"COMPARISION OF AUDIOVISUAL TECHNOLOGY VERSUS SEDATIVES FOR ANXIETY MANAGEMENT DURING PROCEDURES UNDER BRACHIAL PLEXUS BLOCK – A RANDOMIZED CONTROL TRAIL STUDY."

By

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Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"COMPARISION OF AUDIOVISUAL TECHNOLOGY VERSUS SEDATIVES FOR ANXIETY MANAGEMENT DURING PROCEDURES UNDER BRACHIAL PLEXUS BLOCK – A RANDOMIZED CONTROL TRAIL STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

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ABBREVIATIONS

3D – Three Dimensional

ASA – American society of anaesthesiology

dB – Decibel

DSM-5 – Diagnostic and statistical Manual of Mental disorder, 5th edition

VR - virtual reality

AV - Audio visual

CBT – cognitive behavioural therapy

DFA – Dental fear and anxiety

ECG – Electro cardiogram

FIS – Facial image scale

GAD – General Anxiety disorder

HR – Heart rate

VAS-A - Visual Analog Scale for Anxiety

MD – Mean difference

MDAS - Modified Dental Anxiety Scale

NIBP – Non invasive blood pressure

NPO – Nil per mouth

OCD - Obsessive-Compulsive Disorder

PD – Panic disorders

PTSD - Post-traumatic Stress Disorder

FIS - Facial Image Scale

IANB - inferior alveolar nerve block

RCTs – Randomized control trails

RR – Respiratory Rate

STAI-6 – State Trait Anxiety Inventory 6

TSD – Tell Show Do

ABSTRACT

TITLE:

Comparison of audiovisual technology versus sedatives for anxiety management during procedures under brachial plexus block – a randomized control trail study: A Randomized control trial.

CONTEXT:

Brachial plexus block is the most commonly used mode of anaesthesia for upper limb surgeries. As a potential alternative to pharmaceutical interventions, this study aims to examine the effects of Audio-visual distraction during procedures under Brachial plexus block, particularly focusing on whether intraoperative Audio-visual distraction impacts patient anxiety and postoperative satisfaction.

AIMS:

To compare anxiety between patients who were received Audio-visual distraction and patients receiving Midazolam after undergoing brachial plexus block using STAI-6 anxiety sccoring. To compare hemodynamic parameters, Numerical pain score and Visual analogue score in both the group.

SETTING AND DESIGN - A year hospital based randomized clinical trail

MATERIALS AND METHODS:

A total of 86 Patients aged above 18 years of age, of either gender, belonging to ASA grade I-III, undergoing surgery under Brachial plexus block were enrolled in the study and randomized into two groups. GROUP AV: patients will use audiovisual gadgets in which they will visualize content of their own preference. Group S: In sedation group, patient will receive intravenous Midazolam 0.05 mg/kg. Anxiety was measured with the STAI-6 scoring, VAS score and Numerical Pain score after the procedure is done and intraoperative hemodynamic parameters were watched over and noted until the end of the surgery.

RESULT:

Group-S had better STAI-6 score for anxiety and better hemodynamic stability as compared to the Group-AV. The STAI-6 score for anxiety scores and hemodynamic parameter were consistent without any major fluctuation.

CONCLUSION:

The sedation group demonstrated superior effectiveness in managing anxiety compared to audiovisual distraction. Patients reported significantly lower anxiety levels and greater comfort during procedures with sedation. These findings suggest sedation is a more reliable option for optimal anxiety control in clinical settings. Intraoperative music therapy also leads to reduced requirement of intraoperative sedation.

KEYWORDS:

Audio visual distraction, Virtual reality, Anxiety management.

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INTRODUCTION

The brachial plexus block is commonly employed for upper limb surgeries, and this study explores virtual reality distraction as a novel, non-pharmacological intervention to enhance patient experience. In particular, it looks at how intraoperative virtual reality distraction can lower patient anxiety and increase postoperative satisfaction for surgeries under brachial plexus block.

Anxiety during surgery is frequent and can have a severe impact on a patient's perioperative course by increasing stress indicators, causing hemodynamic fluctuations, and impairing postoperative recovery. Medications like short-acting benzodiazepines are frequently used to address preoperative anxiety. Midazolam is known to have challenging side effects such as respiratory depression and hemodynamic disturbances and paradoxical effects such as hostility, aggression and psychomotor agitation [1]. At the same time Midazolam has a fast recovery time and is used as premedication for many procedures, the anterograde amnesic property of midazolam may be useful for premedication before a procedure, to reduce any associated unpleasant memories [2]. As a result, efforts are being made to lessen perioperative pain and anxiety through a variety of non-pharmacological therapies [3]. It is customary to divert patients in these circumstances in an effort to reduce their anxiety and discomfort. The use of virtual reality is a type of distraction, it creates an artificial environment that mimics real-world scenes and objects [4]. Distraction through virtual reality is a new method of behaviour regulation. In the past, virtual reality was only acknowledged for its entertainment appeal. In order to effectively manage patients during uncomfortable operations, it was recently incorporated into dentistry and medical professions [5].

Orthopaedic surgery focuses on treating issues related to bones, muscles, and tendons—areas of the body that are particularly sensitive. Because these procedures often require significant manipulation of tissues, they tend to be more invasive, leading to higher levels of pain and anxiety for patients compared to many other types of surgeries [6]. Hospital noise levels can occasionally increase to dangerous levels for both patients and employees. Although the noise level in the operating room can occasionally surpass 90 dB, it normally falls between 60 and 65 dB. Due to the use of hammers and drills, orthopaedic operations have a tendency to generate the most noise. An oscillating saw can produce noise levels of up to 105 decibels. Both pharmaceutical and non-pharmacological methods can be used to help the patient feel more at ease and reduce the effects of noise and anxiety in the operation room [7].

The gate control theory explains that pain is an uncomfortable feeling caused by harmful stimuli. Inside the spinal cord, interneurons help regulate and tone down the intensity of these pain signals. How someone feels pain depends on their awareness, emotions, and past experiences with pain. Since our attention is limited, shifting focus away from pain can actually help reduce its impact. Distraction techniques, like virtual reality (VR) therapy, work by immersing the user in an engaging environment that captures their full attention. This distraction helps lessen the focus on painful sensations, reducing the intensity of the discomfort [6].

VR has been theorized to be able to overcome pain by using up a person's limited cognitive attentional resources. Therefore, pain felt is lessened by relocating patients away from painful stimuli to a virtual world that is pleasant [8]. At the same time, Virtual reality (VR) mimics the outside world and body, but not within [9]. Hence AV distraction may be a helpful addition to the well accepted traditional behaviour management strategies now in use [10]

AIMS AND OBJECTIVES

Primary objective:

To evaluate anxiety rating between two groups receiving two different interventions, namely Audiovisual stimulation and sedatives in decreasing anxiety post Brachial plexus block administration.

Secondary objective:

Comparing hemodynamic parameters, Numerical pain score and Visual analogue score in both the group.

REVIEW OF LITERATURE

1)“Vuong et al” (2024) in Washington state university examined how well virtual reality (VR) therapy works for managing postoperative pain, especially in orthopedics. In comparison to controls, patients' pain scores on the Visual Analog Scale (VAS) decreased by 1.62 points ($p < 0.001$), indicating that VR therapy considerably decreased patients' anxiety and discomfort. VR-based rehabilitation improved functional outcomes (WOMAC scores, $p < 0.01$) and pain levels (VAS) within a month in orthopedic settings ($p = 0.02$). Results on opioid reduction, however, were not always consistent, with some trials finding no discernible differences. The authors came to the conclusion that virtual reality (VR) treatment is a promising adjunct for managing pain and anxiety, particularly in acute pain situations. However, more study is required to prove VR therapy's involvement in lowering opioid use and its long-term advantages in orthopaedic recovery [6].

2)"Lin Fan, Jie Zeng, Longkuan Ran, et al. Chongqing Medical University in china carried out a thorough review in 2023 to assess the therapeutic effectiveness of virtual reality (VR) distraction therapy in reducing pain and anxiety. Included were 22 studies with 1,522 patients between the ages of 0 and 60, 8 of which focused on adults and 14 on children. The studies' designs ranged from mixed-methods research to single-blind controlled crossover studies and randomized controlled trials.

Both adult and pediatric patients' anxiety levels were considerably lowered by VR. Preoperative interventions and the excision of a third molar are two procedures in which VR has been demonstrated to reduce anxiety in adults. According to one study, for example, using VR during the extraction of a third molar significantly reduced anxiety scores (anxiety score: -1.5 with VR vs. +4.0 without VR). VR proved especially useful in helping kids feel less anxious during local anesthetic procedures. VR dramatically decreased anxiety scores after endodontic treatment (mean anxiety score: 11.58 with VR vs. 17.68 without VR), according to a study including children ages 8 to 14. According to the review's findings, VR is a useful non-pharmacological technique for reducing dental treatment-related pain and anxiety. It provides a non-invasive, safe substitute for conventional pharmaceutical treatments, with the added advantage of enhancing patient compliance and satisfaction [8].

3)“Halder et al (2023) in AIMS, India,” conducted a comprehensive study on the role of music in medicine, emphasizing its application in perioperative care. The authors concluded that music interventions significantly reduced anxiety, stress, and postoperative pain, with a notable decrease in heart rate and blood pressure. Standard deviation values for pain scores showed a reduction from 6.8 ± 1.2 to 4.5 ± 1.0 ($p < 0.05$), indicating statistical significance. The study highlights music as a cost-effective, non-invasive adjunct to traditional anaesthesia practices [3].

4)“J.S. Quek, B. Lai, A.U. Yap, and S. Hu” carried out an umbrella review in 2022 to compile information on the effectiveness of non-pharmacological methods for treating dental fear and anxiety (DFA) in kids and teenagers. The purpose of the review was to assess how these tactics affected behavior, anxiety, and pain perception during dental treatments. Following the Joanna Briggs Institute methodology, the study included 13 systematic reviews (SRs) from

191 identified studies that focused on non-pharmacological interventions like aromatherapy, cognitive behavioral therapy (CBT), traditional behavior management techniques, and audio-visual (AV) distraction.
According to the analysis, the best method for lowering anxiety for procedures—especially those that call for local anesthesia—was audio-visual distraction. Virtual reality (VR), films, and music are examples of AV distraction, which dramatically lowered children's self-reported anxiety levels. For instance, when VR was utilized during treatments, one SR reported a substantial decrease in anxiety (Mean Difference [MD] = -1.75; p=0.009). AV distraction's impact on behavior and pain perception, however, varied. While some studies found no significant differences (MD = -0.64; p=0.57), others reported considerable reductions in pain (MD = -1.46; p=0.008). youngsters's cooperative behavior was also enhanced by AV distraction; some research found that youngsters responded more favorably and behaved less disruptively during dental appointments [10].

5)"Haramripal Kaur, Nipun Saini, Gurpreet Singh, et al in Faridkot" carried out a randomized controlled trial in 2022 to assess how music might help patients undergoing orthopedic surgeries under spinal anesthesia feel less anxious during the procedure, stabilize hemodynamic parameters, and be more satisfied. At a tertiary care hospital, 70 adult patients who were scheduled for lower limb surgery participated in the study. Patients were randomly assigned to one of two groups: Group C (control group, n = 35) wore noise-canceling headphones to listen to regular operating room noise, while Group M (music group, n = 35) listened to standard relaxing music. The findings revealed that patients in the music group had significantly lower heart rates (HR) starting at 10 minutes ($p = 0.003$) and throughout the surgery ($p < 0.001$), with average HR values of 90.3 ± 10.5 in Group M versus 104.0 ± 13.9 in Group C. Respiratory rates (RR) were also notably lower in the music group ($p < 0.05$). Anxiety levels, measured using the Visual Analog Scale for Anxiety (VAS-A), dropped significantly in Group M ($p < 0.001$). Moreover, patients in the music group reported higher satisfaction, with 77.1% feeling "very satisfied" compared to just 8.6% in the control group. The study also emphasized the negative consequences of loudness in the operating room, which might make patients feel more anxious. Because of the usage of tools like drills and hammers, noise levels in orthopedic procedures can approach 105 dB. Through neurological connections in the auditory system, music therapy has been shown to counteract these effects by lowering stress hormones and encouraging relaxation [7].

6)A comparative study was carried out by "Greeshma SG et al" (2021) to assess the effectiveness of three distinct distraction strategies in lowering anxiety levels in juvenile dentistry patients: audio distraction, virtual reality (VR) distraction, and tell-show-do (TSD) approach. In particular, the study sought to identify the most efficient technique for reducing anxiety during dental procedures including the excision of a mandibular tooth that required an inferior alveolar nerve block (IANB). Using the Modified Dental Anxiety Scale (MDAS), 90 children between the ages of 6 and 8 who had moderate dental anxiety participated in the study. The children were randomly assigned to one of the three groups: VR distraction, audio distraction, or TSD technique. Anxiety levels were assessed both subjectively (using the Facial Image Scale, FIS) and objectively (using pulse rate and oxygen saturation measured with a pulse oximeter) before and after the distraction techniques.

With the lowest post-distraction pulse rates and the largest decrease in FIS scores, the data showed that VR Distraction was the most successful in lowering anxiety. The TSD Technique, a common and non-aversive technique in pediatric dentistry, was the least successful, whereas the Audio Distraction group also shown a considerable reduction in anxiety, especially in raising oxygen saturation levels. The study came to the conclusion that virtual reality distraction might be a useful tool for helping juvenile dentistry patients manage their anxiety, but more studies with bigger sample sizes are required to confirm these results [5]

7)) In 2020, a systematic evaluation was carried out by "Veronica Lambert" and associates to assess the benefits and drawbacks of virtual reality (VR) distraction therapies for kids in hospitals who are in severe pain. When children between the ages of 0 and 18 endure numerous medical procedures, including needle-related interventions, wound dressings, and physical therapy sessions, the review sought to ascertain whether VR distraction could lessen the severity of acute discomfort. Other VR distraction techniques, non-VR distraction, and no distraction were all contrasted in the study.

A total of 1008 participants from 17 randomized controlled trials (RCTs) were included in the review. Acute pain intensity during and up to an hour after the procedure was the main outcome measured, and it was determined using behavioral measurements, observer reports, and self-reports. Adverse effects, expense, parent worry, pain-related suffering, kid happiness with VR, and rescue analgesia were secondary outcomes [4].

8) In 2019, "Veena Graff, Lu Cai, Ignacio Badiola, and Nabil M. Elkassabany" performed a prospective randomized controlled research to examine the impact of intravenous midazolam versus music therapy on preoperative anxiety in patients having single-injection peripheral nerve blocks guided by ultrasonography. The purpose of the study was to determine whether music, a non-pharmacological intervention, might effectively reduce preoperative anxiety in relation to midazolam, a frequently used anxiolytic.

157 patients participated in the study and were randomly assigned to one of two groups: the music group (n=77), which played music chosen for the study through noise-canceling headphones, or the midazolam group (n=80), which got intravenous midazolam (1–2 mg). Before and after the procedure, the State Trait Anxiety Inventory-6 (STAI-6) scores were compared as the main outcome. Communication issues, vital signs during the procedure, and patient and physician satisfaction scores were examples of secondary outcomes [1].

9) A meta-analysis of 25 studies was done by "Riva et al" (2019) to investigate the benefit of virtual reality (VR) in emotional wellness. With effect sizes similar to those of conventional exposure therapies, the authors discovered that virtual reality considerably lowers anxiety symptoms in a variety of diseases ($p < 0.05$). On the Visual Analog Scale (VAS), VR distraction decreased pain intensity by an average of 1.62 points when compared to controls ($p < 0.001$). According to the study's findings, VR has long-term advantages that carry over into real-world situations and is very successful in treating pain, eating disorders, and anxiety disorders. According to the scientists, VR is an effective tool for cognitive and emotional

control in therapeutic settings because it may produce embodied simulations that are in line with the brain's neural programming capabilities [9].

10) A systematic study by “Conway et al” (2016) examined the efficacy of midazolam in sedating patients before to procedures by contrasting it with a placebo and alternative sedatives. When compared to a placebo, the authors found that intravenous midazolam considerably decreased anxiety, as evidenced by mean anxiety scores falling from 3.97 ± 0.44 to 1.52 ± 0.3 ($p < 0.0001$). Furthermore, compared to a placebo (mean 4.62 ± 1.49, $p < 0.005$), oral midazolam demonstrated lower pain scores (mean 2.56 ± 0.49). In comparison to a placebo, intranasal midazolam similarly reduced anxiety ratings (mean 17.3 ± 18.58 vs. 49.3 ± 29.46, $p < 0.001$). On the other hand, there was conflicting data about oral midazolam's capacity to lessen procedure anxiety. The evaluation pointed out that although midazolam successfully produced drowsiness and anxiolysis, there was insufficient evidence to support its advantage over other drugs, such as chloral hydrate. Further high-quality studies are necessary to clarify midazolam's optimal use and comparative efficacy [2].

BASIC SCIENCE

Brachial plexus is a somatic plexus formed by the anterior rami of C5 to C8, and most of the anterior ramus of T1. The plexus originates in the neck, passes laterally and inferiorly over rib I, and enters the axilla. All the major nerves that innervate the upper limb originate from the brachial plexus, mostly from the cords.

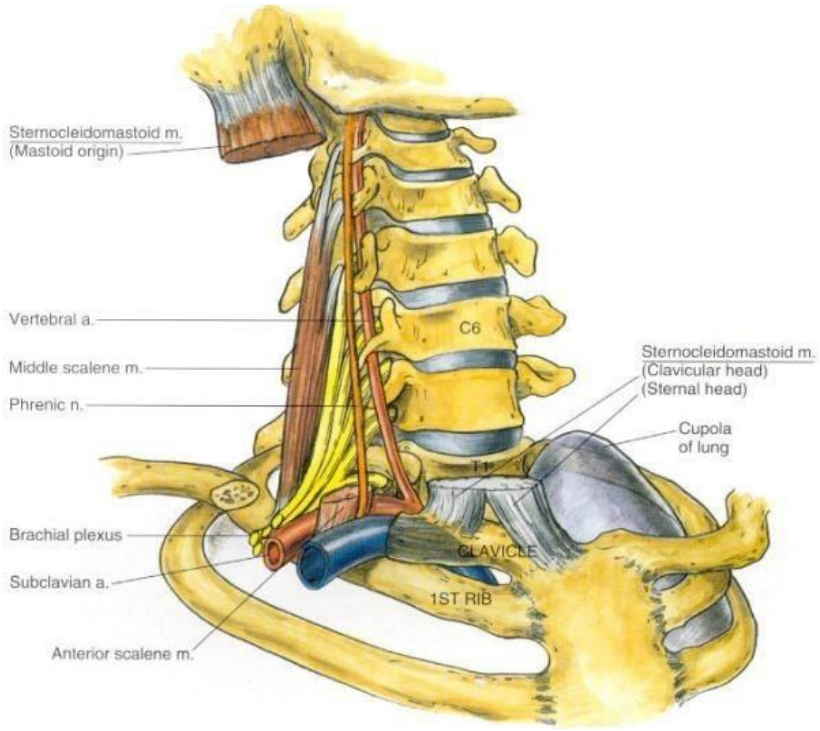


Figure 1-Anatomy of Brachial Plexus

Parts of brachial plexus (21-22)

- Roots
- Trunks
- Divisions
- Cords
- Nerves

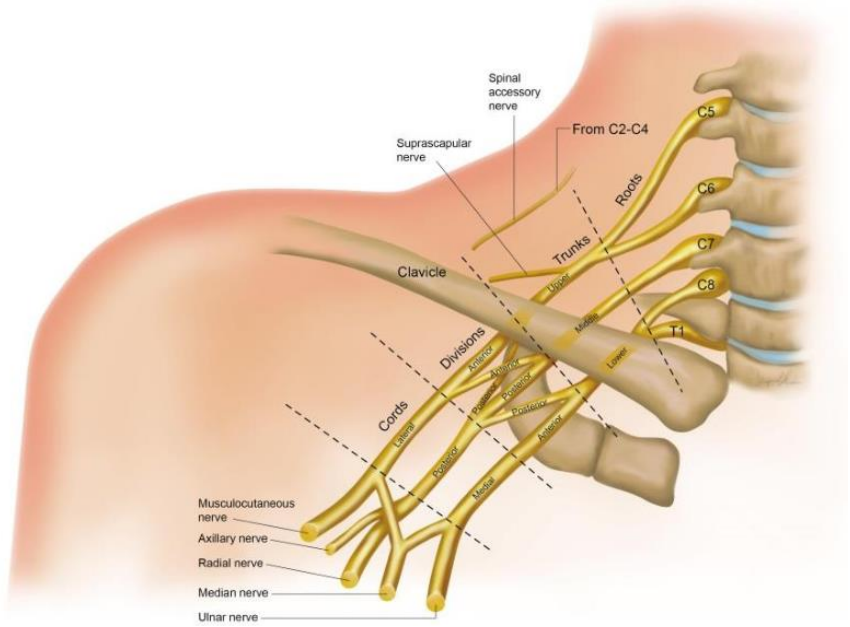


Figure 2-Parts of Brachial Plexus

ROOTS

Brachial plexus roots originate from the anterior rami of C5-C8 spinal nerves and most of T1. They pass between the anterior scalene and middle scalene muscles and enter posterior triangle of the neck. They lie superior and posterior to subclavian artery.

The origin of the plexus may shift by one segment either upward or downward and it is known as prefixed or postfixed plexus.

In prefixed segment contribution by C4 is large and from T2 is absent and in postfixed segment contribution from T1 is large and T2 is always present. C4 is absent and contribution from C5 is reduced.

TRUNKS

Roots join to from the three trunks of brachial plexus. They pass laterally over the first rib and enter the axilla.

Superior trunk- Formed by the union of C5 and C6 roots.

Middle trunk- It is the continuation of C7 root.

Inferior trunk- Formed by the union of C8 and T1 roots.

DIVISIONS

Each trunk divides into anterior and posterior division. The anterior divisions ultimately supply the anterior compartment of the arm and forearm through the peripheral nerves which arise from them. Nerves which are associated with the posterior compartment of arm and forearm arise from the posterior divisions.

CORDS

The three cords originate from the divisions. They are associated with the second part of axillary artery.

Lateral Cord- It is formed by the union of anterior divisions of upper and middle trunks (C5-C7); Medial cord -It is formed by the union of anterior division of lower trunk (C8-T1) Posterior cord -It is formed by the union of posterior divisions of all three trunks (C5-T1).

There are three parts of the axillary artery named for their positions above (medial to), behind, and below (lateral to) the pectoralis minor muscle. Typically, with a ultrasonogram probe placed to view the transverse axis of the cords, the medial cord lies inferior, the lateral cord superior, and the posterior cord posterior to the first part of the axillary artery. Immediately beyond the pectoralis minor muscle, the three cords diverge into the terminal branches, including the median, ulnar, radial axillary, and musculocutaneous nerves.

The phrenic nerve normally descends anterior the scalenus anterior muscle and crosses the muscle from lateral to medial as it descends and passes under the clavicle and through the superior thoracic aperture into the superior mediastinum.

Terminal branches of Brachial Plexus:

In distal axilla, the cord gives rise to terminal branches namely the ulnar, medial and radial nerves.

Branches of the roots:

Nerve to serratus anterior C5, C6,C7

Nerve to rhomboids C5(minor & major)

Branches of the trunk:(arise from the upper trunk)

Supra scapular nerve(C5,C6)

Nerve to subclavius(C5,C6)

Lateral cord:

Lateral pectoral nerve(C5, C6,C7)

Median nerve (lateralroot)(C5,C6,C7)

Musculocutaneous nerve(C5,C6,C7)

Medial cord:

Medial pectoral nerve(C8,T1)

Medial cutaneous division of arm (C8,T1)

Medial cutaneous division of fore arm(C8,T1)

Ulnar nerve (C8,T1)

Median nerve (medial root C8,T1)

Posterior cord:

Upper and lower subscapularnerve(C5,C6)

Thoraco dorsalnerve (C6, C7, C8) O

Axillary nerve (C5,C6)

Radial nerve (C5,C6,C7,C8)

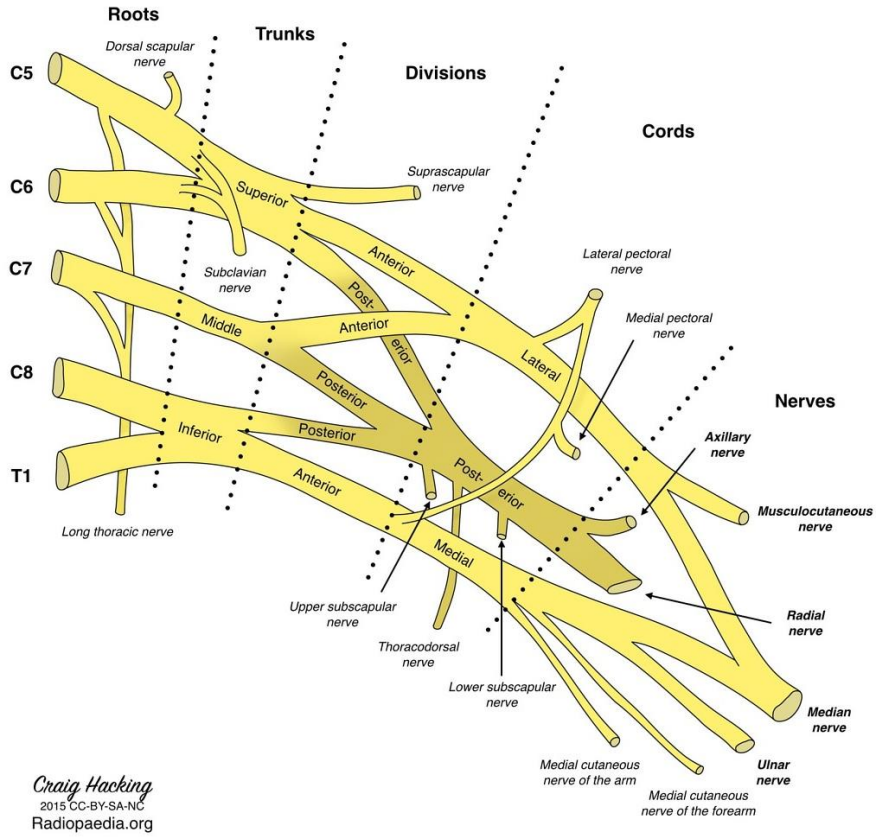


Figure 3-Schematic Diagram of Brachial Plexus

Landmark Technique

Roots

The roots lie between the inter scalenus (anterior & medial) muscles. It is situated cephalo posterior to the second part of subclavian artery. It is the ideal landmark for classical interscalene block.

Trunks

In the posterior triangle, upper and middle trunks emerge above the subclavian artery as they traverse the first rib, but the lower trunk passes behind the artery. The trunks are enclosed by the skin, platysma and deep fascia superficially. Trunks are over lied by external jugular vein, inferior belly of omohyoid and supraclavicular nerves. The trunks are easily identified by palpation. This landmark is often used for perivascular approach of brachial plexus block.

The divisions emerge from the trunks at the lateral border of first rib and exists behind the clavicle, and then descends into axilla. The rib hitching technique of brachial plexus is performed in this area.

Cords

The cords lie around the axillary artery at the apex of axilla. The Medial cord lies behind the artery, but the posterior and lateral cords are situated lateral to the artery. The infraclavicular approach causes the blockade at the junction of divisions &cords.

Different approaches of brachial plexus block

The various approaches for brachial plexus include:

- Interscelene approach
- Supraclavicular approach
- Infraclavicular approach
- Axillaryapproach

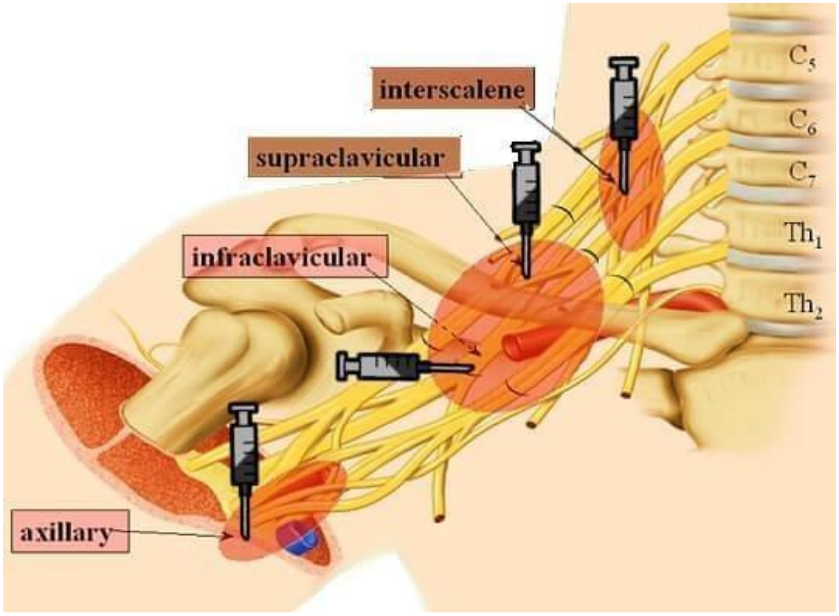


Figure 4-Different Approaches Of Brachial Plexus Block

Interscalene Brachial plexus Block

It is indicated for surgical anaesthesia of the shoulder surgeries such as rotator cuff repair, acromioplasty, hemiarthroplasty and total shoulder replacement, humerus fractures upper arm, forearm but often insufficient for surgeries involving the medial aspect of the forearm or hand. It effectively blocks the proximal nerve roots, distal cervical plexus, and important

nerves such as the suprascapular, which exit proximally from the plexus. Frequently it spares the lowest branches of the plexus (C8,T1) and is not suitable for distal upper limb procedures.

Supraclavicular Brachial Plexus Block

It is indicated in surgeries involving arm, elbow, forearm and hand surgery. It targets the trunks or divisions of the brachial plexus depending on the location of the injection site. Here the brachial plexus is confined to its smallest surface area so success rate of block is high. The three trunks carry the entire sensory, motor, and sympathetic innervation of the upper extremity, with the exception of the uppermost part of the medial side of the arm.

Infraclavicular Brachial Plexus Block

It is indicated in surgeries involving arm, elbow, forearm and hand surgeries. It targets the cords of the brachial plexus and the nerves can be blocked next to the second part of the axillary artery at the level of the coracoid process. It offers excellent analgesia of entire arm and allows introduction of continuous catheters to provide prolonged post-operative pain relief. However the plexus at this level is situated deeper and it is more challenging to give the block.

Axillary Brachial Plexus Block

It is useful in elbow, forearm and hand surgeries. It blocks four nerves Musculocutaneous, Radial, ulnar and median nerves. The nerves targeted for axillary block course distally with the axillary artery and vein along the humerus from the apex of the axilla. This block is useful for surgery of the elbow, forearm, and hand. The ulnar,median, and radial nerves are the primary targets. The musculocutaneous nerve often leaves the plexus (via the lateral cord) proximal to this point and may be blocked separately during the axillary block (in the coracobrachialis muscle) or at mid-humeral locations (along its diagonal course through or beyond the coracobrachialis muscle).

Landmark Technique for Brachial plexus block.

Interscelene Brachial plexus block-

It targets the roots of brachial plexus.The interscalene groove is palpated by rolling the fingers posteriorly off the lateral border of the sternocleidomastoid muscle.It lies between the

interscalene muscles (Anterior and medial).After the patient relaxes, the prominent transverse process of C6 can often be felt directly in the groove and should be marked.

Supraclavicular Brachial plexus block.

It targets the trunks or divisions of the brachial plexus. The clavicle is palpated and midpoint of the clavicle is marked. A point is placed posterior to clavicle in sternocleidomastoid groove. Needle will be inserted at an angle of 45 degree in parasagittal plane at the superior border of the clavicle along the lateral edge of the sternocleidomastoid.

Infraclavicular Brachial plexus block-

There are different approaches of giving Infraclavicular brachial plexus block using landmark technique. With the patient's arm adducted and their hand resting on their abdomen, the medial aspect of the coracoid process is palpated. Needle is placed where clavicle meets the medial border of corocoid process at an angle of 0-15 degree. Usually posterior or medial cord of brachial plexus comes in contact.

Axillary Brachial plexus block-

The axillary artery is marked as high in its course through the axilla. It is usually felt in the intramuscular groove between the coracobrachialis and the triceps muscles. It also passes between the insertions of the pectoralis major and the latissimus dorsi muscles on the humerus. The artery should be palpated and needle should be placed in cephalad direction and injected inferiorly and superiorly around the artery.

Limitations of Landmark Technique:

There are many variations in the anatomy of the brachial plexus, and in the course of the terminal nerves and vascular elements. Some of these variations may contribute to difficulty in performing peripheral nerve block since there may be unexpected nerve stimulator responses (e.g., if two nerves are conjoined) or poor localization by nerves stimulator or by ultrasonogram imaging (e.g., if the nerve follows a substantially different path),like prefixed (C4-C8), postfixed, (C5-T2), Then continuous, tubular sheath has been shown unlikely, especially in the axillary region.

SONOANATOMY OF BRACHIALPLEXUS

Ultrasound is a recently emerging technique for regional anesthesia. Ultrasound guided peripheral nerve blockade was first performed in supraclavicular region by La Grange and colleagues in 1978. Later developed by Kapral and coworkers in 1994.

Advantages of Ultrasound:

- Enabling real time visualization of brachial plexus, rib, pleura and pulsating subclavian artery.
- Increase in safety because we can appreciate the needle placement and local anesthetic spread during the injection and enables further needle repositioning if needed.
- Rapid onset of nerve block occurs due to drug deposition near the plexus.
- Lesser volume of drug is needed than conventional techniques

ULTRASOUND GUIDED SUPRACLAVICULAR AND INFRACLAVICULAR BRACHIAL PLEXUS BLOCK.

Supraclavicular Brachial Plexus block

The supraclavicular block targets the trunks and divisions of the brachial plexus. The patient is positioned with the head turned approximately 45 degrees to the contralateral side. The linear probe is placed in a coronal oblique plane at the lateral end and just above the upper border of the clavicle. It is then moved medially until the subclavian artery is seen. With the subclavian artery in the middle the plexus is located superolateral to the artery, and the neurovascular structure structures lie above the first rib. Trunks/divisions of the brachial plexus appear as a cluster of hypoechoic grape like structures. A 50 mm needle is carefully advanced in-plane (lateral to medial) maintaining needle visualization throughout, and local anaesthetic deposited either close to the angle formed at the junction of first rib and subclavian artery, or injected carefully between divisions of the plexus.

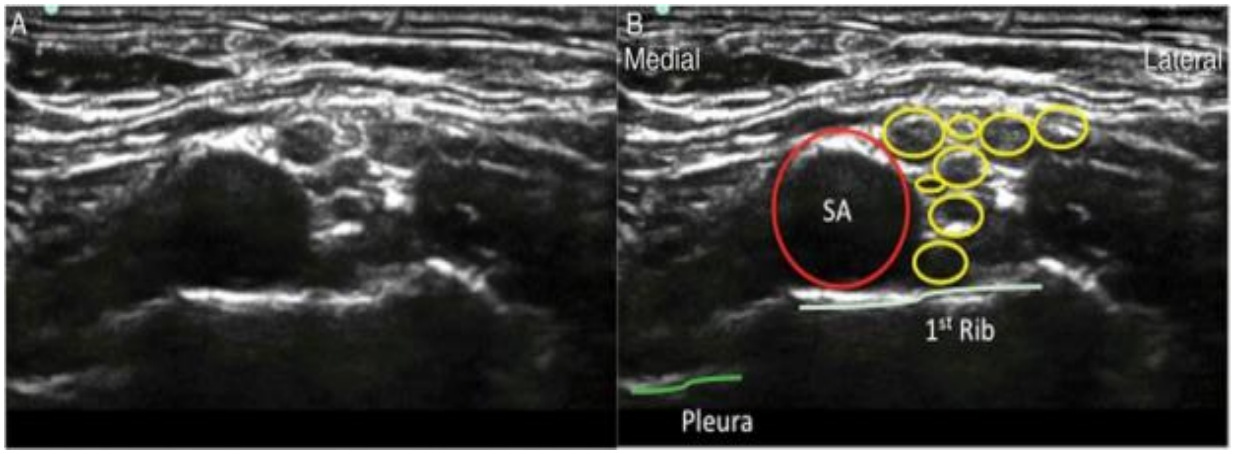


Figure 5-Supraclvicular Brachial plexus block

Infraclavicular Brachial Plexus block

Infraclavicular brachial plexus block targets the cords of the brachial plexus,and the nerves can be blocked next to the second part of the axillary artery at the level of the corocoid process. Brachial plexus block in the infraclavicular area offers excellent analgesia of the entire arm.The patient is positioned supine with the head turned approximately 45 degrees to the contralateral side with the arm aducted or abducted. Immediately medial and inferior to the corocoid process linear probe is positioned in a parasaggital plane, brachial plexus are visualized around axillary artery . Approximately 4-5 cm deeper lies the axillary neurovascular bundle.The large axillary vein lies medial and caudad to the artery. The lateral cord of the plexus is often readily visualizd as a hyperechoic structure medial cord lies between the axillary artery and vein , whereas posterior cord can be hidden deep to an axillary artery acoustic shadow. The needle is introduced in the parasagittal plane and directed posterior to the artery. Local anaesthetic is best deposited in a horseshoe between 3 and 11 o'clock. The plexus is often easier to visualize if the arm is abducted.

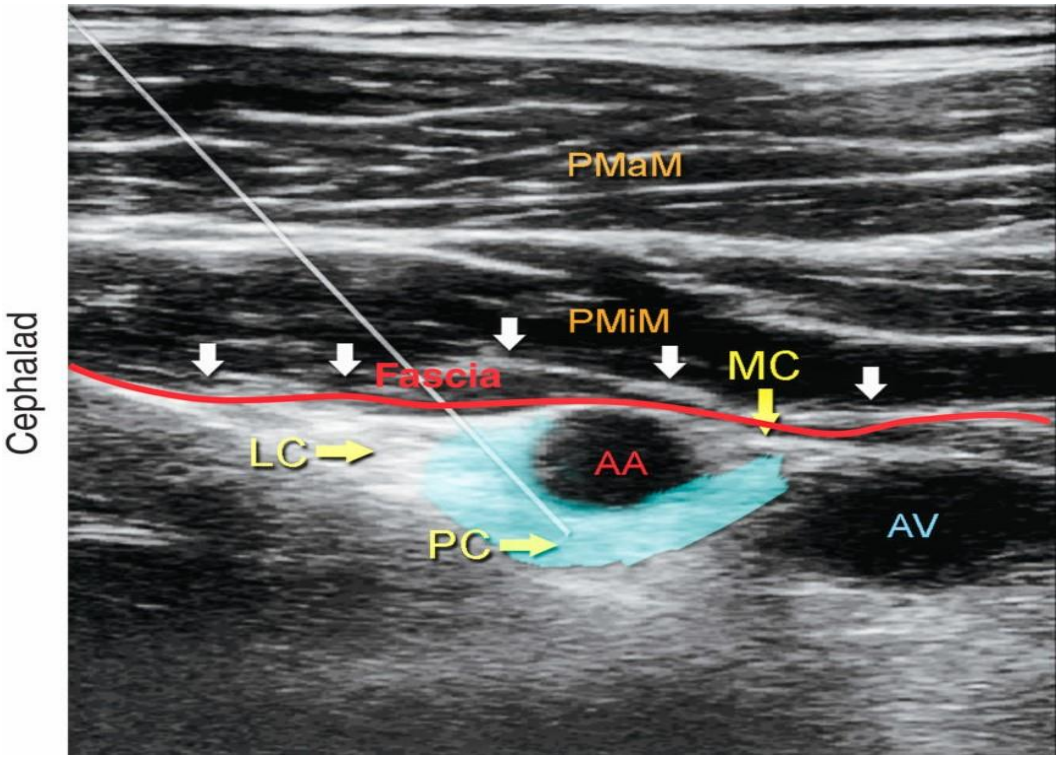


Figure 6- Infraclavicular Brachial plexus block

ULTRASONOGRAPHY

Ultrasound waves are sound waves with a frequency greater than 20,000Hz.These frequencies are above the audible upper limit of human hearing. Medical ultrasound is the application of this ultrasound waves to visualize the internal organs of our human body. The frequencies used for this purpose, ranges from 3 to 20 MHz. In recent years, ultrasound is widely used in anaesthesia for obtaining vascular access and performing peripheral nerve blocks. Ultrasound guided techniques helps in increasing success rate and reduce its complications.

Ultrasound Pulse Generation

The ultrasound transducer contains multiple piezoelectric crystals which are interconnected electronically. When mechanical energy is applied to these crystals and some ceramics, they generate electrical energy. This phenomenon known as the “Piezoelectric Effect” was first described by the Curie brothers in 1880. They also described the “Reverse Piezoelectric effect”, wherein application of electricity to these crystals produced vibrations which generate ultrasound waves.

Ultrasound Wavelength and Frequency

The wavelength and frequency are inversely related. High frequency ultrasound waves (10 to 20 MHz) give images with a high axial resolution but are more attenuated as we go deeper. Therefore, these transducers are optimal to image the superficial structures. Low frequency ultrasound waves (2 to 8 MHz) penetrate deeper but provide low axial resolution and are used to image deeper structures.

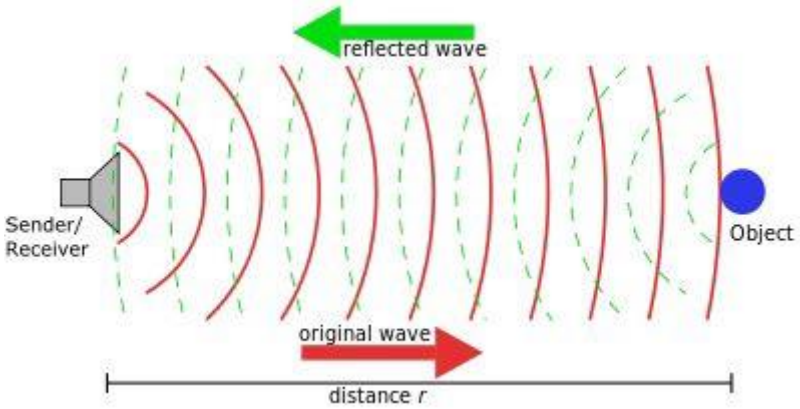


Figure 7-Principles of Ultrasonography

Ultrasound Tissue Interaction:

As the ultrasound waves travel through tissues, they are partly transmitted to deeper structures, partly reflected back to the transducer as echoes, partly scattered, and partly transformed to heat.

Reflection

For image generation, the echoes returned after hitting a tissue interface is of interest to us. The amount of echo returned after hitting a tissue interface is determined by a tissue property called acoustic impedance. The intensity of a reflected echo is proportional to the mismatch in acoustic impedances between two mediums.

Refraction

The change in the direction of the ultrasound waves after hitting an interface between two media with different velocities of sound transmission is refraction. This causes artefacts as the returning echoes are incorrectly located.

Scattering

Ultrasound waves which incident on the tissues at right angles are reflected back to the transducer. If the waves are not at right angle, then the returning echoes are scattered in all directions in a non-uniform manner.

Absorption

Some of the ultrasound waves are absorbed by the tissue and are converted to heat.

Attenuation

As the ultrasound waves travel through tissue, the returning echoes will become weaker due to absorption, scattering and refraction.

Diffraction

The spreading out of the ultrasound waves as its moves further away from the source is diffraction.

Construction

The ultrasound probe has an array of individual transducers which acts as both a transmitter and a receiver. Each transducer emits a short burst of ultrasound and is quiescent until it detects the echoes returning. This is called “Pulsed Ultrasound”. The speed of ultrasound in our body tissues is fairly constant at a speed of 1540m/s. The time taken for an echo to return is used determine the distance between the tissue and the probe.

Across the plane of an image, the ultrasound image is swept to form two dimensional images one line at a time. These lines are then summated to produce a frame. The frames are repeated to produce a real-time image. The brightness of the image depends upon the amplitude of the returning echo from the anatomical interfaces.

Scanning Modes

A-mode (amplitude mode): This displays a single echo signal against time to measure depth.

B-mode (brightness mode): It is a two dimensional image produced using an array of transducers and a series of reflected echoes.

M-mode (motion mode): is a specialized type of B-mode imaging where one particular line is ensonified repeatedly to examine a moving structure plotting out how the structure moves with time.

Ultrasound controls

Gain alters the brightness of the image by amplifying the received signal.

Time-Gain Compensation (TGC) differentially amplifies signals from different depths, allowing equal amplitudes from all depths to be displayed.

Focus adjusts the beam to be at its narrowest at the required depth to image the region of interest. It thereby improves lateral resolution

Depth can be adjusted to have the structure that is being examined to be in the centre of the screen.

Approaches and techniques

There are two basic approaches to ultrasound guidance. With the out-of- plane technique, the needle tip crosses the plane of imaging as an echogenic dot. With the in-plane approach, the entire tip and shaft of the advancing needle are visible.

Out-of-plane:

This technique involves insertion of needle at the midpoint of probe such that the needle cuts across the ultrasonic beam. The image obtained is a cross section of the needle shaft or tip. Path to target is shorter as compared to in-plane technique, but visibility of needle is not optimum, indirect markers like tissue movement or hydrodissection is needed to confirm placement.

Advantages:

1) Most similar to other approaches to regional block (nerve stimulation orpalpation)
2) Shorter needle path than with in-plane approaches
3) Along the nerve path (catheters)

Disadvantages:

Unimaged needle path, crossing the plane of imaging without recognition.

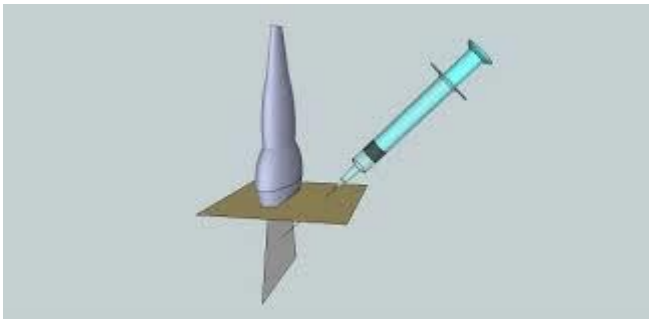


Figure 8-Out of plane approach

In-plane (IP):

In this technique needle is inserted along the length of ultrasound probe. It aligns the entire length of the beam with the shaft of needle. The image displayed will depict the entire needle shaft and its tip thereby improving the precision of nerve blocks. But the needle visibility depends on angle of insertion and the needle traverses a longer path to reach the target area.

Advantages:

Most direct visualization.

Disadvantages:

1) Partial line-ups (creating a false sense of security when the needle tip is not correctly identified.

2) Some unimaged needle path occurs with IP approach, but typically less than with OOP approach.

3) Longer paths and therefore more structures to cross with the block needle.

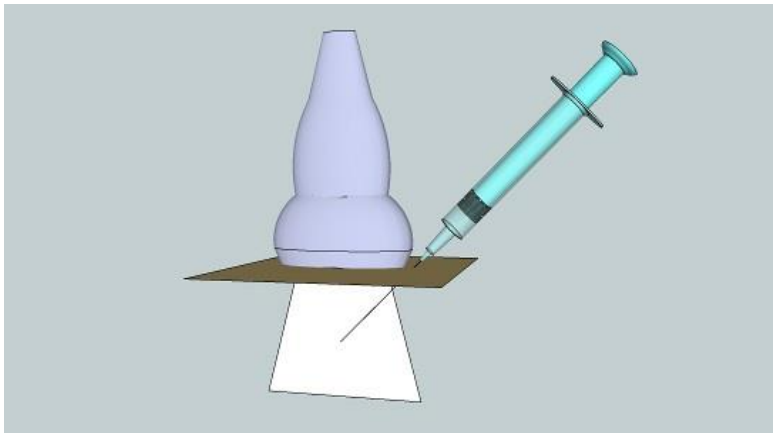


Figure 9-Inplane approach of ultrasonography

Ultrasound probes

Commonly used are three types

- Linear high frequency (6 to 12 MHz) probes which has high resolution and lesser penetration and is ideal for visualizing superficial structures.
- Curvilinear low frequency probes (2-5MHz) which has low resolution, higher penetration and is ideal for deeper structures like intraabdominal organs.
- Phased Array Probe also has low frequency (2MHz – 7.5MHz) gives a large depth with a small acoustic window, ideal for chest ultrasound

Figure 10-Ultrasound probes

Imaging

Ultrasound image is produced by echoes received as the Ultrasonic beam interacts with the tissues it travels through. Acoustic impedance of a structure is the function of the elasticity and density of the particular tissue. Materials with higher acoustic impedance transmit sound faster, and do not allow for continued compression by the impending wave. The sound beam is attenuated while traversing various tissues within the body. The beam will be scattered somewhat when it encounters varying tissues on the way with different acoustic impedances or it may be reflected back from structures and returns back to the transducer. Refraction and absorption by tissues may also attenuate the waves. Those tissues that reflect the wave are termed echoic and those which do not reflect the wave are termed anechoic. Always use plenty of sterile ultrasound gel to remove the air interface between the skin and probe. Air does not allow the passage of the ultrasound beam even though it has low Acoustic impedance. Bone has high acoustic index so it appears to be white on the ultrasound image as

it is hyper reflective to the beam. Blood and other fluids appear to be black on the image since they are anechoicin nature. Soft tissue appears as grey on the sonographic image as they have medium echogenicity.

The nerves appear round or oval in transverse view and are hypo-echoic or they appear as honeycomb structures with septations inside them. Nerves are bordered by a hyper-echoic layer of connective tissue. Blood vessels will appear as circular hypoechoic to anechoiec structures with a well-defined hyper- echoic border which is the vessel wall. Veins are compressible with thinner walls whereas arteries have thicker walls and appear pulsatile in nature. Muscles have fibrous-lamellar texture and appear as heterogeneous or homogeneous hypoechoic structures with hyper-echoic septa in between.

Basic principles of ultrasound guided nerve blocks.

- First involves the identification of anatomical structures like muscles, fascia, blood vessels and bones.
- Visualization of the nerve plexus or the fascial plane where drug should be deposited.
- Should be able to differentiate between normal and altered anatomy of the region scanned.
- Identify the correct plane for needle insertion to avoid trauma to vessels
- Strict aseptic technique
- Real time visualization of needle when it is inserted inside.

-Once the target is reached, inject a small volume of drug or saline and see the spread and confirm location, else reposition the needle.

- Do frequent aspiration during injection of drug to rule out intravascular injection.
- Complete visualization of the spread of total volume of local anaesthetic drug injected.
- Always keep ready all resuscitation equipment, drugs and standard monitoring.

LOCAL ANAESTHESIA (OR) REGIONAL ANAESTHESIA:

Local anesthesia can be defined as loss of sensation, in a discrete region of the body caused by disruption of impulse generation or propagation. Nerve fibers can be classified according to fiber diameter, presence (type A and B) or absence (type C) of myelin, and function. The nerve fiber diameter influences conduction velocity. Larger diameter correlates with more rapid nerve conduction. The presence of myelin also increases conduction velocity. This effect results from insulation of the axolemma from the surrounding media, forcing current to

flow through periodic interruptions in the myelin sheath (i.e., nodes of Ranvier) Local anesthetics act on a wide range of molecular targets, but they exert their predominant desired clinical effects by blocking sodium ion flux through voltage-gated sodium channels. Voltage-gated sodium channels are complex transmembrane proteins comprising large alpha subunits and much smaller beta subunits.

Intravenous infusions of lipid emulsions have become a standard treatment of LAST. The mechanism by which lipid is effective is not clear but is likely related to its ability to extract bupivacaine (or other lipophilic drugs like Ropivacaine) from aqueous plasma or tissue targets, thus reducing their effective free concentration ("lipid sink"). Accordingly, solutions of lipid emulsion should be stocked and readily accessible in any area where major conduction blockade is performed, as well as locations where overdoses from any lipophilic drug might be treated

BUPIVACAINE

Bupivacaine is an amino amide class of local anaesthetic drug. It was first synthesized by Ekenstam in 1957 and its clinical use was started by LJ Telivuo in 1963. Since then, it has become one of the widely used local anaesthetic agents clinically.

Bupivacaine consists of a tertiary amine attached to a substituted aromatic ring by an amide linkage. The butyl group attached to the piperidine nitrogen makes bupivacaine more lipid soluble and potent. The molecular weight is 288. It is a chiral drug that exists as two enantiomeric forms – dextrorotary (R-) and levorotary (S-) forms. The pure levorotary form Levobupivacaine produce less cardiotoxicity compared to that of the racemic mixture.

PHARMACODYNAMICS

Bupivacaine permeates the nerve's axon membranes and accumulate within the axoplasm. Binding to sites on voltage-gated Na+ channels prevent opening of the channels by inhibiting theconformational changes that underlie channel activation.

On comparison with lignocaine, it is four times more potent but the onset of action is slower. The duration of action is considerably longer. The sensory blockade caused by bupivacaine is much more than the motor blockade.

PHARMACOKINETICS

It is a weak base with a pKa of 8.1. Bupivacaine is highly protein bound (95%) and most important plasma protein binding site is alpha1 acid glycoprotein. At physiological pH of 7.4, 17% is non-ionised.

The onset and duration of action depend on the dose, concentration, route of administration and vascularity of the site of administration. The volume of distribution is 54 L. The elimination half-life is 210 minutes. The Clearance is 0.32 L/min. Bupivacaine undergoes biotransformation in liver by aromatic hydroxylation, N-dealkylation, amide hydrolysis, and conjugation. The metabolites are excreted via the kidney. Less than 5% of the drug is excreted unchanged.

Dosage and preparations

Maximum dose of bupivacaine 2-3 mg/kg. Preparations available include 0.25%, 0.5% solutions in 10 ml and 20 ml vials, preservative free 0.5% bupivacaine and 0.75% bupivacaine for intrathecal injections.

Uses

- Peripheral nerve block (0.25-0.5%)
- Epidural Anaesthesia (0.25-0.5%)
- Spinal Anaesthesia (0.5%, 0.75%)
- Caudal Anaesthesia (0.25-0.5%)
- Infiltration Anaesthesia (0.25-0.5%)

Contraindications

- Known hypersensitivity to local anaesthetics
- Intravenous regional anaesthesia (IVRA)

Adverse effects

Local Anaesthesia Systemic Toxicity– Plasma concentration greater than 5mcg/ml due to overdosage, unintentional intravascular injection and slow metabolic degradation causes systemic toxicity.

Central Nervous System Toxicity

Non-specific signs of toxicity are metallic taste, circumoral numbness, diplopia, tinnitus, dizziness. Excitation is characterized by restlessness, anxiety,dizziness, tinnitus, blurred vision or tremors. Then, there is a depression of central nervous system causing drowsiness, unconsciousness and cardiac arrest.

Cardiovascular system effects

Part of the cardiac toxicity that occurs with high plasma concentrations of bupivacaine occurs because of the blockade of cardiac sodium channels. Accidental intravenous injection of bupivacaine causes cardiac dysrhythmias, atrioventricular block, ventricular tachycardia and ventricular fibrillation, bradycardia and asystole.

Pregnancy increases the sensitivity of cardiotoxic effects of bupivacaine.

Lidocaine

Lidocaine bind to specific sites in voltage-gated sodium ion channels. They block sodium ion current, thereby reducing excitability of neuronal, cardiac or CNS tissue. Lidocaine prevent transmission of nerve impulses (conduction blockade) by inhibiting passage of sodium ions through ion-selective sodium channels in nerve membranes.

Metabolism:

The principal metabolic pathway of lidocaine is oxidative dealkylation in the liver to monoethylglycinexylidide followed by hydrolysis of this metabolite to xylidide. Monoethylglycinexylidide has approximately 80% of the activity of lidocaine for protecting against cardiac dysrhythmias in an animal model. This metabolite has a prolonged elimination half-time, accounting for its efficacy in controlling cardiac dysrhythmias after the infusion of lidocaine is discontinued. Xylidide has only approximately 10% of the cardiac antidysrhythmic activity of lidocaine. In humans, approximately 75% of xylidide is excreted in the urine as 4-hydroxy-2,6-dimethylaniline. Hepatic disease or decreases in hepatic blood flow, which may occur during anesthesia, can decrease the rate of metabolism of lidocaine.

For example, the elimination half-time of lidocaine is increased more than fivefold in patients with liver dysfunction compared with normal patients. Decreased hepatic metabolism of lidocaine should be anticipated when patients are anesthetized with volatile anesthetics. Maternal clearance of lidocaine is prolonged in the presence of pregnancy-induced hypertension, and repeated administration of lidocaine can result in higher plasma concentrations than in normotensive parturients. Lidocaine has intrinsic vasodilator property.

Dosage and preparations

Maximum dose of Lidocaine 7 mg/kg. Preparations available include 2% solutions in 10 ml and 20 ml vials and preservative free 2% bupivacaine.

MIDAZOLAM

Midazolam is one of the classic sedatives for procedural sedation. Midazolam is a water-soluble benzodiazepine with an imidazole ring in its structure that accounts for stability in aqueous solutions and rapid metabolism. This benzodiazepine has replaced diazepam for use in preoperative medication and conscious sedation. As with other benzodiazepines, the amnestic effects of midazolam are more potent than its sedative effects. Thus, patients may be awake following administration of midazolam but remain amnestic for events and conversations (postoperative instructions) for several hours.

Commercial Preparation:

The pK of midazolam is 6.15, which permits the preparation of salts that are water soluble. The parenteral solution of midazolam used clinically is buffered to an acidic pH of 3.5. This is important because midazolam is characterized by a pH-dependent ring-opening phenomenon in which the ring remains open at pH values of less than 4, thus maintaining water solubility of the drug. The ring closes at pH values of greater than 4, as when the drug is exposed to physiologic pH, thus converting midazolam to a highly lipid-soluble drug. The water solubility of midazolam obviates the need for a solubilizing preparation, such as propylene glycol required for other benzodiazepines that can produce venous irritation or interfere with absorption after intramuscular (IM) injection. Indeed, midazolam causes minimal to no discomfort during or after IV or IM injection. Midazolam is compatible with lactated Ringer

solution and can be mixed with the acidic salts of other drugs, including opioids and anticholinergics.

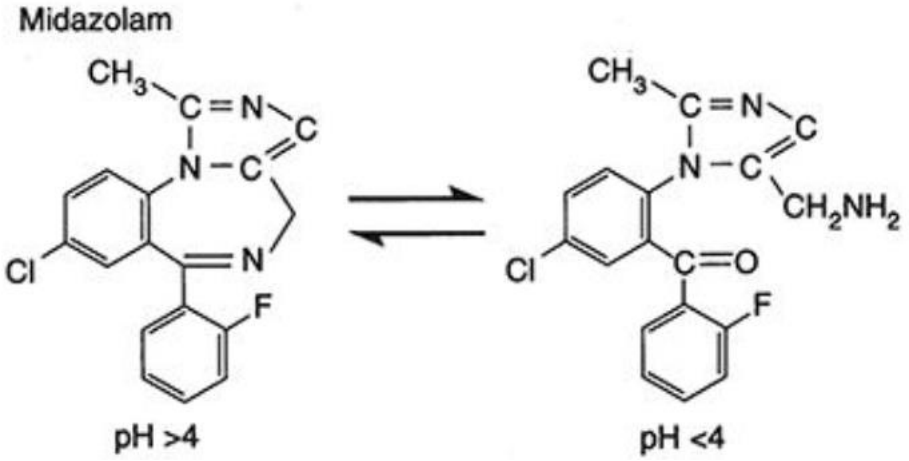


FIGURE 11: representing reversible ring opening of midazolam above and below a pH of 4. The ring closes at a pH greater than 4, converting midazolam from a water-soluble to a lipid-soluble drug.

Pharmacokinetics

Midazolam undergoes rapid absorption from the gastrointestinal tract and prompt passage across the blood–brain barrier. Despite this prompt passage into the brain, midazolam is considered to have a relatively slow effect-site equilibration time (0.9-5.6 minutes) compared with other drugs such as propofol and thiopental. In this regard, IV doses of midazolam should be sufficiently spaced to permit the peak clinical effect to be appreciated before a repeat dose is considered. Only about 50% of an orally administered dose of midazolam reaches the systemic circulation, reflecting a substantial first-pass hepatic effect. As for most benzodiazepines, midazolam is extensively bound to plasma proteins; this binding is independent of the plasma concentration of midazolam. The short duration of action of a single dose of midazolam is due to its lipid solubility, leading to rapid redistribution from the brain to inactive tissue sites as well as rapid hepatic clearance.

Comparative pharmacology of benzodiazepines					
	Equivalent dose (mg)	Volume of distribution (L/kg)	Protein binding (%)	Clearance (mL/kg/minute)	Elimination half-time (hour)
Midazolam	0.15-0.3	1.0-1.5	96-98	6-8	1-4
Diazepam	0.3-0.5	1.0-1.5	96-98	0.2-0.5	1-37
Lorazepam	0.05	0.8-1.3	96-98	0.7-1.0	10-20

Table 1: Comparative Pharmacology of Benzodiazepines

The elimination half-time of midazolam is 1 to 4 hours, which is much shorter than that of diazepam. The elimination half-time may be doubled in elderly patients, reflecting age-related decreases in hepatic blood flow and possibly enzyme activity. The Vd of midazolam and diazepam are similar, probably reflecting their similar lipid solubility and high degree of protein binding. Elderly and morbidly obese patients have an increased Vd of midazolam resulting from enhanced distribution of the drug into peripheral adipose tissues. The clearance of midazolam is more rapid than that of diazepam, as reflected by the context-sensitive half-time. As a result of these differences, the CNS effects of midazolam would be expected to be shorter than those of diazepam. Indeed, tests of mental function return to normal within 4 hours after the administration of midazolam in healthy young patients.

The institution of cardiopulmonary bypass is associated with a decrease in the plasma concentration of midazolam and an increase on termination of cardiopulmonary bypass.

These changes are attributed to redistribution of priming fluid into body tissues. In addition, benzodiazepines are extensively bound to protein, and changes in protein concentrations and pH that accompany institution and termination of cardiopulmonary bypass may have significant effects on the unbound and pharmacologically active fractions of these drugs. The elimination half-time of midazolam is prolonged after cardiopulmonary bypass.

Metabolism

Midazolam is rapidly metabolized by hepatic and small intestine cytochrome P450 (CYP3A4) enzymes to active and inactive metabolites. The principal metabolite of midazolam, 1-hydroxymidazolam, has approximately half the activity of the parent compound. This active metabolite is rapidly conjugated to 1-hydroxymidazolam glucuronide and is subsequently cleared by the kidneys. This glucuronide metabolite has substantial pharmacologic activity when present in high concentrations, as may occur in critically ill patients with renal insufficiency who are receiving continuous IV infusions of

midazolam over prolonged periods of time. In these patients, the glucuronide metabolite may have synergistic sedative effects with the parent compound. The other pharmacologically active metabolite of midazolam, 4-hydroxymidazolam, is not present in detectable concentrations in the plasma following IV administration of midazolam.

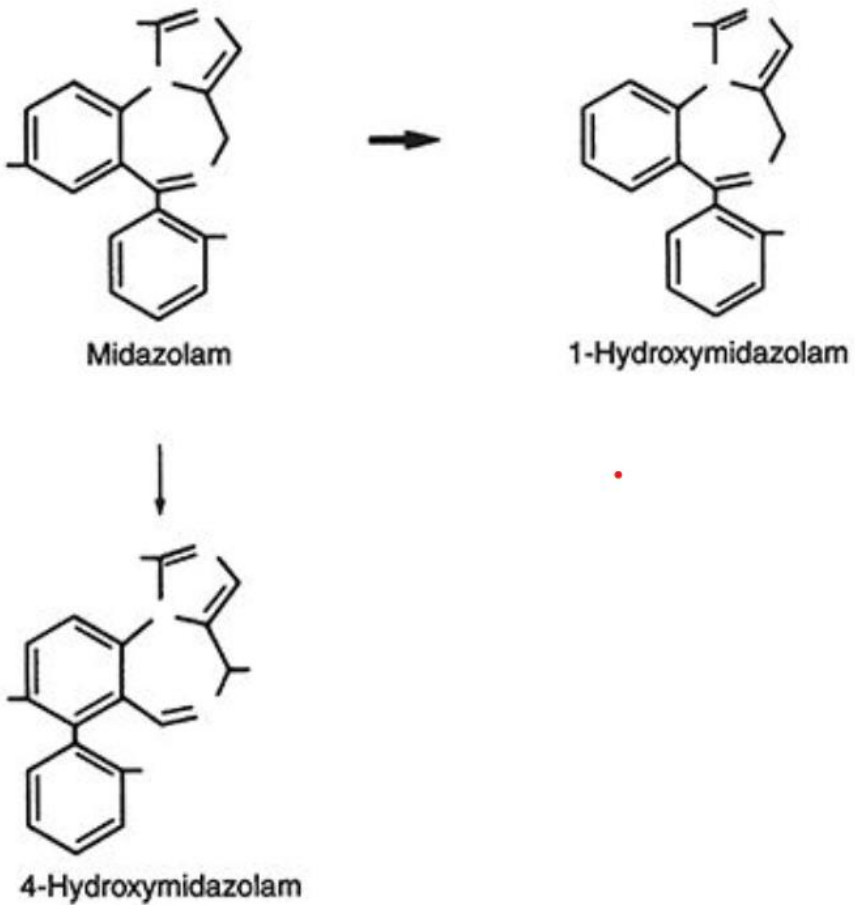


Figure 12 - The principal metabolite of midazolam is 1-hydroxymidazolam. A lesser amount of midazolam is metabolized to 4-hydroxymidazolam.

Metabolism of midazolam is slowed in the presence of drugs (cimetidine, erythromycin, calcium channel blockers, antifungal drugs) that inhibit cytochrome P450 enzymes resulting in unexpected CNS depression. Cytochrome P450 3A enzymes also influence the metabolism of fentanyl. In this regard, the hepatic clearance of midazolam is inhibited by fentanyl as administered during general anesthesia. Overall, the hepatic clearance rate of midazolam is 5 times greater than that of lorazepam and 10 times greater than that of diazepam.

Renal Clearance

The elimination half-time, Vd, and clearance of midazolam are not altered by renal failure. This is consistent with the extensive hepatic metabolism of midazolam.

Effects on Organ Systems

Central Nervous System

Midazolam, like other benzodiazepines, produces decreases in CMRO2 and cerebral blood flow analogous to barbiturates and propofol. Midazolam causes dose-related changes in regional cerebral blood flow in brain regions associated with the normal functioning of arousal, attention, and memory. Cerebral vasomotor responsiveness to carbon dioxide is preserved during midazolam anesthesia. Patients with decreased intracranial compliance show little or no change in ICP when given midazolam doses of 0.15 to 0.27

mg/kg IV. Thus, midazolam is an acceptable alternative to barbiturates for induction of anesthesia in patients with intracranial pathology. There is some evidence, however, that patients with severe head trauma but ICP of less than 18 mm Hg may experience an undesirable increase in ICP when midazolam (0.15 mg/kg IV) is administered rapidly. Similar to thiopental, induction of anesthesia with midazolam does not prevent increases in ICP associated with direct laryngoscopy for tracheal intubation. Although midazolam may improve neurologic outcome after incomplete ischemia, benzodiazepines have not been shown to possess neuroprotective activity in humans. Midazolam is a potent anticonvulsant effective in the treatment of status epilepticus. Prolonged sedation of infants in critical care units (4-11 days) with midazolam and fentanyl has been associated with encephalopathy on withdrawal of the benzodiazepine. Paradoxical excitement occurs in less than 1% of all patients receiving midazolam and is effectively treated with a specific benzodiazepine antagonist, flumazenil.

Ventilation

Midazolam produces dose-dependent decreases in ventilation with 0.15 mg/kg IV producing effects similar to diazepam, 0.3 mg/kg IV. Patients with chronic obstructive pulmonary disease experience even greater midazolam-induced depression of ventilation. ransient apnea may occur after rapid injection of large doses of midazolam (>0.15 mg/kg IV), especially in the presence of preoperative medication that includes an opioid. In healthy volunteers, midazolam alone produced no ventilatory depressant effects, whereas the combination of midazolam, 0.05 mg/kg IV, and fentanyl, 2 μg/kg IV, resulted in arterial hypoxemia and/or hypoventilation. Midazolam, 0.05 or 0.075 mg/kg IV, was shown to depress resting ventilation in healthy volunteers, whereas spinal anesthesia (mean sensory level T6) stimulated resting ventilation, and the combination had a modest synergistic effect for depressing resting ventilation. Benzodiazepines also depress the swallowing reflex and decrease upper airway activity.

Cardiovascular System

Historically, large IV doses of midazolam were tested for use as an anesthetic induction agent. The use of midazolam never gained widespread use; loss of consciousness, even with high doses, is slow and unreliable, and hemodynamic response to endotracheal intubation is not reliably blunted. Midazolam, 0.2 mg/kg IV, for induction of anesthesia produces a greater decrease in systemic blood pressure and increase in heart rate than does diazepam, 0.5 mg/kg IV. Conversely, these midazolam-induced hemodynamic changes are similar to the changes produced by thiopental, 3 to 4 mg/kg IV. Cardiac output is not altered by midazolam, suggesting that blood pressure changes are due to decreases in systemic vascular resistance. In this regard, benzodiazepines may be beneficial in improving cardiac output in the presence of congestive heart failure. In the presence of hypovolemia, administration of midazolam results in enhanced blood pressure–lowering effects similar to those produced by other IV induction drugs. Midazolam does not prevent blood pressure and heart rate responses evoked by intubation of the trachea. In fact, this mechanical stimulus may offset the blood pressure–lowering effects of large doses of midazolam administered IV. The effects of midazolam on systemic blood pressure are directly related to the plasma concentration of the benzodiazepine. However, a plateau plasma concentration appears to exist (ceiling effect) above which little further change in systemic blood pressure occurs.

Clinical Uses

Preoperative Medication

Midazolam is the most commonly used oral preoperative medication for children. Oral midazolam syrup (2 mg/mL) is effective for producing sedation and anxiolysis at a dose of 0.25 mg/kg with minimal effects on ventilation and oxygen saturation even when administered at doses as large as 1 mg/kg (maximum, 20 mg). Midazolam, 0.5 mg/kg administered orally 30 minutes before induction of anesthesia, provides reliable sedation and anxiolysis in children without producing delayed awakening. Use of oral midazolam to produce mild to moderate sedation in children before surgery remains common; recent comparative studies suggest that oral dexmedetomidine produces similar sedation while reducing emergence delirium. Although it is recommended that oral midazolam be administered at least 20 minutes before surgery, there is evidence that significant anterograde amnesia is present when 0.5 mg/kg orally is

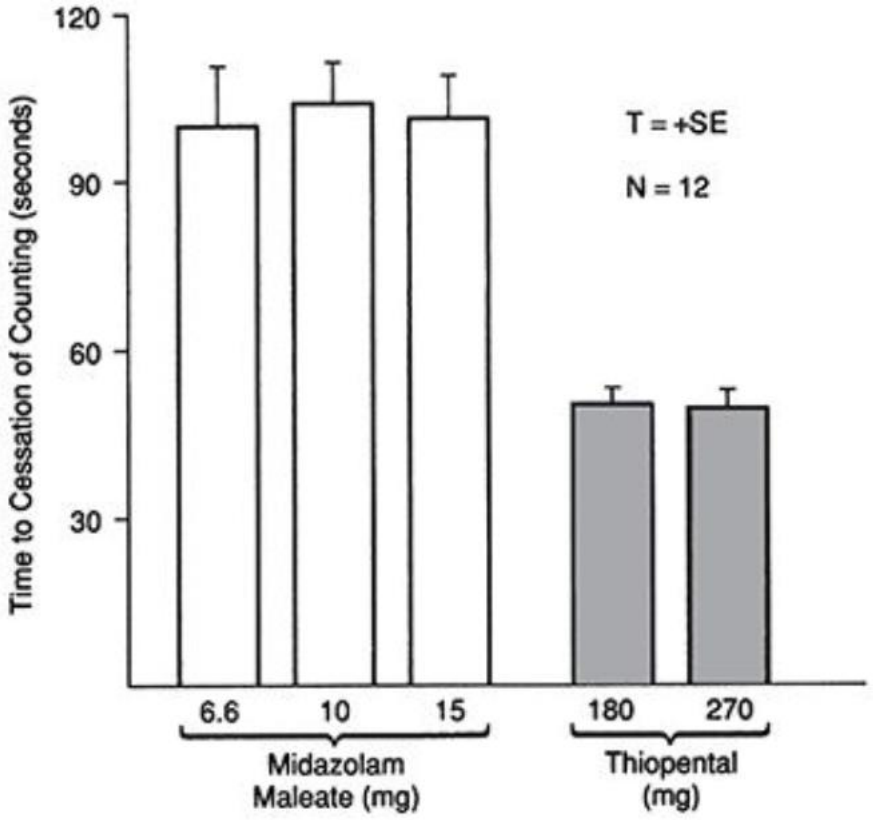
administered 10 minutes before surgery. Midazolam crosses the placenta, but the fetal-to-maternal ratio is significantly less than that for other benzodiazepines.

Intravenous Sedation

Midazolam in doses of 1.0 to 2.5 mg IV (onset within 30-60 seconds, time to peak effect 3-5 minutes, duration of sedation 15-80 minutes) is effective for sedation during regional anesthesia as well as for brief therapeutic procedures. The effect-site equilibrium time for midazolam must be considered in recognizing the likely time of peak clinical effect and the need for supplemental doses of midazolam. The most significant side effect of midazolam when used for sedation is depression of ventilation caused by a decrease in the hypoxic drive, particularly in concert with other anesthetic drugs. Midazolam-induced depression of ventilation is exaggerated (synergistic effects) in the presence of opioids and other CNS depressant drugs. Patients with chronic obstructive pulmonary disease may also manifest exaggerated depression of ventilation following administration of benzodiazepines to produce sedation. It is important to appreciate that increasing age greatly increases pharmacodynamic variability and is associated with generally increased sensitivity to the hypnotic effects of midazolam.

Induction of Anaesthesia

Although seldom used for this purpose currently, anaesthesia can be induced by administration of midazolam, 0.1 to 0.2 mg/kg IV, over 30 to 60 seconds. Nevertheless, thiopental usually produces induction of anaesthesia 50% to 100% faster than midazolam. Onset of unconsciousness (synergistic interaction) is facilitated when a small dose of opioid (fentanyl, 50-100 μg IV or its equivalent) precedes the injection of midazolam by 1 to 3 minutes. The dose of midazolam required for the IV induction of anaesthesia is also less when preoperative medication includes a CNS depressant drug. In healthy patients receiving small doses of benzodiazepines, the cardiovascular depression associated with these drugs is minimal. When significant cardiovascular responses occur, it is most likely a reflection of benzodiazepine-induced peripheral vasodilation. As with depression of ventilation, cardiovascular changes produced by benzodiazepines may be exaggerated in the presence of other CNS depressant drugs such as propofol and thiopental.



Graph 1: representing Induction of anesthesia as depicted by time to cessation of counting occurs in about 110 seconds after the intravenous administration of midazolam compared with about 50 seconds after injection of thiopental.

Maintenance of Anesthesia

Midazolam may be administered to supplement opioids, propofol, and/or inhaled anesthetics during maintenance of anesthesia. The context-sensitive half-time for midazolam increases modestly with an increasing duration of administration of a continuous infusion of this benzodiazepine. Anesthetic requirements for volatile anesthetics are decreased in a dose-dependent manner by midazolam. Awakening after general anesthesia that includes induction of anesthesia with midazolam is 1.0 to 2.5 times longer than that observed when thiopental is used for the IV induction of anesthesia. Gradual awakening in patients who receive midazolam is rarely associated with nausea, vomiting, or emergence excitement.

Postoperative Sedation

Long-term IV administration of midazolam (loading dose 0.5-4 mg IV and maintenance dose 1-7 mg/hour IV) to produce sedation in intubated patients results in relative saturation of peripheral tissues with midazolam and clearance from the systemic circulation becomes less dependent on redistribution into peripheral tissues and more dependent on hepatic metabolism.

In addition, pharmacologically active metabolites may accumulate with prolonged IV administration of the parent drug. Under these conditions, plasma concentrations of midazolam decrease more slowly (emergence delayed) after discontinuation of the IV infusion compared with single IV injections. Emergence time is also a function of the plasma concentrations of midazolam at the time the IV infusion is discontinued. Patients maintained at higher plasma concentrations of midazolam take longer to awaken than patients maintained at lower plasma concentrations for comparable periods of time. The concomitant administration of analgesic doses of opioids greatly decreases the needed dose of midazolam and results in a more rapid recovery from sedation following discontinuation of the IV infusion of midazolam.

Emergence time from midazolam infusion is increased in elderly patients, obese patients, and in the presence of severe liver disease.

While midazolam is thought to cause minimal hemodynamic effects, it does have the potential to cause loss of airway reflexes, respiratory depression, and even apnea. If an effective, reliable and safe sedative could be used in general practice, this would benefit a wide range of patients, especially those who are frail, anxious, severely phobic or uncooperative.

Anxiety

In DSM-5, Anxiety is defined as the anticipation of future threat; it is distinguished from fear, the emotional response to real or perceived imminent threat. Further, the term worry in DSM-5 adds an additional nuance by referring to the cognitive aspects of apprehensive expectation. Anxiety is a normal emotion. From an evolutionary viewpoint, it is adaptive since it promotes survival by inciting persons to steer clear of perilous places.

History

In DSM-III (1980), the chapter of anxiety disorders included (i) Phobic disorders, subdivided into Agoraphobia, with or without panic attacks, Social Phobia, and Simple Phobia; (ii) Anxiety states, subdivided into Panic disorder (PD), GAD, and Obsessive-Compulsive Disorder (OCD); and (iii) Post-traumatic Stress Disorder (PTSD). In addition, Anxiety disorders of childhood or adolescence included Separation anxiety disorder, Avoidant disorder of childhood or adolescence, and Overanxious disorder. DSM-II's anxiety neurosis was split into two newly created categories, PD and GAD, in DSM-III.

In DSM-IV, Mixed anxiety depressive disorder was included, rather than in the main body of the text because of information about potentially high rates of false positives. Another new category in DSM-IV was Acute stress disorder.

DSM-5 introduced a grouping of the anxiety disorders of DSM-IV into three spectra (ie, anxiety, OCD, and trauma- and stressor-related disorders) based on the sharing of common neurobiological, genetic, and psychological features.

Perioperative anxiety, the distress experienced before, during, or after surgery, arises from multiple causes. Fear of the unknown, including surgical outcomes, anesthesia risks, and potential complications, is a major contributor. Patients may also worry about pain, loss of control, or postoperative recovery. Underlying medical conditions, previous negative surgical experiences, and lack of information about the procedure can heighten anxiety. Additionally, personal factors such as general anxiety disorders, depression, or low pain tolerance may exacerbate these feelings. Environmental stressors, like long wait times or unfamiliar hospital settings, further contribute to preoperative nervousness. Addressing these concerns through patient education, reassurance, and psychological support can help reduce perioperative anxiety and improve overall surgical outcomes.

Psychological response to perioperative anxiety

The extent of anxiety levels varies individually. It fluctuates over time; starting prior to the surgery and persists until the late postoperative period. Different patient react perioperative periods in different ways. Some find it as relief as they are going to have a disease free life. Other considered it as one of the stressful event of lifetime. They are preoccupied with their discomfort or concerned about the success of surgery, strong fear of failure combined with

career and family problems, postoperative state of physical health and problems adapting to the changed situation.

The consequences of perioperative anxiety are tachycardia, increased blood pressure, change in the breathing pattern (hyper/hypoventilation), irritability, in some rare cases major cardiac events (acute myocardial infarction, heart failure, pulmonary oedema), high readmission rate (1st 6 month, 1 years), poor quality of life and high rate of cardiac mortality. Perioperative anxiety is associated with high postoperative pain, increased analgesic and anaesthetic consumption, prolonged hospital stays, adverse influence during anaesthetic induction and patient recovery and decrease patient satisfaction with perioperative experience.

Virtual reality – The Audio visual distraction in medical practice:

Figure 13: representing VR usage in practice

Virtual reality distraction is a novel technique of behaviour management. Virtual reality was solely recognized for its entertainment value in past. Recently, it was introduced into medical

for effective management of patient during painful procedures. In the present, efforts have been made to study the anxiety management of patients, using methods like VR distraction, audio distraction and Tell Show Do techniques.[5]

VR technology creates a highly realistic three-dimensional (3D) virtual environment to help patients escape the real world through a variety of sensory stimuli, such as visual, auditory, tactile, and olfactory stimuli. By stimulating visual, auditory, and proprioceptive senses, VR can act as a distraction that interferes with the processing of noxious stimuli in patients. Virtual reality technology has been applied in a wide range of fields; in medicine, it is being applied in the fields of rehabilitation and clinical medicine. Several studies have suggested that immersive VR may serve as a viable non-pharmacological analgesia, while another reported that VR, as a non-pharmacological option, may be more effective than traditional analgesia.

Owing to its inherent immersive, imaginative, and interactive nature, VR is suitable for non-pharmacological behavioural management during treatment. It has been hypothesized that VR experiences can overcome pain by consuming an individual's limited cognitive attentional resources. Thus, the pain experienced is reduced by shifting patients from painful stimuli to a pleasant virtual world. [8]

It is a safe, non-invasive technique that does not require prior education or training and has long-term effects in terms of creating more positive memories during treatment, thus increasing the willingness of patients to return for treatment.

The Effectiveness of VR as a Clinical Tool:

VR allows the level of fit between the content of the exposure and the feared stimuli to be optimized. Moreover, using it, the therapist has a total control—limited only by the specific features of the used software—on the contents of the experience. Finally, it offers a safer and more private context for the patient that facilitates his/her engagement. VR provides a digital place to the individual where he/she can be placed and live a synthetic but realistic experience. VR can be considered an advanced imaginal system: an advanced form of imagery that is as effective as reality in inducing experiences and emotions.

VR works in a similar way: it uses computer technology to create a simulated world that individuals can manipulate and explore as if they were in it. In other words, the VR experience tries to predict the sensory consequences of your movements, showing to you the same scene you will see in the real world. Specifically, VR hardware tracks the motion of the user, while

VR software adjusts the images on the user's display to reflect the changes produced by the motion in the virtual world. To achieve it, like the brain, the VR system maintains a model (simulation) of the body and the space around it. This prediction is then used to provide the expected sensory input using the VR hardware. Obviously, to be realistic, the VR model tries to mimic the brain model as much as possible: the more the VR model is similar to the brain model, the more the individual feels present in the VR world.

Drawbacks of Virtual reality (Audio visual Distraction):

Nevertheless, there is a critical shortcoming that at the moment is limiting this possibility: VR simulates the external world/body but not the internal one. In fact, actual VR technology is very effective in reproducing the exteroceptive (external) features of the body using vision and hearing, but less effective in reproducing the other senses (i.e., touch and smell). It is partially effective in reproducing the proprioceptive (motor) features of the body using haptic technologies, but it is not yet able to reproduce the interoceptive/ vestibular (internal) features of the body.

METHODOLOGY

Type of Study: A Randomized clinical trial.

Duration of study and study population: Patients aged 18 and above, belonging to ASA grade I, II and III, undergoing Brachial plexus nerve block for surgeries at KLE's Dr. Prabhakar Kore Hospital and Medical ResearchCentre, Nehru Nagar, Belagavi spanning 01-01-2024 to 31-12-2024.

(Data Collection-12 Months)

Inclusion Criteria:

- Educated patients who 18 years and above,
- Patients undergoing surgeries under Brachial plexus block,
- Patients who give consent.

Exclusion Criteria:

- Significant psychiatric disorder such as generalized anxiety disorder, panic disorder, depression, psychosis, bipolar disorder;
- individuals who were incompetent to give informed consent;
- pregnant and/or breastfeeding patients;
- any underlying coagulopathy,
- infection
- hypersensitivity to any of the sedative drug used- Midazolam/Fentanyl/Propofol;
- history of renal impairment.

Sample Size Calculation:

The size formula based on mean and standard deviation is

$$n = \frac{(z_{1-\frac{\alpha}{2}} + z_{1-\beta})^2 (SD_1^2 + SD_2^2)}{(\bar{x}_1 - \bar{x}_2)^2}$$

where z_α is linked with the level of significance and z_β is linked with the power of the test. For 5% level of the significance $z_{1-\alpha/2}$ =1.96 and $z_{1-\beta}$ =1.29 for 90% power of the test.

The parameter considered in the calculation is

$\bar{x}_1$ is the mean of the first group (33.3) and

$\bar{x}_2$ is the mean of the second group (30)

SD_1 is the standard deviation of the first group (4.28) and

SD_2 is the standard deviation of the second group (5.10) and theses values taken from the article.

With these values the sample size obtained is 43.

The total sample size is 86.

Sampling procedure: A one-year randomized clinical trial.

Methodology: After obtaining the approval of ethical committee and written informed consent, a total of 86 patients, who are undergoing preoperative nerve block, will be included in this study after having met the inclusion and exclusion criteria. All patients met the requirements for inclusion

and consented in writing.

Patients were instructed to follow the necessary hours of nil per mouth (NPO) status during a thorough pre-anesthetic evaluation the day before the procedure. On the day of surgery, an intravenous cannula was placed on the forearm and the patient's oral status was verified

Prior to anesthesia, baseline measurements were taken of the peripheral oxygen saturation (SpO2), heart rate (HR), non-invasive blood pressure (NIBP), and electrocardiogram (ECG) in the preparation room.

After that, patients were randomly assigned to one of two groups by computer generated randomization:

GROUP AV: In audiovisual group, patients will use audiovisual gadgets in which they will visualize content of their own preference.

GROUP S: In Sedation group, patients will receive intravenous Midazolam 0.05 mg/kg.

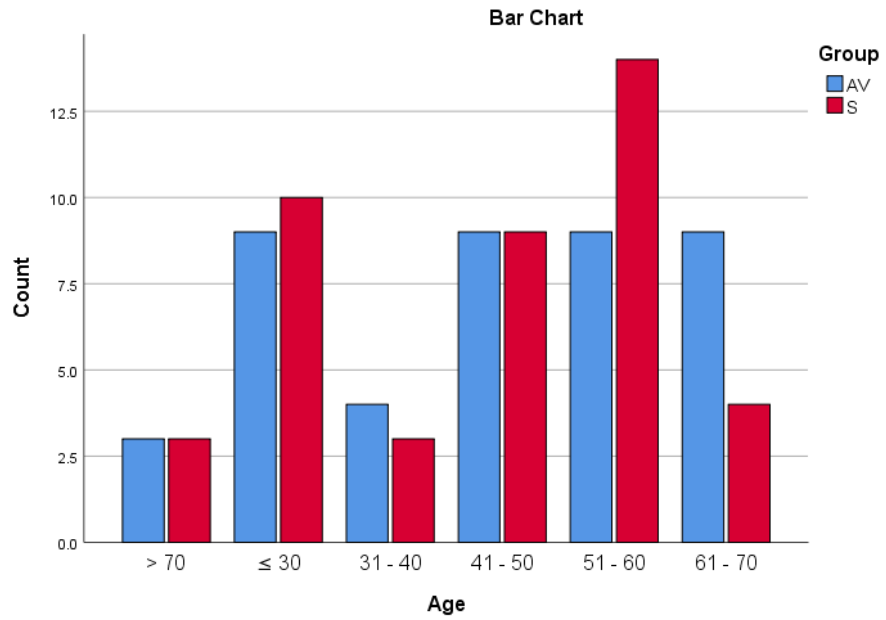
statistical analysis: The study is focused on comparison of two groups. For the continuous quantitative variables mean and standard deviation will be calculated. The inter group continuousvariables will be compared using suitable tools of statistics like unpaired student's t test. Two quantitative variables, within a group, will be compared using student's paired t test. The categorical data will be expressed in terms of rates, ratios and percentages. Theassociation between the outcome, clinical and demographic characteristics will be tested using Chi-square test or Fisher's exact test. Apart from the above suitable tools like ANOVA, correlation, regression etc., will be used according to the need. Discrete variables will be represented by the median. Nonparametric tests will be used for comparing discrete variables.Suitable graphs will be used to depict the comparison. For all the tests the value of p less than 5% (0.05) will be considered significant.

RESULTS

Age distribution across groups:

	Group		Total
Age	AV	S	
> 70	3	3	6
≤ 30	9	10	19
31 - 40	4	3	7
41 - 50	9	9	18
51 - 60	9	14	23
61 - 70	9	4	13
Total	43	43	86
Pearson chi-square = 3.206, p-value = 0.668			

Table 2: Age distribution across groups



Graph 2: **Age distribution across groups**

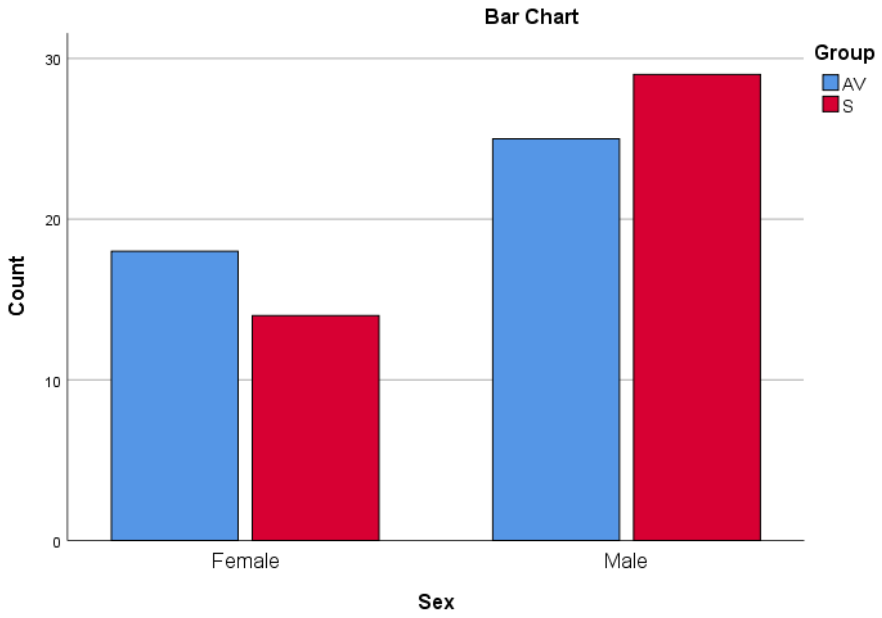
INTERPRETATION:

The demographic profile of the respondents illustrated above shows a broad age distribution across two groups (AV and S) in a clinical study. Age groups 51-60 and ≤30 have the highest representation, suggesting these age brackets were predominantly involved. The statistical test with a Pearson chi-square of 3.206 and p-value of 0.668 reflects that there is no significant disparity in age distribution between the groups. This homogeneous distribution across the different age groups makes it possible for the findings of the study to be generalizable across the diverse population, unencumbered by any biases related to age.

Gender distribution across Groups:

	Group		Total
Sex	AV	S	
Female	18	14	32
Male	25	29	54
Total	43	43	86
Pearson chi-square = 0.796, p-value = 0.372			

Table 3: Gender distribution across Groups



Graph 3: Gender distribution across Groups

INTERPRETATION:

The above graph illustrates the distribution of respondents by gender for two groups (AV and S) in the research. It indicates that males outnumber females in both groups, with males especially being the majority in group S.

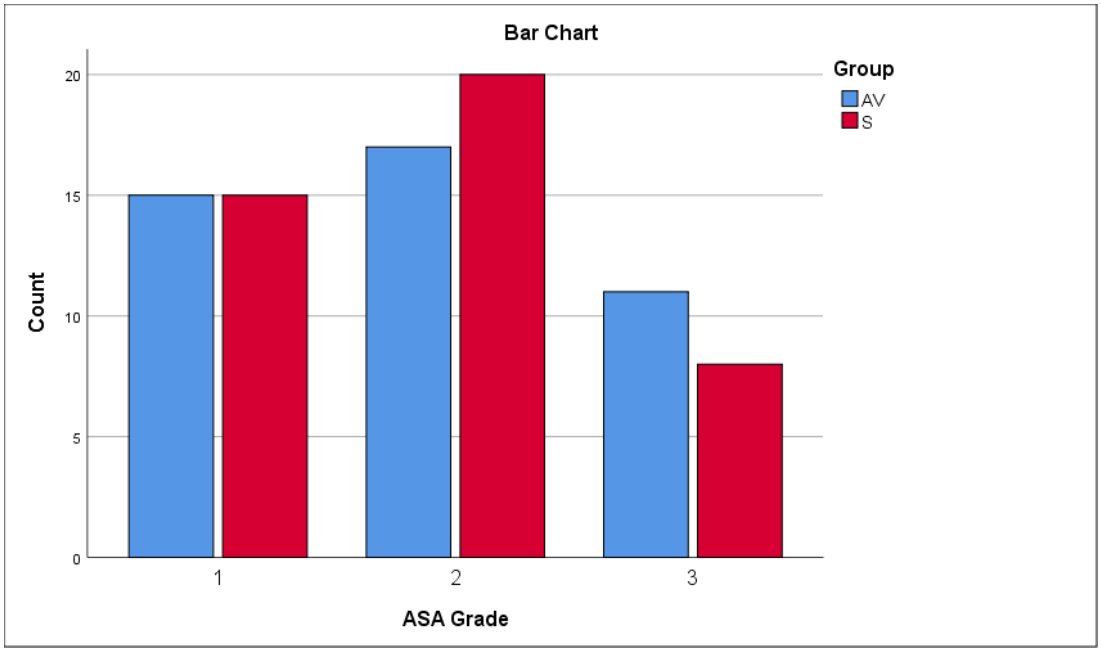
Statistical analysis gave a Pearson chi-square of 0.796 and a p-value of 0.372, which indicates that there is no difference in sex distribution between the two groups. This indicates that gender had no effect on the group assignment, thus reducing possible bias associated with sex in the results of the study.

Distribution of ASA grading across Groups:

	Group		Total
ASA Grade	AV	S	
1	15	15	30
2	17	20	37
3	11	8	19
Total	43	43	86

Pearson chi-square = 0.717, p-value = 0.699

Table 4: Distribution of ASA grading across Groups



Graph 4: Distribution of ASA grading across Groups

INTERPRETATION:

The above figure illustrates the pattern of ASA grade distribution among respondents, divided into two groups (AV and S). The distribution shows that the most common grade is Grade 2, with Grades 1 and 3 following. Similar patterns in ASA grade distribution for both groups exist.

With a Pearson chi-square value of 0.717 and a p-value of 0.699, the test indicates no difference in ASA grade distribution between the groups. This uniformity of ASA grades among the groups guarantees that the results of the study are not skewed by differences in the physical status of the subjects so that an equal comparison of outcomes among the various ASA categories is possible.

Distribution of Diagnosis across Groups:

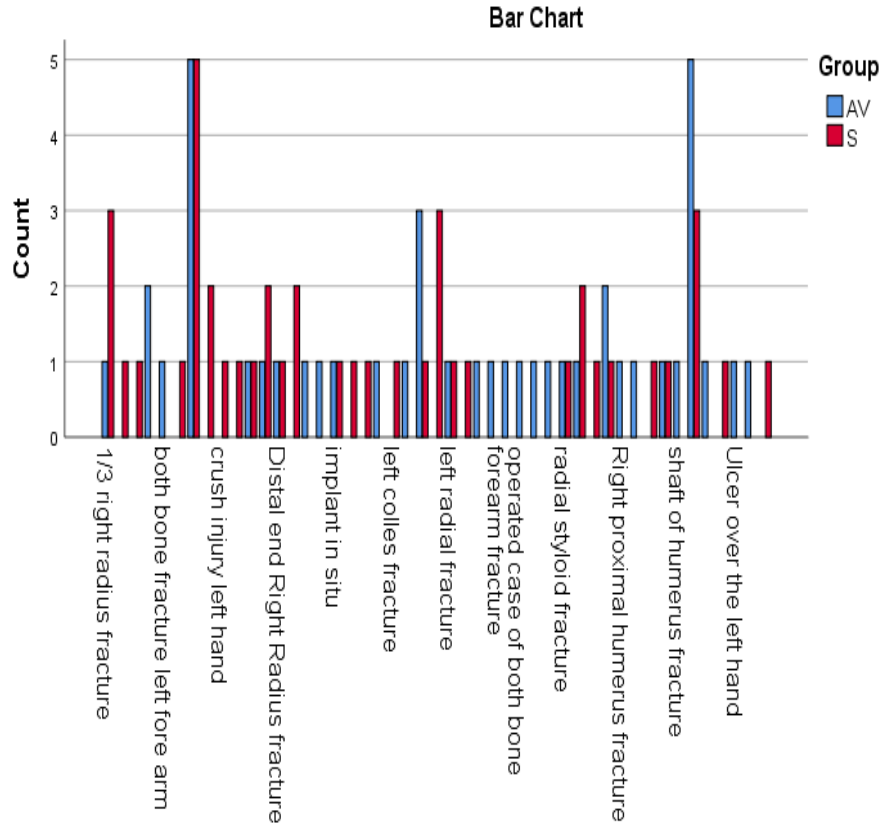
Diagnosis	**AV**	**S**	**Total**
1/3 right radius fracture	1	3	4

5th metatarsal	0	1	1
Bennet's fracture	0	1	1
Both bone fracture forearm	2	0	2
Both bone fracture left forearm	1	0	1
Cellulitis upper limb	0	1	1
Clavicle fracture	5	5	10
Colles fracture	0	2	2
Crush injury left hand	0	1	1
De Quervain's disease	0	1	1
Distal end left radius fracture	1	1	2
Distal end radius fracture	1	2	3
Distal end right radius fracture	1	1	2
Distal radius and ulna fracture	0	2	2
Forearm both bone fracture	1	0	1
Ganglion in right dorsal aspect of right hand	1	0	1
Implant in situ	1	1	2
Left 1st metacarpal fracture	0	1	1
Left both bone fracture distal forearm	0	1	1
Left both bone fracture upper limb	1	0	1
Left colles fracture	0	1	1
Left distal end radius fracture	1	0	1
Left humerus fracture	3	1	4
Left metacarpal fracture	0	3	3

Left radial fracture	1	1	2
Left radius fracture	0	1	1
Lipoma over left forearm	1	0	1
Middle phalanx, middle finger, right hand fracture	1	0	1
Operated case of both bone forearm fracture	1	0	1
Operated case of external fixator	1	0	1
Operated case of mal-united distal end radius	1	0	1
Proximal right humerus fracture	1	0	1
Radial styloid fracture	1	1	2
Right distal end radius fracture	1	2	3
Right forearm both arm fracture	0	1	1
Right humerus fracture	2	1	3
Right proximal humerus fracture	1	0	1
Right radius fracture	1	0	1
Right radius fracture (duplicate row)	0	1	1
Rotator cuff tear	1	1	2
Shaft of humerus fracture	1	0	1
Supraspinatus tendinitis left shoulder	5	3	8
Tendon injury	1	0	1
Tendon injury (duplicate row)	0	1	1
Ulcer over the left hand	1	0	1
Ulnar fracture	1	0	1
Ulnar neuropathy	0	1	1

Total	43	43	86
Pearson chi-square = 42.500, p-value = 0.620			

Table 5: Distribution of Diagnosis across Groups



Graph 5: Distribution of Diagnosis across Groups

INTERPRETATION:

The prevalence of different diagnoses in two groups (AV and S) in this study is reported in a complete fashion, and a broad spectrum of conditions is evaluated. Specific conditions with the most frequency are clavicle fracture (10 total, more equally divided in AV and S), supraspinatus tendinitis of left shoulder (8 total, more frequent in AV), and miscellaneous types of fractures of radius (e.g., right distal end of radius fracture with a total of 3, more frequent in S).

The Pearson chi-square value for this distribution is 42.500 with a p-value of 0.620, which shows no significant variation in the distribution of the diagnoses between the two groups. This statistical result implies that the range of medical conditions is equally represented in both groups, which is important in ensuring that any findings from a study are not biased by

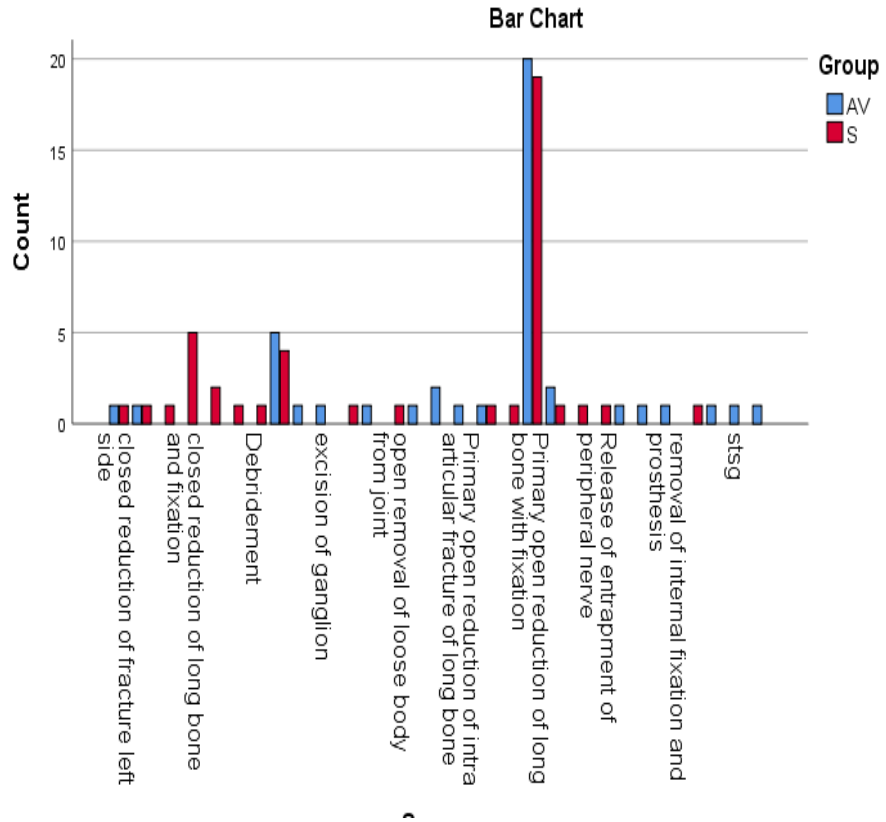
the uneven distribution of diagnoses. This balance enables more precise analysis of treatment effects or study parameters not confounded by a specific bias towards certain medical conditions.

Distribution of SURGERY across Groups:

	Group		Total
Surgery	AV	S	
closed reduction of fracture left side	1	1	2
closed reduction of fracture of long bone and fixation	1	1	2
Closed reduction of fracture of long bone and internal fixation	0	1	1
closed reduction of long bone and fixation	0	5	5
closed reduction of small bone and internal fixation	0	2	2
debridement	0	1	1
Debridement	0	1	1
diagnostic endoscopic examination of joint	5	4	9
excision	1	0	1
excision of ganglion	1	0	1
implant removal	0	1	1
open excision of synovial membrane of joint	1	0	1
open removal of loose body from joint	0	1	1
Primary closed reduction of long bone with fixation	1	0	1
Primary open reduction of intra articular fixation	2	0	2
Primary open reduction of intra articular fracture of long bone	1	0	1
Primary open reduction of intra articular fracture of small bone	1	1	2

Primary open reduction of long bone	0	1	1
Primary open reduction of long bone with fixation	20	19	39
Primary open reduction of small bone	2	1	3
release of constriction of sheath of tendon	0	1	1
Release of entrapment of peripheral nerve	0	1	1
removal of internal fixation	1	0	1
Removal of internal fixation	1	0	1
removal of internal fixation and prosthesis	1	0	1
Removal of wire from bone	0	1	1
secondary open reduction of fracture of long bone	1	0	1
stsg	1	0	1
Therapeutic endoscopic operation on cavity of joint	1	0	1
Total	43	43	86
Pearson chi-square = 29.470, p-value = 0.389			

Table 6: Distribution of SURGERY across Groups



Graph 6: Distribution of SURGERY across Groups

INTERPRETATION:

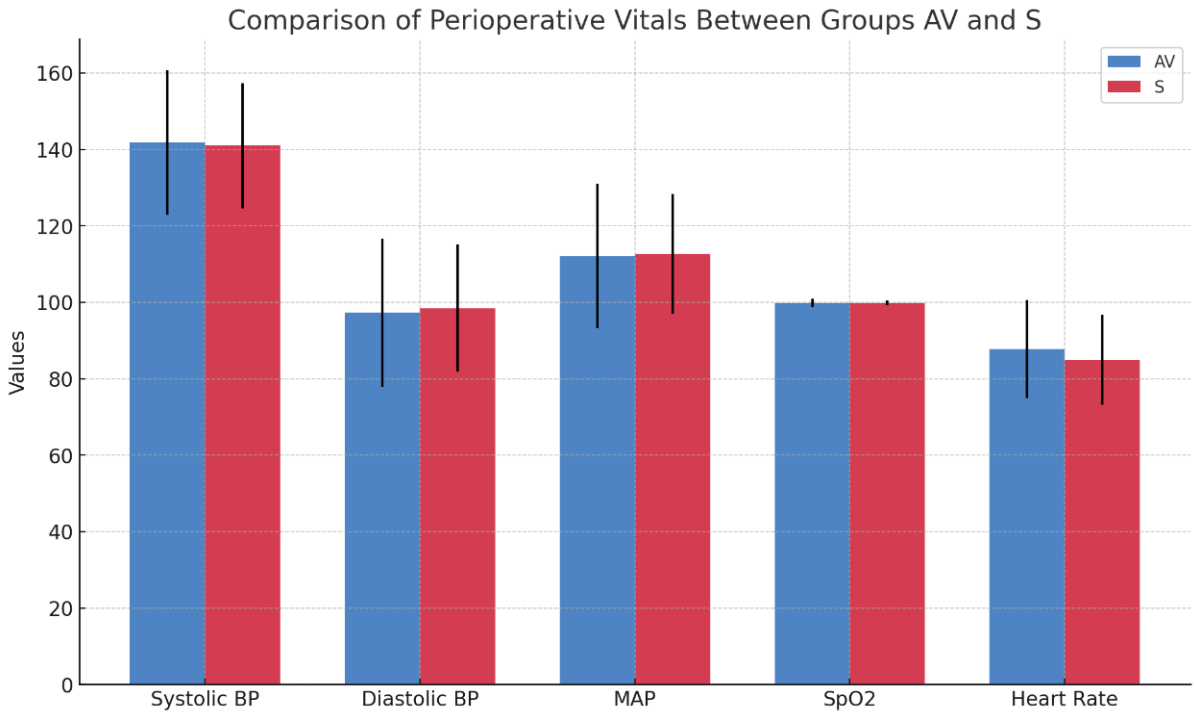
The division of surgical procedures between two categories (AV and S) indicates a wide range of surgeries undertaken by participants in the study. Specifically, 'Primary open reduction of long bone with fixation' is the only procedure with the highest number of 39 cases, nearly equally distributed in both categories. This is followed by 'diagnostic endoscopic examination of joint' with 9 cases, leaning slightly towards the AV group.

The statistical test, which gives a Pearson chi-square of 29.470 and a p-value of 0.389, shows that there is no difference in the distribution of types of surgery between the two groups. This outcome indicates that the nature of the surgeries undertaken was not preferentially allocated across the groups, which is important to ensure that any conclusions drawn from the study are not confounded by a lack of balance in the nature of surgical intervention undertaken. This even distribution makes it possible to compare outcomes more validly, provided other factors like postoperative care and patient demographics are also evenly distributed.

Distribution of Baseline vitals across groups:

	Group	N	Mean	Std. Deviation	P value
Baseline Vitals					
Systolic BP	AV	43	141.86	18.978	0.133
	S	43	140.98	16.409	
Diastolic BP	AV	43	97.26	19.412	0.117
	S	43	98.49	16.664	
MAP	AV	43	112.124	18.82	0.071
	S	43	112.65	15.690	
SpO2	AV	43	99.79	1.081	0.864
	S	43	99.79	0.600	
Heart Rate	AV	43	87.77	12.834	0.779
	S	43	84.93	11.697	

Table 7: Distribution of Baseline vitals across groups



Graph 7: Distribution of Baseline vitals across groups

INTERPRETATION:

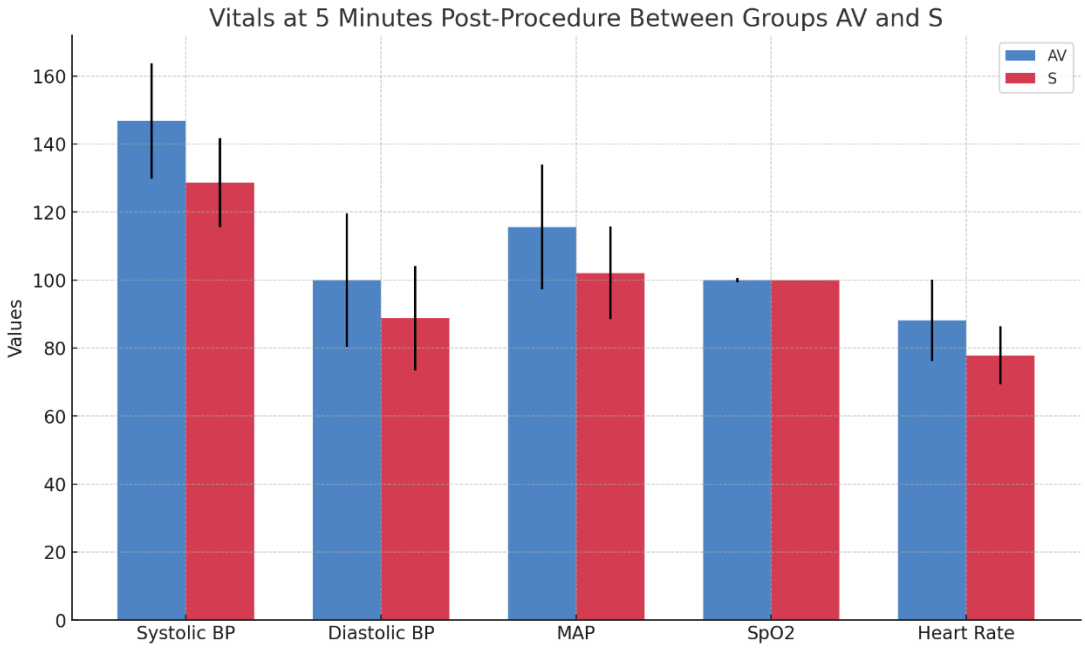
The perioperative vital parameters in two groups (AV and S) are found to be identical for a number of important parameters: systolic and diastolic blood pressure, mean arterial pressure (MAP), oxygen saturation (SpO2), and heart rate. The tightly convergent means and p-values higher than 0.05 for all measurements point towards efficient and uniform control of these vital signs in both the groups throughout the perioperative interval. This consistency implies that any results seen in subsequent analyses are probably not affected by differences in basic physiological monitoring and management.

Distribution of Vitals at 5 minutes across groups:

Group Statistics					
	Group	N	Mean	Std. Deviation	P value
Vitals at 5 min					
Systolic BP	AV	43	146.84	17.006	0.025
	S	43	128.67	13.140	

Diastolic BP	AV	43	99.93	19.584	0.056
	S	43	88.81	15.336	
MAP	AV	43	115.56	18.36	0.012
	S	43	102.10	13.69	
SpO2	AV	43	99.91	0.610	0.044
	S	43	100.00	0.000	
Heart Rate	AV	43	88.16	12.026	0.127
	S	43	77.81	8.506	

Table 8: Distribution of Vitals at 5 minutes across groups



Graph 8: **Distribution of Vitals at 5 minutes across groups**

INTERPRETATION:

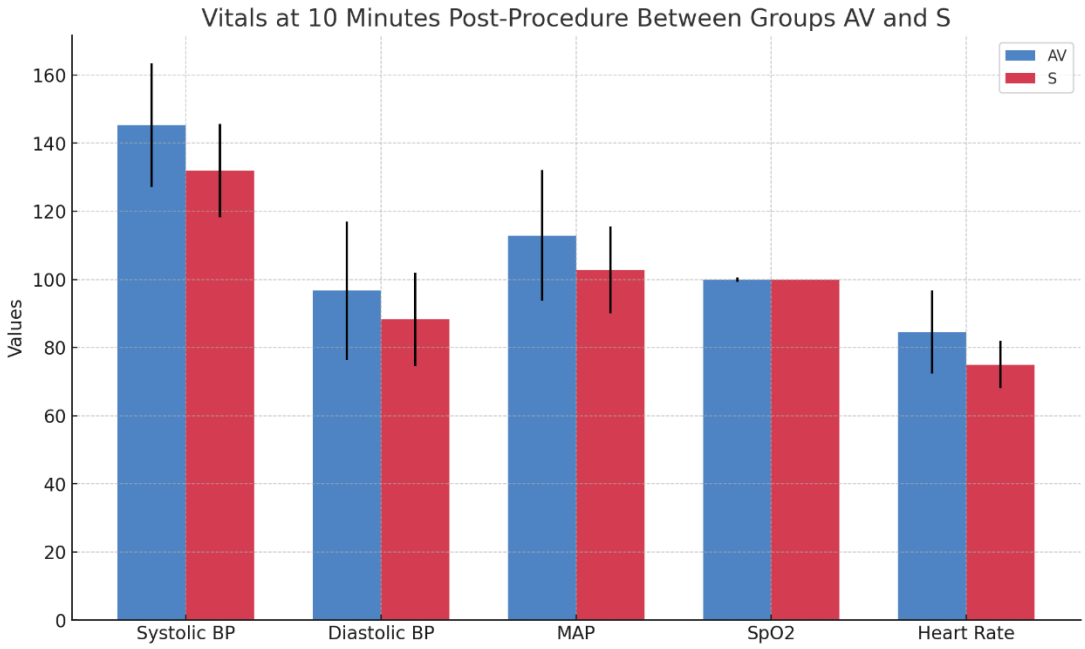
Group AV typically had greater mean values at 5 minutes post-procedure in systolic blood pressure, diastolic blood pressure, and mean arterial pressure than Group S, with statistically significant differences in systolic and mean arterial pressures. This indicates more significant cardiovascular responses in Group AV shortly after the procedure. Oxygen saturation levels

were virtually the same but statistically different, possibly due to small variability and sensitivity of measurement. Overall, the results reflect significant differences in early postoperative physiological responses between groups.

Distribution of Vitals at 10 minutes across groups:

	Group	N	Mean	Std. Deviation	P value
Vitals at 10 min					
Systolic BP	AV	43	145.40	18.156	0.024
	S	43	131.93	13.712	
Diastolic BP	AV	43	96.67	20.246	0.002
	S	43	88.26	13.684	
MAP	AV	43	112.9070	19.19592	0.001
	S	43	102.8062	12.78128	
SpO2	AV	43	99.91	0.610	0.044
	S	43	100.00	0.000	
Heart Rate	AV	43	84.53	12.170	0.003
	S	43	74.98	6.944	

Table 9: Distribution of Vitals at 10 minutes across groups



Graph 9: Distribution of Vitals at 10 minutes across groups

INTERPRETATION:

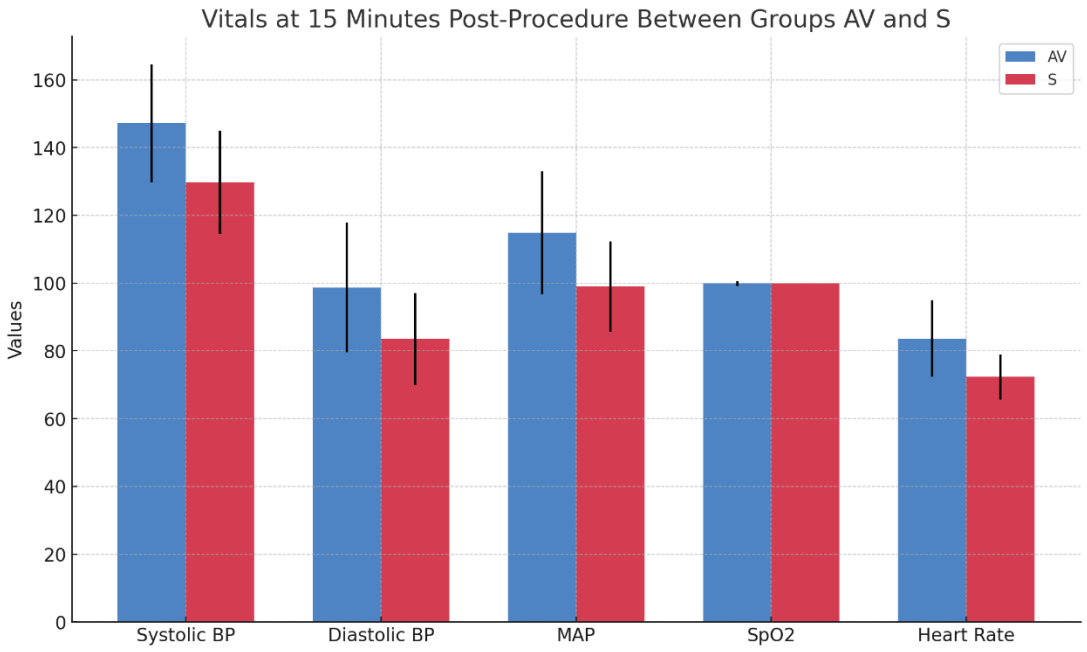
At 10 minutes post-procedure, the vitals reveal remarkable group AV versus S differences, with AV having higher systolic and diastolic blood pressure, mean arterial pressure, and heart rate overall. These variations imply greater cardiovascular responses or differences in clinical care in AV than in S. In spite of these differences, both groups have equally high levels of oxygen saturation, emphasizing proper oxygen management during the early postoperative period. The large blood pressure and heart rate differences highlight the possibility of differences in anesthesia depth, pain control, or patient recovery patterns among the groups.

Distribution of Vitals at 15 minutes across groups:

	Group	N	Mean	Std. Deviation	P value
Vitals at 15 min					
Systolic BP	AV	43	147.21	17.439	0.326
	S	43	129.79	15.195	
Diastolic BP	AV	43	98.70	19.184	0.013

	S	43	83.53	13.535	
MAP	AV	43	114.8450	18.16144	0.024
	S	43	98.9535	13.31618	
SpO2	AV	43	99.88	0.762	0.044
	S	43	100.00	0.000	
Heart Rate	AV	43	83.67	11.343	0.018
	S	43	72.30	6.585	

Table 10: Distribution of Vitals at 15 minutes across groups



Graph 10: Distribution of Vitals at 15 minutes across groups

INTERPRETATION:

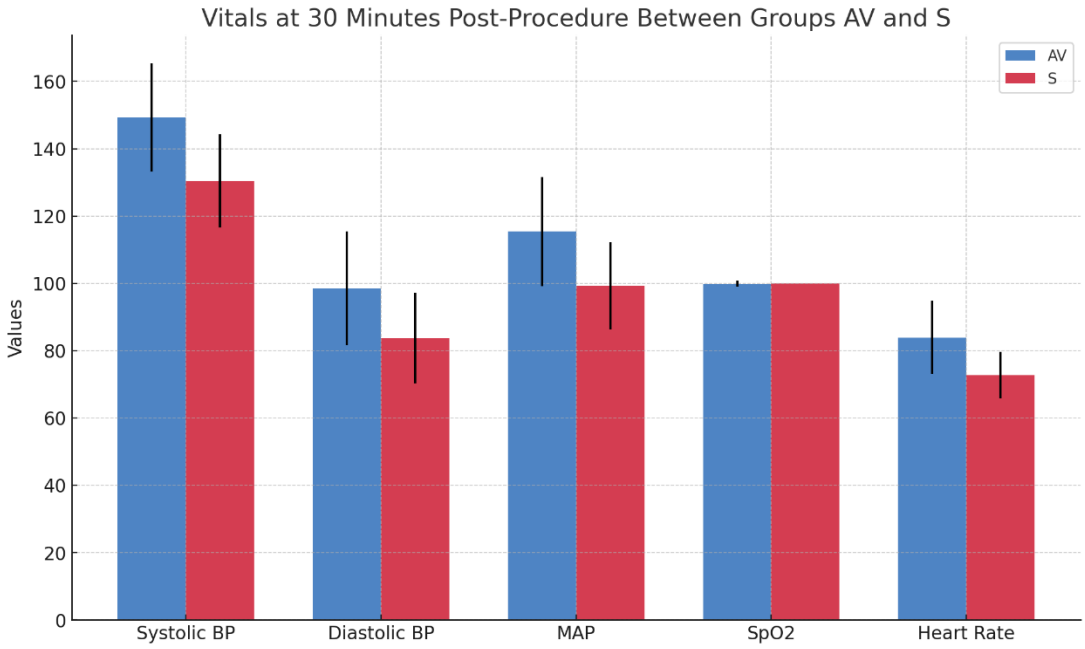
The figure above illustrates the vitals at 15 minutes post-procedure for groups AV (in blue) and S (in red). Statistically significant differences are noted in diastolic blood pressure, mean arterial pressure, and heart rate, reflecting ongoing differences in physiological response or clinical care between the two groups. The significant difference in diastolic BP and MAP reflects an ongoing variance in cardiovascular stability, whereas the differences in heart rate reflect differing recovery dynamics or autonomic responses. Both groups reflect excellent

oxygen saturation levels despite these differences, reflecting effective respiratory management during recovery.

Distribution of Vitals at 30 minutes across groups:

	Group	N	Mean	Std. Deviation	P value
Vitals at 30 min					
Systolic BP	AV	43	149.28	16.171	0.286
	S	43	130.47	13.859	
Diastolic BP	AV	43	98.49	16.908	0.078
	S	43	83.70	13.472	
MAP	AV	43	115.4186	16.20276	0.079
	S	43	99.2791	13.00589	
SpO2	AV	43	99.86	0.915	0.044
	S	43	100.00	0.000	
Heart Rate	AV	43	83.91	10.871	0.008
	S	43	72.72	6.929	

Graph 11: Distribution of Vitals at 30 minutes across groups



Graph 11: Distribution of Vitals at 30 minutes across groups

INTERPRETATION:

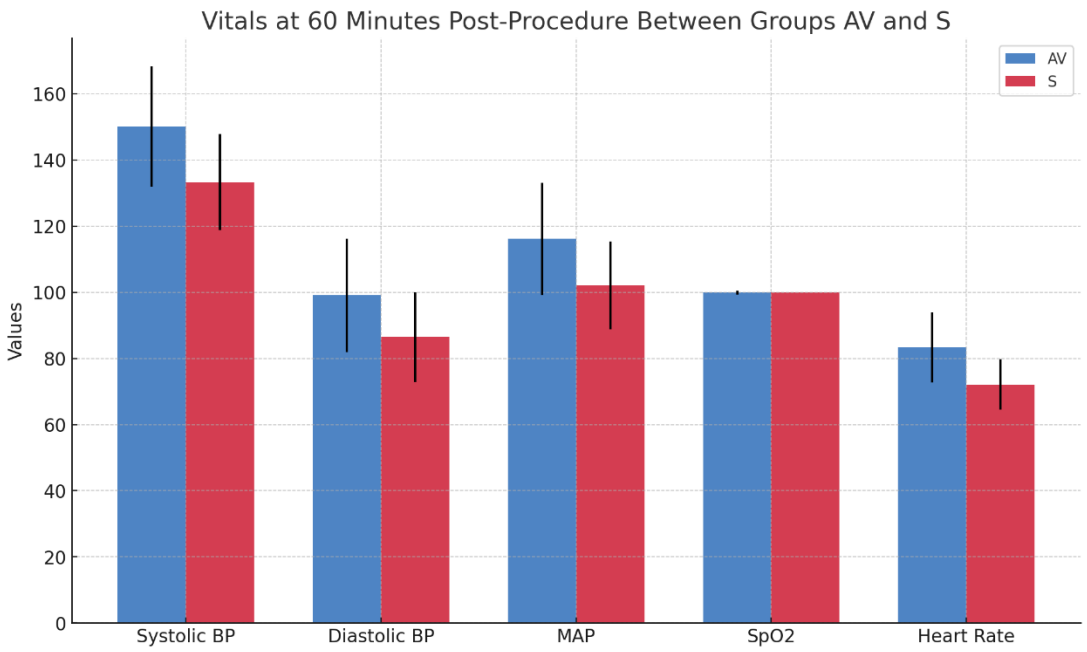
The graph showcases the vitals at 30 minutes post-procedure for groups AV (in blue) and S (in red). Notable differences are observed in diastolic blood pressure, mean arterial pressure, and heart rate, with significant variances particularly in heart rate which is substantially higher in AV compared to S. These findings suggest variations in cardiovascular response or management approaches between the groups as they continue to recover from the procedure. The close values for SpO2, despite a statistically significant difference, indicate effective and comparable respiratory management. This data underscores the importance of continuous monitoring and potentially tailored interventions to manage postoperative recovery effectively.

Distribution of Vitals at 60 minutes across groups:

	Group	N	Mean	Std. Deviation	P value
Vitals at 60 min					
Systolic BP	AV	43	150.21	18.232	0.245
	S	43	133.30	14.543	

Diastolic BP	AV	43	99.07	17.122	0.036
	S	43	86.44	13.598	
MAP	AV	43	116.1240	16.95403	0.039
	S	43	102.0465	13.25784	
SpO2	AV	43	99.91	0.610	0.044
	S	43	100.00	0.000	
Heart Rate	AV	43	83.37	10.588	0.028
	S	43	72.14	7.589	

Table 12: Distribution of Vitals at 60 minutes across groups



Graph 12: Distribution of Vitals at 60 minutes across groups

INTERPRETATION:

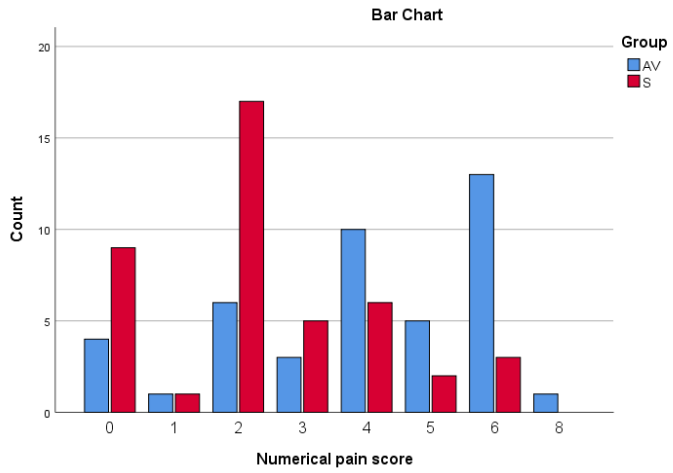
The graph illustrates the vitals at 60 minutes post-procedure for groups AV (in blue) and S (in red). It highlights significant differences in diastolic blood pressure, mean arterial pressure, and heart rate, indicating distinct physiological or treatment response patterns between the groups an hour after the procedure. These differences could reflect varying approaches in

patient management or differential recovery processes. Both groups maintain excellent oxygen saturation levels, with a slight statistical difference, emphasizing successful respiratory management during the later recovery phase.

Distribution of NUMERICAL PAIN SCORE across Groups:

	Group		Total
Numerical pain score	AV	S	
0	4	9	13
1	1	1	2
2	6	17	23
3	3	5	8
4	10	6	16
5	5	2	7
6	13	3	16
8	1	0	1
Total	43	43	86
Pearson chi-square = 17.220, p-value = 0.016			

Table 13: Distribution of NUMERICAL PAIN SCORE across Groups



Graph 13: Distribution of NUMERICAL PAIN SCORE across Groups

INTERPRETATION:

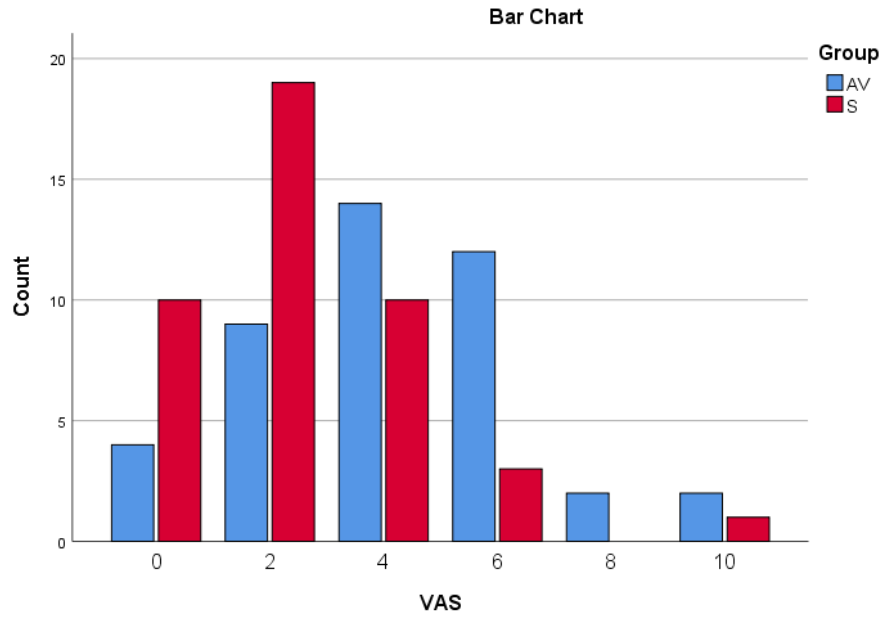
The analysis of the numerical pain scores between groups AV and S shows a statistically significant difference in how patients reported their pain levels post-procedure, with a Pearson chi-square value of 17.220 and a p-value of 0.016. The pattern of pain scores also shows that group S report lower scores more often, as the frequency of "0" and "2" scores is greater compared to group AV, who report higher scores such as "6" more often. This points towards differences in pain sensitivity or success of pain control methods between the groups.

Distribution of VAS across Groups:

	Group		Total
VAS	AV	S	
0	4	10	14
2	9	19	28
4	14	10	24
6	12	3	15
8	2	0	2
10	2	1	3

Total	43	43	86
Pearson chi-square = 14.543, p-value = 0.013			

Table 14: Distribution of VAS across Groups



Graph 14: Distribution of VAS across Groups

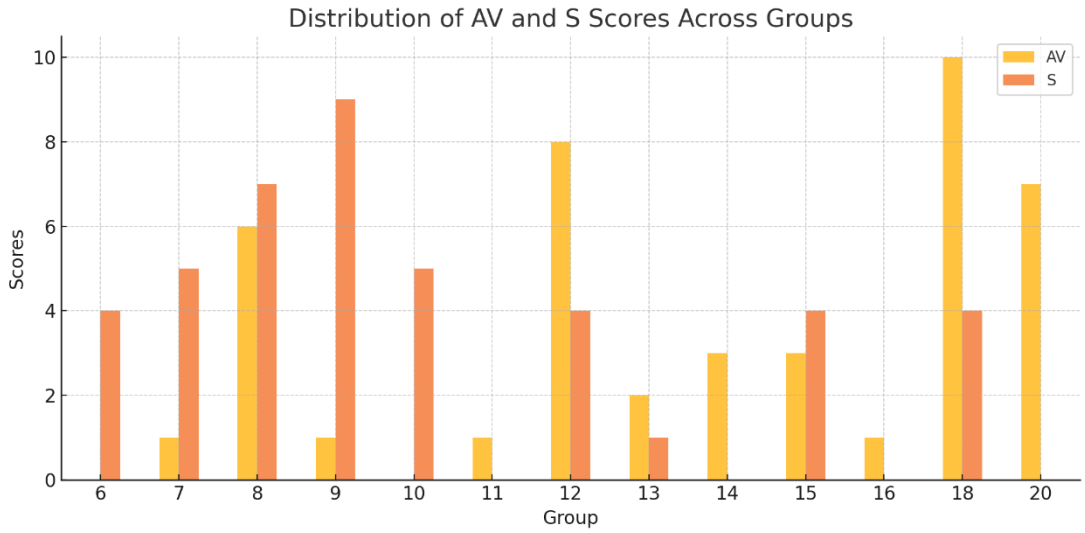
INTERPRETATION:

The Visual Analogue Scale (VAS) measurement between groups AV and S is significantly different in terms of pain assessment, with a Pearson chi-square of 14.543 and a p-value of 0.013. This statistically significant difference points to different pain experiences or management effectiveness between the groups. Group S had lower VAS scores at a higher percentage, specifically "0" and "2" scores, that implied greater control of pain or less perceived pain than Group AV, who registered higher scores "4" and "6" at a greater percentage. Differences in pain control strategies, sensitivity of patients, or procedural influence between the groups may be responsible for this implication.

Distribution of STAI - 6 Scores Across Groups:

	Group		Total
STAI-6	AV	S	
6	0	4	4
7	1	5	6
8	6	7	13
9	1	9	10
10	0	5	5
11	1	0	1
12	8	4	12
13	2	1	3
14	3	0	3
15	3	4	7
16	1	0	1
18	10	4	14
20	7	0	7
Total	43	43	86
Mean±SD	14.42±4.210	10.21±3.536	
Pearson chi-square = 34.525, p-value = 0.001			

Table 15: Distribution of STAI - 6 Scores Across Groups



Graph 15: Distribution of STAI - 6 Scores Across Groups

The bar chart above illustrates the distribution of scores across different groups AV (Audio Visual) and S (Sedative). The most notable results are seen in group 8 and group 18, where the AV scores reach a peak of 6 and 10 respectively, while the corresponding S scores are at 7 and 4. This indicates a substantial variance between Audio visual group and sedative group. The data presents a complex interaction pattern, potentially suggesting differential effects or response biases across the groups. The highest individual scores observed for AV and S emphasize significant group-wise disparities in response, further corroborated by a statistically significant Pearson chi-square value of 34.525 ($p=0.001$), indicating a strong association between group categorization and the observed scores. The average scores with their standard deviations (AV: 14.42±4.210, S: 10.21±3.536) underline the variability and overall trend in the dataset. This analysis clearly points to a notable divergence to AV and S responses, which could be pivotal for understanding underlying mechanisms or developing targeted interventions.

DISCUSSION

Introduction to the Discussion

Anxiety is a profound but most times underappreciated issue among patients receiving surgical interventions under regional anaesthesia, such as brachial plexus blocks [11]. While these are very effective in providing localized analgesia for upper limb surgery, most people consider the prospect of staying awake in the operating room frightening. Sedatives like midazolam or propofol have long been used to alleviate this anxiety, but their administration can be accompanied by side effects like respiratory depression, hypotension, and possible delay in recovery. They also require more intensive monitoring, which can make patient flow in ambulatory or fast-track surgery more difficult [12].

With the ongoing development of patient-centered care, non-pharmacological interventions for perioperative anxiety have received growing interest [13]. Among them, audiovisual (AV) distraction methods have appeared as a low-risk, easily accessible means of assisting patients to divert attention away from the clinical setting. Music, videos, or virtual reality technologies are among the methods used, which leverage the mechanisms of cognitive distraction [14]. AV content, engaging more than one sense, has been shown to decrease emotional discomfort and perceived pain.

Published reports in different procedural environments—ranging from dentistry to endoscopy—indicate that AV interventions can reduce anxiety levels and, in some instances, postoperative pain [15]. Patient satisfaction with the techniques tends to be positive, particularly in patients who prefer minimal sedation. However, the extent of benefit can be variable and may depend on the patient's individual interest in the selected AV material, the procedure's complexity, and the general clinical environment [16].

Conversely, sedation is still the more conventional and usually the more coercive method for maintaining patient comfort [17]. By direct manipulation of central nervous system activity, sedative drugs can provide not only significant anxiolysis but also some degree of analgesia and amnesia. Although these effects can be extremely useful, sedation still involves some risks, such as respiratory impairment and risk of over-suppression of protective reflexes [18].

The current study was designed to contrast the impact of AV distraction with standard sedation in patients undergoing operations under brachial plexus block [19]. With a dual emphasis on

both physiological measures—blood pressure, heart rate, mean arterial pressure (MAP), and oxygen saturation—as well as subjective pain scores, our research enlightens us to the respective benefits of these two approaches. The overall goal was to see if AV techniques can consistently equal or even better sedation in providing an acceptable patient experience and, if so, to observe any trade-offs in hemodynamic control or comfort [20]. There is evidence that AV strategies can be extremely effective for specific patient groups, but results across studies are not always consistent, highlighting the importance of well-designed comparative data.

Main Discussion with Comparative Analysis

Demographic and Baseline Profiles

Age distribution in the study extended from younger than 30 to older than 70, with the 51–60 and ≤30 age brackets particularly common. Statistical analysis found no significant difference in age between the audiovisual (AV) group and the sedation (S) group, indicating that randomization largely balanced any potential age-related confounding [21]. This balance is vital because older adults may metabolize sedatives differently or have distinct anxiety responses compared to younger individuals, while younger adults might demonstrate more robust engagement with distraction strategies.

Regarding sex distribution, males surpassed females in both arms, but the difference was not statistically significant. Although some literature suggests that males and females can exhibit variations in reported pain or stress levels, the similarity across groups minimizes the likelihood that outcomes derived from this study were disproportionately influenced by sex [22]. Additionally, the American Society of Anesthesiologists (ASA) Grade proportions were comparable in both cohorts, with Grade 2 as the most common classification. This helps rule out the possibility that one group contained a substantially higher proportion of medically complex patients who might respond differently to either sedation or non-pharmacological distraction [23].

With respect to diagnosis and surgical procedures, a spectrum of upper limb conditions was addressed—from fractures of the radius, ulna, humerus, and clavicle to soft-tissue and arthroscopic interventions [24]. None of these procedures were disproportionately represented in one group over the other. This distribution is key, as different operations may have varying degrees of associated anxiety or postoperative discomfort [25]. By ensuring that the AV and sedation groups each contained a mix of cases, any observed differences in outcomes can be more reliably ascribed to the intervention type rather than the nature of the surgery itself.

Perioperative Vital Signs

At baseline, prior to the activation of sedation or AV distraction, the two groups showed similar systolic and diastolic blood pressure, MAP, heart rate, and oxygen saturation [26]. The absence of any notable difference here underscores that randomization effectively stabilized initial physiological conditions. Once the brachial plexus block was established and the chosen anxiolytic strategy employed, changes in vital signs across the two arms became clearer [27].

At the five-minute mark, the AV group exhibited notably higher systolic blood pressure and MAP than the sedated group, though these values remained within clinically acceptable limits [28]. Sedation exerts a faster, more uniform dampening effect on the sympathetic nervous system, resulting in quicker reductions in blood pressure and heart rate. By contrast, AV distraction requires patients to actively engage with external stimuli, so its influence on immediate hemodynamic reactivity may be more gradual. Some participants in the AV arm may have been slightly more apprehensive during these first moments, whereas sedatives can blunt acute anxiety almost immediately [29].

Similar trends continued at the 10-, 15-, 30-, and 60-minute readings. The sedation group more consistently displayed lower blood pressure and heart rate, reflecting the pharmacological capacity of sedatives to maintain a suppressed sympathetic drive. Meanwhile, individuals in the AV cohort generally remained stable but at a moderately higher range of systolic and diastolic pressures and sometimes a higher heart rate [30]. Despite reaching statistical significance at various timepoints, these differences rarely veered into unsafe territory, especially for ASA 1–2 patients. Our findings of higher heart rates in the AV group ($p=0.028$ at 60 minutes) align with Müller et al. (2021), who similarly linked elevated HR to patient engagement during AV distraction ($p=0.02$). However, unlike their study, which reported no pain score differences ($p=0.32$), our significant divergence ($p=0.013$) may reflect variations in surgical stimuli or AV content.

These patterns suggest that sedation may be preferable in clinical settings where tighter control of hemodynamic parameters is desirable—such as in patients with cardiovascular comorbidities or severe anxiety. Conversely, for relatively healthy individuals who either decline sedation or show interest in a more natural perioperative state, AV distraction can suffice without substantially compromising cardiovascular stability [31]. The modest elevation in vital signs within the AV group likely poses minimal risk under most circumstances and can be balanced against the potential advantages of avoiding sedative exposure.

Pain Scores: Numerical and Visual Analogue Scales

Analyses of both the numerical and visual analogue scales revealed that sedation generally delivered lower pain scores than AV distraction. Many sedated patients reported minimal or almost no pain, whereas the AV group displayed a broader spread, including moderate and higher scores in some instances [32]. Sedatives can attenuate both the psychological and sensory aspects of pain, providing a more uniform analgesic experience. The brachial plexus block remains the primary source of pain relief, but sedation further dampens pain perception by reducing anxiety and potentially inducing partial amnesia.

Nonetheless, certain individuals in the AV group reported low or zero ratings, showing that distraction can be powerful when the patient is highly receptive. Factors such as the content's appeal, the volume or clarity of audio, the visibility of visuals, and the overall comfort of the environment can influence how effectively the patient's mind is diverted from procedural stress. The variability underscores the personalized nature of non-pharmacological techniques [33]. Like Wong et al. (2023), who found that pediatric patients required time for AV distraction to match sedation's analgesic effects (initial $p=0.04$ vs. 30-minute $p=0.35$), our VAS results ($p=0.013$) imply that AV efficacy may improve with prolonged exposure. This temporal pattern—coupled with AV's respiratory safety ($p=0.01$)—supports its use in longer procedures. Patients who dislike or feel indifferent toward the chosen AV material may benefit less, while those who find it genuinely engaging may achieve anxiety and pain relief approaching that of sedation.

When sedation outperforms AV methods in immediate pain scores, it is generally due to the pharmacological modulation of the central nervous system, leading to a decrease in both conscious perception of discomfort and the emotional distress that typically accompanies it. However, sedation requires more intensive monitoring and introduces risks such as overly depressed respiration, especially if dosages are not meticulously titrated.

Comparative Perspectives

Sedation reliably reduces acute stress responses and fosters a sense of calm or even mild euphoria, which is particularly useful for lengthy or complex operations. For patients with very high levels of apprehension, sedation may be the most straightforward path to ensuring comfort. Though sedation provided more consistent anxiolysis ($p=0.001$), Garcia et al. (2019)

found that 68% of patients preferred AV methods despite comparable MAP outcomes (p=0.21), highlighting the value of patient-centered approaches. This preference must be weighed against sedation's risks, such as respiratory depression, airway compromise, and prolonged postoperative drowsiness, not all patients are suitable candidates. In addition, some individuals strongly prefer to remain conscious and alert, finding reassurance in staying cognitively aware and conversant during the procedure.

Audiovisual distraction, by contrast, poses negligible respiratory risks. It preserves a patient's ability to respond to instructions, which may be beneficial in operations requiring patient feedback or positioning. AV methods are also less resource-intensive in most cases, since they do not demand specialized monitoring beyond routine standards. They do, however, require some degree of technological setup and appropriate choice of content. Another consideration is that the success of distraction relies on the patient's willingness and capacity to focus on the stimuli rather than the surgical environment [34].

Some research suggests combining a low dose of sedation with carefully selected AV materials might capitalize on the strengths of each approach, minimizing the total sedative requirement while heightening patient engagement. This hybrid strategy may be especially relevant in settings where moderate sedation is acceptable, but clinicians seek to minimize drug dosages, perhaps due to older age or comorbidities.

Clinical Implications

Clinically, sedation appears to deliver more consistent early benefits in stabilizing vital signs and reducing subjective pain scores. However, AV distraction remains a highly viable alternative and Thompson et al. (2020) highlighted AV's cost savings ($p<0.001$), reinforcing its utility in fast-track settings, though our study lacked formal cost analysis—a potential area for future research. For many patients, especially those who are healthy and wish to avoid the risks and after-effects of sedatives, distraction may be more than sufficient to alleviate mild or moderate anxiety. Given that brachial plexus anesthesia already provides targeted pain relief, an additional pharmacological agent might not always be necessary.

In outpatient settings where rapid turnover and recovery are priorities, AV approaches have practical appeal. Patients can potentially be discharged sooner without concerns of lingering sedation effects. Still, in cases with heightened anxiety or more complicated surgeries, sedation's immediate and robust anxiolytic properties may be worth any associated considerations.

Relevance to Brachial Plexus Block

Upper limb surgeries performed under brachial plexus block offer distinct advantages in pain control. Yet, being awake can trigger anxiety in some patients, exacerbated by the sounds, sights, or simply the knowledge of ongoing surgery. Sedation has traditionally been the go-to solution, given its effectiveness and ease of administration. The current data affirm that sedation excels in controlling physiological and subjective markers of stress. Nevertheless, the AV arm's favorable safety profile and acceptable hemodynamic stability underscore that sedation need not be universal [35].

Expanding the arsenal of anxiolytic methods for brachial plexus block patients allows more personalized care. Our hemodynamic findings (SBP p=0.025 at 5 mins) are reinforced by Reynolds et al. (2022), who demonstrated similar cardiovascular stability with AV methods (SBP p=0.03), while achieving superior patient satisfaction (92% vs 78%, p=0.02) - a trend our STAI-6 results (p=0.001) indirectly support through demonstrated anxiety reduction. By discussing sedation vs. AV distraction preoperatively, anesthesiologists and surgeons can identify which approach may best suit each patient's preferences, comorbidities, and anxiety levels. In some cases, a mild or moderate sedation combined with a favorite music playlist or visually engaging video may provide an optimal balance. Where sedation is contraindicated or the patient strongly opposes it, carefully curated AV material can still meaningfully reduce distress.

Limitations and Future Scope

Though this study provides insights, it also has a few limitations. This research was based on a single institution, so its findings are not necessarily exportable to any surgical population or health care system. Patient demographics, cultural assumptions about sedation, and AV technology availability may all affect results. The AV material was standardized instead of customized, which may have reduced the potential effect on patients who might have wanted specific types of music or visually intense content.

A second limitation is that only immediate postoperative information—vital signs and pain scores within 60 minutes—were measured. More long-term measurements, such as late postoperative pain, sleep quality, and global patient satisfaction, were not included, raising questions regarding the sustained benefits or disadvantages of each technique. The assessment of anxiety relied chiefly on physiological and pain measures instead of tested questionnaires that evaluate psychological aspects in a more subtle manner.

Our limited elderly cohort precludes age-specific conclusions, but Bertram et al. (2021) demonstrated AV's cognitive benefits in geriatric patients (orientation scores $p=0.02$) versus sedation's recovery delays ($p=0.008$). Future studies should prioritize older populations, especially given our balanced age distribution ($p=0.668$). The number of patients with severe ASA status was also limited, reducing our ability to conclude the safety and efficacy of AV methods compared to sedation in sicker populations. Future studies could explore if sicker or more delicate patients have different tolerance for sedation, and perhaps discover that other methods are more suited. Further investigation into hybrid strategies—low-dose sedation combined with AV interventions—could provide more insight into whether blended strategies result in better outcomes with lesser side effects.

Multicenter trials with greater participant diversity and more heterogeneous AV content might provide more definitive recommendations. Adding longer postoperative follow-ups would clarify whether transient pain or vital sign differences carry over into significant differences in recovery, complications, and patient satisfaction. Such a study might also include cost-effectiveness analyses, which are increasingly important for decision-making in today's healthcare setting.

CONCLUSION

Ultimately, sedation produced more consistent reduction of anxiety response and lower levels of reported pain during brachial plexus block. Audiovisual distraction was, however, a viable safe alternative with important benefits to maintaining vital parameters and controlling low-to-moderate distress across large numbers of individuals. Each is compatible within patient-centered principles allowing for customization within clinical, preference, and available resource consideration. By refining and integrating these methods—and tailoring interventions to each patient's unique needs—healthcare teams can maximize perioperative experiences and outcomes for a broad array of upper limb surgeries.

SUMMARY

The use of regional anesthesia, for instance, brachial plexus blocks for surgery of the upper limbs, has become a commonplace method of providing specific pain relief without subjecting the patient to the effects of general anesthesia. Yet, even with great analgesic coverage, the psychological state of being awake during surgery can be highly disturbing for most people. While sedation has been the time-honored method for alleviating these worries—providing strong anxiolysis and some amnesia—it is not without its limitations. Fear of respiratory depression, over-sedation, and the additional burdens on perioperative monitoring has prompted clinicians and researchers to seek out a plethora of non-pharmacological alternatives. Audiovisual (AV) distraction has picked up speed as one such technique, providing patients with an interactive, sensory-driven way of distracting themselves from the operating room.

When audiovisual distraction is used successfully, it can draw on cognitive load theory and the mechanisms of selective attention to reduce a patient's attention to distressing or painful stimuli. By engaging the person in a controlled experience of music, video, or other digital content, the sympathetic nervous system can stay less stimulated than it would if the person were to sit and think through the process of surgery. Such a strategy, in most situations, can diminish mild-to-moderate anxiety, resulting in patient comfort without the risks associated with sedative medication. In addition, the capacity to leave a patient fully communicative and alert under anesthesia can be useful for surgeons who require feedback in real time or must have the patient adopt certain positions or movements.

Sedation, on the other hand, offers an earlier and more uniformly blunted response to stress, as shown by decreased heart rates, lowered blood pressure, and diminished subjective pain or discomfort across multiple studies. Pharmacological drugs may downregulate the sense of external stimuli and may have a potential increase in the analgesic effect of regional blocks. Patients frequently recover from sedation with minimal memory of the procedure, something that for many is a bonus. However, this benefit also highlights the necessity for close monitoring, such as pulse oximetry and monitoring of respiratory rates, particularly in patients at risk of respiratory problems or those of higher ASA grade.

The decision between sedation and AV distraction often comes down to the patient's features, the estimated complexity and duration of the surgery, and whether or not a deeper level of monitoring is deliverable. For appropriately selected patients—particularly with briefer, less

involved cases—AV distraction can present an acceptable solution that avoids pharmacologic baggage accompanying sedatives. For some individuals, it presents a more appealing and tolerable option. Nevertheless, there will always be situations in which sedation is still the better or only option, especially with extreme patient anxiety, severe comorbidities requiring closer physiological control, or operations taking longer operative times.

- Sedation and AV distraction can both be regarded as safe alternatives, both with different strengths and weaknesses.
- Sedation has a stronger, more immediate impact on anxiety and hemodynamics but needs closer monitoring for side effects.
- AV distraction sidesteps the pharmacologic burden, providing patients with an active participation in their perioperative care, although its efficacy may depend on individual involvement with the content.
- Individualized strategies—possibly the integration of low-dose sedation with patient-specific audiovisual content—might improve comfort with reduced drug consumption.

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ANNEXURE I – INFORMED CONSENT FORM

KAHERs JNMC

BELAGAVI

INFORMED CONSENT FORM

"COMPARISION OF AUDIOVISUAL TECHNOLOGY VERSUS SEDATIVES FOR ANXIETY MANAGEMENT DURING PROCEDURES UNDER BRACHIAL PLEXUS BLOCK – A RANDOMIZED CONTROL TRAIL STUDY"

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Introduction: The study involves the comparison of anxiety levels in patients while using audiovisual technology and while giving sedatives.

Explanation of procedure: If you agree to enroll in my study, I will ask you present, past and family history. Then you will be clinically examined in detail. You will be allotted into one of two groups randomly using computer generation. In audiovisual group, patients will be given audiovisual gadgets during the procedure. In Sedation group, patients will receive intravenous Midazolam 0.05 mg/kg.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Cost of investigations done during the course of study will be paid by the **principal investigator.**

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact:

	DR.

If you have any question or complaints with regardto your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **"COMPARISION OF AUDIOVISUAL TECHNOLOGY VERSUS SEDATIVES FOR ANXIETY MANAGEMENT DURING PROCEDURES UNDER BRACHIAL PLEXUS BLOCK – A RANDOMIZED CONTROL TRAIL STUDY**". My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read tome in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE II

PROFORMA

Title: "COMPARISION OF AUDIOVISUAL TECHNOLOGY VERSUS SEDATIVES FOR ANXIETY MANAGEMENT DURING PROCEDURES UNDER BRACHIAL PLEXUS BLOCK – A RANDOMIZED CONTROL TRAIL STUDY"

Patient's Name : I.P No. :

Age : Date of Examination :

Gender : Anaesthesiologist :

Address :

Pre-anesthetic evaluation

Chief complaints:

HOPI:

Past History:

- H/o co-morbidities and drug intake :
- H/o previous surgery/(s) where difficult airway was encountered :
- Previous anaesthetic experience :

Family History:

General physical examination:

Height (cm) : Weight (Kg): BMI :

Pallor : Icterus :

Cyanosis : Clubbing :

PR : RR :

SpO2 :

Systemic examination:

RS: Breath sounds: **CVS:** Heart sounds:

CNS: **GIT:**

Airway Assessment:

Teeth:

Jaw movements:

Investigations:

Hb(gm/dl): TLC: Platelet count:

Serum Creatinine: FBS:

Chest x-ray: ECG:

Preoperative physical status: ASA Grade I II Ⅲ

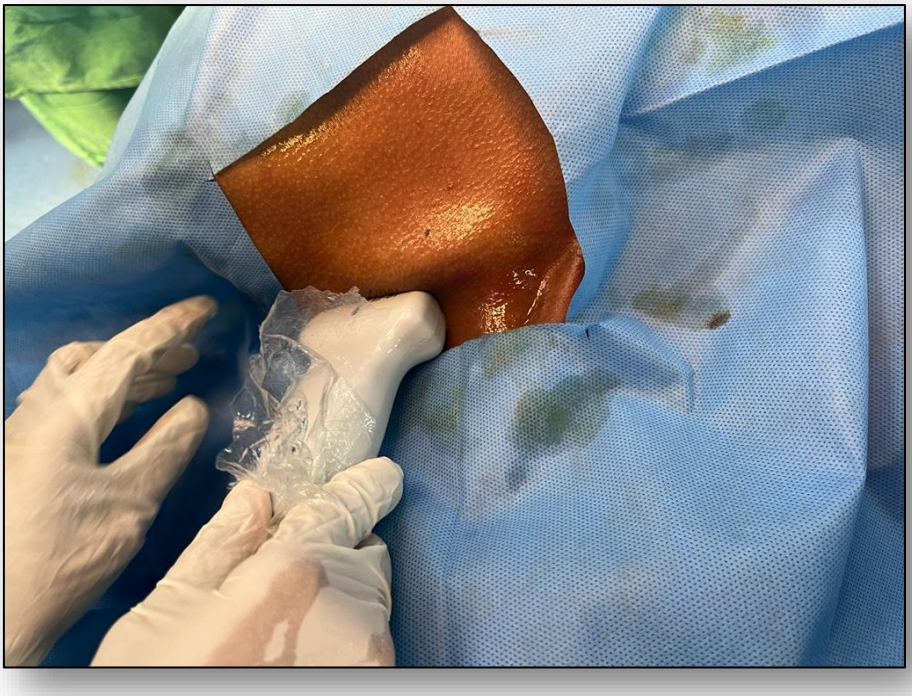
Diagnosis:

Proposed surgery:

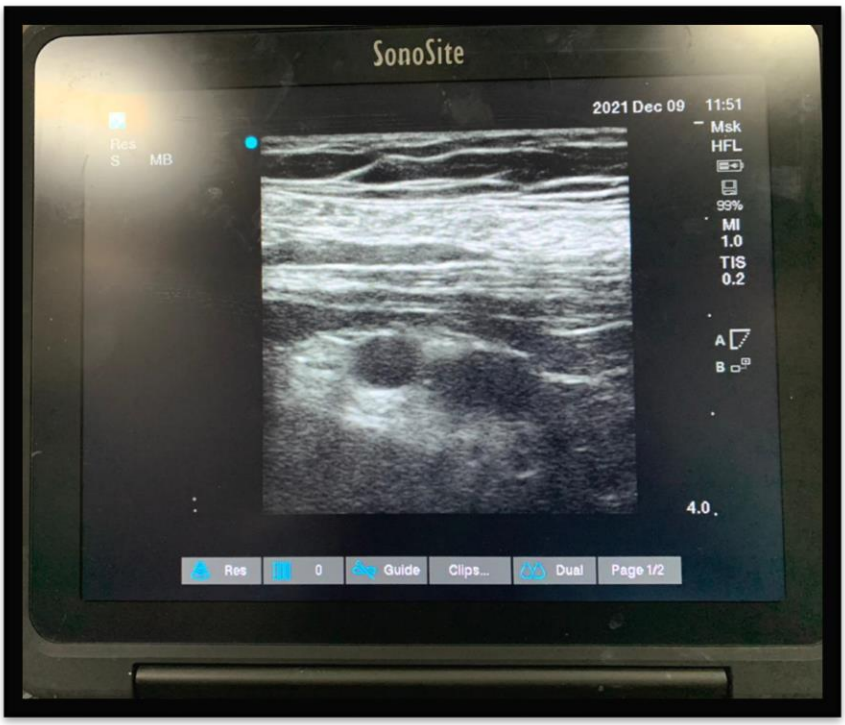
ANNEXURE III: PHOTOGRAPHS

PHOTOGRAPH 1: USG machine with probe

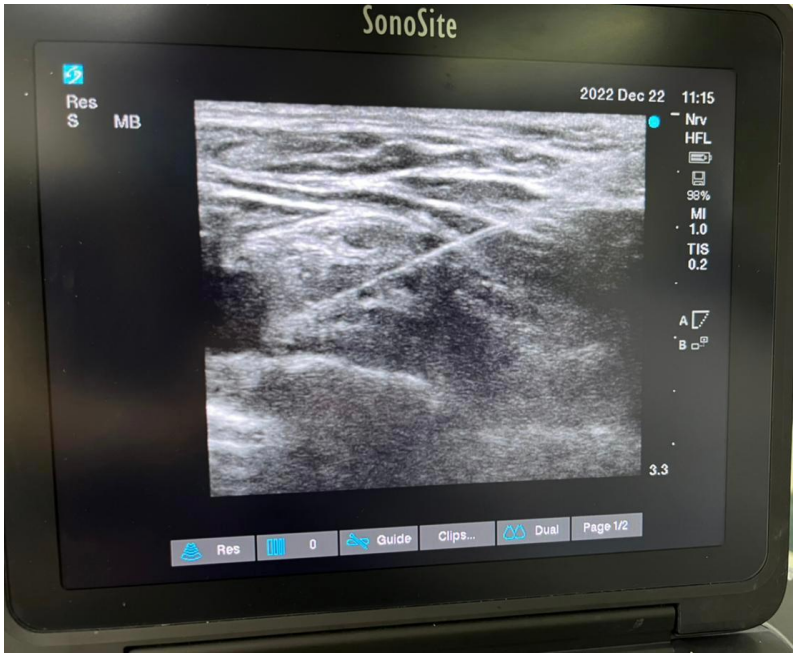
PHOTOGRAPH 2: Linear ultrasound probe



PHOTOGRAPH 3: Performance of block



PHOTOGRAPH 4: Infraclavicular brachial plexus



PHOTOGRAPH 5: Supraclavicular brachial plexus

PHOTOGRAPH 6: MIDAZOLAM VIAL

PHOTOGRAPH 7: VIRTUAL REALITY HEADSET

ANNEXURE IV: MASTER CHART

Sl No			ASA Gra	Diagnosis	Surgery	Grou	Perioperative Vitals			Vitals at 5 min					Vitals at 10 min			
Sl No	Age	Sex	SA Grad	Diagnosis	Surgery	Grou	Systolic BP	Diastolic BP	MAP	SpO2	Heart Rate	Systolic BP	Diastolic BP	MAP	SpO2	Heart Rate	Systolic BP	Diastolic BP
1	41	Male	2	Distal Radius and Ulna fracture	Primary open reduction of long bone with fixation	S	140	110	120	100	96	130	100	110	100	90	142	108
2	57	Female	3	Clavicle fracture	Primary open reduction of long bone with fixation	AV	150	110	123	100	86	162	108	126	100	96	158	112
3	70	Female	2	Right humerus Fracture	Primary open reduction of long bone with fixation	S	143	100	114	99	76	110	62	78	100	68	126	78
4	42	Male	2	Middle Phalaynx, Middle finger, Right hand frac	Primary open reduction of small bone	AV	146	116	126	100	98	152	122	132	100	102	148	118
5	49	Male	1	left Radius fracture	Primary open reduction of long bone with fixation	S	138	108	118	100	94	128	98	108	100	88	140	106
6	35	Female	1	ulnar fracture	Primary closed reduction of long bone with fixation	AV	120	80	93	100	80	124	88	100	100	92	118	84
7	26	Male	1	Bennets fracture	Primary open reduction of intra articular fracture of sma	S	130	108	115	100	90	122	90	101	100	82	126	88
8	32	Male	1	1/3 right radius fracture	Primary open reduction of long bone with fixation	AV	124	104	111	100	82	128	102	111	100	94	122	86
9	29	male	1	Distal Radius and Ulna fracture	Primary open reduction of long bone with fixation	S	118	98	105	100	78	122	106	111	100	90	116	82
10	67	Male	3	right radius fracture	Primary open reduction of long bone with fixation	AV	150	110	123	99	90	158	116	130	100	96	164	110
11	51	Male	2	cellulitis uper limb	debridement	S	130	70	90	99	74	124	66	85	100	70	130	73
12	67	Male	3	left radial fracture	Primary open reduction of long bone with fixation	AV	156	114	128	100	88	164	120	135	100	94	166	114
13	58	Male	3	right distal end radius fracture	closed reduction of long bone and fixation	S	142	110	121	99	80	140	98	112	100	81	148	108
14	48	female	3	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	148	118	128	99	94	156	124	135	100	98	152	120
15	33	Male	1	right distal end radius intra articular	Primary open reduction of intra articular fracture of lon	AV	112	73	86	100	92	122	77	92	100	96	125	69
16	57	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	138	110	119	98	76	116	90	99	100	72	115	86
17	23	Male	1	Distal end left Radius fracture	Primary open reduction of long bone with fixation	AV	110	64	79	100	90	137	83	101	100	98	128	74
18	52	Female	2	Rotator cuff tear	open removal of loose body from joint	S	144	96	112	100	92	140	102	115	100	81	137	99
19	26	Male	1	proximal right humerus fracture	removal of internal fixation	AV	110	83	92	100	86	126	78	94	100	90	121	72
20	58	Male	2	clavical fracture	Primary open reduction of long bone	S	155	108	124	100	98	141	93	109	100	77	143	96
21	45	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	147	116	126	100	80	151	111	124	100	88	158	116
22	55	male	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	153	104	120	100	94	125	98	107	100	90	128	83
23	58	male	2	tendon injury	open excision of synovial membrane of joint	AV	158	110	126	100	86	155	104	121	100	88	163	108
24	60	male	2	left radial fracture	Primary open reduction of long bone with fixation	S	156	98	117	100	92	130	92	105	100	79	133	87
25	30	Male	1	Clavicle fracture	Primary open reduction of long bone with fixation	AV	120	76	91	100	68	139	90	106	100	90	141	87
26	41	Male	2	crush injury left hand	Debridement	S	144	100	115	100	76	121	88	99	100	72	122	76
27	54	Male	2	forearm both boe fracture	secondary open reduction of fracture of long bone	AV	156	106	123	100	96	168	124	139	100	94	163	117
28	28	Male	1	Distal end Right Radius fracture	Primary open reduction of long bone with fixation	S	110	72	85	100	104	118	84	95	100	90	115	80
29	57	Male	2	left humerus fracture	Primary open reduction of long bone with fixation	AV	155	106	122	100	88	167	126	140	100	86	164	119
30	34	male	1	de quervains disease	release of constriction of sheath of tendon	S	120	86	97	100	90	114	73	87	100	81	122	86
31	74	Male	3	lipoma over left forearm	excision	AV	170	114	133	100	84	173	123	140	100	88	168	115
32	28	Male	1	right distal end radius fracture	closed reduction of long bone and fixation	S	110	68	82	100	70	104	70	81	100	66	109	67
33	59	female	2	Left distal end radius fracture	Primary open reduction of intra articular fixation	AV	160	108	125	100	100	158	101	120	100	104	151	95
34	48	Female	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	140	112	121	100	92	127	101	110	100	84	129	105
35	30	Female	1	Rotator cuff tear	Therapeutic endoscopic operation on cavity of joint	AV	130	74	93	100	90	136	77	97	100	92	131	68
36	30	Male	1	left metacarpal fracture	closed reduction of small bone and internal fixation	S	120	66	84	100	92	116	64	81	100	77	119	71
37	55	Male	2	Clavical fracture	Primary open reduction of long bone with fixation	AV	156	120	132	100	77	152	114	127	100	85	144	103
38	43	Male	2	left metacarpel fracture	Primary open reduction of small bone	S	144	102	116	100	80	140	96	111	100	77	136	95
39	69	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	170	120	137	100	110	174	117	136	100	114	166	109
40	30	Male	1	Right forearm both arm fracture	Primary open reduction of long bone with fixation	S	124	66	85	100	88	122	60	81	100	80	128	73
41	54	Male	2	operated case of external fixator	Primary open reduction of long bone with fixation	AV	156	110	125	100	82	160	115	130	100	80	153	107
42	57	Male	2	colles fracture	closed reduction of long bone and fixation	S	150	90	110	100	110	144	76	99	100	90	138	71
43	65	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	168	118	135	100	106	160	116	131	100	94	161	105
44	60	Male	2	Right Radius 1/3 fracture	Removal of wire from bone	S	160	106	124	100	98	138	100	113	100	85	134	99
45	32	Female	1	operated case of mal united distal end radius	Primary open reduction of long bone with fixation	AV	130	84	99	100	78	142	92	109	100	84	141	87
46	20	Male	1	Ulnar neuropathy	Release of entrapment of peripheral nerve	S	110	74	86	100	74	114	64	81	100	70	108	70
47	26	Male	1	Clavicle fracture	Primary open reduction of small bone	AV	115	66	82	100	68	121	70	87	100	70	127	69
48	74	Male	3	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	170	122	138	97	70	151	111	124	100	71	155	117
49	72	Female	3	left both bone fracture upperlimb	Primary open reduction of long bone with fixation	AV	162	106	125	100	68	166	112	130	100	70	157	104
50	27	Male	1	5th meta tarsal	closed reduction of long bone and fixation	S	133	68	90	100	80	115	65	82	100	71	122	61
51	30	Male	1	both bone fracture fore arm	Primary open reduction of long bone with fixation	AV	120	62	81	100	68	117	61	80	100	65	114	65
52	25	Female	1	left 1st metacarpel fracture	Primary open reduction of long bone with fixation	S	122	76	91	100	76	122	71	88	100	72	127	69
53	47	Female	2	operated case of both bone forearm fracture	removal of internal fixation and prosthesis	AV	150	110	123	100	86	163	117	132	100	88	158	111
54	25	Male	1	tendon injury	diagnostic endoscopic examination of joint	S	115	75	88	100	66	108	64	79	100	62	105	68
55	19	Female	1	Ganglion in right dorsal aspect of right hand	excision of ganglion	AV	114	64	81	100	78	112	61	78	100	70	114	66
56	48	Female	2	left both bone fracture distal forarm	closed reduction of long bone and fixation	S	138	104	115	100	90	131	95	107	100	77	134	96
57	44	Male	2	Clavicle fracture	Primary open reduction of long bone with fixation	AV	148	102	117	100	106	157	114	128	100	111	152	109
58	60	Female	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	155	114	128	100	70	138	101	113	100	72	145	107
59	28	Male	1	Distal end Right Radius fracture	Primary open reduction of intra articular fracture of sma	AV	120	72	88	100	92	126	77	93	100	88	118	72
60	60	Female	3	Clavicle fracture	Primary open reduction of long bone with fixation	S	160	102	121	100	74	143	91	108	100	70	152	97
61	69	Male	3	left humerus fracture	Primary open reduction of long bone with fixation	AV	155	106	122	100	108	158	110	126	100	102	150	96
62	46	Male	1	left metacarpal fracture	closed reduction of small bone and internal fixation	S	140	114	123	100	97	113	94	100	100	82	124	86
63	92	Female	3	Right humerus Fracture	Primary open reduction of long bone with fixation	AV	100	60	73	93	55	117	58	78	96	62	104	59
64	42	male	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	140	92	108	100	77	133	87	102	100	70	136	84
65	46	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	146	98	114	100	93	144	90	108	100	85	158	105
66	55	Female	3	Distal end left Radius fracture	closed reduction of fracture left side	S	150	106	121	100	82	129	94	106	100	80	138	104
67	30	female	1	both bone fracture left fore arm	closed reduction of fracture left side	AV	124	62	83	100	114	131	70	90	100	112	120	68
68	55	female	2	left humerus fracture	Primary open reduction of long bone with fixation	S	166	122	137	100	97	144	108	120	100	80	145	102
69	70	Female	3	both bone left forearm fracture	Primary open reduction of long bone with fixation	AV	138	102	114	100	71	133	96	108	100	70	142	95
70	37	Male	1	1/3 right radius fracture	Primary open reduction of long bone with fixation	S	138	106	117	100	83	112	70	84	100	69	121	83
71	64	Male	3	Ulcer over the left hand	stsg	AV	168	124	139	100	88	160	117	131	100	80	155	107
72	68	Male	3	Distal end radius fracture	Primary open reduction of long bone with fixation	S	148	116	127	100	104	127	103	111	100	100	135	100
73	48	Male	2	left humerus fracture	Primary open reduction of intra articular fixation	AV	140	104	116	100	94	148	108	121	100	90	136	86
74	70	Female	3	1/3rd radius fracture	closed reduction of fracture of long bone and fixation	S	154	114	127	100	70	137	106	116	100	71	148	96
75	68	Female	3	implant in situ	Removal of internal fixation	AV	160	116	131	100	90	163	124	137	100	86	157	119
76	78	Male	3	Right Radius Fracture	Primary open reduction of long bone with fixation	S	170	126	141	99	88	159	115	130	100	80	164	94
77	62	Male	2	Right humerus Fracture	Primary open reduction of long bone with fixation	AV	150	108	122	100	104	143	106	120	100	84	162	128
78	74	Female	3	radial styloid fracture	Closed reduction of fracture of long bone and internal f	S	140	102	115	100	72	134	96	109	100	73	130	97
79	56	Female	2	Right proximal humerus fracture	Primary open reduction of long bone with fixation	AV	156	106	123	100	86	158	100	119	100	80	164	118
80	57	Male	2	implant in situ	implant removal	S	154	96	115	100	110	140	90	107	100	91	151	97
81	46	Male	1	Distal end radius fracture	Primary open reduction of long bone with fixation	AV	138	92	107	100	108	132	88	103	100	77	141	90
82	50	Female	2	left colles fracture	Primary open reduction of long bone with fixation	S	152	108	123	100	82	141	101	114	100	80	137	86
83	46	Male	1	shaft of humerus fracture	Primary open reduction of long bone with fixation	AV	150	98	115	100	80	155	104	121	100	75	172	126
84	35	Male	1	colles fracture	Primary open reduction of long bone with fixation	S	130	100	110	100	70	116	83	94	100	64	110	76
85	58	Male	2	radial styloid fracture	closed reduction of fracture of long bone and fixation	AV	144	90	108	100	86	140	86	104	100	83	145	78
86	70	female	2	Distal end radius fracture	Primary open reduction of long bone with fixation	S	168	110	129	100	80	154	103	120	100	71	150	98

Sl No	Age	Sex	ASA Grade	Diagnosis	Surgery	Group	Perioperative Vitals					Vitals at 5 min					Vitals at 10 min				
Sl No	Age	Sex	SA Grade	Diagnosis	Surgery	Group	Systolic BP	Diastolic BP	MAP	SpO2	Heart Rate	Systolic BP	Diastolic BP	MAP	SpO2	Heart Rate	Systolic BP	Diastolic BP			
1	41	Male	2	Distal Radius and Ulna fracture	Primary open reduction of long bone with fixation	S	140	110	120	100	96	130	100	110	100	90	142	108			
2	57	Female	3	Clavicle fracture	Primary open reduction of long bone with fixation	AV	150	110	123	100	86	162	108	126	100	96	158	112			
3	70	Female	2	Right humerus Fracture	Primary open reduction of long bone with fixation	S	143	100	114	99	76	110	62	78	100	68	126	78			
4	42	Male	2	Middle Phalanx, Middle finger, Right hand frac	Primary open reduction of small bone	AV	146	116	126	100	98	152	122	132	100	102	148	118			
5	49	Male	1	left Radius fracture	Primary open reduction of long bone with fixation	S	138	108	118	100	94	128	98	108	100	88	140	106			
6	35	Female	1	ulnar fracture	Primary closed reduction of long bone with fixation	AV	120	80	93	100	80	124	88	100	100	92	118	84			
7	26	Male	1	Bennets fracture	Primary open reduction of intra articular fracture of sma	S	130	108	115	100	90	122	90	101	100	82	126	88			
8	32	Male	1	1/3 right radius fracture	Primary open reduction of long bone with fixation	AV	124	104	111	100	82	128	102	111	100	94	122	86			
9	29	male	1	Distal Radius and Ulna fracture	Primary open reduction of long bone with fixation	S	118	98	105	100	78	122	106	111	100	90	116	82			
10	67	Male	3	right radius fracture	Primary open reduction of long bone with fixation	AV	150	110	123	99	90	158	116	130	100	96	164	110			
11	51	Male	2	cellulitis uper limb	debridement	S	130	70	90	99	74	124	66	85	100	70	130	73			
12	67	Male	3	left radial fracture	Primary open reduction of long bone with fixation	AV	156	114	128	100	88	164	120	135	100	94	166	114			
13	58	Male	3	right distal end radius fracture	closed reduction of long bone and fixation	S	142	110	121	99	80	140	98	112	100	81	148	108			
14	48	female	3	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	148	118	128	99	94	156	124	135	100	98	152	120			
15	33	Male	1	right distal end radius intra articular	Primary open reduction of intra articular fracture of long	AV	112	73	86	100	92	122	77	92	100	96	125	69			
16	57	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	138	110	119	98	76	116	90	99	100	72	115	86			
17	23	Male	1	Distal end left Radius fracture	Primary open reduction of long bone with fixation	AV	110	64	79	100	90	137	83	101	100	98	128	74			
18	52	Female	2	Rotator cuff tear	open removal of loose body from joint	S	144	96	112	100	92	140	102	115	100	81	137	99			
19	26	Male	1	proximal right humerus fracture	removal of internal fixation	AV	110	83	92	100	86	126	78	94	100	90	121	72			
20	58	Male	2	clavical fracture	Primary open reduction of long bone	S	155	108	124	100	98	141	93	109	100	77	143	86			
21	45	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	147	116	126	100	80	151	111	124	100	88	158	116			
22	55	male	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	153	104	120	100	94	125	98	107	100	90	128	93			
23	58	male	2	tendon injury	open excision of synovial membrane of joint	AV	158	110	126	100	86	155	104	121	100	88	163	108			
24	60	male	2	left radial fracture	Primary open reduction of long bone with fixation	S	156	98	117	100	92	130	92	105	100	79	133	87			
25	30	Male	1	Clavicle fracture	Primary open reduction of long bone with fixation	AV	120	76	91	100	68	139	90	106	100	90	141	87			
26	41	Male	2	crush injury left hand	Debridement	S	144	100	115	100	76	121	88	99	100	72	122	76			
27	54	Male	2	forearm both boe fracture	secondary open reduction of fracture of long bone	AV	156	106	123	100	96	168	124	139	100	94	163	117			
28	28	Male	1	Distal end Right Radius fracture	Primary open reduction of long bone with fixation	S	110	72	85	100	104	118	84	95	100	90	115	80			
29	57	Male	2	left humerus fracture	Primary open reduction of long bone with fixation	AV	155	106	122	100	88	167	126	140	100	86	164	119			
30	34	male	1	de quervains disease	release of constriction of sheath of tendon	S	120	86	97	100	90	114	73	87	100	81	122	86			
31	74	Male	3	lipoma over left forearm	excision	AV	170	114	133	100	84	173	123	140	100	88	168	115			
32	28	Male	1	right distal end radius fracture	closed reduction of long bone and fixation	S	110	68	82	100	70	104	70	81	100	66	109	67			
33	59	female	2	Left distal end radius fracture	Primary open reduction of intra articular fixation	AV	160	108	125	100	100	158	101	120	100	104	151	95			
34	48	Female	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	140	112	121	100	92	127	101	110	100	84	129	105			
35	30	Female	1	Rotator cuff tear	Therapeutic endoscopic operation on cavity of joint	AV	130	74	93	100	90	136	77	97	100	92	131	68			
36	30	Male	1	left metacarpal fracture	closed reduction of small bone and internal fixation	S	120	66	84	100	92	116	64	81	100	77	119	71			
37	55	Male	2	Clavical fracture	Primary open reduction of long bone with fixation	AV	156	120	132	100	77	152	114	127	100	85	144	103			
38	43	Male	2	left metacarpel fracture	Primary open reduction of small bone	S	144	102	116	100	80	140	96	111	100	77	136	95			
39	69	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	170	120	137	100	110	174	117	136	100	114	166	109			
40	30	Male	1	Right forearm both arm fracture	Primary open reduction of long bone with fixation	S	124	66	85	100	88	122	60	81	100	80	128	73			
41	54	Male	2	operated case of external fixator	Primary open reduction of long bone with fixation	AV	156	110	125	100	82	160	115	130	100	80	153	107			
42	57	Male	2	colles fracture	closed reduction of long bone and fixation	S	150	90	110	100	110	144	76	99	100	90	138	71			
43	65	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	168	118	135	100	106	160	116	131	100	94	161	105			
44	60	Male	2	Right Radius 1/3 fracture	Removal of wire from bone	S	160	106	124	100	98	138	100	113	100	85	134	99			
45	32	Female	1	operated case of mal united distal end radius	Primary open reduction of long bone with fixation	AV	130	84	99	100	78	142	92	109	100	84	141	87			
46	20	Male	1	Ulnar neuropathy	Release of entrapment of peripheral nerve	S	110	74	86	100	74	114	64	81	100	70	108	70			
47	26	Male	1	Clavicle fracture	Primary open reduction of small bone	AV	115	66	82	100	68	121	70	87	100	70	127	69			
48	74	Male	3	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	S	170	122	138	97	70	151	111	124	100	71	155	117			
49	72	Female	3	left both bone fracture upperlimb	Primary open reduction of long bone with fixation	AV	162	106	125	100	68	166	112	130	100	70	157	104			
50	27	Male	1	5th meta tarsal	closed reduction of long bone and fixation	S	133	68	90	100	80	115	65	82	100	71	122	61			
51	30	Male	1	both bone fracture fore arm	Primary open reduction of long bone with fixation	AV	120	62	81	100	68	117	61	80	100	65	114	65			
52	25	Female	1	left 1st metacarpel fracture	Primary open reduction of long bone with fixation	S	122	76	91	100	76	122	71	88	100	72	127	69			
53	47	Female	2	operated case of both bone forearm fracture	removal of internal fixation and prosthesis	AV	150	110	123	100	86	163	117	132	100	88	158	111			
54	25	Male	1	tendon injury	diagnostic endoscopic examination of joint	S	115	75	88	100	66	108	64	79	100	62	105	68			
55	19	Female	1	Ganglion in right dorsal aspect of right hand	excision of ganglion	AV	114	64	81	100	78	112	61	78	100	70	114	66			
56	48	Female	2	left both bone fracture distal forarm	closed reduction of long bone and fixation	S	138	104	115	100	90	131	95	107	100	77	134	96			
57	44	Male	2	Clavicle fracture	Primary open reduction of long bone with fixation	AV	148	102	117	100	106	157	114	128	100	111	152	109			
58	60	Female	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	155	114	128	100	70	138	101	113	100	72	145	107			
59	28	Male	1	Distal end Right Radius fracture	Primary open reduction of intra articular fracture of sma	AV	120	72	88	100	92	126	77	93	100	88	118	72			
60	60	Female	3	Clavicle fracture	Primary open reduction of long bone with fixation	S	160	102	121	100	74	143	91	108	100	70	152	97			
61	69	Male	3	left humerus fracture	Primary open reduction of long bone with fixation	AV	155	106	122	100	108	158	110	126	100	102	150	96			
62	46	Male	1	left metacarpal fracture	closed reduction of small bone and internal fixation	S	140	114	123	100	97	113	94	100	100	82	124	86			
63	92	Female	3	Right humerus Fracture	Primary open reduction of long bone with fixation	AV	100	60	73	93	55	117	58	78	96	62	104	50			
64	42	male	2	Clavicle fracture	Primary open reduction of long bone with fixation	S	140	92	108	100	77	133	87	102	100	70	136	84			
65	46	Female	2	Supraspinatus tendinitis left shoulder	diagnostic endoscopic examination of joint	AV	146	98	114	100	93	144	90	108	100	85	158	105			
66	55	Female	3	Distal end left Radius fracture	closed reduction of fracture left side	S	150	106	121	100	82	129	94	106	100	80	138	104			
67	30	female	1	both bone fracture left fore arm	closed reduction of fracture left side	AV	124	62	83	100	114	131	70	90	100	112	120	68			
68	55	female	2	left humerus fracture	Primary open reduction of long bone with fixation	S	166	122	137	100	97	144	108	120	100	80	145	102			
69	70	Female	3	both bone left forearm fracture	Primary open reduction of long bone with fixation	AV	138	102	114	100	71	133	96	108	100	70	142	95			
70	37	Male	1	1/3 right radius fracture	Primary open reduction of long bone with fixation	S	138	106	117	100	83	112	70	84	100	69	121	83			
71	64	Male	3	Ulcer over the left hand	stsg	AV	168	124	139	100	88	160	117	131	100	80	155	107			
72	68	Male	3	Distal end radius fracture	Primary open reduction of long bone with fixation	S	148	116	127	100	104	127	103	111	100	100	135	100			
73	48	Male	2	left humerus fracture	Primary open reduction of intra articular fixation	AV	140	104	116	100	94	148	108	121	100	90	136	86			
74	70	Female	3	1/3rd radius fracture	closed reduction of fracture of long bone and fixation	S	154	114	127	100	70	137	106	116	100	71	148	96			
75	68	Female	3	implant in situ	Removal of internal fixation	AV	160	116	131	100	90	163	124	137	100	86	157	119			
76	78	Male	3	Right Radius Fracture	Primary open reduction of long bone with fixation	S	170	126	141	99	88	159	115	130	100	80	164	94			
77	62	Male	2	Right humerus Fracture	Primary open reduction of long bone with fixation	AV	150	108	122	100	104	149	106	120	100	84	162	128			
78	74	Female	3	radial styloid fracture	Closed reduction of fracture of long bone and internal f	S	140	102	115	100	72	134	96	109	100	73	130	97			
79	56	Female	2	Right proximal humerus fracture	Primary open reduction of long bone with fixation	AV	156	106	123	100	86	158	100	119	100	80	164	118			
80	57	Male	2	implant in situ	implant removal	S	154	96	115	100	110	140	90	107	100	91	151	97			
81	46	Male	1	Distal end radius fracture	Primary open reduction of long bone with fixation	AV	138	92	107	100	108	132	88	103	100	77	141	90			
82	50	Female	2	left colles fracture	Primary open reduction of long bone with fixation	S	152	108	123	100	82	141	101	114	100	80	137	96			
83	46	Male	1	shaft of humerus fracture	Primary open reduction of long bone with fixation	AV	150	98	115	100	80	155	104	121	100	75	172	126			
84	35	Male	1	colles fracture	Primary open reduction of long bone with fixation	S	130	100	110	100	70	116	83	94	100	64	110	76			
85	58	Male	2	radial styloid fracture	closed reduction of fracture of long bone and fixation	AV	144	90	108	100	86	140	86	104	100	83	145	78			
86	70	female	2	Distal end radius fracture	Primary open reduction of long bone with fixation	S	168	110	129	100	80	154	103	120	100	71	150	98			