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Original Research Article

Intravenous Regional Anaesthesia for Upper Limb Surgeries: A Retrospective Study

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Abstract

Background: In this study we wanted to evaluate Intravenous Regional Anaesthesia with regard to effectiveness, usefulness, drugs and adjuvants used, types of surgeries done, safety and complications.

Methods: This was a record based descriptive study conducted in Government Medical College, Ernakulam, for a period of 6 months among 129 patients, after obtaining IRC and IEC approval.

Results: Lignocaine 0.5% along with muscle relaxants and either Dexmedetomidine or Buprenorphine or Fentanyl or Morphine as adjuvants can be used for IVRA with high success rate.

Conclusion: IVRA is a safe and effective method for providing anaesthesia for upper limb surgeries of bone and forearm, Metacarpal fractures, Phalanx bone surgeries & Soft tissue surgeries of the hands and wrists. Complications with IVRA are less except for occasional Tourniquet pain, and transient Bradycardia responding to Atropine.

Keywords: IVRA (Intravenous Regional Anaesthesia), Effectiveness, Usefulness, Drugs, Adjuvants, Types of Surgeries Done, Safety and Complications.

Introduction

Intravenous regional anaesthesia (IVRA) is a common regional anaesthesia technique for providing anaesthesia for upper limb surgeries. This technique is simple and effective especially for the upper limb.

The mechanism of action of IVRA involves the diffusion of the local anesthetic from the injected vein into the surrounding tissues. The tourniquet enhances the concentration of the anesthetic by restricting venous outflow, resulting in a greater degree of nerve block.

The technique of IVRA was first described by August Bier in 1908 using local anaesthetic Procaine. Hence the technique is otherwise called Bier's block.

It has a faster learning curve, compared to brachial plexus block and preclude the necessity of costly equipment such as ultrasound which is an advantage in a limited resource setting. This technique also avoids some of the complication associated with Brachial plexus block such as injury to pleura, accidental phrenic nerve palsy, or Horner's syndrome. The technique also provides faster onset of action.

One of the major disadvantages of IVRA is that the duration of action is limited by tourniquet time of the surgery. If the surgery is prolonged, the anaesthesia may have to be converted to general anaesthesia. For short procedures, an early release of torniquet can lead to potential complication of release of local anaesthetic into systemic circulation leading to systemic toxicity. One of the practical difficulties with this technique include difficulty in cannulating peripheral vein the affected limb when it gets obscured by oedema, cast or dressings.

Government Medical College, Ernakulam had a series of IVRA done for upper limb surgeries and a review into this technique will aid in understanding

more about the advantages, disadvantages and its practical aspects, so that future recommendations can be done, and can stimulate further studies in the subject.

Objectives

Primary objective

To find out the effectiveness, effective being defined as adequate analgesia for starting the procedure

Secondary Objectives

To find out the 1) usefulness defined as whether the block was adequate for the entire procedure, 2) Drugs and adjuvants used for IVRA, 3) Types of surgeries done, namely Bone surgeries of forearm; Soft tissue surgeries of wrist , hand and finger; Metacarpal bone surgeries; Phalanx bone surgeries 4) safety defined by absence of complications during and after the procedure and 5) complications of IVRA

Materials & Methods

The present Record based descriptive study was conducted in Government Medical College, Ernakulam, for a period of 6 months on 129 patients, after obtaining IRC and IEC approval.

Inclusion Criteria

The upper limb surgeries done in Government Medical college, Ernakulam from January 1st 2011 to December 31st 2017 as per Anesthesia case register record were included in the study.

Exclusion Criteria

The lower limb surgeries under IVRA, cases done outside the specified study period, incomplete or incomprehensible data from Anesthesia case register record were excluded.

Sample size Ad Sampling Techniques

The formula for calculating the sample size for a retrospective observational study is:

n = [(Zα/2)^2 * p * (1 - p)] / e^2

where:

n = sample size Zα/2 = the critical value for a two-tailed test at the desired alpha level p = the estimated proportion of the outcome of interest in the population e = the desired margin of error (the degree of precision)

129 cases of upper limb surgeries done under IVRA in the above period were included and were analyzed.

Study Procedure

Anaesthesia records and registers from 01/01/2010 to 31/12/2017were reviewed in detail. The following details were reviewed, and analysed.

1. Technique used.
2. Drugs, and adjuvants used and their dose.
3. Types of surgeries done under IVRA- Bone surgeries of forearm; Soft tissue surgeries of wrist, hand, and finger; Metacarpal bone surgeries; Phalanx bone surgeries
4. Duration of whole procedure from introduction of IVRA cannula to the deflation of the distal tourniquet after the procedure.
5. Complications of the procedure
6. Effectiveness and failure of IVRA

The details were recorded and entered in the MS excel sheet and each items were analysed.

Results

Total of 129 cases were included in the study. The following results were obtained.

1. Sex distribution- Females 59 (45.7%) Males 70 (54.26%)
2. Age distribution

Table 1: Age distribution of patients

Age group	Frequency	Percent
14 – 20 years	9	6.9
21 – 30 years	27	20.9
31 – 40 years	37	28.7
41 – 50 years	24	17.8
51 – 60 years	23	18.6
61 – 70 years	7	5.4
71 – 80 years	2	1.5

The youngest were 2 patients of 14 yrs. of age
Oldest patient was 75 yrs. of age

3. Technique used is as follows: Intravenous access is obtained in the opposite limb to be operated by wide bore cannula (20G, 18G, 16G) for giving IV fluids and other drugs. Monitors SPO2, ECG, NIBP are connected. The limb to be operated is cannulated using 22G cannula as distally as possible. Two tourniquets (proximal and distal) are applied to the arm. The limb is exsanguinated first by elevation of limb for few minutes and then by applying the Esmarch bandage. After exsanguination the bandage is removed, and proximal tourniquet is inflated to a pressure 30-

50mm above the systole blood pressure. Local anaesthetics along with adjuvants are injected through 22G cannula. Within 5 minutes anaesthesia is established. Proximal tourniquet is deflated after inflating the distal tourniquet (since the distal tourniquet is applied in an area already anaesthetised ,there will be no tourniquet pain).After the procedure, tourniquet is released slowly and cyclically(alternate inflation and deflation) .This will prevent sudden entry of drugs into the systemic circulation. In situations where the surgical time exceeds the tourniquet time as a standard surgical practice, the limb is elevated, tourniquet is released, pressure is applied over the surgical site using sterile dressings and tourniquet reapplied after 5-10 minutes.

4. Drugs and additives used

(i) Local Anaesthetic -In all cases 0.5% lignocaine at dose 3mg/kg was used

(ii) Table 2- Muscle relaxants used

Table 2: Muscle relaxants used

Drugs used	Frequency	Percent
Vecuronium 0.5 mg	125	96.9
Atracurium 5mg	2	1.5
None	2	1.5

Table 3: Adjuvants used (in addition to Muscle relaxants

Drugs used	Frequency	Percent
Dexmedetomidine	92	71.3
Buprenorphine	21	16.3
Fentanyl	11	8.5
Morphine	5	3.9

Doses of Drugs used

i)Lignocaine 0.5mg/kg was used in all cases

ii) Table 4-Dose of adjuvant drugs

Table 4: Dose of adjuvant drugs

Drug used	Dose given	Number of cases
Vecuronium (n=125)	0.5 mg	125 (96.89%)
Atracurium (n=2)	5 mg	2 (1.5%)
No relaxant used (n=2)	…..	2 (1.5%)
Dexmedetomidine (n=92)	30 mcg	8 (8.69%)
	40 mcg	7 (7.6%)
	50 mcg	55 (59.78%)
	60 mcg	14(15.21%)
	70 mcg	8 (8.69%)
Morphine (n=5)	1.5 mg	7 (100%)
Buprenorphine (n=21)	60 mcg	3 (14.28%)
	90 mcg	11 (52.38%)
	120 mcg	3 (14.28%)
	150 mcg	4 (19.04%)
Fentanyl (n=11)	25 mcg	1 (9%)
	30 mcg	1 (9%)
	40 mcg	1 (9%)
	50 mcg	7 (63.6%)
	60 mcg	1 (9%)

Table 5: Types of surgeries

Forearm bone surgeries		Soft tissue surgeries of wrist and hand		Metacarpal bone surgeries		Phalanx bone surgeries	
Surgery	**Number (Percentage out of 129)**	**Surgery**	**Number (Percentage out of 129**	**Surgery**	**Number (Percentage out of 129**	**Surgery**	**Number (Percentage out of 129**
Fracture radius	19 (14.72%	Carpal tunnel release	33 (25.58%)	Fracture metacarpal ORIF/ K wire	12 (9.3%)	Fracture phalanx K wire / JESS	7 (5.42%)
Fracture ulna	15 (11.62%)	Ganglion excision	5 (3.87%)				
Fracture both bone	12 (9.3%)	Trigger finger release	3(2.32%)				
JESS fixation	7 (5.42%)	Biopsy of finger lesion	2(1.55%)				
radius/ulna K wire fixation of radius/ulna/ both bone	5 (3.87%)	De quervain's	1(0.77%				
Implant removal	3(2.32%)	Foreign body removal	1 (0.77%				
Fracture radial head excision	3 (2.32%)						
Fracture olecranon	1 (0.77%)						
Total	65 (50.38%)		45 (34.88%)		12 (9.30%)		7 (5.42%)

Table 6: Types of surgery and adjuvants used

Type of surgery	Dexmedetomidine	Buprenorphine	Fentanyl	Morphine
	Number (Percentage)	**Number (Percentage)**	**Number (Percentage)**	**Number (Percentage)**
Forearm bone surgery (total 65)	47(72.3%)	8 (12.3%)	7 (10.76%)	3 (4.61%)
Soft tissue surgeries of hand and wrist (Total 45)	33 (73.33%)	8 (17.77%)	2 (4.44%)	2 (4.44%)
K wire /ORIF metacarpal (Total 12)	9 (75%)	2 (16.66%)	1 (8.33%)	
Fracture phalanx bone (Total 7)	3 (42.85%)	3 (42.85%)	1 (14.8%)	
Total - 129	92	21	11	5

Table 7: Total Duration of procedure and number of patients

Duration (Period) Minutes	Number (Total 129)	Percentage
31-60	49	37.98
61-90	57	44.18
91-120	19	14.72
121-150	3	2.32
>151	1	0.77

Table 8: Time duration and adjuvants used

Time interval	Total number	Dexmedetomidine Number (percentage)	Buprenorphine Number (percentage)	Fentanyl Number (percentage)	Morphine Number (percentage)
30-60 min	49	36 (73.46%)	8 (16.32%)	3(6.12%)	2 (4.08%)
61-90 min	57	41(71.99%)	8 (14.03%)	6 (10.52%)	2(3.5%)
91-120 min	19	12 (63.15%)	5 (26.3%)	1 (5.26%)	1(5.26)
121-150 min	3	2 (66.66%)	0(0%)	1 (33.33%)	0(0%)
>150 min	1	1(100%)	0(0%)	0(0%)	0(0%)

Note: In three cases of 121 to 150 minutes (1) Fracture distal end of radius 130 minutes Fentanyl+Vecuronium (2)Fracture both bone fore arm 130 minutes Dexmedtomidine+Vecuronium (3)Fracture Metacarpal bone 140 minutes Dexmedetomidine+ Atracurium were the additives to Lignocaine.

Table 9: Complications of procedure

Type of complication	Number of cases (Percentage)
Local anaesthetic systemic toxicity	0
Respiratory depression	0
Local complication/extravasation	0
Tourniquet pain	2(1.55%)
Hypotension	0
Bradycardia	3 Transient bradycardias responding to atropine in 3 patients of dexmedetomidine group (3/92)-3.26%

Table 10: Efficacy of the procedure

	Outcome	No of cases and percentage	Remarks
1	Successful block for entire procedure	125 (96.89%)	Uneventful
2	Inadequate analgesia and conversion to GA in the beginning	1 (0.77%)	IVRA for JESS fixation forearm inadequate analgesia and converted to GA
3	Tourniquet pain	2 (1.55%)	Both patients complained of tourniquet pain, and was well controlled with IV paracetamol and sedation with midazolam
4	Duration exceeded the analgesia of IVRA	1 (0.77%)	Fracture both bone forearm, ORIF. Total duration was 155 minutes and had to be converted to GA intra operatively
5	Prolonged cases done successfully	3	130 minutes- 2 cases (both bone forearm and distal end of radius) 140 minutes- 1 case, Comminuted fracture metacarpal ORIF.

Discussion

This study is a retrospective study aimed at finding out the effectiveness, drugs used, surgeries done and complications of Intravenous regional anaesthesia (IVRA) for upper limb surgeries. This study was done by reviewing the anaesthesia registers, for cases of upper limb done under IVRA.

A total of 129 cases were reviewed in the study.

Gender distribution was 54.26% females and 45.74% males. The sex distribution was almost equal among the patients.

The procedure was done in various age groups ranging from 14 years to 75 years. (Table number 1). Most of the cases 86% were between the age group 21 years to 60 years. 9 cases (6.9%) were of younger age group, 14-20 years. 7 cases (5.4%) were between 61-70 years and 2 cases (1.5%) were above 70 years. These results point towards usefulness and safety of the technique in older and younger age groups. In a study by Laura Lech et al comparing IVRA and WALANT for upper limb surgeries, IVRA was done in 36 patients over 65 years of age (of which 13 patients over 80 years) with good patient satisfaction and tolerance. [1]

The technique used in all cases was a standard procedure as described in literature. It involves exsanguination of limb, use of double tourniquet and its sequential inflation and deflation. Use of double tourniquet as well as this sequence improves the quality of block and eliminates the tourniquet pain. The tourniquet pain is eliminated because the second (distal tourniquet) is applied to an area where the block have already occurred. [2] After the end of the procedure, the tourniquet is

deflated with intermittent inflation especially when the procedure is short. This intermittent deflation and inflation will allow slow release of residual drug in the venous compartment, into the systemic circulation and thereby toxicity [2-4]

The drugs used were analysed and found that lignocaine 0.5% in the dose of 3mg/kg was used in all cases (100%).

Adjuvants with lignocaine used were 1)muscle relaxants vecuronium and atracurium 2)either Dexmedetomidene or Buprenorphine or Fentenyl or Morphine in addition to muscle relaxants (Table 3)

Muscle relaxant Vecuronium 0.5 mg was used in most cases ie125/129 (96.89%). Atracurium 5 mg was used in two cases (1,55%)and in 2 cases no muscle relaxants were used (1.55%). The addition of Muscle relaxant as adjuvant in IVRA provide good muscle relaxation and suitable surgical conditions especially for deep bone surgeries where good muscle relaxation is required. Feasibility of addition of muscle relaxant in IVRA could be an advantage when compared to regional nerve blocks.

Addition of muscle relaxant as adjuvant have been found to be effective and safe method for enhancing motor blockade and improving quality of IVRA in many studies as adjuvants. In a systemic review by David Flamer et al on local anesthetic drugs and adjuvants for IVRA, it was found that muscle relaxants produce early motor block with enhancement, providing good surgical conditions. [5] A study by Santhosh MCB et al found that addition of 0.5 mg of Vecuronium as adjuvant in IVRA enhanced early onset of motor block with ideal surgical conditions, and is effective and safe. [6] Similar conclusion is seen in systemic review published in Canadian journal of Anaesthesia in 2002. [7]

In our study series, Dexmedetomidine was used as adjuvant in 92 cases (71.31%). Dose of Dexmedetomidine used was in range 30-70 mcg. 50 mcg was the commonest dose used-in 55 patients (Table 4). Many studies have pointed toward the usefulness of Dexmedetomidine as an adjuvant for IVRA.

In a study by Vani Subramanyan et al [8] on dexmedetomidine as an adjuvant for IVRA for upper limb surgeries, it was concluded that dexmedetomidine 0.5 mcg/Kg as an adjuvant to the local anaesthetic shortens the onset of motor and sensory block, improves the quality of block and provides longer post operative analgesia.. In another study by Iosofina karmaniolou etal [9] the addition of dexmedetomidine to IVRA was found to ameliorate the block characteristics -ie reduce the time for sensory block, increase the analgesia duration, reduction of rescue analgesia, and carry low risk of adverse effects. Different doses of dexmedetomidine 0.5 mcg/kg and 1mcg/kg in IVRA was compared in a study by Mansour et al [10] and concluded that the quality of IVRA improved markedly with 1 mcg/kg dose. Similar conclusion with Dexmedetomidine is seen in a in research publication by Moustaf et al in Al Azhar Medical journal viz early onset of sensory and motor block,delayed onset of Tourniqiet pain, lower post operative Visual Analogue score and longer post operative analgesia [11]. Addition of 0.5 mcg/kg of Dexmedetomidine to Lignocaine as adjunct was found to improve quality of Anesthesia, shortening of onset motor and sensory block and prolongation of post operative analgesia in different publications by abdel kader et al [12] and Memis D et al [13] also.

In the present series of cases, Buprenorphine in dose ranges 60-150mcg was used as an additive for 21 (16.27%) cases (Table no 4). In all the cases there were good anesthetic conditions facilitating the surgery. The action of opioids in IVRA is mediated through peripheral opioid receptors. [14]

Addition of buprenorphine as an adjuvant for IVRA have been found to be advantageous in many studies. In a study by Anne Kiran Kumar et al [15] comparing efficacy of plain lignocaine with additive buprenorphine 3mcg/kg added to lignocaine, concluded that Buprenorphine as an adjuvant produced early onset of analgesia ,improved quality of anesthesia and prolonged residual post operative analgesia. There was also no significant side effects in both the study groups. In another study by Nikhil swarnkar et al [16] comparing the efficacy of three groups I.e., (i) 0.5% lignocaine alone, (ii) 0.5% lignocaine with 0.3 mg buprenorphine as adjuvant of IVRA and(iii) 0.5% lignocaine with 0.3 mg buprenorphine intra muscularly, it was found that the addition of 0.3 mg of Buprenorphine as adjuvant to IVRA was associated with significantly prolonged analgesia compared to plain lignocaine or intramuscular group. Major side effects were absent in all the three groups. Similar conclusion is seen in research publication by Jitendra M et al [17] that Buprenorphine 0.3 mg as adjuvant produced early onset of sensory block as well as significantly prolonged post operative analgesia Addition of smaller doses (60 mcg) as adjuvant to IVRA was also found to significantly enhance quality of Anesthesia and post operative analgesia.{yashoda venkappa et al [18].

Fentanyl was used as additive in 11 cases (8.5%). A systemic review by David Flamer et al (5) on Fentanyl as adjuvant to Lignocaine have found to improve quality of anesthesia.(5)

In a study by Nazih Sertoz et al [19] addition of fentanyl was found to be superior to lignocaine alone in duration and quality of block.

Types of surgeries done under IVRA were reviewed in our study(Table No 5) and the adjuvants for type of surgeries were analysed (Table 6). IVRA was used for a wide variety of surgeries including soft tissue and bone surgeries of upper limb.

Soft tissue surgeries of wrist & hand such as carpel tunnel release, ganglion excision, foreign body exploration, trigger finger release, biopsy of tumour, and bone surgeries such as ORIF of radius, ulna or both, K wire fixation, JESS fixation, were done successfully. As described previously adjuvants dexmedetomidine, buprenorphine, fentanyl, morphine, along with muscle relaxant such as vecuronium and atracurium improves the quality of analgesia and muscle relaxation of IVRA and provide good surgical conditions for different soft tissue and bone surgeries of different duration.

In a study published by Abhishek Gupta etal [20], soft tissue surgeries such as carpal tunnel release, ganglion excision, foreign body exploration, trigger finger release, biopsy of tumour, and bone surgeries such as Open reduction and internal fixation of radius, ulna or both, K wire fixation, JESS fixation, radial head excision, AV malformation excision, Bone biopsy, and contracture release are found to be done under IVRA, The bone surgeries of the fore arm and hand such as Radius fracture . ulna fracture, metacarpal fracture; soft tissue surgeries such as trigger finger release, ganglion excision and carpal tunnel release have been reported to be done successfully under IVRA in the research publication by Mousthafa et al(11). A wide range of surgeries such as fracture fixation of bones of fore arm and hand, implant removal, carpal tunnel release, ganglion excision and foreign body removal are found to be done successfully under IVRA in other studies also {T E Hassan et al [21].

The total duration of technique, from introduction of cannula to the release of tourniquet after the procedure were also reviewed (Table no 7). This included the time for cannula insertion, exsanguination, application of Esmarch bandage and application of both tourniquets and the surgical time. The tourniquet time alone was not documented and hence it was not studied in the analysis.

In most cases -106 /129 (82.17%) in the study the duration was less than 90 minutes. In 3 cases the total duration was between 121-150 minutes and surgery were done successfully. In one case the duration was more than 151 minutes and was converted to GA as the patient complained of pain.

In the present study series of IVRA, there was no incidence of major complications such as local anesthetic systemic toxicity (LAST), respiratory depression or hypotension. Transient bradycardia responding to atropine was seen in 3 patients. Tourniquet pain was noted in 2 cases. (Table No: 9)

IVRA have been found to be a safe technique in many studies with low risk of side effects in many studies.

In a systemic review and meta-analysis by Karmaniolou I et al(9) on Dexmedetomidine as an additive to IVRA, it was found that the risk of potential side effects such as significant bradycardia, hypotension are low. Hemodynamic variations such as fall in Blood pressure or variations in Heart rate were found to be only transient with Dexmedetomidine 0.5mcg /kg as additive with lignocaine for IVRA in publication by Vani Subramanya et al. [8]. Also the incidence of Tourniquet pain was less with Dexmedetomidine. The incidence of major hemodynamic disturbances or local anesthetic toxicity were absent either with Lignocaine alone or in combination with Dexmedetomidine in other studies also {Mousthafa et al(11) Abdelkader et al [12] Transient bradycardia responding to Atropine was observed in studies b Tarek E Hassan et al [21] and Kiran et al [22]

In a study by Santhosh et al comparing Lignocaine alone or combination of Lignocaine with Fentanyl and Vecuronium, it was found that significant local anesthetic toxicity or major hemodynamic side effects were absent in either group.[6]

The major adverse effects such as respiratory depression and convulsion were absent with lignocaine or buprenorphine as adjuvant for IVRA as reported by Anne Kiran kumar et al (15). However, there were minor side effects such as nausea and vomiting, and pruritus.

Nikhil Swarnkar et al [16] concluded that major side effects such as respiratory or cardiac depression, or convulsions were absent in IVRA with lignocaine alone, buprenorphine as an additive or when buprenorphine was given Intramuscular (IM) along with IVRA. Minor side effects such as nausea vomiting or sedation was less in Buprenorphine as adjuvant to IVRA when compared to IM Buprenorphine.

Adequate exsanguination and by application of Esmarch bandage and elevation of limb, maintenance of adequate tourniquet pressures, injection of drug solutions as distally as possible, alternate deflation & inflation of tourniquet after the procedure are the recommendations for minimizing the occurrence of adverse effects. [14] A intact secure Tourniquet with sufficient pressures which has to be checked frequently to prevent

undue deflation is important to prevent leakage of drug into circulation. Also slow injection of IVRA drugs will help to maintain drugs within the compartment by avoiding sudden increase in venous pressures. [14]

It has been observed by angiography that almost all of Lower limb IVRA and about 25% of upper limb IVRA have slow leakage of drugs into circulation drug into circulation [14]

The review of this series of IVRA have shown that IVRA is a very effective method for providing anesthesia for upper limb surgeries. There was only one case of failure out of 129 cases necessitating conversion to GA. Only 2 patients had tourniquet pain which was well controlled with IV paracetamol and mild sedation.

The efficacy of IVRA is very high with low failure rates as evident from available literature. In a retrospective study by EM Brown et al on experience of 1906 patients over 20 years on IVRA have confirmed that IVRA is a safe and effective technique and is devoid of any significant morbidity and mortality. In a study by Kiran AV et al [22] comparing Fentanyl or Dexmeditomidine when added to Lignocaine for IVRA, it was found that for Dexmedetomidine group, analgesia was Excellent in 70%, Good in 23.3%, Fair in 6.7% and Poor in 0 % whereas for Fentanyl group analgesia was Excellent in 66%, Good in 26% Fair in 6.9% and poor in 0%.

In a study by Chan et al [23] comparing General Anessthesia, Intra venous Regional Anesthesia and Axillary block for hand surgeries, the systemic analgesic requirements as well as post operative nausea and vomiting were less in IVRA .group compared to General Anesthesia group. Cost incurred was also found to be less in IVRA . A comparative study between IVRA and Supra clavicular Brachial plexus block by Hussain et al [24] have concluded that IVRA appear to be a better alternative to Brachial plexus block with regard to onset of analgesia, quality of analgesia and degree of motor block though duration of analgesia was more with Brachia plexus block.

Limitations of Study: This study being a retrospective study comparison between drugs and their doses for their efficacy, duration of analgesia. Post operative analgesia were not done due to limited data availability. Also analysis of minor side effects such as nausea, vomiting, giddiness, etc. are also not done.

Conclusion

IVRA is a safe and effective method for providing anaesthesia for upper limb surgeries of bone and forearm, Metacarpal fractures, Phalanx bone surgeries & Soft tissue surgeries of the hands and wrists. Lignocaine 0.5% along with muscle relaxants and either Dexmedetomidine or Buprenorphine or Fentanyl or Morphine as adjuvants can be used for IVRA with high success rate. Complications with IVRA are less except for occasional Tourniquet pain, and transient Bradycardia responding to Atropine.

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