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COMPARATIVE ASSESSMENT OF THE EFFICACY OF DEXAMETHASONE ALONE TO PERINEURAL DEXAMETHASONE WITH ROPIVACAINE IN PROVIDING POSTOPERATIVE ANALGESIA DURING ELECTIVE THORACOTOMY

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ABSTRACT

Background: Thoracotomy surgeries are usually painful where improper pain management can lead to complications including respiratory failure, atelectasis, and pneumonia. Also, the chronic post-thoracotomy pain (CPTP), seen in 30-50% of subjects following thoracotomy can persist for months which can lower their quality of life to a wide extent. As limited duration analgesia is provided by a single dose of local anaesthetics, adjuvants are usually used to achieve long-duration analgesia in peripheral nerve blocks.

Aim: The present study was conducted to assess the efficacy of dexamethasone alone to perineural dexamethasone with ropivacaine in providing postoperative analgesia in TPVB (Thoracic paravertebral block) during elective thoracotomy.

Materials and Methods: In 105 subjects undergoing thoracotomy were randomly assigned into three groups having 35 subjects each were Group I was treated with saline, Group II with ropivacaine 0.5%, and Group III combination of 5mg dexamethasone and 0.5 percent ropivacaine). The parameters assessed in the three Groups were chronic discomfort, recuperation time, and postoperative analgesia.

Results: duration for PACU stay was 126.68±74.94, 86.56±30.32, and 82.41±30.05 mins for Group I, II, and III respectively which was statistically significant for Group I and II, and Group II and III with respective p-values of 0.006 and 0.005, whereas, it was non-significant between Group I and III (0.783). The awakening time for the I, II, and III group was 68.50±71.33, 45.40±28.78, and 35.22±19.28 mins respectively where it was statistically significant between Group II and III with p=0.02, and non-significant between Group I and II and I and III with p-values of 0.093 and 0.465. Mean postoperative hospital stay in Group I, II, and III subjects was 16.63±12.44, 10.86±3.17, and 11.64±3.42 respectively which was statistically non-significant with p1, p2, and p3 values of 0.746. VAS was statistically non-significant at 12, 48, and 72 hours with p-values of 0.912, 0.683, and 0.533 respectively, whereas, VAS was statistically significant on the intergroup comparison at day 24 was <0.0001

Conclusion: The present study concludes that using opioid-based anesthetic protocol using perineural dexamethasone with ropivacaine in Thoracic paravertebral block has added advantages of decreased incidence of chronic pain, less recovery time, and better analgesia quality after thoracotomy.

Keywords: Chronic pain, dexamethasone, perineural dexamethasone, nerve block, ropivacaine thoracotomy

INTRODUCTION

Thoracotomy surgeries are usually painful where improper pain management can lead to complications including respiratory failure, atelectasis, and pneumonia. Also, the chronic post-thoracotomy pain (CPTP), seen in 30-50% of subjects following thoracotomy can persist for months which can lower their quality of life to a wide extent.[1] Incorporation of multimodal and preventive measures for managing postoperative pain following thoracotomy has resulted in less pain postoperatively.[2] Hence, adequate pain management in the perioperative interval can help to reduce the incidence and risk of postoperative pain. The most common analgesic method for thoracotomy is TEA (thoracic epidural analgesia). However, it is associated with side effects like coagulopathy.[3]

To overcome these disadvantages and limitations, TPVB (thoracic paravertebral block) is used as an alternative to TEA which provides adequate analgesia and lesser side effects compared to TEA in subjects undergoing thoracotomy.[4] TPVB also has the advantages of better respiratory parameters, fewer hemodynamic complications, and lesser neurologic complications. Also, previous literature data reports that TPVB reduces neuropathically mediated chronic pain following breast surgery which is equivalent to chronic post-thoracotomy pain.[5,6]

The mechanism that reduces chronic post-thoracotomy pain with TPVB is not clear. As limited duration analgesia is provided by a single dose of local anesthetics, adjuvants are usually used to achieve long-duration analgesia in peripheral nerve blocks.[7] Dexamethasone used with ropivacaine as a local anesthetic agent in TPVB effectively reduces acute pain and has lesser side-effects during initial post-surgery duration and also, decreases the chronic post-thoracotomy pain incidence.[8]

Hence, the present study was conducted to assess the efficacy of dexamethasone alone to perineural dexamethasone with ropivacaine in providing postoperative analgesia in TPVB (Thoracic paravertebral block) during elective thoracotomy

MATERIALS AND METHODS

The present prospective randomized clinical study was conducted to assess the efficacy of dexamethasone alone to perineural dexamethasone with ropivacaine in providing postoperative analgesia in TPVB (Thoracic paravertebral block) during elective thoracotomy. The study was conducted at after obtaining clearance from the concerned Ethical committee. The study population was comprised of subjects undergoing thoracotomy at the Institute. The study included 105 subjects from both genders within the age range of 18-75 years and the mean age of 41.46±4.24 years.

The inclusion criteria for the study were subjects undergoing thoracotomy, within the age of 18-75 years, ASA status of I or II, and the subjects who were willing to participate in the study. The exclusion criteria were subjects having local puncture site infection, peptic ulcer,

previous thoracotomy, severe chronic obstructive pulmonary disease, central and peripheral neuropathies, heart disease, coagulopathy, pre-operative chronic opioid medication, and allergy to local anesthetics.

Included 105 study subjects were randomly divided into three groups of 35 subjects each who were randomly assigned into three groups having 35 subjects each were Group I was treated with saline, Group II with ropivacaine 0.5%, and Group III combination of 5mg dexamethasone and 0.5 percent ropivacaine). The parameters assessed in the three Groups were chronic discomfort, recuperation time, and postoperative analgesia. After explaining the detailed study design. Informed consent was taken from all the subjects in both written and verbal form.

For anesthesia induction, a classical TPVB block was given using the classical technique where the parasagittal out-plane approach was used which was guided by ultrasound. After skin preparation, the aseptic and sterile method was used to administer anesthesia. In paravertebral gaps, saline or local anesthesia was given at T5-T6, T4-T5, and T3-T4 vertebrae. Based on ultrasonography, a southward movement of pleura was seen.

All subjects were kept nil orally for a minimum of 6 hours before surgery. On entry to operation theatre parameters assessed at baseline were mean arterial blood pressure, diastolic and systolic blood pressure, and pulse rate. Spo2 was also taken into consideration. Intravenous access was established in all the subjects using a cannula under aseptic conditions. In the supine position, a subarachnoid block was given and the parameters were assessed.

Mean arterial blood pressure, diastolic and systolic blood pressure, and pulse rate was assessed at 5, 10, 30-, 60-, 90-, and 120-minutes following anesthesia. 6mg Mephenteramine inj was given when meaning arterial pressure fall was below 20% compared to baseline values. The pulse rate of fewer than 60 beats was administered with 0.3-0.6 mg i.v atropine.

The primary outcome for the study was PCA (patient-controlled anesthesia. Other outcomes assessed were phenylephrine consumption during anesthesia, fluid volume (colloid and crystalloid solutions), sufentanil use, one-lung ventilation, and surgery duration, hemodynamic changes including blood pressure and heart rate assessed at baseline, 5 minutes after induction and paravertebral block, 10 minutes after skin incision and lung ventilation, 1 hour following lung-ventilation, 10 mins after the end of lung ventilation, end of the surgery, transfer to postanesthesia care unit (PACU), on awakening, extubation, and transfer from a post-anesthesia care unit. Awakening time, stay duration, and extubation time in the post-anesthesia care unit was also assessed along with recovery time, pruritis, and postoperative nausea and vomiting were assessed. Postoperative complications assessed were CPTP, cost, hospital stay, and duration of post-operative activity

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

RESULTS

The present prospective randomized clinical study was conducted to assess the efficacy of dexamethasone alone to perineural dexamethasone with ropivacaine in providing

postoperative analgesia in TPVB (Thoracic paravertebral block) during elective thoracotomy. The study included 105 subjects from both genders within the age range of 18-75 years and the mean age of 41.46±4.24 years. The demographic characteristics of the study subjects are listed in Table 1. The mean age of study subjects in Group I, II, and III were 66.02±6.47, 61.98±7.92, and 61.45±7.24 years respectively with p=0.064 which was statistically non-significant. There were 88.57% (n=31), 65.71% (n=23), and 85.71% (n=30) males in the present study. The ASAI status was seen in 34.28% (n=12) subjects in group I and 37.14% (n=13) subjects from both Group II and III. Surgical site for thoracotomy was lung in 8.57% (n=3), 28.57% (n=10), and 88.57% (n=31) subjects from Group I, II, and III respectively, whereas, the site was oesophagus in 91.52% (n=32), 71.42% (n=25), and 11.42% (n=4) study subjects respectively from Group I, II, and III (Table 1). All parameters had statistically non-significant differences at baseline with respective p-values of 0.942, 0.754, 0.124, and 0.694 for weight, mean BMI, mean arterial pressure, and heart rate respectively.

On assessing the intraoperative parameters in the study subjects, it was seen that duration for PACU stay was 126.68±74.94, 86.56±30.32, and 82.41±30.05 mins for Group I, II, and III respectively which was statistically significant for Group I and II, and Group II and III with respective p-values of 0.006 and 0.005, whereas, it was non-significant between Group I and III (0.783). The awakening time for the I, II, and III group was 68.50±71.33, 45.40±28.78, and 35.22±19.28 mins respectively where it was statistically significant between Group II and III with p=0.02, and non-significant between Group I and II and I and III with p-values of 0.093 and 0.465. Also, sufentanil consumption had a statistically significant difference between Group I and II with p=0.01 whereas for Group II and III and Group I and Group III was 0.197 and 0.266 respectively. Extubation time, phenylephrine consumption, crystalloid and colloid consumption, lung ventilation duration, and surgery duration differed statistically non-significant in three groups (Table 2).

Concerning the postoperative parameters in the study subjects, mean postoperative hospital stay in Group I, II, and III subjects were 16.63±12.44, 10.86±3.17, and 11.64±3.42 respectively which was statistically non-significant with p1, p2, and p3 values of 0.746. First out of bed activity in Group I, II, and III study subjects were at 4.55±2.29, 3.31±1.26, and 3.17±1.05 days which was non-significant with p1, p2, and p3 of 0.763. The mean sum of pressing numbers was 32.93±22.13, 23.86±17.07, and 19.36±15.04 for Group I, II, and III study subjects which were non-significant with p=0.415. VAS was statistically non-significant at 12, 48, and 72 hours with p-values of 0.912, 0.683, and 0.533 respectively, whereas, VAS was statistically significant on the intergroup comparison at day 24 was <0.0001 (Table 3).

The present study also assessed the incidence of PONV and chronic postoperative pain. The study results showed that PONV scores 0 were seen in all the subjects of all three groups. Chronic postoperative pain was seen in 48.57% (n=17) subjects from Group I, 28.57% (n=10) subjects from Group II, and 20% (n=7) subjects of Group III. This difference was statistically significant between Group I and II with p=0.01, and non-significant between Group II and III with p=-.165 and in Group I and III with p=0.05 as depicted in Table 4.

DISCUSSION

The study results showed that the intraoperative parameters in the study subjects, it was seen that duration for PACU stay was 126.68±74.94, 86.56±30.32, and 82.41±30.05 mins for

Group I, II, and III respectively which was statistically significant for Group I and II, and Group II and III with respective p-values of 0.006 and 0.005, whereas, it was non-significant between Group I and III (0.783). The awakening time for the I, II, and III group was 68.50±71.33, 45.40±28.78, and 35.22±19.28 mins respectively where it was statistically significant between Group II and III with p=0.02, and non-significant between Group I and II and I and III with p-values of 0.093 and 0.465. Also, sufentanil consumption had a statistically significant difference between Group I and II with p=0.01 whereas for Group II and III and Group I and Group III was 0.197 and 0.266 respectively. Extubation time, phenylephrine consumption, crystalloid and colloid consumption, lung ventilation duration, and surgery duration differed statistically non-significant in the three groups. These results were consistent with the studies of Kairaluoma PM et al[9] in 2006 and Lin X et al[10] in 2014 where authors have reported comparable intraoperative parameters to the present study.

For the postoperative parameters in the study subjects, mean postoperative hospital stay in Group I, II, and III subjects were 16.63±12.44, 10.86±3.17, and 11.64±3.42 respectively which was statistically non-significant with p1, p2, and p3 values of 0.746. First out of bed activity in Group I, II, and III study subjects were at 4.55±2.29, 3.31±1.26, and 3.17±1.05 days which was non-significant with p1, p2, and p3 of 0.763. The mean sum of pressing numbers was 32.93±22.13, 23.86±17.07, and 19.36±15.04 for Group I, II, and III study subjects which were non-significant with p=0.415. VAS was statistically non-significant at 12, 48, and 72 hours with p-values of 0.912, 0.683, and 0.533 respectively, whereas, VAS was statistically significant on the intergroup comparison at day 24 was <0.0001. These results were in agreement with the studies of Geng W et al[11] in 2015 and Mihara R et al[12] in 2011 where authors have reported similar postoperative parameters as shown by the authors in their studies.

The present study also assessed the incidence of PONV and chronic postoperative pain. The study results showed that PONV scores 0 were seen in all the subjects of all three groups. Chronic postoperative pain was seen in 48.57% (n=17) subjects from Group I, 28.57% (n=10) subjects from Group II, and 20% (n=7) subjects of Group III. This difference was statistically significant between Group I and II with p=0.01, and non-significant between Group II and III with p=-.165 and in Group I and III with p=0.05. These results were comparable to the studies of Wang K et al[13] in 2017 and Sengupta S[14] in 2016 where authors have reported comparable incidence of PONV and postoperative chronic pain as in the present study.

CONCLUSION

Within its limitations, the present study concludes that using opioid-based anesthetic protocol using perineural dexamethasone with ropivacaine in Thoracic paravertebral block has added advantages of decreased incidence of chronic pain, less recovery time, and better analgesia quality after thoracotomy. This also results in fewer complications, less dose, effective pain control, less postoperative chronic pain, and better healing. However, the present study had a few limitations including a small sample size, short monitoring time, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

Characteristics	Group I (n=35)	Group II (n=35)	Group III (n=35)	p-value
Age (years)	66.02±6.47	61.98±7.92	61.45±7.24	0.064
Gender % (n)				
Males	88.57 (31)	65.71 (23)	85.71 (30)	
Females	11.42 (4)	34.28 (12)	14.28 (5)	
Weight (kg)	59.93±11.86	59.56±9.68	60.78±8.57	0.942
ASA status				
I	34.28 (12)	37.14 (13)	37.14 (13)	
II	65.71 (23)	62.85 (22)	62.85 (22)	
BMI (kg/m^2)	21.21±3.27	21.81±3.33	21.79±2.26	0.754
Mean arterial pressure	94.02±14.85	95.98±9.94	102.26±15.64	0.124
Heart rate	74.46±10.81	72.31±9.27	75.31±15.82	0.694
Surgical site				
Lung	8.57 (3)	28.57 (10)	88.57 (31)	
Esophagus	91.42 (32)	71.42 (25)	11.42 (4)	

Table 1: Demographic characteristics of the study subjects

Variables	Group I (n=35)	Group II (n=35)	Group III (n=35)	p-value[1] I-II	p-value[2] II-III	p-value[3] I-III
PACU duration (mins)	126.68±74.94	86.56±30.32	82.41±30.05	0.006*	0.005*	0.783
Extubation time (mins)	51.64±43.14	35.81±18.53	36.02±19.86	0.069	0.06	0.987
Awakening time (mins)	68.50±71.33	45.40±28.78	35.22±19.28	0.093	0.02*	0.465
Phenylephrine consumption (µg)	68.68±101.43	46.94±87.15	22.84±27.07	0.353	0.04	0.319
Sufentanil consumption (µg)	57.15±12.44	49.56±10.44	53.08±7.69	0.01*	0.197	0.266
Crystalloid consumption (ml)	1391.28±393.04	1314.56±467.55	1576.17±607.40	0.594	0.217	0.082
Colloid consumption (ml)	421.72±328.87	520.81±312.07	576.17±277.34	0.272	0.103	0.547
Lung ventilation duration (mins)	96.50±66.07	108.02±73.92	95.93±65.26	0.564	0.976	0.556
Surgery duration (mins)	160.94±62.54	169.77±78.88	156.69±69.95	0.667	0.841	0.536

Table 2: Intraoperative variables in the three groups of study subjects

Parameters	Group I (n=35)	Group II (n=35)	Group III (n=35)	p-value[1] I-II	p-value[2] II-III	p-value[3] I-III
Postoperative hospital stay (days)	16.63±12.44	10.86±3.17	11.64±3.42	0.746	0.746	0.746
First out of bed activity (days)	4.55±2.29	3.31±1.26	3.17±1.05	0.763	0.763	0.763
Pressing numbers sum (day 3)	32.93±22.13	23.86±17.07	19.36±15.04	0.415	0.415	0.415
VAS (hours)						
6	0.94±1.17	0.56±0.81	0.22±0.42	0.194	0.191	0.196
12	1.07±0.88	0.48±0.64	0.46±0.58	0.912	0.912	0.912

24	1.72±1.04	1.73±1.06	0.83±0.42	<0.0001	<0.0001	<0.0001
48	2.02±1.07	1.44±1.16	1.31±0.64	0.683	0.683	0.683
72	2.02±1.43	1.27±0.93	1.12±0.65	0.533	0.533	0.533

Table 3: Intraoperative parameters in the three groups of study subjects

PONV	**Group I (n=35)**	**Group II (n=35)**	**Group III (n=35)**	**p-value[1] I-II**	**p-value[2] II-III**	**p-value[3] I-III**
0	100 (35)	100 (35)	100 (35)	0.323		
1	0	0	0			
2	0	0	0			
3	0	0	5			
Chronic pain	48.57 (17)	28.57 (10)	20 (7)	0.01*	0.165	0.05

Table 4: Incidence of PONV and chronic postoperative pain 72 hours after surgery