Prevention and Treatment of Hypotension during *Neuraxial* Block

Essay

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in Anesthesia

By

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بسم الله الرحمن الرحيم

"قالوا سبحانك لا علم لنا إلا ما
علمتنا إنك أنت العليم الحكيم"

صدق الله العظيم

سورة البقرة آية

(٣٢)

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CONTENTS

Chapter (3): Prevention and treatment of hypotension during neuraxial block

Chapter (4): Prevention and treatment of hypotention during neuraxial block in special situations

LIST OF ABBREVIATIONS

ACEI	: Angiotensine Converting Enzyme Inhibitor
AS	: Aortic Stenosis
ASA	: American Society of Anesthesiologist
ANP	: Atrial Natriuretic Peptide
BP	: Blood pressure
C	: Cervical Vertebra
CAD	: Coronary artery Disease
C.M	: Centimeter
C.AMP	: Cyclic Adenosine MonoPhosphate
CO	: Cardiac Output
CNS	: Central Nervous System
CPP	: Coronary Perfusion Pressure
CS	: Cesarean Section
CSE	: Combind Spinal Epidural
CSA	: Continous Spinal Anesthesia
CSF	: Cerebro Spinal Fluid
CPP	: Cerebral perfusion pressure
CVSE	: Cardiovascular Side Effects
ECG	: Electro Cardio Gram
H.F	: High Frequency
H.R	: Heart Rate

HRV : Heart Rate variability

IONV : Intra-Operative Nausea and Vomitting

IV : IntraVenous

IM : IntraMuscular

L : Lumber vertebrae

LA : Local Anesthetic

LV : Low frequency

LR : Lactated Ringer

MAP : Mean Arterial Pressure

NE : Norepinephrine

NR : Not Recommended

PNS : ParaSympathetic Nervous System

PTT : Pulse Transit time

SA : Spinal Anesthesia

SAP : Systemic Arterial Pressure

SIH : Spinal Induced Hypotention

SNS : Sympathetic Nervous System

SVR : Systemic Vascular Resistance

T : Thoracic vertebra

TEA : Thoracic Epidural Anesthesia

THT : Total Hypotension Time

TURP : Trans-urethral Resection Of Prostate

Wt : Weight

LIST OF FIGURES

LIST OF TABLES

LIST OF DIAGRAMS

Regional neuraxial anesthesia is an effective method of producing analgesia, anesthesia, and neuromuscular paralysis to provide excellent intraoperative surgical conditions and, if continued, effective postoperative analgesia. It involves the use of either an epidural or intrathecal injection of an anesthetic, an analgesic, or a combination of both. Each technique offers the option of either single dosing or a continuous infusion through a catheter placed at the time of needle insertion **(Douglas et al., 2002).**

Subarachnoid block is considered a safe regional anesthesia technique. This technique is widely used for both elective as well as emergency surgical procedures. It is a good anesthesia technique for surgeries like cesarean section, lower abdominal surgeries, lower limb orthopedic surgeries and urological procedures. Spinal anesthesia has several advantages like excellent surgical analgesia, inhibits stress response, post-operative analgesia, good skeletal muscle relaxation, airway instrumentation can be avoided, reduced chances of post-operative deep vein thrombosis and pulmonary embolism **(Jalandhara and Makwana, 2014)**.

Epidural anesthesia is one of the most versatile and extensively utilized regional anesthetic techniques. It is used not only for surgery, but also for obstetrics and trauma as well as acute, chronic, and cancer pain states **(Clemente and Carli, 2008).**

The cardiovascular changes are the most important physiological responses to central neuraxial blockade: spinal, epidural and combined spinal epidural anesthesia. These responses are related with the autonomic denervation and higher levels of neural blockade, and vagal nerve innervations. Usually, these hemodynamic effects could be considered as normal reactions to central neural blockade **(Cousins et al., 2009).**

Hypotension during central neuraxial block is mainly a result of decreased systemic vascular resistance after blockade of preganglionic sympathetic fibres as part of the autonomic nervous system **(Hanss et al., 2007).**

The incidence of hypotension is reported to occur from 5% to 81%. Hypotension is defined as the systolic blood pressure below 85–90 mmHg or a decrease from the baseline level by more than 30%. Higher incidence of hypotension and bradycardiais associated with the level of the block higher than T5 **(Salinas et al., 2003).**

The prevention and treatment of hypotension associated with spinal anesthesia for lower abdomen and lower limb surgeries remained different problem with no consensus as to the optimal mode of management **(Ramesh et al., 2014).**

However, severe hypotension may have significant outcomes in elderly patients with limited reserve, atherosclerosis and coronary artery disease **(Veering, 2006).**

Spinal anesthesia for cesarean sections has proved its popularity and has gradually replaced general anesthesia as it overcomes the common problems of general anesthesia such as difficult intubation, increased chance of gastric acid aspiration and fetal hypoxia **(Mc Keen et al., 2011).**

Total hypotension time (THT) was isolated as a factor significantly associated with morbidity and significantly prolonged hospital stay. Patients who had prolonged THT presented more complications, especially of the cardiovascular, pulmonary, and gastrointestinal systems. These complications led to delayed hospital discharge in a significant number of patients **(Tassoudis et al., 2011).**

Crystalloids or colloids are effective in attenuation and treatment of hypotension. The preload with 1–2 L of crystalloids is

effective, but it should be balanced against the disadvantages and dangers in the individual patient **(Hartmann et al., 2002).**

Vasopressors (Ephedrine, Phenylephrine) are used for treatment of hypotension and bradycardia. The bolus (5–10 mg) of ephedrine which acts indirectly and stimulates α, β1 and β2 receptors, or as a continuous infusion (50 mg/1000 ml of crystalloid) may be titrated to the desired effect. Phenylephrine produces direct stimulation of only α receptors. The intravenous dose is 50–100 μg. Epinephrine produces direct stimulation of more β than α receptors **(Cousins et al., 2009).**

I- Anatomy of spine:

The spine as a whole provides structural support for the body and protection for the spinal cord and nerves, and allows a degree of mobility in several spatial planes. The spine is composed of the vertebral bones and fibro-cartilaginous intervertebral disks. There are 7 cervical, 12 thoracic, and 5 lumbar vertebrae. The sacrum is a fusion of 5 sacral vertebrae, and there are small rudimentary coccygeal vertebrae. At each vertebral level, paired spinal nerves exit the central nervous system **(Bridwell and Boachie, 2003).**

The lumbar vertebrae have a large anterior cylindrical vertebral body. A hollow ring is defined anteriorly by the vertebral body, laterally by the pedicles and transverse processes, and posteriorly by the laminae and spinous processes **(Bridwell, 2005).**

The laminae extend between the transverse processes and the spinous processes and the pedicle extends between the vertebral body and the transverse processes. When stacked vertically, the hollow rings become the spinal canal in which the spinal cord and its coverings sit. The individual vertebral bodies are connected by the intervertebral disks (Fig. 1) (**Boelderl et al., 2002)**

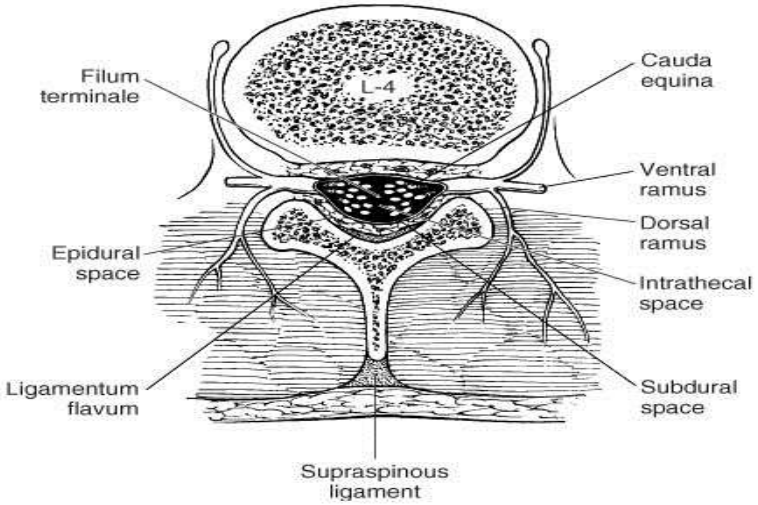

Figure (1): *Contents of dural sac at the level of L4* (Brown, 2005).

The vertebral column usually contains three curves. The cervical and lumbar curves are convex anteriorly, and the thoracic curve is convex posteriorly (Fig. 2).

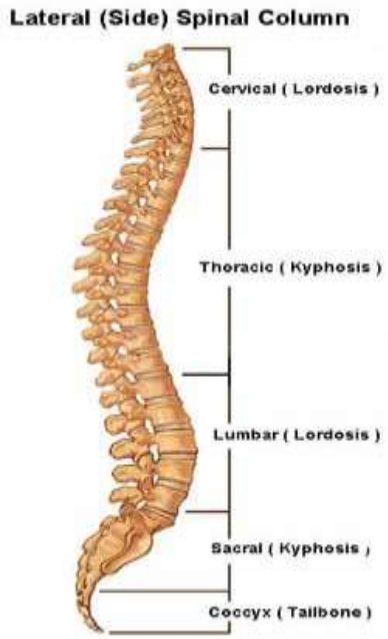

Figure (2): The vertebral column from a lateral view ***(Miller and Pardo, 2011).***