	Group P (n=60)	Group D (n=60)	p-value	Significance
Nausea	6 (10%)	7 (11.7%)	0.77	Not significant
Vomiting	3 (5%)	4 (6.7%)	0.70	Not significant
Injection site discomfort	0	2 (3.3%)	0.15	Not significant
Sedation	2 (3.3%)	3 (5%)	0.65	Not significant
Allergic reaction	0	0	—	—

Haemodynamic Parameters

Heart rate and mean arterial pressure were recorded intraoperatively and postoperatively.

No significant differences were observed between the two groups.

Table 6: Comparison of Postoperative Haemodynamic Parameters

Parameter	Group P	Group D	p-value
Mean heart rate (beats/min)	82.4 ± 8.6	83.1 ± 9.2	0.68
Mean arterial pressure (mmHg)	91.5 ± 7.8	92.2 ± 8.1	0.64

Summary of Results

In the present study, pre-emptive administration of intravenous paracetamol and intravenous diclofenac provided effective postoperative analgesia following laparoscopic surgery under general anaesthesia.

The mean VAS scores at all postoperative assessment intervals were comparable between the two groups. No statistically significant difference was observed regarding:

- Quality of analgesia
- Duration of analgesia
- Rescue analgesic requirement
- Postoperative nausea and vomiting
- Other adverse effects

Both drugs demonstrated similar analgesic efficacy and safety profiles.

Discussion

Postoperative pain following laparoscopic cholecystectomy remains an important concern despite the minimally invasive nature of the procedure. Although laparoscopic surgery is associated with reduced tissue trauma compared with open surgery, patients frequently experience significant pain due to abdominal port-site incision, peritoneal stretching, diaphragmatic irritation caused by carbon dioxide pneumoperitoneum, and inflammatory mediator release.

Adequate postoperative analgesia facilitates early mobilization, improves respiratory function, reduces stress response, and contributes to enhanced recovery after surgery. However, opioid-based analgesia is associated with several adverse effects including sedation, nausea, vomiting, respiratory depression, and delayed recovery. Therefore, multimodal analgesic approaches using non-opioid agents have gained importance in perioperative practice.

The present study was conducted to compare the analgesic efficacy of pre-emptive intravenous paracetamol and intravenous diclofenac sodium in patients undergoing elective laparoscopic cholecystectomy under general anaesthesia.

In the present study, both groups were comparable with respect to demographic characteristics including age, sex, body weight, ASA physical status, duration of surgery, and duration of anaesthesia. There was no statistically significant difference between the groups, suggesting that both groups were adequately matched for comparison.

Effect of Pre-emptive Analgesic Administration

The concept of pre-emptive analgesia is based on preventing central sensitization by administering analgesic agents before the onset of surgical nociceptive stimulation. Tissue injury during surgery activates peripheral nociceptors and triggers inflammatory mediator release, resulting in amplification of pain pathways. Administration of analgesics before surgical stimulus may reduce postoperative pain intensity and analgesic requirements.

In the present study, study drugs were administered 30 minutes

before induction of general anaesthesia, allowing adequate plasma concentration before surgical stimulation. Both intravenous paracetamol and diclofenac demonstrated effective analgesic effects during the early postoperative period.

Comparison of Postoperative Pain Scores

In our study, postoperative VAS scores were comparable between the paracetamol and diclofenac groups at all assessment intervals (0, 1, 2, 3, 4, 6, 12, and 24 hours). Although pain scores gradually increased with time, no statistically significant difference was observed between the two groups. These findings suggest that pre-emptive intravenous paracetamol provides analgesia comparable to intravenous diclofenac following laparoscopic cholecystectomy. Our findings are consistent with the observations of Durak et al., who compared paracetamol and diclofenac for postoperative pain management after laparoscopic cholecystectomy and reported similar analgesic efficacy between the two drugs. They concluded that both medications provided effective postoperative analgesia with comparable pain scores. Similarly, Yoganarasimha et al. compared paracetamol infusion with diclofenac infusion for perioperative analgesia and found no significant difference in postoperative pain scores between the groups. The results of our study are also comparable with the findings of Hiller et al., who evaluated paracetamol and diclofenac after elective tonsillectomy and observed similar analgesic efficacy when used individually.

Mechanism of Analgesic Action

Diclofenac produces analgesic effects primarily by inhibiting cyclooxygenase (COX) enzymes, leading to decreased prostaglandin synthesis and reduced peripheral inflammatory sensitization. Its anti-inflammatory properties make it effective in surgical pain associated with tissue injury.

Paracetamol acts predominantly through central mechanisms involving inhibition of central prostaglandin synthesis and modulation of descending serotonergic pain pathways. It provides analgesia without significant anti-inflammatory effects, platelet inhibition, or gastrointestinal irritation.

The comparable analgesic effect observed in our study may be attributed to the fact that postoperative pain after laparoscopic cholecystectomy involves both inflammatory and central mechanisms, which can be effectively controlled by either drug.

Comparison of Rescue Analgesic Requirement

In the present study, rescue analgesic requirements were comparable between both groups. The number of patients requiring rescue analgesia and the total dose of rescue analgesic consumed during the first postoperative 24 hours showed no statistically significant difference.

Similar findings were reported by Hynes et al., who compared intravenous paracetamol and diclofenac for postoperative orthopaedic pain and found comparable analgesic efficacy and rescue medication requirements.

Hyllested et al. reviewed the comparative effects of paracetamol and NSAIDs in postoperative pain management and concluded that paracetamol provides clinically meaningful analgesia, particularly when administered as part of multimodal analgesic therapy. The similar rescue analgesic requirement in our study indicates that intravenous paracetamol can provide analgesic efficacy comparable to diclofenac after laparoscopic cholecystectomy.

Duration of Analgesia

In the present study, the majority of patients requiring rescue analgesia did so after several hours of surgery, indicating satisfactory duration of analgesic effect with both drugs.

The duration of analgesia observed with intravenous paracetamol was consistent with previous pharmacokinetic studies. Luthy et al. reported that the analgesic effect of paracetamol is influenced by administration rate and that effective analgesia can be maintained for approximately 4–6 hours following intravenous administration. For diclofenac, Willis et al. studied the pharmacokinetics of intravenous diclofenac and observed rapid distribution with detectable plasma levels for several hours following administration, supporting its use as a perioperative analgesic.

Safety Profile and Adverse Effects

Both drugs were well tolerated in our study. The incidence of nausea and vomiting was low and comparable between groups. No serious adverse events such as allergic reactions, renal impairment, gastrointestinal bleeding, or significant haemodynamic instability were observed. Although diclofenac is associated with potential gastrointestinal, renal, and platelet-related adverse effects, these complications are generally associated with repeated administration, prolonged use, or high-risk patient populations. In the present study, a single pre-emptive dose was used in ASA I and II patients, which may explain the minimal adverse effects observed.

Our findings are consistent with Hyllested et al., who suggested that paracetamol may be preferred in patients at increased risk of NSAID-related complications because of its favourable safety profile. Jahr and Lee also highlighted the safety and efficacy of intravenous paracetamol in perioperative patients, emphasizing its role as an opioid-sparing analgesic with minimal adverse effects.

Clinical Implications

The results of this study demonstrate that both intravenous paracetamol and intravenous diclofenac can provide effective postoperative analgesia following laparoscopic cholecystectomy.

Intravenous paracetamol offers several advantages:

- No significant effect on platelet function.
- Lower risk of gastrointestinal irritation.
- Suitable for patients where NSAIDs are contraindicated.
- Good compatibility with multimodal analgesic protocols.

Diclofenac remains an effective analgesic option in patients without contraindications.

Therefore, the choice between these drugs may depend on patient characteristics, comorbidities, risk factors, and institutional analgesic protocols.

Comparison with Previous Studies

Study	Surgical Population	Intervention	Main Findings
Hyllested et al. (2002)	Various postoperative pain	Paracetamol vs NSAIDs	Paracetamol provided effective analgesia with

	models		favourable safety profile
Hiller et al. (2004)	Tonsillectomy	Paracetamol vs Diclofenac	Comparable analgesic efficacy
Hynes et al. (2006)	Orthopaedic surgery	IV Paracetamol vs Diclofenac	Similar postoperative pain relief
Durak et al. (2010)	Laparoscopic cholecystectomy	Paracetamol vs Diclofenac	Both drugs provided effective analgesia
Yoganarasimha et al. (2012)	Perioperative surgical patients	Paracetamol infusion vs Diclofenac infusion	No significant difference in analgesic efficacy
Pratyush et al. (2013)	Various surgical procedures	Pre-emptive IV Paracetamol vs Diclofenac	Both provided comparable postoperative analgesia

The results of the present study are in agreement with previous literature demonstrating that intravenous paracetamol and diclofenac provide comparable postoperative analgesia.

Limitations of the Study

The present study has certain limitations:

- The study included only ASA I and II patients; therefore, results may not be applicable to high-risk surgical populations.
- Only laparoscopic cholecystectomy patients were included, limiting generalizability to other surgeries.
- The study evaluated single-dose administration; repeated-dose effects were not assessed.
- The study focused on pain scores and rescue analgesic requirement; inflammatory markers and long-term recovery outcomes were not evaluated.

Conclusion

Pre-emptive administration of intravenous paracetamol and intravenous diclofenac provides effective and comparable postoperative analgesia in patients undergoing laparoscopic cholecystectomy under general anaesthesia.

Both drugs resulted in similar postoperative pain scores, comparable rescue analgesic requirements, and minimal adverse effects.

Intravenous paracetamol can be considered an effective alternative to diclofenac, especially in patients with contraindications or increased risk of NSAID-related adverse effects. Both drugs may be safely incorporated into multimodal analgesic protocols for laparoscopic cholecystectomy.

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Conflicts of interest

There are no conflicts of interest.

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