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Comparison of Intravenous Paracetamol Versus Intravenous Tramadol for Labour Analgesia

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[1,3-6]Conception; [1]Literature research; [2]Manuscript design and drafting; [2,]Critical analysis and manuscript review; Study Supervision.

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A B S T R A C T

Background: Childbirth is a highly painful physiological event that elicits a systemic stimulus, and this may impair both the health of the mother and fetal well-being. Although neuraxial methods are the best, systemic analgesics such as paracetamol and tramadol are critical in the management of pain in resource-strained areas, such as Azad Jammu and Kashmir.

Objectives: To compare the clinical analgesic efficacy, in terms of mean change in the Visual Analogue Scale (VAS) score, between 1 gram of intravenous (IV) paracetamol and 100 mg of IV tramadol in females presenting in the active phase of labour.

Methodology: A randomized controlled trial with single-blinding was conducted at the Department of Obstetrics and Gynaecology, DHQ Teaching Hospital, Mirpur from 1 December 2025 to 4 March 2026. Sixty term parturients (18-40 years old) were recruited through consecutive sampling during the active labour phase (≥ 4 cm dilatation) and randomized into two groups. Group P (30) was administered a 1g IV paracetamol infusion, and Group T (30) was administered a 100mg IV tramadol. The main outcome was measured by the mean change in VAS score 3 hours after the administration. The level of statistical significance was $p \leq 0.05$.

Results: There were similarities in the demographic profiles of the groups at baseline ($p > 0.05$). The trial showed that Group P had better overall clinical outcomes, with a much shorter labour (4.7 ± 1.5 vs 6.3 ± 2.1 hours, $p < 0.001$) and greater maternal satisfaction (100% vs 80%, $p = 0.024$) than Group T. Although Group T was found to show a greater mean decrease in pain scores (4.71 ± 0.77) than Group P (3.21 ± 0.53) ($p < 0.001$, Mean Difference: 1.50, 95% CI: 1.17 to 1.83), it also had an increased incidence of opioid-related side effects and longer labour.

Conclusion: IV tramadol proved to be better in analgesic effects when it comes to the reduction of pain. Nonetheless, intravenous paracetamol was linked to a reduced labouring period, maternal satisfaction, and a reduced number of opioid-related side effects. The two drugs were maternal and

Introduction

Childbirth is a significant physiological process that involves a very high level of pain and produces a complex cascade of neuroendocrine stress responses affecting maternal and fetal health.[1] This is one of the most intense human experiences, which, in most cases, outweighs chronic diseases such as terminal cancer or acute ones such as several bone fractures.[2] The physiological process includes a significant increase in catecholamine concentrations in the body, particularly epinephrine and norepinephrine, as well as cortisol.[3,4] Epinephrine may induce incoordinate uterine action, whereas the alpha-adrenergic effect of norepinephrine will result in peripheral vasoconstriction that may cut approximately a quarter of uteroplacental blood flow during extreme contractions.[5] This leads to the risks of fetal hypoxia and maternal respiratory alkalosis that require proper pharmacology.

Although the neuraxial methods, such as epidural analgesia, are the universal standard in terms of this method of pain relief, the high expense of equipment, shortage of anesthesiologists, and the socio-cultural beliefs about the nature of delivery are some of the factors that prevent universal application of the technique in Pakistan.[6,7] Systemic pharmacological agents remain the most common modality in public hospitals in resource-deprived areas, such as Azad Jammu and Kashmir. Recent evidence-based anaesthetic guidelines state that the optimal analgesic must provide relief at low doses and act quickly.[8] In the past, opioids such as pethidine were the standard, but the problem of neonatal respiratory depression and nausea led to the identification of safer alternative options.[9] This highlights the necessity to consider non-opioid alternatives as a way to enhance the maternal safety, satisfaction and clinical outcomes.

The literature has sought to fill this gap and has reported improved clinical outcomes. A positive response was observed in one of these studies, in which the use of intravenous paracetamol as routine therapy resulted in a reduction of 3.2 ± 0.51 in the paracetamol

group compared with 4.7 ± 0.71 in the tramadol group.[10] In a similar study, a different group of researchers discovered that paracetamol infusion not only shortened the stages of labour but also demonstrated a lowering of pain levels when compared to traditional opioids.[11,12] These advantages were not universal, though; for example, Marwah et al. (2023) did not show the same benefits across all stages of advanced cervical dilatation.[13] The differences in these results indicate that several medical factors are at play. Certain environmental factors also determine the effectiveness of treatment methods.

The results indicate that further local studies are indispensable. This study is applied to determine the most appropriate treatments for different populations. The impossibility of constantly resorting to costly neuraxial analgesia and the unwillingness of mothers to lose birth satisfaction predetermine a significant role in making the medical treatment as effective as possible.

Methodology

It was a single-blind randomized controlled trial conducted in the Department of Obstetrics and Gynaecology at the Divisional Headquarters Teaching Hospital, Mirpur, AJK, from 1 December 2025 to 4 March 2026. The study protocol was approved by the Hospital Ethics Committee and the CPSP, as there are no significant ethical issues, given that both drugs are used regularly. All the subjects gave written informed consent before enrolment. The sample size of 60 patients (30 in each arm) (5% alpha) 90% statistical power, based on earlier published statistics. OpenEpi version 3.01 was used to calculate the sample size using the literature benchmarks of mean change in VAS scores of 3.21 ± 0.53 vs 4.71 ± 0.71. To reduce Type I errors, a significance value of $p \leq 0.05$ was used in the final data analysis.

The inclusion criteria were female parturients aged 18-40 years with parity <5 and a term singleton pregnancy confirmed by ultrasound. All participants were at the active stage of labour, with cervical dilatation ≥ 4 cm, regular uterine contractions, and progressive dilatation of at least 1.2-1.5 cm per hour. Eligible patients were recruited through consecutive sampling, and the same patients were randomly assigned to their respective interventional cohort using a random number table generated in Microsoft Excel. Participants were not eligible to take part in the study once they had a previous scarred uterus, a history of drug abuse or were hypersensitive to the research drugs.

A clinical protocol was used to standardize procedures. The paracetamol group (Group P) received 100 ml of 1 gram intravenous paracetamol over 15 minutes. In contrast, the tramadol group (Group T) received 100 mg of pharmaceutical paracetamol mixed with 100 ml of normal saline over 15 minutes. Maternal vital signs and fetal heart rates were monitored, and the neonates' Apgar scores were recorded. An obstetrician who was not part of the outcome measure assessment administered the study drug. The main outcome was measured using a 10 cm Visual Analogue Scale (VAS) at baseline and 3 hours after administration to compute the average change in pain score. This form of concealment minimized bias during observation, and the final data were entered into SPSS 25.0.

Results

The study was done in 60 patients who had been treated in the Department of Obstetrics and Gynaecology of the Divisional Headquarters Teaching Hospital in Mirpur, Azad Jammu and Kashmir. The age of population was 28.4 years old on average, 41 housewives and 19 working accounted for 68.3% and 31.7%, respectively. Each group had 30 patients. The ages of both samples were similar, with the mean age of Group P and Group T being 29.8 and 26.9 years, respectively. The results revealed no significant differences in demographics between the two groups.

Maternal anaemia was also prevalent. Among the patients, 17 (28.3%) were clinically anaemic: 23.3% in Group P, and 33.3% in the case of the tramadol Group T. In terms of the primary analgesic outcomes, the mean reduction in pain intensity was 3.21 among patients who received paracetamol (Group P) and 4.71 among those who received tramadol (Group T). All details are in Tables 1 and 2. Group T experienced much greater pain reduction. The mean change in Group P was 3.21 ± 0.53, whereas that in Group T was 4.71 ± 0.77. The difference was also statistically significant ($p < 0.001$; Mean Difference: 1.50; 95% CI: 1.17 to 1.83). There were also significant differences in the time to full dilatation; in Group P, the mean time to full dilatation was 4.7 ± 1.5 hours, and in the tramadol group, the mean time to full dilatation was 6.3 ± 2.1 hours ($p < 0.001$). Group T (6.6% and Group P (13.3%) also demonstrated persistent severe pain (VAS ≥ 7) after 3 hours, which occurred in 2 patients and 4 patients, respectively.

The other significant outcome was maternal satisfaction, in which case High Satisfaction was defined as the combination of Excellent and Good ratings. In the paracetamol group, 100% of patients reported high satisfaction; 12 (40.0%) had the highest level, and 18 (60.0%) had a good level. On the other hand, Group T had an increased number of opioid-induced nausea. Group T showed that 0 patients gave a perfect satisfaction rating and 6 patients (20.0%) gave an impoverished satisfaction rating ($p = 0.024$ through Fisher's exact test). The results for neonatal outcomes were similar to the reference, with mean

Apgar scores at 5 minutes of 8.8 ± 0.4 in Group P and 8.7 ± 0.5 in Group T (p = 0.28). Figure 1 is the comparison of the change in VAS mean, and Figure 2 demonstrates the progression of labour. Figure 3 shows the incidence of maternal nausea.

Table 1: Demographic Characteristics of Patients in the Research (n = 60)

Variable	Group P (Paracetamol)	Group T (Tramadol)	p-value
Age (years)	29.80 ± 7.10	26.93 ± 7.42	0.129
Gestational age (weeks)	38.74 ± 1.25	39.03 ± 1.13	0.354
BMI (kg/m^2)	26.83 ± 4.96	27.31 ± 4.94	0.710
Parity (n)	2.43 ± 1.36	1.93 ± 1.48	0.178

Table 2: Occupation and Clinical Comorbidities

Comorbidity/Profile	Group P (n=30)	Group T (n=30)	Total Frequency (%)
Housewife	22	19	41 (68.3%)
Working Woman	8	11	19 (31.7%)
Hypertension	3	4	7 (11.7%)
Diabetes Mellitus	4	3	7 (11.7%)
Anaemia (Hb < 10g/dl)	7	10	17 (28.3%)

Table 3: Primary Analgesic and Neonatal Outcomes

Outcome Metric	Group P (Mean ± SD)	Group T (Mean ± SD)	p-value
Mean Change in VAS	3.21 ± 0.53	4.71 ± 0.77	<0.001*
1-minute Apgar Score	7.8 ± 0.6	7.7 ± 0.7	0.352
5-minute Apgar Score	8.8 ± 0.4	8.7 ± 0.5	0.282

Discussion

This study was a randomized controlled trial aimed at comparing the pain-killing effect and safety of intravenous paracetamol and tramadol in the treatment of active labour pain in a resource-constrained environment. The outcome showed that tramadol produced a considerably greater decrease in VAS pain scores than paracetamol. Nonetheless, both drugs provided clinically significant pain relief, and the outcomes were similar in both groups of neonates. The findings of this study indicate that systemic analgesics may be a feasible option when neuraxial methods are not readily available.

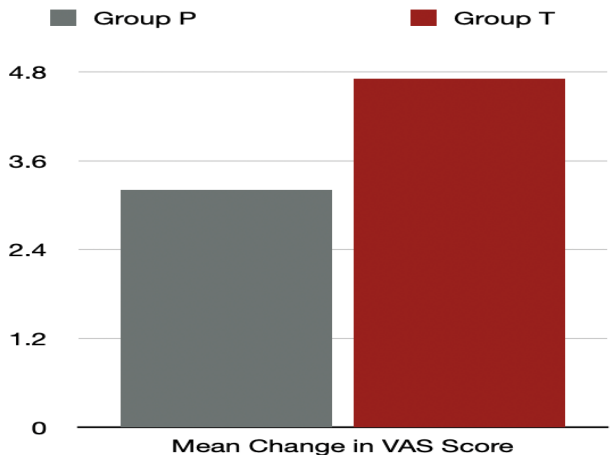

Figure 1: Mean Change in VAS Scores at 3 Hours

Note: Tramadol (Group T) had a higher mean pain reduction (4.71 ± 0.77) than paracetamol (Group P, 3.21 ± 0.53) at 3 hours.

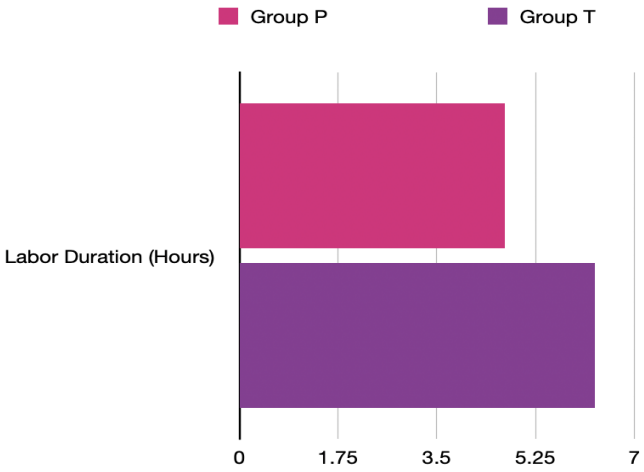

Figure 2: Averaxe Duration of First Stage Labour (Hours)

Note: Paracetamol (Group P) had a shorter first-stage labour (4.7 hours) compared to tramadol (Group T, 6.3 hours).

The same is observed by Mushtaq et al. (2025), who concluded that, in the majority of cases, when patients experience systemic analgesia, they can overcome their physiological distress with no negative effects on neonatal stability. The authors of the article find that the use of systemic analgesics has the potential to be a welcome input to labour rooms that lack sophisticated anaesthetic facilities because they serve to bridge the disjunction between labour pain and quality care during childbirth.[4] Correspondingly, Oso et al. (2025) also

reported a high success rate with paracetamol as a pronounced pain reliever in the late phases of labour, with a significant reduction in pain scores.[2] The results of the research indicate that labour-related physiological stress can be reduced through effective analgesia.

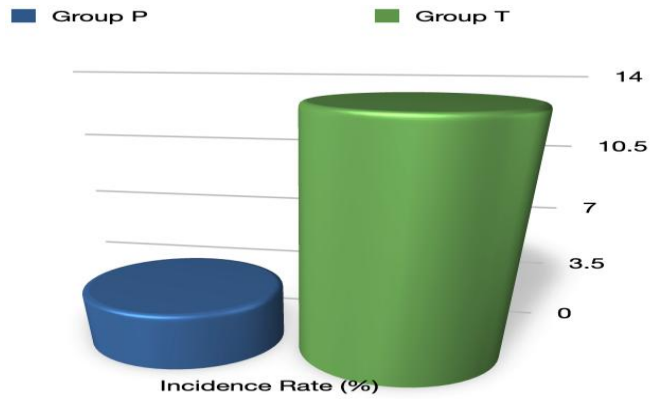

Figure 3: Incidence of Maternal Nausea and Vomiting (%)

Extreme labour pain permits neuroendocrine stress reactions, which can have an impact on uterine behaviour and maternal health. Potential beneficial effects of effective analgesia are better physiological stability in labour. Depending on their assumption, Marwah et al. (2023) assume that secondary neuroendocrine crises can be induced almost immediately during the highest-intensity contractions, thus preventing local recovery in mothers and maintaining a state of chronic fatigue.[13] The pain that is not managed is a grave issue which may greatly slow down the cervical dilatation procedure. Systemic administration relieved physiological stress and decreased the mechanical tension. IV analgesics offer acceptable safety profiles with systemic analgesic effects when used correctly.

A statistically significant difference in labour duration was observed between the paracetamol and tramadol groups: the average first-stage labour duration was 4.7 hours in the paracetamol group and 6.3 hours in the tramadol group ($p < 0.001$). The finding, however, should be taken with caution, as confounding factors such as parity and oxytocin augmentation may be present. We also concur with Gholami et al. (2023), who also realized that patients had a fast recovery after paracetamol procedures despite the relatively better opioid resolution in the past.[14] Recent studies by Rawat et al. (2025) reveal that intravenous paracetamol reduces labour pain and the duration of labour, thereby boosting satisfaction with natural childbirth.[3] The efficacy of tramadol in pain reduction in a severe condition in our study suggests that the opioid-based regimens have a better potency profile in significantly distressed patients.

The sample's demographic characteristics were characterized by a preponderance of clinical anaemia (28.3%). It is probably due to nutritional deficiencies in Azad Jammu Kashmir. Impaired metabolic reserves are a key cause of slow recovery. A hard course of labour is linked with a high level of maternal fatigue, and our data showed a successful analgesia in the paracetamol group despite the presence of heavy comorbidities. Recent studies at DHQ Teaching Hospital Mirpur indicate the need to monitor metabolic conditions, such as anaemia, to prevent adverse outcomes. It carries a dire clinical outcome in resource-strained contexts in Pakistan.

The cutting of the standard proforma to labour analgesia is welcomed as a crucial element of the contemporary obstetric suite. Nonetheless, untreated pain has a high chance of psychological trauma and increased requests for cesarean sections. The authors have also noted that neuraxial analgesia may be the gold standard, but long-term structural limitations to its application in Mirpur are imminent; thus, the most vital approach, as the first line of defence, is systemic optimization. Haider et al. (2026) recommend adopting cost-effective, easily accessible analgesic modalities to improve patient satisfaction and positive labour outcomes in low-resource centres.[15] Obstetric teams can decrease maternal discomfort and unjustified operative interventions by enhancing the provision of effective systemic analgesia.

There are shortcomings in this research. The research is also limited because it covered only 60 targeted patients. This was highly difficult to conduct a rigorous study of long-term matrimonial cheerfulness patterns, as the research process was carried out over a brief period of observation. The authors assessed clinical clearance using a strict VAS evaluation because they have not implemented longitudinal neuroendocrine examination. In general, the research findings have limited generalizability to the global population, as the study was conducted in a single region. The suggested interventional study definitely requires further research in other environments, including additional laboratory examinations, to provide the medical community with deeper insight into the longitudinal effects on participants.

Conclusion

This study shows that intravenous tramadol had greater absolute analgesic efficacy than paracetamol infusion in this context. A mean pain reduction of 4.71 ± 0.77 was obtained with Tramadol therapy compared with 3.21 ± 0.53 with paracetamol. Nevertheless, intravenous paracetamol is better in terms of holistic clinical utility, as it minimizes labour distress, increases maternal satisfaction, and makes the overall birth process more positive. The safety of the mother and neonate was preserved because the paracetamol regimen did not have the gastrointestinal side effects of opioids. The findings justify the use of intravenous

paracetamol as the treatment of choice in the management of acute labour pain, as it is more effective in relation to opioid intervention concerning progression during labour and patient tolerance.

LIMITATIONS & RECOMMENDATIONS

The analysis has a few limitations that limit its scope and the potential future applicability of the results. Although the implemented research methodology is quite powerful, involving random assignment to determine effective interventions and provide clear recommendations to institutions with limited resources, certain limitations should be discussed. The independent variable was confined to a single centre and failed to quantify stress response reductions using neuroendocrine measures objectively. Even the 3-hour follow-up period was not sufficient to predict long-term outcomes or postpartum maternal satisfaction. The researchers of the future ought to address such shortcomings by using multicenter designs, accurate physiological measurements, and extended follow-up time, as these would also add to the findings. In environments with limited health facilities, more effective therapeutic delivery methods can eliminate the need for surgical intervention.

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