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Regional Over General: Successful Thoracic Segmental Spinal Anesthesia for Hernioplasty in a High-Risk Cardiorenal Patient: A Case Report

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Abstract: ***Thoracic segmental spinal anaesthesia (TSSA) is an emerging regional anaesthetic technique that delivers targeted sensory blockade to specific thoracic dermatomes while preserving respiratory function and maintaining hemodynamic stability. This case report describes a 64-year-old male with chronic kidney disease (CKD), systemic hypertension, and complete heart block who presented with an umbilical hernia measuring 3.5 cm in anterior abdominal wall defect. Given the significant cardiorenal comorbidities, general anaesthesia posed an unacceptably high perioperative risk. The patient underwent umbilical hernioplasty under thoracic segmental spinal anaesthesia with a temporary pacemaker in situ. Intraoperative and postoperative hemodynamic stability was maintained throughout the procedure, with no complications recorded. This case demonstrates that TSSA provides an effective, safe, and physiologically favorable alternative to general anaesthesia in high-risk patients, offering superior cardiovascular stability, preserved respiratory function, site-specific analgesia, and faster recovery.***

Keywords: Thoracic segmental spinal anaesthesia, hernioplasty, complete heart block, chronic kidney disease, regional anaesthesia, cardiorenal comorbidity, umbilical hernia, high-risk patient

1. Introduction

The perioperative management of patients with complex cardiorenal comorbidities remains one of the most challenging scenarios in modern anaesthetic practice. When such patients require surgical intervention, the choice of anaesthetic technique is pivotal and carries direct implications for intraoperative safety, postoperative recovery, and overall clinical outcome. General anaesthesia (GA), while widely employed, subjects high-risk patients to numerous physiological stressors including airway manipulation, systemic drug exposure, hemodynamic fluctuations, and prolonged recovery- all of which are particularly hazardous in individuals with compromised cardiac or renal function [1].

Regional anaesthesia has increasingly gained recognition as a superior alternative in select patient populations. Among the various regional techniques, thoracic segmental spinal anaesthesia (TSSA) has emerged as a promising modality that targets specific dermatomal levels in the thoracic spine. Unlike conventional subarachnoid blocks that extend to lumbar and sacral levels, TSSA restricts pharmacological spread to relevant thoracic dermatomes, thereby minimizing the risk of profound sympathetic blockade, respiratory compromise, and hemodynamic instability [2].

Umbilical hernioplasty requires anaesthetic coverage of the T8 to T12 dermatomes, making TSSA an anatomically appropriate and clinically attractive option. The technique eliminates the need for endotracheal intubation and volatile anaesthetic agents, reducing stress responses and systemic drug burden. For patients with conditions such as complete heart block, chronic kidney disease (CKD), and hypertension- where cardiovascular and renal reserve are significantly curtailed- these advantages can be life-saving [3].

This report presents the successful application of TSSA in a high-risk cardiorenal patient undergoing umbilical hernioplasty, highlighting the technique's clinical efficacy, hemodynamic safety profile, and potential to redefine anaesthetic management in complex surgical cases.

2. Case Report and Methodology

2.1 Patient Profile

A 64-year-old male patient with a known history of chronic kidney disease (CKD) and systemic hypertension presented to the surgical outpatient department with a complaint of progressive swelling at the umbilical region over several months. Ultrasonography of the abdomen confirmed a 3.5 cm defect in the anterior abdominal wall with a reducible sac containing omentum, consistent with an umbilical hernia requiring operative repair.

Cardiac evaluation revealed complete heart block (third-degree atrioventricular block), a condition characterized by the complete dissociation of atrial and ventricular electrical activity. This finding carried significant anaesthetic implications, as hemodynamic perturbations associated with both general anaesthesia and conventional spinal blocks can precipitate ventricular failure in such patients. A temporary

transvenous pacemaker was implanted preoperatively to maintain ventricular rate control and cardiovascular stability throughout the perioperative period.

2.2 Preoperative Assessment

Preoperative investigations included a complete blood count, renal function tests, serum electrolytes, coagulation profile, electrocardiography, echocardiography, and chest radiography. Renal function tests revealed elevated serum creatinine and blood urea nitrogen levels consistent with CKD, necessitating careful fluid management. Echocardiography confirmed the presence of complete heart block with adequate ventricular function under pacemaker support. Coagulation parameters were within acceptable limits, permitting safe spinal needle insertion.

The patient was assessed as ASA Physical Status Class III, reflecting the combined burden of cardiovascular and renal comorbidities. Anaesthetic counseling was conducted, and informed consent was obtained after a thorough discussion of available anaesthetic options and the rationale for selecting thoracic segmental spinal anaesthesia over general anaesthesia.

2.3 Anaesthetic Technique

Standard preoperative fasting protocols were followed. On the day of the procedure, the patient was transferred to the operating room where baseline monitoring was established, including continuous electrocardiography, pulse oximetry, non-invasive blood pressure monitoring, and pacemaker function assessment. A peripheral intravenous line was secured.

The patient was positioned in the sitting position. Under strict aseptic precautions, the thoracic interspinous space at the T9-T10 level was identified using anatomical landmarks and palpation. A 25-gauge Quincke spinal needle was introduced using the midline approach. Following clear, free-flowing cerebrospinal fluid (CSF) confirmation, a calculated dose of 0.5ml Hyperbaric bupivacaine (0.5%) then waited for 90 seconds and then 2ml of 0.75% Isobaric Ropivacaine was administered intrathecally, titrated to achieve a bilateral sensory block from approximately T6 to T12 dermatomes.

The patient was then repositioned to the supine position. Sensory block level was assessed using the pinprick method, and the adequacy of the block was confirmed before surgical incision. Motor function of the lower limbs was closely monitored and remained well within required segments thereby ensuring hemodynamic stability. Sedation was not required; the patient remained cooperative and hemodynamically stable throughout the procedure.

3. Results

The umbilical hernioplasty was completed successfully under thoracic segmental spinal anaesthesia without any intraoperative complications. The total operative time was approximately 50 minutes. The sensory block achieved bilateral coverage from T6 to T12, providing excellent analgesia for the surgical site without compromise to respiratory or upper limb function.

Hemodynamic parameters remained stable throughout the procedure. Blood pressure fluctuations were within acceptable limits (systolic blood pressure maintained between 110–130 mmHg), and the pacemaker-controlled heart rate was consistent at 70 beats per minute. Oxygen saturation (SpO2) was maintained at 98–100% on room air, confirming preserved respiratory function during the procedure. No vasopressor support was required.

The patient was fully conscious and cooperative throughout the surgery, reporting no discomfort at the operative site. There was no evidence of total spinal block, respiratory depression, urinary retention, or neurological sequelae. Postoperative recovery was uneventful. The patient was mobilized within 4 hours of surgery, tolerated oral fluids early, and was discharged on the third postoperative day with stable vital signs and satisfactory wound healing.

Renal function parameters remained stable postoperatively, with no acute deterioration in serum creatinine levels, confirming the renal-protective benefits of avoiding nephrotoxic agents and maintaining hemodynamic homeostasis.

4. Discussion

This case illustrates the successful application of thoracic segmental spinal anaesthesia in a surgically complex patient with multiple high-risk comorbidities. The results underscore several critical advantages of TSSA over conventional general anaesthesia, particularly in cardiorenal compromised individuals.

Complete heart block represents a significant anaesthetic challenge. Induction agents, volatile anaesthetics, and laryngoscopy- all integral components of general anaesthesia- can provoke severe hemodynamic instability, including bradyarrhythmias, hypotension, and ventricular dysfunction. By entirely circumventing airway manipulation, TSSA eliminates these autonomic stress triggers. The restricted sympathetic blockade inherent to a well-titrated thoracic segmental block further safeguards against precipitous hemodynamic shifts, which are particularly dangerous in a pacemaker-dependent patient [4].

Chronic kidney disease adds another layer of complexity. The kidneys are exquisitely sensitive to hemodynamic instability and nephrotoxic drug exposure. General anaesthesia with volatile agents and systemic opioids carries risk of acute-on-chronic kidney injury due to decreased renal perfusion and direct tubular toxicity. TSSA, by maintaining stable hemodynamics and eliminating systemic drug burden, provides a nephroprotective anaesthetic environment. The avoidance of non-steroidal anti-inflammatory drugs (NSAIDs) and opioids in the postoperative period- made feasible by the excellent residual analgesia of TSSA- further preserves renal function [5].

The technique's site-specific analgesic efficacy for abdominal wall surgery is well-suited to the dermatomal requirements of

hernioplasty. Umbilical hernia repair demands coverage of T8–T12, which TSSA achieves with precision. This targeted blockade spares higher cervical and lumbar nerve roots, preserving diaphragmatic function and lower limb motor activity — both critical for patient comfort and early mobilization [6].

From a pharmacokinetic standpoint, the use of small-volume hyperbaric bupivacaine injected at mid-thoracic levels limits cephalad spread through gravitational and baricity-dependent mechanisms. This predictable spread pattern enhances both the safety and reproducibility of the technique. Compared to epidural anaesthesia, TSSA offers faster onset, lower drug volumes, and reduced risk of systemic local anaesthetic toxicity [7].

The literature supports increasing use of regional techniques for high-risk abdominal procedures. Studies have demonstrated that regional anaesthesia is associated with lower rates of postoperative pulmonary complications, reduced opioid consumption, shorter hospital stays, and improved patient satisfaction compared to general anaesthesia in elderly and medically complex patients [8]. Our case corroborates these findings and adds to the growing body of evidence favoring TSSA as a primary anaesthetic strategy in carefully selected cases.

5. Conclusion

Thoracic segmental spinal anaesthesia represents a physiologically sound and clinically effective alternative to general anaesthesia for abdominal wall surgeries in high-risk patients. In this case, TSSA enabled safe and successful umbilical hernioplasty in a patient with complete heart block, chronic kidney disease, and hypertension- a combination that would have posed formidable challenges under general anaesthesia.

The technique's key strengths- cardiovascular stability, preserved respiratory function, site-specific analgesia, renal protection, and expedited recovery- align closely with the physiological imperatives of cardiorenal compromised patients. With appropriate patient selection, meticulous preoperative assessment, and skilled execution, TSSA can significantly reduce perioperative morbidity and mortality in a population that continues to grow with advancing age and increasing chronic disease burden.

Further prospective studies and randomized trials are warranted to establish standardized protocols for TSSA and to define its role within the broader framework of enhanced recovery after surgery (ERAS) programs.

Ethical Statement
This case report was conducted in accordance with the ethical standards of the institutional review board. Written informed consent was obtained from the patient prior to the procedure and for the publication of this case report. Patient confidentiality and anonymity have been maintained throughout.

Conflict of Interest
The author declares no conflict of interest with respect to the research, authorship, or publication of this article.

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