"PERFUSION INDEX AS AN EARLY PREDICTOR OF POSTSPINAL HYPOTENSION IN ELECTIVE LOWER SEGMENT CESAREAN SECTION"

By

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Dissertation submitted to the

B.L.D.E. (DU)

SHRI B. M. PATIL MEDICAL COLLEGE

HOSPITAL AND RESEARCH CENTRE

VIJAYAPURA, KARNATAKA

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

Under the guidance of

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B.L.D.E. (DU)

SHRI B. M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE,

VIJAYAPURA, KARNATAKA

2024

DOI 10.5281/zenodo.15501483

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ACKNOWLEDGEMENT

On completion of this contribution of scientific document it gives me immense pleasure to acknowledge the guidance provided by my distinguished mentors. With all due privilege and respect, I would like to express my gratitude and indebtedness to my guide Dr. NIRMALA DEVI, Associate Professor, Department of Anaesthesiology, BLDE (DU) Shri. B. M. Patil Medical College, Hospital and Research Centre Vijayapura, for her constant inspiration, extensive encouragement and support which she rendered in pursuit of my postgraduate studies and in the preparation of this dissertation. I am extremely grateful to my eminent and esteemed teacher Dr. Renuka Holyachi, Professor and Head, Department of Anaesthesiology, B.L.D.E(DU) Shri. B.M. Patil Medical College, Vijayapura for her overall guidance and inspiration during my study.

I am forever grateful to Dr. Vijayakumar, Dr.Vidya, Dr. Vijay Katti, Dr. Sridevi, Dr.Shivanand L K, Dr. Basavaraj Patil, Dr. Prathiba, Dr. Santosh K, Dr. Mala, Dr. Anusha , Dr. Santosh A, Dr. Milind ,Dr .Nayana ,Dr.Rizwana and Dr. Rahul for their valuable help and guidance during my study. I am forever

indebted to my statistician Dr.Vijaya sorganvi for their constant guidance. I am extremely thankful to Principal Of B.L.D.E(DU) Shri. B. M. Patil Medical College Hospital and Research Centre, Vijayapura, for permitting me to utilize the resources in completion of my work.

I am deeply indebted to my Parents Mr.M Doddabasavaraj and Mrs. Sharanamma whose constant encouragement and inspiration led me to successful completion of my dissertation work. I thank Almighty for their blessings in making this work possible and whose grace strengthened me throughout my course.

I am also thankful to my colleagues Dr. Sachin, Dr. Therisha, Dr. Charishma,Dr. Swaroop, Dr.Vanishree,Dr. Sufiyan, Dr. Sinchana, Dr. Arun, Dr. Swati, Dr. Malvika, Dr. Reshma, Dr. Manikandan, Dr.Sethu and all my junior colleagues for their support, suggestions and advice.

I express my gratitude to Library Staff, Anaesthesia Staff, OT Staff and all Hospital Staff for their co-operation in my study. Last but not the least, I convey my heartfelt gratitude to all the patients, without whose co-operation, this study would be incomplete.

DR. AKSHATA .M

ABBREVIATIONS

LSCS-Lower segment ceserean section

PSH- Postspinal Hypotension

PI -Perfusion index

IR - Infrared

IV - Intravenous

CSF -Cerebrospinal fluid

DVT -Deep vein thrombosis

SA -Spinal anaesthesia

SVR - Systemic vascular resistance

CO -Cardiac output

SAP -Systolic arterial pressure

NIRS -Near infrared spectroscopy

LEDs - Light emiting diodes

P- p valve

SD -Standard deviation

HR -Heart rate

SBP- Systolic blood pressure

DBP -Diastolic blood pressure

ASA -American society of Anaesthesiology

MAP -Mean arterial pressure.

ABSTRACT

BACKGROUND AND AIMS :-

Early detection of hypotension benefits in deciding on preventative measures, safe anesthesia for the mother, and improved outcomes for the newborn. Reduced cardiac output from blood pooling in blocked body parts and decreased vascular resistance from sympathetic blockade cause hypotension after spinal anesthesia for Caesarean section. Peripheral perfusion dynamics resulting from variations in peripheral vascular tone have been evaluated using the perfusion index (PI) obtained from a pulse oximeter.This study aims to determine whether baseline perfusion index can be used to predict hypotension following spinal anaesthesia in caesarean section.

METHODS:

In this prospective double blind observational study,140 patients were enrolled.PI and blood pressure ,heart rate were monitored at baseline.every 3 minutes for first fifteen minutes and then every 5 minutes until the end of surgery,after adminstering spinal anaesthesia with 10mg hyperbaric bupivacaine.Incidence of hypotension was compared with baseline PI.ROC curve was plotted for PI and prediction of hypotension.

RESULTS:-

There was a significant association between baseline PI and hypotension .In our study , it was observed that the patients with baseline cut off of PI>3.8 the risk of hypotension was high in first 10-12 minutes following spinal anaesthesia.The sensitivity and specificity for the 3.8 cut off of PI were 88.6% and 69.2% respectively.

CONCLUSION:-

Our study found that a baseline PI cut off of 3.8 has higher predictability for hypotension risk within the first 10-12 minutes following spinal anaesthesia.

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Introduction

Lower segment caesarean section (LSCS) is a common surgical procedure performed to deliver babies in cases where vaginal delivery poses a risk to the mother or child. The administration of spinal anaesthesia is the preferred anesthetic technique for elective caesarean sections due to its rapid onset, effective analgesia, and minimal exposure to general anesthesia, which can be beneficial for both the mother and the newborn. Despite its advantages, spinal anaesthesia is associated with certain complications, among which postspinal hypotension (PSH) is one of the most significant. 'PSH is defined as a decrease in systolic blood pressure of more than 20% from baseline or a systolic blood pressure of less than 100 mmHg'. It occurs in approximately 60-70% of cesarean deliveries under spinal anesthesia and can have deterious effects on both the mother and the fetus.

Hypotension following spinal anaesthesia is primarily due to the sympathetic blockade, leading to vasodilation and reduced venous return. The resultant decrease in cardiac output can compromise placental perfusion, leading to fetal acidosis and adverse neonatal outcomes. Maternal symptoms can include nausea, vomiting, dizziness, and in severe cases, loss of consciousness. Therefore, the timely prediction and management of PSH are crucial in improving maternal and neonatal outcomes. Traditional methods for predicting PSH, such as baseline hemodynamic measurements, have shown limited predictive value. Hence, there is a need for reliable and non-invasive predictors that can facilitate early intervention.

A healthy pregnancy is marked by a reduction in systemic vascular resistance, resulting from decreased vascular tone [1-3]. Near term, pregnant women exhibit lower mean arterial pressure, increased sensitivity to local anaesthetics, and a

reduced response to vasopressors [4]. Consequently, this makes parturients more prone to significant hypotension after receiving central neuraxial blockade for lower segment cesarean section (LSCS) [5].

Various strategies have been employed to prevent hypotension. Some studies suggest that co-loading with crystalloids and colloids is more effective than preloading [5].

The perfusion index (PI) is a non-invasive, simple, and continuous parameter derived from the photoplethysmographic signal obtained from pulse oximetry. 'PI represents the ratio of pulsatile blood flow to non-pulsatile or static blood in peripheral tissues and provides an indirect measure of peripheral perfusion'. It has been increasingly used in various clinical settings to assess peripheral circulation and the effectiveness of therapeutic interventions. The utility of PI in predicting hemodynamic changes during spinal anaesthesia has been a subject of growing interest.

"The Perfusion Index (PI) is a relative measure of pulse strength at the monitoring site. It is obtained from the plethysmographic waveform produced by the pulse oximeter probe. PI represents a numerical value indicating the strength of the infrared (IR) signal returning from the monitoring site. It is calculated using the following formula [6]"

'AC represents the pulsatile component of the infrared signal, corresponds to the light absorbed by the pulsating arterial inflow and the pulse oximeter waveform amplitude'. 'DC signifies the non-pulsatile component of the infrared signal, absorbed by the skin, other tissues, and the non-pulsatile vascular site blood volume expressed in percentage'.

Several studies have suggested that PI can serve as an early indicator of sympathetic blockade and subsequent hypotension following spinal anesthesia. A decline in PI indicates peripheral vasodilation, which precedes a drop in blood pressure. Consequently, monitoring PI may allow for the early detection of PSH, enabling prompt and proactive management. This is particularly relevant in the context of LSCS, where maintaining stable hemodynamics is critical for the well-being of both the mother and the fetus[7].

Previous research has demonstrated a correlation between changes in PI and the occurrence of hypotension during spinal anaesthesia. For instance, studies have shown that a significant decrease in PI following spinal block is predictive of subsequent hypotension. However, the clinical application of PI as a predictor of PSH in the context of elective cesarean sections remains underexplored. There is a need to validate the predictive value of PI in a larger cohort of pregnant women undergoing LSCS and to establish standardized thresholds for PI changes that can reliably forecast PSH.

Moreover, the relationship between baseline PI values, demographic factors (such as age, body mass index, and preexisting conditions), and the incidence of PSH warrants further investigation. Understanding these associations could enhance the predictive accuracy of PI and guide individualized patient management.

Aim and Objectives

Aim

'To find out whether baseline peripheral Perfusion index can be used to predict hypotension following spinal anaesthesia for the elective caesarean section.'

Objectives

- **Primary Objective**

  To evaluate the baseline perfusion index as a predictor of hypotension in parturients undergoing elective lscs under spinal anaesthesia.

- **Secondary Objective**

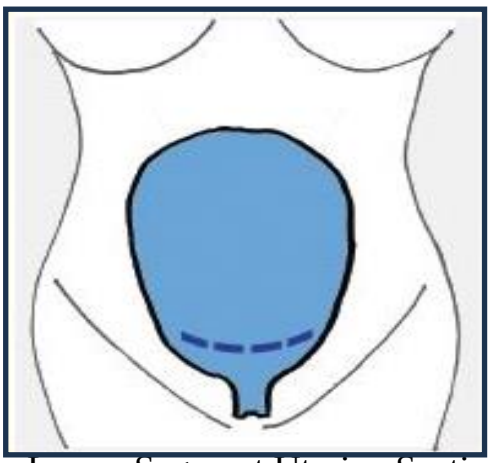
  1. To evaluate the trend of PI before and after ephedrine administration and oxytocin administration.
  2. To study the total requirement of intravenous fluids and ephedrine.

Elective Lower Segment Cesarean Section (LSCS)

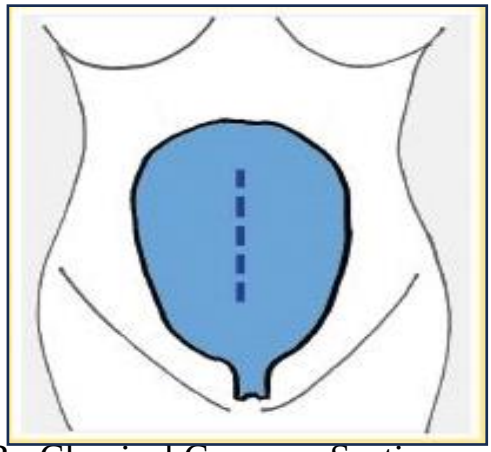
Caesarean section is one of the commonly performed surgical procedures in obstetric and is certainly one of the oldest operations in surgery [8] . A Caesarean section (CS) can be of two varieties. The kind of incision done on the uterus, as opposed to the skin incision, is a crucial distinction. The traditional Caesarean section (CS) and lower uterine segment section (LSCS) are two types of incisions that fall within this category.

- "The classical Caesarean section, which involves a longitudinal incision in the upper uterine segment to provide more space for delivering the baby, is seldom performed today due to its higher risk of complications."
- The most popular treatment performed nowadays is the lower uterine segment section, which entails a transverse cut slightly above the bladder's margin, causing less blood loss and is simpler to repair.It may be transverse (the usual) or vertical in the different conditions that involves presence of lateral varicosities ,constriction ring to cut through it and deeply engaged head.[9]

Figure 1 : Difference between classical Caesarean section and lower uterine segment section



A : Lower Segment Uterine Section



B : Classical Cesarean Section

Indication of LSCS :

1. **Previous Cesarean section :** Women with a history of one or more lower segment cesarean sections, as the lower segment incision is less likely to rupture in subsequent pregnancies.
2. **Placenta Previa :** When the placenta is positioned over the cervix, posing a risk of severe bleeding during vaginal delivery.
3. **Fetal Distress :** Non-reassuring fetal heart rate patterns indicating that the baby is not receiving adequate oxygen.
4. **Malpresentation :** Abnormal positions such as breech or transverse lie, where vaginal delivery would be difficult or dangerous.
5. **Multiple Pregnancies :** Particularly when the first twin is not in a head-down position or in cases of higher-order multiples (triplets or more).
6. **Fetal Macrosomia :** A very large baby, which could lead to complications during vaginal delivery.
7. **Severe Preeclampsia/ Eclampsia :** : High blood pressure and related complications that pose a risk to the mother and baby.

Procedure of LSCS :

A Lower Segment Cesarean Section (LSCS) is a common surgical procedure used to deliver a baby when vaginal delivery is not possible or safe. Spinal anesthesia is the preferred method for anesthesia during LSCS due to its rapid onset, effectiveness, and minimal exposure to general anesthesia for both the mother and the baby.

❖ Preoperative Preparation

- **Preoperative Assessment** : After patients are informed about the procedure, risks, benefits and alternative after taking consent, thorough medical history, physical examination, and relevant investigations. Baseline vitals are recorded.
- **Fasting and Medications** : The patient is typically advised to fast for 6-8 hours before surgery. Prophylactic antibiotics and antacid premedication may be administered.
- **Intravenous Access :** An intravenous (IV) line is established for administering fluids, medications, and blood products if needed.

Spinal Anaesthesia

Spinal anaesthesia is a type of central neuraxial block that temporarily halts nerve transmission by injecting a local anesthetic agent into the cerebrospinal fluid within the subarachnoid space below the L2 vertebra. This subarachnoid block is among the most frequently used regional anaesthesia techniques, offering optimal operating conditions for surgeries performed below the umbilicus.

- **Anatomy[54]**

The vertebral canal extends from foramen magnum to the sacral hiatus. Its boundaries are the dorsal spine, pedicles and lamina of successive vertebrae.

CERVICAL	7 (C1-C7)
THORACIC	12 (T1-T12)
LUMBAR	5 (L1-L5)
SACRUM	5(fused)
COCCYX	5(fused)

‘The vertebrae are connected by overlapping ligaments, including anterior and posterior longitudinal ligaments, Ligamentum Flavum, interspinous ligament, supraspinous ligament, and intervertebral discs’. ‘The spinal cord is a direct continuation of medulla oblongata which begins at the upper border of atlas and terminates distally in the conus medullaris’. ‘The distal termination, because of the differential growth rates between the vertebral canal and spinal cord varies from upper border of L3 in the infant to lower border of L1 in the adults’.

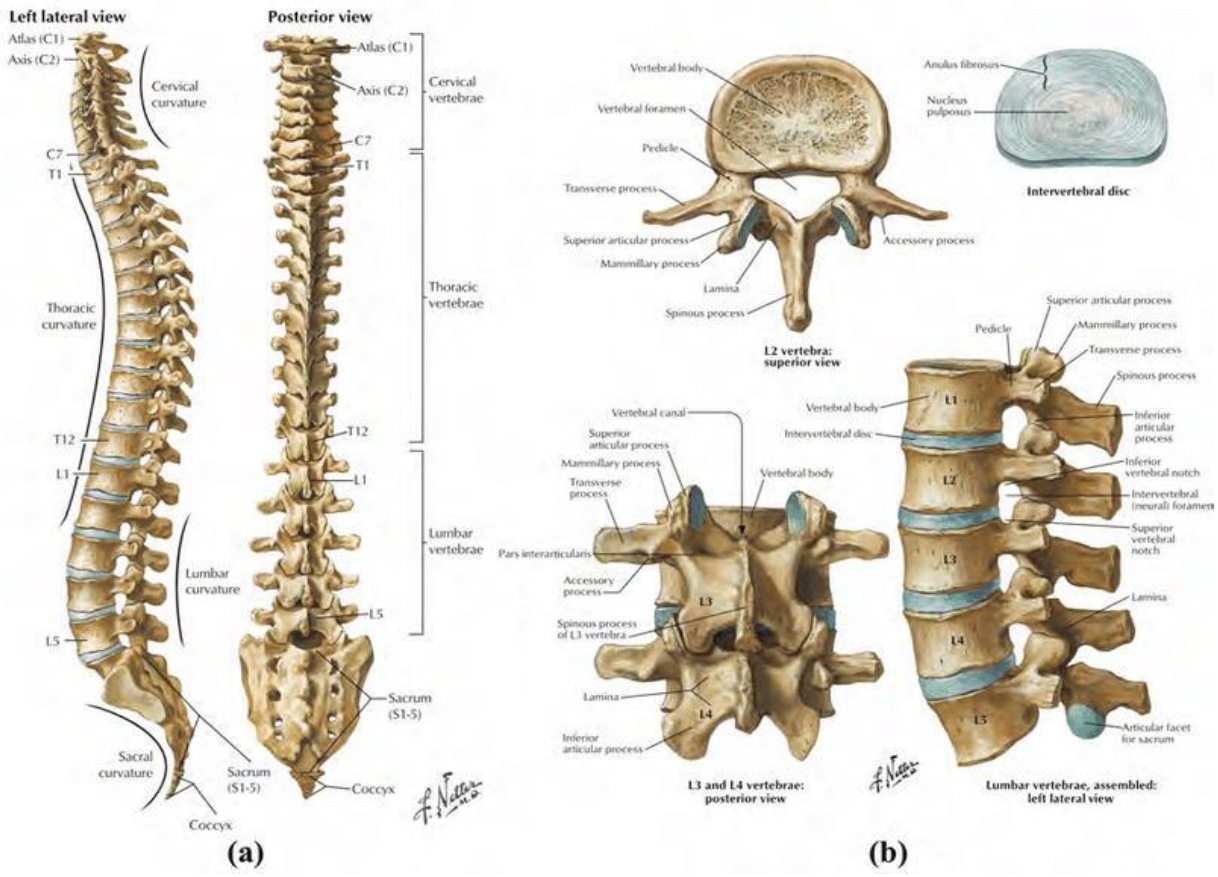
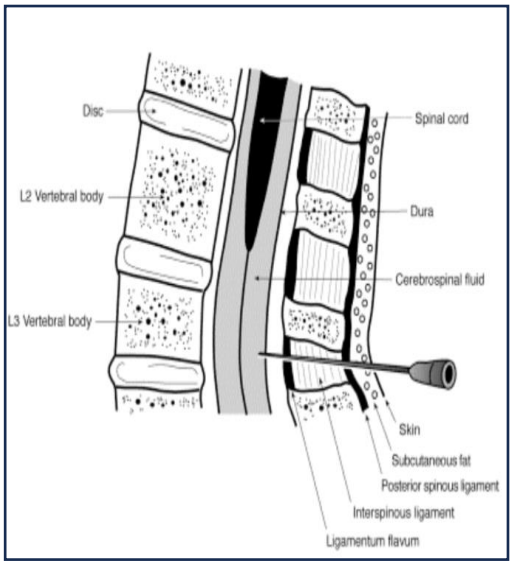


FIGURE 2:- Lateral and posterior view of vertebral column

Three membranes (from within to periphery) encircle the spinal cord in the bony vertebral column.The piamater, arachnoid mater, duramater. The piamater is a highly vascular membrane that closely invests the spinal cord. The arachnoid mater is a delicate non vascular membrane closely attached to outer most duramater.

Figure 3: Structures pierced during Subarachnoid Block



DURAMATER:-comprises two layers: the outer endosteal layer of the cerebral dura merges with the periosteum enclosing the skull at the level of the foramen magnum, and then continues as the periosteal lining of the vertebral canal. The inner meningeal layer is made up of dense fibrous tissue. The dura ends at the second sacral segment, which is usually L5-S3. It connects to the coccygeal periodontal ligament and covers the filumterminale. Although it is free posteriorly, the dura is connected anteriorly to the posterior longitudinal ligament and extends laterally around the nerve roots.

ARACHANOID MATER:a nonvascular, thin, frail membrane that borders theduramer.

PIA MATER: a connective tissue vascular sheath that envelops and shields the spinal cord. The ligamentum denticulatum develops laterally and is connected to the duramater, whereas the frontal part (lineas plendens) thickens. It is attached to the dura posteriorly by an incomplete sheet of pia (posterior subarachnoid septum). It attaches to the coccyx with a dura covering sheath after penetrating the dural sac inferiorly.

SUBDURAL SPACE: A thin serous fluid-filled space exists between the dura mater and the arachnoid mater.

SUBARACHANOID SPACE: Cerebrospinal fluid and spinal nerve roots are located in the anatomical region between the arachanoid and pia maters. While the adult spinal cord terminates at the lower edge of L1, the subarachnoid space continues until S2.

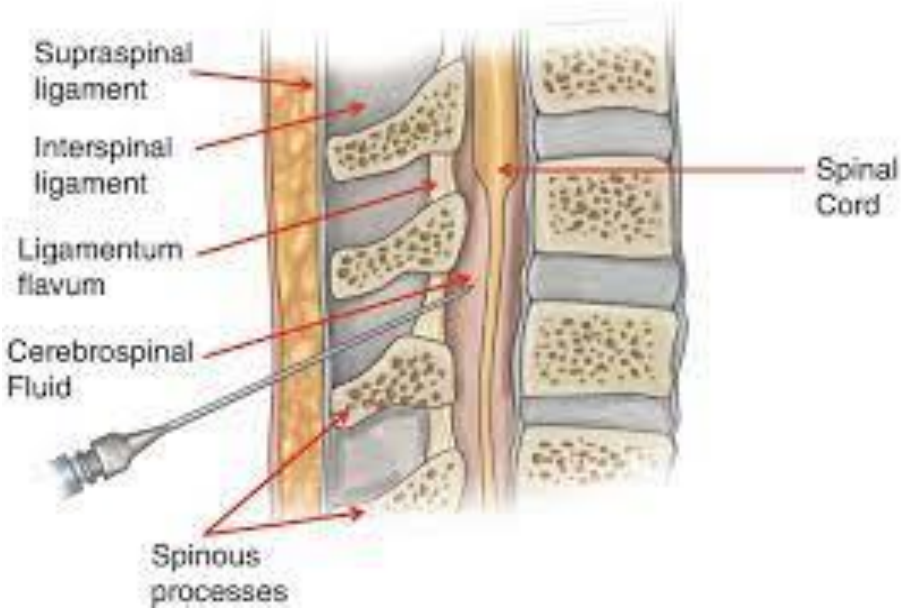


FIGURE 4;-Ligaments covering Spinal cord

The Anterior Logitudnal Ligament: is attached to the intervertebral disc and extends from C2 to the upper sacral vertebrae along the anterior aspect of the vertebral bodies from above downward.

- **Posterior longitudinal ligament** : this ligament runs along the posterior surface of vertebral bodies.
- **Supraspinous ligament** : ascends from the sacrum to the C7 vertebra, and is a strong fibrous cord linking the apices of spinous processes.Then it extends up to the external occipital protuberance as the ligamentumnuchae.

- **The interspinousligament** : It is a thin membranous ligament which connects the spinous processes shafts and joins anteriorly with the ligamentum flavum and posteriorly with the supraspinatous ligament.

- **Ligamentumflavum** : It joins adjacent lamina by linking the downward edge of the above lamina to the cephalad edge of the below lamina. It is also known as the “yellow ligamnet”. It is made up of yellow elastic fibres.

SPINAL CANAL

Spinal cord begins at the level of the foramen magnum and terminates below as the conusmedullaris, is a continuation of the medulla oblongata. It has a cylindrical shape and a length of 45 cm in adults. The spinal cord tapers into the conusmedullaris, which later continues as the filumterminale, a thin thread-like tissue linked to the coccyx. The filumterminale is mainly the pia mater invested in a dura sheath. At birth spinal cord ends at the lower border of the L3 vertebra and rises to end at the lower border of the L1 vertebra in adults.

BLOOD SUPPLY OF SPINAL CORD[53]

Spinal cord gets blood supply ‘from one anterior spinal artey which originates from vertebral artery and two posterior spinal arteries originating from the inferior cerebellar artery’.

‘And the segmental spinal arteries(originating from the intercostal and lumbar arteries’)[53].

The anterial branches provide the ‘anterior two thirds of the spinal cord, whereas the posterior branches supply the posterir third’.

Venous drainage of spinal cord are ‘three longitudinal anterior spinal veins and three posterior spinal veins. Prior to emptying into the internal vertebral venousplexus, they connect with the segmental anterior and posterior radicularveins’[53]

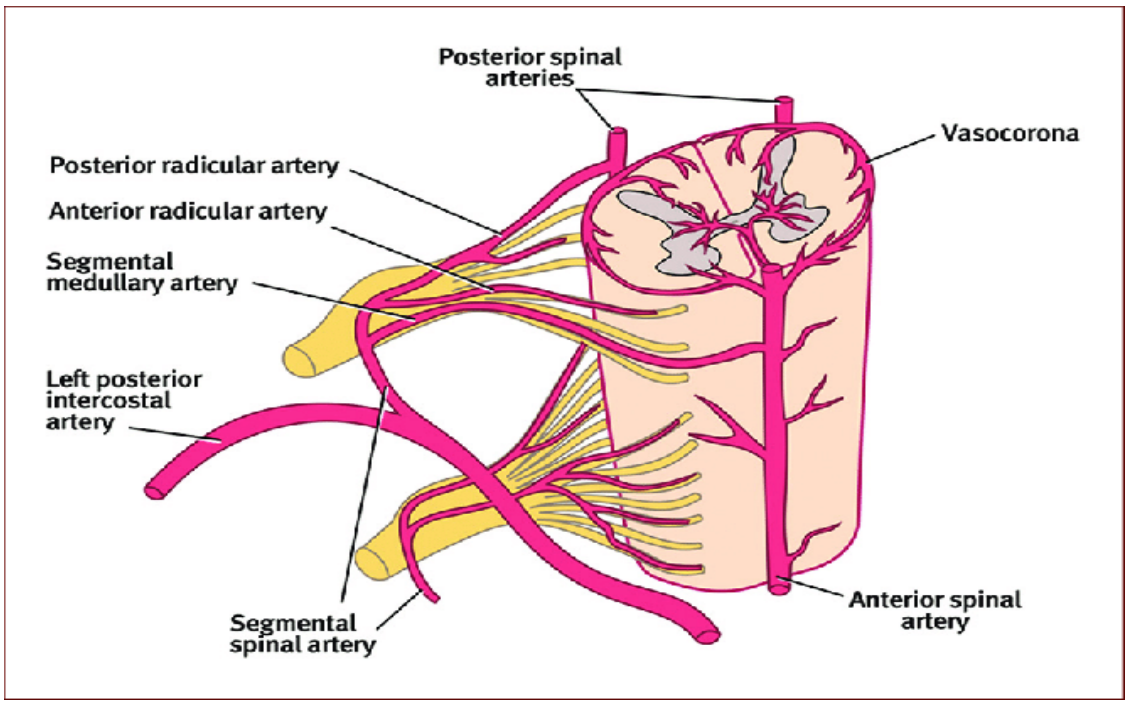


FIGURE 5:-Blood supply of spinal cord

Administration of Spinal Anaesthesia

- **Positioning :** The patient is positioned either sitting or lying on their side with knees drawn up to the chest and back arched (fetal position) to open up the spaces between the vertebrae.
- **Aseptic Technique :** The back is cleaned with an antiseptic solution, and a sterile drape is applied.
- **Identification of injection site :** The anesthesiologist locates the L3-L4 or L4-L5 intervertebral space, where the spinal needle will be inserted.
- **Local Anesthetic** : A small amount of local anesthetic is injected into the skin to numb the area.
- **Spinal Needle Insertion :** A fine spinal needle is inserted into the identified space until it reaches the subarachnoid space, indicated by a flow of cerebrospinal fluid (CSF).
- **Injection of Anesthetic** : A small dose of local anesthetic (usually bupivacaine) with or without an opioid (such as fentanyl or morphine) is injected into the subarachnoid space.
- **Monitoring :** The patient is monitored for blood pressure, heart rate, and signs of effective anesthesia, which includes numbness and loss of movement in the lower body.

❖ Surgical Procedure

- **Patient Positioning :** Once the anesthesia is confirmed, the patient is positioned supine with a slight left tilt to prevent aortocaval compression.
- **Abdominal Preparation :** The abdomen is cleaned with an antiseptic solution and draped with sterile surgical drapes.
- **Incision :** A transverse incision (Pfannenstiel incision) is made about 2-3 cm above the pubic symphysis. The skin, subcutaneous tissue, and fascia are incised and separated to expose the rectus muscles.
- **Entry Into the Abdomen :** The rectus muscles are separated, and the peritoneum is carefully opened to enter the abdominal cavity.
- **Uterine Incision :** A horizontal incision is made in the lower segment of the uterus. The amniotic sac is opened, and the baby is delivered.
- **Delivery of the Baby :** The umbilical cord is clamped and severed, and the baby's mouth and nostrils are suctioned. The baby is handed over to the neonatal team for assessment.
- **Delivery of the Placenta :** The baby’s mouth and nose are suctioned, and the umbilical cord is clamped and cut. The baby is handed over to the neonatal team for assessment.
- **Closure :** The abdominal layers are closed in reverse order – peritoneum, fascia, subcutaneous tissue, and skin. Sutures or staples may be used for skin closure.

❖ Postoperative Care

- **Monitoring :** The patient is monitored in the recovery area for vital signs, level of anesthesia, and any immediate complications.
- **Pain Management :** Additional analgesics are provided as needed, and the effects of spinal anesthesia are continuously assessed.
- **Fluid Management** : IV fluids are continued to maintain hydration and blood pressure. Any necessary medications, such as oxytocin to contract the uterus and reduce bleeding, are administered.
- **Mobilization and Feeding :** Early mobilization and gradual reintroduction of oral intake are encouraged as the effects of anesthesia wear off.

Advantages of Spinal Anaesthesia

- Economical
- Good analgesia
- Patent airway
- Adequate muscle relaxation
- Minimal blood loss
- Fewer respiratory complications
- Lower incidence of DVT and Pulmonary emboli.

Risk and complication of LSCS

- Postspinal Hypotension(PSH)
- Infection (Wound Infection and Endometritis)
- Hemorrhage (Intraoperative bleeding, postpartum Haemorrhage
- Anesthetic Complication (Allergic reaction, Spinal Headache, Nerve damage)
- Deep Vein Thrombosis(DVT)
- Respiratory Complications(Atelectasis or Pneumonia)
- Uterine tract Injuries
- Injury during delivery(Lacerations or Bruising)
- Uterine Rupture
- Adhesions.

❖ Post-spinal Hypotension(PSH)

Hypotension is a frequent side effect of spinal anesthesia (SA), occurring in 16-33% of cases [8].Hypotension is a frequent adverse effect of spinal anesthesia.Upon the start of SA, hypotension is thought to be a result of a reduction in cardiac output (CO), systemic vascular resistance (SVR), or both.

Spinal anesthesia is the preferred method for cesarean sections, particularly for elective procedures, as it avoids common risks associated with general anesthesia, such as aspiration, difficult intubation, and the adverse effects of general anesthetics on the fetus [11]. Nonetheless, spinal anesthesia can cause certain side effects, with hypotension being the most common due to the preganglionic sympathetic block. This block induces sympatholysis, leading to vasodilation and resulting in maternal hypotension. Fetal hypoxia and acidosis may result from a decrease in systolic pressure, which can also affect fetal circulation and uterine blood flow [11, 12].

Medical study on hypotension during cesarean sections performed under spinal anesthesia has been ongoing for more than fifty years [13]. Studies have demonstrated varying incidences of hypotension under spinal anesthesia for cesarean sections (7.4% to 74.1%) [11, 14]. One of the fundamental obstacles in obstetric anesthesiology is still determining the best course of action for maintaining hemodynamic stability during spinal anesthesia for cesarean sections.

Research studies commonly define hypotension in one of two ways: either as a decrease to 80% of the baseline blood pressure measured before anesthesia, or by using a combination of two criteria, which include a drop in systolic arterial pressure (SAP) to 100 mmHg or lower, or a drop to 80% of the baseline or lower [14]. A study from 1999 in the UK found that most consultant obstetric anesthetists set a hypotension threshold at either 100 or 90 mmHg of

SAP [15]. When these various definitions of hypotension are applied to a cohort of women undergoing elective cesarean sections, the incidence of hypotension ranges from 7.4% to 74.1% [11, 14, 15].

- **Pathophysiology and consequences (hypotension during spinal anaesthesia)**

Spinal anesthesia induces hypotension through several pathophysiological mechanisms, the most significant of which is the rapid onset of sympatholysis due to the increased sensitivity of nerve fibers to local anesthetics during pregnancy [16, 17]. The extent of sympathetic chain blockage correlates with the cranial spread of the local anesthetic within the subarachnoid space. This spread is often difficult to predict and usually reaches several dermatomes higher than the sensory block level [18]. The heightened sensitivity to local anesthetics, combined with aortocaval compression from the pregnant uterus, primarily accounts for the increased incidence and severity of hypotension in pregnant women compared to non-obstetric patients [16-19]. Pregnant women also exhibit a higher level of sympathetic activity relative to parasympathetic activity [17, 20]. As a result, sympatholysis leads to greater peripheral vasodilation and a dominance of parasympathetic activity, which reduces venous return and cardiac preload, causing bradycardia, nausea, and vomiting. The diminished preload subsequently lowers cardiac output (CO), resulting in systemic hypotension. This condition is further exacerbated by aortocaval compression [19, 20]. A higher level of sympathetic block reduces the effectiveness of compensatory mechanisms via baroreceptors and heightens the risk of cardioinhibitory reflexes, such as the Bezold-Jarisch reflex, potentially leading to cardiac arrest and death [19, 21].

Nausea and vomiting occur significantly more frequently during spinal anesthesia for cesarean sections compared to non-obstetric surgeries, primarily due to hypotension. Acute hypotension reduces cerebral perfusion, induces transient brainstem ischemia, and activates vomiting centers [22]. This condition may also lead to transient cerebral hypoxia, associated with a significant decrease in maternal cerebral blood volume, cerebral oxygen saturation, and oxygenation, as demonstrated in studies using near-infrared spectroscopy (NIRS) [23]. This correlates with observations that oxygen inhalation can prevent cerebral hypoxia and reduce the incidence of nausea [24, 25]. Severe and prolonged maternal hypotension can lead to vertigo and decreased consciousness levels, which are less common when the drop in blood pressure is promptly treated[26].Spinal anesthesia reduces splanchnic blood flow by approximately 20%, which is further exacerbated in the presence of systemic hypotension [26]. Splanchnic hypoperfusion results in the release of emetogenic substances, such as serotonin, from the digestive tract, contributing to another pathophysiological mechanism of nausea and vomiting [22].

- **Effect on Cardiovascular System**

Spinal anesthesia impacts the cardiovascular system primarily by inducing a blockade of the sympathetic nervous system, leading to significant hemodynamic changes. The injection of a local anesthetic into the subarachnoid space results in the inhibition of preganglionic sympathetic nerve fibers, which play a crucial role in maintaining vascular tone and cardiac output. This blockade causes widespread vasodilation of both arteries and veins. Arterial vasodilation reduces systemic vascular resistance (SVR), causing a drop in blood pressure. Concurrently, venous vasodilation increases the capacity of the venous system, leading to pooling of blood in the lower extremities and a

subsequent decrease in venous return to the heart, known as preload. The reduced preload diminishes stroke volume and, consequently, cardiac output. In pregnant women, these effects are exacerbated by aortocaval compression from the gravid uterus when in a supine position, further decreasing venous return. Additionally, the higher sensitivity to local anesthetics during pregnancy results in a more pronounced blockade. The combined effect of decreased SVR, reduced cardiac output, and impaired compensatory mechanisms, such as the baroreceptor reflex, culminates in significant hypotension. This condition necessitates careful monitoring and management, often requiring fluid administration, vasopressors, and positional adjustments to ensure hemodynamic stability and patient safety.

Perfusion Index(PI)

'The Perfusion Index (PI) is a metric derived from a pulse oximeter, calculated as the ratio of pulsatile blood flow to non-pulsatile blood in peripheral tissues (Hales et al., 1989)'. Essentially, it represents the proportion of pulsing blood compared to non-pulsing blood. This measurement is obtained non-invasively and serves as a reliable indicator of a person's pulse strength. PI values typically range from 0.02% (indicating a very weak pulse) to 20% (indicating a very strong pulse). The pulse oximeter's plethysmograph provides a visual representation of the PI. Physicians frequently utilize this measurement to assess the impact of drugs or treatments on a patient, evaluate medicinal efficacy, and monitor disease progression.

- **Measurement of Perfusion Index (PI)**

The Perfusion Index (PI) is measured using a pulse oximeter, a non-invasive device commonly used to monitor oxygen saturation and pulse rate.

1. **Principle of Pulse Oximetry :**
   a. **Light Absorption** : A pulse oximeter operates based on the principle of light absorption. It uses light-emitting diodes (LEDs) that emit two wavelengths of light, typically red (660 nm) and infrared (940 nm), through a translucent part of the body, such as a fingertip or earlobe.
   b. **Photodetector** : On the opposite side, a photodetector measures the amount of light that passes through the tissue.

2. **Components of Signal :**
   a. **Pulsatile Component (AC) :** The pulsatile component, or AC signal, corresponds to the changes in light absorption caused by the

pulsating arterial blood. It reflects the variations in blood volume with each heartbeat.

b. **Non-Pulsatile Component (DC) :** The non-pulsatile component, or DC signal, represents the constant absorption by non-pulsatile structures such as skin, bone, and non-pulsatile blood.

3. **Calculation of Perfusion Index(PI) :**
   a. **PI Formula : '**PI is calculated as the ratio of the pulsatile blood flow (AC) to the non-pulsatile blood flow' (DC), expressed as a percentage. The formula is: PI=(AC/DC)×100
   b. **Signal Processing :** The pulse oximeter's internal algorithms process the AC and DC components of the photoplethysmographic signal to compute this ratio. The resulting PI value quantifies the relative strength of the pulsatile signal compared to the non-pulsatile baseline.
4. **Procedure of Measurement :**
   a. **Placement :** The pulse oximeter probe is placed on a suitable site, such as a fingertip, earlobe, or toe, ensuring proper alignment and contact.
   b. **Initiation :** Once the probe is positioned, the device is turned on, and the LEDs emit light through the tissue.
   c. **Real-time Monitoring :** The photodetector continuously measures the transmitted light, and the device processes the signals to display real-time PI values on the screen
5. **Interpretation of PI Values :**
   a. **Range of Values :** PI values typically range from 0.02% (indicating a very weak pulse) to 20% (indicating a very strong pulse).
   b. **Clinical Relevance :** Higher PI values suggest stronger peripheral perfusion, while lower values indicate weaker perfusion. Clinicians

use these measurements to assess the patient's cardiovascular status and the effectiveness of therapeutic interventions.

Figure 6 : Pulse oximeter

- **Hemodynamic Changes and PI**
  - **Baseline PI :** Reflects normal peripheral perfusion with stable arterial and venous flow
  - **Sympathetic Blockade :** Spinal anesthesia blocks sympathetic nerves, causing vasodilation and reduced SVR
  - **Vasodilation :** Leads to decreased arterial pressure and venous pooling, reducing preload and cardiac output
  - **PI Decrease :** Indicates reduced pulsatile blood flow, reflecting the hemodynamic changes induced by spinal anesthesia.
  - **Early Detection :** A drop in PI serves as an early warning sign of PSH, allowing for timely intervention to prevent severe hypotension.

Advantages of Using Perfusion Index (PI) Over Traditional Methods for Predicting Postspinal Hypotension (PSH)

The Perfusion Index (PI) offers several advantages over traditional methods for predicting postspinal hypotension (PSH), making it a valuable tool in clinical practice.

1. **Non-Invasive Monitoring :**
    a. **No need for Invasive Procedure** : PI is measured using a pulse oximeter, which is a non-invasive device. This eliminates the risks and discomfort associated with invasive methods like arterial line insertion
    b. Patient Comfort : Non-invasive monitoring enhances patient comfort and reduces anxiety, particularly important in settings like labor and delivery where patient well-being is crucial
2. **Real – time Monitoring :**
    a. Continuous Data : PI provides continuous real-time data on peripheral perfusion. This allows for immediate detection of changes in hemodynamic status, enabling prompt intervention
    b. **Early Detection :** Traditional methods often detect hypotension after significant drops in blood pressure have occurred. PI, on the other hand, can indicate impending hypotension earlier, allowing for preemptive measures
3. **Sensitivity to Hemodynamic Changes :**
    a. Detailed Perfusion Information : PI reflects changes in both arterial and venous blood flow, providing a more comprehensive

view of peripheral perfusion compared to traditional blood pressure monitoring.

b. **Sensitive Indicator :** PI is sensitive to subtle changes in perfusion, which can be an early sign of sympathetic blockade and subsequent hypotension. This sensitivity makes it a reliable early warning system for PSH.

4. **Enhanced Clinical Decision -Making :**
    a. **Timely Interventions :** By providing real-time data and early warning signs, PI enables clinicians to make timely decisions regarding fluid administration, vasopressor use, and other interventions to manage hypotension.
    b. **Improved Outcomes :** Early detection and management of hypotension can lead to better maternal and fetal outcomes by maintaining stable hemodynamics during procedures like cesarean sections.
5. **Versatility in Different Clinical Setting :**
    a. **Wide Range of Applications :** PI can be used in various clinical settings, including operating rooms, labor and delivery units, intensive care units, and emergency departments, making it a versatile tool for monitoring hemodynamics.
    b. **Applicability to Different patients populations :** PI is useful for a wide range of patients, including those undergoing surgery, critically ill patients, and those with cardiovascular conditions.

Differentiation between Perfusion index and NIBP

Parameters	Perfusion Index	NIBP
Definition	A range when measured with a pulse oximeter, represents the proportion of pulsatile blood flow to static or non-pulsatile blood in peripheral tissue. It displays variations in vascular tone, blood flow, and peripheral perfusion.	A method to measure blood pressure without penetrating the skin, commonly done using an inflatable cuff placed around the upper arm, which provides systolic, diastolic, and mean arterial pressures
Measurement Method	Measured using a pulse oximeter sensor placed on a finger,toe,or earlobe. The device uses light absorption techniques to calculate the ratio of pulsatile to non-pulsatile blood flow.	Measuredusing an inflatable cuff that temporarily occludes blood flow in an artery, typically on the upper arm. The cuff inflates and then deflates, detecting changes in arterial wall motion to determine blood pressure.
Parameters Provided	Provides a continuous, real-time value indicating the strength of blood flow and perfusion in peripheral tissues.	Provides discrete readings of systolic, diastolic, and mean arterial pressures, typically recorded at set intervals.
Clinical Use	Useful for early detection of changes in perfusion and hemodynamic status, continuous monitoring of vascular tone, and assessing the effectiveness of interventions like vasopressor administration.	Essential for obtaining accurate measurements of blood pressure, diagnosing hypertension or hypotension,and managing various cardiovascular conditions.

Response Time	Offers immediate, real-time feedback on peripheral perfusion, allowing for rapid detection of changes.	Provides intermittent readings, with each measurement taking a few seconds to a minute, depending on the device and settings.
Hemodynamic Changes	Highly sensitive to changes in peripheral blood flow, making it useful for detecting early signs of hypotension or shock.	While reliable for measuring blood pressure, it may not detect rapid or subtle changes in hemodynamics as quickly as PI.
Ease of Use	Non-invasive, simple to set up, and generally comfortable for patients, requiring only a small sensor on a peripheral site.	Also non-invasive but can be uncomfortable for patients due to cuff inflation, and repeated measurements may cause irritation or discomfort.
Applications	deal for continuous monitoring in critical care, anesthesia, and during surgeries where real-time feedback on perfusion is crucial.	Widely used in various clinical settings, including routine check-ups, emergency care, and surgical procedures, for periodic blood pressure assessments.
Limitations	May be affected by factors like ambient temperature, patient movement, and sensor placement, which can impact accuracy.	Can be less reliable in patients with arrhythmias, obesity, or those who require frequent blood pressure monitoring, leading to potential inaccuracies or discomfort.

Monitoring Perfusion Index (PI) in Clinical Settings During Lower Segment Cesarean Section (LSCS)

Monitoring the Perfusion Index (PI) during a Lower Segment Cesarean Section (LSCS) involves several steps and considerations to ensure accurate and continuous assessment of peripheral perfusion.

1. **Preoperative Preparations**
   a. **Patients Assessment** : Conduct a thorough preoperative assessment, including medical history, vital signs, and baseline PI measurement, to establish a reference point.
   b. **Equipment Check :** Ensure that the pulse oximeter with PI capability is functioning correctly and has been calibrated according to manufacturer specifications.
2. **Placement of the pulse Oximeter**
   a. **Site Selection :** Choose an appropriate site for the pulse oximeter probe, commonly a fingertip, toe, or earlobe. Ensure the site is clean, dry, and free from any barriers to light transmission
   b. **Proper Attachment :** Attach the pulse oximeter probe securely to the selected site, ensuring good contact without causing discomfort to the patient. Poor attachment can lead to inaccurate readings.
3. **Baseline Measurement :** Record the baseline PI value before the administration of spinal anesthesia. This value serves as a reference for detecting changes in perfusion during the procedure.
4. **Administration of Spinal Anaesthesia**
   a. **Spinal Block :** Administer spinal anesthesia using standard aseptic techniques. Monitor the patient closely for immediate responses to the anesthesia.

b. **Initial Monitoring :** Begin continuous monitoring of PI immediately after the administration of spinal anesthesia to detect any early signs of hypotension.

5. **Continuous Monitoring During Surgery**
    a. **Real-time Data :** Continuously monitor and display the PI value on the pulse oximeter's screen. Ensure that the readings are updated in real-time to provide an ongoing assessment of the patient's perfusion status.
    b. **Correlation with Hemodynamic Parameters :** Regularly compare PI values with other hemodynamic parameters, such as blood pressure, heart rate, and oxygen saturation, to obtain a comprehensive understanding of the patient's cardiovascular status.

6. **Detection of Hemodynamic Changes**
    a. **Trend Analysis :** Observe trends in PI values. A significant drop in PI can indicate decreasing peripheral perfusion and potential onset of hypotension.
    b. **Early Interventions :** Use changes in PI as an early warning sign to initiate timely interventions. For example, if PI drops significantly, consider administering intravenous fluids or vasopressors to counteract hypotension.
7. **Management of Hypotension**
    a. **Fluid Management :** Administer crystalloids or colloids as needed to maintain adequate intravascular volume and perfusion.
    b. **Vasopressors :** Use vasopressors like phenylephrine or ephedrine to increase vascular tone and blood pressure if significant hypotension is detected.

c. **Positioning :** Adjust the patient's position, such as tilting to the left side, to reduce aortocaval compression and improve venous return.

8. Post-operative Monitoring

a. **Immediate postoperative Period :** Continue monitoring PI in the immediate postoperative period to ensure stable hemodynamics as the effects of spinal anesthesia wear off.

b. **Ongoing Assessment :** Evaluate PI along with other vital signs to detect any delayed onset of hypotension or other complications.

Review of Literature

Simi. P. Babu et al [2024][27] conducted a study, to find out whether the baseline peripheral perfusion index can be used to predict hypotension following spinal anaesthesia in an elective caesarean section. In the study total 150 patients were included for which baseline Peripheral perfusion index[PI] was recorded every 10 seconds. Following institutional protocol, spinal anesthesia was given. Blood pressure and heart rate are measured during the procedure. According to the study, individuals with baseline PI >3.5 are at a higher risk of suffering post-spinal hypotension compared to those with baseline PI <3.5.

Harde, et al[2024][28] studied, Of the ninety-five females, forty-three had a PI of less than or equal to 3.5, and forty-seven had a PI greater than 3.5. 46 patients in the PI more than 3.5 group had hypotension and needed a lot of IV fluids, and 29 of them required vasopressors. The statistical significance of the correlation with PI was demonstrated by the Pearson's Chi-square values of 32.26 and 32.36, respectively. With a sensitivity of 83.08% and specificity of 96.00%, a baseline PI greater than 2.9 is a good classifier that can predict hypotension, according to the ROC analysis, which revealed an area under the curve of 0.917. The study found a strong correlation between post-spinal hypotension and the use of vasopressors and a baseline PI greater than 3.5.It has been shown that post-spinal hypotension can be accurately predicted with high sensitivity and specificity when the baseline PI is more than 2.9. Due to its ease of use, speed, and lack of invasiveness, PI is a valuable predictor of post-spinal hypotension in

parturients receiving LSCS, enabling preventative steps to enhance outcomes for both the mother and the fetus.

Zainab M. Attia et al [2023][29] evaluated the perfusion index and the blood pressure positional changes in the prediction of hypotension after SA in CSs. In the study total 80 pregnant women who were prepared for elective CS delivery, study observed that, the mean perfusion index (PI) pre-spinal was 5.81 and immediately after spinal was 4.65 with a statistically significant decrease ($P<0.001$). There was also a statistical difference between the mean of mean arterial pressure (MAP) of the studied cases pre-spinal at the lateral position (91.76 mmHg) and mean MAP in the supine position (83.29 mmHg) with P-value <0.001, with a mean difference of 8.48 mmHg. PI cut-off >4 had a sensitivity of 85.9%, specificity of 75%, and accuracy of 83.8% in the prediction of hypotension. The positional change in blood pressure at cut-/off >5 mmHg had a sensitivity of 82.8%, specificity of 75%, and accuracy of 81.3% in the prediction of hypotension among cases, thus they concluded that the preoperative PI and positional blood pressure change can predict spinal anesthesia induced hypotension during caesarean deliveries.

N Rajanalini et[2023][30] in their study**,** employed PI to forecast the likelihood of hypotension following subarachnoid block for a lower segment cesarean section that was elective. Based on baseline PI, 126 parturients were split into two groups in this prospective double-blind observational study. Parturients in Group 1 had a PI value less than 3.5, whereas those in Group 2 had a PI value more than 3.5. 10 mg of intravenous bupivacaine 0.5% (hyperbaric) was used for spinal anesthesia at the L3-L4 interspace. The study discovered that Group 1 had a 10.5% incidence of hypotension, while Group 2 had a 71.42% incidence . A considerable association was seen between the

perfusion index above 3.5, the quantity of hypotensive episodes, and the overall ephedrine dosage. 69.84% and 89.29%, respectively, were the baseline PI of 3.5 sensitivity and specificity for hypotension prediction.

Soni *et al.[2023][31]* included In this prospective, observational study involving 55 people, it was found that the incidence of hypotension using SBP and MAP standards was 29% and 36%, respectively, while the incidence of severe hypotension was 20%. Predicting hypotension at five minutes was 92.3% specific and 87.5% sensitive with a baseline PI of 1.03. the area under the ROC curve (AUC) was 0.913 ($P < 0.001$). The study findings indicate that the perfusion index can be used to forecast hypotension that may occur after propofol induction.

Thapa et al [2022][32] observed that, 247 parturients undergoing elective cesarean section under spinal anesthesia were included. Parturients with a baseline PI less than 3.5 were placed in Group I, while those with a baseline PI more than 3.5 were placed in Group II. All patients received 2.2 ml of 0.5% bupivacaine heavy for spinal anesthesia. In Group I, 30 patients (23.62%) experienced hypotension, whereas in Group II, all 119 patients (100%) experienced hypotension. The incidence of hypotension was significantly lower in Group I compared to Group II . Additionally, the dose of mephentermine used was significantly lower in Group I than in Group II . Thus, we concluded that a baseline PI more than 3.5 predicts hypotension following spinal anesthesia in patients undergoing cesarean section.

M G et al.[2022][33] In their study, they ascertain if PI can predict parturients' hypotension in an equivalent manner following the administration of spinal anesthesia at various time points.In their study Fifty-six parturients were enrolled in the study. After administering spinal anaesthesia with 10 mg of

hyperbaric bupivacaine. Prior to the procedure, PI and blood pressure were recorded every two minutes for twelve minutes, and then every five minutes until the procedure was completed .At every observation point, the incidence of hypotension was compared between the groups. They discovered a strong correlation (r=0.525) between the number of hypotension episodes and baseline PI. Parturients with a baseline PI more than or equal to 3.5 had a substantially higher overall incidence of hypotension than those with a PI less than 3.5. The group with PI more than 3.5 had a significantly greater incidence of hypotension at the sixth, tenth, and 37th minutes post-spinal. The study concluded that parturients with a baseline PI more than 3.9 have a higher risk of hypotension in the first 10-12 minutes following spinal anaesthesia during caesarean delivery. The sensitivity and specificity for a PI cut-off of 3.5 were 85.7% and 60%, respectively, at the 6th and 10th minute post-spinal administration. Increasing the cut-off to 3.9 improves specificity to 69% without significantly altering sensitivity.

Kumar et al.[2022][34] The incidence of hypotension was compared between the groups at each observation point. They found a significant relationship (r=0.525) between baseline PI and the number of hypotension events. The total incidence of hypotension was significantly higher in parturients with a baseline PI more than or equal to 3.5 (79.16%) than in those with a PI less than 3.5 (33.33%). Six, ten, and thirty-seven minutes after spinal cord stimulation, there was a noticeably higher incidence of hypotension in the group with PI more than or equal to 3.5.

Neepa Patel et al[2022][35] studied, to ascertain if baseline PI may be utilized to forecast hypotension and to establish the baseline PI cutoff value for parturients receiving spinal anesthesia during LSCS. 52 participants were split

into two groups for the study according to their perfusion index (PI). Patients classified into two groups: Group I included patients with a PI less than 4.0 and Group II included patients with a PI more than 4.0. Just four patients in Group I experienced hypotension, whereas twenty-two patients in Group II did . Furthermore, a significant association was found between the mephentermine dosage that was given, the occurrence of hypotension, the baseline PI, and fluid boluses. With an area under the curve of 0.903 and a cut-off value of 4.05, the ROC analysis showed 86% sensitivity and specificity for baseline PI. The study found that after spinal anesthesia for LSCS, a higher baseline PI corresponds to a higher incidence of hypotension.

Jabarulla, et al.[2021][36] discovered that the patient's baseline PI and the incidence of hypotension during surgery have a positive association. It was determined that a cutoff value of 1.75 ($P < 0.001$) was significant, signifying that hypotension was unquestionably present over this threshold. This cutoff's corresponding sensitivity and specificity were 75% and 71%. They came to the conclusion that hypotension after spinal anesthesia in LSCS can be predicted by a baseline perfusion index higher than 1.75. For mothers whose baseline was higher than this threshold, the incidence of hypotension was almost 93%.

Yu et al.[2021][37] comprehensive analysis of the determinants of hypotension imposed by spinal anesthesia and their predictive significance during cesarean delivery. There were thirty-eight studies (n=3086 patients) total. Patients received 500–1000 mL of crystalloid preload or 500–2000 mL of crystalloid coload in most of studies. Vasopressors for post-spinal hypotension usually included 25–100 μg of phenylephrine and/or 5–15 mg of ephedrine. The range of the hypotension rate was 29% to 80%.The researchers came to the conclusion that individual and contextual factors enhanced outcome variability, reducing the prognostic validity of peripheral perfusion indices and the autonomic

nervous system for hypotension caused by spinal anesthesia. Supine stress tests have the potential to enhance the predictive power of static state predictors and more accurately reflect parturients' cardiovascular tolerance during hemodynamic changes. In order to anticipate spinal anesthesia-induced hypotension during supine stress tests, future research should concentrate on composite and dynamic characteristics.

Akshay Prasad Pradhan et al [2020][38] studied, relate between the lower segment cesarean section prediction of hypotension and the perfusion index. They observed 106 cases in total for their study, 52 of which had low PI values and 54 of which had high PI values. In the low PI group, the incidence of hypotension was 26%, whereas in the high PI group, it was 48%. Moreover, the high PI group had an increased mean phenylephrine consumption. They came to the conclusion that, in elective LSCS, parturients with a baseline PI index higher than 3.5 are more likely to experience hypotension and need more vasopressor treatment after spinal anesthesia.

Dr Joseph George et al[2019][39] calculated the relationship between the occurrence of hypotension after subarachnoid block in LSCS and the baseline perfusion index. Sixty-seven percent of the study subjects experienced hypotension. Baseline PI and the drop in SAP from baseline showed a strong connection ($r = 0.368$, $P < 0.05$). 3.6 was shown to be the ideal cutoff threshold for PI, with a sensitivity of 80% and a specificity of 60%. The study came to the conclusion that in elective LSCS, a baseline perfusion index higher than 3.6 is linked to a higher incidence of hypotension after spinal anesthesia.

Duggappa, et al[2017][40] investigated the correlation between baseline perfusion index and incidence of hypotension following SAB in LSCS. In this prospective observational study, 126 parturients were divided into two groups

based on their baseline PI. Group I included parturients with a PI of ≤3.5, while Group II consisted of those with a PI >3.5. Spinal anaesthesia was administered with 10 mg of 0.5% hyperbaric bupivacaine at the L3–L4 or L2–L3 interspace. The incidence of hypotension was 10.5% in Group I compared to 71.42% in Group II ($P < 0.001$). There was a significant correlation between a baseline PI >3.5 and the number of hypotension episodes ($rs = 0.416$, $P < 0.001$) as well as the total dose of ephedrine ($rs = 0.567$, $P < 0.001$). The sensitivity and specificity of a baseline PI of 3.5 for predicting hypotension were 69.84% and 89.29%, respectively. The area under the ROC curve for PI in predicting hypotension was 0.848.

Materials and Method

Study Design :

A Prospective double blind observational study

Source of data:

This study was carried out in the "Department of Anaesthesiology, B.L.D.E.U.'s Shri. B. M. Patil Medical College, Hospital and Research centre, Vijayapura".

Study Duration and Place of Study :

The study was conducted for a period of one and Half year

Study Population

Parturients undergoing elective caesarean section under spinal anaesthesia.

Sample Size :

With the Anticipated correlation between SBP and Perfusion index - 0.236 (2), at a 95%confidence level and 80 power in the study, the sample size worked out is 140

Formula used is

"$N=[(\frac{Z_\alpha+Z_\beta}{C})]^2+3$"

"The standard normal deviate for $\alpha = Z_\alpha = 1.9600$"

"The standard normal deviate for $\beta = Z_\beta = 0.8416$"

$C=0.5*\ln[\frac{1+r}{1-r}]=0.2405$

N=140

Inclusion and Exclusion Criteria

Inclusion Criteria

- Parturients posted for elective lower segment cesarean section.
- ASA GRADE II
- Age between 20 and 35 years

Exclusion Criteria

- Placenta previa
- Preeclampsia
- Cardiovascular disease
- Cerebrovascular disease
- Gestational diabetes mellitus
- Contraindication to spinal anaesthesia
- Twin pregnancy.

Ethical Committee Approval:

The present study was approved by institutional ethics committee of our tertiary care centre (B.L.D.E.U.'s) committee.

Methodology

Pre-anaesthetic evaluation:

The Pre anaesthetic evaluation included the following:

History:

History of underlying medical illness, previous history of surgery, anaesthetic exposure, and hospitalization was elicited.

Physical Examination :

- The general condition of the patient
- Vital signs -heart rate, blood pressure, respiratory rate
- Height and weight
- Examination of the respiratory system, cardiovascular system, central nervous system, and vertebral system.
- Airway assessment by Mallampati grading.

Method

- Informed consent was taken before the procedure. The patients were kept nil by mouth for 6hrs before surgery. After shifting the patient to the preoperative room, the parturients were premedicated with Inj ondansetron 4 mg IV.
- A pulse oximeter probe was affixed to the left index finger of parturients in order to ensure consistency in the recording of pulse index.
- Parturients were then be transferred to the operation theatre, standard monitors were applied, and all parturients were given 500 ml of Ringers lactate solution and maintenance intravenous fluids given at the rate of 10ml /kg /hr. Baseline parameters like HR, SBP,DBP,MAP,SPo2 and baseline PI was noted.
- An anesthesiologist blind to the study protocol and baseline characteristics administered spinal anesthesia. Under strict aseptic measures, spinal anesthesia was administered in a sitting posture using a 25 G Quincke's spinal needle at the L3-L4 interspace with 10 mg of 0.5% hyperbaric bupivacaine.
- A wedge was then positioned beneath the parturients' right hip and buttocks, putting them in a supine position.
- Sensory block was checked with a cold swab, and after the achievement

of the T6 level, surgery was started.

- Every three minutes for the first fifteen minutes of the procedure, and then every five minutes until the end, the following parameters were recorded: pulse rate, PI, systolic blood pressure (SBP), diastolic blood pressure, mean arterial blood pressure, and SPo2.
- Following delivery of baby extraction, injection oxytocin 10 units slow iv was given.
- Decrease in SBP by 20% from baseline is defined as hypotension for this study..
- PI measured before and after ephedrine and before and after oxytocin infusion.
- A heart rate less than 60 beats per minute is called bradycardia.
- RESCUE PROTOCOL:
    - If blood pressure drops below 20% of baseline blood pressure rescue dose of vasopressor injection ephedrine 5mg was given.
    - A bolus of atropine 0.5mg is administered if hypotension is associated with bradycardia.

Statistical Analysis

Collected data was entered in the Microsoft Excel 16, for further statistical analysis, Categorical data were expressed interms of frequency and proportion, while quantitative data were expressed interms of mean and standard deviation. Chi-square test of association were applied to find association between the variables. ANOVA was used to find mean difference of quantitative data among the variables. Recover operating curve was used to find out cut off value of perfusion index and also to find out sensitivity and specificity. P-value <0.05 were considered as statistically significant. Statistical analysis was done with the help of statistical software SPSS version 25

Observation and Results

Table 1: Age distribution among study population

Age Interval	Frequency	Percent
20 - 30 Years	90	64.3
31-35 Years	50	35.7
Total	140	100

In the present study majority of the patients were form the age group of 20-30 years of old followed by 31 -35 years as shown in above table.

Graph 1: Age distribution among study population

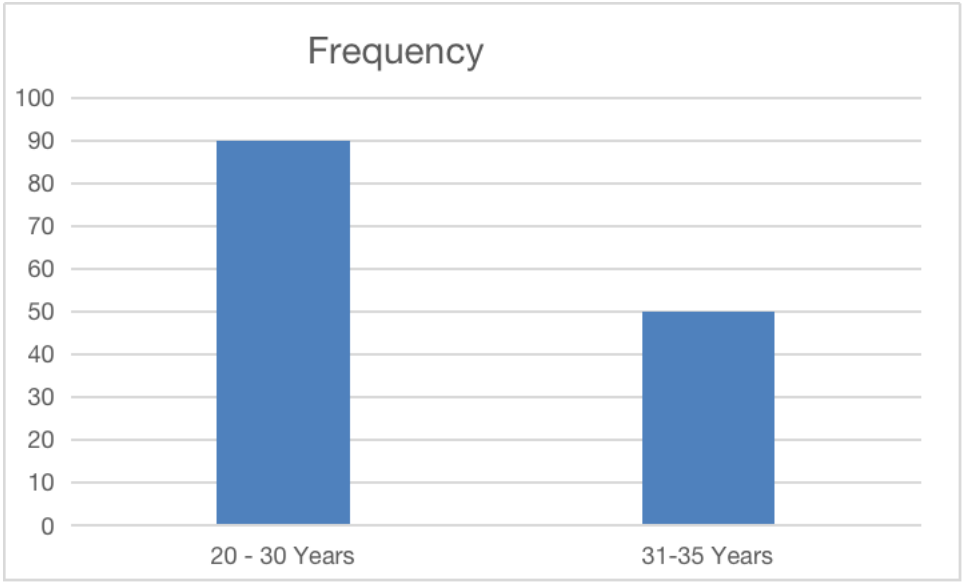


Table 2: Gestational Age distribution among study population

Gestational Age	Frequency	Percent
36	32	22.9
37	57	40.7
38	36	25.7
40	15	107
Total	140	100

Majority of the patients were of gestational age 37 weeks, followed by 38 weeks, 36 weeks and 40 weeks as shown in above table.

Graph 2: Gestational Age distribution among study population

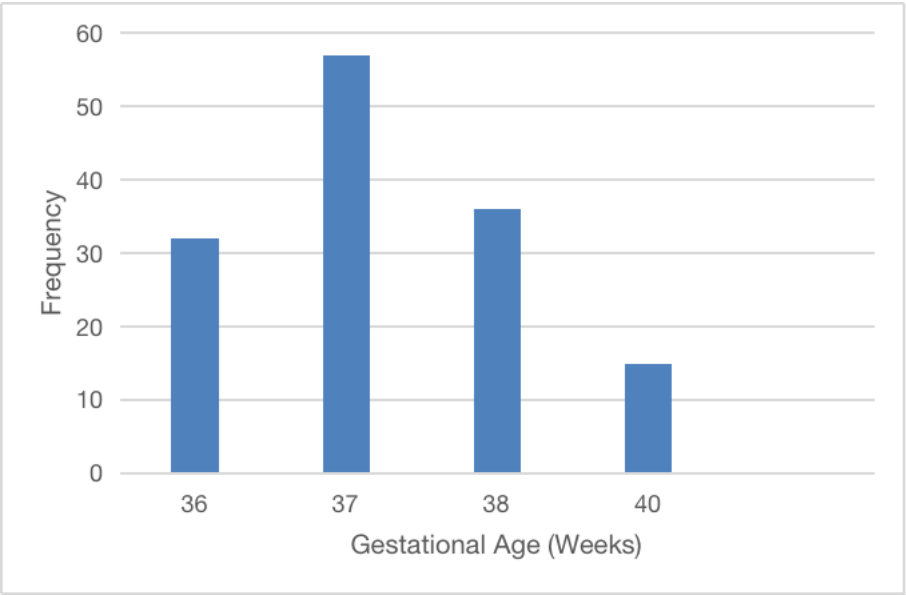


Table 3: Mean distribution of demographic profile among study population

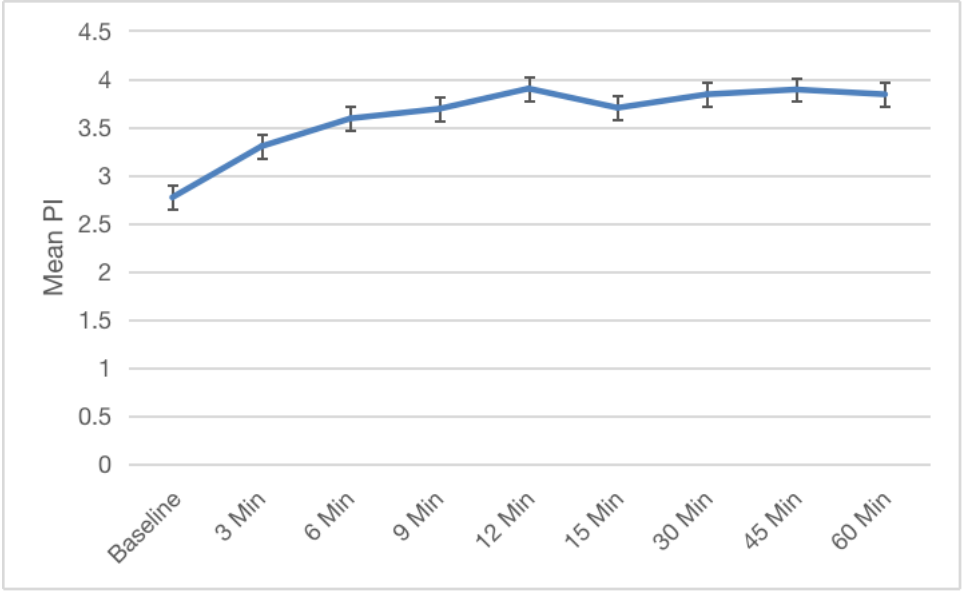
Parameters	Mean	Std. Deviation	Minimum	Maximum
Age(years)	26.02	3.60	20	35
Weight(kilogram)	60.68	3.91	55	68
Height(centimeter)	155.98	0.662	145	157
Gestational Age(weeks)	36.94	1.219	36	38

Above table showed, mean distribution of demographic parameters like age, weight, height and gestational age, in the present study minimum age was 20 years and maximum were 35 years, patients with minimum weight of 55 kg and maximum of 68kg, minimum height of 145cm and maximum of 157cm, minimum gestational age of 36 weeks and maximum of 40 weeks.

Table 4: Mean distribution perfusion index at different time interval.

Time Interval	PI				F-value	p-value
	Mean	Std. Deviation	Minimum	Maximum		
Baseline	2.77	1.311	2	5	3.38	<0.001
3 Min	3.3	1.11	2	8		
6 Min	3.59	1.246	2	8		
9 Min	3.69	1.414	2	6		
12 Min	3.9	1.411	2	5		
15 Min	3.7	1.312	2	4		
30 Min	3.84	1.279	2	4		
45 Min	3.89	1.253	2	4		
60 Min	3.84	1.422	2	4		

Graph 3: Mean distribution perfusion index at different time interval.

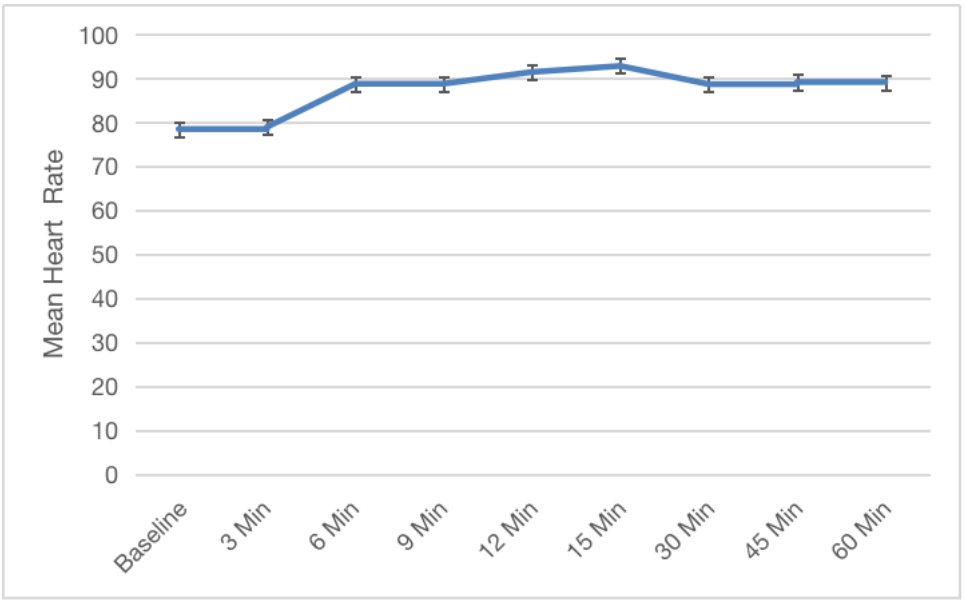


It was observed that at baseline mean PI was 2.77 and SD of 0.989, and minimum was 2 and maximum was 5, but after spinal it was reduced to in the interval of mean PI of 2.77 to 3.9 and difference from baseline to at different intervals of time were statistically highly significant(P-value<0.01), as shown in above table.

Table 5: Mean distribution Heart Rate at different time interval.

Time Interval	Heart Rate				F-value	p-value
	Mean	Std. Deviation	Minimum	Maximum		
Baseline	78.51	1.007	77	80	192.404	<0.001
3 Min	79	1.275	77	81		
6 Min	88.83	4.368	82	96		
9 Min	88.84	4.255	82	96		
12 Min	88.51	4.196	82	96		
15 Min	88.89	3.933	82	96		
30 Min	88.73	3.923	82	96		
45 Min	89.22	3.883	82	96		
60 Min	89.09	3.901	82	96		

Graph 4: Mean distribution Heart Rate at different time interval.

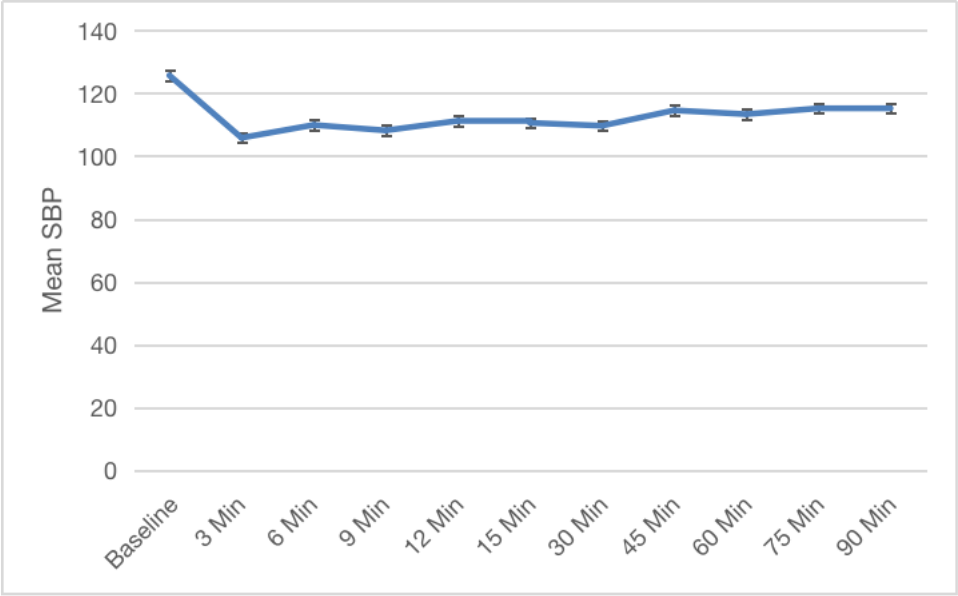


It was observed that at baseline mean HR was 78.51 and SD of 1.007, and minimum was 77 and maximum was 96, but after spinal it was increased to in the interval of mean heart rate of 79 to 89.09 and difference from baseline to at different intervals of time were statistically highly significant(P-value<0.01), as shown in above table.

Table 6: Mean distribution Systolic Blood Pressure at different time interval.

Time Interval	Systolic Blood Pressure				F-value	p-value
	Mean	Std. Deviation	Minimum	Maximum		
Baseline	131.34	2.035	128	135	138.4	<0.001
3 Min	116.38	0.901	115	118		
6 Min	111.54	3.765	105	118		
9 Min	109.26	5.479	100	118		
12 Min	112.37	4.725	105	120		
15 Min	111.14	3.447	105	117		
30 Min	110.2	3.37	105	116		
45 Min	115.19	1.915	112	119		
60 Min	113.79	3.299	108	119		

Graph5 :Mean distribution Systolic Blood Pressure at different time interval.

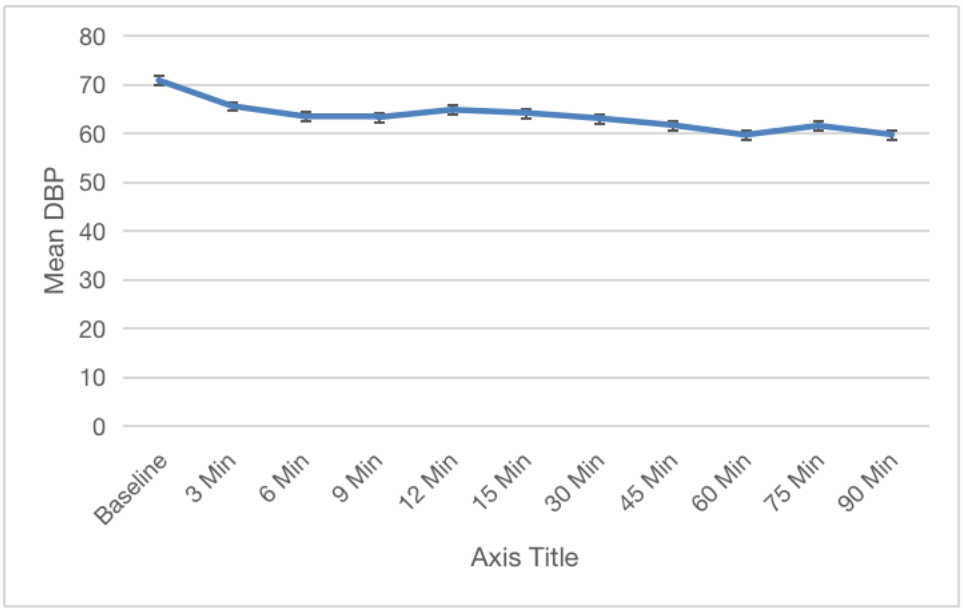


It was observed that at baseline mean SBP was 125.75 and SD of 9.016, and minimum was 100 and maximum was 135, but after spinal it was decreased to in the interval of mean SBP of 105.87 to 115.32 and difference from baseline to at different intervals of time were statistically highly significant(p-Value<0.01), as shown in above table.

Table 7: Mean distribution Diastolic Blood Pressure at different time interval.

Time Interval	Diastolic Blood Pressure				F-value	p-value
	Mean	Std. Deviation	Minimum	Maximum		
Baseline	72.94	0.676	72	74	138.4	<0.001
3 Min	70.54	1.556	68	73		
6 Min	63.49	2.729	58	69		
9 Min	63.31	3.148	58	69		
12 Min	64.84	1.643	62	68		
15 Min	64.21	2.907	60	69		
30 Min	63.11	2.449	59	67		
45 Min	61.71	4.088	55	68		
60 Min	59.68	3.028	55	65		
75 Min	61.58	3.642	55	68		
90 Min	59.75	1.905	57	63		
Total	64.1	4.791	55	74		

Graph 6:Mean distribution Diastolic Blood Pressure at different time interval.

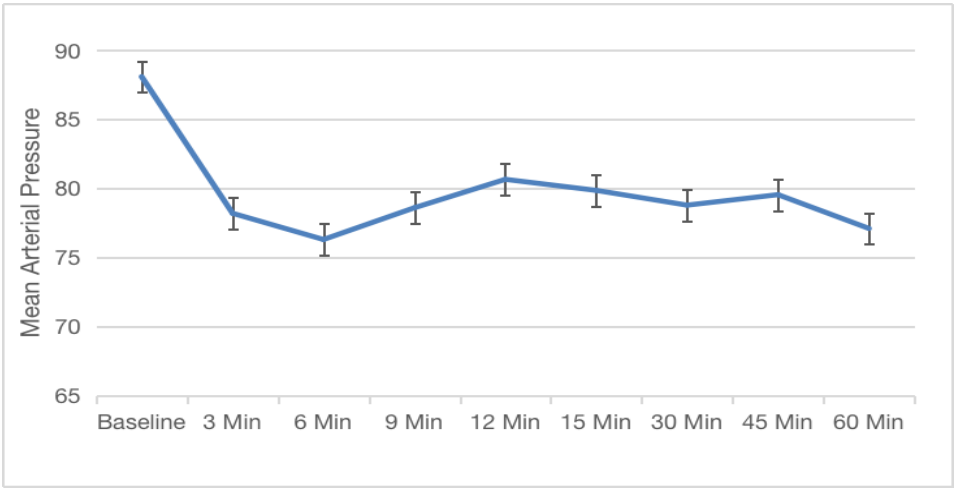


It was observed that at baseline mean DBP was 70.87 and SD of 6.302, and minimum was 60 and maximum was 86, but after spinal it was decreased to in the interval of mean SBP of 59.68 to 70.54 and difference from baseline to at different intervals of time were statistically highly significant(p-value<0.01), as shown in above table.

Table 8: Mean distribution Mean arterial Pressure at different time interval.

Time Interval	Mean Arterial Pressure				F-value	p-value
	Mean	Std. Deviation	Minimum	Maximum		
Baseline	92.44	0.883	91	94	598.14	<0.001
3 Min	85.79	1.116	84	88		
6 Min	79.51	2.233	74	85		
9 Min	78.6	2.943	72	85		
12 Min	80.66	1.995	76	85		
15 Min	79.86	2.251	75	85		
30 Min	78.79	2.021	75	83		
45 Min	79.55	2.837	74	85		
60 Min	77.71	2.232	73	83		

Graph 7: Mean distribution Mean arterial Pressure at different time interval.



It was observed that at baseline mean MAP was 88.1 and SD of 0.883, and minimum was 78 and maximum was 90, but after spinal it was decreased to in the interval of mean SBP of 78.2 to 77.1 and difference from baseline to at different intervals of time were statistically highly significant,(p-value<0.01).

Table 9 : Distribution of Hypotension among study population

Hypotension	Frequency	Percent
Yes	88	62.9
No	52	37.1
Total	140	100

From the systolic blood pressure, it was observed that, among 62.9% of the patients observed with hypotension, with different number of episodes as shown in above table.

Graph 8 : Distribution of Hypotension among study population

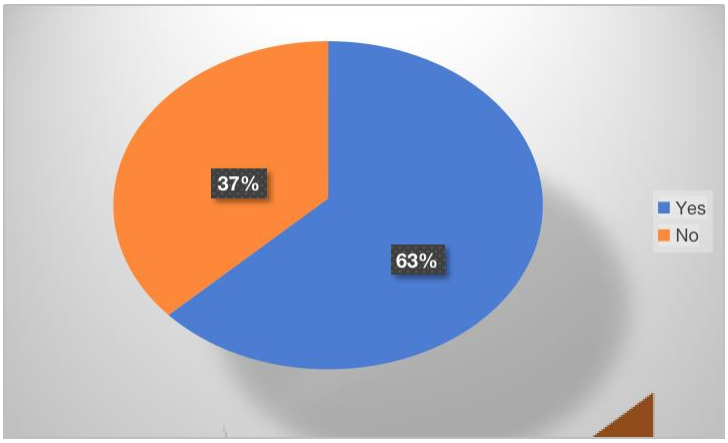


Table 10 : Distribution of Number of Episode of Hypotension

Episodes of Hypotension	Frequency	Percent
0	52	37.1
1	39	27.9
2	36	25.7
3	10	7.1
4	3	2.1
Total	140	100

It was observed that, there were 27.9% of the patients were with one episode of hypotension, followed by 2 episode, 3 episode and 4 episode as shown in above figure.

Graph 9 : Distribution of Number of Episode of Hypotension

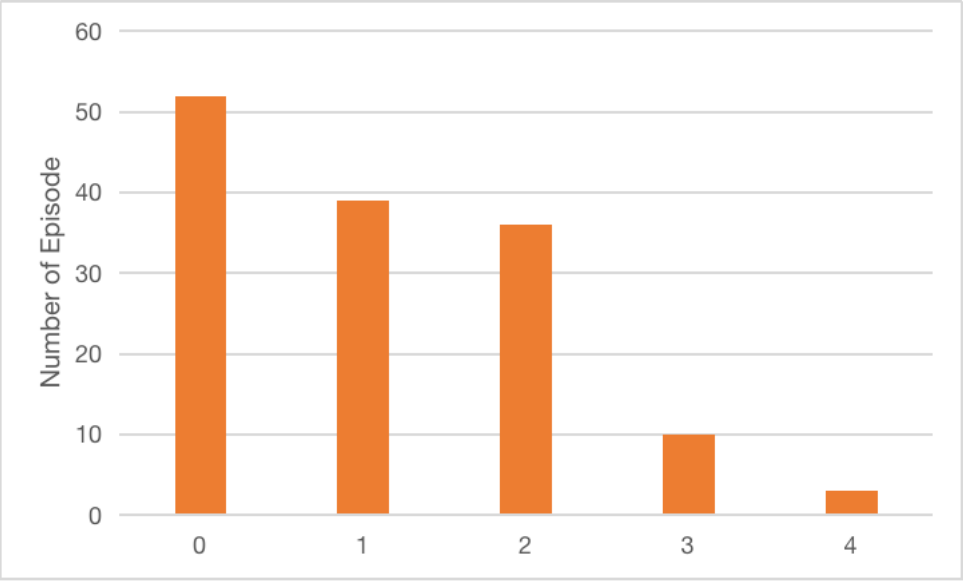


Table 11 : ROC curve to find cut-off value of PI to predict hypotension

ROC Curve	**Values**
AUC	0.832
Std Error	0.41
P-value	<0.0001
95% CI	
Lower Bound	0.748
Upper Bound	0.899
Sensitivity	88.6
Specificity	69.2
Cut-off Value	3.8

It was observed that, area under curve for PI to predict hypotension was 0.821, with p-value<0.001, with sensitivity of 88.6% and specificity of 69.2% and cut-off value in our study was found to 3.8.

Graph 10 : ROC curve to find cut-off value of PI to predict hypotension

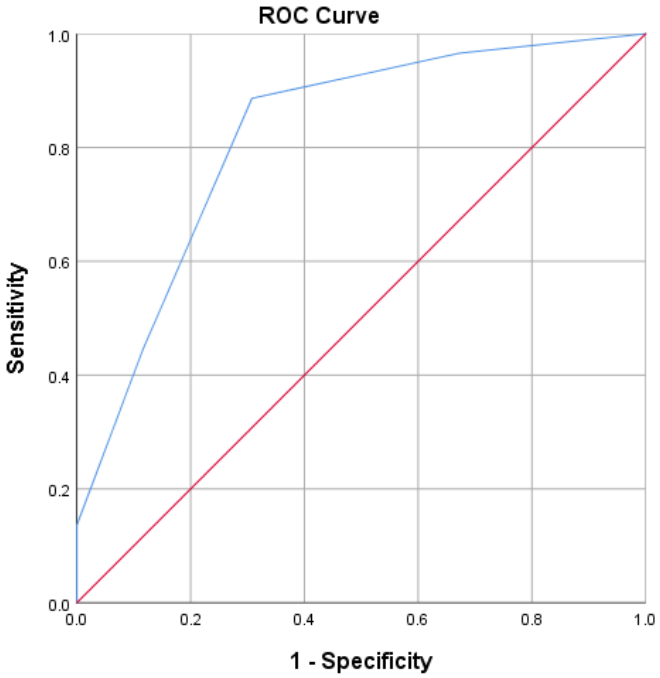


Table 12 : Association between hypotension and PI

Hypotension	PI Interval			Chi-square	P-value
	≥3.8	≤3.8	Total		
Yes	52(78.80%)	29(39.20%)	81(57.90%)	22.43	<0.001
No	14(21.20%)	45(60.80%)	59(42.10%)		
Total	66(100%)	74(100%)	140(100%)		

Association between hypotension and perfusion index were statistically significant.Of the 140 patients, 66 were with PI > 3.8 out of which 52 patients had hypotensive episodes. 29 out of 74 patients in whom PI was less than or equal to 3.8 also had hypotensive episodes as shown in above table.

Graph 11 : Association between hypotension and PI

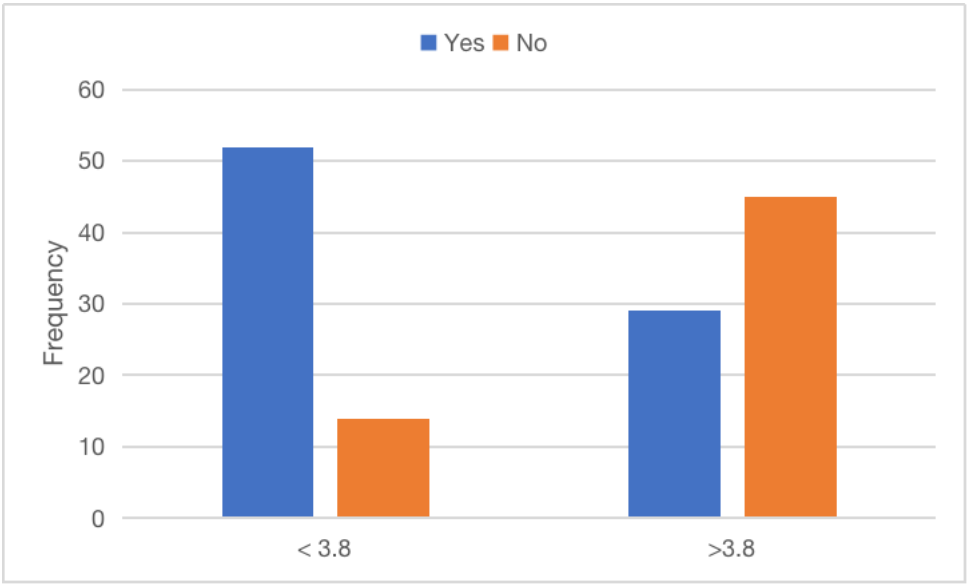


Table 13 : Association between Hypotension episode and Baseline PI

Hypotension Episode	Baseline PI		Chi-square	P-value
	≤3.8	≥3.8		
0	36(48.60%)	16(24.20%)	18.94	<0.001
1	24(32.40%)	15(22.70%)		
2	11(14.90%)	25(37.90%)		
3	3(4.10%)	7(10.60%)		
4	0(0%)	3(4.50%)		
Total	74(100%)	66(100%)		

Among all major number of episode were 1 and 2 among patients with PI >3.8, maximum number of episode were 2 followed by 1, 3 and 4 and this association between number of hypotension episode and baseline PI was statistically highly significant as shown in above table.

Graph 12: Association between Hypotension episode and Baseline PI

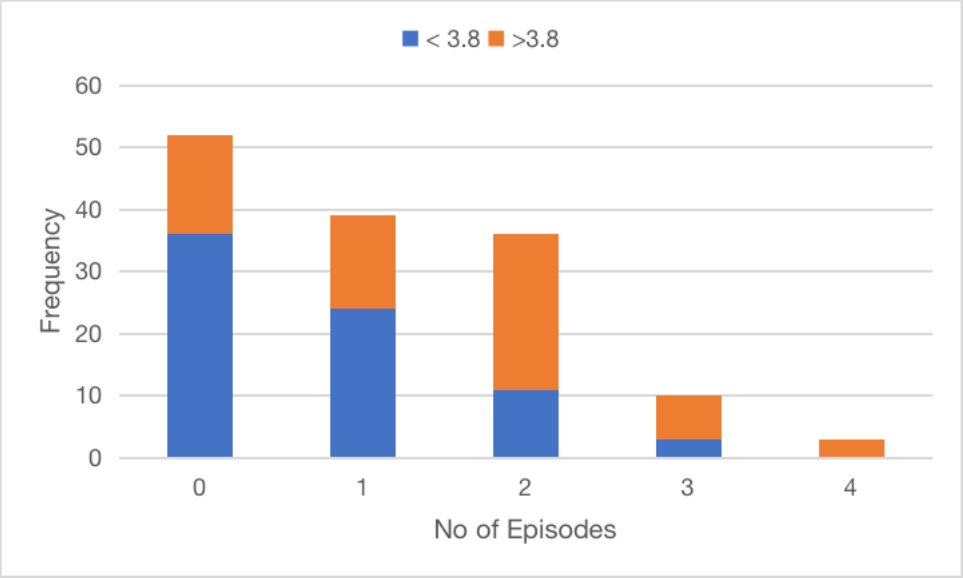
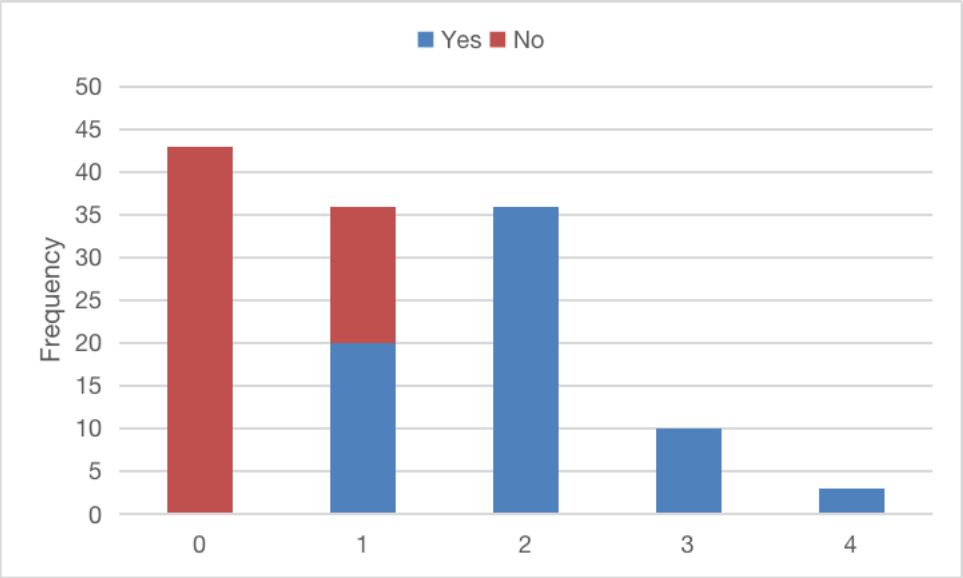


Table 14.1 : Association between Hypotension episode and Use of Ephedrine

Hypotension Episode	Ephedrine		Chi-square	P-value
	Yes	No		
0	0(0%)	43(72.90%)	21.35	<0.001
1	23(28.40%)	16(27.10%)		
2	36(44.40%)	0(0%)		

3	10(12.30%)	0(0%)		
4	3(3.70%)	0(0%)		

Graph13.1 : Association between Hypotension episode and Use of Ephedrine



It was observed that, patient with episode 2 and 1 ephedrine was used followed by in episodes 3 and 4. This association between hypotension episode and use of Ephedrine were statistically significant as shown in above table.

Table14. 2 : Mean Dose of Ephedrine required and fluid required in ml.

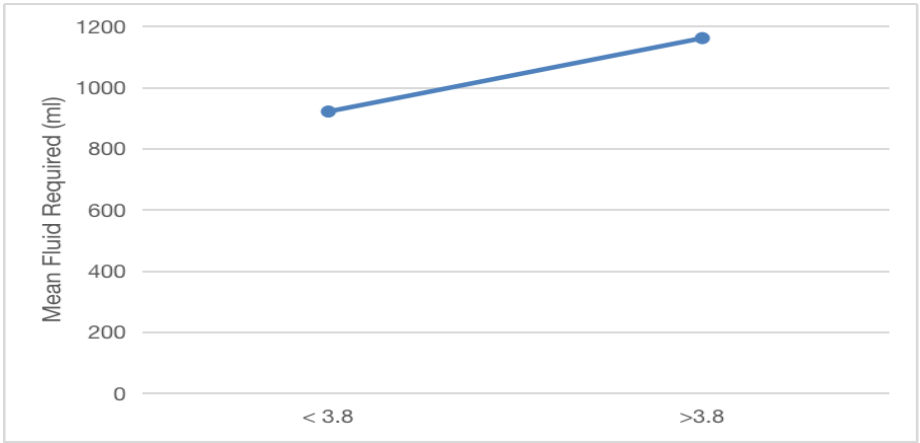
Dose of Ephedrine in mg	PI		t-test	P-value
	≤ 3.8	≥3.8		

Mean	0	6.5	42.22	<0.001
SD	0	1.3		

Mean dosage of ephedrine usage in patients with PI≤3.8 was 0mg ang 6 mg in patients with PI≥3.8.

Fluid Requirement in ml	PI		t-test	P-value
	≤3.8	≥3.8		
Mean	921.21	1161.34	240.13	<0.001
SD	121.63	364.21		

Graph 13.2:**Fluid required in ml.**



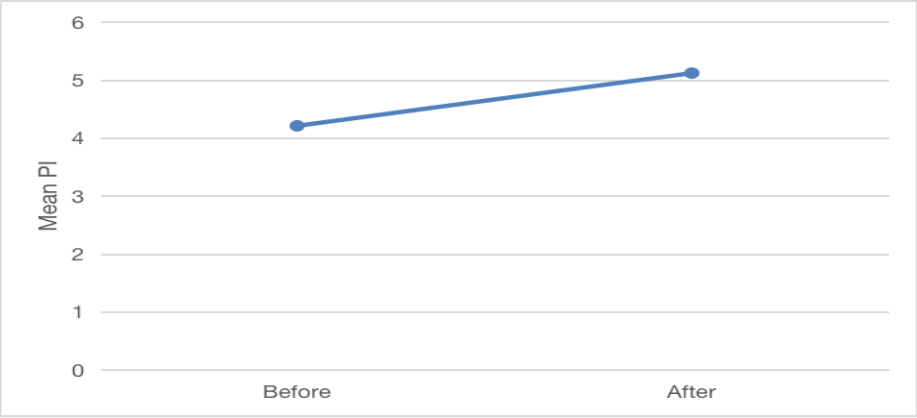
The amount of IV fluids required in patients with PI ≤3.8 was lower than in patients with PI≥3.8.

We found highly significant correlation between baseline PI,total dose of ephedrine used and total fluids used.

Table 15: Perfusion Index before and after giving oxytocin

Perfusion Index	Interval		t-test	P-value
	Before	After		
Mean	4.21	5.12	3.73	0.0004
SD	0.56	2.4		

Graph 14: Perfusion Index before and after giving oxytocin



We observed that there was significant corelation between oxytocin and perfusion index.

Discussion

Pregnancy is characterized by increased metabolic demands. Cardiovascular changes are particularly significant because they interact with the effects of central neuraxial blockade. Hormonal influences lead to peripheral vasodilation, resulting in reduced systemic vascular resistance[41] .The enlarged uterus during pregnancy poses a risk of compressing the vena cava, which decreases venous return and cardiac output as the pregnancy progresses[42]. Despite these variations, spinal anaesthesia remains the preferred method for lower segment cesarean section (LSCS). Significant hypotension results from the sympathetic blockade brought on by spinal anaesthesia, which accentuates the decrease in venous return and systemic vascular resistance. Additionally, adrenergic downregulation during pregnancy increases the demand for vasopressors.[43].

Two light sources, 660 nm and 940 nm in wavelength, which are emitted via the vascular bed of the skin on the finger or earlobe, are essential to the SpO2 measurement theory. There is a pulsatile component to the absorbance at these wavelengths, which indicates variations in the arterial blood volume between the light source and the detector. The venous compartment, bone, and connective tissue are the sources of the non-pulsatile component. ‘ The

perfusion index is the ratio of the pulsatile (arterial) component to the non-pulsatile component of the light reaching the detector'.

A healthy pregnancy is characterized by a decrease in systemic vascular resistance, increased total blood volume, and cardiac output.[43] Ginosar et al. demonstrated that an increase in PI following epidural anaesthesia was a clear and reliable indicator of sympathectomy[44].

Pulse oximetry is one the American Society of Anesthesiologists (ASA) basic monitors and is used for all the cases.Because vasodilatation causes an increase in the pulsatile component, this decrease in tone will correlate with greater perfusion index values. Further reduction in peripheral vascular tone, increased pooling, and hypotension will result after the induction of sympathectomy under spinal anaesthesia irrespective of the type of anaesthesia. Recently, plethysmographic waveform variations have been utilized to detect fluid responsiveness, nociception, the success of regional blocks, and the peripheral perfusion of patients. The perfusion index (PI) offers critical information for predicting hypotension following spinal anaesthesia by analyzing the variations in the calculated plethysmographic waveform values. In the study we have used the perfusion index (PI), a non-invasive tool for predicting hypotension. Previous research has explored its use not only following spinal anaesthesia but also in critical care and severe sepsis patients. Mowafi et al.[44] used PI to detect intravascular injection of epinephrine during epidural test doses, finding it to be a reliable indicator. Similarly, Ginosar et al.[45] demonstrated that PI is an earlier and more sensitive marker of epidural-induced sympathectomy compared to mean arterial pressure (MAP). Kupeli et al.[46] found that PI increased as pain decreased during labor analgesia due to sympathetic blockade and subsequent increased blood flow and perfusion. Klodell et al.[47] successfully showed that PI could effectively detect intraoperative thoracic sympathetic blockade. Toyoma et al.[48] conducted the first study on predicting hypotension with PI in lower

segment cesarean section (LSCS), finding a positive correlation between decreased arterial blood pressure during spinal anesthesia and baseline PI. Their study's ROC curve identified a cutoff value of 3.5 for baseline PI, above which the risk of hypotension increased.

In the present study we have included 140 patients, to evaluate the baseline perfusion index as a predictor of hypotension in parturients undergoing elective LSCS under spinal anaesthesia. Bassline parameters age, majority of the patients were form the age group of 20-30 years, also majority of the patients were with Gravida 1, Parity 2, majority of the patients were with gestational age of 37 weeks. Mean age of the all patient was 26.02 years, mean weight was 60.68 kg, mean height was 155.98 kg and mean gestational age was 36.94 weeks.

Present study showed that, baseline mean PI was 2.77 and SD of 0.989, but after spinal it was reduced to in the interval of mean PI of 2.77 to 3.9 and difference from baseline to at different intervals of time were statistically highly significant(p value<0.001).In the present study from the systolic blood pressure, it was observed that 62.9% of the patients observed with hypotension, with different number of episodes, there were 27.9% of the patients were with one episode of hypotension, followed by 2 episode, 3 episode and 4 episode. ROC cure showed area under curve for PI to predict hypotension was 0.821, with p-value<0.001, with sensitivity of 88.6% and specificity of 69.2% and cut-off value in our study was found to be 3.8. Also mean SBP was 125.75 and SD of 9.016, and minimum was 100 and maximum was 135, but after spinal it was decreased to in the interval of mean SBP of 105.87 to 115.32 and difference from baseline to at different intervals of time were statistically highly significant. Mean MAP was 88.1 and SD of 0.883, and minimum was 88 and maximum was 90, but after spinal it was decreased to in the interval of mean SBP of 77.71 to 85.79 and difference from baseline to at different intervals of

time were statistically highly significant.Association between hypotension episodes and PI interval was statistically highly significant. In above table it showed that, of 66 patients with PI more than 3.8 53% of the patients were with number of hypotension episode 2 to 4 and among patients with PI ≤3.8 out of 74 patients 92% of the patients had 0 to 2 episode of hypotension.In the present study, patient with episode 2 and 1 ephedrine was used followed by in episodes 3 and 4. This association between hypotension episode and use of Ephedrine were statistically significant. Also we have observed there is positive correlation between hypotensive episodes and total dose of ephedrine used(r=0.71, p-value<0.001)and total IV fluids used . A higher requirement of vasopressor was seen in parturient with baseline PI>3.8.

In the study by **Zainab M. Attia et al** observed that, MAP decreased significantly all times after spinal anaesthesia compared to pre spinal. Also, MAP showed decrease from first till fifth readings then started to increase again. Present results were in competence with Toyama et al. [48] who reported a marked decreases in MAP after spinal injection in parturient with both high and low baseline PI.

In the study conducted by **Jabarulla, et al** plotted ROC curve to find out cut-off value of baseline PI and it was observed to be 1.7 with the sensitivity of 75% and specificity of 71% and it was statistically significant (p-value=0.006).

A study by **Duggappa et al.** divided participants into two groups based on a baseline PI of 3.5. ‘With an area under the curve value of 0.848, the study found a positive correlation between baseline PI and the development of hypotension, showing a sensitivity of 69.84% and a specificity of 89.29%. And observed that there were 57 patients were with PI less than or equal to 3.5 among them 51 patients were with no episode or 0 episodes of hypotension while 4, 1, 1, and 0 patients were with 1, 2, 3, and 4 episodes of hypotension respectively also there were 63 patients were with PI more than 3.5, among

them 18 were with no episode of hypotension while remaining 45 were with different number of hypotensive episodes (24, 16, 4, and 1 patients were with 1, 2, 3, and 4 episodes of hypotension respectively). In the same study on Spearman's rank correlation they found highly significant correlation between baseline PI >3.8 and number of episodes of hypotension ($r= 0.416$, $P < 0.001$), these results are similar to our study. In Group I (PI<3.5), the median ephedrine usage was 0 mg (IQR 0–0 mg), while in Group II (PI>3.5), it was 6 mg (IQR 6–12 mg) ($P < 0.001$). Group I required less IV fluids than Group II ($P < 0.001$). They also discovered that the total IV fluids used ($r = 0.249$, $P = 0.019$) and the total dose of ephedrine used (rs 0.567, $P < 0.001$) were different.

Similarly, **George et al**. also found a significant correlation between PI and the decrease in systemic arterial pressure, identifying a baseline PI of 3.6 as their cutoff, with a sensitivity of 80% and specificity of 60%'. Varghese et al[50] conducted a comparable study, confirming the positive correlation with an area under the curve of 0.911, using a baseline PI of 3.5, which had a sensitivity of 86.6% and specificity of 93.33%. A more recent study by Mallawaarachchi et al.[51] correlated the trend in PI with the degree of hypotension, finding a significant relationship between increasing PI values and the incidence of hypotension, and concluded that the response to vasopressors could be quickly assessed using this value.

Harde, et al observed that in the PI >3.5 group, 46 (97.9%) women had hypotension and the relation between baseline PI and development of hypotension was statistically significant. In their study they have explained that pregnancy is associated with increased total blood volume and a decrease in systemic vascular resistance resulting in reduced vascular tone, which corresponds to an increase in pulsatile component and higher PI values.[52] Sympathetic blockade after spinal anaesthesia (SA) leads to a further decrease in peripheral vascular tone, increased venous pooling, and hypotension.

Therefore, parturients with a high baseline perfusion index (PI > 3.5) are at greater risk of experiencing severe hypotension following SA. A baseline PI > 3.5 can thus predict post-spinal hypotension, and for these patients, precautions such as IV fluids and prophylactic vasopressors should be considered. In the same study, the ROC curve demonstrated an AUC of 0.917 (95% CI 0.840–0.965), confirming baseline PI as an excellent predictor of hypotension with a threshold >2.9. Hence, a baseline PI >2.9 indicates a high likelihood of hypotension post-spinal anaesthesia. The study established a new cutoff for baseline PI >2.9, predicting post-spinal hypotension with a sensitivity of 83.08% and specificity of 96.06%. Thus, parturients with a baseline PI >2.9 have a high predisposition for post-spinal hypotension, and prophylactic measures should be considered to prevent it. They made use of IV fluids and vasopressors for the management of hypotension. IV fluid and vasopressors use was more in group with PI>3.5. Phenylephrine 50mcg IV boluses or ephedrine 6mg ,if associated with bradycardia , were the choice of vasopressors. Inspite of high requirement of IV fluid, vasopressor requirement was also high (61.7%) in the group with PI>3.5.

Study done by **Thapa et al** studied that, In Group I, 30 patients (23.62%) experienced low blood pressure, while in Group II, all 119 patients (100%) experienced hypotension. Within Group I, 22 patients (17.3%) had one episode of hypotension, 6 patients (4.7%) had two episodes, and 2 patients (1.6%) had three episodes. In Group II, 3 patients (2.5%) had one episode, 5 patients (4.2%) had two episodes, 8 patients (6.7%) had three episodes, 23 patients (19.3%) had four episodes, 17 patients (14.3%) had five episodes, 28 patients (23.5%) had six episodes, 17 patients (14.3%) had seven episodes, 13 patients (10.9%) had eight episodes, 1 patient (0.8%) had nine episodes, 3 patients (2.5%) had ten episodes, and 1 patient (0.8%) had eleven episodes.

Also in our study we have found there is positive correlation (r=0.42, p-value<0.001) PI >3.8 and number of episodes and this correlation between them found statistically significant. In the same study by Thapa et al observed that the correlation between baseline PI >3.5 and number of episodes of hypotension was highly significant (r = 0.78 p< 0.01). They have observed that, median mephentermine used in Group I was 0 mg (IQR, min-max: 0-0mg, 0-15mg). In Group II it was 30 mg (IQR, min-max: 20-35 mg, 5-55 mg). The administration of mephentermine was significantly less in Group I compared to Group II.

Summary and Conclusion

❖ Summary

- Majority of the patients were form the age group of 20-30 years.
- Majority of the patients were with Gravida 1
- Majority of the patients were with Parity 2
- Majority of the patients were of gestational age 37 weeks.
- Baseline mean PI was 2.77 and SD of 0.989, and minimum was 2 and maximum was 5 and its statistically significant intraoperatively (p-value<0.001)
- Baseline mean HR was 78.57 and SD of 1.007, and minimum was 77 and maximum was 96 and its statistically significant intraoperatively (p-value<0.001).

- Baseline mean SBP was 131.34 and SD of 2.035, and minimum was 128 and maximum was 135, its statistically significant intraoperatively (p-value<0.001).
- Baseline mean DBP was 70.87 and SD of 6.30, and minimum was 60 and maximum was 86, and its statistically significant intraoperatively (p-value<0.001).
- Baseline mean MAP was 88.1 and SD of 0.883, and minimum was 78 and maximum was 90, and its statistically significant intraoperatively (p-value<0.001).
- Among all 62.9% of the patients observed with hypotension.
- There were 27.9% of the patients were with one episode of hypotension, followed by 2 episode, 3 episode and 4 episode.
- Area under curve(AUC) for PI to predict hypotension was 0.821, with p-value<0.001, with sensitivity of 88.6% and specificity of 69.2% and cut-off value in our study was found to 3.8
- Association between hypotension and perfusion index were statistically significant(P-value<0.001)
- Association between hypotension episodes and PI interval was statistically highly significant(p-value<0.001)

❖ Conclusion

The perfusion index (PI) was observed to increase significantly and more rapidly in parturients experiencing significant hypotension, likely due to sympathetic blockade. The response to ephedrine can be quickly evaluated by changes in PI, aiding in the decision-making process for additional ephedrine doses. PI can serve as a predictor of hypotension in parturients undergoing caesarean section with spinal anaesthesia. Our study found that a baseline PI cut-off of 3.8 has higher predictability for hypotension risk within the first 10-12 minutes following spinal anaesthesia. Further research with PI measurements taken from the patients undier going cesarean section needed to assess the correlation between PI changes and changes in systolic blood pressure (SBP).

References

1.Bowyer L,Brown MA,Jones M:Forearm blood flow in pre-eclampsia.Int J Obstet Gynec.2003;110:383-391

2.Sakai K,Imaizumi T,<Maeda H,Nagata H,Tsukimori k,Takeshita A,Nakano H:Venous distensibility during pregnancy .Comparison between normal pregnancy and preeclampsia.Hypertension.1994,24:461-466

3.Ajne G,Ahborg G,Wolff K,Nisell H:Contribution of endogenous endothelin-1 to basal vascular tone during normal pregnancy and preeclampsia.Am J Obstet Gynecol.2005,193:234-240

4.Gaiser R.Physiological changes of pregnancy:In :Chestnut DH,editor.Chestnut's Obstetric Anesthesia:Principles and practice.5th ed.Philadelphia:Mosby Elsevier Publishing:2014.15-38

5.Park GE,Hauch MA,Curlin F,Dutta S,Bader AM.The effects of varying volumes of crytalloid administration before Cesarean delivery on maternal hemodynamics and colloid osmotic pressure.Anesth Analg 1996:83:299-303

6.Ginosar Y, Weiniger CF, Meroz Y, Kurz V, Bdolah-Abram T, Babchenko A, *et al.* Pulse oximeter perfusion index as an early indicator of sympathectomy after epidural anesthesia. Acta Anaesthesiol Scand 2009;53:1018-26.

7. Huang B, Sun K, Zhu Z, Zhou C, Wu Y, Zhang F et al. Oximetry-derived perfusion index as an early indicator of CT-guided thoracic sympathetic blockade in palmar hyperhidrosis. Clinical Radiology. 2013;68(12):1227-1232
8. Carpenter RL, Caplan RA, Brown DL, Stephenson C, Wu R. Incidence and risk factors for side effects of spinal anesthesia. *Anesthesiology*. 1992;76(6):906–916.
9. Hartmann B, Junger A, Klasen J, et al. The incidence and risk factors for hypotension after spinal anesthesia induction: an analysis with automated data collection. *Anesth Analg*. 2002;94(6):1521–1529,
10. Salinas FV, Sueda LA, Liu SS. Physiology of spinal anaesthesia and practical suggestions for successful spinal anaesthesia. *Best Pract Res Clin Anaesthesiol*. 2003;17(3):289–303.
11. The New York School of Regional Anesthesia (NYSORA) continuing medical education [Internet]. New York. [cited 2019 Feb 24] Spinal anesthesia; [about 111 KB]. Available from: https://www.nysora.com/techniques/neuraxial-and-perineuraxial-techniques/spinal-anesthesia/.
12. Corke BC, Datta S, Ostheimer GW, Weiss JB, Alper MH. Spinal anaesthesia for caesarean section. The influence of hypotension on neonatal outcome. *Anaesthesia*. 1982;37:658–62. 10.1111/j.1365-2044.1982.tb01278.x
13. Kennedy RL, Friedman DL, Katcka DM, Selmants S, Smith RN. Hypotension during obstetrical anesthesia. *Anesthesiology*. 1959;20:153–5. 10.1097/00000542-195903000-00001
14. Klöhr S, Roth R, Hofmann T, Rossaint R, Heesen M. Definitions of hypotension after spinal anaesthesia for caesarean section: literature search and application to parturients. *Acta Anaesthesiol Scand*. 2010;54:909–21. 10.1111/j.1399-6576.2010.02239.x
15. Burns SM, Cowan CM, Wilkes RG. Prevention and management of hypotension during spinal anaesthesia for elective Caesarean section: a survey of practice. *Anaesthesia*. 2001;56:794–8. 10.1046/j.1365-2044.2001.02058-5.x

16. Kestin IG. Spinal anaesthesia in obstetrics. *Br J Anaesth*. 1991;66:596–607. 10.1093/bja/66.5.596 [PubMed] [CrossRef] [Google Scholar]
17. Salinas FV, Sueda LA, Liu SS. Physiology of spinal anaesthesia and practical suggestions for successful spinal anaesthesia. *Best Pract Res Clin Anaesthesiol*. 2003;17(3):289–303. 10.1016/S1521-6896(02)00114-3 [PubMed] [CrossRef] [Google Scholar]
18. McClure JH, Brown DT, Wildsmith JA. Effect of injected volume and speed of injection on the spread of spinal anaesthesia with isobaric amethocaine. *Br J Anaesth*. 1982;54:917–20. 10.1093/bja/54.9.917 [PubMed] [CrossRef] [Google Scholar]
19. Neal JM. Hypotension and bradycardia during spinal anesthesia: Significance, prevention, and treatment. *Tech Reg Anesth Pain Manage*. 2000;4(4):148–54. 10.1053/trap.2000.20600 [CrossRef] [Google Scholar]
20. Lewinsky RM, Riskin-Mashiah S. Autonomic imbalance in preeclampsia: evidence for increased sympathetic tone in response to the supine-pressor test. *Obstet Gynecol*. 1998;91:935–9. 10.1097/00006250-199806000-00011 [PubMed] [CrossRef] [Google Scholar]
21. Kashihara K. Roles of Arterial Baroreceptor Reflex During Bezold-Jarisch Reflex. *Curr Cardiol Rev*. 2009;5(4):263–7. 10.2174/157340309789317805
22. Borgeat A, Ekatodramis G, Schenker CA. Postoperative nausea and vomiting in regional anesthesia. *Anesthesiology*. 2003;98:530–47. 10.1097/00000542-200302000-00036.
23. Hirose N, Kondo Y, Maeda T, Suzuki T, Yoshino A. Relationship between regional cerebral blood volume and oxygenation and blood pressure during spinal anesthesia in women undergoing cesarean section. *J Anesth*. 2016;30:603–9. 10.1007/s00540-016-2165-6
24. Ratra CK, Badola RP, Bhargava KP. A study of factors concerned in emesis during spinal anaesthesia. *Br J Anaesth*. 1972;44:1208–11. 10.1093/bja/44.11.1208

25. Hirose N, Kondo Y, Maeda T, Suzuki T, Yoshino A, Katayama Y. Oxygen supplementation is effective in attenuating maternal cerebral blood deoxygenation after spinal anesthesia for cesarean section. *Adv Exp Med Biol*. 2016;876:471–7. 10.1007/978-1-4939-3023-4_59.
26. Cooperman LH. Effects of anaesthetics on the splanchnic circulation. *Br J Anaesth*.
27. Simi. P. Babu, Ashwini. B, Balasandhiya. P,Preoperative baseline peripheral perfusion index as an early predictor of the incidence of hypotension following spinal anaesthesia in elective caesarean section. *Int J Acad Med Pharm* 2024; 6 (2); 346-349.
28. Harde MJ, Ranale PB, Fernandes S. Perfusion index to predict post spinal hypotension in lower segment caesarean section. J Anaesthesiol Clin Pharmacol 2024;40:37-42.
29. Zainab M. Attia, Essam F. Abdelgalel, Ramy M. Alsewe*, Naglaa Fathy Abdelhaleem, Perfusion Index and Positional Blood Pressure Changes as Preoperative Predictors for Post-Spinal Hypotension in Caesarean Section: An Observational Study., The Egyptian Journal of Hospital Medicine (January 2023) Vol. 90 (2), Page 3047-3052.
30. N Rajanalini, S ArulRajan, Deepa David, Perfusion Index as an Early Predictor of Hypotension during Spinal Anaesthesia for Cesarean Delivery, Journal of Cardiovascular Disease Research, 2023, VOL14,ISSUE01, Pp : 4067 – 4070
31. Manoj Kumar Soni, Mahipal Singh Dhaka, Siddharth Rathore, Hemant Singh Rajawat, Jitendra Yadav, Pankaj Garg, Perfusion Index A Probable Indicator of Hypotension following Propofol Induction: A Prospective Observational Study, International Journal of Pharmaceutical and Clinical Research 2023; 15(6); 506-514
32. Thapa, C., Bajracharya, G. R., Acharya, S., & Thakur, A. (2022). The Usefulness of Perfusion Index Derived from a Pulse Oximeter in Predicting

Hypotension following Spinal Anesthesia for Cesarean Section. *Nepal Medical College Journal*, *24*(4), 289–294. https://doi.org/10.3126/nmcj.v24i4.50579

33. M G N, Srinivasaiah M, Prabhat K S J, et al. (June 06, 2022) Peripheral Perfusion Index: A Predictor of Post-Spinal Hypotension in Caesarean Section. Cureus 14(6): e25699. DOI 10.7759/cureus.25699.
34. Kumar U, Tripathi A, Somvanshi M, Karasala V, Clinical evaluation of perfusion index (PI) as a predictor of post spinal hypotension in lower segment caesarean section (LSCS). ***Indian J Clin Anaesth*** 2022;9(4):445-449
35. Neepa Patel, Nikul K Joshi, Divyang Shah. Higher baseline perfusion index can predict hypotension in parturient undergoing elective lower segment caesarean section under spinal anaesthesia. MedPulse International Journal of Anesthesiology. March 2021; 17(3): 99-102.
36. Jabarulla R, Dhivya D, Kumar MS. To study the role of perfusion index as a predictor of hypotension during spinal anesthesia in lower segment cesarean section – A prospective observational study Anesth Essays Res 2021;15:263-7.
37. C. Yu, J. Gu, Z. Liao, S. Feng., Prediction of spinal anesthesia-induced hypotension during elective cesarean section: a systematic review of prospective observational studies., International Journal of Obstetric Anesthesia 47 (2021) 103175.
38. Pradhan AP, Sharma A, Shrestha AB, Gurung T, Shrestha S, Basnet U, et al. Prediction of hypotension using perfusion index following spinal anesthesia in lower segment caesarean section. Nep J Obstet Gynecol. 2020;15(31):67–72. DOI: https://doi. org/10.3126/njog.v15i2.32909.
39. Dr Joseph George et al, Role of Perfusion Index as a Predictor of Hypotension during Spinal Anaesthesia for Caesarean Section-A Prospective Study, March 2019 JMSCR Volume 07 Issue 03, Page 1208-1216.
40. Duggappa DR, Lokesh M, Dixit A, Paul R, Raghavendra Rao RS, Prabha P. Perfusion index as a predictor of hypotension following spinal anaesthesia in lower segment caesarean section. Indian J Anaesth 2017;61:649-54.

41. Bedson R, Riccoboni A. Physiology of pregnancy: Clinical anaesthetic implications. Contin Educ Anaesth Crit Care Pain 2014;14:69-72.
42. Bhatia P, Chhabra S. Physiological and anatomical changes of pregnancy: Implications for anaesthesia. Indian J naesth 2018;62:651-7. 9. Lanni SM, Tillinghast J, Silver HM. Hemodynamic changes and baroreflex gain in the supine hypotensive syndrome. Am J Obstet Gynecol 2002;187:1636-41.
43. Ajne G, Ahlborg G, Wolff K, Nisell H. Contribution of endogenous endothelin-1 to basal vascular tone during normal pregnancy and preeclampsia. Am J Obstet Gynecol 2005;193:234-40.
44. Mowafi HA, Ismail SA, Shafi MA, Al-Ghamdi AA. The efficacy of perfusion index as an indicator for intravascular injection of epinephrine-containing epidural test dose in propofol-anesthetized adults. Anesth Analg 2009;108:549-53.
45. Ginosar Y, Weiniger CF, Meroz Y, Kurz V, Bdolah-Abram T, Babchenko A, *et al.* Pulse oximeter perfusion index as an early indicator of sympathectomy after epidural anesthesia. Acta Anaesthesiol Scand 2009;53:1018-26.
46. Kupeli I, Kulhan NG. Can perfusion index be used as an objective tool for pain assessment in labor analgesia? Pak J Med Sci 2018;34:1262-6.
47. Klodell CT, Lobato EB, Willert JL, Gravenstein N. Oximetry-derived perfusion index for intraoperative identification of successful thoracic sympathectomy. Ann Thorac Surg 2005;80:467-70.
48. Toyama S, Kakumoto M, Morioka M, Matsuoka K, Omatsu H, Tagaito Y, *et al*. Perfusion index derived from a pulse oximeter can predict the incidence of hypotension during spinal anaesthesia for Caesarean delivery. Br J Anaesth 2013;111:235-41.
49. George J, Valiaveedan SV, Thomas MT. Role of perfusion index as a predictor of hypotension during spinal anaesthesia for caesarean section – A prospective study. J Med Sci Clin Res 2019;07:1208-16.

50. Varghese RV. Perfusion index assessed from a pulse oximeter as a predictor of hypotension during spinal anaesthesia for caesarean section. J Med Sci Clin Res 2018;06:427-31.

51. Mallawaarachchi RP, Pinto V, De Silva PH. Perfusion index as an early predictor of hypotension following spinal anesthesia for cesarean section. J Obstet Anaesth Crit Care 2020;10:38-41.

52. Ajne G, Ahlborg G, Wolff K, Nisell H. Contribution of endogenous endothelin-1 to basal vascular tone during normal pregnancy and preeclampsia. Am J ObstetGynecol 2005;193:234-40.

53. Gropper MA, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, Leslie K, editors. Miller's anesthesia, 2-volume set E-book. Elsevier Health Sciences; 2019 Oct 7.

54. Ellis H, Lawson A. Anatomy for anaesthetists. John Wiley & Sons; 2013 Sep 30.

ANNEXURE- 1

ETHICAL CLEARANCE CERTIFICATE

BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956
Accredited with 'A' Grade by NAAC (Cycle-2)
The Constituent College
SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA

BLDE (DU)/IEC/ 776/2022-23 30/8/2022

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this University met on **Friday, 26th August, 2022 at 3.30 p.m. in the Department of Pharmacology** scrutinizes the Synopsis of Post Graduate Student of BLDE (DU)'s Shri B.M.Patil Medical College Hospital & Research Centre from ethical clearance point of view. After scrutiny, the following original/ corrected and revised version synopsis of the thesis/ research projects has been accorded ethical clearance.

TITLE: "Perfusion index as an early predictor of Postspinal hypotension in elective lower Segment cesarean section".

NAME OF THE STUDENT/PRINCIPAL INVESTIGATOR: Dr.Akshata M

NAME OF THE GUIDE: Dr.Nirmaladevi, **Dept. of Anaesthesiology**

Dr. Santoshkumar Jeevangi
Chairperson
IEC, BLDE (DU),
VIJAYAPURA.

Chairman
Institutional Ethical Committee
BLDE (Deemed to be University)
Vijayapura

Dr.Akram A. Naikwadi
Member Secretary
MEMBER SECRETARY
Institutional Ethics Committee
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

Following documents were placed before Ethical Committee for Scrutinization.

- Copy of Synopsis/Research Projects
- Copy of inform consent form
- Any other relevant document

Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
BLDE (DU): Phone: +918352-262770, Fax: +918352-263303, Website: www.bldedu.ac.in, E-mail:office@bldedu.ac.in
College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

ANNEXURE –II

SAMPLE INFORMED CONSENT FORM:

B.L.D.E.U.(DEEMED TO BE UNIVERSITY) SHRI B M PATIL
VIJAYAPURA - 586103, KARNATAKA

TITLE OF THE PROJECT: PERFUSION INDEX AS AN EARLY PREDICTOR OF POSTSPINAL HYPOTENSION IN LOWER ELECTIVE SEGMENT CESAREAN SECTION**.**

PRINCIPAL INVESTIGATOR: Dr. AKSHATA .M

Department of Anesthesiology

BLDE University's Shri B M Patil Medical

College and Research Center,

Solapur Road ,Vijayapura

Email: akshathamustur@gmail.com

PG GUIDE: Dr. K NIRMALA DEVI

M.D.ANESTHESIOGY

Associate Professor

Department of Anesthesiology

BLDE(Deemed to be university)

Shri B M Patil Medical College and

Research Centre,

Solapur road , Vijayapura-586103

PURPOSE OF RESEARCH:

I have been informed that this study is a synopsis of:" Perfusion index as an early predictor of post spinal hypotension in lower elective segment cesarean section."

I have been explained about the reason for doing this study and selecting me/my ward as a subject for this study. I have also been given free choice of either being included or not in the study.

PROCEDURE:

I understand that I will be participating in the study "Perfusion index as an early predictor of post spinal hypotension in elective lower segment cesarean section." A prospective observational study.

RISKS AND DISCOMFORTS:

I understand that my ward may experience some discomfort during the procedure, and I understand that necessary measures will be taken to reduce them.

BENEFITS:

I understand that my ward participating in this study will help in the "early predictor of post spinal hypotension in elective lower segment cesarean section." A prospective double blind observational study.

CONFIDENTIALITY:

I understand that medical information produced by this study will become a part of this hospital record and will be subjected to the confidentiality and privacy regulation of this hospital. If the data are used for publication in the medical literature or teaching purposes, no names will be used and other identities such as photographs and audio and videotapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. Dr. AKSHATA M is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study or later I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me. And that a copy of this consent form will be given to me to keep for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary, and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I also understand Dr. AKSHATA.M will terminate my participation in this study at any time after she has explained the reason for doing so and has helped arrange for my continued care by my own physician or therapist if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely events of injury to me/my ward, resulting directly due to my participation in this study, such injury will be reported promptly, and then medical treatment would be available to me, but no further compensation will be provided. I understand that by my agreement to participate in this study, I am not waiving my legal right. I have explained the purpose of this research, the procedure required, and the possible risk

and benefits to the best of my ability in patients, own language.

DATE:

Dr. AKSHATA. M(investigator)

PATIENT/PARENT SIGNATURE

Witness

STUDY SUBJECT CONSENT STATEMENT:

I confirm that Dr. AKSHATA.M has explained to me the purpose of this research, the study procedure that I will undergo, and the possible discomforts and benefits that I may experience in my own language. I have been explained all the above in detail in my own language and I understand the same.

Therefore, I agree to give my consent to participate as a subject in this research project.

_____ _____

(Participant) (Date)

_____ _____

(Witness to above signature) (Date)

ANNEXURE –III

SCHEME OF CASE TAKING

PROFORMA:

STUDY: PERFUSION INDEX AS AN EARLY PREDICTOR OF POSTSPINAL HYPOTENSION IN ELECTIVE LOWER SEGMENT CESAREAN SECTION

1. Patient Details:

Name:

Age:

Sex:

Height:

Weight:

Ward:

Diagnosis:

2. Type of surgery

Indication:

3.Significant history:

4. General physical examination:

Pallor

Icterus

Cyanosis

Clubbing

Lymphadenopathy

Edema

5. **Vital parameters:**

Pulse

Blood pressure

Respiratory rate

Temperature

6. Systemic Examination:

CVS

RS

CNS

PA

7. Airway assessment:

Mallampatti grade

Mouth opening

Cervical spine

ASA grading

8. Investigations:

Haemoglobin:

TLC:

Platelet count:

Urine routine:

HIV:

HbsAg:

Parameters:

INTRAOPERATIVE PARAMETERS	SYSTOLIC BP	DIASTOLIC BP	MEAN ARTERIAL PRESSURE	SPO2	PERFUSIINDEX

	BEFORE GIVING EPHEDRINE	AFTER GIVING EPHEDRINE
SBP		
DBP		
HR		
PI		

	PI
before giving oxytocin	
after giving oxytocin	

MASTER CHART

Sr.No	Name	Age	Weigh	Heigh	tion	ravid	Parit	PI											Heart Rate																			Diastolic Blood Pressure										Mean Arterial Pressure										Oxygen Saturation									potens	Episo
								aseli	3 Min	6 Min	9 Min	12 M	15 M	30 M	45 M	60 M	ing	ing e	asel	3 Min	6 Min	9 Min	12 Mi	15 Mi	30 Mi	45 Mi	60 Min	inge	3 Min	6 Min	9 Min	12 Min	15 Min	30 Min	45 Min	60 Min	ing e	Baseline	3 Min	6 Min	9 Min	12 Min	15 Min	30 Min	45 Mn	60 Min	ing e	asel	3 Min	6 Min	9 Min	12 Min	15 Min	30 Min	45 Min	60 Min	ing e	Baseline	3 Min	6 Min	9 Min	12 Min	15 Min	30 Min	45 Min	60 Min		
1	Preethi	20	60	156	38	2	2	4	3	3	4	2	2	5	5	2	4	4	78	80	93	96	85	95	89	87	89	94	109	112	114	108	117	112	116	114	116	86	62	66	60	63	67	65	68	57	64	93	86	81	78	78	84	81	84	76	81	99	99	99	99	100	99	99	99	99	2	0
2	Sapna	35	62	156	40	1	3	2	4	4	3	5	6	2	6	4	4	4	77	77	87	88	88	85	85	93	95	94	100	108	106	113	106	114	116	117	115	68	64	63	64	65	60	62	68	63	66	92	88	78	78	81	75	79	84	81	82	100	99	100	99	99	99	99	99	100	1	2
3	Swetha	21	57	157	37	2	1	2	3	5	5	2	3	4	5	2	2	3	80	80	86	95	87	90	92	95	82	87	110	112	118	106	111	112	112	111	116	86	60	66	60	66	63	67	68	56	65	91	84	81	79	79	79	82	83	74	82	99	100	99	99	99	99	98	99	100	1	1
4	Rajeshwar	23	58	156	40	1	2	4	2	2	6	5	2	4	2	6	6	3	79	81	90	91	86	92	94	92	85	83	120	105	108	117	107	115	114	119	112	70	68	59	65	63	62	63	62	56	66	92	86	74	79	81	77	80	79	77	81	98	99	99	100	100	99	100	98	99	1	2
5	Jyoti	29	56	155	39	2	2	4	5	4	3	6	2	3	2	2	5	3	78	81	93	84	91	84	93	92	82	92	102	114	115	115	113	107	113	109	117	62	60	62	66	63	65	66	56	55	58	92	87	79	82	80	81	80	75	73	78	98	99	100	98	98	99	99	98	100	1	1
6	Prema	32	67	156	36	1	1	3	2	3	5	5	2	5	2	4	4	3	78	78	84	96	88	90	93	95	90	87	98	98	110	112	107	108	115	112	116	62	58	63	65	67	66	61	58	64	56	93	86	78	78	82	80	77	77	80	76	99	100	99	100	99	99	100	98	99	1	3
7	Priyanka	33	66	156	37	1	1	5	4	4	2	6	5	5	4	4	4	4	80	80	91	83	89	91	86	93	86	83	110	110	106	116	111	115	116	118	114	70	60	66	68	66	69	62	61	61	61	91	87	81	81	83	83	80	79	80	79	99	99	100	100	99	100	99	99	99	1	1
8	Reshma	32	62	157	37	1	2	4	4	5	2	6	4	4	3	5	3	3	78	79	82	92	85	86	82	89	95	86	100	90	92	80	100	112	112	118	113	60	64	62	63	66	69	64	63	61	65	91	85	78	79	80	85	81	81	80	81	99	99	100	98	100	99	100	98	100	2	0
9	Yallawa	28	58	156	37	2	3	5	2	5	3	3	2	5	4	4	6	6	78	79	93	85	84	90	84	89	89	92	114	106	107	108	109	110	115	108	118	70	64	63	66	66	67	62	64	58	61	94	84	77	80	80	81	78	81	75	80	98	99	99	99	100	99	100	100	98	1	2
10	Suznani	30	59	156	37	2	2	3	4	2	5	4	2	4	3	6	3	5	78	80	83	88	83	93	92	84	96	91	104	108	108	107	110	113	116	115	112	74	62	64	68	66	60	62	59	57	64	92	86	79	81	80	77	79	78	76	80	98	99	100	99	99	100	100	99	99	1	1
11	Shridevi	33	60	156	40	2	2	3	3	5	3	5	6	6	5	6	5	3	78	77	82	92	91	95	91	89	84	95	110	108	102	105	115	105	114	111	117	80	60	67	68	67	60	60	56	64	67	93	85	81	79	80	78	75	75	80	84	98	99	99	99	99	99	99	99	99	1	3
12	Pooja	31	57	157	39	2	3	2	3	5	4	6	5	4	4	5	3	6	80	79	89	93	90	90	94	87	84	89	98	110	109	106	115	112	117	109	117	66	58	67	63	68	68	63	67	64	61	92	85	81	78	81	84	79	84	79	80	100	99	100	98	98	99	99	98	98	1	1
13	Alfiya	27	65	156	38	1	1	4	3	4	4	6	6	2	4	3	4	2	80	80	96	89	85	86	90	89	91	84	106	116	115	111	106	105	114	117	117	70	64	62	59	63	68	65	62	55	61	93	84	80	78	79	81	78	79	76	80	99	99	100	99	100	99	100	99	98	1	2
14	Priyanka	31	61	157	37	1	2	2	4	2	2	5	5	3	2	3	5	4	80	81	95	90	88	95	91	87	88	84	117	107	101	106	116	112	115	118	113	70	68	66	63	63	61	59	66	62	65	93	85	80	76	77	79	77	82	81	81	100	99	100	98	99	100	99	99	100	1	3
15	Priya	29	56	157	39	1	1	3	2	5	2	4	5	4	5	5	2	6	79	77	88	95	95	84	95	95	89	93	110	113	108	107	109	112	116	110	112	62	60	65	65	63	66	63	58	56	68	92	87	81	79	78	80	79	77	74	83	100	99	100	100	100	100	98	99	100	1	1
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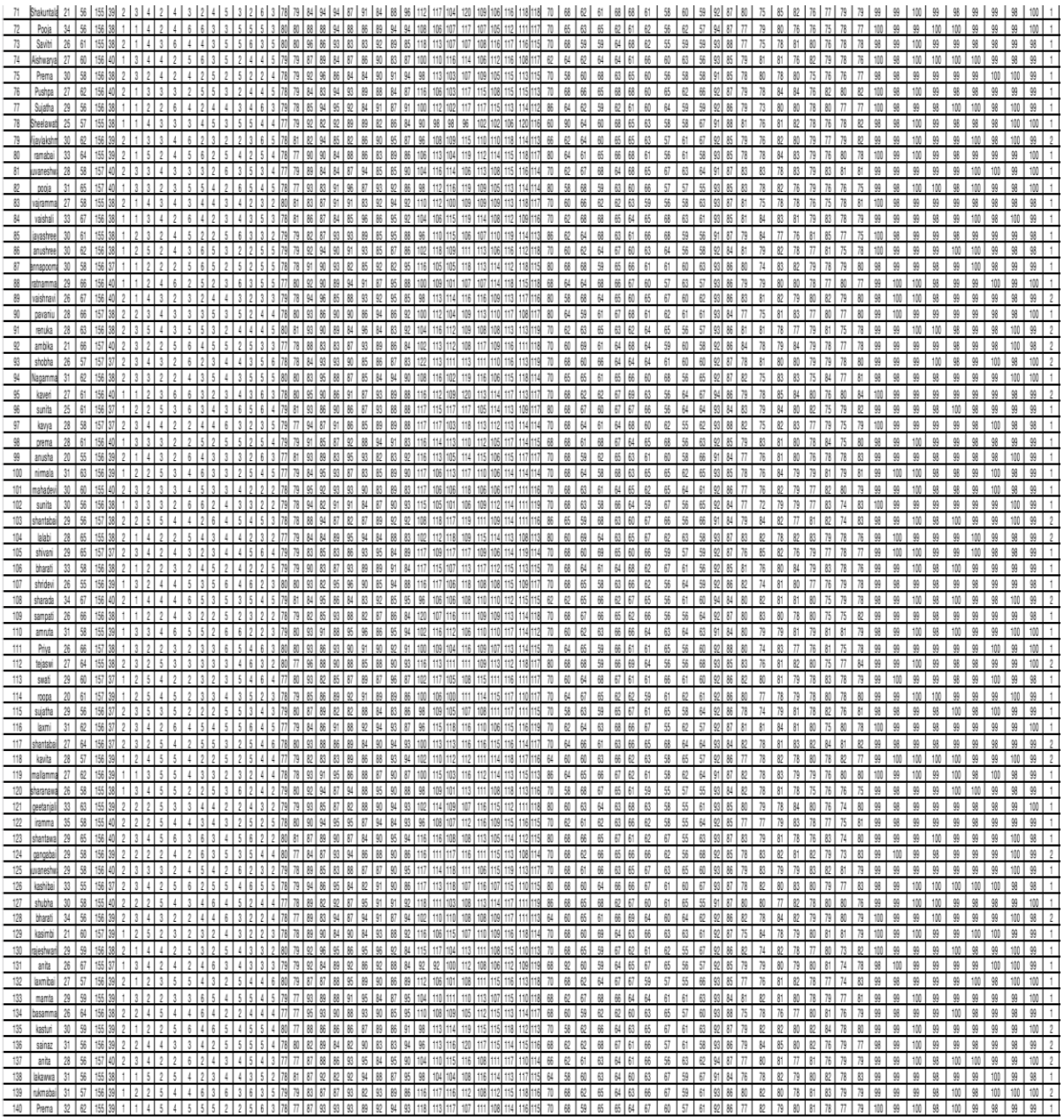

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