

Ultrasound Guided Interscalene Brachial Plexus Block In Arthroscopic Shoulder Surgeries: Clinical Profile

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Abstract

Over years, many more techniques were developed as the plexus is accessible at different anatomical regions depending on the clinical purpose required. In 1970, Alon Winnie described the first consistently effective and technically suitable approach to the brachial plexus block at the level of the cricoid cartilage between the anterior scalene and middle scalene muscles called as interscalene brachial plexus block. This was a prospective observational study started after attaining approval from the departmental dissertation committee and institutional ethics committee. Clinical Trials Registry-India (CTRI) registration was also obtained. Informed consent was taken by all patients included. In DMD group, 30 subjects belong to ASA-PS-I and 16 subjects belong to ASA-PS-II, In DXM group, 35 subjects belong to ASA-PS-I and 11 subjects belong to ASA-PS-II. The mean duration of surgery in DXM group was 115.52 mins and in DMD group was 119.67 mins.

Keyword: Brachial plexus block, arthroscopic shoulder surgeries, clinical profile

Introduction

The brachial plexus (plexus brachialis) is a somatic nerve plexus formed by intercommunications among the ventral rami (roots) of the lower 4 cervical nerves (C5-C8) and the first thoracic nerve (T1). Branches from the 4th cervical and the 2nd thoracic ventral ramus may contribute. The upper extremity is innervated by the brachial plexus ^[1].

Five spinal nerves gives rise to the formation of 3 trunks which subsequently divide into 6 divisions, located anteriorly and posteriorly. From these divisions, merging of nerves will form 3 cords as the lateral, posterior and medial cords. Finally 5 specific nerves will arise from the cords as the terminal branches of the brachial plexus allowing specific muscles of the upper limb to perform corresponding actions. Apart from these nerves, there are also collateral nerves which are found in the brachial plexus which innervate the proximal limb muscles as they arise proximal to the ventral rami, trunks and cords ^[2].

The first brachial plexus block was performed by William Stewart Halsted, in 1885, at the Roosevelt Hospital in New York City. The need for surgical exposure of the brachial plexus led to limited clinical utility of this technique.

Over years, many more techniques were developed as the plexus is accessible at different anatomical regions depending on the clinical purpose required. In 1970, Alon Winnie described the first consistently effective and technically suitable approach to the brachial plexus block at the level of the cricoid cartilage between the anterior scalene and middle scalene muscles called as interscalene brachial plexus block ^[3].

Winnie's approach was modified over the years to include some variations to the technique. More recently, the introduction of ultrasound guided techniques has allowed for additional refinements and improved block consistency with reduced local anaesthetic volumes and lesser complications ^[4].

In the early 1800's Lazzaro Spallanzani, an Italian biologist discovered ultrasound after studying bats which navigate using sound rather than sight. It is also known as echolocation where locations are determined through sound waves being reflected or bounced back from objects in an environment. The same principles are used in ultrasonography ^[5].

In 1877, Pierre and Jacques Curie discovered piezoelectricity and it was found that ultrasound waves are emitted by piezoelectric effect. At present ultrasound has gained paramount importance in many fields especially the medical field.

In 1942, Karl Dussik used ultrasonic waves as a diagnostic tool for the first time, since then ultrasound technology and its application in medical field have continued to evolve ^[6]. The advancement and refinement of procedures are happening every day.

Ultrasonography as a means to guide peripheral nerve blockade (PNB) was first explored by anesthesiologists at the University of Vienna in the mid- 1990s. Though radiologists had made use of ultrasound technology to guide needles for biopsy, the application of this imaging modality for PNB was novel at that time. The utility of ultrasound to facilitate a range regional anaesthesia techniques including brachial plexus and femoral blocks was demonstrated. A number of advances in technology took place in the meantime, including smaller and more mobile ultrasound platforms, improved resolution and needle recognition software, all cumulatively leading to increased bedside utility of ultrasound by anesthesiologists ^[5].

Introduction of ultrasound guidance in regional anaesthesia has led to refinement of many nerve block techniques, expanded use of PNB and greater acceptance by surgical colleagues and patients.

Ultrasound guided interscalene brachial plexus block has been one of the popular regional anaesthesia technique for shoulder and proximal humerus surgeries. General anaesthesia when combined with nerve block reduces intraoperative anaesthetic and analgesic requirements and provides good postoperative analgesia. Nerve blocks when performed with the addition of adjuvants are known to prolong the duration of analgesia ^[6].

Methodology

This was a prospective observational study started after attaining approval from the departmental dissertation committee and institutional ethics committee. Clinical Trials Registry-India (CTRI) registration was also obtained. Informed consent was taken by all patients included.

Inclusion Criteria

- 18-60 years of either gender.

- ASA PS I or II.
- Patients undergoing elective arthroscopic shoulder surgeries under interscalene block with 0.2% ropivacaine + 1 µg/kg of dexmedetomidine or 100 µg/kg of dexamethasone + GA as per standard protocol.

Exclusion criteria

- Patient refusal.
- On anticoagulants or h/o of bleeding disorder.
- Neurological deficits.
- Known allergy to local anaesthetics.
- Local infection at injection site.
- History of seizures.
- Pregnant women.

Sample size

Calculated based on the duration of sensory blockade (pilot study). 30% difference in duration of sensory blockade between the groups was considered to be significant, with α -error of 0.05 and power of 80%, a total of 92 patients were required. We included forty six patients in each group.

Results

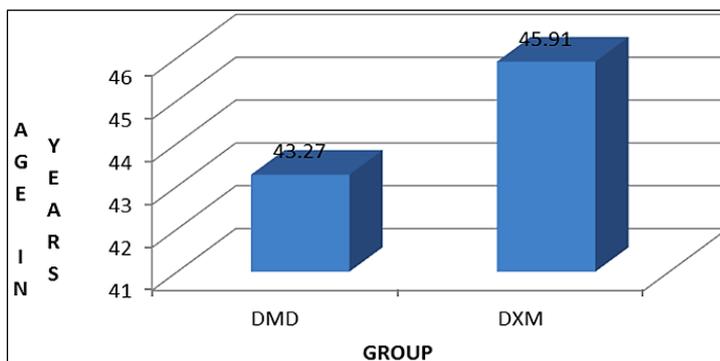


Fig 1: Mean Age

The mean age of study subjects in DXM group was 45.91 years and in DMD group was 43.27 Years.

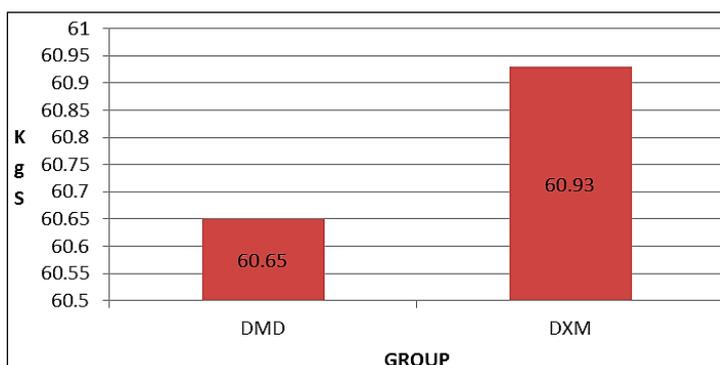


Fig 2: Mean Weight

The mean weight of study subjects in DXM group was 60.93 Kgs and in DMD group was 60.65 Kgs.

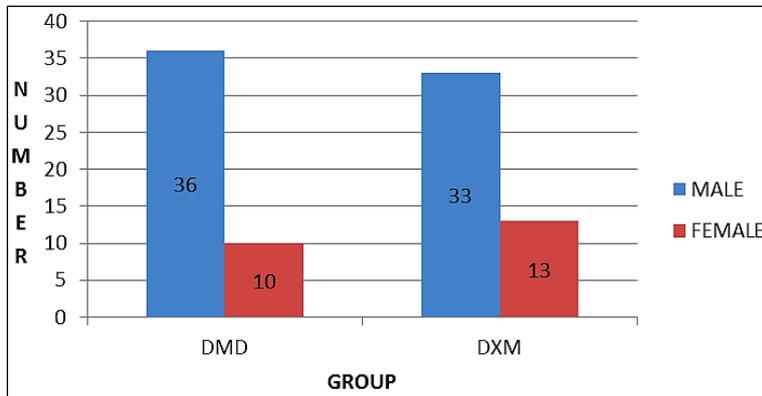


Fig 3: Gender Distribution

In DMD group, 36 males and 10 females participated in the study.
In DXM group, 33 males and 13 females participated in the study.

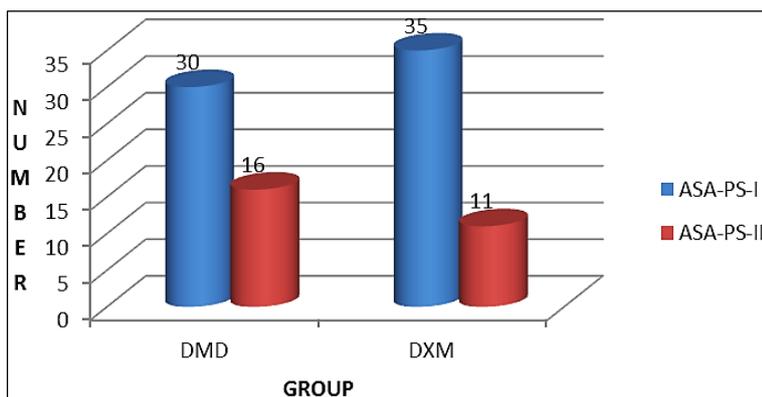


Fig 4: ASA PS

In DMD group, 30 subjects belong to ASA-PS-I and 16 subjects belong to ASA-PS-II.
In DXM group, 35 subjects belong to ASA-PS-I and 11 subjects belong to ASA-PS-II.

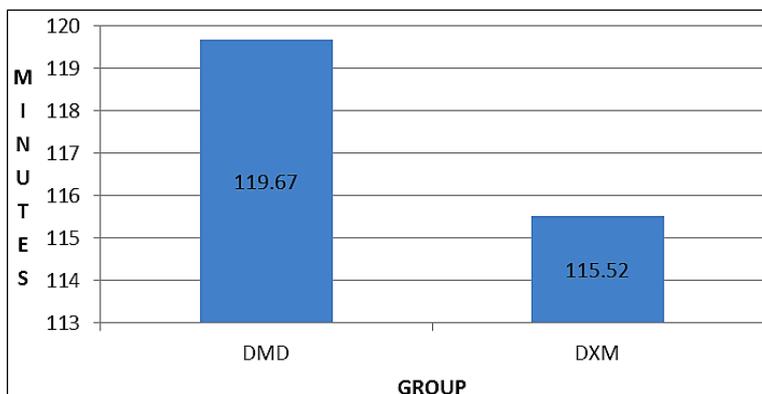


Fig 5: Mean Duration of Surgery

The mean duration of surgery in DXM group was 115.52 mins and in DMD group was 119.67 mins.

Discussion

Ropivacaine is a local anaesthetic belonging to amino amide group and it is also long acting. Bupivacaine and mepivacaine also belong to the same group but differ in multiple characteristics.

Chemically ropivacaine is a monohydrate of hydrochloric salt of 1-propyl-2, 6 piperidylidide compared to bupivacaine which has butyl group.⁸ Ropivacaine is prepared as an optically pure S-enantiomer from parent chiral molecular ropivacaine, whereas bupivacaine and mepivacaine are available as racemic mixtures.

Ropivacaine causes reversible inhibition of sodium ion influx by which the nerve impulse conduction occurs. Ropivacaine does not penetrate into large myelinated motor fibres as it is less lipophilic compared to bupivacaine. It has selective action on C fibres which carry pain sensation than on motor fibres. Clinically once the action of the drug begins, pain sensation, temperature, touch, proprioception and skeletal muscle tone is lost in the same order. Ropivacaine is known to have intrinsic property of vasoconstriction and addition of adrenaline has not shown any extra benefits ^[7].

It is contraindicated in patients who have known hypersensitivity to local anaesthetic agents. Several studies are done till now to compare the safety profile of ropivacaine with other local anaesthetics and most of the studies inferred that ropivacaine has better safety profile. Reiz et al. ^[8] conducted study on pigs by injecting equipotent doses of ropivacaine and bupivacaine intra-arterially (left anterior descending artery) and found out that the former is less cardio toxic than bupivacaine.

Moller et al. ^[9] conducted studies on rabbit's Purkinje fiber and found out that ropivacaine depresses cardiac excitation & conduction, thereby decreases arrhythmogenic potential. Hence ropivacaine is preferred over bupivacaine in elderly patients.

Local anaesthetics have done miracle in providing analgesia in any surgical intervention for acute pain and also for chronic pain management. But some of the factors limit their usage alone in large quantity. Adjuvants or additives are the drugs co-administered. They provide synergistic effect. They are also limit the cumulative dose of local anaesthetics required to achieve the block.

The collection of additives have progressed to a wide range of drugs with different mechanisms of action. Opioids such as morphine, hydromorphone, fentanyl, buprenorphine, tramadol have been used. However, their use has been restricted due to their adverse effects. Adrenaline is added to local anaesthetics due to its vasoconstrictive property. It is also found out that it also has antinociceptive properties. Hence epinephrine is used as an adjuvant commonly.

Alpha 2 adrenoreceptor agonists like clonidine and dexmedetomidine are one of the most extensively used class of adjuvants in recent era. The analgesic effects are both due to central and peripheral actions. However, they have effects on haemodynamics as well such as hypotension and bradycardia. They are also found to produce sedation due to central actions. In spite of all these side effects, many studies have concluded that they are helpful in providing better and prolonged analgesia.

Steroids are another category of drugs used as adjuvants to local anaesthetic agents due to their anti-inflammatory properties as well as local actions when administered perineurally. Most commonly used steroid is dexamethasone ^[10].

Conclusion

Total of 92 patients were included in the study and there were no drop outs and none had failed block. Both the groups were comparable with respect to age, gender, weight and ASA-physical status. The duration of surgery in both the groups were also comparable.

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