**ORIGINAL ARTICLE**

# The effect of bilateral superficial cervical block in the prevention of post operative pain, nausea and vomiting in patients undergoing thyroidectomy – a randomised controlled study

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**ABSTRACT**

***Background:***

*Thyroidectomy is a commonly performed surgical procedure in the department of Surgical Endocrinology. It is associated with a significant incidence of post operative pain and nausea & vomiting (PONV). Opioid analgesic use in the intra operative and post operative period is one of the causes for PONV, which is one of the most common and distressing symptom in our experience.*

*Bilateral superficial cervical plexus block has been used in thyroidectomy for its analgesic effects and many studies show reduced pain and opioid requirement in these patients. However, it is unclear if this translates into a decrease in the incidence of PONV as all previous studies have routinely used opioid analgesics in the post operative period*

***Objectives:***

*We prospectively recruited 100 patients who underwent thyroidectomy (hemi, completion, total thyroidectomy) without neck dissection. The patients were randomised to receive either bilateral superficial cervical plexus block (Intervention group n = 50) using 20 ml of 0.25% bupivacaine (10 ml on each side) or no block (no intervention, n = 50), after introduction of general anaesthesia. The post operative pain and PONV scores were assessed for all the patients during the first 48 hours after surgery and it was compared between the two groups.*

***Methods:***

*The study was a randomised controlled trial between cervical plexus block and no intervention. Patients undergoing thyroidectomy with no lateral neck dissection were enrolled. A total of 100 patients were enrolled in the study with 50 in each arm. The end points studied were pain scores and PONV scores in the two groups. These patients were followed up in the ward for the next 48 hours with pain scores and PONV scores.*

***Results:***

*The demographic and clinical characteristics were similar in both the groups. The pain and PONV scores in both groups showed a decline with time. However, there was no statistically significant difference between the two groups. Bilateral superficial cervical plexus block before thyroidectomy did not significantly decrease the post operative pain scores or the incidence of post operative nausea and vomiting. From our study results, we do not recommend its routine use in thyroid surgery for prevention of pain or post operative nausea and vomiting.*

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## INTRODUCTION

Thyroidectomy is the most commonly performed surgical procedure in the unit of Surgical Endocrinology. It is associated with a significant incidence of post operative pain (mild to moderate pain for up to 48 hours)[1] and nausea & vomiting (PONV), up to 32% in some reports[2]. The cause of post operative nausea and vomiting in post thyroidectomy patients is multi factorial and includes pain, side effects of drugs used and stimulation of the trachea during the operation. Opioid analgesic use in the intra operative and post operative period is one of the important causes for PONV. PONV is a very unpleasant and distressing symptom for both the patients and the treating surgeon. It often decreases the patient satisfaction and also delays the recovery and increases the discharge time.

Intra and post-operative opioid requirements can be minimised by use of multi-modal analgesic techniques using local anaesthetic infiltration, regional blocks with long acting local anaesthetics where possible and the use of NSAIDs and paracetamol along with general anaesthesia. This reduces opioid requirements thereby reducing PONV.

Bilateral superficial cervical plexus block has been used in thyroidectomy for its analgesic effects and studies have consistently shown reduced opioid requirements. However, not all studies have shown improved pain relief. Additionally, it is unclear if this translates into a decrease in the incidence of PONV as most previous studies have routinely used opioid analgesics in the post operative period.

Bilateral superficial cervical plexus block is a simple, feasible and popular regional technique with minimal procedure related complications[3]. It is commonly used in surgical procedures in the neck like thyroidectomy and carotid end arterectomy. It blocks the C2-4 nerve roots thereby provides anaesthesia on the anterior aspect of the neck (C2, 3, 4 dermatomes). It has been proven that it reduces the intra operative opioid as well as the post operative opioid requirements. With the reduction in the opioid dose, there is a potential reduction in the incidence of PONV. The goal of the study was to compare the pain and PONV scores between patients given bilateral superficial cervical plexus block and those who were not.

A review of five studies that used cervical plexus block for thyroid surgery revealed the following results:

| | **Aunac et al[4]** | **Alsaif et al[5]** | **Herbland et al[6]** | **Dieudonne et al[7]** | **Andrieu et al[8]** |
|---|---|---|---|---|---|
| Drug used | Ropivocaine | Bupivocaine | Ropivocaine | Bupivocaine | Ropivocaine |
| Placebo | Saline | Saline | No intervention | Saline | Saline |
| Timing of block | Under GA | Under GA | Under GA | Under GA | Under GA |
| Before/After Operation | Before | Both | Before or After | After | Before |
| Technique | Superficial & deep block | Not mentioned | 2 point technique | 3 point technique | 3 point technique |
| No. of Patients | 87 | 45 | 111 | 90 | 39 |
| Type of Study | Double Blind RCT | Double Blind RCT | Double Blind RCT | Double Blind RCT | Double Blind RCT |
| Pain score | 0 - 10 VAS | 0 - 10 VAS | 0 - 10 NRS | NRS-11 & VRS-4 | 0 - 10 VAS |
| Opioid Requirements | Reduced | Reduced | No Change | Reduced | Reduced |
| Post Op pain scores | Lower | Lower | No Change | Lower | No difference |
| PONV Score | Not mentioned | NA | Yes/No | Not mentioned | Not mentioned |
| PONV | No change | Not assessed | Reduced (Not significant) | Not significant | Not significant |
| Type of Operation | Total thyroidectomy | Total & Hemi thyroidectomy | Total thyroidectomy | Total & Hemi thyroidectomy | Total & Hemi thyroidectomy |

**METHODS:**

After getting approval from the ethics and institutional review board, a total of 100 patients were enrolled in the study with 50 patients in each arm. Patients fulfilling the eligibility criteria were approached and explained about the trial. Informed consent was taken from all the patients enrolled in the study. Once consent was given, they were randomised into either intervention or no intervention. A computer generated code was used for randomization of patients into two groups with blocks of varying sizes. The patients and the outcome assessor were both blinded.

The inclusion criteria included all adult patients undergoing hemi, total and completion thyroidectomy. Exclusion criteria included all patients undergoing lateral neck dissection, other additional surgical procedures that fell outside the C2-4 dermatomes and those with contraindications to the drugs used in the study - diclofenac or bupivacaine.

Previously randomized proformas were sent to the OR with the patient. The proforma was placed in a sequentially numbered, sealed, opaque envelope which indicated the allocation. The senior operating surgeon or the anaesthetist administered the block if indicated after induction of general anaesthesia. The envelope is subsequently discarded. The anaesthetist adheres to the study protocol for administration of anaesthesia. The operation was then carried out by the surgical team.

The standard general anaesthetic technique was used as per our standardised protocol. All patients were premedicated with diazepam (0.2 mg/kg and 10 mg of metoclopramide 60 to 90 minutes before surgery. In the operating room, after placement of routine monitors (ECG, non-invasive blood pressure and pulse oximetry) a 16 or 18 gauge iv cannula was inserted and anaesthesia was induced with intravenous fentanyl (2μg/kg), thiopentone (5mg/kg) and vecuronium (0.1 mg/kg). The trachea was intubated with an appropriate size cuffed endotracheal tube. Anaesthesia was maintained with air, oxygen, isoflurane (0.9 – 1 MAC). Further muscle relaxant was administered as needed. After positioning the patient for surgery bilateral superficial cervical plexus block was performed on those patients randomised to the intervention arm. Intra operatively, fentanyl was given for analgesia as a 0.5 to 1 μg/kg bolus if the heart rate or blood pressure went above 20% from the baseline. All patients were given ondansetron 8mg 30 minutes before skin closure. Neuromuscular blockade was reversed with 0.5 μg/kg of neostigmine and 10 μg/kg of glycopyrolate. Trachea was extubated when the extubation criteria were met.

The technique of superficial cervical plexus block used was as follows. Bupivacaine, 20 ml of 0.25 % strength was used. The midpoint of the sternocleidomastoid was marked. The superficial cervical plexus was blocked at the midpoint of the posterior border of the sternocleidomastoid muscle. A skin wheal was made at this point, and a 22-gauge, 4-cm needle was advanced, injecting 10 ml of solution along the posterior border and medial surface of the sternocleidomastoid muscle. A further 10 ml was injected on the opposite side. The skin mark was removed at the end of the procedure to maintain blinding. The block was usually performed by the senior surgeon on the team.

The post operative care protocol was followed by the nursing staff and the doctors. Post operatively, all patients were given IV diclofenac 50 mg Q8H and paracetamol 4 gm per day in four divided doses for pain relief. All patients were also given ondansetron 8 mg Q8H. Those patients who continued to have PONV were given metoclopramide and dexamethasone. Break through pain was treated with subcutaneous morphine (0.1 mg/kg). Once they were able to take orally, medication was converted to the oral route. This was typically by the evening of surgery or the next morning.

Patients were seen in the ward at twelve hourly intervals for 48 hours by the investigator. Their pain and PONV scores were recorded. Pain scores were calculated based on a visual analogue scale of 1 to 10. PONV scores were based on the following scale:

0 = No nausea

1 = Mild nausea not requiring treatment

2 = Nausea requiring treatment

3 = Retching and/or vomiting

Pain and PONV scores were marked on the proforma by the principal investigator who remained unaware of the allocation. The data that was collected was then transferred to a spread

sheet programme and analysed at the end of the study.

**RESULTS**

Of the total of 100 patients, 50 were in the intervention group and 50 were in the control group.

**Table 1: Comparison of the two groups**

| | | Intervention | No intervention |
|---|---|---|---|
| **Mean age (years)** | | 41 | 37.5 |
| **Gender** | Male | 13 | 9 |
| | Female | 37 | 41 |
| **Type of operation** | Hemi thyroidectomy | 3 | 5 |
| | Completion thyroidectomy | 6 | 3 |
| | Total thyroidectomy | 41 | 42 |
| **Anaesthesia time (minutes)** | | 180.19 | 178.79 |
| **Pathology** | Thyroiditis | 3 | 4 |
| | Benign nodular hyperplasia | 24 | 23 |
| | Malignant | 23 | 23 |
| **Weight(grams)** | | 46 | 47 |

**Pain scores**

**Graph 1:**

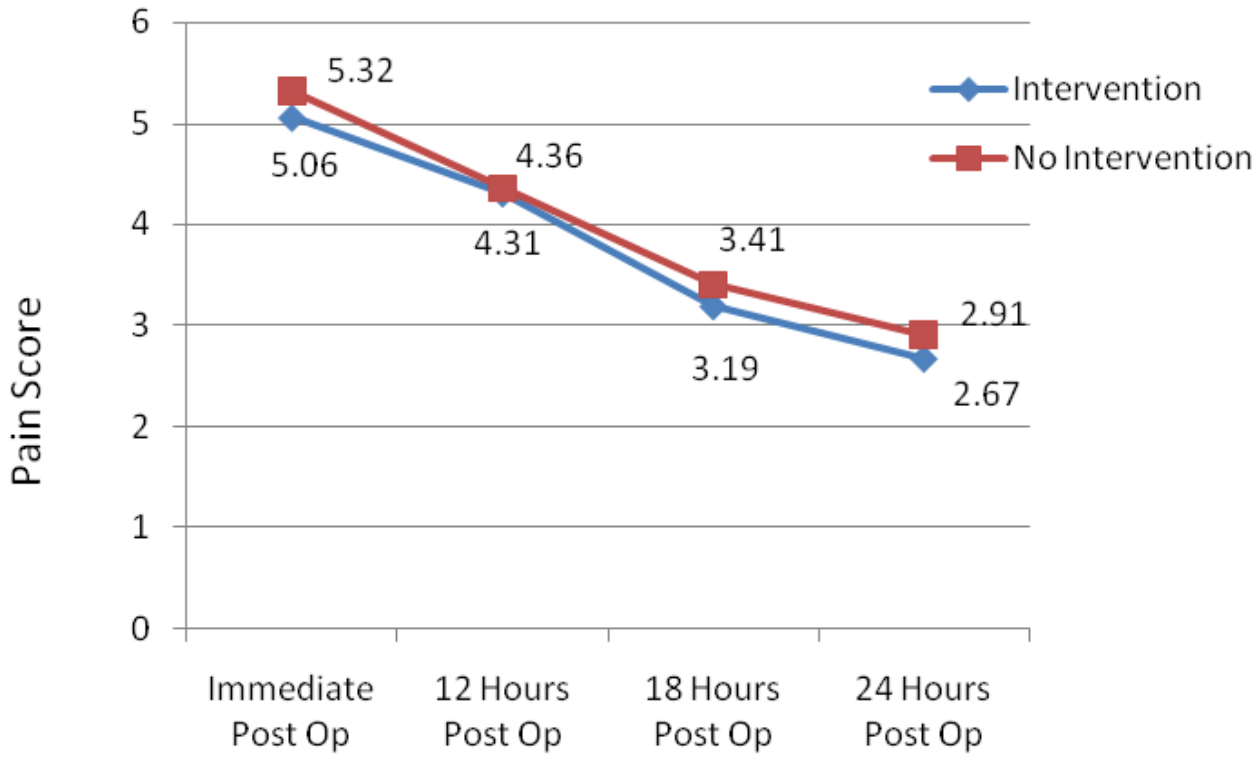


**Table 2:**

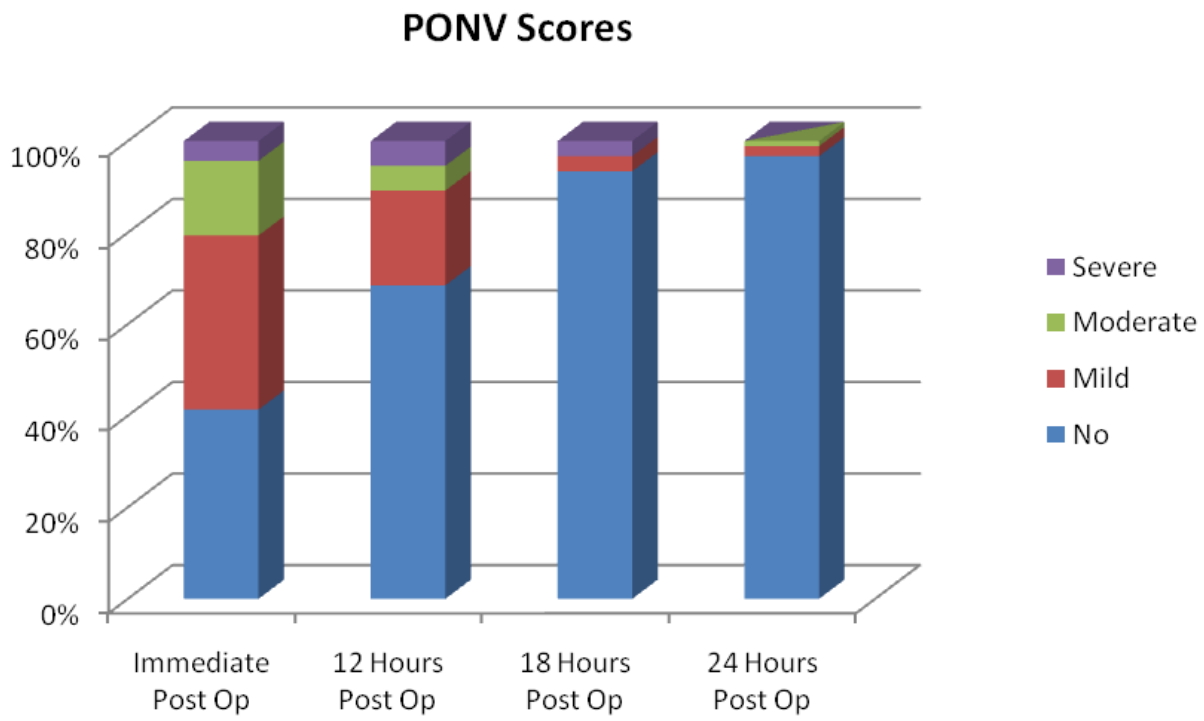
| | Group | Mean Pain Score | Std. Deviation | Std. Error Mean | P value |
|---|---|---|---|---|---|
| Immediate Post Op | Intervention | 5.06 | 1.827 | .264 | 0.661 |
| | No Intervention | 5.32 | 2.009 | .303 | |
| 12 Hours Post Op | Intervention | 4.31 | 1.881 | .272 | 0.831 |
| | No Intervention | 4.36 | 1.793 | .270 | |
| 18 Hours Post Op | Intervention | 3.19 | 1.179 | .170 | 1.965 |
| | No Intervention | 3.41 | 1.499 | .226 | |
| 24 Hours Post Op | Intervention | 2.67 | .975 | .141 | 0.114 |
| | No Intervention | 2.91 | 1.074 | .162 | |

**PONV Scores**

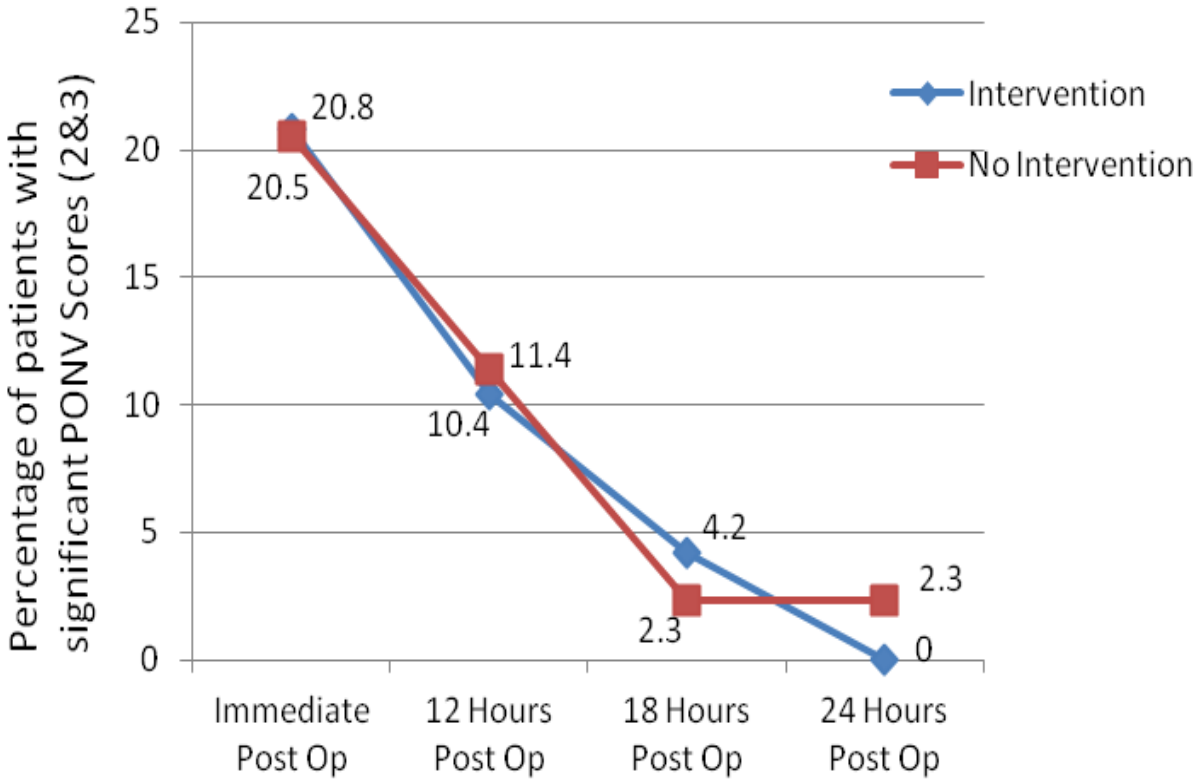
**Table 3: Overall PONV Scores**

| PONV Scores | Immediate Post Op | 12 Hours Post Op | 18 Hours Post Op | 24 Hours Post Op |
|---|---|---|---|---|
| No | 41.3% | 68.5% | 93.5% | 96.7% |
| Mild | 38% | 20.7% | 3.3% | 2.2% |
| Moderate | 16.3% | 5.4% | 0% | 1.1% |
| Severe | 4.3% | 5.4% | 3.3% | 0% |
| Total | 100% | 100% | 100% | 100% |

**Graph 2:**



**Graph 6: Patients with significant PONV scores**




**RESULTS AND DISCUSSION**

Table 1 describes the clinical characteristics of patients comparing both groups. The majority of the patients were female. There was near equal distribution of male and female patients in both the arms. Most of the patients in this series underwent total thyroidectomy with relatively few undergoing hemi thyroidectomy or completion thyroidectomy. Being a referral centre, we get a higher percentage of thyroid malignancies (46%). The three types of operations were divided equally between the two arms of the study. The final histopathological diagnoses in these patients were also compared and the spectrum of thyroid diseases in these groups was found to be similar. The other variables such as age of the patient, weight of the gland and operating times were also comparable between the two groups. There was a wide range in the sizes of the resected specimens. However, this was distributed evenly across the two groups with no significant difference (*p value 0.941*). The difference in operation time was also similarly not significant (*p value 0.355*). Thus, the demographic and clinical characteristics were similar in both the groups.

The pain scores in the two groups were plotted on a graph (Graph 2). Only 92 of the 100 patients had adequately recorded pain and PONV scores and so, the data from the remaining 8 were excluded from this analysis. In both groups, there was a gradual decline in the pain scores with time. The actual scores were similar in both the groups (Table 4). No significant difference in the pain scores was found in between the two groups. A 't' test was performed which confirmed this observation. In the immediate post operative period, the difference in the pain scores between the two groups was 5.06 in the intervention group versus 5.32 in the control group. The difference was not statistically significant with a p value of 0.661. At 12 hours, the p value was 0.831. Beyond this time period, the local anaesthetic is unlikely to influence the pain scores as it would have been metabolised by this time. This finding has been noted in other studies too in which opioid requirements were reduced in the patients who got the block even though the formal pain scores were not significantly different[7]. The opioid sparing effect of nerve blocks is a well known phenomenon. This may be because all post operative care protocols have provisions for rescue pain medication. However, this rescue

medication which is often an opioid analgesic may not be requested by the patients getting the block as their level of comfort is adequate. Patients generally request for and get additional analgesics when their pain tolerance is breached as a result of which extremes of scores are not seen in the VAS. Thus, it is possible to get similar pain scores in the two groups even with reduced analgesic use in the bupivacaine group. The analgesic efficacy might have been improved with larger bupivacaine doses, but this must be balanced against the risk from the injection of such doses in a highly vascularised area like the neck. It is unlikely that postoperative administration of local anesthetics would have been more effective than preoperative administration. Although studies have suggested that the timing of administration of analgesic drugs could influence their efficacy by reducing the sensitization of the nervous system induced by the nociceptive inputs, this concept of pre-emptive analgesia is debated in both clinical and basic science research [13].

The PONV scores were also assessed at the same times as the pain scores. The scoring system is based on similar ones used in the other studies examined. A few studies had only looked at a "yes" or "no" type of questionnaire for PONV but this was not found to be satisfactory for evaluation of PONV by those authors[7]. While scoring systems for predicting the risk of PONV are available - such as the Apfel scoring system[9], there was a paucity of scoring systems for assessing the degree of PONV. For this study, we went by the other studies using the scale from 0-3 to assess the severity of PONV[1].

The combination of superficial and deep cervical plexus blocks might have provided lower pain scores and analgesic requirements. Such a combination allows surgery in the anterolateral cervical area and has been used for thyroid surgery[10,11]. However, bilateral deep cervical plexus blocks can produce a highly dangerous bilateral diaphragmatic dysfunction due to phrenic nerve palsy. This complication - if it occurs - necessitates post operative ventilation till the local anaesthetic wears off and the diaphragmatic palsy recovers. Further, some studies have shown better results with superficial cervical plexus block alone[12]. In view of the potential risks, we considered this procedure unsafe for postoperative pain relief.

The overall PONV scores showed maximum incidence of PONV in the immediate post operative period with gradual decrease and plateau by 18 hours post op (Table 3). In the immediate post operative period, the number of patients experiencing no or mild nausea was almost identical. Most patients with a PONV score of 1 did not volunteer the information about their nausea unless they were specifically asked for. So by taking significant PONV as scores 2 and 3, the graph was redrawn to better understand the differences in these groups. The total number of patients in these two groups falls at around 20% in the immediate post operative period with decline over time. This number is lower than the 32% incidence found earlier during the chart review. Fewer patients suffered from moderate nausea in the intervention group. The number of patients with severe retching and vomiting was too small to make reliable conclusions. There were only four patients in this group and although the intervention group had a higher percentage of vomiting, statistically, the PONV scores were not significant to make any conclusions *(p value 0.437)*.

The later measurements at 12 and 18 hours showed an increase in the number of patients with a score of 0 in the PONV scale. With time, the number of patients with significant nausea reduced and by 18 hours, there was not much noticeable difference between the two groups (*p value 0.763)*. This is probably due to the fact that local anaesthetics have relatively short durations of action. Further the effects of the anaesthetic agents would also have worn off by this time. A chi square test was performed to analyse the data from the two groups. The difference was not statistically significant.

In conclusion, there was an overall non-significant trend toward decrease in the post operative pain scores and PONV scores when using the superficial cervical block. We were able to achieve a reduction of significant PONV from 32% in historical unit data to 20% in this study. As a reult patients who undergo thyroidectomy in our unit do not get routine opioid analgesics but are managed with paracetamol and NSAIDs alone with opioid analgesics used only for rescue analgesia. Cervical plexus block is not used routinely but selectively at the discretion of the surgeon and anaesthetist.

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