Original Research Article

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Comparison of Postoperative Analgesic Effect of Ropivacaine Hydrochloride with Bupivacaine Hydrochloride in Transversus Abdominis Plane Block after Total Abdominal Hysterectomy

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Abstract

Background and Aims: Total abdominal hysterectomy (TAH) is one of the commonly performed major surgical procedures resulting in substantial postoperative pain and discomfort. Hence, the study was carried out to compare the postoperative analgesic effect of Ropivacaine hydrochloride with Bupivacaine hydrochloride in transversus abdominis plane (TAP) block after total abdominal hysterectomy (TAH). The primary objective was to compare the post operative analgesic duration and secondary objective was comparing the hemodynamic parameters, nausea and sedation score. *Methods:* The Prospective, double blind and randomized comparative trial was conducted in 60 ASA physical status I and II patients scheduled for elective total abdominal hysterectomy. Patients were randomly divided into two group R and group B and they were given TAP block by 'double pop off ' technique with Ropivacaine and Bupivacaine respectively. Heart rate, systolic and diastolic blood pressure, NRS NRS nausea and sedation score were measured. Data was analysed with Mann Whitney U Test and Chi square test. *Results:* Haemodynamic variables like heart rate, systolic and diastolic blood pressure does not show significant difference with p value > 0.05. Time for rescue analgesia was significantly higher in patients with group B when compared with group R with p value of < 0.001. Nausea and Sedation score also remains normal without any significant changes with p value > 0.05. *Conclusion:* Bupivacaine hydrochloride gave longer duration of postoperative analgesia compared with Ropivacaine hydrochloride and there is no significant differences in hemodynamic variables, nausea and sedation score.

Keywords: Ropivacaine; Bupivacaine; Transversus Plane Block; Total Abdominal Hysterectomy.

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Introduction

Total abdominal hysterectomy (TAH) is one of the commonly performed major surgical procedures resulting in substantial postoperative pain and discomfort. The abdominal wall sensory afferents course through the transversus abdominis (neuro fascial) plane superficial to the transversus abdominis muscle. Drugs administered through epidural catheter have been used for postoperative pain relief in TAH. Behar and his colleagues published the first report on the epidural use of morphine for the treatment of pain in 1979 [1]. Use of epidural opioids for postoperative pain relief has the disadvantage of hemodynamic instability, motor blockade and respiratory depression [2].

Alternative approaches to control postoperative pain like TAP block have been tried in recent years [3]. These simple but often overlooked blocks can offer several advantages like excellent postoperative

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analgesia, decrease opioid requirements, allow patients to breathe and cough more comfortably. They also facilitate early mobilization and discharge, significantly improving the patient's quality of life postoperatively [4].

TAP block involves deposition of local anesthetic agent into the fascial plane superficial to the transversus abdominis muscle with achieving a block from T7 to L1 blocking anterior intercostal nerve T7 to T11, subcostal nerve, ilioinguinal nerve, iliohypogastric nerve. Hence the block was found to be suitable for use in midline laparotomy surgeries like TAH [4,5]. Ropivacaine HCl [4] and Bupivacaine HCl [5] are amide group of local anesthetics and ropivacaine was introduced into clinical anesthesia as an alternative to bupivacaine because of latter's association with cardiac toxicity.

Though the usage of both ropivacaine HCl and bupivacaine HCl in TAP block has been studied separately for postoperative analgesia, till now no literature compared the effect of above two local anesthetics in TAH. Hence, this study was carried out to compare the postoperative analgesic effect of ropivacaine hydrochloride with bupivacaine hydrochloride in TAP block after TAH.

Material and Methods

This Prospective, double blind and randomized comparative trial was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from patients. 60 ASA physical status I and II patients scheduled for elective total abdominal hysterectomy were enrolled for the study.

Inclusion Criteria

Patients of ASA status I and II

Patients posted for elective total abdominal hysterectomy.

Exclusion Criteria

1. Pre-existing coagulation disorders.
2. Morbid obesity
3. Local infection at the site of block
4. Allergy to Ropivacaine HCl or Bupivacaine HCl.

After a thorough pre-operative evaluation, patients were randomly divided into two groups,

Group R: TAP block with Ropivacaine HCl.

Group B: TAP block with Bupivacaine HCl.

The allocation sequence was generated by a random number table and group allocation was concealed in sealed opaque envelope. The patient, the anesthesiologist administering the block and the one involved in postoperative observation of the patient were blinded to the drug being administered. All the patients received standardized general anesthesia as per the institute protocols. Standard monitoring includes non-invasive blood pressure monitoring, oxygen saturation, electrocardiogram and end tidal carbon dioxide. Baseline parameters (heart rate, systolic and diastolic blood pressure, SpO_2) were recorded. After premedication with inj. Midazolam 1 mg, anesthesia was induced with Propofol 2mg/kg and inj. Fentanyl 2 µg/kg. Neuromuscular blockade was achieved with inj. Vecuronium 0.1 mg/kg and trachea was intubated using appropriate sized cuffed endotracheal tube. Anesthesia was maintained with Isoflurane as inhalational agent and intermittent boluses of inj. Vecuronium. Intraoperative analgesia was provided with inj. Fentanyl 0.5 µg/kg repeated every hourly. Intravenous Paracetamol 1 gm was given 30 minutes prior to the reversal of neuromuscular blockade. The TAP block was performed bilaterally after conclusion of surgery using 'double pop off ' technique. The Triangle of Petit was identified above the pelvic rim in the midaxillary line. The puncture site was just above the iliac crest and just posterior to the midaxillary line within the triangle of petit. A needle was inserted perpendicular to the skin and a give or pop to the skin is felt when the needle passes through the fascial extensions of the internal oblique muscle. Further advancement with the second pop indicates that the needle has advanced into the fascial plane above transversus abdominis muscle. After aspiration, the test drug was injected bilaterally. Patients in group B received 0.8 ml/kg body weight of 0.25% Bupivacaine HCl divided equally on each side (total dose less than 2mg/kg) and group R received 0.8 ml/kg body weight of 0.25% Ropivacaine HCl divided equally on each side (total dose less than 2 mg/kg). After performing the block, trachea was extubated after administering neuromuscular block reversal and the patients were shifted to PACU. All the patients received inj. Paracetamol 1 gm every 6 hours. Pain intensity was assessed by the numerical rating scale (NRS: 0, no pain; 10, worst pain imaginable) at arrival in the recovery room (time 0) and 1, 2, 3, 6, 12 and 24 hours post operatively. Every assessment of NRS was performed by a blinded interviewer, and pain was scored under two

conditions: at rest (NRSr) and at movement knee flexion (NRSm).

Nausea was measured using a categorical scoring system (none = 0; mild = 1; moderate = 2; severe = 3). Sedation scores was assigned by the investigator using University of Michigan Sedation Scale (UMSS)

0- Awake and Alert

1- Minimally sedated: tired/sleepy, appropriate response to verbal conversation and/or sound,

2- Moderately sedated: somnolent/sleeping, easily aroused with light tactile stimulation or a simple verbal command

3- Deeply sedated: deep sleep, arousable only with significant physical stimulation,

4- Unarousable.

Primary outcome was the time for first rescue analgesia. Secondary outcome was the postoperative pain at rest and movement (knee flexion) as evaluated by Numeral Rating Scale (NRS), variation in hemodynamics in relation to HR, SBP and DBP, postoperative nausea and sedation score. Rescue analgesia with Inj. Tramadol 1mg/kg was given when the NRS score is > 4. The patient was deemed to have nauseated or sedated if they had a nausea or sedation score>0. Antiemetics in the form of Ondansetron 4 mg was given if patient has nausea score > 0. Pulse, blood pressure were recorded at each study interval. Any complications in terms of local anesthetic toxicity were also noted. The result was analysed with SPSS16. A p value < 0.05 was considered significant. Duration of analgesia was analysed by Student´s T test. NRS scores, with paired comparisons at each time interval, was performed using the T test or Mann Whitney U test, as appropriate. Categorical test was assessed using Chi square or Fischer´s exact test.

Results

After obtaining approval from institutional ethics committee, 60 ASA physical status I and II patients who were posted for elective total abdominal hysterectomy were selected and randomly divided into two groups B and R. both the groups were comparable according to age and weight (Table 1 and 2) On comparing the postoperative analgesic duration, patients in group B showed mean analgesic duration of 4.52 hours with maximum duration of 8.15 hours and minimum duration of 3.45 hours while patients in R group showed mean analgesic duration of 3.2 hours with maximum and minimum duration of 6 hours and 2.3 hours respectively and their differences are statistically significant with P value of 0.001 as shown in TABLE 3. On comparing the numeral rating scale at rest (Figure 1) and movement (Figure 2), there was no significant difference noted in both the groups at 1st, 2nd, 3rd and 6th hours with p value of > 0.05. Comparison

Table 1: Comparison of age in both groups

Age Groups	Broup B		Group R		Pvalue
	Frequency	%	Frequency	%	
21-30yrs	2	6.7%	2	6.7%	0.381
31-40yrs	15	50.0%	9	30.0%	
41-50yrs	12	40.0%	16	53.3%	
>50yrs	1	3.3%	3	10.0%	
Total	30	100%	30	100%	
Mean±SD	40.93±6.34		43.60±7.38		0.139

Table 2: Comparison of weight in Both Groups

Weight(kg)	Mean ± SD	P Value
GroupB	59.63±7.61	0.839
GroupR	59.27±6.26	

Table 3: Postoperative analgesic duration

	GroupB Mean±SD	GroupR Mean±SD	P value
Duration(Hrs)	4.52±1.74	3.20±0.87	0.001

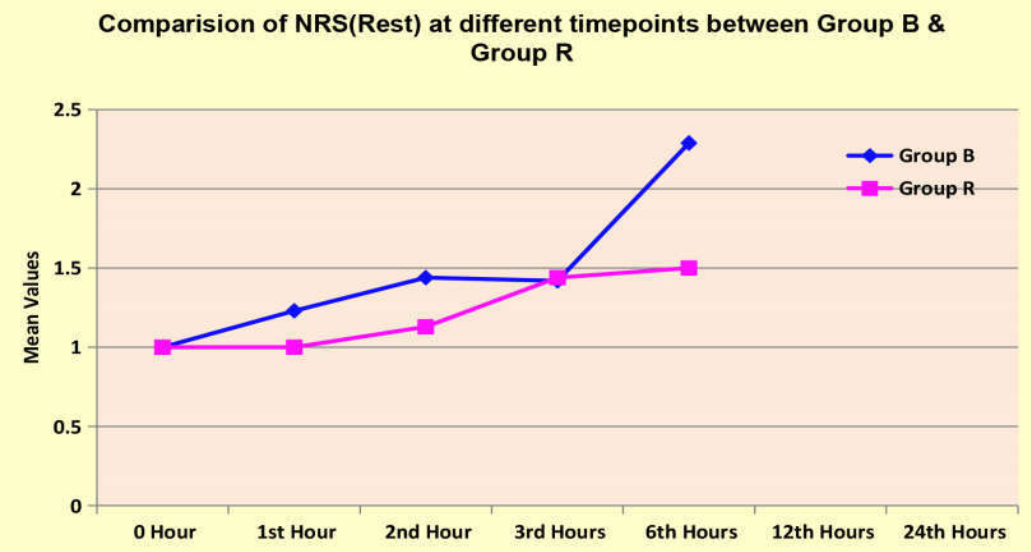
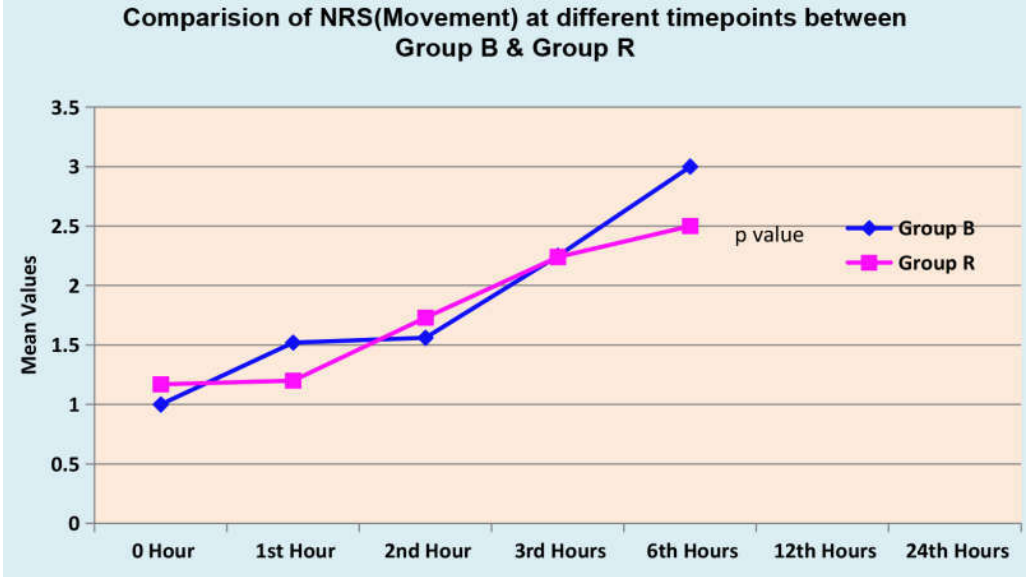


Fig. 1:



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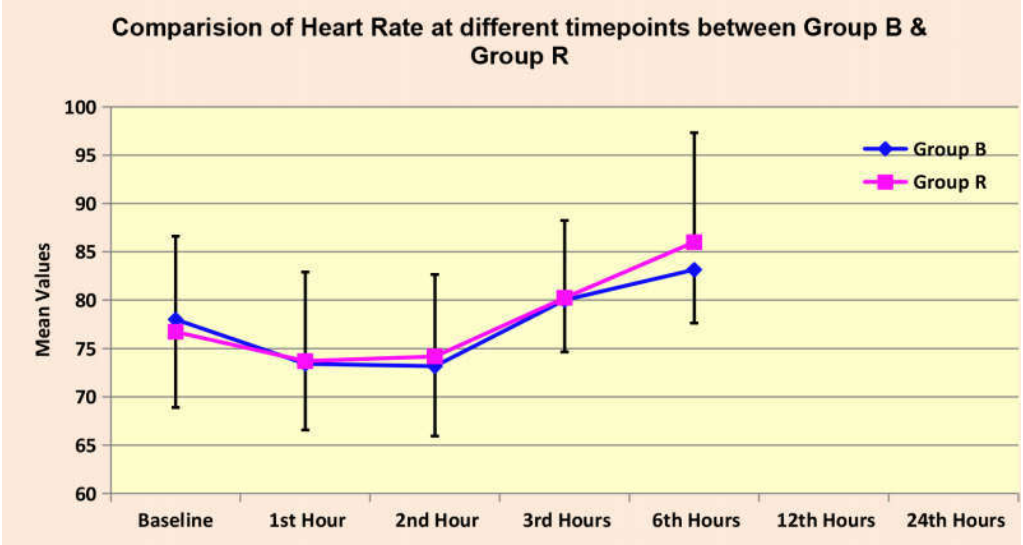
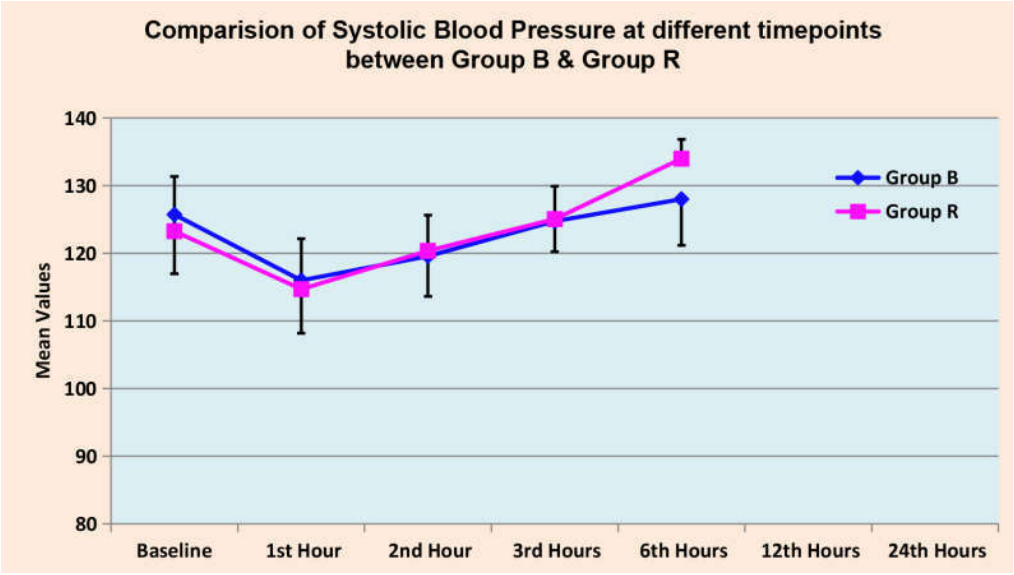


Fig. 3:



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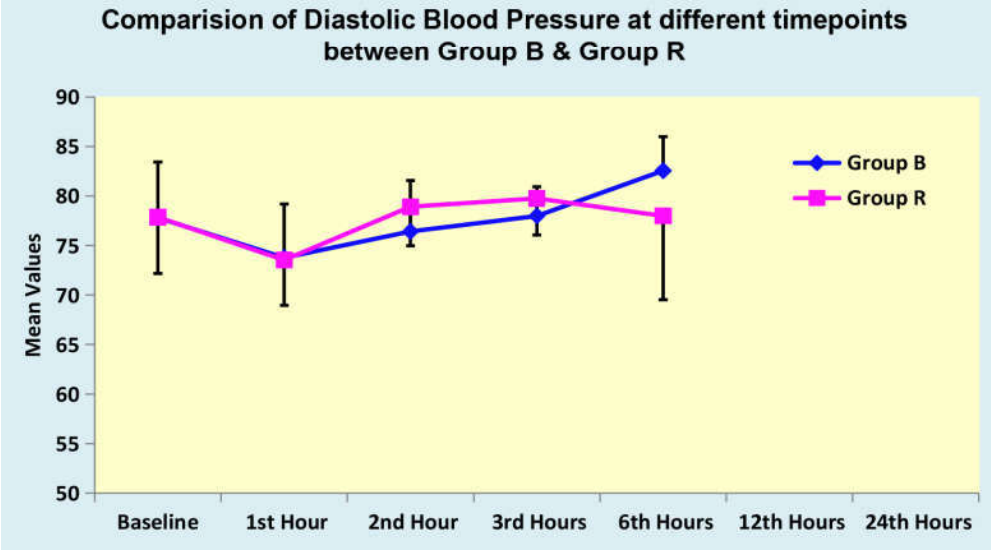

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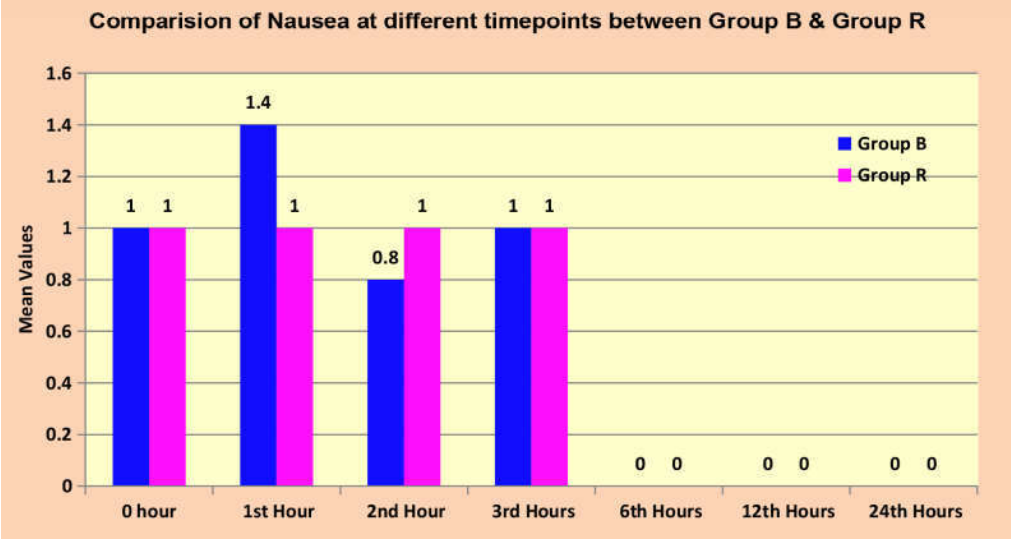

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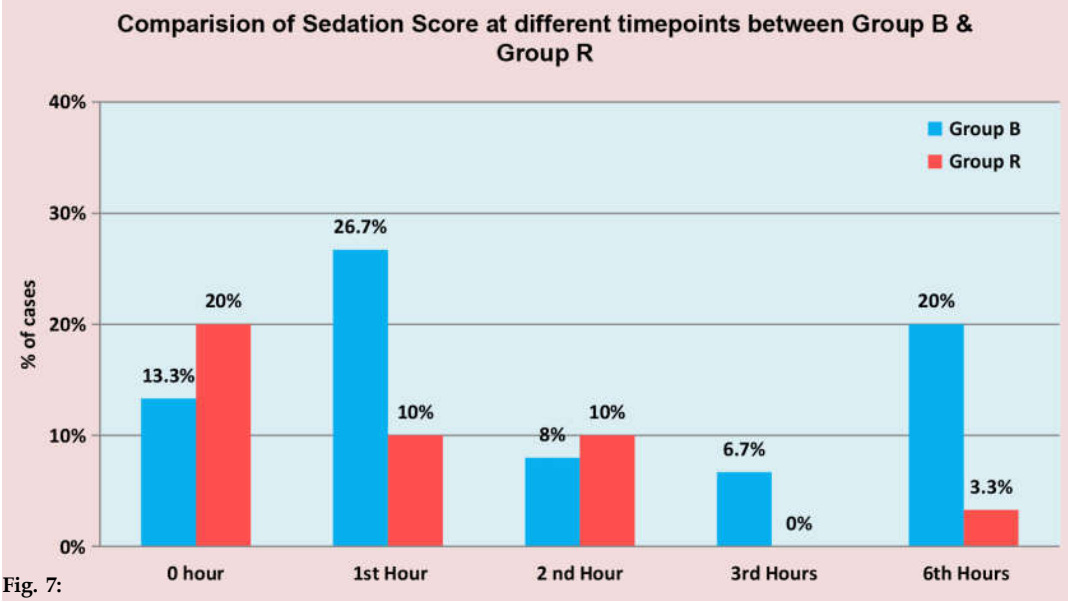

Fig. 7:

of heart rate, systolic blood pressure, diastolic blood pressure, nausea score and sedation score has been shown in Figure 3,4,5,6,7 respectively.

Discussion

Management of postoperative pain relieve suffering and leads to earlier mobilization, shortened hospital stay, reduced hospital costs, and increased patient satisfaction. Pain control regimens should not be standardized; rather, they should be tailored to the needs of the individual patient, taking into account medical, psychological, and physical condition; age; level of fear or anxiety; surgical procedure; personal preference; and response to agents given. The major goal in the management of postoperative pain is minimizing the dose of medications to lessen side effects while still providing adequate analgesia. Various analgesic modalities have been tried for total abdominal hysterectomy like administering narcotics [1] nonsteroidal anti-inflammatory drugs [6] local anesthetics injected through epidural catheter [7] patient controlled anesthesia with opioids and blocks of anterior abdominal wall like transversus abdominis plane block [3,4,5].

Anti-inflammatory agents [5] (nonsteroidal anti-inflammatory agents) can reduce inflammatory response to tissue injury, thus indirectly decreasing pain receptor activation however it has its own side effects like bleeding, gastric ulcers. Postoperative pain therapy has traditionally used a single-agent narcotic to bind Mu-binding sites in the central nervous system such as in the posterior amygdala, hypothalamus, thalamus, caudate nucleus, putamen, and certain cortical areas. Analgesic effectiveness of several opioids administered via PCA has been evaluated. Morphine and Pethidine administered via PCA for postoperative pain have been shown to provide effective analgesia. However opioids has some disadvantages like respiratory depression [2] hemodynamic instability. Local anesthetic via epidural [7] has been shown to be effective in pain relief and may offer an advantage in improved gastrointestinal motility compared with opioid-based analgesia. However epidural anesthetic fails to control abdominal hysterectomy pain because the postoperative pain impulses are transmitted in multiple pathways of which not all are effectively blocked by epidural anesthesia. Hence current practice is moving toward an approach that uses multiple agents acting at various sites of the pain. This approach synergizes different pain medications, augmenting pain control properties and reducing potential adverse effects. In our study, in patients undergoing total abdominal hysterectomy, multimodal analgesia isgiven to block nociceptive pain transmission from skin incision and abdominal and pelvic viscera. Somatic pain from abdominal wall incision was proposed to be taken care by TAP block and visceral pain was relieved with inj. Paracetamol given 6 hourly. Transversus Abdominis Plane Block has been demonstrated to provide excellent analgesia to the skin and musculature of the anterior abdominal wall in patients undergoing colonic resection

surgery [8] involving a midline abdominal wall incision, patients undergoing cesarean delivery [9] and patients undergoing radical prostatectomy [10]. There are two methods of localizing the transversus abdominis plane with a needle: the 'double pop off' technique and the USG technique. In the double-pop technique, an anatomical area called the Triangle of Petit [3] is located by palpation. This triangle lies adjacent to the iliac crest in the flank. A needle introduced perpendicular to the skin, into the triangle will provide a sensation of 'pops' or alterations in resistance as it passes through the layers of tissue, and by deduction the needle tip will be appropriately sited in the correct plane. Local anesthetics is then injected via the needle in this plane [4,5]. Theusefulness of TAP block has been well established when used as a part of multimodalanalgesia in total abdominal hysterectomy. Bupivacaine HCl and Ropivacaine HCl, both amide group of local anesthetics produce anesthesia by inhibiting excitation of nerve endings or by blocking conduction in peripheral nerves.

Various drugs like bupivacaine [5] ropivacaine [4] levobupivacaine [11] have been used during TAP block. In current clinical practice there is a need for local anesthetics whose action is long lasting and which present low systemic uptake to minimize any toxic side effects. Intoxication with local anesthetics may induce cardiac arrhythmias by interaction with ion channels Ropivacaine is an amide local anaesthetic agent and first produced as a pure enantiomer and has been introduced into clinical anesthesia as a safer alternative to bupivacaine, which is associated with a relatively high risk of cardiac arrhythmias. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced motor blockade. Thus, ropivacaine has a greater degree of motor sensory differentiation, which could be useful when motor blockade is undesirable. Though ropivacaine was found to have faster onset of action, it has major disadvantage of having shorter duration of action. The reduced lipophilicity is also associated with decreased potential for central nervous system toxicity and cardiotoxicity [12].

Hence it may be a preferred option because of its reduced central nervous system and cardiotoxic potential and its lower propensity for motor block. In our study, the mean duration of analgesia with ropivacaine was 3.2 hours with maximum duration of 6 hours and minimum duration of 2.3 hours while in bupivacaine group, mean duration of analgesia was 4.52 hours with maximum duration of 8.15 hours and minimum duration of 3.45 hours. The difference is statistically significant. Cuvillon et al. [13] compared the efficacy of bupivacaine and ropivacaine in femoral and sciatic nerve blocks and they concluded that ropivacaine tends to have a quicker onset time than bupivacaine (by 2 to 15 minutes), but bupivacaine exerts a longer duration of anaesthesia (approximately 4 hours).

Junca et al,[14] compared the effectiveness of cervical plexus block for carotid surgery using bupivacaine or ropivacaine. Despite the administration of a larger dose of the ropivacaine (150 mg of bupivacaine vs 225 mg of ropivacaine), the duration of analgesia provided by the cervical plexus block was longer for bupivacaine than for ropivacaine as evaluated by visual analogue scale which was higher in ropivacaine group at 2nd and 3rd hours.

Petterrson et al. [15] compared 100 milligrams of bupivacaine and 300 milligrams of ropivacaine for local infiltration after inguinal hernia repair and they suggested that no statistically significant differences noted in both the groups with respect to pain scores and consumption of supplementary analgesics. The patients in ropivacaine group had faster motor recovery as suggested by early ability to walk with little or no problems compared to the patients who received bupivacaine.

Griffin RP et al. [16] compared 0.5% bupivacaine and 0.5% ropivacaine for epidural anesthesia in caesarean section patients and they concluded that sensory blockade was comparable but motor blockade was weaker with ropivacaine as suggested by more rapid recovery of leg mobility. Though there are studies which advocate that there is less of motor blockade with ropivacaine as compared to bupivacaine, this carries little significance in our study where single shot of local anesthetics was given. Bupivacaine in some cases causes fall in arterial blood pressure, cardiac index, ventricular systolic work index mainly and no important changes in vascular resistances as explained by Udelsmann A et al. [17].

In our study, there was no significant difference in systolic and diastolic pressure after administering TAP block. Sivapurapu et al. [18] in 2013 has compared the incidence of postoperative nausea and vomiting based on total requirements of opioids in postoperative period in patients who received TAP block, since we did not administer any opioids in the postoperative period, there is no increase in the incidence of postoperative nausea and vomiting in both the groups and the patients are not sedated in both the groups.

Hence from our study it was found that both the drugs were effective for TAP block and bupivacaine showed long duration of postoperative analgesia with mean duration of 4.52 hours as compared to ropivacaine which showed mean duration of 3.2 hours with no adverse effects in relation to hemodynamic variables like heart rate, SBP, DBP, nausea and sedation score noted in both the groups.

Conclusion

Bupivacaine hydrochloride provides statistically significant longer duration of postoperative analgesia compared with ropivacaine hydrochloride and there is no Significant differeces in hemodynamic variables (HR, SBP, DBP), nausea and sedation score. There are no adverse effects noted with respect to drugs or procedure.

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