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A Comparative study of intraoperative peritonsillar infiltration versus intravenous dexemedetomidine for perioperative analgesia in tonsillectomy

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ABSTRACT

Background: Tonsillectomy is one of the most common surgical procedures in population and post tonsillectomy pain affects analgesic consumption, hospital stay, oral intake and return to regular activity. **Aims and Objectives:** The purpose of the study was to compare peritonsillar infiltration and intravenous administration of dexmedetomidine for perioperative analgesia in tonsillectomy. **Materials and Methods:** This was a placebo-controlled study to compare peritonsillar infiltration and intravenous administration of dexmedetomidine in patients undergoing tonsillectomy. Ninety patients were included in this study on the basis of a predefined inclusion and exclusion criteria. These patients were divided in 3 groups on the basis of whether they received Peritonsillar dexmedetomidine, intravenous dexmedetomidine or peritonsillar and intravenous normal saline. The groups were compared for perioperative pain, time to first request of rescue analgesia (duration of analgesia), post-operative sedation, analgesic requirement during first 24 hours and side effects. SSPS 21.0 was used for statistical analysis and p value less than 0.05 was taken as statistically significant. **Results:** Out of total 90 patients included in this study there was a female preponderance with a M: F ratio of 1:1.5. The mean age and ASA grades and mean duration of surgery of patients in all 3 groups were found to be comparable with no statistically significant difference in any of the groups ($P>0.05$). Preoperative mean systolic and diastolic blood pressures as well as mean arterial pressure and SPO2 was found to be comparable in all 3 groups. However intraoperative blood pressures (systolic, diastolic as well as mean arterial pressures) and SPO2 showed significant difference amongst the groups ($P<0.05$). Time to first request of rescue analgesia was found to be more in group - Dpt than group – Div and group – Pb which was highly statistically significant ($p<0.0001$).There was statistical significant difference in number of diclofenac injections consumed during first 24 hours between group – Dpt & group – Div and highly significant difference between group – Dpt & group – Pb, group – Div & group – Pb. **Conclusion:** Peritonsillar infiltration of dexmedetomidine is better alternative to intravenous dexmedetomidine in tonsillar surgeries.

Key words: Tonsillar surgery; Dexmedetomidine; Analgesia; Sedation Hemodynamics; SpO2

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INTRODUCTION

Tonsillectomy is one of the most common surgical procedures in population and post tonsillectomy pain affects analgesic consumption, hospital stay, oral intake and return to regular activity. Post tonsillectomy pain is probably the result of muscle spasm caused by inflammation and irritation of the pharyngeal musculature. Poor control of perioperative pain levels may lead to morbidity and complications including nausea, delayed mobilization,

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prolonged hospital stay, poor surgical outcome and risk of developing chronic pain syndromes.[1]

In the light of problems associated with postoperative pain, various strategies in the management of postoperative pain in these patients have been proposed like infiltration of local anaesthetic, non-steroidal anti-inflammatory drugs (NSAID), narcotic and oral analgesics.[2,3] The usual trend is to prescribe an opioid or NSAID for perioperative analgesia. Opioids may cause nausea, respiratory depression, hypotension, dizziness, mental confusion, constipation, itching and urinary retention. NSAIDs have certain side effects like hemostasis alteration, renal dysfunction, and gastrointestinal hemorrhage etc.[4]

Peritonsillar infiltration of local anesthetic drug like lignocaine adrenaline is popularly used in tonsillectomy surgeries but the accidental intravascular injection of lignocaine adrenaline may occur which can lead to develop fatal arrhythmias and even cardiac arrest. However, dexmedetomidine is a highly selective alpha 2 adrenoreceptor agonist recently introduced in anesthesia practice which causes dose dependent sedation, anxiolysis and analgesia without respiratory depression.[5]

There are 4 proposed mechanisms of actions of alpha 2-adrenergic receptor agonist in peripheral nerve block that includes direct action on peripheral nerves, centrally mediated analgesia, Alpha 2 B-Adrenergic receptor 2 mediated vasoconstrictive effects and attenuation of inflammatory response.[6]

Alpha2 adrenergic agonist effect also has peripheral analgesic effects as they can be directly applied to peripheral nervous system causing dose dependent inhibition of C fibers and alpha fibers and acts on locus ceruleus area, inhibiting nociceptive neurotransmission through posterior horn of spinal cord.[7] They also act on presynaptic membrane, inhibiting the release of norepinephrine which in turn induces hyperpolarization and inhibits pain signals to brain. It also promotes release of acetylcholine from spinal interneurons; resulting increased release and synthesis of nitric oxide could be involved in the regulation of analgesia.[8]

Dexmedetomidine can be administered intravenously, intramuscularly, orally, buccally, intranasally and in spinal epidural, peripheral nerve blocks.[9] Inadvertent intravascular injections of it doesn't produce arrhythmogenic side effects like intravascular lignocaine adrenaline does. It is also having shorter elimination of half life. It has additional benefit that it prevents emergence delirium and post anaesthesia shivering.[10] It also decreases opioid usage and anesthetic requirement.[11]

We undertook this study to compare peritonsillar infiltration and intravenous administration of dexmedetomidine for perioperative analgesia in tonsillectomy.

MATERIALS AND METHODS

After institutional ethical committee approval, present study was conducted at a tertiary health care center. It was a prospective randomized double blinded placebo controlled study. Study population comprised of 90 patients, belonging to ASA physical status grade I and II, more than 5 years' ages of either sex, posted for elective tonsillectomy surgeries randomly selected after thorough history taking and clinical examination. A valid informed written consent obtained prior to the procedure.

The study population was randomly divided into one of the following three groups in a double blinded fashion based on a computer-generated code: Dpt, Div and Pb.

1. Group-Dpt: Group of 30 patients who received 1 mcg/kg of dexmedetomidine diluted in 2 ml of 0.9% normal saline (1 ml per tonsil) by peritonsillar infiltration and 10 ml of 0.9% normal saline by intravenous infusion.
2. Group-Div: Group of 30 patients who received 1 mcg/kg of dexmedetomidine diluted in 10 ml of 0.9% normal saline by intravenous infusion and 2 ml of 0.9% normal saline (1 ml per tonsil) by peritonsillar infiltration.
3. Group-Pb: Group of 30 patients who received 10 ml of 0.9% normal saline by intravenous infusion and 2 ml of 0.9% normal saline (1 ml per tonsil) by peritonsillar infiltration.

Pre-anaesthetic evaluation was done. Basic laboratory investigations like Hemoglobin, complete blood count, blood sugar level, blood urea, serum creatinine, liver function test, chest X-ray, Electrocardiography (ECG) and urinary investigations were carried out. The entire procedure was explained to the patient in their own language. All the patients were reviewed in the previous night of proposed day of surgery. All the patients were reviewed in the previous night of proposed day of surgery. Intramuscular glycopyrrolate (0.04 mg/kg) was given 45 minutes before induction of anaesthesia. Patients were pre-medicated with intravenous Ondansetron (0.1 mg/kg), intravenous midazolam (0.05 mg/kg) and Pentazocine (0.3 mg/kg).

After pre-oxygenation for 3 minutes, induction of anaesthesia was done with Injection Propofol 2mg/kg. Neuromuscular blockade for insertion of Airway device was achieved in the three groups with Injection Succinyl

Choline 2mg/kg after confirmation of successful manual bag-mask ventilation. Then nasal intubation was done using the cuffed endotracheal tube. The endotracheal tube was inserted. Bilateral air entry was checked and after confirmation, the cuff was inflated and endotracheal tube was fixed. Throat packing was done to prevent the aspiration.[12] Patient was maintained on 33% O2, 66% N2O and 0.5-1% Isoflurane and non-depolarizing muscle relaxant inj. Vecuronium (0.1mg/kg). Patients received peritonsillar or IV dexmedetomidine or normal saline according to the group they belonged.[13] The infiltration was done in rose's position with patient being supine and head extended. The needle was inserted superficially into the anterior and posterior pillars and the pillars were infiltrated. Finally, the needle was inserted posterior to the tonsils and the solution was injected between the tonsillar capsule and the surrounding tissues. Three injections were made on every patient, at the superior pole, at the inferior pole, and between the poles. Peritonsillar infiltration was done by Operating surgeon.

At the end of procedure, neuromuscular blockade was antagonized with the neostigmine 0.05 mg/kg and glycopyrolate 0.008mg/kg iv. Patient was extubated after the confirmation of the return of the airway protective reflexes. Patients were positioned in post tonsillectomy recovery position. Then patient was shifted to the postoperative room and then patients were shifted to ward. They were monitored for 24 hours postoperatively for the pain score, sedation score, rescue analgesic requirement and side effects if any.

Patients were monitored at for pulse rate, BP, RR, pain by VAS score, sedation score and side effects if any. The presence and severity of pain was assessed systematically by same investigator blinded to group allocation. The groups were compared for post operative pain, time to first request of rescue analgesia (duration of analgesia), post-operative sedation, analgesic requirement during first 24 hours and side effects. SSPS 21.0 was used for statistical analysis and p value less than 0.05 was taken as statistically significant.

Inclusion criteria

1. Patient giving valid informed written consent
2. Age group of more than 5 years of both sexes
3. ASA grade I or II
4. Patients undergoing elective tonsillectomy surgeries.

Exclusion criteria

1. Patients with Enlarged peritonsillar abscess
2. ASA grade III and onwards
3. Patients with cardiovascular, respiratory, liver or renal disease
4. Patients with history of allergy to local anaesthetic or α-2 adrenergic agonists
5. Patients with deranged platelet count, bleeding or clotting time.

RESULTS

Out of the total 90 cases included in this study there were 54 (60%) females and 36 (40%) males. There was an overall female preponderance with a M: F ratio of 1:1.5. The difference however was found to be statistically insignificant amongst the three groups (Table 1).

The analysis of mean age of the studied cases showed that the mean age of patients in Group-Dpt, Group-Div and Group Pb was 18.80 ± 11.77, 17.60 ± 9.19 and 19.90 ± 12.16 years respectively. The mean age of cases in all 3 groups was found to be comparable with no statistically significant difference (P=0.7262) (Table 2).

Total number of patients in ASA grade I and II were 29 & 1 in group – Dpt, 29 & 1 in group – Div, 28 & 2 in group – Pb respectively. There was no any statistical significant difference among three groups in terms of age (p >0.05) (Table 3). So the study groups were comparable with respect to age.

Mean ± SD duration of surgery in minutes was 66.63 ± 5.08 mins in group – Dpt, 67.20 ± 6.48 mins in group – Div, 67.27 ± 5.14 mins in group – Pb respectively (Table 4).

Table 1: Gender distribution of the studied cases

Groups	Gender Distribution		Significance
	Male	Female	
Group – Dpt	12	18	P= 0.5738 (Non-Significant)
Group – Div	10	20	
Group – Pb	11	16	

Table 2: Mean age of the studied cases

Groups	Mean age (in years)	Significance
Group – Dpt	18.80 ± 11.77	P= 0.7262 (Non-Significant)
Group – Div	17.60 ± 9.19	
Group – Pb	19.90 ± 12.16	

Table 3: ASA grades in studied cases

Groups	ASA grade		Total (n)	X^2	P value	Significance
	I	II				
Group – Dpt	29	01	30	0.5233	0.7698	Not-Significant
Group – Div	29	01	30			
Group – Pb	28	02	30			
Total	86	04	90			

There was no any statistical significant difference among three groups in terms of duration of surgery (p >0.05).

The analysis of preoperative parameters of the studied cases showed that all 3 groups were comparable in terms of heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and SpO2. There was no any statistical significant difference among three groups in terms of HR, SBP, DBP, MABP and SPO2 (p >0.05). So, the study groups were comparable with respect to preoperative parameters (Table 5).

The analysis of intra-operative parameters showed that there was statistical significant difference (p < 0.05) in Heart rate at various time intervals between group – Dpt and group – Pb, group – Div and group – Pb. The analysis of Mean systolic blood pressures showed that there was statistical significant difference (p < 0.05) in SBP at various time intervals between group – Dpt and group – Pb, group – Div and group – Pb. There was statistical significant difference (p < 0.05) in DBP and mean arterial pressure at various time intervals between group – Dpt and group – Pb, group – Div and group – Pb. There was no statistically significant difference in oxygen saturation at various Intraoperative time intervals between group – Dpt, group – Div and group – Pb (P > 0.05) (Table 6).

The analysis of postoperative VAS scores showed that There was highly statistically significant difference (p<0.001) between three groups at 0 min, 30 mins, 60 mins, 2 hours, 4 hours, 6 hours and 8 hours. Median VAS score was lower in group – Dpt at various postoperative time intervals as compared with group – Div and group – Pb.

Table 4: Mean duration of the studied cases

	Mean duration of surgery		
	Group- Dpt (n=30)	Group – Div (n=30)	Group – Pb (n=30)
In minutes	66.63 ± 5.08	67.20 ± 6.48	67.27 ± 5.14
CI 95% (Lower Limit – Upper Limit)	64.73 –68.53	64.78 – 69.62	65.35 – 69.19
P value	0.8912(Not significant)		

Mean ± SD time to first request of rescue analgesia was 446.8 ± 145.6 mins in group– Dpt, 151.4 ± 89.1 mins in group – Div and 59.4 ± 10.5 mins in group – Pb. We found that time to first request of rescue analgesia to be more in group - Dpt than group – Div and group – Pb which was highly statistically significant (p <0.0001). There was also statistically significant difference between group – Dpt & group – Div (p<0.001), group – Dpt & group – Pb (p<0.001) and group – Div & group – Pb (p = 0.0015).

The analysis of mean sedation scores showed that there was no significant difference between group – Dpt & group – Div at 0 min; significant difference at 15 mins, 30 mins, 60 mins, 120 mins and 180 mins. There was no significant difference between group – Dpt & group – Pb at 15 mins, 30 mins, 60 mins, 120 mins and 180 mins. There was significant difference between group – Div & group – Pb at 0 min,15 mins, 30 mins, 60 mins and 120 mins and 180 mins.

Injection Diclofenac requirement in group - Dpt was one time in 3 patients and two times in 25 patients and 3 times in 2 patients which was significantly less as compared to group - Div in which diclofenac requirement was one time in 0 patient and two times in 18 patients and three times in 12 patients in the first 24 hours. In group - Pb, one time in 0 patients and two times in 1 patient and three times in 29 patients. There was statistically significant difference in number of diclofenac injections consumed during first 24 hours between group – Dpt & group – Div and highly significant difference between group – Dpt& group – Pb, group – Div & group – Pb (Table 7).

Mean ± SD of total analgesic requirement during first 24 hours was 102.8 ± 47.23 mg in group – Dpt, 127.3 ± 63.80 mg in group – Div and 171.9 ± 72.49 mg in group – Pb. Total dose of analgesic requirement during first 24 hours was lower in group – Dpt as compared with group – Div and group – Pb. But there was no statistical significant difference in total dose of analgesic requirement in first 24 hours between group – Dpt and group – Div; statistical significant difference between group – Dpt and group – Pb, group – Div and group – Pb.

Table 5: Comparison of preoperative parameters

Preoperative parameters	Heart rate (Beats/min) (Mean ± SD)	Systolic BP (mmHg) (Mean ± SD)	Diastolic BP (mm Hg) (Mean ± SD)	Mean arterial Pressure (mmHg) (Mean ± SD)	SPO2 (%) (Mean ± SD)
Group I (n=30)	88.6 ± 9.51	109.3± 8.08	67.07 ±4.77	81.16±5.66	99.23±0.62
Group II (n=30)	90.4 ± 11.75	111.2± 8.54	67.60 ± 6.70	82.14±5.66	99.20±0.84
Group III (n=30)	89.5 ± 10.74	110.3± 9.91	67.18± 7.18	82.26±7.83	99.33±0.95
P Value	0.8031 (Not significant)	0.7105 (Not significant)	0.9310 (Not significant)	0.893 (Not significant)	0.8081 (Not significant)

Table 6: Comparison of intra-operative parameters

Time (Minutes)	Group I (n=30)	Group II (n=30)	Group III (n=30)	P Value
		Heart rate		
15	91.4± 10.0	86.37± 11.5	102.8 ± 9.9	<0.0001 (Highly Significant)
30	88.2 ± 10.5	85.4 ± 12.3	96.8 ±9.6	0.0003 (Highly Significant)
45	87.9 ± 10.5	86.3 ± 11.6	96.8 ±9.7	0.0006 (Highly Significant)
60	90.2±9.9	86.2 ± 11.5	97.1±9.3	0.0014 (Significant)
		Systolic blood pressure		
15	110.8± 6.5	108.4± 8.0	117.1± 8.5	0.0001 (Highly Significant)
30	109.6± 9.6	107.6± 7.8	117.5± 7.6	<0.0001 (Highly Significant)
45	108.8± 8.8	108.3± 7.8	112.6± 8.8	<0.0001 (Highly Significant)
60	108.9± 8.2	108.8± 7.5	114.1± 8.5	<0.0001 (Highly Significant)
		Diastolic blood pressure		
15	67.7±4.35	64.70± 3.44	74.57± 8.81	<0.0001 (Highly Significant)
30	67.40± 6.00	64.07± 3.03	77.57± 7.92	<0.0001 (Highly Significant)
45	67.07±5.27	65.37± 5.05	73.18± 7.77	<0.0001 (Highly Significant)
60	67.0 ± 5.26	65.22± 4.61	74.5 ± 7.85	<0.0001 (Highly Significant)
		Mean arterial blood pressure (mmHg)		
15	83.61± 5.91	79.26±3.68	88.7±7.4	<0.0001 (Highly Significant)
30	81.46±7.07	78.59±3.89	90.89 ± 6.0	<0.0001 (Highly Significant)
45	80.99±6.26	79.68±5.54	87.86 ± 6.5	0.0004 (Significant)
60	80.95±6.04	79.75±5.14	88.92 ± 6.0	<0.0001 (Highly Significant)
		SpO2 (%)		
15	99.17± 0.5	99.10± 0.7	99.17± 0.8	0.9178 (Not Significant)
30	99.13± 0.6	99.13± 0.8	99.13± 0.8	0.3721 (Not Significant)
45	99.17± 0.6	99.03± 0.9	99.0±40.7	**0.7837** (Not Significant)
60	99.07± 0.7	99.07± 0.9	99.0± 0.9	**0.9320** (Not Significant)

Table 7: No.of Diclofenac injections consumed in first 24 hours

Study groups	No. of Diclofenac injections consumed in first 24 hours				P Value
	0	1	2	3	
Group – Dpt	00	03	25	02	<0.0001
Group – Div	00	00	18	12	Highly Significant
Group - Pb	00	00	01	29	

DISCUSSION

Preincisional Peritonsillar infiltration of tonsillar fossa is routinely done with purpose of achieving haemostasis by decreasing bleeding and for post-tonsillectomy pain relief. Inadequate pain relief after tonsillectomy can lead to delayed oral intake, longer hospital stay and increased incidence of secondary haemorrhage.

Various agents have been used for this purpose over years like normal saline, local anaesthetic drugs, epinephrine (1:2,00,000), Tramadol, ketamine, low dose tenoxicam, pethidine, Dexamethasone, alpha-2 agonists like clonidine and dexmedetomidine.[14] Dexmedetomidine has better analgesic profile and routinely used in our setup for parenteral administration for monitored anaesthesia care.[15] We decided to study this drug for peritonsillar infiltration in comparison to normal saline used by surgeons routinely. Though references for this study are limited, it is one of the novel agents that can be used to alleviate post-tonsillectomy pain.

The present study was undertaken to evaluate and compare the efficacy and perioperative analgesia of intraoperatively administered 1ug/kg of dexmedetomidine by peritonsillar infiltration with intravenous administration and with placebo.

There was statistical significant difference ($p < 0.05$) in all Intraoperative hemodynamic parameters at various time intervals between group – Dpt and group – Pb, group – Div and group – Pb. There was no statistically significant difference in oxygen saturation at various Intraoperative time intervals between group – Dpt, group – Div and group – Pb. Hala S. Abdel- Ghaffar et al found that the mean Intraoperative heart rates were significantly slower in DEX.IV group during ($p = 0.03$) and after the intravenous infusion of dexmedetomidine ($p = 0.01$) and at 15th min Intraoperative ($p = 0.02$) when compared with placebo and no significant difference in mean heart rates at various Intraoperative time intervals when compared with DEX. PT.[16] These results were similar to our study and this study supports our study.

Cheung et al in his study found that both heart rate and systolic blood pressure in immediate postoperative period were significantly lower in intravenous dexmedetomidine group than in peritonsillar infiltration of dexmedetomidine group (P<0.001). oxygen saturation was similar in all three groups[17]. These results correlate with our study.

Olutoyin A. Olutoye et al similarly found that patients receiving dexmedetomidine (Dex) had significantly slower heart rates. They found significant difference in heart rates intraoperatively in dexmedetomidine 0.75 g/kg (P = 0.002) and dexmedetomidine 1g/kg (P = 0.002). This study also supports our study[18.]

In our study, mean ± SD time to first request of rescue analgesia was 446.8 ± 145.6 mins in group – Dpt, 151.4 ± 89.1 mins in group – Div and 59.4 ± 10.5 mins in group– Pb. We found that time to first request of rescue analgesia to be more in group - Dpt than group – Div and group – Pb which was highly statistically significant (p <0.0001). Hala S. Abdel-Ghaffar a et al (2011) found the mean time to first request of rescue analgesia in DEX.IV (583.45 ± 157.94 min), in DEX.PT (537.61 ± 106.17 min) and in Placebo group (119.75 ± 43.44 min) which were more than that of our study.[16] They found no statistical significant difference between group DEX.IV and DEX.PT which differs from our study.

We found significantly better sedation (highest grade – 3) in patient who received intravenous dexmedetomidine than those who received peritonsillar infiltration of dexmedetomidine and placebo group. Hala S. Abdel-Ghaffar et al (2011) found sedation score to significantly higher in DEX.IV group compared to DEX.PT and Placebo group at 15, 30, 60, 120 and 180 mins postoperatively which supports our study.[16] Cheung et al (2011) found more sedation in intravenous dexmedetomidine group and infiltration group than placebo group which correlated to our study.[17]

Diclofenac requirement in group - Dpt was one time in 3 patients and two times in 25 patients and 3 times in 2 patients which was significantly less as compared to group. There was statistically significant difference in no. of diclofenac injections consumed during first 24 hours between group – Dpt & group – Div and highly significant difference between group – Dpt & group – Pb, group – Div & group – Pb. Hala S. Abdel-Ghaffar a et al (2011) found that the number of patients required >1rescue analgesic dose was higher in the Placebo group (n = 11/30.8%), compared to DEX.IV and DEX.PT groups which is similar to our study. The mean total dose of iv. paracetamol rescue analgesia consumed in first 24 h postoperative was significantly lower in DEX.IV (459.37 ± 114.82 mg, P < 0.000), and DEX.PT (475.38 ± 143.11 mg, P < 0.000) groups, but not the Placebo group (705.00 ± 249.27 mg) which did not correlate with our study.[16]

Schnabel A et al (2012) found that children receiving dexmedetomidine showed a reduced RR (relative risk) for postoperative opioids (0.4; 95% CI: 0.26–0.62; P < 0.00001) than children in placebo group which was similar to our study.[19] Similar results were also reported by DeHart AN et al.[20]

CONCLUSION

Peritonsillar infiltration of dexmedetomidine is better alternative to intravenous dexmedetomidine in tonsillar surgeries for providing better perioperative analgesia, lesser analgesic requirement and lesser postoperative sedation score.

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