INTRAOPERATIVE ANALGESIA AND POSTOPERATIVE RECOVERY IN CHILDREN UNDERGOING TONSILLECTOMY: A COMPARISON BETWEEN FENTANYL AND PETHIDINE

Basheer P. M. A[1], Mubarak K. K[2]

[1]Assistant Professor, Department of Anaesthesia, Government Medical College, Kozhikode, Kerala.
[2]Professor & HOD, Department of Anaesthesia, Government Medical College, Kozhikode, Kerala.

ABSTRACT

BACKGROUND

Tonsillectomy is a common surgical procedure done in children. Adequate intraoperative and post-operative analgesia is required for a smooth postoperative recovery in these children. Among the various modalities, opioids are still used for this due to their effective analgesic property, despite their undesirable side effects. The aim and Objectives of the study is to compare the effects of fentanyl and pethidine for intraoperative analgesia and post-operative recovery in children undergoing elective tonsillectomy.

MATERIALS AND METHODS

80 children between 5 to 15 years of age with American Society of Anaesthesiologists Physical Status (ASA PS) class I and II posted for elective tonsillectomy were selected and randomly divided into two equal groups A & B. Group A was given fentanyl 1. 5 µg/kg body weight and Group B, pethidine 0. 75 mg/kg body weight intravenously just before the induction of general anaesthesia. Intraoperative parameters measured for assessing inadequate analgesia were heart rate (HR), systolic blood pressure (SBP), arterial oxygen saturation (SpO_2). In the post-operative period the parameters noted were heart rate (HR), systolic blood pressure (SBP), arterial oxygen saturation (SpO_2), sedation and pain level. Any complications during the post-operative period were also noted.

CONCLUSION

In this study we found that both fentanyl and pethidine provided adequate intraoperative analgesia for children undergoing elective tonsillectomy, without any significant effect on the postoperative recovery. The differences in analgesia between the two groups were not statistically significant.

KEYWORDS

Tonsillectomy, Intraoperative analgesia, Postoperative recovery, Pethidine, Fentanyl.

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BACKGROUND

Tonsillectomy is a common surgical procedure done in children, and is often considered to be done as day care surgery. [1] Good intra-operative and post-operative analgesia is required to have a smooth postoperative recovery in these children. A painful struggling child in the post anaesthesia care unit (PACU) is likely to have post-tonsillectomy bleeding, for which repeated anaesthesia and surgery carries a very high risk. Apart from surgical pain, positioning and insertion of mouth gag to facilitate the surgery are additional stressful situations during the procedure. This stress and pain, if not relieved can produce physiological as well as psychological disturbances in the postoperative period,[2,3] which can later lead to even behavioural problems, especially in children.

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Corresponding Author:
Dr. Basheer P. M. A,
Department of Anaesthesiology, Government Medical College,
Kozhikode-8, Kerala.
E-mail: basheer2008pma@gmail. com
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Good intra operative analgesia during tonsillectomy in children offers a smooth recovery which results in lesser requirement for opioid analgesics in the post-operative period. This produces less sedation with a calm and awake patient in the PACU. It also helps for an early intake of oral feeds due to decreased pain during swallowing, which is especially needed in these children, preventing dehydration in the postoperative period.

Various modalities for pain relief have been tried to reduce the stress and provide effective analgesia in children undergoing elective tonsillectomy. These include parenteral opioids, non-steroidal anti-inflammatory drugs (NSAIDs), infiltration of the tonsillar pillars prior to surgery with local anaesthetics,[4] rectal suppositories of NSAIDs[5] and the use of Transcutaneous Electrical Nerve Stimulation (TENS).[6]

Opioids are very effective in providing intraoperative and postoperative analgesia for tonsillectomy in children, but carry the risk of respiratory depression, if not properly monitored. The commonly used opioids are morphine, pethidine, fentanyl and tramadol.

Morphine is a potent opioid which provides effective intra-operative and post-operative analgesia. Its major disadvantages are prolonged sedation, respiratory depression, nausea and vomiting. Pethidine is a potent

opioid which is relatively shorter acting than morphine and hence preferred in many centres. Fentanyl is a potent synthetic opioid with 50-100 times as potent as morphine with a rapid onset and duration of action of about one hour when administered intravenously. It has minimal side effects like nausea, vomiting and less chance for delayed respiratory depression[7] and cardiovascular side effects. Tramadol has also been studied as an analgesic for tonsillectomy, but it is only one tenth as potent as morphine with a risk for respiratory depression.[8]

NSAIDs are widely used as both parenterally and suppositories for intraoperative and postoperative analgesia for surgical procedures under general anaesthesia including tonsillectomy. The commonly used drugs are diclofenac sodium and paracetamol. Advantages of these are minimal sedation with less chance for nausea and vomiting. But studies have shown that these drugs can increase the incidence of bleeding in the intraoperative and postoperative period due to reduced platelet aggregation,[9] which is undesirable in children undergoing tonsillectomy.

Post-operative recovery after tonsillectomy will be smoother when effective intra operative and postoperative analgesia is provided. Prevention of pain has greater benefits than attempts at rescue therapy when pain exacerbation occurs. Altered central processing of nociceptive input prior to surgery by preoperative administration of analgesic drugs as opposed to after the surgery prevents central sensitisation.

Post extubation laryngospasm after tonsillectomy is a dreaded life threatening complication which is often precipitated by inadequate perioperative analgesia and is difficult to treat, especially in children. Effective analgesia by various methods including parenteral opioids can prevent its occurrence. Other methods used to minimise this includes applying topical lignocaine to the glottic and supraglottic areas before intubation. This has been proved as effective as giving intravenous lignocaine just prior to extubation, and does not produce higher sedation scores. [10]

AIM OF THE STUDY: To compare the effects of fentanyl and pethidine for intra-operative analgesia and postoperative recovery in children undergoing elective tonsillectomy.

MATERIALS AND METHODS: This study was conducted at the Department of Anaesthesiology, Government Medical College, Kozhikode, Kerala, India which is a tertiary care teaching hospital. The study was a randomized controlled trial, which included 80 children undergoing elective tonsillectomy. Sample size was calculated by the formula based on difference in means $n= (Z\infty+Z\beta)^2\times2\times sd^2/D^2$. Approval from the institutional ethics committee and informed consent from the parents of the children were taken for the study.

Inclusion Criteria:

- Children of age 5-15 years of either sex.
- ASA PS IorII.
- Posted for elective tonsillectomy.

Exclusion Criteria:

- Upper respiratory infection.
- History of seizures.
- Coagulation abnormalities.
- Any other serious systemic illnesses.

Procedure: Children selected as per the above criteria were divided into two equal groups, A & B of 40 each by randomisation according to numbers from random number tables.

After the routine preoperative investigations, on the pre-operative day, pre-anaesthetic evaluation was done and weight of the child was recorded. Good rapport was established with the children. The anaesthetic procedure was explained to the parents and their written informed consent was obtained. Parents were advised to keep the children fasting for 6 hours prior to surgery.

The children were reassured by the anaesthesiologist and EMLA (eutectic mixture of local anaesthetics) cream applied with occlusive dressing over the forearm veins of the non-dominant hand. They were brought into the operation theatre thirty minutes after this without any pharmacological premedication. Three lead electrocardiogram, non-invasive blood pressure and pulse oximeter were attached and the baseline heart rate, systolic blood pressure and arterial oxygen saturation (SpO_2) by pulse oximeter were noted.

The occlusive dressing was then removed and intravenous cannula of size 20-22 gauge was inserted into the forearm vein, and an infusion of 0. 9% saline was started at a rate of 10 mI/kg/hr. Injection atropine 0.02 mg/kg intravenously was given as an antisialogogue and to reduce the possibility of bradycardia during induction of anaesthesia. Inj. dexamethasone 0.3 mg/kg was given intravenously to reduce the chance for nausea, vomiting, postoperative inflammation and oedema.

This was followed by administration of the test drug, fentanyl 1.5 µg/kg or pethidine 0.75 mg/kg intravenously by an assistant as per the random numbers assigned, the principal investigator being blinded. Those given fentanyl were designated as Group A and those given pethidine as Group B.

This was followed by induction of general anaesthesia using Inj. thiopentone sodium 5 mg/kg and succinylcholine 2 mg/kg intravenously. Endotracheal intubation was done orally with appropriately sized cuffed PVC endotracheal tube, bilateral air entry confirmed and capnogram was connected. Anaesthesia was maintained by intermittent positive pressure ventilation using a mixture of nitrous oxide 66%, oxygen 33% and isoflurane 0.5-1%. As the effect of succinyl choline was wearing off, skeletal muscle relaxation was maintained with vecuronium bromide 0.08 mg/kg intravenously. All the children were given paracetamol 40 mg/kg as rectal suppository before surgery was initiated as a baseline postoperative analgesic.

Afterwards, the children were positioned in the Rose position with neck extended using a folded towel beneath the shoulder and head supported on a ring. Boyle Davis mouth gag was inserted and bilateral air entry was

reconfirmed both by auscultation and capnography. Tonsillectomy was then done by dissection method.

Pulse rate, blood pressure and arterial oxygen saturation (SpO_2) was monitored and were recorded every 10 minutes. Signs of inadequate analgesia such as tachycardia, high blood pressure, lacrimation, and sweating if any were noted. The duration of surgery (Time from the insertion of mouth gag to its removal) was noted.

At the end of the surgery, isoflurane was cut off and throat cleared by inspection and gentle suction. On observing signs of recovery from neuromuscular blockade, reversal of residual muscle paralysis was done using Inj. neostigmine 0. 05 mg/kg and lnj. glycopyrrolate 0.01 mg/kg intravenously. Nitrous oxide was cut off and the child was put on 100% oxygen. After ensuring spontaneous respiration with good muscle tone, hemodynamic stability, consciousness and haemostasis, trachea was extubated in lateral position with slight head down tilt and oxygen was administered through face mask.

The time for spontaneous eye opening, which was the time from end of surgery to the time at which the patient opened his eyes was noted.

The child was then shifted to PACU and kept in the lateral position with the head slightly down (recovery position) and oxygen through face mask at a flow rate of 5-6 litres per minute. Post-operative complications like pain, bleeding, stridor, nausea and vomiting if any were noted.

If the child was restless or complained of pain, rescue analgesia with Inj. fentanyl 0.05 mg/kg intravenously was given and the time of administration was noted. All the children were monitored in the recovery room until they were fully awake.

In the post-operative period pulse rate, respiratory rate, arterial oxygen saturation, pain scale and sedation level were continuously monitored and these were recorded every 15 minutes for one hour by a blinded observer.

Once the child was fully awake and haemostasis ensured by the surgeon and the anaesthesiologist, the patients were shifted to the post-operative ward.

OBSERVATION AND RESULTS: The observed values were expressed as mean with standard deviation. To analyse differences between the two groups for demographic profile, intra-operative analgesia and post-operative recovery, students' t test was used. Chi-square test was used for qualitative data. A p value less than 0.05 was considered statistically significant.

Both the groups were comparable with respect to gender, age and body weight.

Gender	Group A		Group B	
	Number	%	Number	%
Male	18	45	17	42.5
Female	22	55	23	57.5
Total	**40**	**100**	**40**	**100**

Table 1. Distribution according to Gender

There were 18 male and 22 female patients in Group A, whereas there were 17 male patients and 23 female patients in Group B.

Parameter	Group A	Group B
Age (in years)	8.25±2.34	8.10±2.46
Body Weight (in kg)	23.95±7.78	22.73±6.78

Table 2. Demographic profile

The mean age in Group A was 8.25±2.34 years and was 8.10±2.46 years in Group B the mean body weight in Group A was 23.95±7.78 kg and 22.73±6.78 kg in Group B.

Parameter	Group A	Group B
Pulse rate (Per minute)	120.98±9.86	122.40±8.83
Systolic Blood Pressure (mm Hg)	113.70±7.89	114.78±7.01
SpO_2(%)	98.20±0.72	98.33±0.62

Table 3. Baseline vital signs

The mean baseline pulse rate, systolic blood pressure and arterial oxygen saturation was 120±9.86 beats per minute, 113.70±7.89 mm of Hg and 98.20±0.72% respectively for Group A, and were 122.40±8. 83 beats per minute, 114.78±7.01 mm of Hg and 98.33±0.62% respectively for Group B. These parameters were comparable among the groups.

The parameters monitored in the intra operative period were pulse rate (PR), systolic blood pressure (SBP) and arterial oxygen saturation (SpO_2). These were monitored continuously and recorded every 10 minutes.

Parameter	Group A	Group B
PR 0 min. (per min.)	151.38±14.24	153.78±13.11
SBP 0 min. (mm Hg)	123.85±6.19	124.35±7.55
SpO_2 0 min. (%)	99	99
PR 10 min. (per min.)	148.75±16.22	149.62±11.61
SBP 10 min. (mm Hg)	123.35±7.46	122.68±7.58
SpO_2 10 min. (%)	99	99
PR 20 min. (per min.)	142.12±14.76	145.00±11.35
SBP 20 min. (mm Hg)	119.75±7.19	119.35±7.39
SpO_2 20 min. (%)	99	99
PR 30 min. (per min.)	139.70±14.01	138.55±12.19
SBP 30 min. (mm Hg)	117.75±6.96	114.55±17.38
SpO_2 30 min. (%)	99	99
PR 40 min. (per min.)	138.29±11.02	134.16±10.97
SBP 40 min. (mm Hg)	117.54±6.96	117.74±6.96
SpO_2 40 min. (%)	99	99
PR 50 min. (per min.)	134.28±16.79	133.14±9.27
SBP 50 min. (mm Hg)	112.89±7.00	115.71±4.89
SpO_2 50 min. (%)	99	99

Table 4. Intra-operative Parameters

Both the groups were comparable with respect to intraoperative analgesia as the parameters were not statistically significant among the two groups.

Parameter	Group A	Group B
Duration of surgery (min)	44.32±6.22	43.60±8.18
Eye opening time (min)	8.20±2.10	8.55±1.66

Table 5. Surgery & Awakening

The mean duration of surgery was 44.32±6.22 minutes in Group A and was 43.60±8.18 in Group B. The spontaneous eye opening time for patients of Group A was 8.20±2.10 and that of Group B was 8.55±1.66.

Supplemental Analgesia	Group A	Group B	Total
Nil	38	35	73
Yes	2	5	7
Total	**40**	**40**	**80**

Table 6. Supplemental Analgesia Requirement

2 patients in Group A and 5 patients in Group B needed supplemental analgesia in the post-operative period. Chi square test analysis of this observation showed no statistical significance.

One patient in Group A had bleeding in the post-operative period which responded to conservative measures. There were no such complications in Group B. There was no incidence of nausea and vomiting in the post-operative period in either of the groups.

Postoperatively, the patient was monitored continuously and the parameters were recorded every 15 minutes. Sedation level was assessed by the scoring system shown below.

Sedation Score[16]:

Level of sedation	Score
Alert	0
Arousable	1
Drowsy	2
Very drowsy	3

Table 7. Level of sedation

Post-operative pain was assessed using the objective pain scale of Hanallah Objective pain scale of Hanallah. [12]

No.	Parameter	Finding	Points
1	Systolic Blood Pressure	Increase< 20% of pre-operative value	0
		Increase < 20-30% of pre-operative value	1
		Increase <30% of pre-operative value	2
2	Crying	Not crying	0
		Responds to tender care	1
		No response to nurturing	2
3	Movements	Relaxed	0
		Restless moving about	1
		Moving wildly	2
4	Agitation	Calm and asleep	0
		Can be comforted	1
		Cannot be comforted	2
5	Complaints of pain	Asleep, No pain	0
		Cannot localize pain	1
		Localizes pain	2

Table 8. Pain Assessment

All the five parameters were measured and the total score was calculated by adding up all the points in each parameter. A score of 10 meant that the patient did not have any pain relief and with a score of 0 excellent analgesia.

Postoperative Recovery Analysis:

Parameter	Group A	Group B
Resp. rate: 0 min.	21.70±1.40	21.30±1054
Pulse rate: 0 min.	114.50±13.82	113.20±12.56
Sedation score: 0 min.	1.65±0.53	1.55±0.6
SpO_2: 0 min.	99	99
Pain score: 0 min.	2.53±0.88	2.72±0.72
Resp. rate: 15 min.	20.60±1.52	20.55±1.43
Pulse rate: 15 min.	108.15±11.34	108.60±11.61
Sedation score: 15 min.	2.38±0.77	1.80±0.56
SpO_2: 15 min.	99	99
Pain score: 15 min.	2.38±0.77	2.55±0.68
Resp. rate: 30 min.	19.15±1.35	19.40±1.52
Pulse rate: 30 min.	104.08±10.13	103.55±10.64
Sedation score: 30 min.	2.03±0.36	2.05±0.5
SpO_2: 30 min.	98.95±0.43	98.95±0.22
Pain score: 30 min.	2.23±0.77	2.53±0.75
Resp rate: 45 min.	18.58±1.11	18.15±2.91
Pulse rate 45 min.	99.40±8.82	100.50± 8.74
Sedation score: 45 min.	1.95±0.55	2.20±0.56
SpO_2: 45 min.	98.93±0.38	98.90±0.30
Pain score: 45 min.	1.95±0.75	2.15±0.77
Resp rate: 60 min.	18.00± 1.01	18.00±0.91
Pulse rate: 60 min.	98.80±8.32	97.30±7.42
Sedation score: 45 min.	2.02±0.62	2.10±0.50
SpO_2: 60 min.	98.53±0.55	98.43±0.59
Pain score: 60 min.	1.85±0.80	2.10±0.74

Table 9. Postoperative Recovery Assessment

P value <0. 05, statistically not significant.

Respiratory rate and pulse rate in the recovery period showed a gradual decrease throughout the observation period for both the groups.

Patients of Group A had a higher sedation score in the first 30 minutes of the post-operative period when compared to Group B. After 30 minutes, sedation scores were higher for patients of Group B.

There was no significant change in the arterial oxygen saturation throughout the intraoperative and post-operative period in both the groups.

Although pain scores decreased in both the groups post operatively throughout the observation period, they were higher in Group B.

All these values on analysis showed no statistical significance.

DISCUSSION: Adequate intra-operative as well as postoperative analgesia results in better perioperative outcome after tonsillectomy, especially in children. A crying restless child in the PACU after tonsillectomy is more likely to have post-tonsillectomy bleeding, which necessitates intervention, carrying a very high morbidity and even mortality. Post-tonsillectomy pain delays oral fluid intake resulting in a restless child with dehydration.

This study was undertaken in 80 children between 5-15 years of age of either sex, scheduled for elective tonsillectomy. They were divided into two equal groups of 40 each, receiving either fentanyl 1.5 µg/kg or pethidine 0.75 mg/kg intravenously for analgesia. The study groups were comparable with respect to age, sex and body weight. Both the groups had similar baseline pulse rate, blood pressure and arterial oxygen saturation.

In a study by Mukherjee et al[13] the efficacy of intravenous fentanyl and morphine for perioperative analgesia in children undergoing adenotonsillectomy were similar and had comparable pain scores and requirement of rescue analgesia in the postoperative period. They observed that postoperative vomiting was less with those received fentanyl. In our study we found out that postoperative pain scores and requirement of rescue analgesia were less with those who received fentanyl compared to pethidine. There were no incidence of post-operative nausea and vomiting in any of the patients, probably due to the administration of dexamethasone as no other antiemetics were given.

In a study by Taheri R et al,[14] fentanyl and ketamine was compared for postoperative pain relief in children undergoing tonsillectomy and they observed that i/v fentanyl extended time to first analgesia than i/v ketamine.

Ozer et al[15] found that pethidine was more effective for pain relief and provides better emergence characteristics than tramadol after adenotonsillectomy in children. In our study both fentanyl and pethidine provided effective and comparable pain relief.

S Amani et al[16] compared i/v pethidine, oral gabapentin and local bupivacaine and found out that oral gabapentin significantly reduced the post-operative pain severity.

Chew et al[17] compared the recovery after tonsillectomy following administration of morphine and tramadol. They observed that patients receiving tramadol recovered faster than those with morphine and the incidence of postoperative nausea and vomiting was less in those receiving tramadol compared to morphine.

Thomas Engelhardt[18] et al compared tramadol versus morphine for post tonsillectomy pain and found out that tramadol provided reasonable analgesia with very minimal respiratory depression.

Elshamma[19] and colleagues combined ketamine i/v along with i/v fentanyl and observed that the combination provided superior analgesia than both the drugs alone.

Davis et al[20] investigated the effect of remifentanil, an ultra-short acting synthetic opioid versus fentanyl on post-operative pain in children undergoing tonsillectomy and adenoidectomy and concluded that remifentanil was associated with higher postoperative pain scores. Our study showed that those received fentanyl had lesser post-operative pain scores than those who received pethidine.

Van Den berg et al[21] compared the effect of nalbuphine, tramadol and pethidine and found out that post-operative requirement of opioid was less for those who received pethidine, but spontaneous respiration was delayed in them. In our study, postoperative eye opening was delayed in those received pethidine but there was no delay in spontaneous respiration when compared to those received fentanyl.

A study by Mokhtar et al[22] found out that preoperative dexamethasone 0.5 mg/kg intravenously reduced both post-operative vomiting and pain in children after tonsillectomy. We administered dexamethasone 0.3mg/kg preoperatively and there was no incidence of nausea and vomiting in any of our patients.

Ohlms et al[23]and Steward et al[24] found that a single dose of steroid did not increase post-operative morbidity in children undergoing tonsillectomy. We also found no complications following administration of a single dose of dexamethasone 0.3 mg/kg to our patients.

J. A. Alhashemi[24] et al compared i/v acetaminophen and i/m pethidine for post tonsillectomy pain and found out that i/v acetaminophen provided better analgesia than i/m pethidine.

There is a possibility of prolonged sedation and respiratory depression following the administration of opioids for perioperative analgesia. In our study we observed that fentanyl had more sedation in the initial postoperative period while pethidine had it in the later postoperative period. There was no incidence of significant respiratory depression in any patients as we monitored respiration and continuous pulse oximetry.

CONCLUSION: From this study, it is concluded that intravenous administration of either 1. 5µ/kg fentanyl or 0. 75 mg/kg pethidine are equally effective in providing intraoperative analgesia in children undergoing elective tonsillectomy without any significant effects on their postoperative recovery.

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