
**“A COMPARISION OF INTRATHECAL FENTANYL AND
CLONIDINE AS AN ADJUVANT TO HYPERBARIC ROPIVACAINE
DURING SUB ARACHANOID BLOCK FOR LOWER ABDOMINAL
SURGERIES: A PROSPECTIVE RANDOMIZED CLINICAL TRIAL.”**

By

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Dissertation

Submitted to

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In

ANAESTHESIOLOGY

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LIST OF ABBREVIATIONS

ASA - American Society of Anaesthesiologists

SA - Spinal anaesthesia

SAB - Subarachnoid Block

LA - Local Anaesthetic

SAS -Subarachnoid Space

CSF - Cerebrospinal Fluid

CVS - Cardiovascular system

CNS - Central Nervous System

CS - Caesarean Section

[H] - Hyperbaric

HR - Heart Rate (bpm)

SBP - Systolic Blood Pressure (mmHg)

DBP - Diastolic Blood Pressure (mmHg)

MAP - Mean Arterial Pressure (mmHg)

SpO₂ - Saturation of peripheral oxygen (%)

Inj - Injection

IV - Intravenous

ml - milliliter

mcg - micrograms

Mg - milligram

Kgs - kilograms

Cms - centimeters

g/mol - grams per mol

mins - minutes

L/min - Litres per minute

RCT - Randomized controlled trial

CBC - Complete Blood Count

BG - Blood Grouping

RBS - Random Blood Sugar

LFT - Liver Function Test

RFT - Renal Function Test

SD - Standard Deviation

Vs - Versus

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ABSTRACT

Title: A comparison of intrathecal fentanyl and clonidine as an adjuvant to hyperbaric ropivacaine during subarachnoid block for lower abdominal surgeries: A prospective randomized clinical trial.

Context:

Spinal anaesthesia with hyperbaric ropivacaine is used. Adjuvants are used with local anesthetics for synergistic effect and for prolonging the duration of sensory and motor block. We aimed to compare onset and duration of sensory-motor block and hemodynamic effects between fentanyl and clonidine when used along with hyperbaric ropivacaine.

Aims:

To compare onset and duration of sensory-motor block of fentanyl and clonidine with hyperbaric formulations of ropivacaine and in spinal anaesthesia for infraumbilical surgeries and to assess hemodynamic parameters and sedation score.

Settings and design: one-year randomized controlled trial.

Methods:

150 patients (18-60 years) undergoing elective infraumbilical surgeries under spinal anaesthesia were randomly assigned to 2 groups of 75 each -Group RF (2.5ml of 0.75% Hyperbaric Ropivacaine with 25mcg Fentanyl) and Group RC (2.5ml 0.75% Hyperbaric Ropivacaine with 30mcg clonidine). Onset and duration of sensory-motor block and intraoperative hemodynamic parameters and sedation score were assessed.

Results:

Similar haemodynamic parameters were observed in both groups . Group RC exhibited significantly longer durations of sensory block compared to RF. Hemodynamic parameters did not differ significantly between groups, however it showed variation over time within both groups . Onset of action was quicker with RF when compared with RC. Motor block duration was similar in both groups.

Conclusion:

When compared to Hyperbaric Ropivacaine with clonidine, with Fentanyl demonstrated faster onset of subarachnoid block but prolonged sensory block

durations were seen with hyperbaric Ropivacaine with clonidine. Haemodynamic variations were similar and stable though varied with time in both the groups. Sedation was minimal in both groups showing identical patterns.

INTRODUCTION

The most used methods of anesthesia for lower abdominal surgeries is the subarachnoid block. It has rapid onset and is inexpensive, also providing efficient analgesia, relaxing muscles, and providing extended post-operative pain relief ^[1].

Hyperbaric local anesthetic solutions used intrathecally have gained popularity due to their consistent block properties and dependable subarachnoid blockade compared to isobaric local anesthetic solutions ^[2].

Bupivacaine is the most preferred and widely studied local anesthetic for intrathecal use.

For subarachnoid block, Ropivacaine, a more contemporary amide local anesthetic drug that is structurally identical to bupivacaine but 30–40% less efficacious, has been extensively studied.

Ropivacaine is believed to be 30–40% less effective and to have short-lived effects than bupivacaine, which makes it useful for ambulatory or short- to intermediate-duration procedures.

The level of sensory block attained was comparable to bupivacaine, but the period of the sensory block was much shorter with ropivacaine. It was observed that ropivacaine generated a significantly slower onset but shorter time to peak effect than bupivacaine. ^[3]

Adjuvants or additives are commonly combined with local anesthetics to enhance their effects by extending the duration of sensory motor block while reducing the total required dose. Several drugs including opioids, epinephrine, and alpha-2 adrenergic agonist have been utilized to strengthen the action of local anaesthetics.^[4,5]

Local anesthetics have been combined with a variety of adjuvants to extend intraoperative and postoperative analgesia.

However, opioids and alpha 2 adrenergic agonists are most widely utilized adjuvants in clinical practice.

Local anesthetic drug's analgesic duration is enhanced by intrathecal opioids. Fentanyl has a quicker onset and shorter half-life when administered intrathecally. It is the most widely used neuraxial opioid and has a stronger activity than morphine.^[6,7]

However, side effects are linked to using opioids as an adjuvant with local anesthetics, such as respiratory depression, pruritus, nausea, and vomiting guided the study in support for nonopioid adjuvants, which led to the use of clonidine as an adjuvant.^[8]

It has been shown that intrathecal clonidine increases the effects of subarachnoid block and prolongs spinal analgesia, which reduces the need for postoperative morphine. 150 micrograms of intrathecal clonidine were used as an analgesic; nevertheless, this resulted in sedation and hypotension. [9]

Hence the present study is being undertaken to compare the effects of Fentanyl and Clonidine intrathecal adjuvants to Ropivacaine [H].

OBJECTIVES

- 1.** To compare onset and duration of sensory and motor block between fentanyl and clonidine groups.
- 2.** To monitor and compare the haemodynamic stability heart rate, blood pressure between the two study groups.
- 3.** To assess and compare the quality of anesthesia and postoperative analgesia provided by fentanyl and clonidine as adjuvants.
- 4.** To evaluate and compare the effects of both adjuvants on sedation levels during the intraoperative and postoperative periods.

REVIEW OF LITERATURE

Several drugs have been used as local anaesthetics in sub arachnoid block.^[10,11]

Ropivacaine a pure enantiomer and is a long-acting, amide local anesthetic. It works by reversibly inhibiting sodium ion inflow in nerve fibers, producing effects akin to those of other local anesthetics. Due to its lower lipophilicity and less ability to pierce big myelinated motor fibers, ropivacaine produces comparatively less motor blockage than bupivacaine. When motor blockage is not mandatory, ropivacaine's higher degree of motor sensory distinction may be helpful. Lesser risk of cardiotoxicity and toxicity to the central nervous system is also linked to the decreased lipophilicity. Although hyperbaric solutions of Ropivacaine appears to provide a more predictable block when used intrathecally, the spread and duration of block varies markedly.^[12]

The following are the reviews of literature for this study:

1. “Dang Chi Binh and Vo Van Hien” (2024) at “Vietnam Military Medical University”, conducted a randomized clinical trial comparing spinal anesthesia with ropivacaine (10mg) and bupivacaine (10mg) in 70 patients who went through lower limb surgery. The study demonstrated that ropivacaine provided effective anesthesia

with a shorter motor block duration (97.60 ± 7.10 minutes vs. 158 ± 14.79 minutes, $p < 0.05$) and fewer cardiovascular side effects (bradycardia: 5.71% vs. 22.86%; hypotension: 2.86% vs. 17.14%, $p < 0.05$) compared to bupivacaine. Sensory block levels (T6–T8) were adequate for surgery, and no respiratory depression occurred. These findings align with prior studies by Dar FA et al. (2015) and Nguyen Anh Tuan (2015), reinforcing ropivacaine’s safety profile and faster recovery advantages. The study highlights ropivacaine as a preferable alternative for lower limb surgeries due to its balanced efficacy and reduced adverse effects. ^[13]

2. “Priya Kalia, Ram Gopal Maurya” and associates in 2023 at “Hind Institute of Medical Sciences”, “Uttar Pradesh”, performed a randomized double-blind trial by compared two clonidine dosages (15 μ g vs. 30 μ g) as additive to hyperbaric bupivacaine (12.5 mg) in SAB for infraumbilical procedures. Sixty ASA I/II patients were segregated into Group A (15 μ g clonidine) and Group B (30 μ g clonidine). Results demonstrated that Group B had a rapid onset of sensory (160.37 ± 33.64 vs. 182.56 ± 43.82 seconds, $p = 0.032$) and motor block (197.24 ± 12.36 vs. 205.61 ± 16.82 seconds, $p = 0.032$). Duration of analgesia was prolonged in Group B (318.73 ± 29.46 vs. 302.58 ± 18.62 minutes, $p = 0.014$), with lower VAS scores postoperatively. Sedation scores (Ramsay scale) were higher in Group B ($p < 0.0001$), though hemodynamic stability was stable in both groups. The study concluded that 30 μ g clonidine provided superior intraoperative block characteristics

and prolonged postoperative analgesia compared to 15 µg, with manageable sedation, making it a more effective adjuvant for spinal anesthesia in infraumbilical surgeries.

[14]

3 “Sampat Rathod, Chetali Das, and Trishala Jain” in 2023 at “S.M.S Medical college”, “Jaipur” conducted a RCT comparing isobaric 0.5% ropivacaine and levobupivacaine, both with 25 µg fentanyl, for SAB in lower limb surgeries. The study involved 60 ASA I/II divided into two study groups: Group A (ropivacaine-fentanyl) and Group B (levobupivacaine-fentanyl). Results showed a quicker onset of sensory (6.04 ± 0.7 vs. 10.59 ± 1.2 minutes) and motor block (10.31 ± 0.8 vs. 14.13 ± 1.5 minutes) in Group B ($p < 0.001$). However, Group A demonstrated shorter durations of sensory (139.8 ± 8.0 vs. 197.4 ± 23.1 minutes) and motor block (126.4 ± 6.7 vs. 173.0 ± 11.4 minutes) ($p < 0.001$), along with earlier ambulation. While Group A needed fewer analgesics after surgery, Group B's time to first rescue analgesia was longer (389.0 ± 28.1 vs. 305.3 ± 31.9 minutes, $p < 0.001$). There were little adverse effects and similar hemodynamic stability. The study came to the conclusion that levobupivacaine-fentanyl provides longer analgesia for lengthier procedures, whereas ropivacaine-fentanyl is better for daycare surgeries because of its shorter block duration and quicker recovery. [15]

4. “Bimal Prasad Sahu, Abhishek Patro” and colleagues in 2023 at “SLN Medical

College”, “Odisha”, conducted a randomized controlled trial comparing clonidine (50 µg) and fentanyl (25 µg) as additive to hyperbaric bupivacaine (10 mg) for SAB in 80 patients undergoing elective cesarean sections. The study revealed that clonidine significantly prolonged the period of sensory block ($p < 0.001$) and motor block (189.09 ± 6.01 vs. 180.31 ± 4.58 minutes, $p < 0.001$) compared to fentanyl. Time to first analgesic dose was also delayed in the clonidine group (590.84 ± 4.10 vs. 434.95 ± 19.06 minutes, $p < 0.001$). But only the fentanyl group experienced pruritus (3 patients), but clonidine caused higher sedation (10 patients vs. 0, $p < 0.001$). Between groups, hemodynamic stability was similar. The study found that fentanyl delivers enough analgesia with fewer sedative effects, making it the better choice when sedation is undesirable, while clonidine offers superior extended analgesia but with more sedation. ^[16]

5. “Girish BK , Manjula BP” and colleagues in 2022 at “JSS Medical college and hospital, Mysuru, Karnataka” conducted a prospective randomized study comparing intrathecal nalbuphine (0.4 mg) and clonidine (30 µg) as adjuvants to bupivacaine (H) (12.5 mg) for spinal anesthesia in 60 patients undergoing elective infraumbilical surgeries. In comparison to nalbuphine, the study found that clonidine significantly increased the duration of motor blockage (232.00 ± 25.51 vs. 195.83 ± 18.57 minutes, $p < 0.0005$) and postoperative analgesia (351.00 ± 31.00 vs. 256.00 ± 8.14 minutes,

$p < 0.0005$). The clonidine group also experienced a delayed recovery from sensory block (251.33 ± 25.43 vs. 211.33 ± 16.13 minutes, $p < 0.0005$). Although there were no appreciable variations in hemodynamic stability or adverse effects, clonidine showed greater analgesia prolonging, even though the start periods for sensory and motor blocks were same across groups. The sustained analgesic and motor-blocking effects of clonidine make it a better intrathecal adjuvant than nalbuphine, according to the study's findings. ^[17]

6. “Dr. Purushottam, Dr. Suresh Pandey and colleagues” in 2021 at “Jhalawar Medical college, Rajasthan” conducted a RCT evaluating clonidine as an adjuvant to hyperbaric bupivacaine for spinal anesthesia in elderly patients (≥ 60 years) undergoing infraumbilical surgeries. Sixty ASA I/II patients were segregated into three groups: Group C (bupivacaine alone), Group C₁₅ (bupivacaine + 15 μ g clonidine), and Group C₃₀ (bupivacaine + 30 μ g clonidine). Results demonstrated that both clonidine doses significantly enhanced sensory block levels, with Group C₃₀ achieving superior median block levels (T₅ vs. T₇ in Group C, $p < 0.05$). In clonidine groups, sensory block regression to T₁₂ took longer (196.4 ± 36.5 minutes in C₃₀ vs. 133.1 ± 27.1 minutes in Group C, $p < 0.001$). Clonidine also caused a significant increase in motor block duration (178.0 ± 35.3 minutes in C₃₀ vs. 135.2 ± 32.4 minutes in Group C, $p < 0.001$). No discernible variations in the incidence of hypotension were seen, and

hemodynamic stability was preserved. The study found that while clonidine at 15 µg and 30 µg doses enhances sensory and motor blockade without affecting hemodynamics, the latter dose may cause older people to experience unexpectedly elevated sensory levels.^[18]

7. “Geeta Kamal, Raman Piplani and colleagues” in 2021 at a “Paediatric Tertiary care centre, Delhi” conducted a prospective randomized double-blind trial evaluating clonidine (1.5 µg/kg) as an additive to bupivacaine (H) (0.4 mg/kg) in spinal anesthesia for 60 children (5–12 years) undergoing infraumbilical surgeries. The study demonstrated that clonidine significantly prolonged sensory block (310.33 ± 10.17 vs. 147.50 ± 7.28 minutes, $p < 0.001$), motor block (283.33 ± 11.77 vs. 132.50 ± 10.06 minutes, $p < 0.001$), and postoperative analgesia (364.50 ± 28.75 vs. 172.00 ± 9.61 minutes, $p < 0.001$) compared to bupivacaine alone. The clonidine group showed less intraoperative awakening (20% vs. 40%, $p = 0.045$) and needed fewer rescue analgesics (2.43 ± 0.57 vs. 3.10 ± 0.55 doses, $p < 0.001$). Hemodynamic stability was preserved, and there were just three bradycardia occurrences. They inferred that clonidine at a dose of 1.5 µg/kg is a safe and efficient adjuvant for pediatric spinal anesthesia that improves analgesia and block duration without having a major negative impact.^[19]

8. “Khaled Mohamed Fares, Sahar Abdal- Baky Mohamed and colleagues” in 2020 at “South Egypt Cancer Institute, Assiut University, Assiut, Egypt” conducted a randomized trial comparing intrathecal fentanyl (0.2 µg/kg) and dexmedetomidine (0.2

$\mu\text{g}/\text{kg}$) as additives to bupivacaine in pediatric abdominal cancer surgeries. The study involved 60 children aged 3–12 years, divided into three groups: bupivacaine alone (Group C), bupivacaine with fentanyl (Group F), and bupivacaine with dexmedetomidine (Group D). Results demonstrated significantly lower FLACC pain scores in Groups D and F at 6, 8, and 12 hours postoperatively compared to Group C ($p \leq 0.05$). Dexmedetomidine prolonged the period to first analgesic request (7.67 ± 0.57 hours) versus fentanyl (5.40 ± 1.09 hours) and control (4.23 ± 3.27 hours) ($p < 0.04$), with reduced paracetamol consumption (316.67 ± 28.86 mg vs. 354.44 ± 46.67 mg in Group F). Despite temporary intraoperative blood pressure drops in Group D, hemodynamic stability was preserved. Dexmedetomidine offered better analgesia with less rescue analgesics, according to findings, which made it a good adjuvant for pediatric abdominal procedures. ^[20]

9. “Yong-hong Bi, Jia-min Wu, and associates” in 2020 at “Second Affiliated Hospital of Harbin Medical University, China” carried out a study to assess the effectiveness of different dosages of dexmedetomidine as a supplement for hyperbaric ropivacaine in spinal anesthesia for cesarean sections. In the trial, 75 parturients randomly received ropivacaine by itself or in conjunction with 3 or 5 mg of dexmedetomidine. The findings showed that both dexmedetomidine groups had better analgesia and noticeably quicker onset times for sensory block than the control group ($p < 0.05$). Furthermore, the dexmedetomidine groups saw a significantly decreased incidence of shivering ($p <$

0.05). According per the the study, 3 µg of intrathecal dexmedetomidine improves postoperative analgesia and intraoperative sensory block features without extending motor block or producing serious side effects, which makes it a viable option for cesarean delivery. [21]

10. “Baljit Singh Bajwa, Arwinder Pal Singh and associates” in 2017 at “PIMS Medical College, Punjab” compared the effects of intrathecal fentanyl (25 µg) and clonidine (50 µg) as adjuvants to hyperbaric bupivacaine in SAB for lower abdominal procedures. There were two groups of 100 ASA I/II patients in the randomized experiment. The findings showed that both adjuvants offered equal hemodynamic stability as well as identical sensory and motor block onset and duration. Comparing the clonidine group to the fentanyl group, the former showed noticeably longer postoperative analgesia (497.20 ± 139.78 min) ($p < 0.05$). Clonidine had superior sedation scores ($p < 0.05$), but other adverse effects were similar. When sedation is undesirable, fentanyl is preferred, according to the study, because clonidine provides better analgesia but with more drowsiness. These results support the use of clonidine as a non-opioid substitute for spinal anesthesia by matching other studies that shown its analgesic effectiveness and dose-dependent sedative effects. [23]

So the present study is undertaken to compare effects of intrathecal Fentanyl and clonidine in combination with 0.75% Hyperbaric Ropivacaine.

BASIC SCIENCES

Applied Anatomy

For the safe and effective delivery of spinal anesthesia, an anesthesiologist needs a comprehensive and precise understanding of the vertebral column's structure and its contents. This knowledge is crucial not only for the procedure itself but also for understanding how the drug disperses in the sub arachnoid space and the extent of the block achieved.

Vertebral column

The primary role of the vertebral column is to protect the spinal cord. The vertebral column comprises 33 vertebrae.

- Cervical - 7
- Thoracic - 12
- Lumbar - 5
- Sacrum - 5 (fused)
- Coccyx - 4 (fused)

Curves of spine

In adults, the curves of the vertebral column play a crucial role in the distribution of drugs in the subarachnoid space, and these curves include:

- Cervical curve - Convexity anterior
- Thoracic curve - Concave anterior
- Lumbar curve - Convexity anteriorly

Cervical (C) five and lumbar (L) five are the highest points of cervical and lumbar curves in supine position and the lowest points of thoracic and sacral are at thoracic (T) five and sacral (S) two respectively.

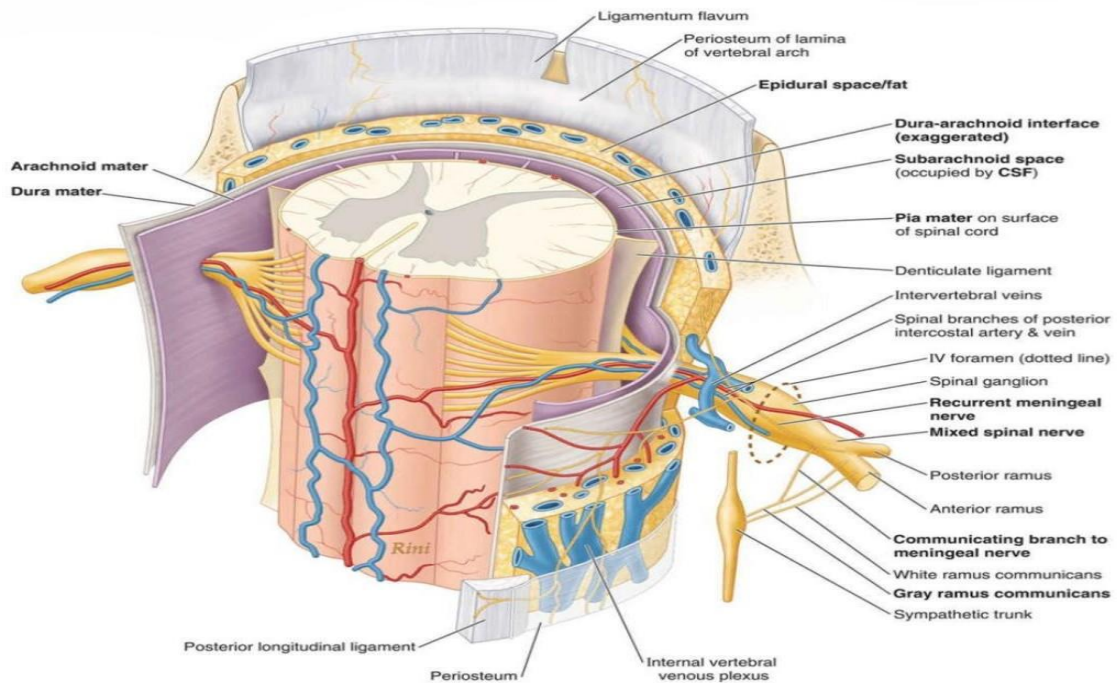


Figure 1: Vertebral column

Lumbar vertebrae

A typical lumbar vertebra consists of:

- A kidney shaped body.
- Two pedicles directed backwards from the upper part of the body.
- Two transverse processes

- Two laminae meeting posteriorly and enclosing the triangular vertebral foramen.
- Thick, broad and quadrilateral spinous processes.
- Two upper and lower articular processes which prevent rotation but allow limited flexion and extension between contiguous vertebrae.

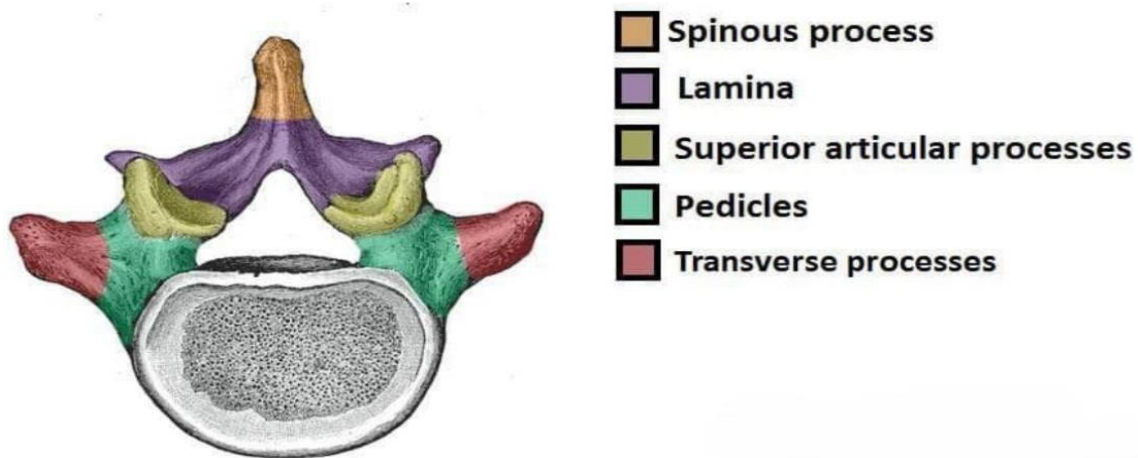


Figure 2: Typical Lumbar vertebrae

Thoracic vertebrae :

- A heart shaped body
- A small costal demi facet on superior border of lateral side of body and a

larger demi facet on the inferior surface

- Shallow superior vertebral notches and deeper inferior vertebral notches

Transverse processes are directed backwards and laterally , carrying a costal facet for articulation with ribs.

Vertebral ligaments

The following overlapping ligaments provide stability to the vertebral column and protect the spinal cord:

Supraspinous ligament: This is a strong fibrous calcifies, thus making the midline approach difficult.

Interspinous ligament: This is a thin membranous ligament running obliquely and connecting spinous processes blending anteriorly with ligamentum flavum and posteriorly with supraspinous ligament. In the lumbar region, this ligament is rectangular in shape, leading to the characteristic and identifiable “loss of resistance” feel to air or saline.

Ligamentum flavum: This ligament comprises of yellow elastic fibres and connects adjacent laminae. Laterally, this ligament begins at the root of articular processes and extends posteriorly and medially to the point where laminae join to form the spinous process. It provides the classic springy resistance in the lumbar region.

Longitudinal ligaments: There are two longitudinal ligaments (anterior and

posterior) that bind vertebral bodies together.

In spinal anesthesia, the needle is advanced beyond the dura mater and into the subarachnoid space, which lies between the lumbar vertebrae. To access this space, the needle traverses several layers of tissue and ligaments, including the supraspinous ligament, interspinous ligament, and ligamentum flavum.

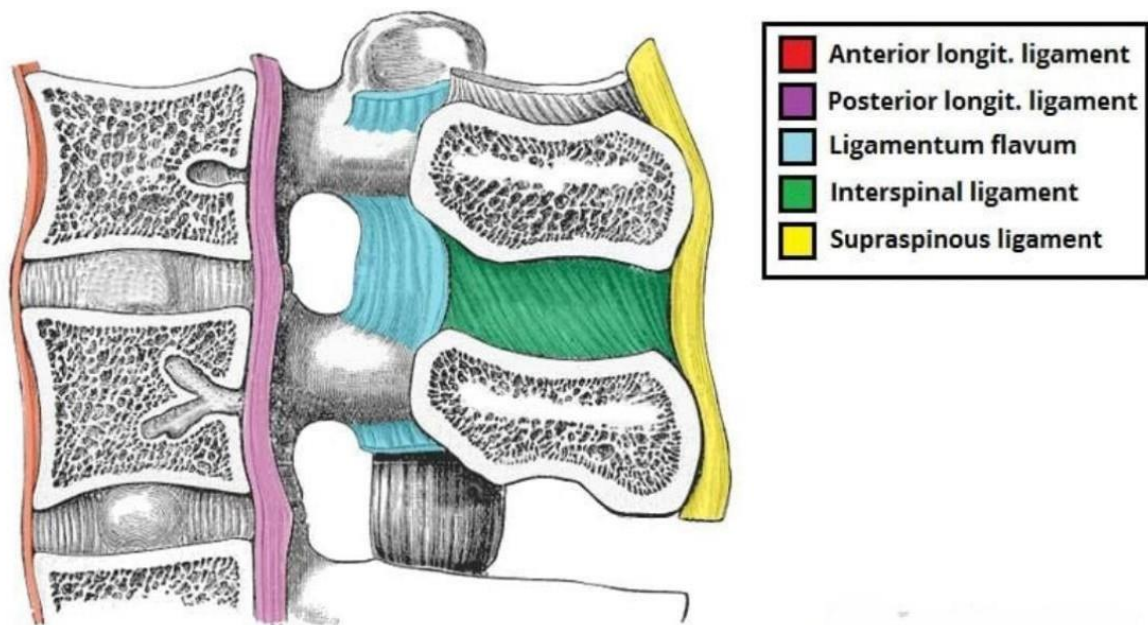


Figure 3: Vertebral Ligaments

Intervertebral Discs

These are principle connecting link between vertebral bodies. They form about 25% of the length of the spine. They consist of two parts - The outer fibrous part called the *annulus fibrosus* (made up of fibrous tissue), while the *nucleus pulposus* is the

softer core. The discs serve as shock absorbers and lend flexibility to the vertebral column.

Topographical Line of Tuffier

This is a horizontal line across the back between the crests of the iliac bone passing over the spine of the 4th lumbar vertebra in the upright position. In a patient lying in the lateral position it may also pass through L4 and L5 interspaces. The superior iliac crest is used to identify the L4 and L5 interspace during epidural anesthesia.

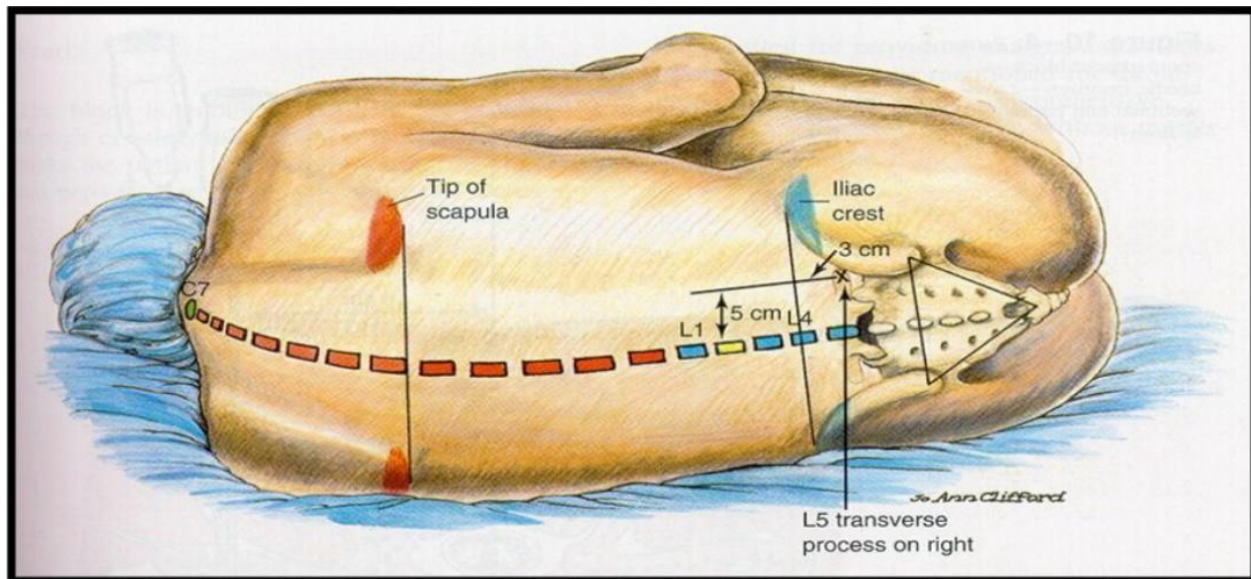


Figure 4: Topographical line of Tuffier

Vertebral canal:

The vertebral canal is bound by the vertebral bodies and intervertebral discs anteriorly , the laminae , ligamentum flavum and laterally by pedicles and laminae.

The contents of vertebral canal are as follows:

- Spinal cord
- Spinal nerve roots
- Meninges
- Cerebrospinal fluid
- Vessels
- Fat
- Loose areolar tissue

Spinal cord

The average length of the spinal cord in males is 45 centimetres (cms) and in females it is 42 cms. The average weight is approximately 30 gm.

The spinal cord is a continuation of the medulla oblongata below the level of foramen magnum and it tapers off into a conical extremity known as conus medullaris. Filum terminale descends to the back of first segment of coccyx from

apex of conus medullaris.

At birth, Spinal cord ends at the level of lower border of lumbar (L) three vertebra and in adults, it is as follows:

- Lower border of L1 - 50%
- Upper border of L2 - 40%
- Upper border of L3 - 3%

From the spinal cord arise 31 pairs of spinal nerves, each made of a ventral and a dorsal root. These anterior and posterior roots after crossing the subarachnoid space, pass through the dura and extradural space independently and unite at the level of intervertebral foramen to form spinal nerve trunks, which further divide into anterior and posterior primary divisions.

The amount of white matter declines progressively from the cervical region down to the lumbar region. The gray matter is greatly increased in the both the lumbar and cervical enlargement.

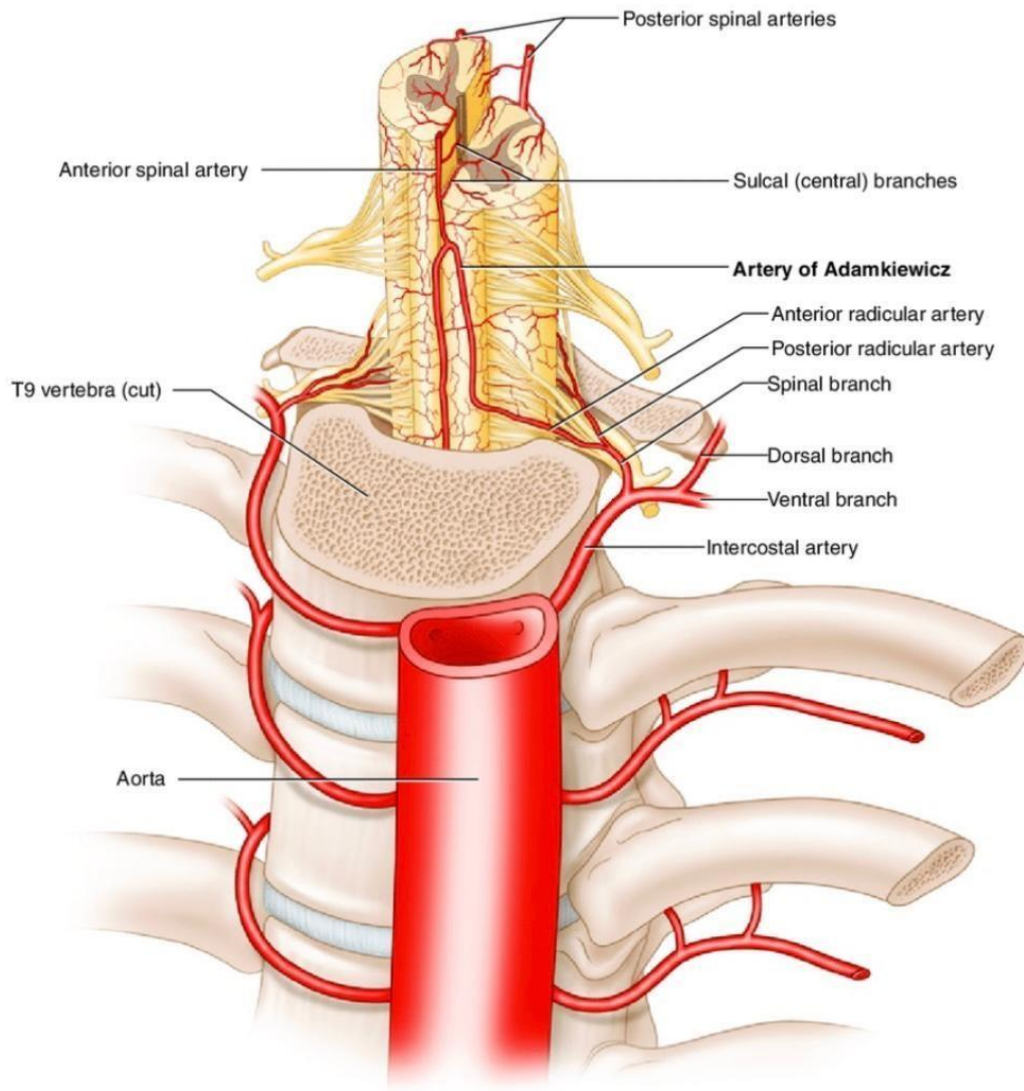


Figure 5: Blood Supply of spinal cord

Blood Supply of Spinal Cord:

The spinal cord receives its blood supply from anterior and posterior spinal arteries. The anterior spinal artery is a single vessel lying in front of the anterior median fissure. It is formed by two small arteries, one given off from each vertebral artery

at the level of the foramen magnum. It receives small communications from the intercostal and lumbar arteries; to provide the extra blood supply needed in the cervical, thoracic and lumbar enlargements.

There are two posterior spinal arteries—one on each side. They are derived from the vertebral artery or more often from a primary branch of each vertebral artery. They supply the posterior one-third of the spinal cord. This supply is augmented by spinal branches of vertebral, ascending cervical, posterior intercostals, lumbar and lateral sacral arteries, which pass through the intervertebral foramina.

Venous drainage is through a plexus of anterior and posterior veins in the neck, azygous veins in the thorax, lumbar veins in the abdomen, and lateral sacral veins in the pelvis. There is no anastomosis between the anterior and posterior spinal arteries. The longest of the feeder arteries is the radicularis magna (artery of Adamkiewicz), which supplies the anterior spinal artery in the area of the lumbar enlargement of the cord. It enters by way of a single intervertebral foramen (78% of the time on the left) between the T8 and L3 foramina.

Meninges

The spinal cord is covered by three membranes from inward to outward, they are the pia mater, the arachnoid mater and the dura mater. The dural sac is the continuation of meningeal layer of the cranial dura mater. It is a circular sac or sleeve surrounding the spinal cord. Above, it is attached firmly to the circumference of the foramen magnum.

Duramater

It is the outermost membrane, the fibres of which run longitudinally. Although continuous, it can be described in two parts: the cranial and the spinal. The cranial dura consists has two layers, outer endosteal layer, which lines the skull, and an inner meningeal layer, which invests the brain and folds inward to form the falx cerebri and tentorium cerebelli.

Arachnoid Mater

The arachnoid mater is a delicate non-vascular membrane applied closely to the dura mater. The lower extent of dural sac is as follows;

Below this the dura continues as the filum terminale. The subarachnoid space is the space between the arachnoid and pia mater. This space is occupied by the cranial and spinal nerves and by the cobweb trabeculae. The space is annular in the cranial and thoracic vertebrae and is about three mm deep. Below the first lumbar vertebrae

it is circular in shape.

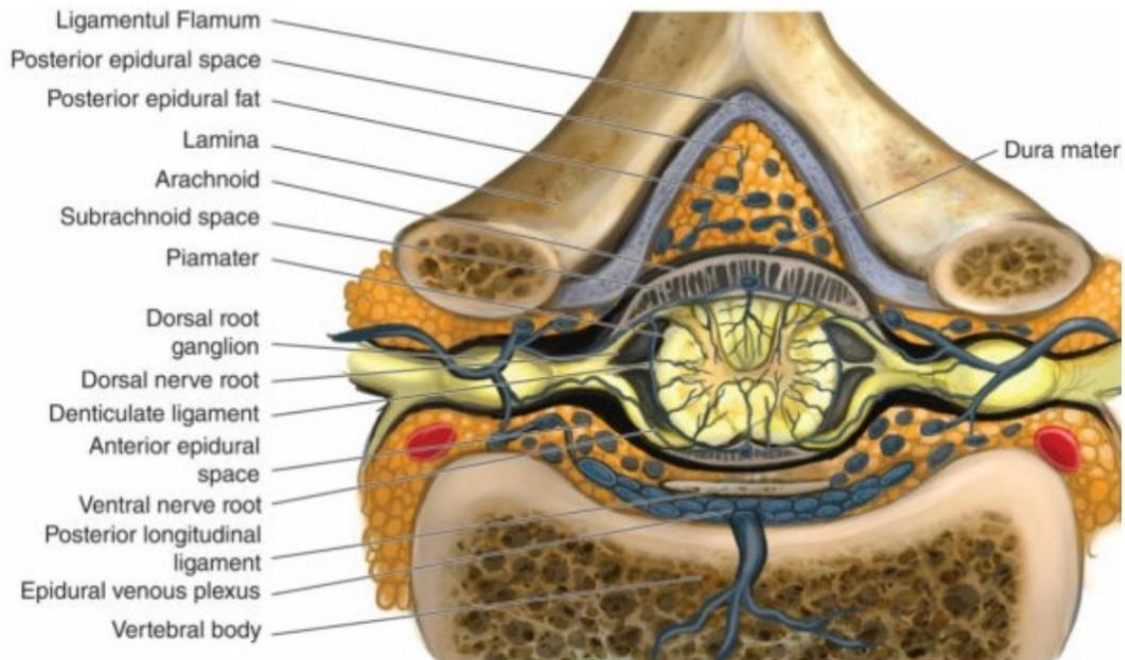


Figure 6 : Epidural Space

Boundaries of the epidural space

The epidural space is bounded

Superior: by foramen magnum , where periosteal and spinal layers of dura mater fuse.

Inferior: by sacrococcygeal membrane and sacral hiatus .

Anterior : by the posterior longitudinal ligament, vertebral bodies and discs

Posterior : by ligamentum flavum , periosteum of anterior surface of laminae and

connecting ligaments.

Lateral : by periosteum of pedicles and intervertebral foramina.

Rarely, a fold of dura mater divides the space into ventral and dorso – medial compartments leading to patchy or unilateral analgesia or missed segments.

Shape and size: These are largely determined by the shape of the lumbar vertebral canal and the position and size of the dural sac within it.

Cervical : 1.5 mm

Upper thoracic : 2.5 – 3 mm

Lower thoracic : 4-5 mm

Lumbar : 5-6 mm

Types of epidural space

The epidural space can be categorized into cervical, thoracic, lumbar and sacral epidural spaces. These spaces can be defined according to their margins. At the cervical epidural space, there is a fusion of the spinal and periosteal layers of dura mater at the foramen magnum to lower margin of the 7th cervical vertebra. While the thoracic epidural space is formed by the lower margin of C₇ to the upper margin of L₁, the lumbar epidural space is formed by the lower margin of L₁ vertebra to the upper margin of S₁ vertebra. The sacral epidural space is formed by the upper margin

of S₁ to sacrococcygeal membrane and sacral hiatus.

Contents of the epidural space:

Contains semi liquid fat , lymphatics , arteries , loose areolar tissue spinal nerve roots and a very rich plexus of veins.

PHARMACODYNAMICS OF SPINAL ANESTHESIA

The pharmacodynamics of spinal injection of local anesthesia vary widely. The following discussion covers the effects of spinal anesthesia on the cardiovascular, respiratory, gastrointestinal, hepatic, and renal systems.

Cardiovascular Effects of Spinal Anesthesia

It is well known that spinal anesthesia often leads to hypotension. In fact, some degree of hypotension can reassure the anesthesiologist that the nerve block is effective. However, this hypotension can also cause nausea and vomiting, ischemia of vital organs, cardiovascular collapse, and, in pregnant women, pose a risk to the fetus. Over time, there have been changes in the definitions, proposed mechanisms, and management strategies for hypotension.

Many mechanisms have been proposed for spinal anesthesia-induced hypotension, including the direct circulatory effects of local anesthetics, relative adrenal insufficiency, skeletal muscle paralysis, ascending medullary vasomotor nerve

block, and concurrent respiratory insufficiency. However, the primary cause is the preganglionic sympathetic nerve block produced by spinal anesthesia. Since the height of the nerve block determines the extent of the sympathetic block, it consequently affects the changes in cardiovascular parameters. However, this relationship is unpredictable. The sympathetic nerve block can vary between two and six dermatomes above the sensory level and may be incomplete below this level. The sudden onset of the sympathetic nerve block with spinal anesthesia allows little time for cardiovascular compensation, which may explain why similar sympathetic nerve blocks with epidural anesthesia result in less hypotension.

Sympathetic nerve block induces hypotension by affecting preload, afterload, contractility, and heart rate essentially the determinants of cardiac output (CO)—as well as by reducing systemic vascular resistance (SVR). Preload decreases due to venodilation caused by the sympathetic nerve block, leading to blood pooling in the peripheral areas and reduced venous return. During a sympathetic nerve block, the venous system is maximally vasodilated and depends heavily on gravity to return blood to the heart. Therefore, patient positioning and aortocaval compression, such as from a gravid uterus, significantly impact venous return during spinal anesthesia.

Sympathetic nerve block can also reduce arterial vasomotor tone, thereby lowering systemic vascular resistance (SVR) and afterload. Unlike venodilation, arterial vasodilation is not complete after a spinal block, as vascular smooth muscle retains

some autonomic tone even after sympathetic denervation. This residual tone can be lost in the presence of hypoxia and acidosis, potentially leading to cardiovascular collapse following high spinal anesthesia without cardiorespiratory support. Despite vasodilation below the level of the spinal block, compensatory vasoconstriction occurs above it, mediated by carotid and aortic arch baroreceptors. This is crucial for two reasons: First, higher dermatomal blocks may result in reduced compensatory response. Second, using vasodilatory drugs such as glyceryl trinitrate (GTN), sodium nitroprusside, or volatile anesthetics can eliminate this compensatory mechanism, worsening hypotension or even causing cardiac arrest.

There may initially be an increase in cardiac output (CO) due to decreased afterload. Alternatively, CO might decrease because of reduced preload. Some studies have indicated that CO remains unchanged or is only slightly reduced during the onset of spinal anesthesia.

The impact of spinal anesthesia on contractility may be influenced by the blockade of upper thoracic sympathetic nerves. Intriguingly, a study exploring the common occurrence of ST segment depression in healthy women undergoing cesarean section (25-60%) revealed that ST depression was linked to a hyperkinetic contractile state.

The effect of spinal anesthesia on heart rate (HR) is multifaceted. HR might rise (due to hypotension triggering the baroreceptor reflex) or fall (either from the blockade

of sympathetic nerve fibers originating from T1–T4 spinal segments, or through the reverse Bainbridge reflex). The reverse Bainbridge reflex leads to a decrease in HR caused by reduced venous return, sensed by stretch receptors in the right atrium, albeit it is weaker than the baroreceptor reflex. Another reflex, the Bezold-Jarisch reflex (BJR), reduces HR and has been associated with bradycardia, hypotension, and cardiovascular collapse following central neuraxial anesthesia, especially spinal anesthesia.

While the BJR is a cardioinhibitory reflex, its association with spinal anesthesia is likely weak. The BJR has been implicated in bradycardia after spinal anesthesia, particularly following hemorrhage, where forceful contractions of an underfilled heart may initiate the reflex. This occurrence is more probable with ephedrine use rather than phenylephrine.

Young, healthy patients (American Society of Anesthesiologists class 1) and those using beta-blockers face a heightened risk of bradycardia. The incidence of bradycardia in the nonpregnant population is approximately 13%. Although bradycardia is generally well tolerated, it can lead to asystole and higher-degree heart nerve block, underscoring the importance of vigilant monitoring and prompt treatment post-spinal anesthesia.

Various risk factors contribute to hypotension, including hypovolemia, preoperative hypertension, high sensory nerve block height, age over 40, obesity, combined

general and spinal anesthesia, chronic alcohol consumption, elevated BMI, and the urgency of non-obstetric surgery. Hypotension is less common in women in labor compared to those undergoing elective cesarean section.

Management of Hypotension After Spinal Anesthesia

Evolving perspectives on the underlying mechanisms of spinal-induced hypotension have led to changes in its management strategies. For instance, if reduced preload is deemed the main issue, then positioning and fluid therapy are favored treatments; likewise, if vasodilation is identified as the cause, a vasoconstrictor is preferred. This has sparked intense debates. In the 1970s, there was a suggestion to avoid vasopressors until all other methods to address hypotension had been exhausted, highlighting the emphasis on preload.

Invasive blood pressure monitoring may be considered for patients with significant cardiac issues. Fluid therapy is crucial in dehydrated patients to restore volume before spinal anesthesia.

Non Pharmacological interventions such as positioning, leg compression, and uterine displacement are also effective in managing hypotension. While Trendelenburg positioning can enhance venous return, extreme angles should be avoided to prevent reduced cerebral perfusion. To mitigate the risk of altering spinal anesthesia levels, maintaining a modest elevation of the upper body with a pillow

under the shoulders is recommended. Lower limb compression has shown some benefit in pregnant women, although its efficacy varies depending on the method used.

There have been conflicting views on fluid management during spinal anesthesia, with early studies advocating for crystalloid "preloading" before the procedure, while recent research suggests minimal benefits from preloading. Colloid preloading appears to be effective but needs to be balanced against the risk of allergic reactions and increased costs. "Coloading" with crystalloid immediately after spinal anesthesia seems more effective than preloading in preventing hypotension.

Reducing the dose of spinal local anesthetic can help limit hypotension. However, lower doses may compromise anesthetic efficacy, necessitating early top-up doses via an epidural catheter. Regarding the choice of vasopressor, ephedrine and phenylephrine have been the main contenders, with phenylephrine gaining preference due to its superior efficacy in reducing hypotension and nausea. Although phenylephrine may decrease cardiac output and spinal nerve block height, concerns about its potential side effects, such as hypertensive crisis and drug concentration errors, persist. Cardiovascular collapse following spinal anesthesia is rare but requires prompt treatment, typically involving intravenous atropine, ephedrine, and epinephrine.

Respiratory Effects of Spinal Anesthesia

In patients with normal lung function, spinal anesthesia typically has minimal impact on pulmonary physiology. Parameters such as lung volumes, resting minute ventilation, dead space, arterial blood gas levels, and shunt fraction tend to remain relatively unchanged following spinal anesthesia. The primary respiratory effect occurs during a high spinal block when active exhalation is hindered due to the paralysis of abdominal and intercostal muscles. This can result in reductions in expiratory reserve volume, peak expiratory flow, and maximum minute ventilation, particularly in patients with obstructive pulmonary disease who rely on accessory muscles for adequate ventilation. However, patients with normal lung function experiencing a high spinal nerve block may experience dyspnea, which is typically due to the inability to sense chest wall movement during respiration. Simple reassurance is often sufficient to alleviate their distress.

Arterial blood gas measurements generally remain stable during a high spinal anesthesia in patients breathing room air spontaneously. The primary effect of a high spinal anesthesia is on expiration, as the muscles responsible for exhalation are impaired. Since a high spinal block typically spares the cervical area, the function of the phrenic nerve and the diaphragm remains normal, and inspiration is minimally affected. While some studies have shown no significant changes in vital capacity, maximal inspiratory pressure, or resting end-tidal PCO₂ with spinal anesthesia,

increased ventilatory responsiveness to CO₂ has been observed with bupivacaine spinal anesthesia.

Gastrointestinal Effects of Spinal Anesthesia

Sympathetic innervation to the abdominal organs originates from T6 to L2. Following a spinal block, sympathetic blockade and the subsequent dominance of parasympathetic activity lead to increased secretions, sphincter relaxation, and bowel constriction.

Heightened vagal activity post-sympathetic nerve block triggers increased gastrointestinal peristalsis, often resulting in nausea. Additionally, nausea may stem from gut ischemia induced by hypotension, which stimulates the production of serotonin and other emetogenic substances. The incidence of intraoperative and postoperative nausea and vomiting (IONV) in non-obstetric surgery can reach up to 42%, rising to as high as 80% in parturient women.

Hepatic and Renal Effects of Spinal Anesthesia

Hepatic blood flow is directly linked to arterial blood flow without autoregulation. Therefore, as arterial blood flow decreases following spinal anesthesia, so does hepatic blood flow. Maintaining the mean arterial pressure (MAP) post-spinal anesthesia ensures the preservation of hepatic blood flow. Patients with hepatic

disease require careful monitoring and blood pressure control during anesthesia to safeguard hepatic perfusion. While no definitive studies have determined the superiority of regional versus general anesthesia in liver disease patients, either can be administered as long as MAP remains close to baseline.

Renal blood flow, on the other hand, is autoregulated, with kidneys maintaining perfusion when MAP stays above 50 mm Hg. Temporary reductions in renal blood flow may occur if MAP drops below 50 mm Hg, but renal function typically returns to normal once blood pressure normalizes. Attention to blood pressure post-spinal anesthesia is crucial to maintaining MAP close to baseline. Importantly, spinal anesthesia does not disrupt the autoregulation of renal blood flow, as evidenced by minimal changes in renal perfusion observed in sheep following spinal anesthesia.

Factors affecting level of spinal block

Numerous factors have been proposed as potential determinants of spinal block level, broadly categorized into four main groups: (1) attributes of the local anesthetic solution, (2) patient-related variables, (3) aspects of the spinal block technique, and (4) diffusion dynamics. Attributes of the local anesthetic solution encompass factors

such as baricity, dosage, concentration, and volume administered. Patient-related variables include age, weight, height, gender, intra-abdominal pressure, spinal column anatomy, cerebrospinal fluid characteristics, and patient positioning. Techniques of spinal block involve considerations like injection site, injection speed, needle bevel direction, injection force, and the inclusion of vasoconstrictors. While these factors have been theorized to influence the spread of anesthetic in the spinal region, only a few have demonstrated significant alteration in block distribution when other influencing factors remain constant.

Site of Injection

The injection site of local anesthetics for spinal anesthesia can influence the level of block achieved. For instance, in certain studies, the administration of isobaric spinal 0.5% bupivacaine at interspaces L2–L3, L3–L4, and L4–L5 has been associated with a sensory block reduction of two dermatomes per interspace. However, there is no discernible difference in nerve block height when hyperbaric bupivacaine or dibucaine is injected as a spinal anesthetic across different interspaces.

Age

Some studies have indicated varying alterations in nerve block height following spinal anesthesia in elderly patients compared to younger individuals, while others

have found no significant difference. These investigations involved both isobaric and hyperbaric 0.5% bupivacaine.

Isobaric bupivacaine seems to elevate nerve block height, whereas hyperbaric bupivacaine shows no apparent change in nerve block height with advancing age. However, any potential correlation between age and spinal anesthesia height alone does not appear robust enough to serve as a reliable predictor in clinical practice. Similar to the role of injection site, it seems that baricity predominantly influences nerve block height following spinal anesthesia in older populations, with age not acting as an independent determinant.

Position

The positioning of the patient is crucial in determining the level of block following hyperbaric and hypobaric spinal anesthesia, but not for isobaric solutions. Variations in positioning such as sitting, Trendelenburg, and prone jackknife positions can significantly influence the distribution of the local anesthetic, primarily due to the gravitational effects.

The level of spinal nerve block is determined by the combination of the baricity of the local anesthetic solution and patient positioning. For instance, sitting posture combined with a hyperbaric solution can induce analgesia in the perineum. Trendelenburg positioning also impacts the spread of hyperbaric and hypobaric local

anesthetics due to gravitational effects. Prone jackknife positioning, typically utilized for rectal, perineal, and lumbar procedures with a hypobaric local anesthetic, prevents upward spread of the spinal block post-injection.

Flexing the hips and knees of a supine patient flattens lumbar lordosis and reduces pooling of local anesthetic in the sacral area. When combined with Trendelenburg positioning, this may facilitate upward spread. This position may inadvertently occur during urinary catheterization following spinal insertion.

Speed of Injection

The impact of injection speed on spinal nerve block height has been investigated, but findings in the literature are inconsistent. Studies using isobaric bupivacaine have shown no variation in spinal nerve block height with different injection speeds. Despite the lack of effect on nerve block height, it is recommended to administer a smooth, slow injection when delivering a spinal anesthetic. Forceful injection, especially if the syringe is not tightly connected to the spinal needle, may result in needle disconnection from the syringe and subsequent loss of local anesthetic.

Volume, Concentration, and Dose of Local Anesthetic

Maintaining consistency in the volume, concentration, or dose of local anesthetic while altering other variables poses a challenge, making it difficult to conduct high-quality studies investigating these factors individually. Axelsson et al. demonstrated

that the volume of local anesthetic can impact both the height and duration of spinal nerve block when equivalent doses are administered.

Similarly, Peng et al. found a direct correlation between the concentration of local anesthetic and the effective anesthesia dose. However, when it comes to determining the duration of spinal nerve block, the dose of local anesthetic emerges as the primary determinant, with neither volume nor concentration of isobaric bupivacaine or tetracaine affecting block duration when the dose remains constant. Numerous studies have consistently shown that higher doses of local anesthetic lead to longer durations of spinal nerve block. It is crucial to consider not only the dose of local anesthetic but also its volume and concentration during spinal anesthesia to avoid over- or under-dosing the patient.

The utilization of hyperbaric solutions diminishes the significance of dose and volume, except in instances where doses of hyperbaric bupivacaine equal to or less than 10 mg are employed, resulting in reduced cephalad spread and shorter durations of action. However, doses ranging between 10 and 20 mg of hyperbaric bupivacaine yield comparable nerve block heights. When employing hyperbaric solutions, it's essential to recognize that patient positioning and baricity exert the most influence on nerve block height, except in cases of low-dose hyperbaric bupivacaine usage.

ROPIVACAINE

INTRODUCTION

Ropivacaine, a newer and longer-lasting local anesthetic belonging to the amino amide group, was synthesized by Ekenstam in 1957 but wasn't introduced for clinical use until 1996. Chemically akin to bupivacaine and mepivacaine, ropivacaine is a pipercoloxylidide local anesthetic.

Research revealed that butyl derivatives of pipercoloxylidides, such as bupivacaine, posed greater cardiotoxicity risks, leading to numerous cardiac arrests. In response, ropivacaine was developed as a pure S-enantiomeric form of pipercoloxylidides. While ropivacaine has been available internationally for over three decades, its introduction to the Indian market is relatively recent.

Ropivacaine is gaining popularity among anesthesiologists and is extensively utilized in various regional anesthesia techniques, including infiltration, peripheral nerve blocks, spinal anesthesia, epidural anesthesia, and caudal epidural blocks in pediatric patients.

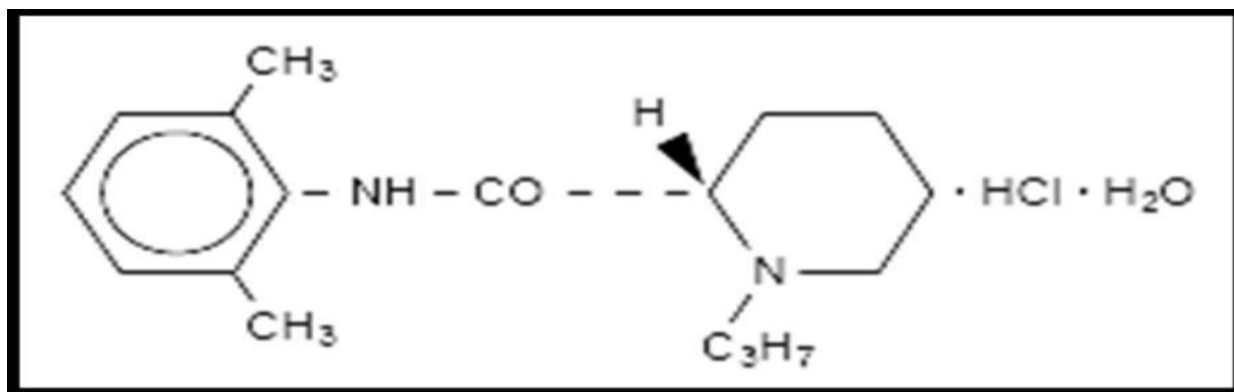


Figure 7 : Structure of Ropivacaine

Ropivacaine is an amino amide local anaesthetic agent, chemically described as S-(-)-1-propyl-2',6'-pipercoloxylylidide hydrochloride monohydrate. The *International Union of Pure and Applied Chemistry* name is (S)-N-(2,6-dimethylphenyl) -1-propylpiperidine-2-carboxamide. It's molecular formula is $C_{17}H_{26}N_2O \cdot HCl \cdot H_2O$ and it has a molecular weight of 328.89.

Ropivacaine is a white crystalline powder. At 25°C ropivacaine hydrochloride has a solubility of 53.8 mg/mL in water and a distribution ratio between n-octanol and phosphate buffer at pH 7.4 of 14:1. The pKa of ropivacaine is 8.07 which is very similar to that of bupivacaine (8.1).

However, ropivacaine has a much lesser lipid solubility as compared to bupivacaine and mepivacaine. This can be explained on the basis of presence of a propyl (3Carbon) side chain in ropivacaine as compared to a butyl (4 Carbon) side chain in the other two local anaesthetics. This lower lipid solubility ***Physical Properties***

of ropivacaine has a significant effect on the block characteristics of ropivacaine as discussed ahead.

Mechanism Of Action And Correlation With Structure

Ropivacaine reversibly inhibits the voltage gated sodium channels present on the nerve cell membranes thus preventing the influx of sodium ions into the cells.

This:

I) Block generation and conductance of nerve impulses.

II) Slows propagation of nerve impulses

III) Reduces the rate of rise of action potential

Almost all local anaesthetic agents block the unmyelinated C and myelinated A δ fibres, which transmit pain impulses, at the same rate.

The rate of blockade of motor fibres (A α and A β), however depends upon the physio chemical properties like pKa and lipid solubility of the individual drug. As ropivacaine is less lipid soluble than bupivacaine, the A α and A β blockade is slower and hence motor blockade is less potent. Studies of lumbar epidural block in humans have confirmed that equal volumes and concentrations of bupivacaine and ropivacaine produce similar degree of sensory block but the motor block produced

by ropivacaine is slower in onset, lesser in intensity and shorter in duration.

Clinically the order of blockade of nerve fibres is autonomic, sensory and motor, while the regression of the block occurs in reverse order.

The nerve impulse transmission is lost in the following order:

The order of the loss of nerve function is

1. Pain
2. Temperature
3. Touch
4. Proprioception
5. Skeletal muscle tone.

Pharmacokinetics

Absorption: The systemic concentration of ropivacaine depends on the total dose and concentration of drug given, the route of administration, the patient's haemodynamic state and the vascularity of the site of administration. When administered in the epidural space, ropivacaine has a biphasic absorption. The half-lives of the two phases (mean \pm SD) are 14 \pm 7 minutes and 4.2 \pm 0.9 hours respectively.

Distribution :

After intravascular infusion, ropivacaine has a steady state of distribution of 41 ± 7 litres. It is 94% protein bound, mainly to α_1 -acid glycoprotein. In case of continuous epidural infusion of ropivacaine the plasma concentration can rise due to increased protein binding and reduced clearance. Ropivacaine can easily cross the placenta.

Metabolism and excretion :

Ropivacaine is extensively metabolized by the liver, predominantly by the cytochrome P_{4501A} mediated aromatic hydroxylation to produce 3 – hydroxyl ropivacaine. After a single IV dose, approximately 37% of the total dose is excreted in the urine as both free and conjugated 3-hydroxy ropivacaine. An additional unquantified amount of 2 – hydroxyl – methyl ropivacaine has also been identified as metabolite.

Ropivacaine metabolites are mainly excreted via kidney. After i.v. administration 86% of the dose is excreted in urine of which only 1% is in unchanged form.

Following IV administration, ropivacaine has a mean \pm SD total plasma clearance of 387 ± 107 mL/min, an unbound plasma clearance of 7.2 ± 1.6 L/min and a renal clearance of 1 mL/min. The mean \pm SD terminal half life is 1.8 ± 0.7 h and 4.2 ± 1.0 h after i.v. and epidural administration respectively.

Pharmacodynamics

Central Nervous System & Cardio Vascular System :

Ropivacaine exhibits a higher threshold for both cardiac and neurotoxicity compared to bupivacaine, attributed to its lower lipid solubility and stereo-selective properties. This characteristic applies to both isomers of ropivacaine, which have demonstrated less cardio depressant effects than their respective bupivacaine counterparts in animal studies. In healthy volunteers, CNS toxicity manifests earlier than cardiac toxicity during intravenous infusion.

Potency :

Lipid solubility of a local anaesthetic correlates well with its potency and toxicity. Compounds which are more lipophilic penetrate the nerve cell membrane more readily. Thus, fewer molecules are required to produce the desired conduction blockade.

Others:

Continuous epidural infusion of 0.375 % and 0.188% ropivacaine has been shown to inhibit platelet aggregation in plasma.

Adverse Effects

Excessive plasma levels are due to over dosage, unintentional intravascular injection or slow metabolic degradation. The mean doses at which CNS symptoms of toxicity begin to occur in human beings are 4.3 and 0.6 mcg/mL of total and free plasma

concentrations respectively. When prolonged blocks are used the risks of reaching a toxic plasma concentration or inducing local neural injury are increased. Various possible side effects include

- a. Injection site pain
- b. **Cardiovascular system toxicity:** Vasovagal reaction, syncope, postural hypotension, non-specific ECG abnormalities which include wide QRS complexes, increased conduction time and reduced contractility.
- c. **Gastrointestinal system toxicity:** Faecal incontinence, tenesmus, nausea, vomiting.
- d. **Central nervous system toxicity:** Tremor, Horner's syndrome, dyskinesia, neuropathy, vertigo, convulsion and coma. Because of depressant effect of ropivacaine on medulla, excitatory stage of CNS might not occur.
- e. **Liver and Biliary system toxicity:** Jaundice
- f. **Metabolic disorders:** Hypomagnesemia

Advantages Over Other Local Anaesthetics

Ropivacaine offers a more distinct blockade, providing improved differentiation between sensory and motor functions. Consequently, it is favored for labor analgesia and postoperative pain relief. In comparison to bupivacaine, ropivacaine induces a

less intense motor blockade of shorter duration, facilitating earlier patient mobilization and discharge. This leads to reduced morbidity and treatment costs. Additionally, ropivacaine exhibits lower systemic toxicity and a more favorable cardiovascular profile than bupivacaine. Developed as a safer alternative to bupivacaine, ropivacaine maintains the desirable blocking properties of racemic bupivacaine.

FENTANYL

Fentanyl was synthesized by Janssen Pharmaceutica in the year 1960 with the emphasis on potency and safety. Fentanyl citrate is a synthetic phenyl piperidine opioid analgesic and a chemical congener of the reversed ester of Pethidine (Meperidine).

PHYSIOCHEMICAL PROPERTIES

It is a white crystalline powder and is highly lipid soluble and sparingly soluble in water. The commercially available injections have a pH of 7 to 7.5, pKa value of 8.4. Less than 10% is in unionized form at physiologic pH of 7.4. its plasma protein binding is 84%. It is 50 to 100 times more potent than Morphine. The

preparation should be protected from light and should be stored at 15°C to 30°C.

It is also available as intrabuccal, transdermal and aerosolized preparations.

MECHANISM OF ACTION

Fentanyl is primarily a Mu (μ) receptor agonist and these Mu (μ) receptors are present in the brain (periaqueductal gray matter of brain stem, amygdala, corpus striatum and hypothalamus), spinal cord (substantia gelatinosa) and peripheral nerves. These receptors are involved with pain perception, integration of pain impulses and responses to pain.

Opioids act as agonists at stereospecific opioid receptors at pre- synaptic and post-synaptic sites. The most likely mechanism of these peripheral actions appears to be activation of opioid receptors on primary afferent neurons. Fentanyl mimics the actions of endogenous ligands by binding to receptors resulting in activation of pain modulating system.

Opioid receptor activation leads to decrease in neurotransmission. This decrease occurs largely by pre-synaptic inhibition of neurotransmitter (Acetylcholine, Dopamine, Norepinephrine, Substance P) release.

Biochemical events on activation are increased Potassium conductance leading to Hyperpolarization and Calcium channel inactivation or both. Fentanyl also binds to Kappa receptors (κ) to a lesser extent in the spinal cord and mediates miosis and sedation.

Fentanyl is metabolized in the liver via the CYP450 enzyme system, specifically CYP3A4. It has a half-life of 3-7 hours and 75% is excreted in the urine and 9% in feces.

PHARMACOKINETICS

After intravenous administration, Fentanyl has rapid onset of action with a short duration of action. The effect site equilibrium time between blood and brain is 6.4 minutes.

DISTRIBUTION

Fentanyl has high lipid solubility so it gets widely distributed throughout the body to inactive sites. Initially it distributes to vascular organs such as the heart, lungs and brain. It then gets distributed to skeletal muscles and fat. Lungs also serve as inactive storage site with estimated 75% of initial dose undergoing first pass pulmonary uptake. Volume of distribution of Fentanyl after administration is 4 ± 0.4 L/Kg.

METABOLISM

Fentanyl is extensively metabolized in the liver by N-demethylation producing Norfentanyl and hydrolysed to 4-N amilinopiperidine and proprionic acid. Lungs exert significant first pass effect and transiently take up 75% of injected dose of Fentanyl, 80% of Fentanyl is bound to plasma proteins, approximately 50% to α -acid glycoprotein.

ELIMINATION

Fentanyl is excreted mainly in the urine as metabolite as less than 8% is excreted as unchanged drug. The mean clearance after IV administration is between the range of 34-53 Litres/hour or approximately 13 ml/min/Kg body weight. Mean terminal half-lives are between 2.5 to 8 hours. Context sensitive half-life (after continuous infusion of 4 hours) is 260 minutes and this reflects saturation of inactive tissues during infusion.

ADVERSE REACTIONS

CARDIOVASCULAR SYSTEM: Hypotension, orthostatic hypotension, syncope, drug- induced bradycardia.

RESPIRATORY SYSTEM: Dose-dependent depression of ventilation which is characterized by reduced response of ventilator centres to carbon dioxide.

CENTRAL NERVOUS SYSTEM: In the absence of hypoventilation, Fentanyl decreases cerebral blood flow and in turn decreases intracranial pressure. Myoclonus during administration may resemble generalized tonic- clonic seizures. It can produce thoracic and abdominal skeletal muscle rigidity. Miosis may occur as most of Mu and Kappa agonists cause constriction of pupil by an excitatory action on the parasympathetic nerves innervating the pupils.

It causes pruritis when administered for central neuraxial blockade, which is likely due to cephalad migration of opioids in the cerebrospinal fluid and

subsequent interaction with opioid receptors in the trigeminal nucleus. Pruritis is likely to be localized to face, neck and upper thorax.

HEPATOBIILIARY SYSTEM: Fentanyl causes dose-dependent increase in biliary duct pressure and sphincter of Oddi tone.

GASTROINTESTINAL SYSTEM: Fentanyl delays gastric emptying and can also produce nausea and vomiting by directly stimulating the *CTZ*.

IMMUNE SYSTEM: The overall effect appears to be suppressive, leading to increased susceptibility to infections.

ALLERGIC REACTIONS: True allergic and anaphylactoid reactions are rare. Most commonly, local reactions may occur due to preservatives or histamine release.

TOLERANCE AND PHYSICAL DEPENDENCE: Tolerance can occur without physical dependence but the reverse does not seem to occur. Cross tolerance develops between all opioids.

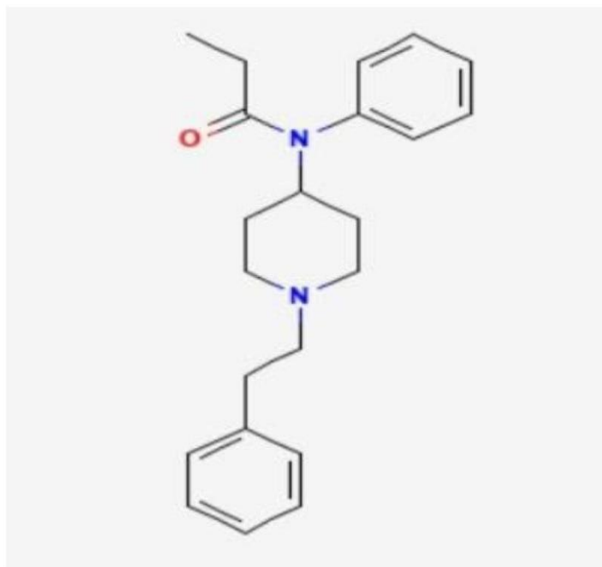


Figure 8 : Structure of fentanyl

CLONIDINE

Clonidine is an antihypertensive medication that acts on alpha-adrenergic and imidazoline receptor agonists. Clonidine is an antihypertensive drug that lowers blood pressure and heart rate by relaxing the arteries and increasing the blood supply to the heart; it has other FDA-approved indications such as treatment of attention deficit hyperactivity disorder (ADHD) in children (FDA approval 2010); management of tics commonly found with Tourette syndrome; and adjunct therapy

for severing cancer-related pain. This activity reviews the mechanism of action, adverse event profile, toxicity, dosing, pharmacodynamics, and monitoring of clonidine, pertinent for interprofessional team members when indicated for therapy.

It is an agonist on alpha-adrenergic and imidazoline receptors. Clonidine is an antihypertensive drug that lowers blood pressure and heart rate by relaxing the arteries and increasing the blood supply to the heart.

Mechanism of action

Clonidine hydrochloride is an imidazoline derivative that acts centrally on alpha-2 adrenergic as an agonist. The chemical name for clonidine is 2-((2,6-dichlorophenyl)amino)-2-imidazoline hydrochloride.

As an alpha-adrenergic agonist in the nucleus tractus solitarii (NTS), clonidine excites a pathway that inhibits excitatory cardiovascular neurons. Clonidine has an alpha-antagonist effect in the posterior hypothalamus and medulla. The final response is reduced sympathetic outflow from the central nervous system (CNS), which clinically causes a decrease in arterial blood pressure.

Epidural clonidine used as an adjunct to local anesthetics has three different mechanisms of action. First, the stimulation of alpha-2-receptors in the dorsal horn reduces pain transmission. Secondly, clonidine can cause local vasoconstriction that limits vascular removal of local epidural anesthetics. Lastly, clonidine enhances

neuraxial opioids and, in combination with fentanyl, interacts in an additive manner, which can reduce the dose of each component by 60% for postoperative analgesia.

The intrathecal application of clonidine increases the duration of both sensory and motor block,²⁻⁵ as well as postoperative analgesia.⁶ The mechanism of clonidine in spinal anesthesia is reported to be mediated by presynaptic (inhibition of transmitter release)⁷ and postsynaptic (enhancing hyperpolarization)^{8,9} effects. Marked decrease in arterial blood pressure was observed with 75 µg of intrathecal clonidine (in combination with intrathecal morphine),¹⁰ whereas relative hemodynamic stability was maintained with doses ≥ 150 µg, as demonstrated by using clonidine as the sole analgesic.

1. Absorption:

- **Bioavailability:** Clonidine has a relatively high oral bioavailability, around 75-95% after an oral dose.
- **Onset of Action:** After oral administration, clonidine usually starts to take effect within 30 minutes, with peak plasma concentrations occurring around 1-3 hours.
- **Food Effect:** Food can slightly increase the absorption of clonidine but does not significantly affect its overall bioavailability.

2. Distribution:

- **Volume of Distribution (Vd):** Clonidine has a moderate volume of distribution, around 2-4 L/kg. This indicates that the drug is well-distributed throughout the body, including the central nervous system (CNS), where it exerts its therapeutic effects.
- **Plasma Protein Binding:** Approximately 20-40% of clonidine is bound to plasma proteins. The low binding suggests that a significant proportion of the drug is available in its free form to interact with its target sites.

3. Metabolism:

- **Hepatic Metabolism:** Clonidine is primarily metabolized in the liver. It undergoes N-demethylation and glucuronidation, forming several metabolites. However, only a small portion of these metabolites is pharmacologically active.
- **Enzymes Involved:** The main enzymes involved in the metabolism of clonidine include cytochrome P450 enzymes (CYP2D6 and CYP3A4).
- **Metabolites:** The major metabolites are excreted in the urine, and only a small fraction is eliminated in the feces.

4. Elimination:

- **Half-Life:** Clonidine has a terminal half-life of about 12-16 hours when taken orally. This relatively long half-life supports once- or twice-daily dosing.
- **Excretion:** Clonidine is primarily excreted by the kidneys. Approximately

40-60% of the drug is excreted unchanged in the urine, and the rest is eliminated as metabolites [26].

- **Renal Impairment:** In patients with renal impairment, clonidine's clearance is reduced, leading to an increased half-life and potentially higher plasma concentrations. Dosage adjustments are necessary for these patients.

5. Steady-State:

- When clonidine is taken regularly, it reaches steady-state concentrations after about 2-4 days of administration, with a consistent therapeutic effect.

6. Toxicokinetics:

- **Overdose Risk:** In overdose, clonidine can cause significant central nervous system depression, including sedation, bradycardia, hypotension, and respiratory depression. The drug's effects can be particularly dangerous in children.

ADVERSE EFFECTS OF CLONIDINE:

1. Cardiovascular Effects

- **Hypotension (Low Blood Pressure):** Clonidine reduces sympathetic tone and thus lowers blood pressure. When the drug is overused or not adjusted for

an individual, it can lead to excessive hypotension (low blood pressure), which can cause dizziness, fainting, or shock.

- **Bradycardia (Slow Heart Rate):** By inhibiting norepinephrine release, clonidine can cause a reduction in heart rate. In some individuals, especially those with existing heart conditions, this can lead to dangerously slow heart rates, resulting in fatigue, dizziness, or fainting.
- **Rebound Hypertension:** A **dangerous effect** occurs if clonidine is abruptly discontinued. The sudden withdrawal leads to a rapid increase in blood pressure, known as rebound hypertension, which can be severe and even life-threatening. This is due to upregulation of adrenergic receptors that were previously inhibited by clonidine.

2. Central Nervous System Effects

- **Sedation and Drowsiness:** Clonidine has a sedative effect because it inhibits the release of norepinephrine in the brain, reducing sympathetic outflow. This results in drowsiness, lethargy, or sedation, making it difficult for individuals to perform tasks that require alertness.
- **Depression:** The suppression of norepinephrine in the brain has been linked to mood alterations, including depression. Clonidine's effects on central neurotransmission can alter emotional regulation in some individuals, leading to symptoms of depression.

- **Mental Status Changes:** In rare cases, clonidine can cause confusion, hallucinations, or agitation, especially when taken in high doses or by vulnerable populations such as the elderly.

3. Gastrointestinal Effects

- **Dry Mouth:** Clonidine can reduce salivation as part of its anticholinergic effect, leading to dry mouth (xerostomia), which is a common side effect.
- **Constipation:** The decrease in sympathetic activity also affects gastrointestinal motility, leading to constipation in some patients.

4. Renal and Fluid Balance Effects

- **Water Retention and Sodium Retention:** The reduction of sympathetic nervous system activity can influence renal function, leading to issues like water and sodium retention, which may exacerbate conditions like heart failure or kidney disease.

5. Toxicological and Metabolic Effects

- **Overdose Toxicity:** Clonidine overdose can be life-threatening, manifesting as severe bradycardia, hypotension, respiratory depression, and even coma. This is due to the excessive stimulation of alpha-2 adrenergic receptors, which inhibits norepinephrine release and depresses central sympathetic activity.
- **Hypoglycemia in Diabetic Patients:** Clonidine may mask the symptoms of

hypoglycemia (low blood sugar), as it reduces sympathetic nervous system activation, which would normally lead to tachycardia or tremors in response to low blood sugar levels. This can make it difficult for diabetic patients to recognize and manage hypoglycemic episodes.

6. Skin and Allergic Reactions

- **Rash or Dermatitis:** Though rare, clonidine can cause skin reactions, including rash or pruritus (itching).
- **Allergic Reactions:** Hypersensitivity reactions such as angioedema or difficulty breathing, though uncommon, are serious side effects of clonidine.

7. Neurological Effects

- **Withdrawal Symptoms:** Abrupt cessation of clonidine can result in a set of withdrawal symptoms due to the body's adaptation to the drug's presence. Symptoms can include anxiety, agitation, headache, tachycardia (rapid heart rate), and increased blood pressure.
- **Central Nervous System Depression:** High doses or prolonged use can lead to CNS depression, potentially affecting mental clarity, reflexes, and overall brain function.

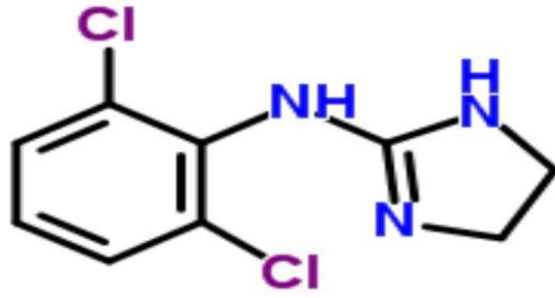


Figure 9: Structure of clonidine

MATERIALS AND METHODS

Source of Data

“The data for the present study were collected from patients aged between 18 and 60 years, classified under American Society of Anesthesiologists (ASA) physical status I and II, scheduled for elective infraumbilical surgeries under subarachnoid block at KLE’s Dr. Prabhakar Kore Hospital and Medical Research Centre, Nehru Nagar, Belagavi-590010.”

Study Design

It is a hospital-based, double-blinded, prospective randomized clinical trial.

Study Period

One year.

Sample Size

The total sample size calculated for the study was 150 patients (75 patients in each group). The sample size was determined based on the following statistical formula for comparing two means:

$$n = \frac{(Z_{\alpha} + Z_{\beta})^2 (s_1^2 + s_2^2)}{(\bar{X}_1 - \bar{X}_2)^2}$$

Where:

- $Z_{\alpha}=1.96$ at 5% significance level (two-tailed).
- $Z_{\beta}=1.64$ corresponding to 80% power.
- X^{-1} (mean of first group) = 0.52
- X^{-2} (mean of second group) = 1.28
- S_1 (standard deviation of first group) = 0.96
- S_2 (standard deviation of second group) = 1.31

Using the above parameters, the sample size calculated was 75 patients per group, totaling 150 patients.

Sampling Technique and Randomization

After meeting the inclusion criteria and obtaining informed written consent, study subjects were allotted into one of two groups by employing a sealed- envelope technique with computer-generated random numbers:

- Group RF: Patients received intrathecal administration of 2.5 mL of hyperbaric 0.75% ropivacaine with 0.5ml (25 μ g fentanyl).
- Group RC: Patients received intrathecal administration of 2.5 mL of hyperbaric 0.75% ropivacaine with 0.3ml (30 μ g clonidine) and 0.2ml normal saline.

Inclusion Criteria

Patients eligible for enrollment included those:

- Aged between 18 and 65 years.
- Classified as ASA physical status I or II.
- With heights ranging from 160 to 170 cm.
- Undergoing elective infraumbilical surgical procedures.

Exclusion Criteria

Patients were excluded from the study based on:

- Refusal to participate.
- Presence of coagulation disorders.
- Known neurological deficits.
- Significant spinal deformities.
- Allergy or sensitivity to any study medication.

Study Protocol

Ethical approval was given by the institutional ethical committee before study commencement. All participants underwent a pre-anesthetic evaluation, and informed consent was obtained one day prior to surgery.

Anaesthetic Technique:

Patients adhered to standard preoperative fasting guidelines. Upon arrival at the preoperative area, intravenous access was secured, and aspiration prophylaxis was administered. Patients received a fluid preload of Ringer's lactate solution at 20 mL/kg body weight over 10-20 minutes.

In the operating theatre, standard monitoring included electrocardiography (ECG), pulse oximetry (Spo₂), and non-invasive blood pressure (NIBP). Baseline hemodynamic parameters were recorded before the procedure.

Under strict aseptic conditions, SAB was done with a 25G Quincke's spinal needle at the L3–L4 intervertebral space via a midline approach in lateral position. The allocated study medication was administered intrathecally as per randomization. Patients were immediately repositioned supine following the block. No sedation or general anesthesia was given during the procedure.

Clinical Assessment and Data Collection

The following parameters were systematically evaluated and recorded by an independent anesthesiologist blinded to group allocation:

- Sensory Block:
 - Sensory block initiation (defined as the interval from intrathecal injection to the absence of pin-prick sensation at T8 dermatome) was assessed bilaterally along the midclavicular line using a 24G hypodermic needle.
 - Highest dermatomal level of sensory block and the time taken to achieve it were documented every 2 minutes up to 20 minutes, and thereafter every 15 minutes.
 - Sensory block period was measured as the time interval from peak block height to regression of two dermatomes.
- Motor Block:
 - Motor block was assessed using the Modified Bromage Score:
 - 0 = Full movement at hip, knee, and ankle.
 - 1 = No hip movement; knee and ankle movements intact.
 - 2 = No hip or knee movement; ankle movement intact.

- 3 = Complete paralysis of hip, knee, and ankle joints.
- Motor block onset was noted as the time when a Modified Bromage Score of 3 was achieved. Complete recovery from motor blockade was considered at a Bromage score of 0.
- Duration of Subarachnoid Block:
 - The period from the intrathecal injection to the patient's first complaint of pain postoperatively.
- Sedation Score:
 - Intraoperative sedation was assessed at 5-minute intervals throughout surgery using Ramsay sedation scale:
 - “1 = Awake.
 - 2 = Cooperative and tranquil.
 - 3 = Responds to commands only.
 - 4 = Brisk response to a glabellar tap.
 - 5 = Sluggish response to a glabellar tap.
 - 6 = No response.”

- Hemodynamic Monitoring:
 - Hemodynamic parameters were recorded before block placement, at 5-minute intervals for the first 30 minutes, then every 15 minutes until surgery completion.
- Postoperative Pain Assessment:

Rescue analgesia, intravenous diclofenac (75 mg) or tramadol (50–100 mg), was provided if VAS scores were ≥ 4 during the initial 72 hours postoperatively.

Management of Adverse Events

- Hypotension was managed with IV fluids and bolus doses of mephentermine (6mg)
- Bradycardia managed using IV atropine (0.2mg bolus)
- Adverse effects like pruritus, nausea, vomiting, or respiratory depression were recorded.

- Blood loss, if significant, was managed with colloids or blood transfusions as clinically indicated.

Blinding

The anesthesiologist who administered the intrathecal drug was not involved in data collection. The patients and the anesthesiologist who assessed study outcomes remained blinded to group allocation throughout the study period.

Statistical Analysis

“Data were entered into Microsoft Excel spreadsheets and analyzed using Statistical Package for Social Sciences (SPSS), version 17. Continuous variables were expressed as mean \pm standard deviation and analyzed using unpaired t-test. Categorical variables were presented as frequency and percentage, analyzed using Chi-square or Fisher’s exact test. Non-parametric tests, ANOVA, correlation, or regression analyses were employed as appropriate. Statistical significance was established at a p-value of <0.05 .”

Data Analysis Parameters

The following parameters were analyzed:

- Onset and duration of sensory block.
- Highest sensory block height.

- Onset and duration of motor block.
- Hemodynamic stability (SBP, DBP, MAP, HR,).
- Sedation scores.

RESULTS

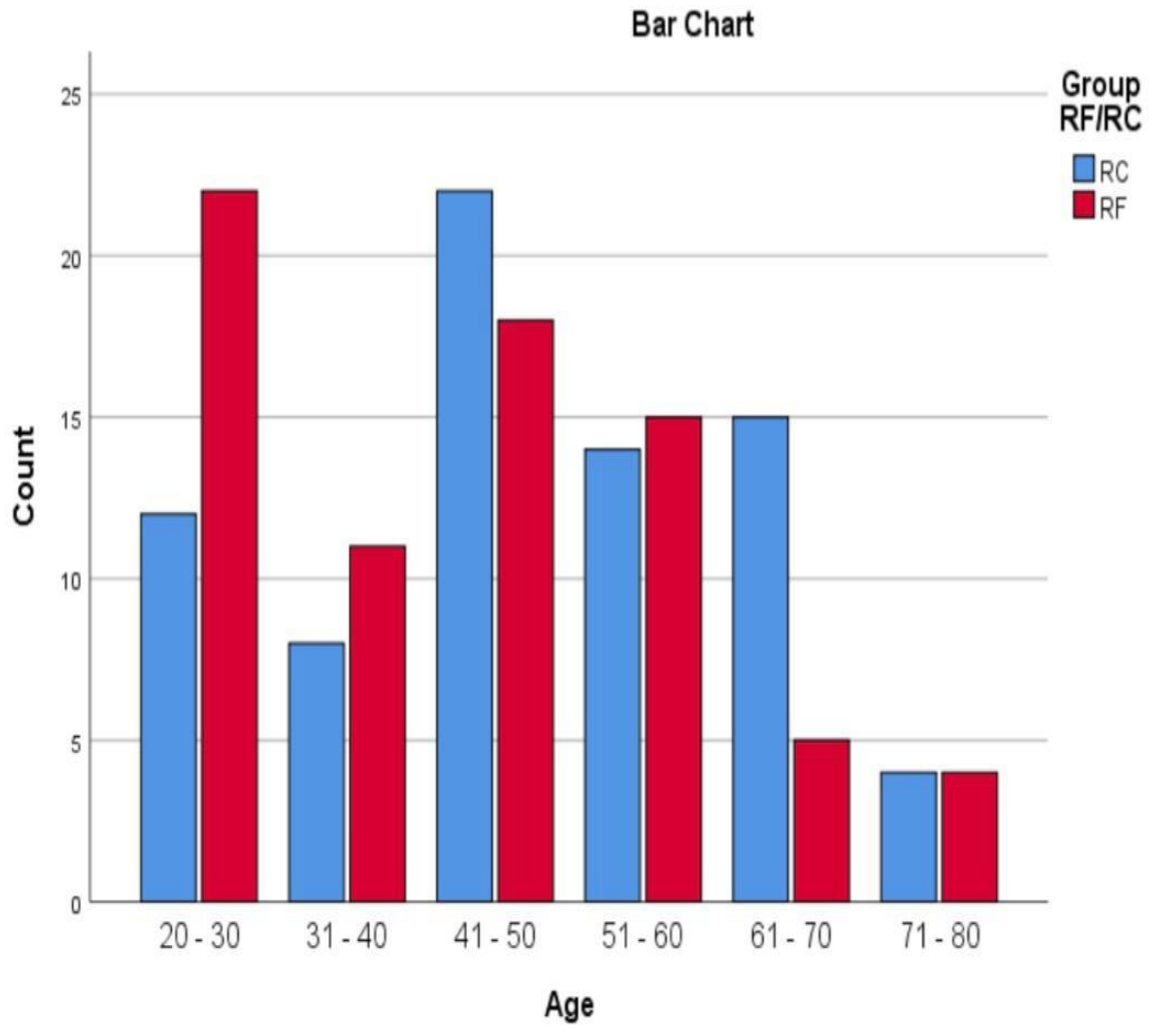
Demographic Profile of the Respondent (Age)

	Group RF/RC		
Age	RC	RF	Total
20 - 30	12	22	34
31 - 40	8	11	19
41 - 50	22	18	40
51 - 60	14	15	29
61 - 70	15	5	20
71 - 80	4	4	8
Total	75	75	150

Pearson chi-square = 8.849, p-value = 0.115

INTERPRETATION:

The age distribution shows a larger proportion of younger participants (20-30 years) in the RF group, while those in the 41-50 and 51-60 age brackets appear more frequently in the RC group. Although these age differences are visually noticeable, they are not statistically significant (Pearson chi-square = 8.849, $p = 0.115$). Thus, age likely does not play a pivotal role in distinguishing the two groups in this study.



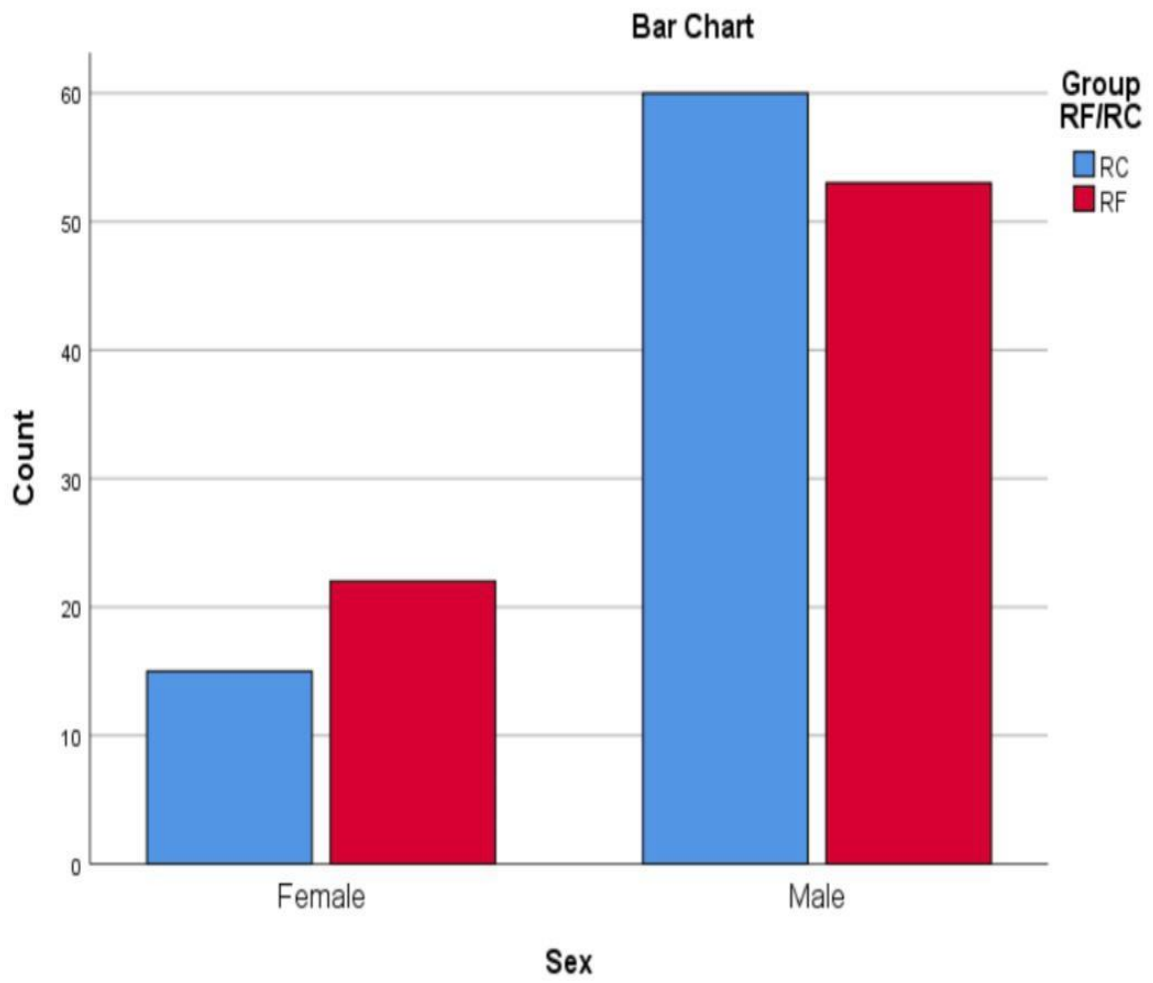
Demographic Profile of the Respondent (Sex)

	Group RF/RC		
Sex	RC	RF	Total
Female	15	22	37
Male	60	53	113
Total	75	75	150

Pearson chi-square = 1.758, p-value = 0.185

INTERPRETATION:

In both groups, males outnumber females. Although the RC group has a slightly higher proportion of males compared to the RF group, the difference remains statistically insignificant (Pearson chi-square = 1.758, $p = 0.185$). Sex, therefore, does not seem to impact group allocation in a meaningful way.



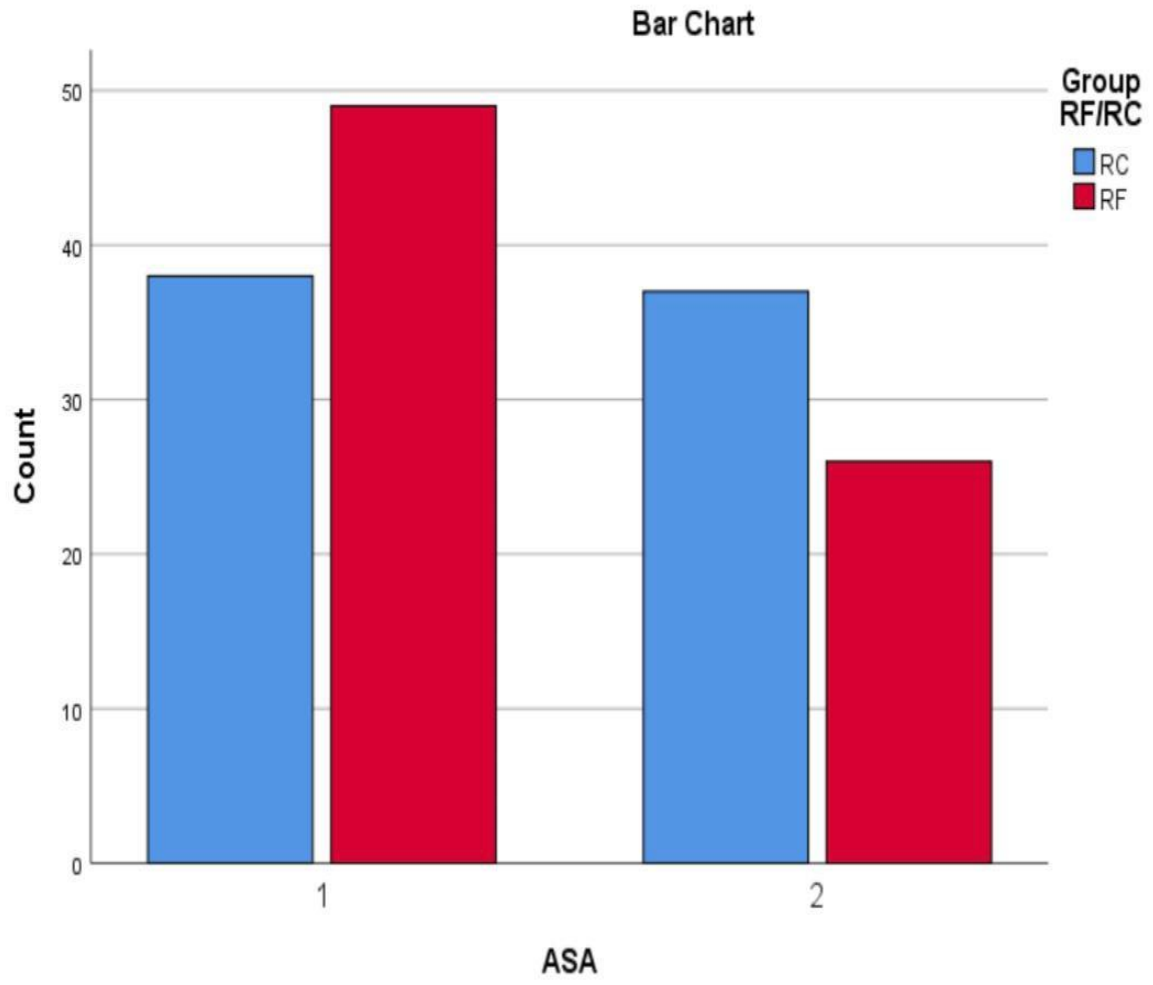
Demographic Profile of the Respondent (ASA)

	Group RF/RC		
ASA	RC	RF	Total
1	38	49	87
2	37	26	63
Total	75	75	150

Pearson chi-square = 3.311, p-value = 0.069

INTERPRETATION:

The RF group includes more ASA I patients, while the RC group contains slightly more ASA II patients. The p-value is 0.069, which is close to the threshold of significance, suggesting there may be a trend requiring additional investigation.



Demographic Profile of the Respondent (Diagnosis)

Diagnosis	Group RF/RC		Total
	RC	RF	
Abscess on L Thigh	2	0	2
Antral stricture	0	1	1
Appendicitis	1	1	2
B/l Hydrocele	1	0	1
CLW over foot	1	0	1
Diabetic foot ulcer	4	0	4
Epididymal cyst	1	1	2
Fissure in ano	10	13	23
Fournier's gangrene	1	1	2
Gangrene of foot	1	2	3
Gangrene of R foot toes	1	0	1
Gluteal abscess	2	1	3
Haemorrhoids	4	5	9
Hydrocele	0	4	4
Incisional Hernia	1	2	3
Inguinal Hernia	3	2	5
L diabetic foot	5	3	8

L foot gangrene	1	0	1
L inguinal Hernia	6	3	9
L lower limb cellulitis	1	0	1
L Thigh infected wound	2	0	2
Lateral condyle fracture	0	1	1
Left diabetic foot ulcer	0	1	1
Lipoma	1	2	3
Il cellulitis	0	4	4
Ll raw area	0	1	1
Ll ulcer	1	1	2
Necrotizing fasciitis	1	0	1
op/c/o Amputation	1	0	1
op/c/o Hernia	1	0	1
P3L3 for Tubectomy	0	1	1
Perianal abscess	0	2	2
Perianal fistula	1	1	2
Phimosis	1	1	2
Pilonodal abscess	1	0	1
Pubic Rami fracture	0	1	1
R diabetic foot	1	2	3

R Hydrocele	2	0	2
R inguinal Hernia	5	2	7
R leg cellulitis	0	1	1
R thigh Abscess	0	1	1
R thigh swelling	0	1	1
Raw area on foot	0	2	2
Sphincteric fistula	1	0	1
Sterilization	0	1	1
Swelling on thigh	1	0	1
Thermal burns	0	1	1
Tibia fracture	0	2	2
Ulcer over foot	1	0	1
Ulcer over gluteal region	0	1	1
Ulcer over L foot	3	0	3
Ulcer over L thigh	1	0	1
Ulcer over R foot	1	2	3
Ulcer over R thigh	0	1	1
Umbilical Hernia	3	0	3
Varicocele	0	1	1
Varicose vein & lipoma	0	1	1

Varicose vein ulcer	0	1	1
Varicose veins	1	0	1
Venous ulcer w maggot	0	1	1
Wound dehiscence	1	0	1
Total	75	75	150
Pearson chi-square = 78.354, p-value = 0.209			

INTERPRETATION:

The demographic profile based on diagnosis displays a wide variety of medical conditions treated in both RC and RF groups. Notably, "Fissure in ano" has the highest count with 23 cases, with a higher representation in the RF group (13) compared to the RC group (10). "Haemorrhoids" also shows a relatively higher frequency with 9 cases, slightly more common in the RF group (5) than in the RC group (4). The distribution of cases like "Diabetic foot ulcer," "L diabetic foot," and "Inguinal Hernia" suggests diverse surgical interventions are prevalent among respondents.

Despite a varied presentation across diagnoses, the overall chi-square value of 78.354 with a p-value of 0.209 indicates no statistically significant difference between the RC and RF groups regarding the type of diagnosis. This outcome suggests that the type of medical condition, although varied, does not significantly

influence the allocation into either the RC or RF group within this population sample. The data reflects a balanced distribution of medical and surgical conditions across both groups, which is essential for maintaining comparability in clinical studies.

Demographic Profile of the Respondent (Surgery)

	Group RF/RC		Total
	RC	RF	
Surgery			
amputation	3	0	3
Appendicectomy	1	1	2
circumcision	1	1	2
Closed reduction	0	1	1
Debridement	15	22	37
Debridement & excision	0	1	1
Debridement and STSG	0	1	1
Debridement&grafting	1	0	1
Excision	6	3	9
Fasciotomy	1	0	1
Fistulectomy	11	8	19
Forefoot amputation	0	1	1
Grafting	1	0	1
Haemorrhoidectomy	4	5	9
Hernia Repair	19	8	27
Implant removal	0	2	2

Incision and drainage	5	4	9
Jabonlay's procedure	2	0	2
Open Tubectomy	0	2	2
ORIF	0	1	1
Repair	2	12	14
Right AK Amputation	0	1	1
Secondary suturing	1	0	1
Stripping	0	1	1
STSG	1	0	1
Suturing	1	0	1
Total	75	75	150
Pearson chi-square = 50.495, p-value = 0.046			

INTERPRETATION:

The surgical interventions among the respondents reveal significant differences in procedures such as "Debridement," where the RF group (22) had notably more cases compared to the RC group (15). The "Hernia Repair" and "Fistulectomy" procedures also show a marked difference, with the RC group having a higher count in "Hernia Repair" (19 vs. 8) and a relatively balanced but slightly higher occurrence in the RC group for "Fistulectomy" (11 vs. 8). The chi-square test (value: 50.495, p=0.046)

confirms that the distribution of surgery types differs significantly between the two groups. This indicates that group-specific factors may be influencing the choice of procedure, which could in turn affect surgical outcomes.

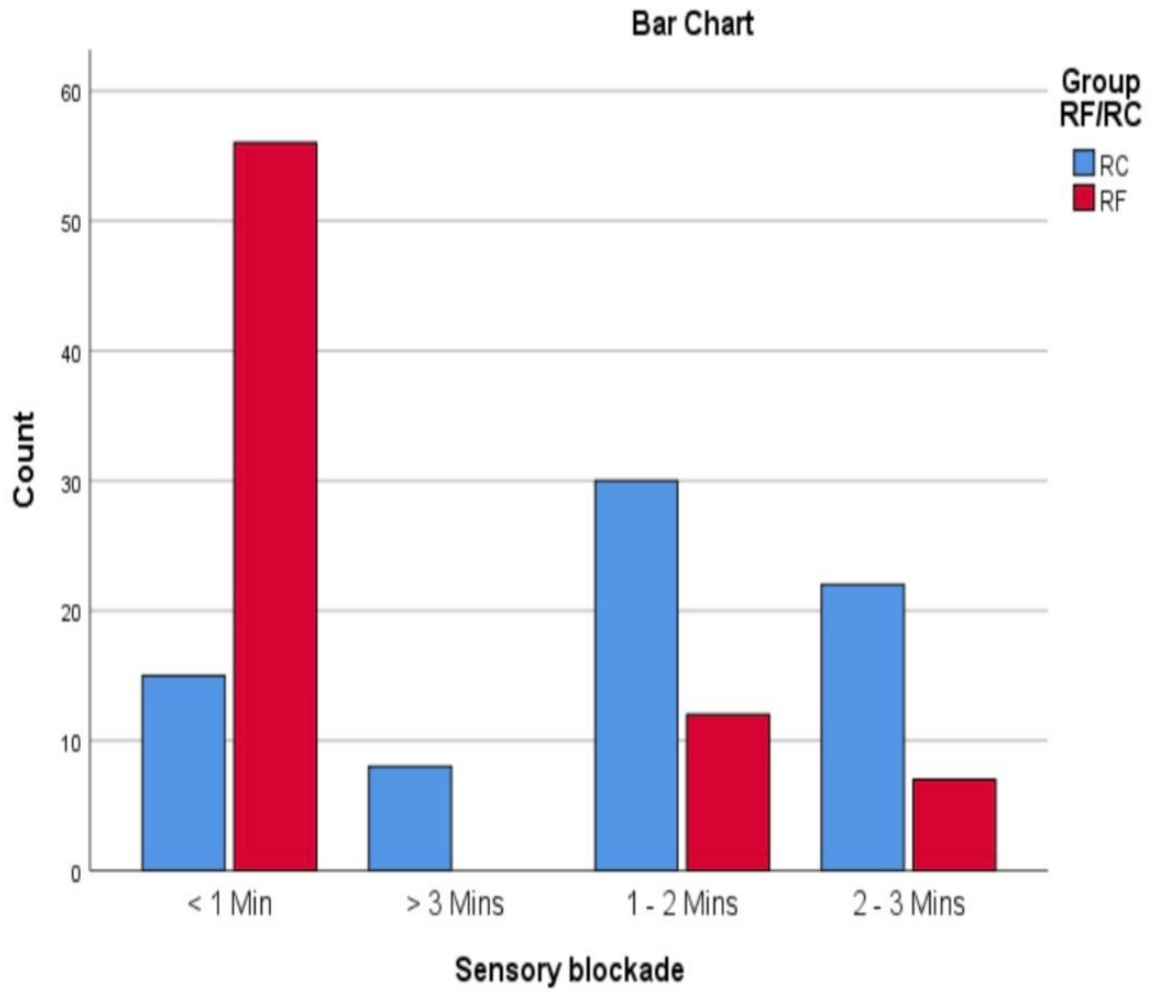
Sensory Blockade

Sensory blockade	Group RF/RC		Total
	RC	RF	
< 1 Min	15	56	71
1 - 2 Mins	30	12	42
2 - 3 Mins	22	7	29
> 3 Mins	8	0	8
Total	75	75	150

Pearson chi-square = 47.149, p-value < 0.001

INTERPRETATION:

The data reveal that the RF group achieves sensory blockade much faster, with 56 patients experiencing onset in under one minute versus 15 in the RC group. Conversely, the RC group shows a more gradual onset, primarily between 1 and 3 minutes. The difference is highly significant ($p < 0.001$), indicating the two groups differ greatly in how quickly the nerve block becomes effective.



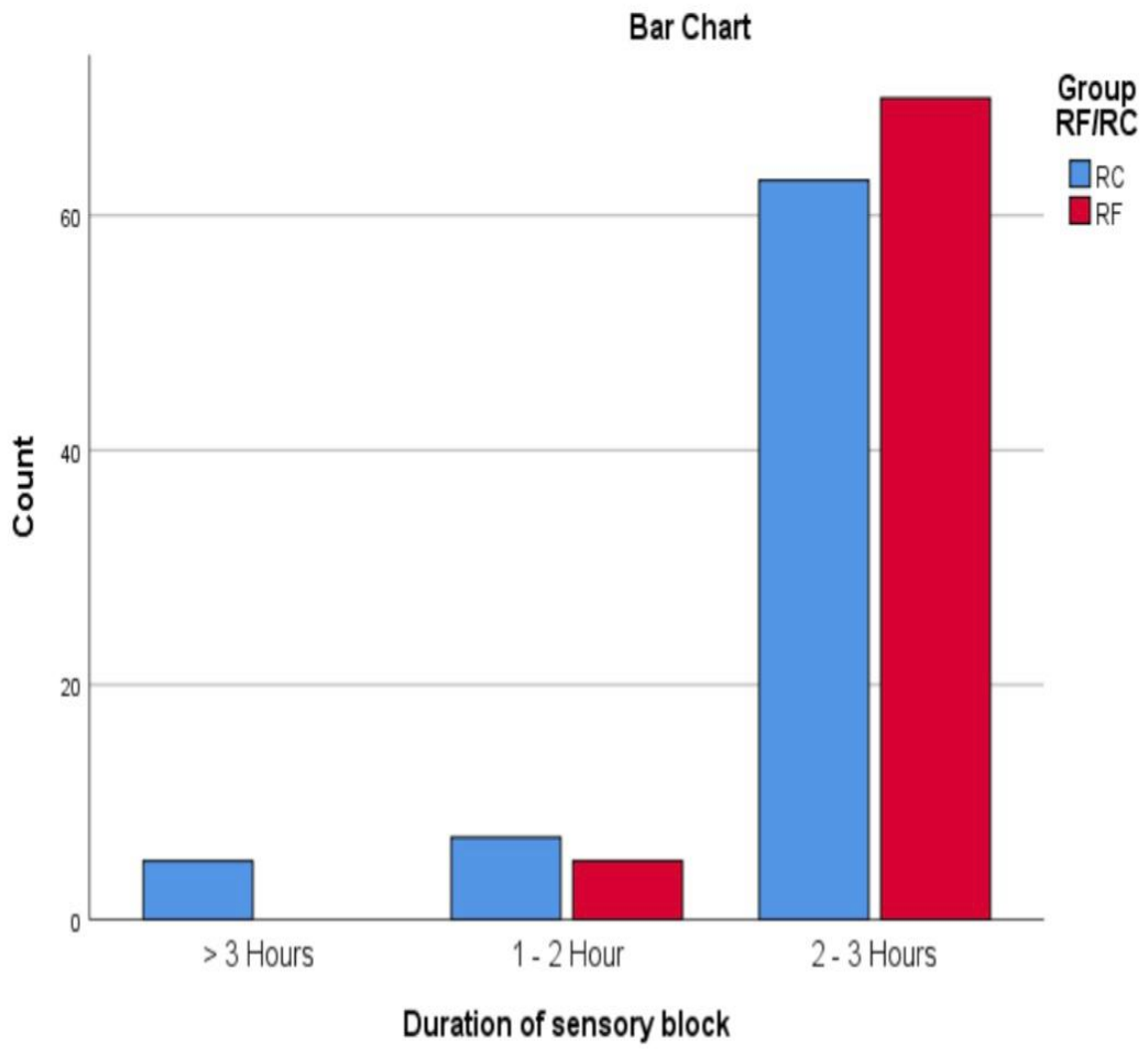
Duration of Sensory Block

Duration of sensory block	Group RF/RC		
	RC	RF	Total
1 - 2 Hour	7	5	12
2 - 3 Hours	63	70	133
> 3 Hours	5	0	5
Total	75	75	150

Pearson chi-square = 7.357, p-value = 0.048

INTERPRETATION:

Most participants in both groups have a sensory block lasting between 2 and 3 hours. However, only the RC group reports instances extending beyond 3 hours (5 cases). The p-value of 0.048 signifies a meaningful distinction in sensory block duration between the groups, possibly reflecting differences in drug synergy or technique.



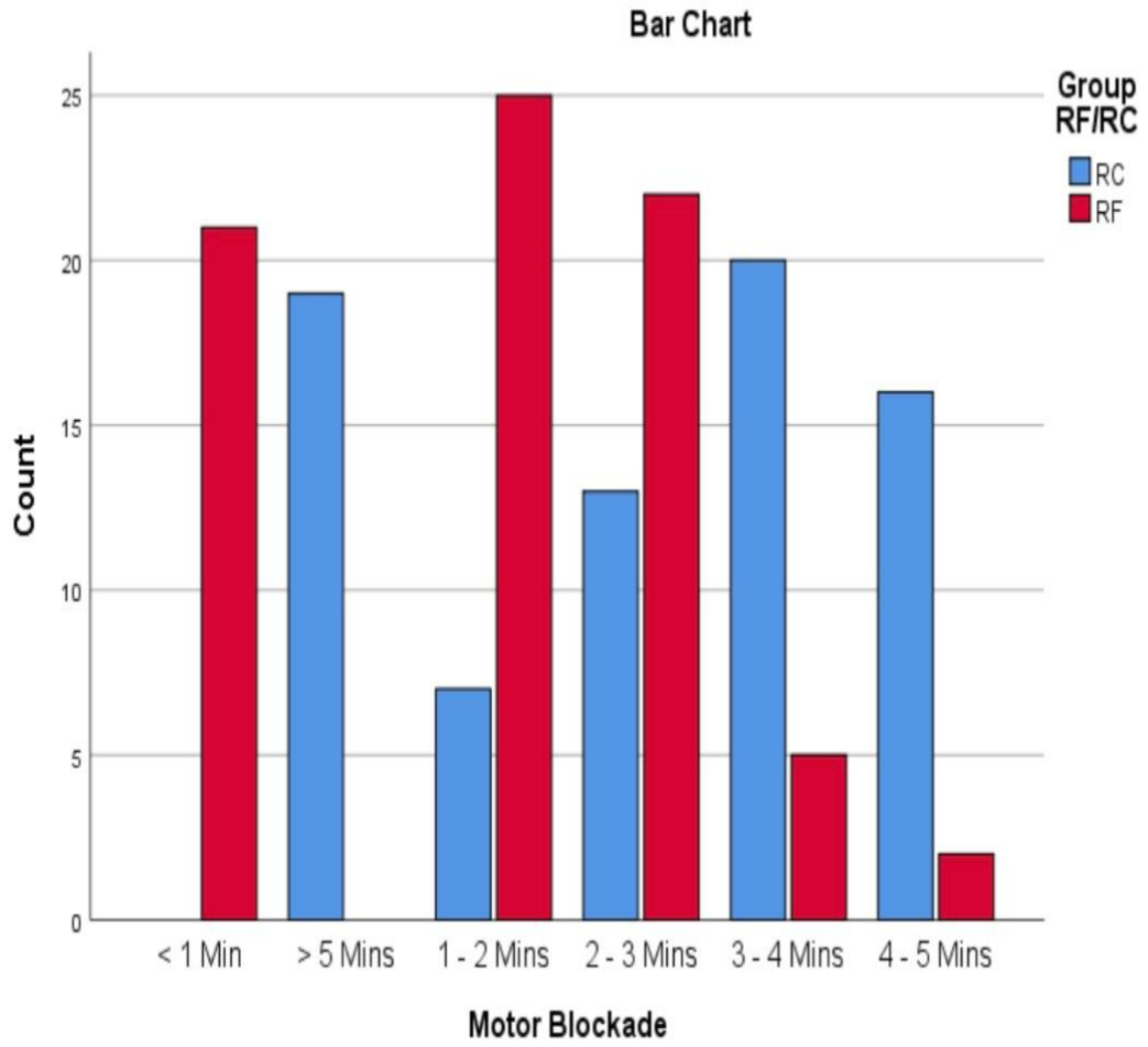
Motor Blockade

Motor Blockade	Group RF/RC		
	RC	RF	Total
< 1 Min	0	21	21
1 - 2 Mins	7	25	32
2 - 3 Mins	13	22	35
3 - 4 Mins	20	5	25
4 - 5 Mins	16	2	18
> 5 Mins	19	0	19
Total	75	75	150

Pearson chi-square = 72.328, p-value < 0.001

INTERPRETATION:

The RF group manifests a prompt motor blockade, with a notable 21 patients achieving it in under 1 minute, whereas no participants in the RC group do so that quickly. In contrast, a larger number of RC subjects experience onset times of 3 minutes or longer. This highly significant difference ($p < 0.001$) underscores markedly distinct profiles for motor block onset between the two groups.



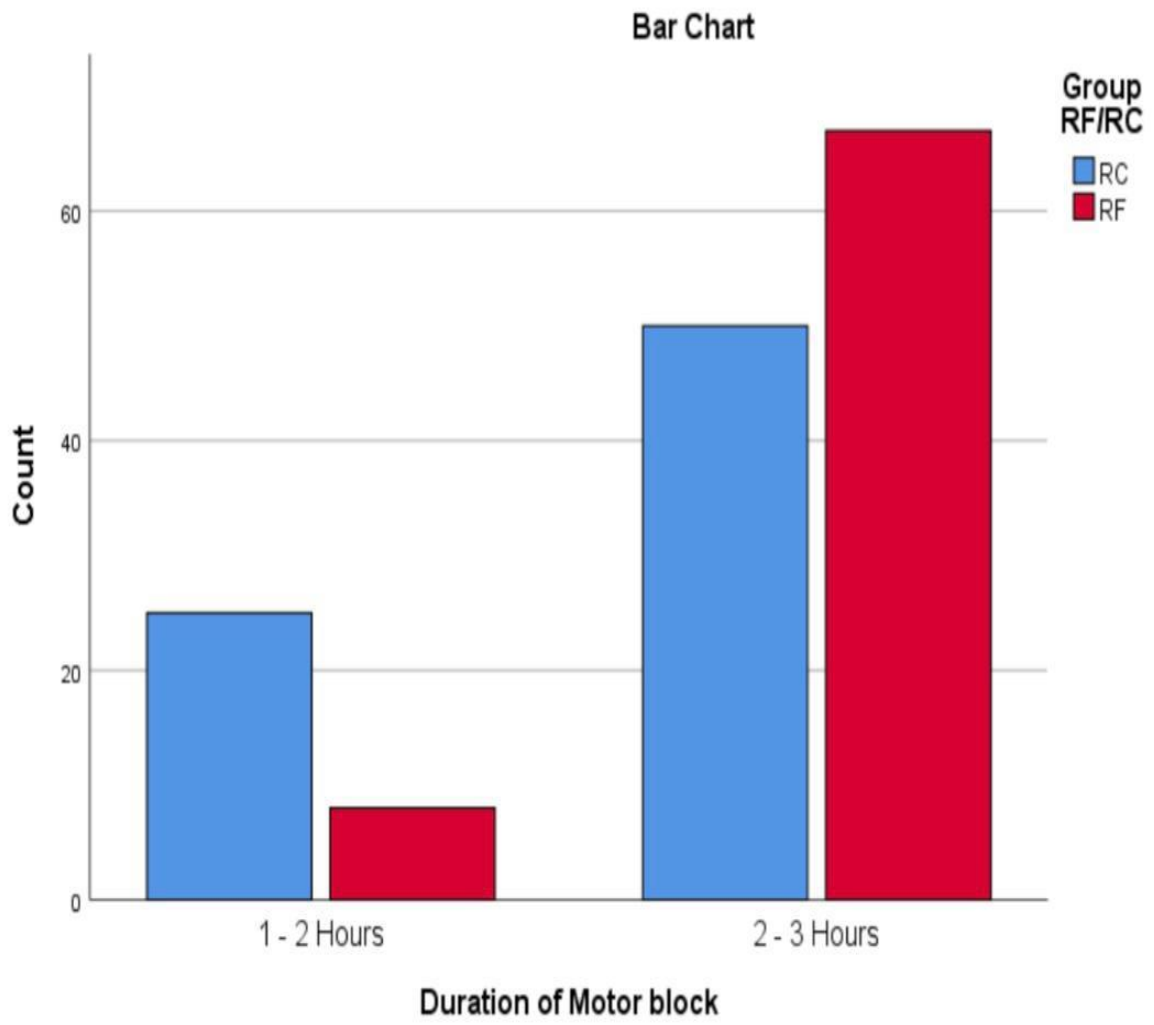
Duration of Motor Block

Duration of Motor block	Group RF/RC		
	RC	RF	Total
1 - 2 Hours	25	8	33
2 - 3 Hours	50	67	117
Total	75	75	150

Pearson chi-square = 11.228, p-value = 0.001

INTERPRETATION:

Both groups mainly experience motor blockade lasting 2-3 hours. The RF group has a somewhat higher count (67) in that duration window. By contrast, the RC group includes more individuals (25) in the 1-2 hour range. This distribution difference ($p=0.001$) suggests variations in how each adjuvant (clonidine or fentanyl) may extend the motor component of the block.



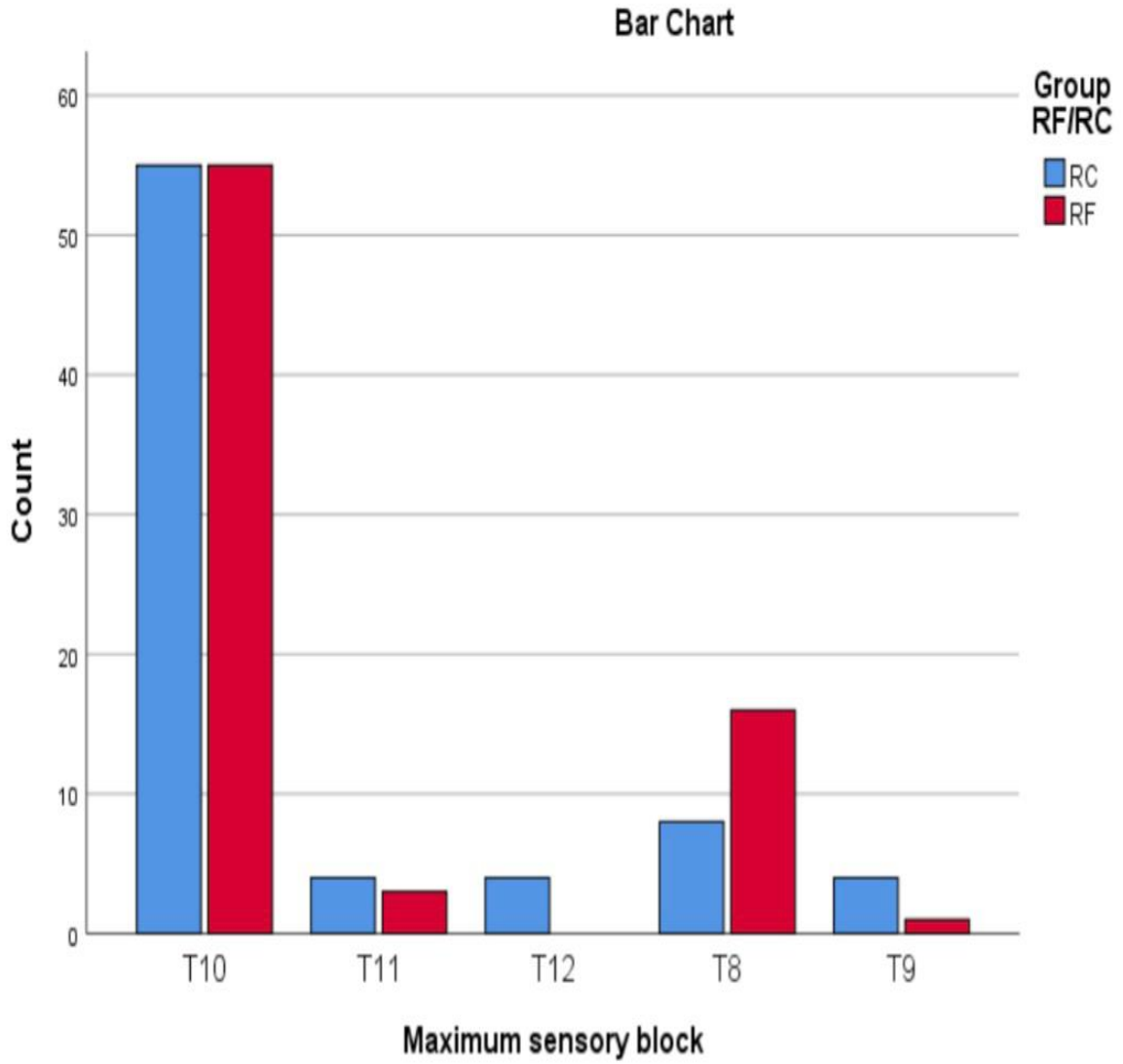
Maximum Sensory Block

Maximum sensory block	Group RF/RC		Total
	RC	RF	
T10	55	55	110
T11	4	3	7
T12	4	0	4
T8	8	16	24
T9	4	1	5
Total	75	75	150

Pearson chi-square = 8.610, p-value = 0.72

INTERPRETATION:

The most common maximum sensory level achieved in both groups is T10, with each group contributing 55 subjects. A portion of the RF group also reaches T8 more frequently (16 cases vs. 8 in RC). The chi-square test ($p = 0.72$) indicates that overall, there is no statistically notable difference between the groups regarding the highest level of sensory blockade.

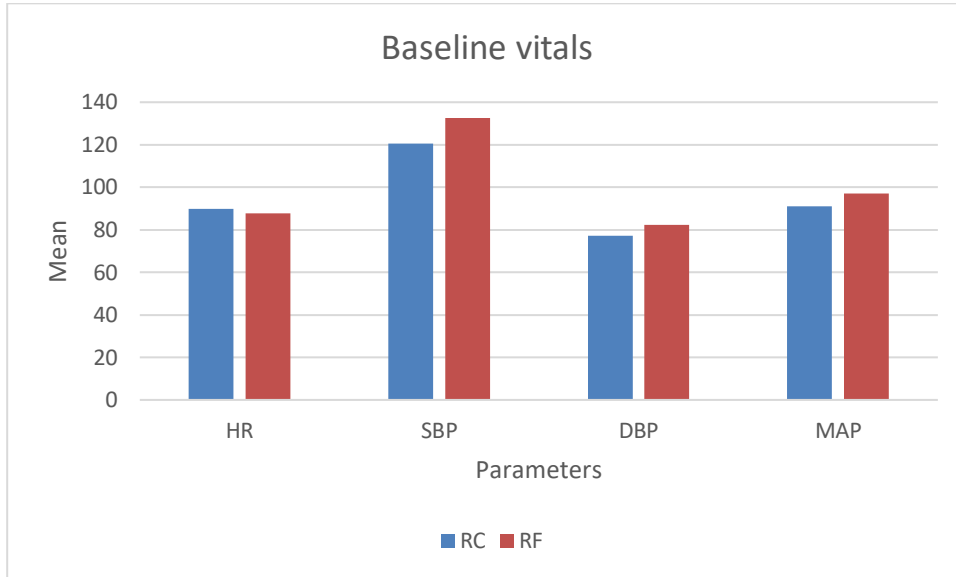


Baseline Vitals

	Group	N	Mean	Std. Deviation	P value
Baseline Vitals					
HR	RC	75	89.77	22.640	0.008
	RF	75	87.69	16.547	
SBP	RC	75	120.41	17.035	0.828
	RF	75	132.57	16.092	
DBP	RC	75	77.19	12.182	0.278
	RF	75	82.39	11.586	
MAP	RC	75	90.9466	12.901	0.365
	RF	75	97.093	12.454	

INTERPRETATION:

At baseline, HR (heart rate) differs significantly ($p = 0.008$) between groups, with the RC group showing a marginally higher average. SBP, DBP, and MAP exhibit variations but do not reach statistical importance, implying no major initial cardiovascular imbalance aside from HR.



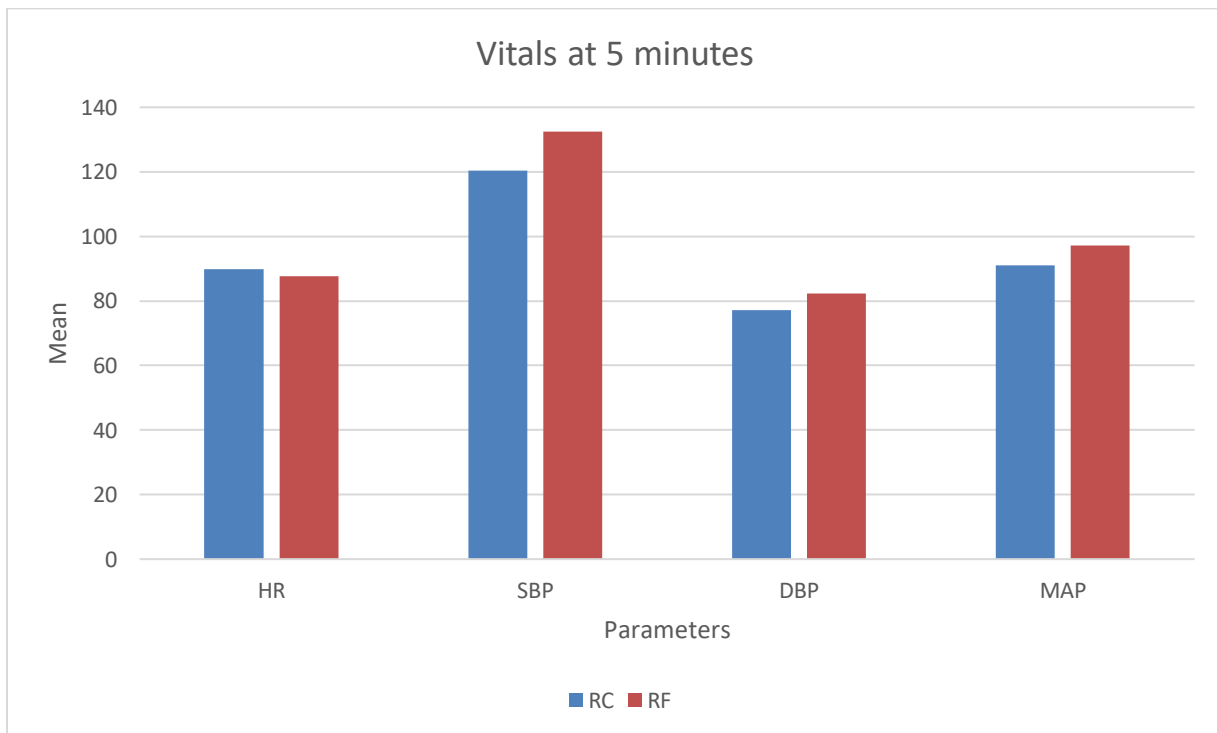
Vitals at 5min

	Group	N	Mean	Standard Deviation	P value
Vitals at 5min					
HR	RC	75	85.76	21.727	0.047
	RF	75	86.56	17.592	
SBP	RC	75	111.59	14.374	0.473
	RF	75	124.72	17.058	
DBP	RC	75	72.77	10.150	0.791
	RF	75	77.59	10.651	
MAP	RC	75	84.66	11.239	0.922
	RF	75	92.01	12.286	

INTERPRETATION:

Five minutes after the procedure, heart rate demonstrated a statistically significant yet minimal difference between the RC (85.76 bpm) and RF groups (86.56 bpm), with a p-value of 0.047. Systolic blood pressure (SBP) showed numerically higher values in the RF group (124.72 mmHg) compared to the RC group (111.59 mmHg),

yet this was not statistically significant ($p=0.473$). Similarly, diastolic blood pressure (DBP) and mean arterial pressure (MAP) values were slightly elevated in the RF group (77.59 mmHg and 92.01 mmHg) compared to the RC group (72.77 mmHg and 84.67 mmHg), but these differences were statistically non-significant (DBP $p=0.791$; MAP $p=0.922$). The modestly significant heart rate variation may indicate mild differences in autonomic or stress-related physiological responses between groups at this early postoperative stage.



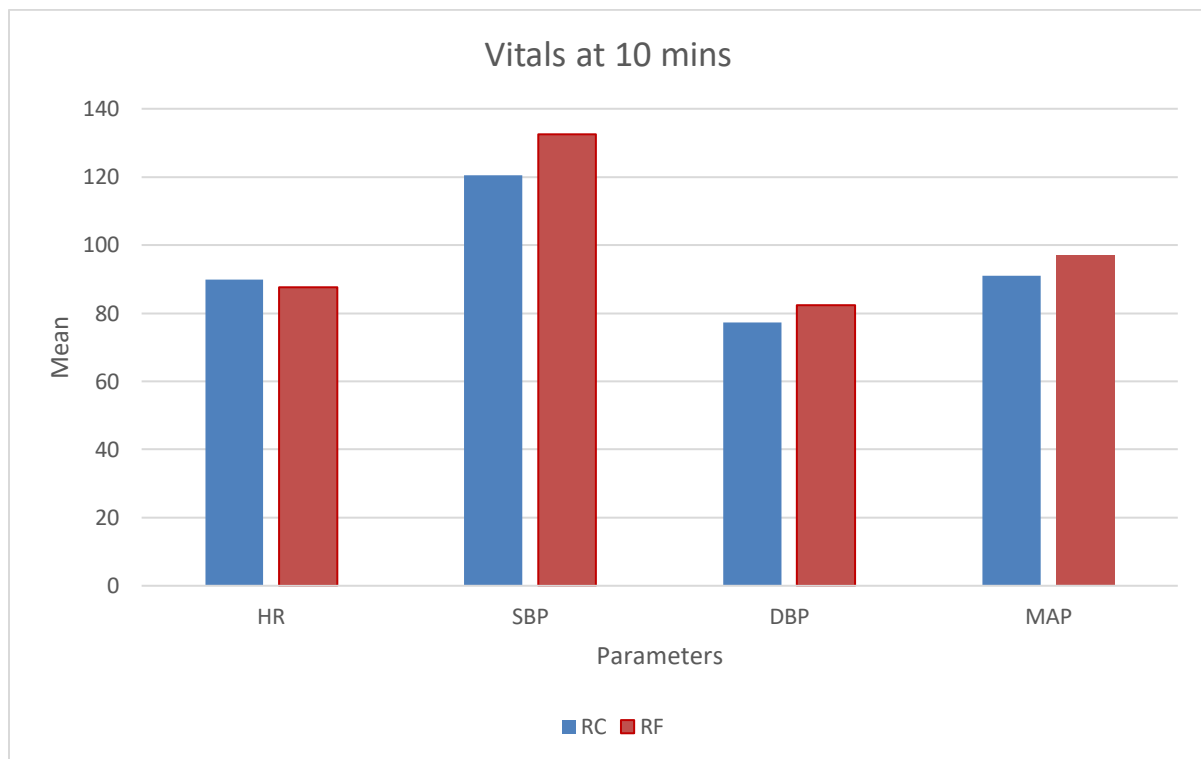
Vitals at 10min

	Group	N	Mean	Std. Deviation	P value
Vitals at 10min					
HR	RC	75	82.64	20.434	0.336
	RF	75	84.32	18.094	
SBP	RC	75	111.44	13.842	0.223
	RF	75	121.95	18.006	
DBP	RC	75	73.39	9.785	0.446
	RF	75	75.00	13.469	
MAP	RC	75	85.32	10.59	0.087
	RF	75	89.28	14.69	

INTERPRETATION:

At 10 minutes post-procedure, all vital parameters—including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP)—showed numerically modest differences between the RC and RF groups, yet none attained statistical significance. The heart rate was marginally higher in the RF group (84.32 bpm) compared to the RC group (82.64 bpm) ($p=0.336$). Systolic blood pressure values were numerically greater in the RF group

(121.95 mmHg) compared to the RC group (111.44 mmHg), although statistically insignificant ($p=0.223$). Diastolic pressure exhibited a minimal numerical variation (RF: 75.00 mmHg vs. RC: 73.39 mmHg, $p=0.446$). MAP values differed modestly (RF: 89.28 mmHg vs. RC: 85.32 mmHg), and this difference approached but did not achieve statistical significance ($p=0.087$). These findings suggest a stable and comparable cardiovascular response in both groups at 10 minutes.



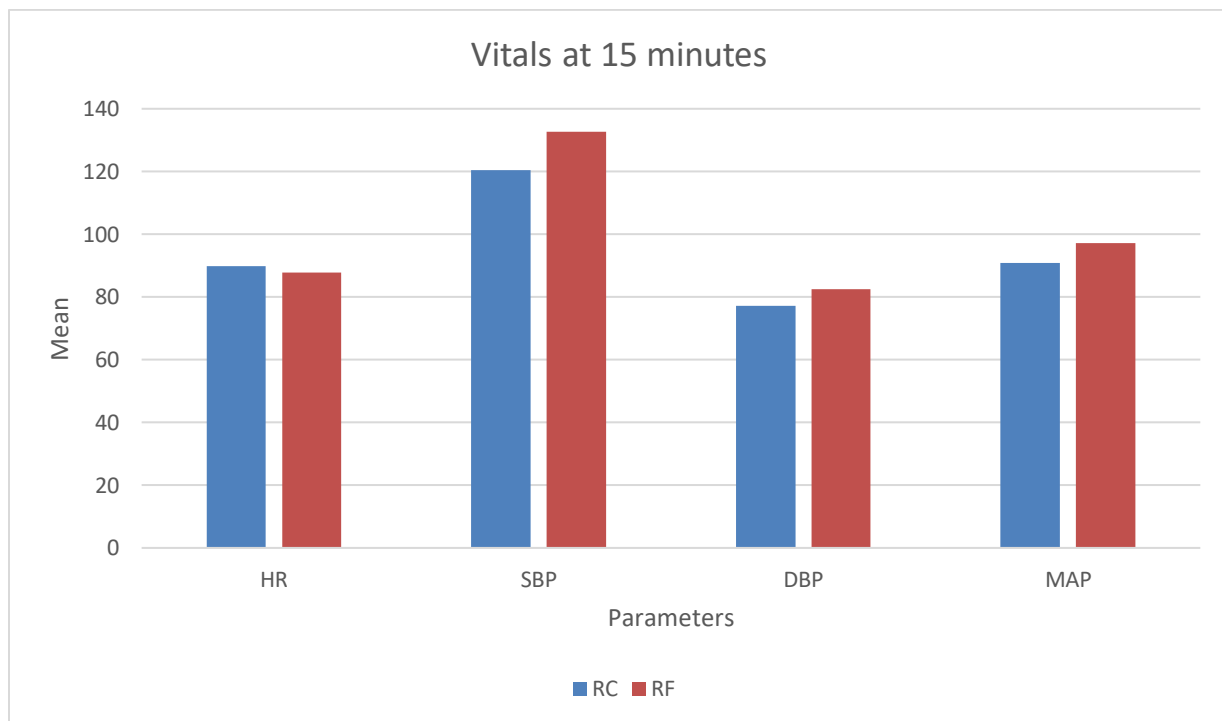
Vitals at 15min

	Group	N	Mean	Std. Deviation	P value
Vitals at 15min					
HR	RC	75	82.43	21.404	0.045
	RF	75	83.11	17.472	
SBP	RC	75	112.68	14.010	0.297
	RF	75	119.00	18.097	
DBP	RC	75	75.47	9.141	0.041
	RF	75	74.55	12.326	
MAP	RC	75	87.711	10.055	0.027
	RF	75	88.613	14.32	

INTERPRETATION:

At 15 minutes post-procedure, heart rate (HR) demonstrated a borderline significant difference ($p = 0.045$), with the RF group showing a marginally higher mean HR (83.11 bpm) compared to the RC group (82.43 bpm). While systolic blood pressure (SBP) remained statistically insignificant (RC: 112.68 mmHg vs RF: 119.00 mmHg,

$p = 0.297$), diastolic blood pressure (DBP) exhibited a significant yet minimal difference (RC: 75.47 mmHg, RF: 74.55 mmHg, $p = 0.041$). Similarly, mean arterial pressure (MAP) showed a statistically meaningful distinction (RC: 87.71 mmHg vs RF: 88.61 mmHg, $p = 0.027$). These subtle yet significant differences indicate emerging, mild hemodynamic variations between the groups as the anesthetic block matures.



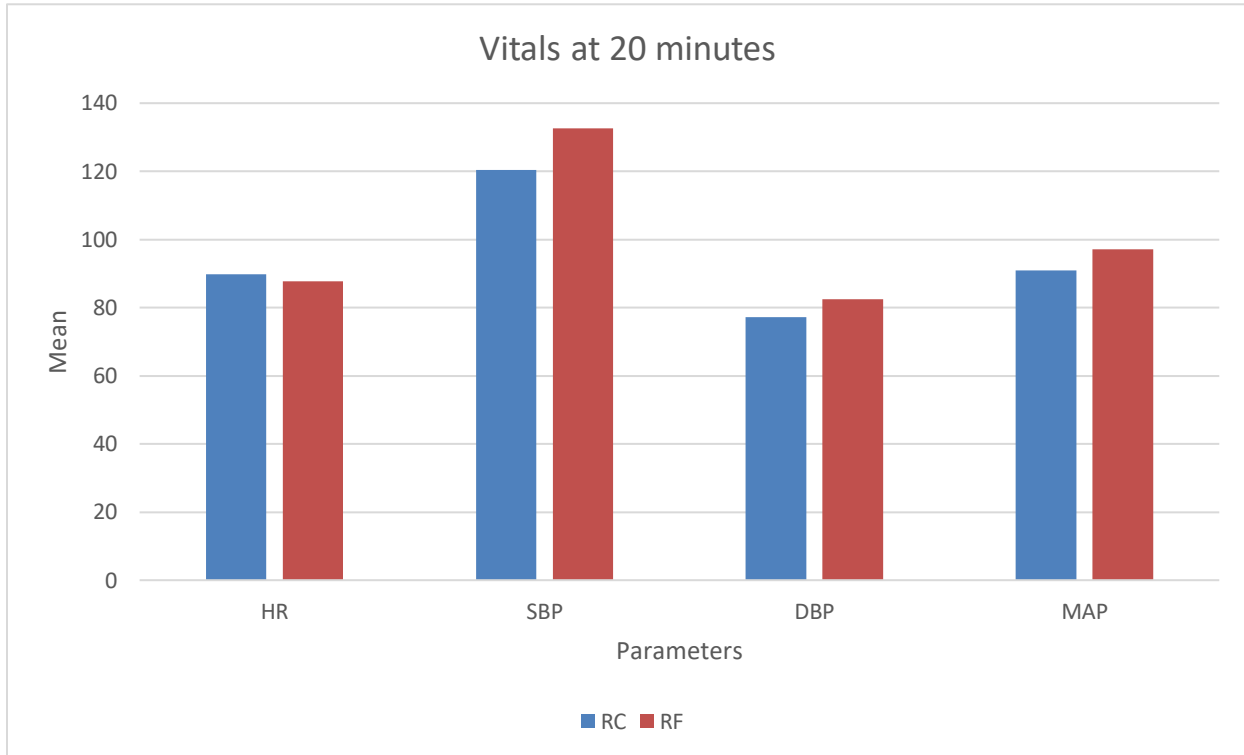
Vitals at 20min

	Group	N	Mean	Std. Deviation	P value
Vitals at 20min					
HR	RC	75	83.84	21.222	0.033
	RF	75	82.56	16.153	
SBP	RC	75	112.91	14.248	0.837
	RF	75	118.12	16.441	
DBP	RC	75	74.85	9.666	0.340
	RF	75	74.32	11.449	
MAP	RC	75	86.78	10.637	0.254
	RF	75	87.76	13.015	

INTERPRETATION:

Twenty minutes into the procedure, heart rate (HR) presented a slight yet statistically meaningful difference, with the RC group averaging 83.84 bpm compared to the RF group's 82.56 bpm ($p = 0.033$). However, other cardiovascular parameters including systolic blood pressure (SBP; RC: 112.91 mmHg, RF: 118.12 mmHg, $p = 0.837$), diastolic blood pressure (DBP: RC: 74.85 mmHg, RF: 74.32 mmHg, $p = 0.340$), and mean arterial pressure (MAP: RC: 86.78 mmHg, RF: 87.76 mmHg, $p = 0.254$)

remained statistically indistinguishable. This suggests the early cardiovascular stability across both anesthetic regimens is maintained, with minor hemodynamic variability clinically insignificant at this point.



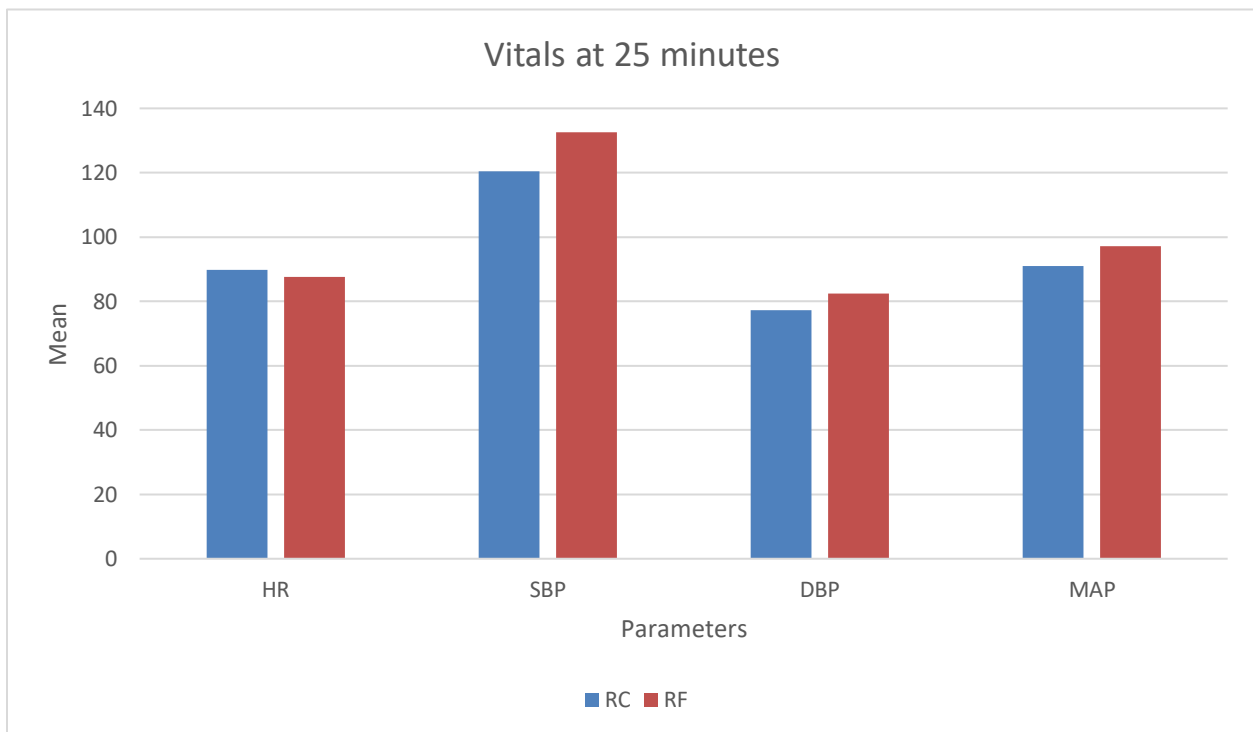
Vitals at 25min

	Group	N	Mean	Std. Deviation	P value
Vitals at 25min					
HR	RC	75	84.41	20.266	0.009
	RF	75	81.49	14.918	
SBP	RC	75	115.79	14.977	0.553
	RF	75	118.27	16.754	
DBP	RC	75	77.05	9.695	0.148
	RF	75	74.47	12.037	
MAP	RC	75	89.73	10.25	0.043
	RF	75	87.98	13.35	

INTERPRETATION:

At 25 minutes post-procedure, significant differences were observed in heart rate (HR) and mean arterial pressure (MAP). The RC group exhibited a higher mean HR (84.41 bpm) compared to the RF group (81.49 bpm), achieving statistical significance ($p = 0.009$). The MAP was also notably higher in the RC group (89.73 mmHg) compared to the RF group (87.98 mmHg), with statistical significance ($p = 0.043$). In contrast, differences in systolic (RC: 115.79 mmHg vs RF: 118.27 mmHg,

p=0.553) and diastolic blood pressures (RC: 77.05 mmHg vs RF: 74.47 mmHg) remained statistically insignificant. These data indicate evolving group-specific differences, with the RC group maintaining marginally higher cardiovascular activity, reflected primarily through heart rate and mean arterial pressure.



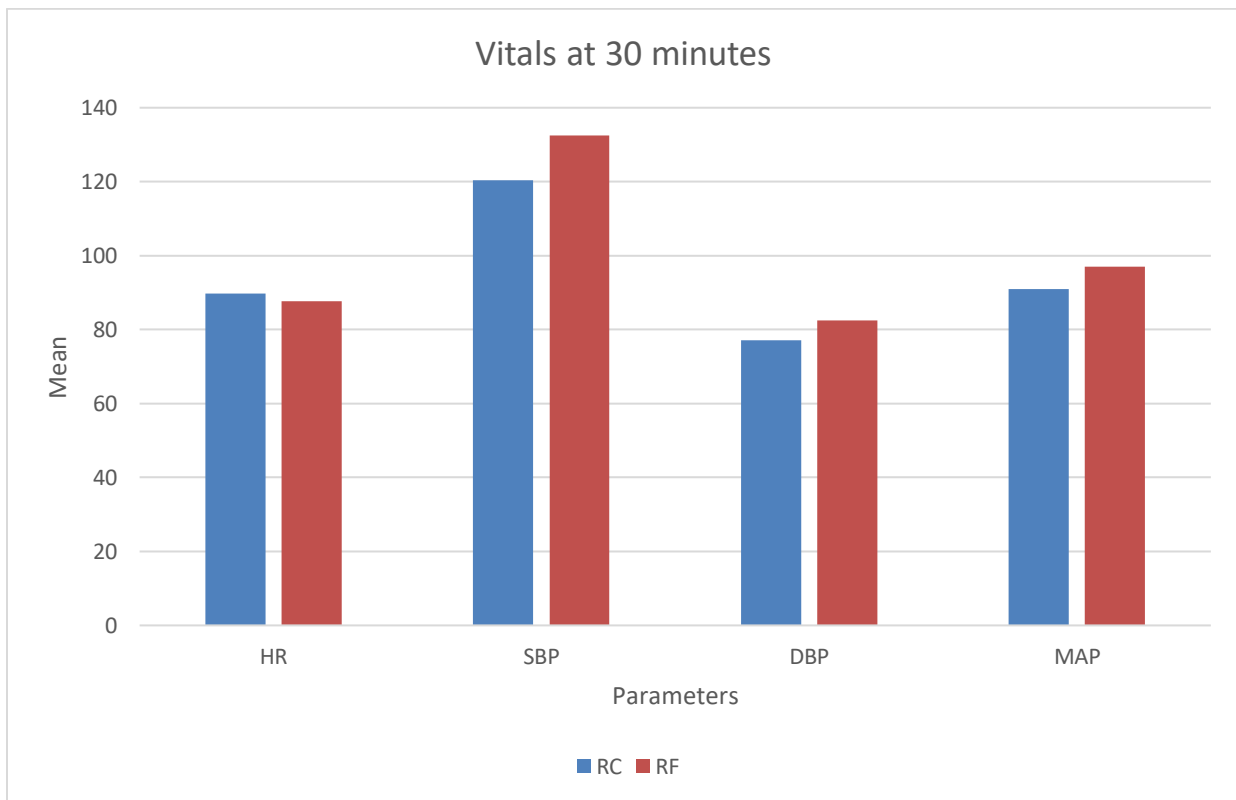
Vitals at 30min

	Group	N	Mean	Std. Deviation	P value
Vitals at 30min					
HR	RC	75	84.67	19.761	0.012
	RF	75	80.87	15.823	
SBP	RC	75	113.31	13.922	0.604
	RF	75	118.63	15.758	
DBP	RC	75	76.45	10.018	0.361
	RF	75	74.63	12.192	
MAP	RC	75	88.42	9.62	0.049
	RF	75	87.93	13.50	

INTERPRETATION:

At 30 minutes post-procedure, heart rate (HR) and mean arterial pressure (MAP) remained significantly different between groups. The RC group continued to exhibit a slightly higher heart rate (84.67 bpm) compared to the RF group (80.87 bpm), which was statistically significant ($p = 0.012$). Similarly, MAP demonstrated statistical significance (RC: 88.42 mmHg vs. RF: 87.93 mmHg, $p = 0.049$). Although systolic (RC: 113.31 mmHg vs. RF: 118.63 mmHg, $p=0.604$) and diastolic blood

pressures (RC: 76.45 mmHg vs. RF: 74.63 mmHg, $p=0.361$) varied numerically, these differences remained insignificant. These findings reinforce the mild but consistent cardiovascular variations between the groups, notably in terms of heart rate and MAP.

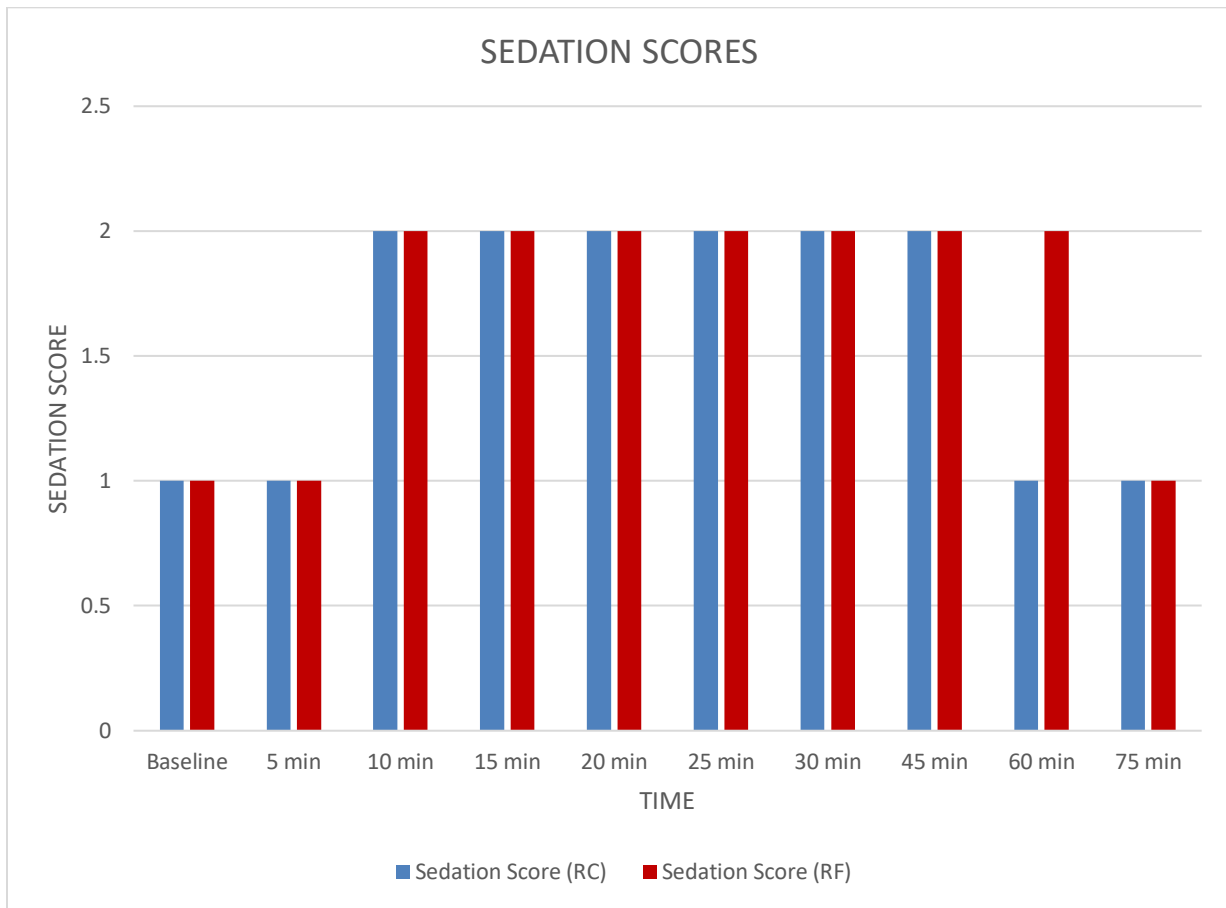


Sedation Scores Over Time

Time	Sedation Score (RC)	Sedation Score (RF)
Baseline	1.0	1.0
5 min	1.0	1.0
10 min	2.0	2.0
15 min	2.0	2.0
20 min	2.0	2.0
25 min	2.0	2.0
30 min	2.0	2.0
45 min	2.0	2.0
60 min	1.0	2.0
75 min	1.0	1.0

INTERPRETATION:

Sedation scores remained largely similar between the RC and RF groups across the measured intervals. Both groups began at baseline sedation scores of 1.0 and increased uniformly to a sedation level of 2.0, maintaining this score from 10 minutes until 45 minutes post-procedure. At the 60-minute mark, the RC group displayed a slightly higher sedation level (2.0) compared to the RF group (1.0), indicating minor differences in sedation persistence at this point. By 75 minutes, both groups returned to baseline sedation scores of 1.0. The sedation profiles reflect a generally similar pattern of sedative effect for clonidine and fentanyl as intrathecal adjuvants, suggesting their comparable safety profiles with respect to sedation.



DISCUSSION

I. INTRODUCTION TO THE DISCUSSION

Spinal anesthesia has long been a key method for lower abdominal surgery, as it delivers strong analgesia and muscle relaxation through a relatively direct approach. In modern practice, hyperbaric ropivacaine has garnered attention for its potentially safer cardiac profile, reflected in fewer cardiovascular complications than older long-acting agents. One investigation describing this benefit is by McNamee et al. [23]. In a different study, Whiteside et al. documented a reduced tendency toward overly prolonged motor blockade with ropivacaine, which can be important for postoperative mobilization [24]. Despite these advantages, ropivacaine on its own might not provide sufficient duration of anesthesia for more extended operations, prompting clinicians to look for intrathecal adjuvants such as fentanyl or clonidine to bolster its analgesic properties [25].

The aim of this study is to compare these adjuvants based on their onset of sensory and motor block and also the duration of the sensory and motor block.

One such additive, fentanyl, is recognized for its high lipid solubility and capacity to speed up the onset of spinal anesthesia [26]. In a study conducted by Harbhej Singh et al , it was concluded that adding fentanyl as an additive to bupivacaine did not significantly fastened the onset of action($p > 0.05$), however, the duration of action was prolonged and the time period required for obtaining rescue analgesia was

higher^[27]. In this study, where we are comparing intrathecal ropivacaine (H) with fentanyl, compared to ropivacaine (H) and clonidine the onset of sensory and motor blockade was quicker in the fentanyl group with significant p value < 0.001.

According to Kanazi et al., even small doses of intrathecal fentanyl can enhance both sensory and motor block potency ^[28].

Meanwhile, De Kock et al. concluded that Intrathecal administration of 8 mg of ropivacaine alone resulted in a short duration of sensory anesthesia and motor blockade, lasting 132 ± 38 minutes and 110 ± 35 minutes, respectively (mean \pm SD). However, the anesthesia efficacy was reduced compared to all other groups ($P < 0.05$). In contrast, combining 8 mg of ropivacaine with 75 μ g of clonidine led to a significantly longer duration of sensory (195 ± 40 minutes) and motor (164 ± 38 minutes) anesthesia ($P < 0.05$). ^[29] Similarly, In this study intrathecal hyperbaric ropivacaine with 30mcg was administered, the duration of sensory and motor block was increased in the clonidine group compared to fentanyl group with significant P value = 0.048.

Malleeswaran et al. reported that opioids like fentanyl might pose fewer hemodynamic shifts compared to α_2 agonists, which can sometimes trigger bradycardia or hypotension ^[30]. However, in this study there is no changes in the haemodynamic parameters on both the groups $p = 0.922$ probably owing to the lower dosages of the adjuvants used. Alternatively, research by Varrassi et al. indicated

that opioids still warrant vigilance, particularly in higher doses, due to possible respiratory depression in susceptible individuals ^[31]. In this study, there were no such adverse events recorded, due to the usage of low opioid dosage.

In broader contexts, authors such as Filos have underscored clonidine's capacity to deepen and prolong subarachnoid blocks, though it may alter heart rate and blood pressure through its centrally mediated sympatholysis ^[32]. Dobrydnjov discussed how such effects are dose-dependent and can be kept in check with moderate dosing and careful monitoring ^[33]. Additionally, Mantouvalou et al. evaluated different local anesthetics for lower abdominal surgery, stressing the importance of an agent's safety margin alongside any extended analgesic benefits ^[34]. Amid these choices, ropivacaine remains an attractive base local anesthetic for spinal anesthesia, often requiring an adjunct to optimize onset or duration.

Within the Results of this thesis, the focus has been on comparing two principal approaches—ropivacaine-fentanyl (RF) and ropivacaine-clonidine (RC)—across multiple indicators: time to reach sensory and motor blockade, the total length of block, sedation levels, and hemodynamic steadiness. Some earlier reports, such as Racle's, suggest clonidine can lead to a longer spinal block, but might require extra caution in elderly or frail patients ^[35]. Chiary also highlighted clonidine's role in labor analgesia, presenting the concept that α_2 agonism delivers more consistent extension of blockade ^[36]. Meanwhile, work by McNamee points out that ropivacaine

combined with an opioid may grant a fast onset, making it appealing for urgent or short-duration surgeries ^[23]. Vuong's meta-analysis further considered how α_2 agonists can provide sedation and prolong analgesia, yet remain relatively well-tolerated with proper dose adjustments ^[37].

The subsequent sections interpret the data we observed in the context of existing knowledge: we examine how quickly the two groups achieved surgical anesthesia, how long the blocks and sedation lasted, and how each regimen affected heart rate, blood pressure, and mean arterial pressure. Then, the discussion addresses any constraints in our methodology and proposes avenues for additional research. While Casati and others have already outlined how ropivacaine can be employed safely in subarachnoid blocks ^[38], the present findings refine those insights by directly comparing fentanyl and clonidine as complementary agents.

II. MAIN COMPARATIVE DISCUSSION

A. Demographic Factors, Surgical Profiles, and Study Setup

Age and Sex Distribution The RC (ropivacaine-clonidine) and RF (ropivacaine-fentanyl) groups demonstrated no large statistical distinctions in age or sex distribution. Gautier explored how participant demographics can influence anesthetic uptake and spread, but found no pronounced effect when randomization is appropriately done^[39]. Consistent with McNamee et al. from another publication, a balanced demographic layout enhances the validity of direct

comparisons because any disparities in block profiles are more likely attributable to medication effects rather than demographic bias ^[40]. Some individuals in the RF group were in a younger age bracket (20–30), while more from the RC group fell into middle-age categories; however, neither pattern showed significance. Bajwa, in another systematic review, posited that older adults can exhibit changes in pharmacodynamics that make them more susceptible to hemodynamic fluctuations, yet the present distribution did not highlight such differences ^[41].

ASA Classification:

In a study conducted by Bajwa et al, the demographic data like age, height, weight, ASA grade, gender, and duration of surgery were statistically insignificant with $P > 0.05$ as seen with our study. ^[22]

In our data, the RF group includes more ASA I patients, while the RC group contains slightly more ASA II patients. The p-value is 0.069, which is close to the threshold of significance, suggesting there may be a trend requiring additional investigation.

Types of Surgery:

Hernia repairs, debridements, fistulectomies, and other lower abdominal surgeries were represented in both groups. Hunt described how different procedures may require varying degrees of anesthetic coverage and analgesic intensity ^[42]. Saxena,

however, argued that as long as the surgeries align with the T10–T12 dermatomal range, the effect of the procedure type itself on block attributes remains modest^[43]. In our study, the mild difference ($p=0.046$) in surgical categories between RC and RF is unlikely to overshadow the drug-related outcomes, reflecting that randomization kept the distribution relatively fair.

B. Sensory Block: Observations on Onset and Duration

Onset of Sensory Block: A prominent outcome in our results was how swiftly the RF group attained full sensory anesthesia. More than half achieved a complete sensory block within one minute. Benhamou pointed out that intrathecal fentanyl, because of its lipophilicity, interacts rapidly with spinal cord receptors, thereby hastening local anesthetic conduction blockade. They concluded that improved analgesia and faster onset of blockade was seen with the clonidine-fentanyl combination ($P < 0.05$)^[26]. Our data align with that viewpoint with significant faster onset of sensory and motor blockade seen with the fentanyl group with significant p value < 0.001 . Bajwa, exploring fentanyl-bupivacaine with clonidine- bupivacaine combinations, reported a similarity in onset of sensory block ($p=0.82$) and motor block ($p= 0.44$)^[22] In our study, fentanyl group has a faster onset ($p < 0.001$).

Duration of Sensory Block: Both groups typically had 2–3 hours of sensory blockade, but five individuals in RC experienced well over three hours. Bajwa concluded in his study that clonidine extends the block rather than speeds it up,

because it predominantly modulates α_2 receptors that inhibit nociceptive transmission without drastically accelerating ropivacaine's onset.

The Bupivacaine – Clonidine(BC) group experienced a longer duration of analgesic effect compared to the Bupivacaine-fentanyl (BF) group, with a delayed requirement for the first analgesic dose in the BCgroup relative to the BF group ($P < 0.05$). [22]

Routray SS had performed a study which concluded that the sensory and motor block duration was longer in Group Clonidine than in Group Fentanyl with hyperbaric ropivacaine ($P < 0.001$). [44] Racle historically drew attention to clonidine's capacity for lengthening the timeframe of sensory anesthesia by intensifying local anesthetic impact through dorsal horn hyperpolarization [35]. In our study extended sensory block with RC group is seen with a pvalue = 0.048. Contrastingly, while fentanyl does quicken onset, it might not produce the same prolonged blockade as clonidine unless specific conditions (e.g., exact dose ratios) are met. This dynamic supports the notion of “rapid onset but moderately lasting block” for fentanyl.

C. Motor Block: Timeline and Total Duration

Onset of Motor Block: The RF group also exhibited a more rapid motor blockade, echoing the pattern seen with sensory onset with pvalue < 0.001 . Varrassi demonstrated that fentanyl can enhance motor block rates in older individuals, although at a potential cost of mild respiratory concerns [31]. Our data, however, did

not show significant respiratory depression, likely due to moderate intrathecal doses. Saxena underscored that while opioids primarily enhance sensory analgesia, they do sometimes intensify and expedite motor fiber block in synergy with local anesthetics [43]. The RC group's comparatively slower establishment of motor blockade fits clonidine's usual profile, focusing on block prolongation rather than speed.

Duration of Motor Block:

Traditionally, clonidine is recognized for extending both sensory and motor aspects of spinal anesthesia. Filos wrote extensively on how it prolongs the motor blockade by suppressing excitatory neurotransmitters. They concluded that there is a dose dependant increase in the duration of sensory and motor block (p value <0.01) [32].

Sahu also concluded in his study that clonidine group had a prolonged duration of motor block (p <0.001) maybe owing to the higher dosage of clonidine usage (50mcg) [16]. However In our study, we observed that the RF group remained under motor blockade for approximately 2–3 hours in a considerable number of subjects (pvalue=0.001). Variation in anatomic or physiologic parameters (e.g., subarachnoid space volume, injection site) might account for certain patients in RF matching or exceeding typical clonidine durations.

D. Highest Level of Sensory Block:

Both RC and RF arms largely achieved T10 as the target level, mirroring patterns

found in De Kock's study on ropivacaine plus different adjuncts for knee arthroscopy, where T10–T12 coverage proved adequate for most lower-limb or abdominal operations [29]. Only a few participants attained T8 or T9, more commonly in the RF group, but the difference ($p=0.72$) suggests that neither fentanyl nor clonidine drastically shifts ropivacaine's distribution upward. Chiary indicated that block height is determined by multiple factors, including solution baricity and patient positioning, rather than solely by the presence of clonidine or fentanyl [36].

E. Hemodynamic Trends

Heart Rate & Blood Pressure

In some time blocks (e.g., 15 min, 25 min), the RC group exhibited a heart Rate ($p = 0.336$) that was higher than expected, given clonidine's typical sympatholytic reputation. Dobrydnjov asserted that moderate-dose clonidine does not always bring about major bradycardia if fluid management and analgesic synergy are appropriately balanced, it was also concluded that intrathecal clonidine had lesser incidents of bradycardia and hypotension compared to the oral route ($p<0.01$) [33].

In our study, usage of intrathecal 30mcg of clonidine has nonsignificant decrease in blood pressure or heart rate. Meanwhile, Bimal Sahu had non significant differences in their heart rate ($p= 0.457$) and MAP ($p= 0.795$) when comparing clonidine – bupivacaine and fentanyl – bupivacaine. [16]

Given that most participants in either group remained in ASA I–II status, the mild but

statistically discernible HR differences did not escalate into clinically significant events in our study.

Our results revealed minor fluctuations in SBP, DBP, and MAP, with no severe hypotension or hypertensive surges. Casati explained that moderate volumes of hyperbaric ropivacaine, combined with careful fluid loading, can uphold stable hemodynamics^[38]. The mild differences observed occasionally reflect the interplay between clonidine's potential to reduce sympathetic tone and fentanyl's minimal direct effect on blood pressure. Bajwa's review indicated that older local anesthetics like bupivacaine might lead to more pronounced hemodynamic drops, so ropivacaine's lesser potency for cardiovascular depression could be why both groups fared well here^[41].

F. Sedation Scores

A unique feature of our approach was systematically tracking sedation levels. Across the observation window, sedation remained mild in both RC and RF populations, generally around sedation scores of 1–2. Routray SS observed that intrathecal clonidine had higher sedation score than fentanyl group ($p < 0.001$)^[44]. Gautier observed that α_2 agonists, including clonidine, can yield sedation, but typically within clinically tolerable limits^[39]. Separately, Bajwa observed more sedation in

BC (50mcg) group as compared to BF(25mcg) (group ($p < 0.05$). Since our study uses lesser dosages of clonidine ,the sedation results fit a broader consensus: moderate dosing rarely provokes worrisome sedation therefore the difference in insignificant ($p = 0.48$)^[22]. Several authors, including Hunt, describe enhanced comfort with a minimal sedation burden when fentanyl is added intrathecally ^[42]. In contrast, some authors like Racle highlight that clonidine's sedation might be advantageous in anxious patients, providing a calmer intraoperative experience ^[35].

- Possible Downsides: Saxena warns that sedation can sometimes mask early signs of complications, necessitating thorough monitoring, regardless of whether clonidine or fentanyl is used ^[43].

Despite these considerations, sedation in our cohorts remained at a manageable degree. Patients were able to communicate effectively, and sedation never approached a level that compromised airway safety or required advanced interventions.

One possible “con” for the fentanyl route is that analgesic duration might be slightly shorter than what clonidine delivers, although synergy can sometimes match clonidine's durations. Conversely, a “con” for clonidine is that dose-related bradycardia or hypotension can emerge in certain patients, even if that was not strongly reflected here.

III. LIMITATIONS AND FUTURE SCOPE

Limitations

1. Single-Center Design

This research was completed at a single institution, possibly constraining the application of findings across diverse populations. Different facilities may have alternative anesthesia protocols or distinct patient demographics, which can influence the outcomes.

2. Fixed Adjuvant Dosages

We selected specific doses for fentanyl and clonidine without exploring a range of doses. It is thus uncertain whether smaller or larger doses might provide better or worsen sedation and analgesia.

3. Varied Surgical Types

While it mirrors routine clinical practice to include many lower abdominal surgeries, the variety in operative duration and tissue disruption might obscure subtle differences in sedation or block duration among participants.

4. Subjective Sedation Scale

Although sedation was tracked systematically, we used a standard clinical sedation score. More advanced measures, such as EEG-based indices, might shed light on subtle sedation differences or earlier detection of sedation depth changes.

Future Scope

1. Dose-Response Analysis

Further investigations might vary fentanyl and clonidine dosages to see if there is an optimal ratio balancing a swift onset, prolonged sensory blockade, and minimal adverse effects.

2. Multicenter Initiatives

Enlisting multiple centers in different regions could broaden the demographic pool, enhancing external validity and confidence in the results.

3. Alternative Agents

Future trials might compare ropivacaine with dexmedetomidine, magnesium, or neostigmine in tandem, evaluating whether any surpass fentanyl or clonidine in synergy, duration, or sedation profile.

4. Objective Sedation Monitoring

Implementing advanced technologies, such as BIS or entropy monitoring, would clarify sedation nuances between the two adjuvants and help interpret sedation-related data more accurately.

Collectively, these possibilities highlight that ropivacaine combined with either fentanyl or clonidine appears effective and safe for spinal anesthesia in lower abdominal operations, subject to the details of dosing and patient management.

Fentanyl is favored for its swift onset, while clonidine holds appeal for extending

block duration. Hemodynamic trends and sedation outcomes, though slightly distinct, remain within an acceptable range for clinical use when moderate doses are employed. Additional research into dose variations, and objective sedation metrics should enhance our knowledge and fine-tune spinal anesthesia practices, with the ultimate goal of optimizing patient care and surgical outcomes.

SUMMARY

Spinal anesthesia has remained a cornerstone for lower abdominal procedures due to its simplicity, efficiency, and suitability for a wide range of patient populations. Over time, various adjuncts have been combined with local anesthetics to enhance both the quality and duration of subarachnoid block. Ropivacaine, in particular, has gained prominence because of its safer cardiac profile and a reduced propensity for causing a lengthy motor block compared to other local anesthetics. However, ropivacaine by itself may not always provide sufficient analgesia for longer or more complex surgeries, prompting researchers to explore adding agents like fentanyl or clonidine.

When paired with ropivacaine, fentanyl often accelerates the onset of both sensory and motor blockade, thus enabling faster readiness for surgical intervention. The high lipid solubility of fentanyl facilitates rapid penetration at the spinal cord's dorsal horn, synergistically boosting ropivacaine's blockade of pain pathways. On the other hand, clonidine is known for deepening and prolonging the block, especially on the sensory side, by working through α_2 -adrenergic mechanisms that inhibit nociceptive transmission. In the current study, the primary distinctions emerged in terms of how swiftly each block was established and how long it persisted. Fentanyl-containing blocks were quicker to achieve full surgical anesthesia, while clonidine-enriched blocks had a subset of patients who experienced analgesia lasting beyond three hours. Notably, motor block duration was not

exclusively prolonged by clonidine; ropivacaine mixed with fentanyl also showed potential for extending motor block in some individuals. Nevertheless, hemodynamic variables (heart rate and blood pressure) generally remained in a tolerable range for both groups, though the RC group often demonstrated a slightly higher heart rate.

A new dimension in this comparison was the introduction of sedation scores at multiple intervals. The addition of opioids or α 2-agonists in spinal anesthesia can influence patients' sedation levels, which, if too pronounced, may reduce patient cooperation or mask critical signs of complications. In the analyzed data, sedation levels in both groups were mild to moderate, without marked oversedation. Both regimens therefore seem promising in maintaining adequate comfort while avoiding deep sedation that might interfere with postoperative assessments or discharge readiness.

Key Takeaways:

- **Enhanced Onset:** Fentanyl provided a rapid establishment of surgical block in most patients.
- **Extended Analgesia:** Clonidine helped some participants achieve notably long sensory blockade.
- **Motor Block Variations:** Both agents, when combined with ropivacaine, influenced the extent and longevity of motor block.

- Mild Sedation: Neither adjunct caused excessive sedation; scores remained in a moderate, clinically manageable range.
- Stable Hemodynamics: Despite minor fluctuations in heart rate and blood pressure, both protocols demonstrated a satisfactory safety profile.

CONCLUSION

In summary, combining ropivacaine with fentanyl or clonidine provides reliable and effective spinal anesthesia for lower abdominal surgeries, each with its own strengths: fentanyl tends to yield a quicker onset of surgical block, whereas clonidine offers the benefit of a more prolonged sensory component in certain cases. Throughout the observed time frame, sedation remained moderate and hemodynamic parameters were comparatively stable, suggesting that either agent can be chosen based on specific clinical requirements—whether the priority is to expedite operating conditions or extend postoperative analgesia.

REFERENCES

1. Casey WF. *Spinal anaesthesia – A practical guide*. Pract Preoced. 2000;12:1-7.
2. Fettes PD, Hocking G, Peterson MK, Luck JF, Wildsmith JA. *Comparison of plain and hyperbaric solutions of ropivacaine for spinal anaesthesia*. Br J Anaesth. 2005 ;94:107-11.
3. Kulkarni KR, Deshpande S, Namazi I, Singh SK, Kondilya K. *A comparative evaluation of hyperbaric ropivacaine versus hyperbaric bupivacaine for elective surgery under spinal anaesthesia*. 2014;30(2):238-242.
4. Swain A, Nag DS, Samaddar DP. *Adjuvants to local anesthetics : current understanding on future trends*. World J Clin cases. 2017;5(8):307-23.
5. Staikou C, Paraskeva A. *The effects of intrathecal and systemic adjuvants on subarachnoid block*. Minerva Anesthesiol 2014;80:96-112.
6. Dobrydnjov I, Axelsson K, Gupta A, Lundin A, Holmström B, Granath B. *Improved analgesia with clonidine when added to local anesthetic during combined spinal-epidural anesthesia for hip arthroplasty: A double-blind, randomized and placebo-controlled study*. Acta Anaesthesiol Scand 2005;49:538-45.
7. Engelman E, Marsala C. *Efficacy of adding clonidine to intrathecal morphine in acute postoperative pain: Meta-analysis*. Br J Anaesth 2013;110:21-7
8. Idowu OA, Sanusi AA, Eyelade OR. *Effects of intrathecally administered Fentanyl on duration of analgesia in patients undergoing spinal anesthesia for elective caesarean*

*section. Afr J Med Med Sci.*2011;40:213-9.

9. Filos KS, Goudas LC, Patroni O, Polyzou V. *Hemodynamic and analgesic profile after intrathecal clonidine in humans. A dose-response study.* *Anesthesiology*1994; 81: 591-601.

10. Naghibi K, Saryazdi H, Kashefi P, Rohani F. *The comparison of spinal anesthesia with general anesthesia on the postoperative pain scores and analgesic requirements after elective lower abdominal surgery: A randomized, doubleblinded study.* *J Res Med Sci.* 2013;18(7):543-48.

11. Maurer SG, Chen AL, Hiebert R, Pereira GC, Di Cesare PE. *Comparison of outcomes of using spinal versus general anesthesia in total hip arthroplasty.* *Am J Orthop (Belle Mead NJ)* 2007;36:E101-6.

12. Kuthiala G, Chaudhary G. Ropivacaine : *A review of its pharmacology and clinical use.* *Indian J Anaesth* 2011;55(2):104-10.

13. Dang, C. B., & Vo, V. H. (2024). *SPINAL ANESTHESIA WITH ROPIVACAINE FOR LOWER LIMB SURGERY.* *Tạp chí Y Dược học Quân sự*, 49(4), 139-148.

14. Kalia P, Maurya RG, Rai SK, Rastogi H, Moorthy MK. *Comparison of bupivacaine with two different doses of clonidine under spinal anaesthesia in infraumbilical surgeries: A randomised clinical study.* *J Clin Diagn Res.* 2023 Jun;17(6):UC15-UC18.

15. Rathod S, Das C, Jain T. *Comparison of anesthetic and analgesic effect of isobaric*

0.5% ropivacaine versus levobupivacaine with fentanyl as adjuvant in lower limb surgeries under spinal anesthesia: a randomized double-blind, interventional study. J Appl Pharm Res. 2023;11(1):15-19.

16. Sahu BP, Patro A, Dash LN, Biswal D. *A comparison of clonidine and fentanyl as an adjuvant to intrathecal bupivacaine for spinal anaesthesia and postoperative analgesia in patients undergoing caesarean section.* Int J Acad Med Pharm. 2023;5(2):1357-1361

17. Girish BK, Manjula BP, Akshay HM, Shiva Kumar KG, Navakanth D, Nandi Vinayaka B. *Comparison of intrathecal nalbuphine and clonidine as adjuvants to bupivacaine heavy for spinal anesthesia in elective infraumbilical surgeries in adult patients – a prospective study.* Asian J Med Sci. 2022 Apr;13(4):31-37.

18. Singhal P, Pandey S, Chittora SP, Hussain A. *Clonidine as an adjuvant to hyperbaric bupivacaine for spinal anesthesia in elderly patients undergoing infraumbilical surgeries.* Int J Sci Res. 2021;10(2):72-74.

19. Kamal G, Piplani R, Gupta A, Sehgal N. *Clonidine as an adjuvant to bupivacaine in spinal anaesthesia for infra-umbilical surgeries in children: a prospective randomized, double-blind trial.* Ghana Med J. 2021 Jun;55(2):103-110

20. Fares KM, Mohamed SA, Abd El-Rahman AM, AbdeLemam RM, Osman AMM. *Analgesic effect of intrathecal fentanyl vs dexmedetomidine as adjuvants*

to bupivacaine following abdominal surgery for cancer in children: a randomized trial. Pain Med. 2020;21(11):2634-2641.

21. Bi YH, Wu JM, Zhang YZ, Zhang RQ. *Effect of different doses of intrathecal dexmedetomidine as an adjuvant combined with hyperbaric ropivacaine in patients undergoing cesarean section.* Front Pharmacol. 2020 Mar 20;11:342.

22. Bajwa BS, Singh AP, Rekhi AK. *Comparison of intrathecal clonidine and fentanyl in hyperbaric bupivacaine for spinal anesthesia and postoperative analgesia in patients undergoing lower abdominal surgeries.* Saudi J Anaesth. 2017;11(1):37-40.

23. McNamee DA, Parks L, McClelland AM, Scott S, Ahlen K, Gustafsson U, et al. *Intrathecal ropivacaine for total hip arthroplasty: A dose-finding study.* Anesth Analg. 2002;94(2):436–40.

24. Whiteside JB, Burke D, Wildsmith JAW. *Comparison of ropivacaine 5 mg ml⁻¹ with bupivacaine 5 mg ml⁻¹ for subarachnoid block in foot and ankle surgery.* Br J Anaesth. 2003;90(3):304–8.

25. Strebel S, Gurzeler JA, Schneider M, Aeschbach A, Kindler CH. *Small-dose intrathecal clonidine and isobaric bupivacaine for orthopedic surgery: A dose–response study.* Anesth Analg. 2004;99(4):1231–8.

26. Benhamou D, Thorin D, Brichant JF, Dailland P, Bouaziz H, Laxenaire MC.

- Intrathecal clonidine and fentanyl with hyperbaric bupivacaine improves analgesia during cesarean section.* Anesth Analg. 1998;87(3):609–13.
27. Singh H, Yang J, Thornton K, Adolph H. *Intrathecal fentanyl prolongs sensory bupivacaine spinal block.* CAN J ANAESTH 1995 / 42: II /pp987-91.
28. Kanazi GE, Aouad MT, Jabbour-Khoury SI, et al. *Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block.* Acta Anaesthesiol Scand. 2006;50(2):222–7.
29. De Kock M, Gautier P, Fanard L, Vandepitte C, Darimont V. *Intrathecal ropivacaine 2 mg ml⁻¹ combined with different doses of intrathecal clonidine in patients undergoing knee arthroscopy.* Anesthesiology. 2001;94:574–8.
30. Malleeswaran S, Panda N, Mathew P, Bagga R. *A randomized study of intrathecal fentanyl and low-dose bupivacaine for cesarean delivery.* Int J Obstet Anesth. 2008;17(2):112–7.
31. Varrassi G, Celleno D, Capogna G, Palmer CM, Ulmsten U, Bung P. *Ventilatory effects of subarachnoid fentanyl in the elderly.* Anaesthesia. 1992;47(7):558–62.
32. Filos KS, Goudas LC, Patroni O, Polizou V. *Hemodynamic and analgesic profile after intrathecal clonidine in humans: A dose-response study.* Anesthesiology. 1994;81(3):591–601.
33. Dobrydnjov I, Axelsson K, Samarütel J, Holmstrom B. *Postoperative pain relief following intrathecal bupivacaine combined with intrathecal or oral clonidine.* Acta Anaesthesiol Scand. 2002;46(7):806–14.

34. Mantouvalou M, Ralli S, Arnaoutoglou H, Tziridis K, Papadopoulos G. *Spinal anesthesia: comparison of plain ropivacaine, bupivacaine, and levobupivacaine for lower abdominal surgery*. Acta Anaesthesiol Belg. 2008;59(2):65–71.
35. Racle JP, Benkhadra A, Poy JY, Gleizal B. *Prolongation of isobaric bupivacaine spinal anesthesia with epinephrine and clonidine for hip surgery in the elderly*. Anesth Analg. 1987;66(5):442–6.
36. Chiary A, Lorber C, Eischnigg C, Wildling E, Klimscha W, Zavrsky A, et al. *Analgesic and hemodynamic effects of intrathecal clonidine as the sole analgesic agent during first stage of labor: A dose-response study*. Anesthesiology. 1999;91(2):388–96.
37. Vuong K, Bilgin AB, Ganesh A, Finlayson RJ. *The effects of clonidine on postoperative analgesia after intrathecal bupivacaine: Meta-analysis of randomized trials*. J Anesth. 2018;32(4):482–92.
38. Casati A, Fanelli G, Beccaria P, et al. *Block distribution and cardiovascular effects of subarachnoid plain ropivacaine in moderately hyperbaric solutions*. Anesth Analg. 1998;87(1):130–5.
39. Gautier P, De Kock M, Van Steenberge A, et al. *Intrathecal ropivacaine for ambulatory surgery*. Anesthesiology. 1999;91(5):1239–45.
40. McNamee DA, Parks L, McClelland AM, et al. *Intrathecal ropivacaine for knee arthroplasty: A comparison with bupivacaine*. Br J Anaesth. 2001;87(5):743–8.
41. Bajwa SJS, Kaur J. *Clinical profile of levobupivacaine in regional anesthesia: A systematic review*. J Anaesthesiol Clin Pharmacol. 2013;29(4):530–9.

42. Hunt CO, Naulty JS, Bader AM, Hauch MA, Datta S, Perlow JH, et al. *Perioperative analgesia with subarachnoid fentanyl-bupivacaine for cesarean delivery*. *Anesthesiology*. 1989;71(4):535–40.
43. Saxena AK, Arava SK. *Current concepts in neuraxial administration of opioids and non-opioids: An overview and future perspectives*. *Indian J Anaesth*. 2004;48(1):13–24.
44. Routray SS, Raut K, Pradhan A, Dash A, Soren M. Comparison of Intrathecal Clonidine and Fentanyl as Adjuvant to Hyperbaric Bupivacaine in Subarachnoid Block for Lower Limb Orthopedic Surgery. *Anesth Essays Res*. 2017 Jul-Sep;11(3):589-59

INFORMED CONSENT

PROJECT TITLE

A Comparison of intrathecal fentanyl and clonidine as an adjuvant to hyperbaric ropivacaine during subarchanoid block for lower abdominal surgeries: A prospective randomized clinical trial.

Name of Student/Principal Investigator: X

Name of Guide/Co Investigators: X

Introduction: The study involves the comparison of effects of fentanyl and clonidine as an adjunct to hyperbaric ropivacaine during subarchanoid block for lower abdominal surgeries.

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 generated randomization.

Withdrawal from participation in the study: Participation in this study is 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 the population at large.

Possible risks from participating in the study: There is risk of desaturation, airway obstruction, apnoea, bradycardia, hypotension, risk of intubation, extended hospital stay.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying 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:

If you have any question or complaints with regard to your right as a study participant you may Contact X, Professor, Dept of Anaesthesiology, J N Medical College.

X, Post Graduate , Dept of Anaesthesiology, J N Medical College, Phone No: X.

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 “A Comparison of intrathecal fentanyl and clonidine as an adjuvant to hyperbaric ropivacaine during subarchanoid block for lower abdominal surgeries: A Prospective Randomized Clinical Trial.”

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 to me 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:

PROFORMA

TITLE: “A Comparison of intrathecal fentanyl and clonidine as an adjuvant to hyperbaric ropivacaine during sub archanoid block for lower abdominal surgeries: A Prospective Randomized Clinical Trial.”

Patient’s Name :

I.P No :

Age :

Date :

Gender :

Anesthesiologist :

Address :

Contact no :

Pre-anesthetic evaluation:

Chief complaints:

Past History:

- H/o co-morbidities and drug intake :
- Previous anaesthetic experience :

General physical examination:

Height (cms):

Weight (Kgs):

BMI :

Pallor:

Icterus:

Cyanosis:

Clubbing:

Lymphadenopathy:

BP:

PR:

RR:

SpO2:

Systemic examination:

RS:

CVS:

CNS:

GIT:

Airway Assessment:

Teeth:

Jaw movements:

MPG:

Investigations:

Hb (gm/dl):

TLC:

Platelet count:

Serum Creatinine:

FBS:

Chest x-ray:

ECG:

Preoperative physical status: ASA Grade I / II

Diagnosis:

Data collection:

Group Allocation:

1.	Onset of sensory block	
2.	Maximum height of sensory block	
3.	Duration of sensory block	
4.	Onset of motor block	
5.	Duration of motor block	
6.	Duration of subarachnoid block	

B) Intraoperative sedation and Haemodynamic data

Time	Sedation score	Heart Rate	SBP	DBP	MAP
Baseline					
5min					
10min					
15min					
20min					
25min					
30min					
45min					
60min					

C) Any adverse events:

Signature of the anaesthesiologist:

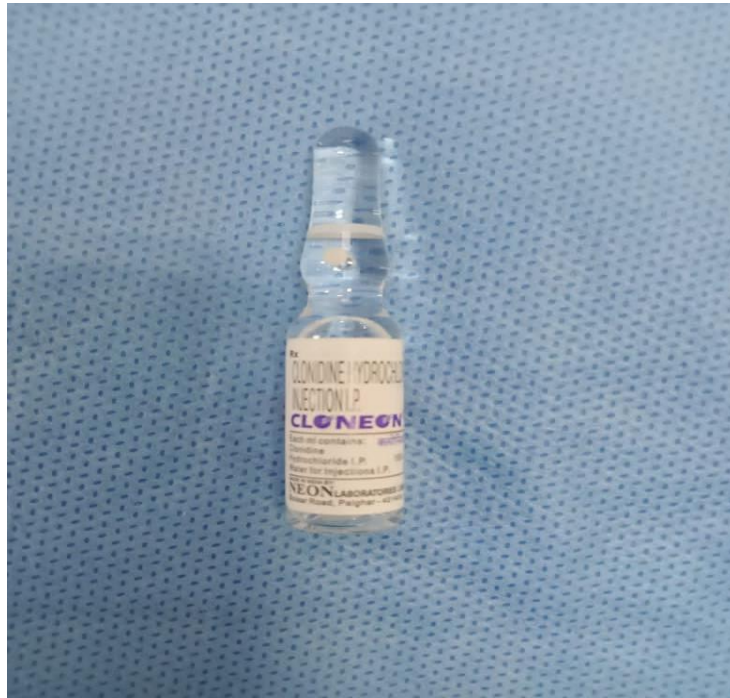
Signature of the principal investigator:

PHOTOGRAPHS

ROPIVACAINE HYPERBARIC



CLONIDINE



FENTANYL





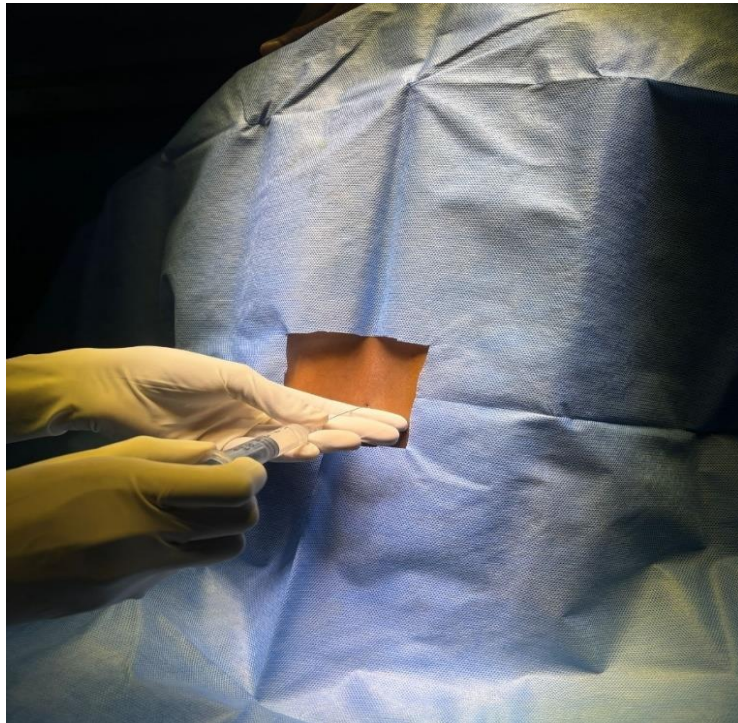
25G QUINCKE'S SPINAL NEEDLE



SPINAL TRAY



SPINAL ANAESTHESIA PROCEDURE



MONITOR



MASTER CHART

SNo.	Sex	Age	ASA	Diagnosis	Surgery	Group RC/RF	Sensory blockade	Duration of sensory block	Motor Blockade	Duration of Motor block	Maximum sensory block	Baseline Vitals					Sedation
												HR	SBP	DBP	MAP	SpO2	
1	F	53	2	Left diabetic foot ulcer	Debridement	RF	23sec	2hrs 15min	25sec	2hrs	T10	88	138	88	104	100%	1
2	M	45	1	Haemorrhoids	Haemorrhoidectomy	RF	24 sec	2hr 24min	40sec	2hrs 40min	T10	71	114	76	89	100%	1
3	M	57	2	Perianal abscess	Incision and Drainage	RF	15sec	2hrs 15min	40sec	2hrs 30min	T10	95	160	84	106	100%	1
4	M	57	2	Fistula in Ano	Fistulectomy	RF	34sec	2hrs 25min	40sec	2hrs 40min	T10	112	146	98	114	100%	1
5	F	45	1	Fissure in ano	Repair	RC	45sec	2hrs 20min	40sec	2hrs 25min	T10	106	153	80	96	100%	1
6	F	24	1	Ulcer over gluteal region	Debridement	RF	15sec	2hrs 20min	20sec	2hrs 20min	T10	83	110	84	93	100%	1
7	M	63	2	Fournier's gangrene	Debridement	RF	30sec	2hrs 25min	25sec	2hrs 40min	T10	72	152	94	113	100%	1
8	M	25	1	Gangrene of foot	Right AK Amputation	RF	35sec	2hrs 40min	2min	2hrs 30min	T10	104	124	77	88	98%	1
9	M	24	1	Ll cellulitis	Debridement	RF	12sec	2hrs 20min	20sec	2hrs	T8	87	140	90	106	100%	1
10	M	41	2	R thigh Abscess	Debridement	RF	30sec	2hrs 10min	2min	2hrs 30min	T10	85	123	70	87	99%	1
11	M	36	1	R leg cellulitis	Debridement	RF	23sec	2hrs	30sec	2hrs 35min	T8	99	154	108	118	97%	1
12	M	56	2	Gangrene of foot	Forefoot amputation	RF	30sec	1hr 40sec	1min	1hr 20min	T11	109	113	76	88	100%	1
13	M	47	2	R diabetic foot	Debridement	RF	45sec	1hr 40min	2min 6sec	1hr 20min	T8	82	137	80	99	100%	1
14	M	40	2	Venous ulcer w maggots	Debridement	RF	30sec	1hr 25min	1min 27 sec	1hr 10min	T11	74	135	100	112	100%	1
15	M	43	1	L inguinal Hernia	Hernia Repair	RF	46sec	2hrs 6min	1min 47sec	2hrs	T10	56	108	60	76	100%	1
16	M	45	1	Wound dehiscence	Suturing	RC	30sec	2hr 25min	1min	2hrs	T10	82	129	89	102	100%	1
17	M	30	1	L inguinal Hernia	Hernia Repair	RF	48sec	2hr 26min	1min 26sec	2hrs 4min	T10	61	111	63	79	100%	1
18	M	32	1	Pubic Rami fracture	Closed reduction	RF	55sec	2hr 26min	1min 50sec	2hr 4min	T10	77	113	66	82	100%	1
19	F	37	2	Ll cellulitis	Debridement	RF	30sec	2hr 20min	40sec	2hrs	T10	58	154	70	98	100%	1
20	F	28	1	Gluteal abscess	Incision and Drainage	RF	30sec	2hr 20min	45sec	2hrs	T10	111	133	78	96	100%	1
21	M	68	2	R diabetic foot ulcer	Debridement	RF	20sec	2hr 15min	2min 40sec	2hrs 5min	T11	86	181	97	125	99%	1
22	M	40	1	Perianal fistula	Fistulectomy	RF	35sec	2hr 25min	40sec	2hr 46min	T10	120	176	123	140	100%	1
23	F	44	2	Ll cellulitis	Debridement	RF	33sec	1hr 40min	40sec	1hr 25min	T10	65	165	80	108	100%	1
24	M	49	2	ll cellulitis	Debridement	RF	10sec	2hr 25min	18sec	2hr 5min	T8	76	157	77	103	100%	1
25	F	45	1	Fissure in ano	Repair	RF	45sec	2hr 20min	1min 40sec	2hr 25min	T10	106	153	80	96	100%	1
26	M	50	1	Appendicitis	Appendicectomy	RF	2min 36sec	2min 24sec	2min 24sec	2hrs 20min	T10	77	123	87	99	100%	1
27	M	36	1	Haemorrhoids	Haemorrhoidectomy	RF	1min 2sec	2hr 36min	2min 46sec	2hr 28min	T10	77	123	79	94	100%	1
28	M	51	1	Hydrocele	Repair	RF	1min 20sec	2hr 26min	2min 14sec	2hr 3min	T10	96	116	81	93	100%	1
29	M	75	2	Inguinal Hernia	Hernia Repair	RF	52sec	2hr 20min	2min 16sec	2hr	T8	90	137	85	102	100%	1
30	M	34	1	Fistula in Ano	Repair	RF	52sec	2hr 32min	1min 4sec	2hr 7min	T10	93	131	89	103	100%	1
31	F	55	2	Incisional Hernia	Repair	RF	38sec	2hr 26min	2min 5sec	2hr 2min	T10	88	126	86	99	100%	1
32	M	51	1	Hydrocele	Repair	RF	22sec	2hr 13min	1min 4sec	2hr 6min	T8	68	117	80	91	100%	1
33	F	27	1	Fistula in Ano	Fistulectomy	RF	38sec	2hr 18min	2min	1hr 56min	T10	86	146	82	103	100%	1
34	M	41	1	Varicose vein ulcer	Debridement	RF	1min 24sec	2hr 28min	1min 46sec	2hr 18min	T10	121	126	78	91	100%	1
35	F	60	2	Varicose vein & lipoma	Debridement & excision	RF	1min 30sec	2hr 25min	1min 45sec	2hr 12min	T10	118	122	74	90	100%	1
36	M	43	1	Phimosi	circumcision	RC	1min 13sec	2hr 28min	3min 4sec	2hr 6min	T10	97	124	88	100	100%	1
37	M	50	2	L diabetic foot	Debridement	RF	40sec	2hr 35min	2min 10sec	2hr 20min	T10	96	127	87	100	100%	1
38	M	26	1	Tibia fracture	Implant removal	RF	45sec	2hr	2min 5sec	2hr 26min	T10	76	128	75	90	100%	1
39	F	72	2	Ulcer over R foot	Debridement	RF	38sec	2hr 4min	2min 4sec	2hr 8min	T10	65	124	76	90	100%	1
40	M	24	1	Varicocele	Stripping	RF	30sec	2hr 8min	1min 30sec	2hr 25min	T10	104	124	88	100	100%	1
41	F	20	1	Tibia fracture	Implant removal	RF	48sec	2hr 15min	2min 4sec	2hr 4min	T10	112	136	86	103	100%	1
42	M	24	1	Fistula in Ano	Fistulectomy	RF	32sec	2hr 25min	35sec	2hr 40min	T10	78	112	82	92	100%	1
43	M	46	1	Inguinal Hernia	Hernia Repair	RF	28sec	2hr 32min	1min 28sec	2hr 16min	T8	72	102	68	79	100%	1
44	M	30	1	Haemorrhoids	Haemorrhoidectomy	RC	45sec	2hrs	1min 20sec	2hr 10min	T10	73	130	84	99	100%	1
45	M	23	1	R inguinal Hernia	Hernia Repair	RF	23sec	2hrs 15min	25sec	2hrs	T10	88	138	88	104	100%	1
46	M	53	2	L inguinal Hernia	Hernia Repair	RF	48sec	2hr 35min	2min 20sec	2hr 16min	T10	66	118	84	95	100%	1
47	M	59	1	R thigh swelling	Excision	RF	38sec	2hr 46min	2min 9sec	2hr 32min	T10	87	127	92	104	100%	1
48	F	76	2	Umbilical Hernia	Hernia Repair	RC	1min 15sec	2hr 26min	3min 40sec	2hr 2min	T10	118	99	60	72	100%	1
49	F	41	1	Fistula in Ano	Fistulectomy	RC	56sec	2hr 60min	3min 30sec	1hr 58min	T10	77	123	87	99	100%	1
50	M	40	1	Fistula in Ano	Fistulectomy	RC	1min 46sec	2hr 24min	4min 10sec	1hr 56min	T8	78	123	105	111	100%	1

Vitals at 5min						Vitals at 10min						Vitals at 15min						Vitals at 20min						Vitals at 25min					
HR	SBP	DBP	MAP	SpO2	Sedation	HR	SBP	DBP	MAP	SpO2	Sedation	HR	SBP	DBP	MAP	SpO2	Sedation	HR	SBP	DBP	MAP	SpO2	Sedation	HR	SBP	DBP	MAP	SpO2	Sedation
86	130	84	98	100%	1	86	128	81	99	100%	2	87	127	83	98	100%	2	82	128	82	99	100%	2	84	126	86	97	100%	2
69	108	69	82	100%	1	68	106	64	78	100%	2	73	110	72	85	100%	2	71	112	72	85	100%	2	72	114	70	85	100%	2
95	125	98	104	100%	1	93	133	58	75	100%	2	88	124	60	76	100%	2	85	119	63	77	100%	2	83	123	62	76	100%	2
115	135	88	103	100%	1	106	115	74	102	100%	2	102	105	70	99	100%	2	94	96	68	82	100%	2	86	94	67	71	100%	2
99	143	66	87	100%	1	88	125	67	81	100%	2	78	122	67	79	100%	2	73	117	75	61	100%	2	71	115	66	78	100%	2
86	106	80	91	100%	1	87	100	77	85	100%	2	92	105	78	87	100%	2	90	112	80	91	100%	2	83	114	84	94	100%	2
74	142	88	106	100%	1	76	148	82	104	100%	2	77	135	84	101	100%	2	75	145	84	104	100%	2	72	140	82	101	100%	2
98	103	72	83	100%	1	77	104	74	84	100%	2	73	102	74	83	100%	2	70	102	74	83	100%	2	73	102	74	83	100%	2
88	131	84	99	100%	1	87	129	85	99	100%	2	92	129	84	99	100%	2	84	127	82	97	100%	2	84	115	86	95	100%	2
98	125	75	91	100%	1	92	119	71	87	100%	2	97	120	68	84	100%	2	91	122	69	86	100%	2	90	126	74	93	100%	2
107	135	87	103	100%	1	102	123	73	89	100%	2	80	103	58	73	99%	2	80	103	57	72	100%	2	83	102	58	72	100%	2
111	88	76	72	100%	1	108	106	72	83	100%	2	100	112	73	84	100%	2	102	115	76	89	100%	2	104	117	74	88	100%	2
80	124	78	94	100%	1	82	128	76	93	100%	2	84	99	67	78	100%	2	86	101	67	78	100%	2	87	102	68	79	100%	2
75	146	87	107	100%	1	76	143	87	106	100%	2	74	131	84	100	100%	2	75	126	84	98	100%	2	74	125	84	98	100%	2
68	123	88	100	99	1	50	112	70	84	98	2	51	117	76	90	98	2	59	116	82	93	98	2	87	135	98	110	98	2
72	116	90	99	100%	1	78	110	73	85	100%	2	70	111	77	88	100%	2	68	106	72	83	100%	2	76	100	70	80	100%	2
63	114	70	85	100%	1	61	108	72	84	98	2	62	111	69	83	98	2	63	107	65	79	98	2	61	114	66	82	98	2
83	135	77	96	100%	1	84	125	75	92	100%	2	76	123	84	97	100%	2	103	124	82	76	100%	2	84	127	93	104	100%	2
60	160	96	117	100%	1	62	147	69	95	100%	2	64	148	65	93	100%	2	59	130	64	86	100	2	55	131	64	86	100%	2
101	106	61	76	100%	1	98	105	59	74	100%	2	96	87	67	55	100%	2	97	93	54	67	100	2	98	103	75	84	100%	2
87	178	96	123	100	1	99	191	141	158	100%	2	85	209	121	150	100%	2	78	203	112	142	100	2	74	189	108	135	100%	2
114	156	100	118	100	1	92	152	108	112	100%	2	103	143	98	113	100%	2	102	139	97	111	100	2	89	134	92	106	100%	2
64	147	75	99	100%	1	63	150	75	99	100%	2	65	153	75	100	100%	2	66	147	72	98	99	2	65	148	70	97	99	2
76	152	85	107	100	1	77	160	85	110	100%	2	73	147	82	103	100%	2	73	145	79	101	100%	2	76	161	86	111	100%	2
99	143	66	87	100%	1	88	125	67	81	100%	2	78	122	67	79	100%	2	73	117	61	75	100%	2	71	115	66	78	100%	2
72	123	86	98	100%	1	69	122	82	95	100%	2	64	120	75	90	100%	2	78	128	91	103	100%	2	77	124	91	102	100%	2
69	92	61	71	100%	1	70	90	58	69	100%	2	79	93	59	70	100%	2	64	110	72	85	100%	2	88	113	81	92	100%	2
106	119	79	92	100%	1	112	126	79	95	100%	2	108	120	79	93	100%	2	112	119	79	92	100%	2	108	119	81	94	100%	2
92	126	75	92	100%	1	96	118	75	89	100%	2	92	125	79	94	100%	2	89	109	70	83	100%	2	86	103	56	72	100%	2
93	138	94	109	100%	1	91	137	95	109	100%	2	81	143	99	114	100%	2	80	125	86	99	100%	2	75	111	75	87	100%	2
86	132	80	97	100%	1	80	126	78	94	100%	2	84	127	78	94	100%	2	84	128	78	94	100%	2	82	129	79	91	100%	2
76	119	81	94	100%	1	80	128	97	101	100%	2	85	127	92	104	100%	2	76	124	88	100	100%	2	80	124	91	102	100%	2
88	144	80	101	100%	1	84	138	78	98	100%	2	92	137	78	98	100%	2	82	142	82	102	100%	2	84	136	78	97	100%	2
126	98	62	72	100%	1	138	88	58	65	100%	2	132	91	58	65	100%	2	121	96	62	72	100%	2	126	92	56	65	100%	2
119	90	58	70	100%	1	122	84	52	65	100%	2	124	87	52	65	100%	2	118	92	58	70	100%	2	116	88	52	65	100%	2
96	116	79	92	100%	1	95	113	74	89	100%	2	94	112	74	88	100%	2	88	106	75	87	100%	2	86	108	75	81	100%	2
85	115	80	92	100%	1	72	113	76	89	100%	2	74	110	77	88	100%	2	81	108	76	87	100%	2	73	107	75	86	100%	2
77	130	78	91	100%	1	78	124	82	93	100%	2	76	125	82	95	100%	2	75	128	78	90	100%	2	75	119	75	89	100%	2
66	126	78	92	100%	1	67	128	78	92	100%	2	65	124	76	90	100%	2	62	122	74	90	100%	2	63	120	72	92	100%	2
106	130	77	95	100%	1	84	126	75	92	100%	2	80	119	74	89	100%	2	79	116	71	86	100%	2	67	114	69	84	100%	2
110	142	82	102	100%	1	112	138	82	101	100%	2	114	128	76	93	100%	2	96	126	75	92	100%	2	95	126	76	93	100%	2
77	114	80	91	100%	1	76	106	80	89	100%	2	78	112	86	95	100%	2	79	120	87	98	100%	2	80	124	88	100	100%	2
74	111	78	89	100%	1	73	109	78	88	100%	2	74	109	75	86	100%	2	78	103	72	82	100%	2	72	106	73	84	100%	2
58	132	82	99	100%	1	59	128	77	94	100%	2	63	126	75	92	100%	2	68	128	75	93	100%	2	65	125	76	92	100%	2
86	130	84	98	100%	1	86	128	81	99	100%	2	87	127	83	98	100%	2	82	128	82	99	100%	2	84	126	86	97	100%	2
76	121	83	96	99	1	78	133	88	103	100%	2	75	118	90	99	100%	2	75	126	92	103	100%	2	77	132	85	101	100%	2
76	124	80	95	100	1	77	122	85	97	100%	2	78	128	88	101	100%	2	85	123	87	99	100%	2	83	127	91	103	100%	2

Vitals at 30min						Vitals at 45min						Vitals at 60min						Vitals 75min					
HR	SBP	DBP	MAP	Spo2	Sedation	HR	SBP	DBP	MAP	Spo2	Sedation	HR	SBP	DBP	MAP	Spo2	Sedation	HR	SBP	DBP	MAP	Spo2	Sedation
79	124	84	95	100%	2	78	129	82	95	100%	2	84	132	88	95	100%	2	86	128	76	90	100%	1
74	116	75	89	100%	2	74	111	69	83	100%	2	76	112	74	87	100%	2	77	111	75	87	100%	1
77	115	92	98	100%	2	82	115	92	98	100%	2	80	95	69	76	100%	2	75	102	78	82	100%	1
79	86	62	66	100%	2	73	78	57	64	100%	2	73	92	62	72	100%	2	86	127	84	109	100%	1
71	117	63	75	100%	2	71	116	70	80	100%	2	67	112	66	77	100%	2	67	115	70	80	100%	1
84	115	86	96	100%	2	77	121	82	95	100%	2	82	124	80	95	100%	2	84	126	82	92	100%	1
68	143	80	101	100%	2	71	135	78	97	100%	2	78	128	76	93	100%	2	79	126	72	91	100%	1
71	103	73	83	100%	2	67	102	73	83	100%	2	75	104	74	84	100%	2	74	104	73	83	100%	1
86	127	82	97	100%	2	80	126	83	97	100%	2	87	123	75	91	100%	2	72	125	82	90	100%	1
95	132	76	94	100%	2	93	132	76	94	100%	2	96	136	77	94	100%	2	98	132	78	95	100%	1
85	125	76	88	100%	2	86	126	77	89	100%	2	85	128	78	90	100%	2	90	129	79	91	100%	1
96	120	74	89	100%	2	94	112	78	93	100%	2	100	118	76	90	100%	2	100	119	79	92	100%	1
89	111	72	88	100%	2	84	114	72	86	100%	2	85	115	75	88	100%	2	86	116	74	88	100%	1
74	125	87	100	100%	2	74	122	84	97	100%	2	76	125	86	93	100%	2	77	126	86	93	100%	1
68	117	81	93	98	2	53	103	65	78	99	2	58	106	74	84	99	2	76	122	84	92	100%	1
71	104	70	81	100%	2	75	109	68	82	100%	2	72	103	71	82	100%	2	75	126	75	83	100%	1
63	116	77	90	98	2	66	114	76	89	100%	2	63	113	70	84	98	2	87	115	80	92	98	1
110	126	88	96	100%	2	115	117	68	84	100%	2	99	114	76	89	100%	2	88	113	70	84	100%	1
54	125	63	84	100	2	54	121	64	83	100%	2	54	123	65	84	100%	2	54	123	65	84	100%	1
97	103	68	80	100%	2	96	102	68	79	100%	2	101	101	68	78	100%	2	102	101	66	76	100%	1
80	186	105	132	100%	2	76	177	109	129	100%	2	78	173	104	127	100%	2	75	177	101	126	100%	1
90	129	90	103	100%	2	87	126	85	98	100%	2	89	134	92	106	100%	2	90	129	90	103	100%	1
65	150	75	98	100%	2	63	150	75	98	100%	2	65	153	75	100	100%	2	67	147	72	98	100%	1
66	143	76	98	100%	2	66	148	76	100	100%	2	64	145	76	98	100%	2	63	141	78	100	100%	1
71	117	63	75	100%	2	71	116	70	80	100%	2	67	112	66	77	100%	2	67	115	70	81	100%	1
80	124	88	100	100%	2	76	128	87	101	100%	2	85	119	81	94	100%	2	80	117	80	92	100%	1
65	123	79	94	100%	2	58	114	72	86	100%	2	54	110	68	82	100%	2	54	107	64	78	100%	1
109	125	83	97	100%	2	108	131	85	100	100%	2	96	121	82	95	100%	2	89	129	83	98	100%	1
88	101	57	72	100%	2	84	110	58	75	100%	2	82	103	57	72	100%	2	86	103	57	72	100%	1
78	116	72	86	100%	2	73	120	83	95	100%	2	70	123	86	98	100%	2	70	116	72	87	100%	1
80	122	72	89	100%	2	78	122	72	89	100%	2	78	118	69	85	100%	2	75	120	72	88	100%	1
77	143	93	110	100%	2	78	128	91	103	100%	2	64	120	75	90	100%	2	69	122	82	95	100%	1
80	132	78	96	100%	2	81	133	76	95	100%	2	78	137	75	95	100%	2	80	129	72	91	100%	1
122	92	52	64	100%	2	125	90	52	63	100%	2	122	82	54	60	100%	2	122	92	52	64	100%	1
126	88	59	62	100%	2	126	86	50	63	100%	2	125	78	50	60	100%	2	121	80	50	62	100%	1
79	114	76	82	100%	2	78	116	73	86	100%	2	82	126	72	84	100%	2	78	116	73	86	100%	1
72	107	74	85	100%	2	75	102	70	81	100%	2	80	100	67	78	100%	2	72	107	74	85	100%	1
74	118	74	88	100%	2	67	116	72	86	100%	2	68	116	72	86	100%	2	64	116	72	86	100%	1
58	118	68	88	100%	2	58	118	68	88	100%	2	56	116	68	88	100%	2	62	122	70	90	100%	1
62	117	68	84	100%	2	74	119	70	86	100%	2	65	111	68	82	100%	2	71	116	60	85	100%	1
95	125	72	90	100%	2	93	125	72	90	100%	2	85	132	76	95	100%	2	79	130	76	94	100%	1
82	122	82	95	100%	2	84	120	80	93	100%	2	80	117	77	90	100%	2	84	120	80	93	100%	1
76	105	72	83	100%	2	79	108	72	84	100%	2	69	126	91	103	100%	2	65	121	89	94	100%	1
68	126	78	94	100%	2	69	127	80	96	100%	2	68	124	75	91	100%	2	69	127	80	96	100%	1
79	124	84	95	100%	2	78	129	82	95	100%	2	84	132	88	95	100%	2	86	128	76	90	100%	1
83	129	89	102	100%	2	77	123	87	99	100%	2	72	123	82	95	100%	2	69	120	75	90	100%	1
81	135	97	110	100%	2	73	115	89	98	100%	2	7	132	89	98	100%	2	72	132	84	100	100%	1

51	M	29	1	Haemorrhoids	Haemorrhoidectomy	RC	1min53sec	2hr38min	3min20sec	2hr6min	T10	77	112	72	86	100%	1
52	M	42	1	R inguinal Hernia	Hernia Repair	RC	1min4sec	2hr22min	3min	2hr2min	T10	70	131	89	103	100%	1
53	M	43	1	Haemorrhoids	Haemorrhoidectomy	RC	56sec	2hr37min	4min20sec	2hr12min	T10	91	120	85	97	99	1
54	F	56	2	Fistula in Ano	Fistulectomy	RC	1min23sec	2hr18min	3min48sec	1hr48min	T10	92	117	80	92	100%	1
55	M	34	1	Appendicitis	Appendicectomy	RC	55sec	2hr23min	2min6sec	2hrs	T9	61	117	80	92	100%	1
56	M	46	1	L inguinal Hernia	Hernia Repair	RC	50sec	2hr20min	1min10sec	2hr5min	T10	86	138	95	109	100%	1
57	M	78	2	Inguinal Hernia	Hernia Repair	RC	1min2sec	2hr25min	2min	2hrs	T10	117	99	58	72	100%	1
58	M	24	1	Sphincteric fistula	Fistulectomy	RC	1min40sec	2hr35min	2min20sec	2hr5min	T8	67	113	79	90	100%	1
59	M	43	2	Fistula in Ano	Fistulectomy	RF	1min20sec	2hr36min	3min40sec	2hr4min	T10	87	127	92	104	100%	1
60	F	41	1	Fissure in ano	Repair	RF	46sec	2hr20min	1min40sec	2hr	T10	66	118	84	95	100%	1
61	M	40	2	Raw area on foot	Debridement	RF	1min13sec	2hr28min	3min4sec	2hr6min	T10	97	124	88	100	100%	1
62	M	31	1	R inguinal Hernia	Hernia Repair	RF	40sec	2hr35min	2min10sec	2hr20min	T10	96	127	87	100	99	1
63	M	26	1	Ulcer over R foot	Debridement	RF	1min24sec	2hr26min	1min46sec	2hr18min	T10	121	126	78	91	100%	1
64	F	20	1	Ll raw area	debridement	RF	1min30sec	2hr25min	1min45sec	2hr12min	T10	118	122	74	90	100%	1
65	M	35	1	Epididymal cyst	Incision and drainage	RF	30sec	2hr20min	1min30sec	2hrs	T10	86	153	80	96	100%	1
66	M	43	1	Ulcer over R thigh	Debridement	RF	34sec	2hr30min	40sec	2hr46min	T10	112	146	98	114	100%	1
67	F	24	1	P3L3 for Tubectomy	Open Tubectomy	RF	35sec	2hr40min	2min20sec	2hr20min	T10	82	126	82	93	100%	1
68	F	25	1	Fissure in ano	Repair	RF	56sec	2hr38min	2min18sec	2hr16min	T10	97	126	87	100	100%	1
69	M	37	1	Fistula in Ano	Fistulectomy	RF	46sec	2hr33min	1min26sec	2hr18min	T10	94	122	86	98	100%	1
70	M	76	2	Antral stricture	Repair	RF	1min	2hr20min	1min20sec	2hr15min	T9	122	124	76	91	100%	1
71	F	62	1	Incisional Hernia	Hernia Repair	RF	15sec	2hr313min	2min32sec	2hr34min	T8	94	160	84	106	100%	1
72	F	55	1	Haemorrhoids	Haemorrhoidectomy	RF	10sec	2hr25min	18sec	2hr5min	T8	76	157	77	103	100%	1
73	M	27	1	Raw area on foot	Debridement	RF	23sec	2hr15min	25sec	2hrs	T10	88	138	88	104	100%	1
74	F	48	1	Haemorrhoids	Haemorrhoidectomy	RF	35sec	2hr14min	45sec	2hrs	T8	92	126	89	101	100%	1
75	M	59	2	Ll ulcer	Debridement	RF	1min	2hr18min	4min	2hr2min	T10	78	130	68	89	100%	1
76	M	55	1	Fissure in ano	Repair	RF	2min	2hr37min	3min	2hr15min	T10	79	125	81	64	100%	1
77	M	21	1	Lipoma	Excision	RF	2min12sec	2hr8min	3min16sec	2hrs	T10	79	126	81	94	100%	1
78	F	66	2	L Diabetic foot ulcer	Debridement	RF	2min32sec	2hr25min	2min50sec	2hrs15min	T10	88	131	60	78	100%	1
79	M	26	1	Perianal abscess	Incision and drainage	RF	46sec	2hr6min	2min4sec	1hr45min	T10	58	113	60	75	100%	1
80	M	59	2	Fistula in Ano	Fistulectomy	RF	1min26sec	2hr24min	4min6sec	2hr4min	T10	78	131	69	89	100%	1
81	M	67	2	Lipoma	Excision	RF	43sec	2hr40min	2min30sec	2hr25min	T8	93	140	103	115	100%	1
82	F	21	1	Sterilization	Open Tubectomy	RF	2min36sec	2hr26min	2min	2hr18min	T8	89	114	58	78	100%	1
83	M	51	1	Hydrocele	Repair	RF	2min	1hr40min	4min6sec	2hrs	T10	78	150	90	70	100%	1
84	F	74	1	Lateral condyle fracture	ORIF	RF	35sec	2hr	45sec	2hr35min	T8	68	142	90	107	100%	1
85	M	22	1	Fistula in Ano	Fistulectomy	RF	43sec	2hr40min	3min	2hr25min	T8	93	140	103	115	100%	1
86	M	27	1	Hydrocele	Repair	RF	35sec	2hrs	45sec	2hr35min	T8	68	142	90	107	100%	1
87	M	35	2	Thermal burns	Debridement and STSG	RF	2min36sec	2hr26min	2min	2hr18min	T8	89	130	58	78	100%	1
88	M	53	1	L inguinal Hernia	Hernia Repair	RF	2min	1hr40min	2min20sec	2hrs	T10	78	150	90	70	100%	1
89	M	48	2	Ll ulcer	Debridement	RF	1min26sec	2hr24min	4min6sec	2hr4min	T10	78	131	69	89	100%	1
90	F	37	1	Umbilical Hernia	Hernia Repair	RC	1min26sec	2hr48min	3min48sec	2hr20min	T9	102	112	68	82	100%	1
91	F	37	1	Fistula in Ano	Fistulectomy	RC	1min15sec	2hr10min	4min4sec	2hr	T10	67	113	79	90	100%	1
92	M	50	2	Diabetic foot ulcer	Debridement	RC	58sec	2hrs	4min17sec	1hr45min	T10	82	129	89	102	100%	1
93	M	70	2	Diabetic foot ulcer	Debridement	RC	2min	2hrs10min	3min	1hr55min	T8	118	99	60	72	100%	1
94	M	55	1	Fistula in Ano	Fistulectomy	RC	2min36sec	2hrs15min	3min26sec	2hrs	T10	77	123	87	99	100%	1
95	M	49	2	Diabetic foot ulcer	Debridement	RC	2min30sec	2hrs25min	3min55sec	2hrs15min	T10	78	123	105	111	100%	1
96	F	60	2	Varicose veins	Repair	RC	1min 30sec	2hr 25min	1min45sec	2hrs12min	T10	118	122	74	90	100%	1
97	M	59	2	Fistula in Ano	Fistulectomy	RC	1min26sec	2hr24min	4min6sec	2hr4min	T10	78	131	69	89	100%	1
98	M	67	2	L Diabetic foot ulcer	Excision	RC	2min35sec	2hr	2min40sec	2hr20min	T8	93	140	103	115	100%	1
99	M	43	1	Phimosis	circumcision	RF	1min13sec	2hr28min	3min4sec	2hrs6min	T10	97	124	88	100	100%	1
100	M	28	1	L inguinal Hernia	Hernia Repair	RC	1min12sec	2hr36min	4min	2hr24min	T10	67	121	82	95	100%	1

73	104	65	77	100%	1	80	116	65	82	100%	2	65	129	81	97	100%	2	69	129	80	97	100%	2	82	129	84	99	100%	2
69	92	61	71	100%	1	70	90	58	69	100%	2	79	93	59	70	100%	2	64	95	61	72	100%	2	88	110	72	85	100%	2
75	138	94	109	100%	1	73	137	95	109	100%	2	78	143	99	114	100%	2	93	141	96	111	100%	2	93	145	103	114	100%	2
70	110	76	87	99	1	60	116	77	90	100%	2	58	116	72	87	99	2	75	118	78	91	99	2	61	116	80	92	100%	2
105	138	88	100	100%	1	94	116	83	94	100%	2	97	124	82	97	100%	2	97	120	83	97	100%	2	89	116	65	85	100%	2
66	134	90	105	100%	1	82	118	82	93	100%	2	82	128	81	97	100%	2	89	122	85	97	100%	2	73	119	68	85	100%	2
70	124	86	99	100%	1	87	150	98	115	100%	2	67	121	85	97	100%	2	77	127	92	104	100%	2	76	137	94	108	100%	2
73	104	59	67	99	1	74	103	60	67	99	2	78	107	62	72	99	2	80	109	64	72	99	2	86	118	67	84	100%	2
68	119	79	92	100%	1	65	120	81	94	100%	2	69	119	77	91	100%	2	58	107	69	82	100%	2	62	113	76	88	100%	2
76	124	80	95	100%	1	77	122	85	97	100%	2	78	128	88	101	100%	2	85	123	87	99	100%	2	83	127	91	103	100%	2
72	121	83	96	99	1	78	133	88	103	100%	2	75	118	90	99	100%	2	75	126	92	103	100%	2	77	132	85	101	100%	2
96	116	79	92	100%	1	95	113	74	89	100%	2	94	112	74	88	100%	2	88	106	75	87	100%	2	86	108	75	81	100%	2
85	115	80	92	100%	1	72	113	76	89	100%	2	74	110	77	88	100%	2	81	108	76	87	100%	2	73	107	75	86	100%	2
126	98	62	72	100%	1	138	88	58	65	100%	2	132	91	58	65	100%	2	121	96	62	72	100%	2	126	92	56	65	100%	2
119	90	58	70	100%	1	122	84	52	65	100%	2	124	87	52	65	100%	2	118	92	58	70	100%	2	116	88	52	65	100%	2
84	143	66	87	100%	1	82	125	67	81	100%	2	86	122	67	79	100%	2	83	117	61	75	100%	2	92	115	66	78	100%	2
115	135	88	103	100%	1	106	115	74	102	100%	2	102	105	70	99	100%	2	94	96	68	82	100%	2	86	94	67	71	100%	2
78	124	80	92	100%	1	77	122	78	88	100%	2	75	122	78	92	100%	2	76	122	76	91	100%	2	86	120	74	92	100%	2
86	116	81	96	100%	1	77	114	77	88	100%	2	75	112	78	88	100%	2	76	110	78	87	100%	2	77	106	76	86	100%	2
92	114	80	94	100%	1	96	112	78	86	100%	2	98	110	76	86	100%	2	97	112	76	85	100%	2	94	116	74	86	100%	2
132	92	60	72	100%	1	133	86	54	65	100%	2	131	89	54	65	100%	2	130	94	60	72	100%	2	126	90	54	65	100%	2
93	125	98	104	100%	1	92	133	58	75	100%	2	86	124	60	76	100%	2	86	119	63	77	100%	2	88	123	62	76	100%	2
76	152	85	107	100%	1	77	160	85	110	100%	2	73	147	82	103	100%	2	73	145	79	101	100%	2	74	161	86	111	100%	2
86	130	84	98	100%	1	86	128	81	99	100%	2	87	127	83	98	100%	2	82	128	82	99	100%	2	84	126	86	97	100%	2
92	118	74	89	100%	1	93	116	72	87	100%	2	94	120	82	95	100%	2	90	118	85	96	100%	2	88	124	86	99	100%	2
72	128	74	72	100%	1	68	128	74	72	100%	2	68	109	72	84	100%	2	67	114	70	84	100%	2	65	112	72	85	100%	2
71	111	71	84	100%	1	71	117	72	82	100%	2	69	105	68	79	100%	2	69	105	66	77	100%	2	65	104	66	77	100%	2
70	113	71	84	100%	1	72	119	73	82	100%	2	68	106	69	79	100%	2	68	106	67	77	100%	2	67	103	66	77	100%	2
76	121	53	71	100%	1	72	112	53	68	100%	2	71	113	50	66	100%	2	74	112	49	66	100%	2	75	109	52	67	100%	2
56	124	70	85	100%	1	57	121	66	81	100%	2	58	116	65	81	100%	2	58	114	64	79	100%	2	58	113	62	77	100%	2
72	121	76	72	100%	1	68	121	76	72	100%	2	68	108	77	84	100%	2	67	115	72	84	100%	2	65	116	74	85	100%	2
102	136	76	94	100%	1	85	121	72	85	100%	2	83	127	73	89	100%	2	113	119	70	85	100%	2	82	126	74	89	100%	2
77	120	54	71	100%	1	73	111	51	68	100%	2	72	113	50	66	100%	2	75	112	51	66	100%	2	76	108	52	67	100%	2
63	108	65	78	100%	1	60	121	66	78	100%	2	54	108	70	82	100%	2	53	106	79	90	100%	2	65	119	80	93	100%	2
68	138	88	105	100%	1	69	136	86	103	100%	2	67	132	87	102	100%	2	66	130	88	102	100%	2	66	126	81	96	100%	2
102	136	78	94	100%	1	85	121	72	85	100%	2	83	127	73	89	100%	2	103	119	70	85	100%	2	82	126	74	89	100%	2
68	138	88	105	100%	1	69	136	86	103	100%	2	67	132	87	102	100%	2	66	130	88	102	100%	2	66	126	81	96	100%	2
77	120	54	71	100%	1	73	111	51	68	100%	2	72	113	50	66	100%	2	75	112	51	66	100%	2	76	108	52	67	100%	2
63	108	65	78	100%	1	60	108	66	78	100%	2	54	106	70	82	100%	2	53	109	79	90	100%	2	65	124	80	93	100%	2
72	121	76	72	100%	1	68	121	76	72	100%	2	68	108	77	84	100%	2	67	115	72	84	100%	2	65	116	74	85	100%	2
100	115	74	87	100%	1	99	112	72	85	100%	2	97	116	75	88	100%	2	92	113	74	87	100%	2	92	117	78	86	100%	2
68	119	79	92	100%	1	65	120	81	94	100%	2	69	119	77	91	100%	2	58	107	69	82	100%	2	62	113	76	88	100%	2
72	116	90	99	100%	1	78	110	73	85	100%	2	70	111	77	88	100%	2	68	106	72	83	100%	2	76	100	70	80	100%	2
78	104	52	67	100%	1	76	103	52	68	100%	2	80	107	55	72	100%	2	82	109	60	75	100%	2	76	118	67	84	100%	2
72	123	86	98	100%	1	69	122	82	95	100%	2	64	120	75	90	100%	2	78	128	91	103	100%	2	77	143	93	110	100%	2
73	104	65	77	100%	1	80	116	65	82	100%	2	65	129	81	97	100%	2	69	129	80	97	100%	2	82	129	84	99	100%	2
119	90	58	71	100%	1	122	84	52	65	100%	2	124	87	52	65	100%	2	118	92	58	70	100%	2	116	88	52	65	100%	2
72	121	76	72	100%	1	68	121	76	72	100%	2	68	108	77	84	100%	2	67	115	72	84	100%	2	65	116	74	85	100%	2
102	136	76	94	100%	1	85	121	72	85	100%	2	83	127	73	89	100%	2	103	119	70	85	100%	2	82	126	74	89	100%	2
96	116	79	92	100%	1	95	113	74	89	100%	2	94	112	74	88	100%	2	88	106	75	87	100%	2	86	108	75	81	100%	2
78	133	91	105	100%	1	68	119	82	94	100%	2	73	124	89	101	100%	2	84	128	94	105	100%	2	62	117	74	88	100%	2

76	130	83	99	100%	2	75	136	83	99	100%	2	79	136	93	107	100%	2	82	130	83	99	100%	1
65	113	81	92	100%	2	58	123	79	94	100%	2	58	114	72	86	100%	2	58	110	68	82	100%	1
91	117	90	99	100%	2	80	138	90	107	100%	2	62	125	86	99	100%	2	71	111	75	87	100%	1
64	120	83	95	100%	2	62	123	86	98	100%	2	62	134	90	105	100%	2	80	128	88	101	100%	1
76	117	83	95	100%	2	73	106	77	89	100%	2	73	120	84	93	100%	2	75	120	85	96	100%	1
76	118	82	95	100%	2	75	108	79	89	100%	2	73	118	81	93	100%	2	76	121	84	96	100%	1
68	130	92	105	100%	2	67	122	79	93	100%	2	59	116	78	95	100%	2	50	116	79	89	100%	1
77	113	66	82	100%	2	83	125	77	96	100%	2	84	131	75	92	100%	2	76	123	73	92	97	1
62	112	78	89	100%	2	63	114	78	90	100%	2	67	117	77	90	100%	2	67	115	80	92	100%	1
81	135	97	110	100%	2	73	114	89	98	100%	2	77	132	84	100	100%	2	72	132	82	99	100%	1
83	129	89	102	100%	2	77	123	87	99	100%	2	72	122	82	95	100%	2	69	129	75	90	100%	1
79	114	76	82	100%	2	78	116	73	86	100%	2	82	126	72	84	100%	2	78	116	73	86	100%	1
72	107	75	86	100%	2	72	107	74	85	100%	2	75	102	70	81	100%	2	80	100	67	78	100%	1
122	92	52	64	100%	2	125	90	52	63	100%	2	122	83	54	60	100%	2	122	92	52	64	100%	1
126	88	50	62	100%	2	126	86	50	63	100%	2	125	78	50	60	100%	2	121	80	52	62	100%	1
96	117	63	75	100%	2	88	116	70	80	100%	2	79	112	66	77	100%	2	88	116	70	80	100%	1
79	86	62	66	100%	2	73	78	57	64	100%	2	73	92	62	72	100%	2	86	127	84	109	100%	1
82	118	72	92	100%	2	80	116	72	92	100%	2	81	117	70	86	100%	2	78	117	68	82	100%	1
87	106	76	85	100%	2	83	112	72	81	100%	2	84	112	72	78	100%	2	81	116	74	82	100%	1
92	114	74	86	100%	2	88	114	78	85	100%	2	86	112	78	82	100%	2	90	112	76	80	100%	1
122	90	52	64	100%	2	125	88	50	63	100%	2	125	80	50	60	100%	2	123	82	52	61	100%	1
86	115	92	98	100%	2	87	115	92	98	100%	2	88	95	69	76	100%	2	87	115	92	98	100%	1
78	146	76	100	100%	2	76	148	76	100	100%	2	77	145	75	98	100%	2	69	141	78	100	100%	1
79	124	84	95	100%	2	83	129	82	95	100%	2	84	132	88	95	100%	2	83	129	82	95	100%	1
85	124	82	96	100%	2	86	126	80	95	100%	2	85	124	80	95	100%	2	86	126	80	95	100%	1
65	111	71	83	100%	2	64	114	70	74	100%	2	67	109	72	70	100%	2	70	105	68	79	100%	1
60	110	74	85	100%	2	62	127	85	97	100%	2	62	125	82	94	100%	2	70	110	70	82	100%	1
63	112	78	85	100%	2	62	125	82	97	100%	2	68	116	75	94	100%	2	69	118	72	96	100%	1
80	111	46	61	100%	2	74	104	50	63	100%	2	72	120	53	70	100%	2	75	114	52	66	100%	1
59	111	58	75	100%	2	62	100	82	81	100%	2	62	111	70	82	100%	2	62	100	82	81	100%	1
66	112	76	85	100%	2	69	115	72	83	100%	2	70	106	76	76	100%	2	71	105	78	71	100%	1
74	121	69	86	100%	2	77	112	66	79	100%	2	64	115	72	85	100%	2	79	119	78	91	100%	1
81	112	51	61	100%	2	75	105	54	63	100%	2	72	124	52	70	100%	2	76	116	56	66	100%	1
77	124	81	94	100%	2	73	121	82	94	100%	2	72	121	79	92	100%	2	68	119	82	95	100%	1
65	129	83	98	100%	2	67	134	85	101	100%	2	65	129	83	98	100%	2	66	126	81	96	100%	1
74	121	69	86	100%	2	77	112	66	79	100%	2	64	115	72	85	100%	2	79	119	78	91	100%	1
65	129	83	98	100%	2	67	134	85	101	100%	2	65	129	83	98	100%	2	67	134	85	101	100%	1
81	112	51	61	100%	2	75	105	54	63	100%	2	72	124	52	70	100%	2	76	116	56	66	100%	1
77	121	81	94	100%	2	73	121	82	94	100%	2	72	121	79	92	100%	2	68	119	82	95	100%	1
66	112	76	85	100%	2	69	115	72	83	100%	2	70	106	76	76	100%	2	71	105	78	71	100%	1
93	119	72	84	100%	2	94	126	78	90	100%	2	95	124	77	88	100%	2	96	122	76	84	100%	1
62	112	78	89	100%	2	63	114	78	90	100%	2	67	117	77	90	100%	2	67	115	80	92	100%	1
71	104	70	81	100%	2	75	109	68	82	100%	2	72	103	71	82	100%	2	75	126	75	83	100%	1
77	113	66	82	100%	2	83	135	77	96	100%	2	84	125	75	92	100%	2	86	121	73	92	100%	1
80	124	91	102	100%	2	76	127	92	100	100%	2	85	128	87	104	100%	2	76	119	81	101	100%	1
76	130	83	99	100%	2	75	136	83	99	100%	2	79	136	93	107	100%	2	82	130	83	99	100%	1
126	88	50	62	100%	2	126	86	50	63	100%	2	125	78	50	60	100%	2	121	80	52	62	100%	1
66	112	76	85	100%	2	69	115	72	83	100%	2	70	106	76	76	100%	2	71	105	78	71	100%	1
74	121	69	86	100%	2	77	112	66	79	100%	2	64	115	72	85	100%	2	79	119	78	91	100%	1
79	114	76	82	100%	2	78	116	73	86	100%	2	82	126	72	84	100%	2	78	116	73	86	100%	1
92	117	83	94	100%	2	81	131	93	106	100%	2	82	130	93	105	100%	2	90	130	97	110	100%	1

101	F	52	1	L lower limb cellulitis	Debridement	RC	2min28sec	2hr2min	5min10sec	2hr18min	T8	147	90	74	79	100%	1
102	M	29	1	Fistula in Ano	Fistulectomy	RC	3min	2hr32min	6min20sec	2hrs	T10	61	99	71	80	100%	1
103	F	26	1	Fissure in ano	Repair	RC	4min12sec	2hr38min	8min	2hrs	T10	51	98	59	72	100%	1
104	M	43	2	Inguinal Hernia	Hernia Repair	RC	2min29sec	2hr46min	6min	2hr20min	T8	68	104	71	82	100%	1
105	M	48	1	Epididymal cyst	Excision	RC	3min40sec	2hr50min	5min4sec	2hr 35min	T11	67	121	85	97	100%	1
106	F	24	1	Abscess on L Thigh	Excision	RC	2min	2hr29min	5min16sec	2hr 16min	T10	93	108	64	78	100%	1
107	M	59	2	R Diabetic foot ulcer	Debridement	RC	1min50sec	2hr18min	5min	2hrs	T10	82	102	53	69	100%	1
108	F	52	2	L Diabetic foot ulcer	Debridement	RC	1min48sec	2hr45min	7min	2hrs 35min	T10	77	112	80	90	100%	1
109	M	64	2	L Thigh infected wound	Incision and drainage	RC	1min39sec	2hrs	7min30sec	1hr 45min	T11	126	74	53	60	100%	1
110	M	48	2	R inguinal Hernia	Hernia Repair	RC	4min	2hrs5min	6min	1hr45min	T12	147	90	74	79	100%	1
111	M	51	2	R inguinal Hernia	Hernia Repair	RC	3min50sec	2hrs56min	5min30sec	2hr32min	T10	137	91	66	74	100%	1
112	M	70	2	L Diabetic foot ulcer	Debridement	RC	2min	2hr10min	3min	1hr55min	T8	122	91	64	73	100%	1
113	M	55	1	Fistula in Ano	Fistulectomy	RC	2min36sec	2hr15min	3min26sec	2hrs	T10	77	123	87	99	100%	1
114	M	27	1	L inguinal Hernia	Hernia Repair	RC	3min	3hr 2min	5min20sec	2hr 27min	T10	70	107	61	76	100%	1
115	F	55	2	Swelling on thigh	Excision	RC	1min45sec	2hr 33min	3min 25sec	2hr 15min	T10	82	120	80	93	100%	1
116	M	68	2	Diabetic foot ulcer	STSG	RC	1min22sec	2hr 48min	2min45sec	2hr 33min	T10	112	112	76	88	100%	1
117	M	56	2	op/c/o Amputation	Grafting	RC	1min48sec	2hr36min	3min 57sec	2hr 28min	T10	116	128	84	99	100%	1
118	F	23	1	Pilonodal abscess	Incision and drainage	RC	2min10sec	2hr14min	4min9sec	1hr 50min	T10	93	133	88	103	100%	1
119	M	35	1	Abscess on L Thigh	Incision and drainage	RC	3min 2sec	2hr 29min	6min	2hr	T11	96	146	99	115	100%	1
120	M	68	2	Ulcer over L foot	Debridement	RC	48sec	2hr	2min29sec	1hr50min	T9	95	126	72	90	100%	1
121	M	67	2	Haemorrhoids	Haemorrhoidectomy	RC	56sec	1hr56min	2min	1hr 32min	T10	126	142	87	105	100%	1
122	M	49	2	Ulcer over L foot	Debridement&grafting	RC	32sec	1hr 37min	1min42sec	1hr 30min	T10	131	133	89	104	100%	1
123	F	66	2	L Diabetic foot	Debridement	RC	39sec	1hr 40min	1min 46sec	1hr 30min	T10	82	129	78	95	100%	1
124	M	65	2	Ulcer over L foot	Debridement	RC	2min24sec	1hr 42min	4min	1hr20min	T10	83	141	88	106	100%	1
125	M	68	2	Gangrene of R foot toe	Amputation of toes	RC	2min8sec	2hr 36min	4min12sec	2hr20min	T10	91	112	72	85	100%	1
126	M	56	2	Ulcer over R foot	Debridement	RC	1min29sec	2hr 48min	3min	2hr 25min	T10	92	116	74	88	100%	1
127	M	66	2	Ulcer over L thigh	Debridement	RC	1min54sec	3hr	4min	2hr 40min	T8	82	118	70	86	100%	1
128	M	48	2	R Hydrocele	Excision	RC	1min 29sec	2hr 40min	5min	2hr 30min	T10	72	123	68	86	100%	1
129	F	63	2	Incisional Hernia	Hernia Repair	RC	1min 32sec	2hr 28min	3min28sec	2hr 15min	T10	74	106	62	77	100%	1
130	M	63	1	Umbilical Hernia	Hernia Repair	RC	1min48sec	2hr 33min	3min	2hr	T10	75	111	58	76	100%	1
131	M	48	1	B/I Hydrocele	Jabonlay's procedure	RC	1min27sec	2hr 36min	3min	2hr	T10	112	114	56	75	100%	1
132	M	63	2	R inguinal Hernia	Hernia Repair	RC	33sec	3hr	4min	2hr 45min	T10	87	149	99	116	100%	1
133	M	72	2	Ulcer over foot	Debridement	RC	42sec	3hr 20min	4min 24sec	2hr45min	T10	142	122	76	91	100%	1
134	F	54	2	Necrotizing fasciitis	Fasciotomy	RC	2min29sec	3hr 24min	5min	2hr 35min	T9	98	150	88	109	100%	1
135	M	69	2	Gangrene of great toe	Amputation o	RC	2min 19sec	2hr 40min	6min30sec	2hr15min	T11	112	110	72	85	100%	1
136	M	30	1	L inguinal Hernia	Hernia Repair	RC	2min30sec	2hr 35min	3min46sec	2hr 15min	T12	82	123	76	92	100%	1
137	M	24	1	Gluteal abscess	Incision and drainage	RC	2min32sec	2hr	5min	2hr	T12	93	142	78	99	100%	1
138	M	46	2	L foot gangrene	amputation	RC	3min4sec	2hr 38min	5min39sec	2hr 18min	T12	61	107	62	77	100%	1
139	M	43	1	Fissure in ano	Fistulectomy	RC	2min	2hr 42min	4min20sec	2hr 18sec	T10	65	111	68	82	100%	1
140	M	30	1	Lipoma on leg	Excision	RC	2min20sec	2hr 18min	4min42sec	1hr55min	T10	72	131	72	92	100%	1
141	M	41	1	Inguinal Hernia	Hernia Repair	RC	2min	2hr 32min	4min30sec	2hr18min	T10	65	112	72	85	100%	1
142	M	45	2	op/c/o Hernia	Hernia Repair	RC	1min40sec	2hr 30min	3min28sec	2hr 10min	T10	62	119	75	90	100%	1
143	M	31	1	Haemorrhoids	Haemorrhoidectomy	RC	1min29sec	2hr 46min	3min40sec	2hr 20min	T10	98	152	80	104	100%	1
144	M	30	1	L inguinal Hernia	Hernia Repair	RC	1min4sec	2hr 29min	4min	2hr8min	T10	92	115	72	86	100%	1
145	M	75	2	R inguinal Hernia	Hernia Repair	RC	1min10sec	1hr 48min	3min	1hr 35min	T10	95	123	78	93	100%	1
146	M	31	1	Gluteal abscess	Incision and drainage	RC	2min20sec	1hr 52min	4min45sec	1hr 40min	T10	112	137	80	99	100%	1
147	M	50	1	Fourier's gangrene	Debridement	RC	2min 29sec	2hr	5min	1hr 45min	T10	113	110	70	83	100%	1
148	M	45	1	CLW over foot	Secondary suturing	RC	2min	2hr16min	4min30sec	2hr	T10	61	145	88	107	100%	1
149	M	46	1	R Hydrocele	Jabonlay's procedure	RC	49sec	2hr18min	4min28sec	2hr	T10	67	162	90	114	100%	1
150	M	38	1	Perianal fistula	Fistulectomy	RC	48sec	2hr 42min	4min20sec	2hr 16min	T10	68	152	88	109	100%	1

146	103	76	74	100%	1	147	109	65	76	100%	2	145	97	66	68	100%	2	144	100	65	66	100%	2	142	102	65	66	100%	2
71	114	78	90	100%	1	72	114	80	91	100%	2	75	113	79	88	100%	2	69	112	81	92	100%	2	68	108	86	97	100%	2
51	98	65	74	100%	1	54	93	63	75	100%	2	50	93	62	74	100%	2	50	94	65	76	100%	2	51	99	69	78	100%	2
68	108	71	82	100%	1	63	104	68	81	100%	2	59	104	68	78	100%	2	54	101	68	77	100%	2	52	98	66	77	100%	2
68	121	85	97	100%	1	68	123	84	97	100%	2	68	121	85	96	100%	2	66	120	87	96	100%	2	65	121	87	97	100%	2
101	107	65	79	100%	1	103	104	67	87	100%	2	91	104	77	88	100%	2	82	109	77	72	100%	2	84	106	79	86	100%	2
95	103	76	85	100%	1	79	110	83	82	100%	2	77	104	76	92	100%	2	76	118	88	85	100%	2	75	107	72	98	100%	2
75	110	79	86	100%	1	70	106	81	90	100%	2	79	99	83	90	100%	2	70	103	74	82	100%	2	78	102	70	81	100%	2
124	75	53	60	100%	1	125	76	53	61	100%	2	131	78	54	62	100%	2	127	106	68	81	100%	2	130	107	67	80	100%	2
146	103	74	84	100%	1	147	109	76	87	100%	2	145	97	65	76	100%	2	144	100	65	77	100%	2	142	102	65	77	100%	2
135	91	66	74	100%	1	130	93	67	76	100%	2	131	93	66	75	100%	2	129	94	68	77	100%	2	124	95	69	78	100%	2
121	88	66	71	100%	1	119	98	69	79	100%	2	116	103	72	82	100%	2	122	77	58	64	100%	2	116	91	64	73	100%	2
72	123	86	98	100%	1	69	122	82	95	100%	2	110	100	71	81	100%	2	111	90	65	73	100%	2	121	115	78	90	100%	2
72	112	64	80	100%	1	73	114	64	81	100%	2	70	115	65	82	100%	2	70	117	64	82	100%	2	70	116	64	81	100%	2
77	112	80	91	100%	1	72	130	80	97	100%	2	74	126	77	93	100%	2	76	131	80	97	100%	2	77	126	84	98	100%	2
110	110	72	85	100%	1	98	114	82	93	100%	2	100	110	79	89	100%	2	102	115	82	93	100%	2	103	110	86	94	100%	2
114	118	75	89	100%	1	98	116	78	91	100%	2	100	112	75	87	100%	2	102	117	78	91	100%	2	103	112	82	92	100%	2
90	126	78	94	100%	1	88	120	81	94	100%	2	90	116	78	91	100%	2	92	121	81	94	100%	2	93	116	85	95	100%	2
90	132	86	101	100%	1	87	122	89	100	100%	2	89	118	86	97	100%	2	91	123	89	100	100%	2	92	118	93	101	100%	2
91	118	74	89	100%	1	86	116	77	90	100%	2	88	112	81	91	100%	2	90	117	84	95	100%	2	91	112	88	96	100%	2
118	130	85	100	100%	1	109	121	88	99	100%	2	111	117	92	100	100%	2	113	122	95	104	100%	2	114	117	99	105	100%	2
126	124	78	93	100%	1	112	118	81	93	100%	2	114	123	85	98	100%	2	114	128	88	101	100%	2	115	123	92	102	100%	2
77	118	73	88	100%	1	75	115	76	89	100%	2	77	120	80	93	100%	2	77	115	83	94	100%	2	78	110	87	95	100%	2
72	124	82	96	100%	1	75	118	85	96	100%	2	78	123	89	100	100%	2	78	118	92	101	100%	2	79	113	96	102	100%	2
88	106	65	79	100%	1	79	102	68	79	100%	2	82	107	72	84	100%	2	82	102	72	82	100%	2	83	97	76	83	100%	2
89	108	68	81	100%	1	78	101	71	81	100%	2	81	106	76	86	100%	2	81	101	76	84	100%	2	82	96	80	85	100%	2
87	102	68	79	100%	1	78	102	71	81	100%	2	81	107	76	86	100%	2	81	102	76	85	100%	2	82	97	80	86	100%	2
69	109	62	78	100%	1	65	111	65	80	100%	2	68	116	70	85	100%	2	68	111	70	84	100%	2	64	106	74	85	100%	2
68	93	58	70	100%	1	63	92	61	71	100%	2	66	95	66	76	100%	2	69	90	66	74	100%	2	65	98	70	79	100%	2
72	90	58	69	100%	1	68	88	61	70	100%	2	71	91	66	74	100%	2	74	86	66	73	100%	2	70	94	70	78	100%	2
107	88	55	66	100%	1	98	86	58	67	100%	2	101	89	63	72	100%	2	104	84	57	66	100%	2	100	92	61	71	100%	2
85	115	78	90	100%	1	78	107	81	90	100%	2	81	110	86	94	100%	2	84	113	80	91	100%	2	80	121	84	96	100%	2
132	95	72	80	100%	1	112	99	75	83	100%	2	115	102	80	87	100%	2	118	105	74	84	100%	2	114	113	78	90	100%	2
88	116	78	91	100%	1	85	103	81	88	100%	2	88	106	88	94	100%	2	91	109	82	91	100%	2	87	117	86	96	100%	2
108	95	70	78	100%	1	88	95	73	80	100%	2	91	98	80	86	100%	2	94	101	74	83	100%	2	90	109	78	88	100%	2
77	100	68	79	100%	1	82	111	71	84	100%	2	85	117	78	91	100%	2	86	120	72	88	100%	2	82	128	76	93	100%	2
90	128	68	88	100%	1	88	121	71	88	100%	2	84	127	78	94	100%	2	85	130	72	91	100%	2	81	138	76	97	100%	2
60	90	60	70	100%	1	57	90	63	72	100%	2	53	96	70	79	100%	2	54	99	64	76	100%	2	60	107	68	81	100%	2
62	95	64	74	100%	1	58	100	67	78	100%	2	54	106	74	85	100%	2	55	104	68	80	100%	2	61	112	72	85	100%	2
69	120	63	82	100%	1	64	125	66	86	100%	2	60	131	73	92	100%	2	61	129	67	88	100%	2	67	137	71	93	100%	2
68	95	68	77	100%	1	65	100	71	81	100%	2	61	106	78	87	100%	2	62	104	72	83	100%	2	68	112	76	88	100%	2
68	110	62	78	100%	1	98	115	65	82	100%	2	94	121	69	86	100%	2	95	119	63	82	100%	2	101	127	67	87	100%	2
95	121	70	87	100%	1	110	126	73	91	100%	2	106	133	77	96	100%	2	107	131	71	91	100%	2	113	139	75	96	100%	2
91	95	68	77	100%	1	86	100	71	81	100%	2	82	107	75	86	100%	2	87	105	69	81	100%	2	93	113	73	86	100%	2
92	105	72	83	100%	1	82	110	75	87	100%	2	78	117	79	92	100%	2	83	115	73	87	100%	2	89	123	77	92	100%	2
107	102	75	84	100%	1	92	107	78	88	100%	2	88	114	82	93	100%	2	93	112	76	88	100%	2	99	120	80	93	100%	2
108	105	68	80	100%	1	93	110	71	84	100%	2	89	117	75	89	100%	2	94	115	69	84	100%	2	100	123	73	90	100%	2
58	124	85	98	100%	1	52	129	88	102	100%	2	48	136	92	107	100%	2	53	134	86	102	100%	2	53	142	90	107	100%	2
65	144	75	98	100%	1	61	149	78	102	100%	2	57	156	82	107	100%	2	62	154	76	102	100%	2	68	162	80	107	100%	2
63	138	80	99	100%	1	58	143	83	103	100%	2	54	150	87	108	100%	2	59	148	81	103	100%	2	65	156	85	109	100%	2