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Comparative Evaluation of Efficacy of Plain Xylocaine 0.5% (3mg/kg) with Xylocaine 0.5% (3mg/kg) + Buprenorphine (3µg/kg) in Intravenous Regional Anesthesia (Holme's Modification of Bier's Block)

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Abstract: ***Aim: To evaluate the usefulness of adding opioid analgesic in intravenous regional anesthesia for forearm and hand surgeries. Materials and methods: Two groups were randomly assigned as group – A & B, Each group consisting of 25 patients and surgery was done under intravenous regional anesthesia. The dose was given according to the following combinations - Group – A – Received xylocaine 0.5% (3mg/kg) 0.6ml/kg & Group – B – Received xylocaine 0.5% (3mg/kg) 0.6ml/kg with 3µg /kg- Buprenorphine. Results: We observed injection to analgesia time (onset of analgesia) as 5.40 min in Buprenorphine +Lignocaine (Group B) which was significantly less as compared to group –A and duration of analgesia was also significantly more prolonged in group –B 464.4 minutes (P- 59.705). The prolonged duration of analgesic could be attributed to the perineural effects of buprenorphine in group B. Conclusions: It is concluded that the technique of intravenous regional anesthesia with addition of Buprenorphine to Lignocaine results in early onset of analgesia, prolonged residual analgesia and is free from any significant side effects.***

Key words: Intravenous regional anesthesia1,Biers block, Holmes modifications,Xylocaine, Buprenorphine

1. Introduction

The main object of the anesthesiologist is to provide anesthesia and analgesia for surgery, even though the general anesthesia was the earliest technique adapted to provide analgesia for surgery. The search for an alternative was made in order to overcome the problems and complications related to general anesthesia.

Regional anesthesia may provide an ideal operative condition when used optimally with reduced stress response, also avoiding polypharmacy with alert awake and co-operative patients. The adequately administered regional anesthesia provides excellent intra operative pain control and also good relief of post-operative pain.Since regional blocks are less stressful for the patients, they could form the ideal anesthesia of choice for emergency surgery in unprepared patients.However, the main drawbacks were that these agents have delayed onset of action, varying of blockade and unpredictable duration of action and the need for systemic analgesics for post-operative pain relief. To overcome these drawbacks an attempt was made in this study to evaluate the effect of adding opioid to Xylocaine with respect to onset time, quality, and duration of block and post operative analgesia.

2. Aim of the Study

To evaluate the usefulness of adding opioid analgesic in intravenous regional anesthesia (Holme's modification of Biers Block) for forearm and hand surgeries and to assess its usefulness in providing post-operative analgesia without increased incidence of side effects and complications.

3. Materials and Methods

This clinical study was conducted at Mahatma Gandhi Government Hospital attached to KAPV Government Medical College, Trichy in the year of 2016-2017, 50 patients of ASA Grade – I and II of either sex undergoing upper limb (forearm and hand) surgery were randomly assigned to group – A -0.5% xylocaine 0.6ml / kg (3mg/kg) &group - B- Buprenorphine3 µg/kg to 0.5% xylocaine 0.6ml (3mg /kg), each group consisting of 25 patients and surgery was done under intravenous regional anesthesia. The technique applied with 2% concentration and volume of 12–15 mL xylocaine may also be suggested as a safe option [1].

Patient was starved for at least four hours before elective surgery. Procedure was explained to patient including the feeling of tourniquet application and informed consent was obtained from the patient. Full resuscitation equipment's (Boyle's machine, O2 source, ETT Laryngoscopes, suction

apparatus, drugs (adrenaline, atropine, steroid,midazolametc) with leak-proof tourniquet must be ready. Recommended cuff size 20% wider than the limb diameter and pressure gauge must be reliable. On the table in supine position Intravenous line was established, BP cuff, Pulse oximeter were applied on the opposite arm.

Usually a vein on the dorsum of the hand near the surgical field is selected. However, failure to obtain analgesia or patchy analgesia is more likely to occur when proximal veins are used. A plastic cannula or short IV catheter should be used, flushed with saline and taped securely. Care must be taken not to dislodge it during the exsanguination and subsequent injection. In this study uniformly 22Gintravenous cannula was used.

The exsanguination by an Esmarch bandage snugly applied upto the arm, starting where it is possible, just proximal to the needle in the hand. The Tourniquet pressure for the first tourniquet was applied after the exsanguinations and was inflated to pressure of 150mmHg above the systolic or 50 to 100 mm Hg above pulse occlusion pressure. Disappearance of radial pulse should be checked in all cases. Practice of cross clamping the tubing of the cuff after inflation is not recommended.

Calculated dose of drug was injected slowly at a rate of 1ml/sec. The quantity may be varied according to the mass of tissue below the tourniquet.As the drug is injected, the skin usually becomes mottled. Analgesia and muscular relaxation appear at the same time.

The Tourniquet discomfort may develop at the site of the tourniquet. To alleviate this discomfort another tourniquet below the first one placed and inflated it over the analgesic part of the arm. The first tourniquet was slowly released and watched for any local anesthetic toxic manifestation. The surgery was started and completed within the tourniquet time. At the end of operation, the tourniquet was released slowly and sequentially for 10 seconds. At this time adverse reactions may occur, hence Pulse, O2 saturation, BP, ECG should be monitored closely during the first few minutes.

The evaluation of the block by a different anesthesiologist, who did not know the constituents of the local anestheticsolution, was done in the study. Theyevaluate the degree of the blockade and suitability of the hand for surgery was assessed on a "**4 Point scale**". Poor- No analgesia, no motor paralysis, Moderate- Adequate sensory block with weak grip, Good- Adequate sensory block, nearly complete loss of Motor power (minor movements of digits possible), Excellent- Complete sensory and motor paralysis, sensory blockade was assessed by needle prick.

The Parameters studied are analgesia onset time in minutes (Table: 2) from the injection to the lack of appreciation of pinprick. This was checked for every minute until the onset of analgesia. The completion time is from the time of onset to the completion of blockade in minutesafter the tourniquet release (Table: 2). At the end of the surgery, a note was made about the pulse rate, BP, O2 sat., pattern of respiration and the level of consciousness. Duration of Analgesia was assessed by 'VAP Scale' having 10cms length, numbered from 0-1cm. Patient was explained about VAP Scale as O- no pain and 10- worst possible pain. All the patients were asked to note the score in VAP Scale when they feel back the pain in the post-operative period. The duration of analgesia measured was the time in minutes (Table: 4) from the onset of analgesia to the VAP Scale>5 (recurrence of pain) and patient was given IM. NSAID (Inj.Diclofenac). The time of onset and completion of the motor blockade and Tourniquet time were also monitored. (Table:3)

Patients were observed for side effects in any, like drowsiness, nausea, vomiting and pruritus (Table : 5) The results were statistically analyzed using students two sample't' test for testing the statistical significance of the differences between the results.The incidence of CNS side effects is slightly higher with lidocaine compared to ropivacaine [3]. This was, likely, offset by slower release from tissues and lesser percentage of unbound (free) drugs [3].Seizures have been reported with lidocaine at its lowest effective dose (1.5 mg/kg) [4].

The contraindications are patient refusal, allergy, anticoagulants, sickle cell anemia or trait, ischemic limbs, infection of the limbs, malignant disease, cardiac disease, untreated heart block.The greater number of venous channels close to the median and ulnar nerveswould explain the earlier onset of analgesia on the antero medial aspect of the forearm.

4. Observation and Results

Both groups are comparable with respect of age, weight and sex. (Table: 1). the groups were also compared with respect to mean onset time and mean completion time of sensory and motor blockade (Table: 2). The mean Tourniquet time compared with two groups. (Table: 3). Residual Post – Operative analgesia in minutes (Table: 4). In this study of 50 patients, the commonest complications are respiratory depression, nausea, vomiting , itching and convulsions (Table : 5). Only one patient (2%) required supplementation with intravenous anesthesia as the duration of surgery prolonged for 1 hours 30 minutes.

5. Discussion

To avoid general anesthetic due to the hazards of the theatre pollution, the employment of regional technique by use of local anesthetic solutions was used.The surgeries in the upper limb required the use of various nerve blocks which are technically difficult and are not without their complications. One of such technique for surgeries in the upper limb was the intravenous regional anesthesia, which is relatively simple, efficient and free from complications.

Veins of the upper limb are conveniently grouped as superficial and deep, but these are widely interconnected. Both

the groups have valves, which are more numerous in deep veins.The superficial veins are subcutaneous in the superficial fascia. These include the cephalic, basilic, median cubital and additional ante brachial veins and their tributaries. Deep veins (Venae comitantes) will accompany arteries, usually in pairs, flanking the artery connected by short transverse links. Since much blood from the upper limb is returned by the superficial veins, the deep ones are relatively small.

The brachial plexus supplies all of the motor and almost all of the sensory function of the upper extremity. The brachial plexus is formed the anterior primary rami of the C5,6,7,8, and T1 nerves and frequency receives small contributing branches from the C4 and nerves.

Perhaps Bier should have the last word – "This new method uses the vascular bed to bring the anesthetic agent to the nerve endings as well as the nerve trunks".

Xylocaine (Lignocaine): Lignocaine is the most commonly used local anesthetic agent. It is a derivative of acetanilide, chemically a tertiary amide, diethy1 amino acety1 2, 6 – Xylidine hydrochloride monohydrate. It is a local anesthetic of moderate potency and duration, but of good penetrative power and rapid onset of action.The safe dose is 3mg/kg without of adrenaline and 7mg/kg with addition of adrenaline. Safe blood level for lignocaine is 0.5-4µg/ml.

Buprenorphine: Buprenorphine is a semi synthetic opioid derived from Thebaine. It is a partial agonist of Mu-receptor and also binds to Delta and Kappa receptors. Structurally similar to morphine, but it is 33 times (25-50) more potent that morphine and highly lipophilic. Its opiate receptor association and dissociation are slow.The onset is slow, takes 30 min to achieve equilibrium after administration. The Location of **o**pioid receptors is found in the various regions in CNS. Unlike the A fiber the C-fiber terminal possesses the opioid receptors.An opioid has a spectrum of intrinsic activity ranging from maximum (Agonist) to zero (Antagonist). Partial agonists have affinity to the receptors but intrinsic activity is intermediate and they are incapable of producing the maximal effects of a full agonist. The Partial agonists are buprenorphine, butorphanol, naurophine, pentazocine.

6. Conclusion

The technique of intravenous regional anesthesia with addition of Buprenorphine to Lignocaine results in early onset of analgesia, prolonged residual analgesia and is free from any significant side effects.Buprenorphine is a promising agent for use in prolongation of local anesthetic peripheral nerve blocks, and further studies of safety and efficacy are merited. However, caution is recommended with use of any perineural adjuvant, as none have Food and Drug Administration approval, and concerns for side effects and potential toxicity persist [2].

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Table 1: Mean age, weight and sex distribution

	Age	Weight	Male	Female
Group – A	30.16	49.48	15	10
Group – B	33.56	58.44	11	14

Table 2: Mean onset time and mean completion time in minutes

	Mean Onset Time in Minutes				Mean Completion Time in Minutes			
	Sensory		Motor		Sensory		Motor	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group – A	6.12	2.047	7.08	2.30	48.4	7.32	59	8.16
Group – B	5.40	1.384	5.40	1.38	65.6	10.73	64	9.128
't' value	-0.656		-1.01		-14.81		-16.292	

Table3: Tourniquet time in minutes

	MEAN	SD
Group – A	47.8	13.07
Group – B	47.4	11.19
't' value	-6.175	

Table 4: Residual (Post –Operative) analgesia in minutes

	MEAN	SD
Group – A	8.36	2.73
Group – B	464.4	62.52
't' value	59.705	

Table 5: Complications

	No of patients	
	Group – A	Group – B
1. Respiratory Depression	Nil	Nil
2. Nausea	Nil	5
3. Vomiting	2	14
4. Itching	Nil	3
5. Convulsion	Nil	Nil