Bilateral Superficial Cervical Plexus Block in Thyroid Surgery with Intravenous versus Local Infiltration of Dexamethasone – A Randomized Single Blinded Comparative Study

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Background: Post-operative pain for thyroid surgeries under general anaesthesia is inadequately managed. Bilateral superficial cervical plexus block (BSCPB) for thyroid surgery causes adequate analgesia without any significant side effects. Dexamethasone is commonly used in anaesthesia to prevent postoperative nausea and vomiting (PONV). The study objective was comparison of efficacy between add-on Dexamethasone intravenously and Ropivacaine alone in bilateral superficial cervical plexus block versus Dexamethasone added with Ropivacaine in the same block in producing post-operative analgesia and in preventing post-operative nausea vomiting.

Methods: Randomized single-blind clinical study was done on eighty patients of 18-60 years of either sex, ASA I and II, scheduled for elective thyroid surgery under general anaesthesia. Patients were divided into two groups (n=40). In bilateral superficial cervical plexus block, Group DB (n=40) had received 20 ml Inj. Ropivacaine (0.25%) and 2ml (8 mg) Inj. Dexamethasone and Group DI (n=40) had received 20ml Inj. Ropivacaine (0.25%) and 2 ml of distilled water, along with 2 ml IV distilled water in DB group and Inj. Dexamethasone 2ml (8 mg) IV in DI group. Time of rescue analgesia with VAS (Visual Analogue Scale) score of that moment and incidence of PONV were noted up to 24 hrs post-operatively.

Results: No statistically significant difference was found among the two groups in respect of time of rescue analgesia, VAS score and incidence of PONV.

Conclusion: From our study, we conclude that different routes of administration of Inj. Dexamethasone during BSCPB has no extra benefit in respect of postoperative analgesia and incidence of PONV in thyroid surgery.

Keywords: Superficial Cervical Plexus Block, Thyroid surgery, Dexamethasone

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Introduction

Thyroid surgery causes incisional pain, discomfort in swallowing, burning sensation in the throat, nausea and vomiting due to general anaesthesia, especially within 24 hours of the operation. Post-operative pain for thyroid surgeries under general anaesthesia is inadequately managed. [1,2] Bilateral Superficial Cervical Plexus Block (BSCPB) is associated

with decreased opioid and intra-operative analgesic requirement,[3,4] lesser complications like post-operative nausea and vomiting, postoperative pulmonary complications and hospital stay.

Compared to blocking both the deep and superficial cervical plexus, it is easier to block only the superficial plexus bilaterally, which is also superior to local infiltration in terms of analgesic quality.[5] It is cost-effective and supports the principle of multimodal analgesia.

Postoperative nausea and vomiting (PONV) are a common complication after thyroidectomy and incidence is approximately 63-84% if no prophylactic antiemetic is administered.[6,7] The volatile anaesthetics, Nitrous oxide, and opioids increase the incidence of PONV.

Dexamethasone (glucocorticoid) maintains homeostasis during severe stress and exerts anti-inflammatory and immunosuppressive effects, maintains post-operative analgesia via peripherally inhibiting phospholipase enzyme that is necessary for the inflammatory chain reaction along both the cyclooxygenase and lipoxygenase pathways.[8] It is also used in the treatment of post-intubation laryngeal oedema. Intravenous Dexamethasone as an adjunct to local anaesthetic improves block duration, analgesia and postoperative pain control.[9] The present study was conducted to compare perineural and intravenous dexamethasone on the block characteristics of ropivacaine in terms of effect on the duration of postoperative analgesia (Primary outcome). Other outcome measures were to compare the effect on the incidence of PONV.

Methods

This prospective, randomized, single-blind, comparative clinical study was conducted in the Bankura Sammilani Medical College and Hospital from March 2019 to August 2020 after receiving approval from the Institutional Ethical Committee and the West Bengal University of Health Sciences. After explaining in the vernacular language, it was made sure that all the patients had given consent in written format to participate in the study. Inclusion criteria comprised age between 18 to 60 years, The American Society of Anaesthesiologists (ASA) physical status class of I & II and scheduled for elective thyroidectomy. The patient with a history of known drug allergy or contraindication to the use of study drugs, history of congestive heart failure, labile hypertension, diabetes mellitus, and peptic ulcer was excluded. Patients not willing to participate in the study were not recruited. Patients were educated about the Visual Analogue Scale in the preoperative visit so that they could describe the severity of their pain after surgery as no-pain (0) to worst pain imaginable.[10]

For sample size calculation we have used the methods and formula as mentioned in the article of *Das S, et al.*[10] used for $n = [(Z_\alpha + Z_\beta)^2 \times 2S^2] / d^2$

As per previous study by *Elbahrawy K, et al.*[11] the variance (S) in the amount of rescue analgesia in the group receiving intravenous dexamethasone (event of interest) was identified to be 0.61 and the minimum clinically important difference (d) was assumed to be 0.4 mg/kg. Allowing an alpha error of 5% and setting the power of the study at 80%, the sample size for each group (n) was calculated to be 36. Anticipating the possibility of dropout (assumed 10%), we recruited 40 patients in each group.

There was total 80 sealed opaque envelopes each containing a paper slip printed as ‘DB’ or ‘DI’. After the patient was anaesthetised and intubated, an envelope was randomly picked up by the attending nurse on request and opened the envelope. The alphabet thus found helped to indicate about group allocation. The paper slip was discarded each time after use. Thus, the DB group received 20 ml inj. Ropivacaine 0.25% with inj. Dexamethasone 2 ml [8mg] perineurally for the BSCPB and 2 ml distilled water intravenously. Similarly, the DI group received

20 ml inj. Ropivacaine 0.25%- and 2-ml distilled water perineurally for the BSCPB and 2 ml [8mg] inj. Dexamethasone intravenously. Pharmacist who was not otherwise involved in the study, prepared the set of two solutions for perineural and intravenous injections. The volumes for either group was similar and thus remained identical. The anaesthesiologist who administered the local anaesthetic solution was not aware whether or not the dexamethasone was added to the solution or not. All the participants completed the study, and there were no lost to follow up cases. Patients were prescribed tab. Alprazolam (0.5 mg) PO to be taken at bedtime on the day before surgery and tab. Pantoprazole PO in the early morning on the day of surgery. As patients arrived in the operation room, they were attached with ASA standard monitors and baseline ECG, heart rate, non-invasive recordings of mean arterial pressure (MAP), SpO_2 were documented. A good IV access was done by 18G cannula and Ringer's lactate infusion started at 10ml/kg. The sternocleidomastoid of the side of block was made prominent by asking the patient to raise his/her head and to turn head on the opposite side of block. A straight line with surgical skin marker pen (Sony Officemates Surgical and Medical Skin Marker Pen) was drawn from tip of mastoid process to clavicular head of sternocleidomastoid muscle. Then midpoint of that line was marked.

That was the needle insertion point. Similarly needle insertion point was marked on the contralateral side. The superficial cervical plexus is arranged in such a way that infiltration deep to the posterior border of the sternocleidomastoid produces the block. Then inj. Glycopyrrolate 4mcg/kg; inj. Midazolam 0.025mg/kg and inj. Fentanyl 2mcg/kg were administered intravenously. Inj. Propofol 2mg/kg was used for the induction of anaesthesia. Succinylcholine 2mg/kg IV was given to facilitate endotracheal intubation with laryngoscopy. The maintenance of anaesthesia was done with Sevoflurane to keep end-tidal concentration of 0.8-1.2% with gas mixture of 50% Oxygen and 50% Nitrous Oxide using circle system. Patient was ventilated with tidal volume 6-8ml/kg and at rate of 12-15 breaths /minute to maintain $EtCO_2$ 35-40mm of Hg. 0.5mg/kg inj. Atracurium was administered after recovering from the effect of Succinylcholine and maintenance dose of inj. Atracurium 0.1mg/kg in intermittent bolus.

After giving loading dose of inj. Atracurium; the patient's head was positioned, raised and turned to the opposite side and antiseptic dressing and draping was done. Then a 22G (5cm length) needle was inserted at the marked point on sternocleidomastoid. The needle was then directed 4 cm both superiorly and inferiorly along posterior border of sternocleidomastoid and 5.5 ml of solution was injected along each of these sites --superior and inferior sites of both sides. Then 2 ml IV solution of study drug was administered. A single anaesthesiologist performed all blocks to avoid the operator bias.

Inj.Glycopyrrolate(0.01mg/kg) and inj. Neostigmine (0.05mg/kg) IV were used for complete reversal of motor paralysis at the end of surgery.

Haemodynamic observations (SpO_2, MAP, ECG, heart rate, $EtCO_2$) were documented at baseline, immediately after block, before incision, at 10 min, 20min, 30 min, 40 min, 60 min, 8 min, 100 min,120 min intraoperatively and at 1hr, 2hr, 4hr, 8hr, 12hr, 24hrin post-operative period.

Modified Aldrete Discharge Criteria were calculated to discharge patients from PACU. VAS was calculated for the severity of pain after surgery. Rescue analgesic inj. Pethidine 0.5mg/kg IM was given if visual analogue scale was ≥ 4, assurance was given if <4. An anti-emetic rescue drug 0.1 mg/kg inj. Ondansetron IV was administered when patient complained of an uncomfortable urge for vomiting or the first episode of vomiting within the first 24 hours post-operatively. Only one resident who was unaware of the group assignment assessed pain and PONV. This was to reduce the assessment bias.

Result

Master chart was prepared in Microsoft Excel 2016 with all collected data and Statistical Package for the Social Science (SPSS) version 22 (SPSS Inc., Chicago, IL, USA) was utilized for statistical analysis. Data from all 80 patients were available for analysis. Statistical tests applied -

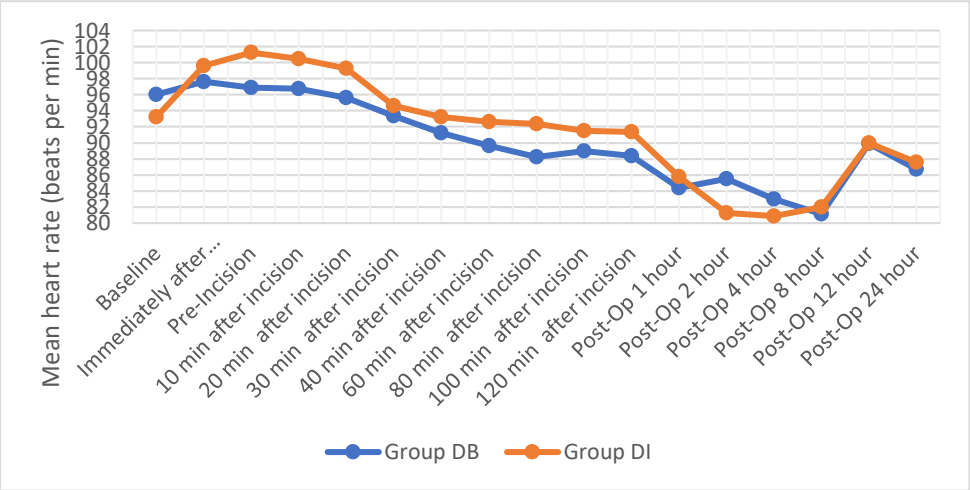
- Chi-square test was applied for gender and ASA physical status
- Student's unpaired t-test was applied for age, body weight, duration of surgery, time of rescue analgesia, VAS score at time of rescue analgesia, incidence of PONV.
- Statistically significant p-value was taken to be <0.05.

Table1: *Table showing demographical profile, ASA physical status and duration of surgery of patient*

Parameters	**Group DB (n = 40)**	**Group DI (n = 40)**	**P value**
Male: Female	10:30 (25%: 75%)	5:35 (12.5%: 87.5%)	0.15
ASA I: ASA II	36:4 (90%: 10%)	38:2 (95%: 5%)	0.36
Age (years)*	36.15 ± 11.47	35.59 ± 12.13	0.83
Distribution of age			
<20 years	5	5	The chi-square statistic is 4.386. The p-value is 0.356284. The result is not significant at p <0.05
21-30 years	15	15	
31-40 years	10	5	
41-50 years	1	5	
51-60 years	9	10	
Body Weight (Kgs)*	55.38 ± 4.61	55.08 ± 4.56	0.77
Duration of surgery * (minutes)	149.3 ± 14.91	150.58 ± 14.48	0.70
The data are presented as number of patients (proportion) and were tested using Chi-square test, except those marked with * which are presented as mean±standard deviation, and were tested using Student's t-test (unpaired).			

Both the groups were found to be comparable (Table 1) in terms of demographic profile, ASA physical status and duration of surgery (p value >0.05). The heart rate and mean arterial pressure were comparable between the two groups at different time points. (Graph 1 and 2)

Graph 1: *showing heart rate changes among two groups*



Graph 2*:* showing mean arterial blood pressure changes among two groups

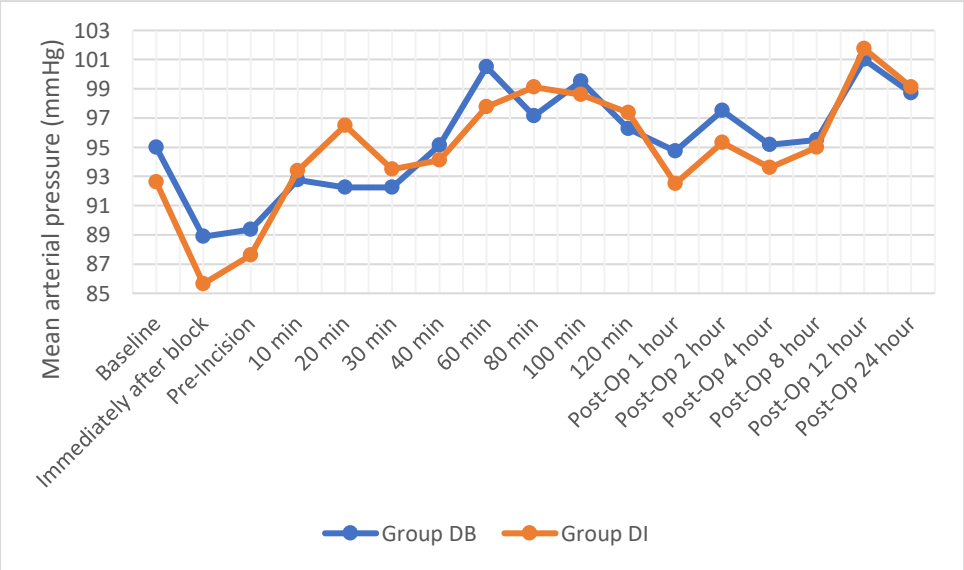


Table2: *Table showing time of rescue analgesia & VAS score at the time of rescue analgesiapost-operatively*

Parameters	**Group DB**	**Group DI**	**P value**
Time of rescue analgesia (inminutes)	818.74 ± 276.39	869.33 ± 251.00	0.4
VAS Score	5.95 ±0.82	5.88 ±1.02	0.74

In Table 2, results are showing statistically insignificant difference in terms of time of rescue analgesia and VAS score at the time of rescue analgesia post-operatively among the two groups.

Table 3: *Incidence of post-operative nausea vomiting*

Incidence of PONV	**Group DB (n = 40)**	**Group DI (n = 40)**	**P value**
Yes	6 (15%)	4 (10%)	0.16
No	34 (85%)	36 (90%)	

Statistically there was no significant difference among two groups in terms of incidence of PONV (Table 3). No potential harmful effects or unintended effects such as regional anaesthesia associated nerve injuries, diaphragmatic paralysis or Horner's syndrome were observed.

Discussion

Use of short acting opioids is effective for post-operative analgesia in thyroid surgery, but major drawback is post-operative hyperalgesia.[9]BSCPB significantly lowers the severity of post-operative pain during first 24hours and postoperative opioid requirements.[9]Stimulation of chemoreceptor trigger zone via vagus, recurrent laryngeal and glossopharyngeal nerves due to oedema and inflammatory mediators in tissues surrounding the thyroid possibly leads to PONV.[12]

The present study finds that use of dexamethasone via intravenous route and as perineural adjuvant during BSCPB yields no benefit in terms of postoperative analgesia, and PONV. *Aweke Z, et al*[13]came to the conclusion that BSCPB for thyroidectomy lead to decreased pain score post-operatively, reduced consumption analgesics and increased time for first analgesic requirement. In regard to time of rescue analgesia, two groups in our study were comparable. Elbahrawy K, *et al*.[11] found in their study that BSCPB added with inj. Dexamethasone resulted in elapsing of greater time until the first requirement of supplemental analgesic, better analgesia and lesser requirements for analgesic postoperatively. This finding is the same whether Dexamethasone is added with block or given intravenously. *Mathew R et al*[14]concluded that intravenous and perineural Dexamethasone equally prolongs duration of analgesia in supraclavicular brachial plexus block, in other words, systemic dexamethasone has comparable effects on analgesia duration as perineural dexamethasone. Results of our study are similar to these.

When a patient in our study, complained of unpleasant urge to vomit or suffered an episode of emesis for the first time post-operatively, the patient was attended and rescue antiemetic drug i.e., inj. Ondansetron (0.1mg/kg) IV was given and time is noted. At this point, the study about post-operative nausea, vomiting was put to end for that very patient.

Shih ML, et al[11]found lower rate of PONV in their study, which might be related to their routine use of 5mg dexamethasone intravenously during thyroid surgeries. *FujiiY, et al*[15]concluded that dexamethasone 8mg effectively decreased PONV and analgesic requirements after

thyroidectomy. *Elbahrawy K, et al.*[11]concluded that dexamethasone given with block or intravenously does not differ occurrence of PONV. There was similar result obtained from our study in regarding post-operative occurrence of PONV.

Limitations

Replicating the study with a bigger sample can reveal interesting elements. Other confounding factors can exist as the underpinning facts influencing the pain perception. However, the present study was not designed to detect that. The experience of pain is characterized by considerable inter-individual variability.[16] The pain experience by one person can be vastly different than that of another, even when they have received similar sensory input.[16] Multiple variables such as demographic variables, genetic factors, and psychosocial processes can contribute to these individual differences in pain perception.[16]

Conclusion

From our study, we conclude that different routes of administration of Inj. Dexamethasone during bilateral superficial cervical plexus block have no extra benefit in respect of postoperative analgesia and the incidence of PONV in thyroid surgery.

Conflict of interest

None

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