Postoperative Management of the Physiological Effects of Spinal Anesthesia

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Spinal anesthesia is a common regional anesthesia used in ambulatory and hospital settings. Spinal anesthesia has been shown to reduce postoperative pain and morbidity in certain populations. Understanding the physiological changes during spinal anesthesia can help predict and manage side effects including hypotension, bradycardia, decreased expiration, nausea, vomiting, and urinary retention. This article describes the physiological effects of spinal anesthesia in a body systems approach, describes how to assess the spinal level, and presents common side effects seen postoperatively and how to successfully manage and treat these patients.

Keywords: *spinal anesthesia, postoperative management, neuraxial blockade, PACU.*

OBJECTIVES—AFTER READING THIS ARTICLE, the perianesthesia nurse should be able to (1) describe the benefits of spinal anesthesia; (2) describe the normal physiological changes that occur with spinal anesthesia; (3) identify strategies to manage side effects of spinal anesthesia.

Spinal anesthesia involves the placement of local anesthetic solution directly into the cerebrospinal fluid that surrounds the spinal cord. Spinal anesthesia can be used for surgeries from the upper abdomen to the foot and ankle. The location of the surgery determines the placement of the anesthetic (Table 1). For example, a patient undergoing a laparoscopic cholecystectomy will require an injection at or above dermatome level T4, which is considered a high spinal.[1] Foot and ankle surgeries are covered at or above L2.[1] And a saddle block at levels S2 to S5 allows for adequate anesthesia for perianal and anal surgery[1] (Figure 1).

The dermatome level achieved is determined by the injection site, baricity of the anesthetic, the positioning of the patient both during and immediately after administration, and the amount and type of anesthetic given.[1] Briefly, baricity determines the spread of anesthetic and is relative to cerebral spinal fluid (CSF).[1] A hypobaric solution is less dense than CSF and has a tendency to rise higher than the site of injection, while a hyperbaric solution is denser and tends to follow gravity downward.[1] An isobaric solution has equal density and tends to remain at the site of injection.[1]

Benefits of Spinal Anesthesia

Spinal anesthesia is becoming more popular and common in the perioperative setting.[2] When regional anesthesia is effective, the surgical stress response is partially or completely suppressed.[3] This leads to a decrease in hyperglycemia response to surgery, decrease in cortisol levels, reduced nitrogen loss, reduction in water retention, and a decrease in thrombogenesis.[4] In patients

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Conflicts of interest: None to report.

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Table 1. Assessing Spinal Levels by Dermatome and Anatomic Structures

Dermatome Level	Anatomic Structure	Systemic Effects	Surgical Procedures According to Blockade Height
C8	Fifth digit	Blockade of cardiac accelerator fibers	
T1–T2	Inner aspect of arm/forearm	Some blockade of cardiac accelerator	
T3	Apex of axilla	Possible blockade cardiac accelerator	
T4	Nipple line	Possible blockade of cardiac accelerator	Upper abdominal procedures, cholecystectomy
T6	Bottom of xiphoid process	Possible splanchnic blockade	Lower abdominal procedures, gynecologic procedures, bladder and prostate surgery, cystoscopy
T10	Umbilicus	Sympathetic nervous system blockade	Hip surgery, vaginal delivery
L1	Inguinal ligament area	Sympathetic nervous system blockade of the legs	Lower extremity surgery, foot and ankle surgery
L3	Top of knee		
S1	Lateral foot		Perineal and anal surgery

undergoing hip arthroplasty surgery, when spinal anesthesia is compared with general anesthesia, intraoperative blood loss is reduced.[3] This reduction in blood loss is due to a decrease in central venous pressure.[3] Other benefits of spinal anesthesia include lower incidence of respiratory complications, pulmonary embolism, and deep vein thrombosis while preserving pulmonary gas exchange.[4,5] The use of regional anesthesia results in reduced postoperative pain and morbidity, which may reduce the need for opiate administration.[6] These effects lead to more rapid recovery and earlier hospital discharge and may reduce the risk of developing chronic pain.[6] As spinal anesthetics only block pain and motor and sensory pathways, patients will likely require sedation for their procedure as well, depending on preference and psychological states.[1,2] Propofol and/or midazolam are well suited for sedation, as they are titratable to prevent significant respiratory depression, allowing airway patency to be maintained.[1]

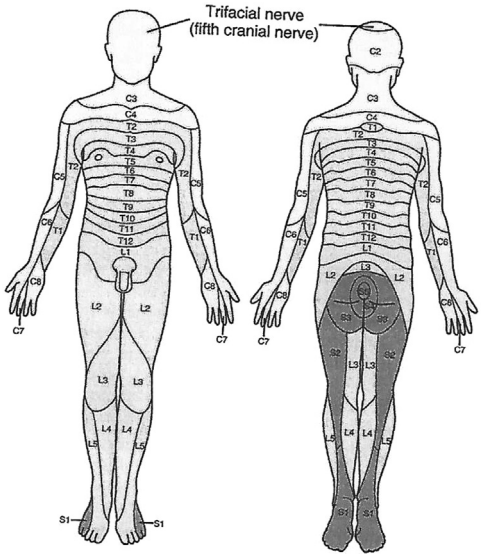

Figure 1. Dermatomes. From Olson RL, Pellegrini JE, Movinsky BA. Regional anesthesia. In: Nagelhout JJ, Plaus KL: *Nurse Anesthesia*. St. Louis; 2014, Elsevier, p. 1073. Used with permission.

Physiology

Regional blockade involves the motor, sensory, and autonomic nervous systems. Spinal anesthesia requires a small amount of anesthetic injected into the CSF. The systemic effects that occur are the result of blockade of the autonomic nervous system. Spinal anesthesia technique involves the injection of a drug, usually a local anesthetic agent, into the cerebrospinal fluid within the subarachnoid space via the lumbar 1-2 region.[7] The subarachnoid space lies between the arachnoid