MODIFIED LOCAL INTRAVENOUS ANESTHESIA WITH REVERSED CANNULA FOR TRAUMATIC HAND AND DISTAL FOREARM INJURIES

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ABSTRACT

Background: Investigations have attempted to improve intravenous regional anesthesia by modifying the technique in order to hasten onset and improve analgesia and safety. **Objectives:** To evaluate the modification of intravenous regional anesthesia with reversed cannula to intensify the degree of block and analgesia for traumatic hand and distal forearm injuries. **Patients and methods:** 50 patients with trauma to the hand or distal forearm divided into two groups: Group A (25 patients) received local intravenous anesthesia by the original technique, and group B (25 patients) received local intravenous anesthesia with using forearm IV cannula with reversed direction away from elbow directed toward injured hand or forearm. **Results:** Intraoperative VAS was lower in the patients with modified technique in group B, 2 (1-3) compared to 5 (3-6) in the other group A, the number of patients who received analgesics and sedation was lower in the modified group (2 patients), compared with 8 patients received analgesia and sedation in the original group B. **Conclusion:** Modified intravenous regional anesthesia with reversed cannula technique is more potent anesthesia technique for hand and distal forearm injuries.

Keywords: intravenous, regional, reversed cannula

INTRODUCTION

Intravenous Regional Anesthesia (IVRA) is well recognized and safe technique for producing anesthesia during minor surgical procedures of the extremities[(1)]. First described in 1908 by the German surgeon August Bier, the technique originally used 2 rubber tourniquets; one above and one below the elbow[(2)].

Bier block is an intravenous regional anesthesia technique in which an extremity (generally an arm) is made numb for surgery by injecting a local anesthetic solution into a vein after the blood has been squeezed out of the extremity and a tourniquet has been placed on it. The tourniquet prevents the local anesthetic from leaving the extremity and blood from entering it, giving the patient a numb (anesthetic) extremity and the surgeon a bloodless field to work in[(3)].

The advantages of the technique is that it is simple to perform, and provides a blood less field that is easy to work in and minimizes blood loss. The disadvantages are that there is a practical time limit and its use (1-2 hours) due to that tourniquet restricting blood flow to the extremity[(3)] add to the potential for local anesthetic toxicity and lack of postoperative analgesia[(8)].

The precise mechanism for production of anesthesia after IVRA remains unknown. Other investigations have suggested that retrograde intravenous pressure infusion leads to high tissue concentrations of local anesthetic by intensifying the filtration and diffusion of molecules into the local interstitium[(4)].

It is commonly believed that valves are absent in veins smaller than two millimeters in diameter. Consequently, current investigations on pathophysiology of chronic venous disease consider and evaluate only the valvular competence of large veins.

Microscopic venous valves were first described in 1934 in the human digits and have subsequently been demonstrated in other parts of the human body as well as many tissues and organs of animals. Their location and arrangement suggests that microscopic venous valves prevent blood reflux in small-sized veins and restrict flow from postcapillary venules back into the capillary bed[(9)].

Investigators have attempted to improve IVRA by modifying the technique in order to hasten onset and improve analgesia and safety. One technique that has been proposed is the use of a simple Penrose drain placed on the forearm of the side that is being blocked[5] , another modification may offer several advantages over the use of an upper arm tourniquet, as it allows the dose of local anesthetic to be decreased without affecting the quality of analgesia[6].

The best IVRA solution should have the following characteristics: fast onset, low dose of local anesthetic, decreased tourniquet pain, and extended postdeflation analgesia. Right now this may merely reached by adding adjuncts to local anesthetics[7].

Our work aimed at the evaluation for new modification for old technique which is the local intravenous anesthesia (Bier block) by putting intravenous cannula in forearm directed toward traumatized hand or distal forearm and the cannula placed below the elbow-joint in the upper forearm.

PATIENTS AND METHODS

Patients:

50 patients with traumatic injury for the hand and distal forearm scheduled for debridement with muscle and tendon repair under local intravenous anesthesia. Those patients divided into two groups:

Group A: 25 patients received local intravenous anesthesia by the usual original technique with double tourniquet on the arm above the elbow and 22 G intravenous cannula placed in the forearm proximal to the lesion and below the elbow.

Group B: 25 patients received local intravenous anesthesia with modified cannula technique by applying double tourniquet over the arm with intravenous cannula placed proximal to the lesion, below the elbow with the direction of the cannula toward the lesion and against the direction of the normal venous drainage of the forearm.

Method:

Patients with traumatic hand and forearm injuries scheduled for debridement, muscle and tendon repair under local intravenous anesthesia.

Exclusion criteria: All patients with coagulopathy, preferal vascular diseases as Reynaud's phenomenon, patients with history of previous deep venous thrombosis and patients having allergy to the drugs to be used.

After written informed consent, intravenous cannula placed in the forearm of the normal side for intravenous fluid therapy during the operation.

In the traumatized limb, another intravenous cannula placed in the forearm above the lesion and below the elbow.

For group A, those will receive local intravenous anesthesia by the usual technique without modifications with the direction of the cannula toward the elbow with the normal venous drainage pathway.

But, for group B, those will receive local intravenous anesthesia with the modified cannula technique. The 22 G cannula placed in the forearm below the elbow and its tip directed away from the elbow and towards the injured distal forearm or hand.

For all patients, double arm tourniquet was used and inflated after elevating the forearm and squeezing the blood by the hand or Esmarch pandage if tolerable for the patient.

10 ml lidocaine 2% diluted in 40 ml saline (2.5 ml lidocaine in 10 ml saline in one syringe) is injected slowly in the cannula after inflating the tourniquet to 250 cmH_2O in all patients.

Time of onset of anesthesia is tested. Measurement of intraoperative pain using VAS (10 points), degree of patient satisfaction during the operation, intraoperative sedative and analgesic administration with calculation of total dose of ketamine and pethidine used during the operation and the number of patients seeking for sedation during the procedure in the two groups.

Statistical analysis:

Statistical data are expressed as mean ± SD, percentage and median with arranging all

data analyzed using student t-test and Mann Whitney test.

RESULTS

Table (1) showed some patient characteristics with no differences related to number of patients, age and percentage of male to female in each group. Also, time onset of sensory block had no difference between groups A and B.

Intraoperative VAS was 5 (3-6) in group A (usual group) with high statistical difference compared to the other group B (modified anesthesia group) (2, 1-3).

Number of patients who received sedation during the operation was high in group A (8 patients), compared to 2 patients in group B.

Total dose of ketamine used for sedation was high in group A 400 mg compared to 100 mg in group B.

Also, the total dose of pethidine used during the procedure was higher in group A (200 mg) compared with group B (50 mg).

In table (2), the degree of patient satisfaction after the operation showed high difference in group A compared to group B, as 5 patients (20%) were very satisfied in group A compared to 15 patients (60%) in group B.

5 patients (20%) were satisfied in group A compared to 7 patients (28%) in group B which is higher.

For the degree of somewhat satisfied, it was 4 patients (16%) in group A which was higher compared to group B (2 patients, 8%).

8 patients (32%) in group A were unsatisfied during the operation, compared to one patient (4%) only in group B.

Lastly, 3 patients (12%) were very unsatisfied during the operation in group A, but no patient in group B.

Table (1): Patient characteristics and data

Data	Group A	Group B
Number of patients	25	25
Male/female	20/5	21/4
Age	35 ± 6	34 ± 8
Onset time of sensory block	4.5 (3.5-6.5)	4 (3-6)
Intraoperative VAS	5 (3-6)	2 (1-3)
Number of patients received sedation	8/25	2/25
Dose of intraoperative ketamine used	400 mg	100 mg
Dose of intraoperative pethidine used	200 mg	50 mg

Table (2): Degree of patient satisfaction

Degree of satisfaction	Group A		Group B	
	No	%	No	%
Very satisfied	5	20	15	60
Satisfied	5	20	7	28
Somewhat satisfied	4	16	2	8
Unsatisfied	8	32	1	4
Very unsatisfied	3	12	0	0

DISCUSSION

Bier's block is an intravenous regional anesthesia technique in which an extremity (generally an arm) is made numb for surgery by injecting a local anesthetic solution into a vein after the blood has been squeezed out of the extremity[(1)].

Investigations have attempted to improve IVRA by modifying the technique in order to hasten onset and improve analgesia and safety[5].

In our study, we compared modified local intravenous anesthesia technique with cannula directed toward the injured hand or distal forearm and against the normal venous blood circulation, with the original old Bier's block technique.

We found that intraoperative VAS was lower in the group B with modified technique (2, 1-3), compared with 5 (3-6) in the group A with original technique.

Also, the number of patients received sedation intraoperatively by using ketamine and pethidine IV was lower in the modified group B (2/25), compared with 8/25 patients in the other group A.

Higher doses of ketamine 400 mg and pethidine 200 mg for all patients received sedation in group A (original group) compared with 100 mg ketamine, and 50 mg pethidine only used for sedation and analgesia in the patients received modified local intravenous anesthesia (group B).

The degree of patient satisfaction during the operation was higher in group B patients as 15 patients were very satisfied, 7 patients were satisfied, 2 patients only were somewhat satisfied, and only one patient unsatisfied compared with 5 patients, 5 patients, 4 patients, and 8 patients respectively in group A added to 3 patients who were very unsatisfied in that group with no patients in group B being very unsatisfied.

Eastwood et al.[5] modified the original technique by putting a simple Penrose drain placed on the forearm of the side to be blocked.

Nazim et al.[6] modified the local intravenous anesthesia by using forearm tourniquet which may offer several advantages over the use of an arm tourniquet, as it allows the dose of local anesthetic to be decreased without affecting the quality of analgesia.

CONCLUSION

Modified local intravenous anesthesia, with reversed intravenous cannula technique, was more potent for distal forearm injuries and hand injuries, with less usage of analgesic and sedative drugs compared with the old original Bier block technique.

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التخديرالمعدل عن طريق الحقن الوريدي بمحقن عكسي لإصابات اليد واعلي الساعد

خلفية:هناك محاولات تحسين التخدير الإقليمي عن طريق الحقن الوريدي بتعديل هذه التقنية بهدف الإسراع ببدء التخدير وتحسين تسكين الالم وسلامة المريض اثناء العملية.

الأهداف: تقييم تعديل التخدير عن طريق الحقن الوريدي الإقليمي بعكس المحقن على تكثيف درجة التخدير وعدم الاحساس بالالم لاصابات اليد واصابات اعلي الساعد.

المرضى والطرق: ٥٠ مريضا مصابا بصدمة لليد أو الساعد الأعلى مقسمة إلى مجموعتين: المجموعة ا (٢٥ مريضا) المتلقاة تخدير عن طريق الحقن الوريدي بالأسلوب الأصلي، وفي المجموعة ب (٢٥ مريضا) المتلقاة تخدير عن طريق الحقن الوريدي مع استخدام محقن اعلي الساعد مع اتجاه المحقن عكسيا بعيداً عن الكوع موجها نحو اليد المتضررة أو الساعد.

النتائج: معدل الاحساس بالالم كان أقل في مرضى المجموعة باء ٢ (١-٣) مقارنة مع ٥ (٣-٦) في المجموعة الأخرى.عدد ٢ مرضي فقط في المجموعة ب تم اعطاؤهم ادوية مسكنة للالم ومنومة وهو اقل من المجموعة ا حيث تلقي عدد ٨ مرضي الادوية المسكنة للالم.

الاستنتاج": تعديل التخدير الإقليمي عن طريق الحقن الوريدي مع اسلوب المحقن المقلوب أكثر فعالية في تخدير إصابات أعلى الساعد واليد.