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Assessing the effectiveness of continuous wound infiltration vs. rectus sheath catheter for postoperative analgesia during laparotomy surgery

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Abstract
Introduction and Background: Since insufficient pain control can lead to delayed mobilisation, extended hospital stays, and an increased risk of complications, postoperative pain management is an essential part of recuperation after laparotomy surgery. Evaluating the effects on pain relief, opioid intake, patient satisfaction, and safety outcomes, this study seeks to assess the postoperative analgesic efficacy of rectus sheath catheters and continuous wound infiltration in patients having laparotomy.
Materials and Methods: This prospective, randomized, and comparative study was conducted on patients undergoing elective laparotomy under general anesthesia. This study was conducted at the department of Anesthesiology, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India from December 2019 to November 2020. Additional outcome measures included total opioid consumption over the first 24 hours, time to first rescue analgesia, patient satisfaction scores, and the incidence of complications such as catheter-related issues, local site infections, and systemic toxicity. Statistical analysis was performed using appropriate methods, with a p-value of less than 0.05 considered statistically significant.
Results: After surgery, participants who received continuous wound infiltration reported significantly higher levels of discomfort at 6, 12, and 24 hours compared to those who received rectus sheath catheters, according to the study's results. Also, patients who had rectus sheath catheters reported increased happiness with their pain treatment experience overall. The fact that both methods were safe and well-tolerated by patients and that problems occurred at similar rates in both groups demonstrates that they are equally effective.
Conclusion: This study suggests that rectus sheath catheter implantation gives better postoperative analgesia than continuous wound infiltration in laparotomy patients. Low pain scores, less opioid intake, longer time to initial rescue analgesia, and improved patient satisfaction demonstrate that the rectus sheath catheter is a successful and dependable approach for treating postoperative pain after laparotomy.

Keywords: Laparotomy, pain management, opioid consumption, regional anesthesia

Introduction
Particularly after large abdominal surgeries like laparotomy, postoperative pain control is an essential part of surgical treatment. Improving patient recovery, allowing early mobilisation, reducing postoperative complications, and minimising opioid-related side effects all depend on effective pain control. Overall patient outcomes can be impacted by insufficient pain treatment, which in turn can increase morbidity, slow wound healing, and lengthen hospital stays [1-3].
With the goal of reducing opioid usage while yet providing adequate analgesia, regional analgesic treatments have become widely accepted as part of multimodal pain management regimens. Among these approaches, continuous wound infiltration (CWI) and the rectus sheath catheter (RSC) have shown promise in treating postoperative pain following laparotomy. In order to provide a sustained blockage of the nerves in the anterior abdominal wall, the rectus sheath catheter technique entails inserting a catheter into the sheath. This allows for the continuous injection of local anaesthetics [2-4].
This strategy provides a focused way to alleviate pain, which could lead to a decrease in the need for opioids systemically and an improvement in patient comfort. However, with continuous wound infiltration, a multi-hole catheter is inserted into the surgical wound so that local anaesthetics can be continuously administered to the area of tissue stress.

By adjusting signals at the level of the wound, this method attempts to alleviate localised pain [3-5].

Despite the widespread use of both procedures, clinical inquiry into their relative usefulness is ongoing. While continuous wound infiltration offers more targeted pain relief at the incision site, rectus sheath catheters may give better analgesia by inhibiting nociceptive transmission at the fascial level, according to certain research. There has to be more research into the differences between the two modalities to determine whether one is better for analgesic efficacy, opioid sparing, pain relief duration, patient satisfaction, and safety [4-6].

In patients undergoing laparotomy, this study intends to assess the postoperative analgesic efficacy of continuous wound infiltration vs rectus sheath catheters. Using the Visual Analogue Scale (VAS) at various time intervals after surgery, the major goal is to assess the level of pain alleviation. Opioid use, duration until first rescue analgesia is administered, patient satisfaction levels, and complication rates are all considered secondary outcomes. The results of this study will help doctors choose the best regional analgesic methods for abdominal procedures and improve postoperative pain management tactics [6-8].

Materials and Methods

This study was designed as a prospective, randomized, comparative clinical trial to evaluate the postoperative analgesic efficacy of rectus sheath catheter versus continuous wound infiltration in patients undergoing laparotomy under general anesthesia. This study was conducted at the department of Anesthesiology, Mahavir Institute of Medical Sciences, Vikarabad, Telangana, India from December 2019 to November 2020. Patients were randomly assigned to either the RSC group or the CWI group using a computer-generated randomization sequence. The study was conducted in a tertiary care hospital following ethical approval from the institutional review board, and informed consent was obtained from all participants.

Inclusion Criteria

- Adults aged 18 to 70 years, of either gender.
- Undergoing elective laparotomy under general anesthesia.
- ASA physical status I-III.
- Provided written informed consent.

Exclusion Criteria

- Coagulation disorders or on anticoagulant therapy.
- Pregnant or lactating women.
- Chronic pain conditions or long-term opioid use.
- Infection at the catheter site or severe systemic infections.

Results

The research had 60 participants, 30 from the Rectus Sheath Catheter (RSC) group and 30 from the Continuous Wound Infiltration (CWI) group, who were randomly assigned to each group. The Visual Analogue Scale (VAS) was used to evaluate postoperative pain at2, 6, 12, and 24 hours. We also tracked the total amount of opioids taken, how long it took before patients needed rescue analgesia, and how satisfied they were with the treatment overall.

Table 1: Pain Scores (VAS) at Different Time Intervals

Time (hours)	RSC Group (Mean ± SD)	CWI Group (Mean ± SD)	p-value
2	4.8 ± 1.2	5.1 ± 1.3	0.35 (NS)
6	3.5 ± 1.1	4.8 ± 1.4	0.01*
12	2.8 ± 1.0	4.2 ± 1.3	0.001*
24	2.1 ± 0.9	3.6 ± 1.2	0.002*

(***NS:** Not significant, **p*< 0.05: Statistically significant)

According to table 1, both groups experienced similar levels of pain after 2 hours ($p > 0.05$). Nevertheless, the RSC group had superior long-term analgesia at 6, 12, and 24 hours when contrasted with the CWI group, which had significantly higher pain levels ($p < 0.05$).

Table 2: Opioid Consumption and Time to First Rescue Analgesia

Parameter	RSC Group (Mean ± SD)	CWI Group (Mean ± SD)	p-value
Total Opioid Consumption (mg morphine equivalent in 24 hrs)	12.5 ± 3.2	18.9 ± 4.1	0.001*
Time to First Rescue Analgesia (hours)	8.4 ± 1.2	5.7 ± 1.5	0.003*
Patient Satisfaction Score (1-10 scale)	8.7 ± 1.1	7.2 ± 1.3	0.02*

(**p*< 0.05: Statistically significant)

The opioid-sparing effect of RSC is demonstrated in Table 2, which shows that patients in the RSC group needed considerably less opioid consumption in the first 24 hours compared to the CWI group ($p = 0.001$). There was a statistically significant increase in the amount of time it took for the RSC group to have pain relief compared to the control group ($p = 0.003$). A higher level of perceived pain control was also shown by the considerably higher patient satisfaction levels in the RSC group ($p = 0.02$) [9].

After surgery, the Rectus Sheath Catheter (RSC) method was more effective than Continuous Wound Infiltration (CWI) in reducing pain. Lower pain scores, less opioid medication requirement, longer duration until rescue analgesia was needed, and higher satisfaction levels were observed in the RSC group of patients. There were no discernible variations in the occurrence of side effects or problems between the two groups, and both procedures were well-tolerated [10, 11].

Discussion

Due to the fact that delayed ambulation, greater morbidity, and extended hospital stays can result from inadequate pain control following a laparotomy, postoperative pain management is crucial to the recovery process. In this study,

the purpose was to evaluate the relative analgesic effectiveness of Continuous Wound Infiltration (CWI) and Rectus Sheath Catheter (RSC) in laparotomy patients. Lower VAS pain scores at 6,12, and 24 hours postoperatively [11-13], less opioid use, longer time to initial rescue analgesia, and better patient satisfaction scores revealed that RSC offered superior and sustained pain relief compared to CWI.

By repeatedly injecting local anaesthetics into the rectus sheath, which targets the nerves in the anterior abdominal wall, the rectus sheath catheter approach suppresses somatic discomfort [14-16].

Compared to direct wound infiltration, which primarily operates at the incision site, this method offers a more comprehensive regional blockage. Consistent with other research, our findings demonstrate that RSC outperforms CWI in terms of giving longer-lasting pain relief. Our study found that RSC considerably reduced opioid doses needed in the first 24 hours compared to CWI, which is a major discovery [15-17]. Excessive opioid use is linked to adverse effects such nausea, vomiting, respiratory depression, and a delayed recovery time; thus, it is essential to reduce opioid use in postoperative care. The fact that the RSC group took longer to experience first rescue analgesia is more evidence of the technique's long-term analgesic effects [18-20].

On the other hand, percutaneous wound irrigation (CWI) is less complicated and easier to administer than laparotomy, but it has limited effectiveness because of its localised infiltration, which might not be enough to alleviate pain in deeper structures [21-23]. Since CWI only addresses pain at the incision site rather than deeper nociceptive pathways, our results are in line with studies that have proposed that it may not be enough for significant abdominal surgeries. Both methods were determined to be safe and well-tolerated, with no discernible variation in the incidence of complications, even though RSC had better analgesic efficacy [24-26].

Serious side effects, including toxicity from the local anaesthetic, catheter displacement, or systemic problems, did not occur in either group. Unfortunately, RSC placement is more technically demanding, which may restrict its usage in places where regional anaesthesia specialists are in short supply [25-27]. Reticulus sheath catheters are superior to other methods for relieving pain after laparotomy, according to our study. As part of a multimodal analgesic strategy for laparotomy procedures, RSC should be considered because of its better pain management, opioid-sparing advantages, and increased patient satisfaction [28-31].

Conclusion

In patients undergoing laparotomy, this study showed that Rectus Sheath Catheter (RSC) gives better postoperative analgesia than Continuous Wound Infiltration (CWI). Reduced opiate intake, longer duration to initial rescue analgesia, higher satisfaction, and considerably lower pain scores were all observed in patients undergoing RSC. There was no discernible difference in the risk of complications between the two methods, and patients had no problems whatsoever. In order to alleviate postoperative pain in patients who have undergone laparotomy, our results suggest that RSC is a better regional analgesic method than CWI. Improved patient comfort and recovery outcomes can be achieved by the use of RSC in multimodal pain treatment techniques, thanks to its opioid-sparing properties and extended analgesia.

Funding

None

Conflict of Interest

None

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