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A Comparative Study of Duration of Analgesia with Ropivacaine Against Ropivacaine Plus Dexmedetomidine given by Subarachnoid Block in Patients who undergo Total Abdominal Hysterectomy.

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Abstract: ***Background:*** This comparative study aimed to evaluate the impact of adding dexmedetomidine as an adjuvant to 0.75% isobaric ropivacaine in subarachnoid blockfor patients undergoing total abdominal hysterectomy. ***Methods:*** Fifty female patients within the age range of 35-65 years, classified as ASA grades I and II, were included in this study. They were divided into two groups: Group A (Dexmedetomidine) and Group B (Control). Various parameters were assessed, including the duration of sensory and motor blockade, duration of analgesia, and hemodynamic parameters. ***Results:*** The addition of dexmedetomidine significantly prolonged the duration of sensory blockade (142.20±5.61vs.74.40±3.91minutes,p<0.001),motorblockade(233.80±4.15vs. 140.80 ± 5.53 minutes, $p < 0.001$), and analgesia (358.80 ± 7.26 vs. 179.60 ± 7.76 minutes, $p < 0.001$) compared to the control group. Hemodynamic parameters remained stable, and the incidence of side effects was low. ***Conclusion:*** The addition of dexmedetomidine to ropivacaine in subarachnoid block provides prolonged sensory and motor blockade, leading to extended postoperative analgesia, without compromising hemodynamic stability. This approach presents a promising option for pain management in patients undergoing total abdominal hysterectomy.

Keywords: Dexmedetomidine, ropivacaine, subarachnoid block, total abdominal hysterectomy, sensory blockade, motor blockade, analgesia, hemodynamic parameters, safety profile.

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INTRODUCTION

Total abdominal hysterectomy, one of the most commonly performed surgical procedures in gynecology, often requires effective postoperative analgesia for patient comfort and early mobilization. The development and refinement of regional anesthesia techniques, particularly subarachnoid block (SAB), have significantly improved postoperative pain managementinthesepatients[1].Ropivacaine,along-actinglocalanesthetic,iswidelyusedforSABduetoitsfavorable safety profile and effective sensory and motor blockade [2]. However, the quest for enhanced analgesic efficacy and duration has led to the investigation of adjuvants to local anesthetics in spinal anesthesia.

Dexmedetomidine, a highly selective α2-adrenoceptor agonist, has emerged as a promising adjunct due to its analgesic, sedative,andminimalrespiratorydepressantproperties[3].Whencombinedwithlocalanesthetics,dexmedetomidinehas been shown to prolong the duration of both sensory and motor blockade, thus extending the analgesic effects without significant side effects [4]. This introduction will explore the rationale and implications of combining ropivacaine with dexmedetomidine for SAB in patients undergoing total abdominal hysterectomy, examining the potential benefits and drawbacks through a comparative analysis.

The pharmacological properties of ropivacaine make it a suitable choice for SAB in major abdominal surgeries. Its lower lipid solubility compared to bupivacaine results in less motor blockade and a reduced risk of systemic toxicity [5]. This profileisparticularlyadvantageousinabdominalhysterectomieswherepostoperativeambulationiscrucial.However,the duration of analgesia with ropivacaine alone may be insufficient for extended postoperative pain relief, necessitating additional analgesic interventions [6].

Dexmedetomidine, when used as an adjuvant, has been reported to potentiate the effects of local anesthetics. The mechanism involves hyperpolarization of nerve cells and suppression of nociceptive neurotransmitters, which enhances analgesic efficacy and prolongs the duration of blockade [7]. Clinical studies have demonstrated that the addition of dexmedetomidine to ropivacaine in SAB significantly prolongs the duration of postoperative analgesia, reduces the need for rescue analgesics, and provides stable hemodynamics during surgery [8].

Despite these advantages, the use of dexmedetomidine is not without concerns. Issues such as hypotension, bradycardia, and sedation have been observed, although these effects are generally mild and well-managed with appropriate dosingand monitoring [9]. It is crucial to balance the benefits of prolonged analgesia with the potential risks, particularly in patients with specific comorbidities or those undergoing major surgeries like abdominal hysterectomy.

The objective of this comparative study is to systematically evaluate the duration of analgesia and the overall safety profile of ropivacaine alone versus ropivacaine combined with dexmedetomidine in patients undergoing total abdominal hysterectomy.Thisevaluationwillprovidevaluableinsightsintooptimizingpostoperativepainmanagementstrategiesin this patient population, potentially leading to improved patient outcomes and satisfaction.

AimsandObjectives:

Primary Objective: The primary objective of this study was to compare the duration of analgesia, sensory and motor blockade achieved when dexmedetomidine is used as an adjuvant to 0.75% isobaric ropivacaine (Group A) and when 0.75% isobaric ropivacaine is administered alone (Group B) in females undergoing total abdominal hysterectomy under regional anesthesia.

Secondary Objective: The secondary objective was to investigate the effects of adding dexmedetomidine to 0.75% isobaric ropivacaine on hemodynamic parameters, including heart rate (HR), mean arterial pressure (MAP), and oxygen saturation (SpO2).

MATERIALANDMETHODS:

This study was designed as a comparative, non-randomized study with two study groups: Group A and Group B. The study took place at the Department of Anaesthesiology, Cosmopolitan Hospital, a tertiary care center in Trivandrum. The study population included females aged 35-65 years undergoing total abdominal hysterectomy under regional anesthesia. Ethical committee clearance was obtained, and the study was conducted from June 2018 to June 2019.

Sample Size Calculation: The sample size was determined using the formula: $n = 2 / [(\sigma1^2 + \sigma2^2) / (\mu1 - \mu2)^2]$.With the assistance of a biostatistician, a sample size of 25 participants was determined for each group.

Sampling Strategy: Patients were selected based on specific inclusion and exclusion criteria. Inclusion criteria included females aged 35-65 years with ASA grade I or II. Exclusion criteria encompassed patients who did not provide consent, were allergic to local anesthetics, or had an ASA grade higher than II.

Procedure: Understrictasepticconditions,thefollowingprocedurewasfollowedforbothgroups:

1. Skininfiltration:2%lignocainewasinfiltratedatthesite.
2. Subarachnoidblock:A25GQuinkesspinalneedlewasusedtoadministertheblockattheL2-L3space.
    - GroupA:3.5mlofisobaric0.75%ropivacainewiththeadditionof10µgofdexmedetomidine.
    - GroupB:3.5mlofisobaric0.75%ropivacainewith0.5mlofnormalsaline.
3. Epidural catheter insertion: An epidural catheter was inserted at the L2-L3 space to provide rescue analgesia if needed.
4. Evaluation:Patientswereassessedfor:
    - Durationofanalgesia
    - Sideeffectsassociatedwithdexmedetomidine
    - Sensoryblockusingthepinprickmethod
    - MotorblockusingthemodifiedBromageScaleforlowerextremities
    - Hemodynamicparameters(HR,MAP,SpO2)atregularintervals.
5. Monitoring: Hemodynamic and respiratory monitoring was conducted every 5 minutes for the first 20 minutes, then every 10 minutes up to 60 minutes, and every 20 minutes up to 2 hours or the end of surgery.

6. Postoperative Period: Patients were observed in the postoperative critical care unit for 24 hours, and the time of request for rescue analgesia was recorded.

DataEntryandAnalysis: Data were entered into Microsoft Excel software and analyzed using SPSS version 16 for statistical analysis. The primary outcomes included the duration of analgesia, sensory and motor blockade, while the secondary outcomes involved changes in hemodynamic parameters. Any side effects or complications were also documented and analyzed.

This study aimed to provide valuable insights into the efficacy and safety of dexmedetomidine as an adjuvant to ropivacaine in regional anesthesia for total abdominal hysterectomy in female patients.

RESULTS:

This comparative study aimed to evaluate the duration of analgesia, sensory and motor blockade when using dexmedetomidine as an adjuvant to 0.75% isobaric ropivacaine in subarachnoid block compared to using 0.75% isobaric ropivacaine alone in patients undergoing total abdominal hysterectomy. Additionally, the study investigated the effectson hemodynamic parameters with the addition of dexmedetomidine.

PatientCharacteristics(Table1)

Atotalof50femalepatientsbelongingtoASAgradesIandII,agedbetween35-65years,wereevaluated.Therewereno significant differences in age, ASA grading, height, or weight between Group A (Dexmedetomidine) and Group B (Control).

BlockadeParameters(Table2)

The onset of sensory and motor blockade was similar between both groups, indicating homogeneity. However, the duration of sensory and motor blockades and analgesia was significantly prolonged in Group A compared to Group B, with p-values < 0.001, demonstrating the effectiveness of dexmedetomidine as an adjuvant.

HemodynamicParameters(Table3)

Hemodynamic parameters, including heart rate (HR), mean arterial blood pressure (MAP), SpO2, and respiratory rate, were monitored at various time intervals (baseline, 0 min, 5 min, 10 min, 15 min, 20 min, 30 min, 40 min, 60 min, 80 min, 100 min, 120 min). The comparison showed no statistically significant differences ($p > 0.05$) between Group A and Group B at any time point, suggesting that the addition of dexmedetomidine did not significantly affect hemodynamics during the study period.

IntraoperativeandPostoperativeComplications(Table4)

The incidence of side effects was low in both groups. In Group A (Dexmedetomidine), one patient experienced hypotension, and another patient experienced bradycardia. No episodes of nausea and vomiting, shivering, pruritis, respiratory depression, or urinary retention were observed in either group.

In summary, this study found that the addition of dexmedetomidine to 0.75% isobaric ropivacaine in subarachnoid block significantly prolonged the duration of sensory and motor blockades as well as analgesia without adversely affecting hemodynamic parameters. The incidence of side effects remained low in both groups, with no major complications observed. These findings suggest that dexmedetomidine can be a valuable adjuvant in regional anesthesia for patients undergoing total abdominal hysterectomy, potentially improving postoperative pain management.

Table1:ComparisonofPatientCharacteristics

Characteristics	GroupA(Dexmedetomidine)	GroupB(Control)	p-value
Age(Mean±SD)	56.7±5.5	57.9±4.8	0.430
ASAGradeI(%)	44.0%	60.0%	0.258
ASAGradeII(%)	56.0%	40.0%	
Height(Mean±SD)	160.72±2.03	161.48±1.96	0.185
Weight(Mean±SD)	57.60±4.98	57.68±3.44	0.948

Table2:ComparisonofOnsetandDurationofBlockade

BlockadeParameters	GroupA(Dexmedetomidine)	GroupB(Control)	p-value
OnsetofSensoryBlock(Mean±SD)	3.30±0.38	3.36±0.37	0.575
OnsetofMotorBlock(Mean±SD)	5.88±0.36	5.76±0.48	0.324
DurationofSensoryBlock(Mean± SD)	142.20±5.61	74.40±3.91	<0.001
DurationofMotorBlock(Mean± SD)	233.80±4.15	140.80±5.53	<0.001
DurationofAnalgesia(Mean± SD)	358.80±7.26	179.60±7.76	<0.001

Table3:ComparisonofHemodynamicParametersatDifferentTimePoints

HemodynamicParameters	Baseline	0min	5min	10min	15min	20min	30min	40min	60min	
HeartRate(GroupA)	69.68	71.52	69.04	67.52	65.92	64.56	63.36	63.44	64.32	6
HeartRate(GroupB)	70.80	72.80	70.32	68.24	66.48	65.04	63.28	62.40	64.88	6
MAP(GroupA)	73.56	75.12	71.68	69.60	68.20	66.80	64.88	64.32	64.08	6
MAP(GroupB)	74.28	76.24	74.00	69.44	70.08	68.00	66.16	65.36	64.48	6
SpO2(GroupAandB)	99.00	100.00	99.96	100.00	99.96	99.96	100.00	100.00	99.96	9
RespiratoryRate(GroupA)	11.36	11.56	11.16	10.96	11.24	11.16	11.32	11.24	11.20	1
RespiratoryRate(GroupB)	11.64	11.60	11.40	11.12	11.12	11.52	11.48	11.48	11.32	1

Table4:ComparisonofIntraoperativeandPostoperativeComplications

SideEffects	GroupA(Dexmedetomidine)	GroupB(Control)
Nausea&Vomiting	0	0
Shivering	0	0
Pruritis	0	0
RespiratoryDepression	0	0
UrinaryRetention	0	0
Hypotension	1	0
Bradycardia	1	0

DISCUSSION:

The present study investigated the impact of adding dexmedetomidine as an adjuvant to 0.75% isobaric ropivacaine in subarachnoidblockforpatientsundergoingtotalabdominalhysterectomy.Thestudyprimarilyfocusedontheduration of analgesia,sensoryandmotorblockade,aswellastheeffectsonhemodynamicparameters.Theresultsshowedsignificant differences in the duration of sensory and motor blockade and analgesia between the two groups, favoring the use of dexmedetomidine as an adjuvant. Additionally, the study demonstrated that the addition of dexmedetomidine did not significantly affect hemodynamic parameters during the study period.

The extended duration of sensory and motor blockade achieved with dexmedetomidine in our study is consistent with findings from previous research. This observation aligns with a study conducted by Marashi et al. [9], which reported similar results in patients undergoing spinal anesthesia. Their study found that dexmedetomidine as an adjuvant to ropivacaine significantly prolonged the duration of sensory and motor block compared to ropivacaine alone, with p-values < 0.05.

The notable extension of analgesia in the dexmedetomidine group is also in accordance with the findings of Das et al. [10]. In their investigation, they concluded that dexmedetomidine added to ropivacaine in brachial plexus blocks significantlyprolongedthedurationofpostoperativeanalgesiacomparedtoropivacainealone. Thedifferenceinduration was statistically significant ($p < 0.001$).

Moreover, the safety profile of dexmedetomidine observed in our study is consistent with that reported in the literature. The incidence of side effects, particularly hypotension and bradycardia, was low and manageable, which is consistent with the findings of Singh et al. [11]. They conducted a study in which they used dexmedetomidine as an adjuvant in epidural anesthesia and found that the incidence of hypotension and bradycardia was not significantly different from the control group. In our study, only one patient experienced hypotension and bradycardia in the dexmedetomidine group.

However, it is important to note that the results of our study contrast with those of some previous investigations. For instance, Sripriya et al. [12] reported no significant difference in the duration of sensory and motor blockade between dexmedetomidine and control groups in patients undergoing lower limb surgeries with subarachnoid block. This discrepancy in findings may be attributed to differences in patient populations, surgical procedures, or dosages of dexmedetomidine used in the studies.

In summary, our study suggests that the addition of dexmedetomidine to ropivacaine in subarachnoid block significantly prolongs sensory and motor blockades and enhances postoperative analgesia without adversely affecting hemodynamic parameters. These findings are in line with previous studies, emphasizing the potential clinical benefit of using dexmedetomidine as an adjuvant in regional anesthesia. However, further research is needed to explore the optimal dosage and safety profile of dexmedetomidine in various clinical scenarios.

CONCLUSION:

Inthiscomparativestudy,theadditionofdexmedetomidineasanadjuvantto0.75%isobaricropivacaineinsubarachnoid block for patients undergoing total abdominal hysterectomy demonstrated several noteworthy findings:

Prolonged Blockade Duration: Dexmedetomidine significantly prolonged the duration of sensory and motor blockade compared to ropivacaine alone. The duration of sensory blockade in the dexmedetomidine group was 142.20 ± 5.61 minutes, whereas in the control group, it was 74.40 ± 3.91 minutes ($p < 0.001$). Similarly, the duration of motor blockade in the dexmedetomidine group was 233.80 ± 4.15 minutes, compared to 140.80 ± 5.53 minutes in the control group ($p < 0.001$).

ExtendedAnalgesia:Theadditionofdexmedetomidinealsoresultedinasignificantlyprolongeddurationofanalgesia.In thedexmedetomidinegroup,thedurationofanalgesiawas358.80±7.26minutes,whileinthecontrolgroup,itwas 179.60±7.76minutes($p<0.001$).

Safe Hemodynamic Profile: Dexmedetomidine did not significantly affect hemodynamic parameters, including heart rate and mean arterial blood pressure, throughout the study period. Additionally, there was a low incidence of side effects, with only one patient in the dexmedetomidine group experiencing hypotension and bradycardia.

These findings suggest that the use of dexmedetomidine as an adjuvant to ropivacaine in subarachnoid block can provide prolonged sensory and motor blockade, leading to extended postoperative analgesia. Importantly, the addition of dexmedetomidine

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