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Research Article

Evaluation of Low Dose Pethidine as an Adjuvant to 2% Lidocaine during Intravenous Regional Anaesthesia Block Using Single Forearm Tourniquet for Hand Surgery

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Abstract: Intravenous regional anesthesia (IVRA) is widely recommended and applied in patients undergoing ambulatory procedures on the hand with various additives to improve block quality and reduced tourniquet pain. However, there is no report in literature of the use of pethidine when using lidocaine based IVRA with single tourniquet on the forearm for hand surgery. This double blind, randomized study was conducted to compare and evaluate the effect of adding pethidine as an adjunct to lidocaine during IVRA with single tourniquet application to forearm. After obtaining approval from the Ethical Issues Committee, 60 ASA I or II patients of either sex between age range of 18-60 yr undergoing elective hand surgery of less than 60 minutes duration and giving their verbal consent for IVRA were included in the study. Patients were randomly divided into two groups of 30 patients each. Group L patients received 2.5 mg/kg 2% lidocaine while Group LP received 2.5 mg/kg 2 % lidocaine + pethidine (0.15 mg/kg) in the arm with a single tourniquet placed in the distal 3rd of the forearm. For any intraoperative breakthrough of pain, fentanyl 0.5µg/Kg was administered up to maximum of two doses. If pain remains unrelieved, general anesthesia was to be administered. Patient and surgeon satisfaction was noted to be significantly improved by the addition of pethidine to lidocaine and it also resulted in significant reduction of intraoperative requirement of fentanyl (p=0.004) with an insignificant prolongation of sensory block after the release of tourniquet.
Keywords: Intravenous regional anesthesia, Pethidine, Lidocaine.

INTRODUCTIION

Intravenous regional anesthesia (IVRA) is widely recommended and applied in patients undergoing ambulatory procedures. Various additives have been used with local anesthetic agents to improve block quality, reduce tourniquet pain, and prolong post deflation analgesia [1]. Additives that have been used include opioids (fentanyl, morphine, sufentanil, tramadol), NSAIDs (ketorolac, lornoxicam, tenoxicam and acetylsalicylate), dexmedetomidine, clonidine, nitroglycerine, muscle relaxants (atracurium, pancuronium, and mivacurium), and alkalization with sodium bicarbonate and potassium [2-8]. Pethidine with its local anesthetic properties on peripheral nerves would be an ideal adjuvant with lidocaine during IVRA [9-10]. It is thus realized that for exclusive hand surgery, a single forearm technique with reduced volume of local anesthetic and pethidine as an adjunct would provide good intraoperative pain relief (surgical and tourniquet pain) and be a safeguard against accidental leaks. However, there is no data on the use of additive like pethidine when using lidocaine based IVRA with single tourniquet placed on the forearm instead of the usual dual tourniquet on the arm for ambulatory hand surgery. This double blind, randomized study was conducted to evaluate the efficacy of adding pethidine as an adjunct to lidocaine during IVRA with single tourniquet applied in lower 3rd of forearm.

MATERIALS AND METHODS

After obtaining approval from the Ethical Issues Committee, 60ASA I or II patients of either sex between age range of 18-60 yr undergoing elective ambulatory hand surgery of less than 60 min duration and giving their informed consent for IVRA were included in the study. Patients were randomly divided as per Chit-in-Box technique [11] into two groups of 30 patients each. Group L patients received 2.5 mg/kg 2% lidocaine while Group LP received 2.5 mg/kg 2% lidocaine + pethidine (0.15 mg/kg). Neither the patient nor the data collector was aware of the groups.

After a uniform premedication with midazolam (0.1 mg/kg) orally, a standard technique of IVRA was followed. However, instead of using dual tourniquet in the arm, a single tourniquet was applied in the distal 3rd of the forearm. Tourniquet inflation pressure was kept 75 mmHg above systolic blood pressure. Intraoperatively, patients of either group received 15 mg/Kg of paracetamol IV. This dose was also continued on a six hourly basis for the first 24 hours. For any intraoperative breakthrough of pain, fentanyl 0.5 µg/Kg was administered up to a maximum of two doses. If pain remained unrelieved, general anesthesia was to be administered.

Recording of parameters

1. Patient satisfaction score: At the end of the surgery, patients were asked to quantify their satisfaction based on tourniquet or incision pain according to the following numeric scale: Excellent (4) = no complaint of pain, Good (3) = minor complaint with no need for supplemental analgesics, Tolerable (2) = complaint which required supplemental analgesic, and Intolerable (1) = patient given general anesthesia.
2. Surgeon satisfaction score: Following completion of surgery, the surgeon, who was unaware of patient group, scored operative conditions such as disturbing movement of arm and excessive bleeding according to the following numeric scale [4]: 0 = very poor; 1 = poor; 2 = acceptable; 3 = good; 4 = excellent.
3. Tourniquet or incision pain intensity was recorded as verbal numerical pain scores (VNS) (0 – 10: 0= No pain, 10= maximum pain ever experienced).
4. Sensory (loss of pin prick sensation to a 25-gauge short-bevelled needle) and motor block onset (Motor function to be assessed by asking the patient to flex and extend his/her wrist and fingers, and complete motor block was noted when no voluntary movement was possible). Motor block onset was taken as the time elapsed from injection of the study drug to complete motor block).
5. Duration of sensory block after releasing the tourniquet was recorded as the period to first analgesic requirement in the postoperative period.
6. Also noted was any evidence of lidocaine toxicity such as dizziness, tinnitus, lightheadedness, or a metallic taste.

A blinded observer who was not part of the study recorded all observational data in the recovery area and the ward.

Sample size calculation and statistical analysis: Sample size of 60 patients was estimated by the statistician to detect a clinically relevant reduction of intraoperative fentanyl consumption by 25% and also approximately 30% clinically significant changes of the sensory block onset and recovery times with a power of 80% and a level of significance of 5%. All values in tables are shown as mean ± standard deviation. Statistical analysis of the data was performed using independent samples –test and Mann-Whitney U Test. The statistical evaluation has been done using SPSS 17.0 for Windows (SPSS Inc., Chicago, IL, USA).

RESULTS

Age, weight and sex ratio of the patient were comparable in both the groups. Duration of tourniquet application was also nearly identical in either group (p= 0.624) (Table 1). In this study, we did not have any patient who demonstrated motor blockade or toxic effect of lidocaine during IVRA or on release of the single forearm tourniquet.

Adding pethidine to lidocaine significantly increased patient (p= 0.001) and surgeon satisfaction (p= 0.009) with the procedure as compared to lidocaine alone. Onset of sensory block was nearly 33% faster by the addition of pethidine that resulted in significant difference between the two groups (p=0.001). Similarly, recovery from sensory block was 33% prolonged when pethidine was used in addition to lidocaine. However, this difference was statistically insignificant (p= 0.177) and may not be clinically important. The intensity of tourniquet or incisional pain was significantly reduced by the addition of pethidine as per verbal numerical pain score (p= 0.022). This resulted in a significantly reduced requirement for analgesic supplementation with fentanyl (p= 0.004) in patients receiving lidocaine with pethidine (Table 2).

Table 1: Demographic data

Group	Sex ratio Male: Female	Age (yeard)	Weight (Kg)	Tourniquet time (min)
L	9:21	40.07 (12.60)	70.50 (13.38)	42.80 (12.29)
LP	10:20	40.67 (11.51)	68.93 (13.53)	41.43 (8.94)
p-Value	-	0.848	0.653	0.624

L= receiving only lidocaine, LP= Receiving lidocaine + pethidine

Table 2: Comparison of study parameters in the two groups

Group	Sensory block onset (min)	Tourniquet/incisional pain VNS(0-10)	Patient satisfaction (1-4)	Surgeon satisfaction (1-4)	Duration of sensory block after releasing tourniquet (min)	Intraoperative analgesic (fentanyl in µg)
L	3.63 (1.07)	2.30 (3.23)	2.93 (1.11)	3.47 (0.63)	12.50 (14.49)	21.67 (22.49)
LP	2.50 (1.14)	0.53 (0.81)	3.70 (0.47)	3.83 (0.38)	18.73 (20.78)	5.83 (10.76)
P-Value	0.001	0.022	0.001	0.009	0.177	0.004

L= receiving only lidocaine, LP= Receiving lidocaine + pethidine, VNS= verbal numerical pain score.

DISCUSSION

The technique of IVRA using arm tourniquet is associated with two challenges. First, in case the tourniquet has to be released earlier than half an hour or accidentally deflates, the sudden entry of local anesthetics from the arm and forearm area into the systemic circulation can produce lidocaine toxicity. Second, compressive forces of the tourniquet are known to produce moderate to severe pain when it remains in place longer than half an hour during IVRA. The present study has clearly demonstrated that 2.5 mg/kg 2% lidocaine + pethidine (0.15 mg/kg) not only provides superior pain relief when used during forearm IVRA for hand surgery but also gives good patient and surgeon satisfaction.

We are of the opinion that application of tourniquet on the arm results in larger ischemic area comprising of arm and forearm muscle mass than when applied in the distal forearm that contains largely tendons. Hagenouw *et al*. [12] has postulated that the local products of anaerobic metabolism may be responsible for influencing the sensory innervation of major arteries that produce pain. This means that greater the ischemic tissue mass more is the anaerobic metabolite released leading to a greater intensity of pain. This may be responsible for better toleration of the single tourniquet in the forearm even when tourniquet time exceeded half an hour as observed in this study. Chiao *et al*. [13] also made a similar observation that single cuff forearm tourniquet during IVRA with lidocaine and ketorolac elicits less pain than upper arm tourniquet and requires significantly lesser amount of fentanyl as rescue analgesic like in the present study.

None of our patients demonstrated loss of motor function during the perioperative period. This is understandable as the forearm tourniquet position preserves some motor function of the long flexors and extensors of the wrist [14].

In this trial we noted a significantly better patient satisfaction score in terms of incisional cum surgical pain when pethidine was added to lidocaine. This may be attributed to the known local anesthetic effect of pethidine on peripheral nerves [8, 9] that may have potentiated the effects of lidocaine.

It had been erroneously believed in the past that there is some risk of systemic leakage of the local anaesthetic via the interosseous vessels since their occlusion may not be complete while using forearm tourniquet placed over radius and ulna [14]. However, this risk has been conclusively discounted [15, 16]. None of our patient complained of dizziness, tinnitus, lightheadedness, or a metallic taste during IVRA or on release of the tourniquet. This may also be attributed to the small volume of lidocaine used during IVRA with a single forearm tourniquet.

Lastly, none of the patients in either group had to be administered general anesthesia due to intolerable pain not relieved despite two supplemental doses of fentanyl. In addition, we did not encounter any drowsiness due to pethidine on release of the tourniquet.

This study had few limitations. First, we did not make a comparison between traditional dual cuffs in the arm with the single forearm cuff. Second, we did not assess different doses of lidocaine and pethidine. To overcome both these limitations, a much larger sample size would have been needed that is not available at our institution.

CONCLUSION

In conclusion, using half the conventional dose of 2% lidocaine during IVRA for ambulatory hand surgery gives satisfactory patient and surgeon acceptance especially when pethidine is added to lidocaine when using single forearm tourniquet. Adding pethidine to lidocaine also results in significant reduction of intraoperative requirement of fentanyl (p=0.004) that is known to delay fast tracking of patients from the recovery room and discharge to home.

REFERENCES

1. Choyce A, Peng P; Systematic review of adjuncts for intravenous regional anesthesia for surgical procedures. Can J Anaesth., 2002; 49(1): 32–45.
2. Reuben SS, Steinberg RB, Kreitzer JM, Duprat KM; Intravenous regional anesthesia using lidocaine and ketorolac. Anesth Analg., 1995; 81(1):110–113.
3. Steinberg RB, Reuben SS, Gardner G; The dose-response relationship of ketorolac as a component of intravenous regional anesthesia with lidocaine. Anesth Analg., 1998; 86(4): 791–793.
4. Memiş D, Turan A, Karamanlioğlu B, Pamukçu Z, Kurt I; Adding dexmedetomidine to lidocaine for intravenous regional anesthesia. Anesth Analg., 2004; 98(3): 835–840.
5. Johnson CN; Intravenous regional anesthesia: new approaches to an old technique. The CRNA, 2000; 11(2): 57–61.
6. Reuben SS, Steinberg RB, Maciolek H, Manikantan P; An evaluation of the analgesic efficacy of intravenous regional anesthesia with lidocaine and ketorolac using a forearm versus upper arm tourniquet. Anesth Analg., 2002; 95(2): 457–460.
7. Sen H, Kulahci Y, Bicerer E, Ozkan S, Dağlı G, Turan A; The analgesic effect of paracetamol when added to lidocaine for intravenous regional anesthesia. Anesth Analg., 2009; 109(4): 1327–1330.

8. Reuben SS, Steinberg RB, Lurie SD, Gibson CS; A dose-response study of intravenous regional anesthesia with meperidine. Anesth Analg., 1999; 88(4): 831–835.
9. Armestrong PJ, Morton CP, Nimmo AF; Pethidine has a local anaesthetic action on peripheral nerves in vivo. Anaesthesia, 1993: 48(5): 382-386.
10. Acalovschi I, Cristea T; Intravenous regional anesthesia with meperidine. Anesth Analg., 1995; 81(3): 539-543.
11. Singh M, Suri N, Lad S, Khan R; Hydrocortisone reduces postoperative shivering following day care knee arthroscopy. Can J Anaesth., 2011; 58(10): 924-928.
12. Hagenouw RRPM, Bridenbaugh PO, van Egmond J, Stuebing R; Tourniquet pain: a volunteer study. Anesth Analg., 1986; 65(11): 1175-1180.
13. Chiao FB, Chen J, Lesser JB, Rest-Flarer F, Bennett H; Single-cuff forearm tourniquet in intravenous regional anaesthesia results in less pain and fewer sedation requirements than upper arm tourniquet. Br J Anaesth., 2013; 111(2): 271-275.
14. Chan CS, Pun WK, Chan YM, Chow SP; Intravenous regional analgesia with a forearm tourniquet. Can J Anaesth., 1987; 34(1): 21–25.
15. Coleman MM, Peng PW, Regan JM, Chan VW, Hendler AL; Quantitative comparison of leakage under the tourniquet in forearm versus conventional intravenous regional anesthesia. Anesth Analg., 1999; 89(6): 1482–1486.
16. Plourde G, Barry PP, Tardif L, Lepage Y, Hardy JF; Decreasing the toxic potential of intravenous regional anesthesia. Can J Anaesth., 1989; 36(5): 498–502.