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Case Report

A rare case of delayed subarachnoid anesthetic blockade effects in a 103-year-old female patient

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Abstract

Background: The elderly represent a unique challenge for the effects of regional anesthesia, and very few cases of block onset delay have been described. Their delayed response is attributed to a number of factors that include: Physiologic deterioration, musculoskeletal contractures, degenerative joint disease, autonomic regulatory dysfunction, cognitive dysfunction, altered pharmacokinetics, and pharmacodynamics of local anesthetics and adjuvants.

Case Description: In this report we present the rare case of 45-min delay between the administration and onset of action of a subarachnoid blockade in a 103-year-old female, who was scheduled for left hip pinning, for repair of a femoral neck fracture. Patient received an injection of hyperbaric bupivacaine, 1.5 ml of 0.75% (11.25 mg), with 15 mcg of fentanyl into the subarachnoidal space and underwent the surgical procedure without complications.

Conclusions: Delayed responses to subarachnoid anesthesia can be expected in extremely elderly patients. Anesthetic procedures should be monitored and managed on a case-by-case basis.

Key Words: Delayed response, elderly patients, subarachnoid anesthetic blockade

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INTRODUCTION

In the United States, it has been estimated that the elderly population at 65 years and older will account for approximately 20% of total population by 2030, due to increased life expectancy and an aging baby boomer segment (Center for Disease Control and Prevention (CDC)). Life expectancy is longer as a result of improvements in the healthcare system, and we need to face the higher prevalence of chronic illnesses and disabilities along with increasing health care expenditures. Better understanding and management of physiologic and pathologic variations in geriatric populations are essential to fine-tune medical care, prevent complications and reduce morbidity and mortality.[1] This report presents the pattern of delayed responses to anesthetic spinal blockade, which is a characteristic of elderly patients.

Neuraxial blockade consists of subarachnoidal and epidural injections. In subarachnoid anesthesia, medications are injected into the intrathecal space, in which lower doses of medications are required together for clinical efficiancy with decreased toxicity from each individual drug.[4] Neuraxial blockade is a safe and effective anesthetic procedure, which is an alternative method to general anesthesia.[14] In comparison with general anesthesia, a meta-analysis found neuraxial

blockade reduced the events of postoperative complications such as thromboembolism, bleeding, infection, respiratory depression, and renal failure.[14] These postoperative benefits are particularly alluring in elderly patients who are fragile and vulnerable.

Elderly surgical patients present specific challenges to anesthesiologists during and after surgery where they may suffer serious morbidity compared with their younger counterparts undergoing the same types of surgeries. Altered anatomical, physiological, and pharmacological aspects with increasing age complicate anesthetic procedures, whereas the optimal anesthetic methods have not been described.[11] Spinal anesthesia plays a beneficial role in the elderly as it provides an adequate anesthetic effect in several common orthopedic and urogynecologic problems, without the risks adherent to general anesthesia.[14]

Limited literature is available on the effects of subarachnoid or general anesthesia in patients over 90 years of age. In this manuscript, we highlight the rare occurrence and presentation of a significantly delayed anesthetic onset in a 103-year-old woman with a hip fracture and with multiple co-morbid conditions.

CASE REPORT

A 103-year-old (body mass index [BMI]=27.2) African-American female from an assisted living home presented for left hip pinning of a femoral neck fracture following a fall from a wheelchair. Preoperative evaluation revealed an elderly women moaning in distress from severe excruciating left hip pain. After she was diagnosed with a left femoral neck fracture, she was scheduled for a hip pinning procedure under subarachnoid anesthesia. Past medical history was significant for hypertension, congestive heart failure, atrial fibrillation, osteoporosis, renal insufficiency, right lower extremity lymphedema with cellulitis, and peripheral vascular disease. She had a history of right tibial fracture and was taking furosemide, morphine, and enoxaparin. She had no history of known allergy.

Preoperative laboratory reports were significant for blood urea nitrogen (BUN) 35, creatinine (Cr) 1.75, hemoglobin (Hgb) 9.4, platelets 113, and international normalized ratio (INR) 1.1. Preoperative vital signs were blood pressure (BP) 120/70, heart rate (HR) 87. Blood gas analysis revealed a pH 7.39, CO_2 40, PO_2 85. In the operating room (OR) at 16:45, the patient was placed into the right lateral decubitus position. Approximately 500 ml of normal saline solution was given as preload prior to the spinal blockade. At 17:00 nasal cannula O_2 was administrerd, while maintaining good spontaneous ventilation and with 2 mg of midazolam injected intravenously. Following local skin infiltration, a 25G 5-inch Pencan brand spinal needle was used to access the subarachnoid space, with free flow of clear cerebrospinal fluid (CSF). Multiple attempts by an experienced, pain fellowship trained anesthesiologist were necessary to obtain CSF due to severe scoliosis and multiple bony osteophytes. Hyperbaric bupivacaine, 1.5 ml of 0.75% (11.25 mg), with 15 mcg of fentanyl was injected into the subarachnoidal space. Adequate analgesia was not reached for approximately 45 min, at which time she developed a dense sensory level of anesthesia to the T12 level. Once this level was obtained, the remainder of the procedure was uneventful. Postoperativly, the patient was comfortable, and she returned to full alert status after one and half hours. At the end of the surgery, she had BP 126/78, HR 91, RR 18, Temperature 37.0°C, SaO_2 100%. Laboratory results showed PT 10.8, INR 1.1, albumin 3.3, Na 138. She received 1.5 L of crystalloids and estimated blood loss was 100 ml, urine output 200 ml. She also received 1 unit of blood and 250 mL of red blood cells (RBC).

DISCUSSION

As a consequence of the increasing life expectancy in the USA, elderly health issues and age-related diseases have become more prevalent. With more technologically advanced health care, more elderly patients are able to proceed with complex operations. However, the incidence of anesthetic and surgical complications are predictably increased due to their senescent changes. The incidence of postoperative respiratory, cardiac, and renal complications were significantly increased in 404 patients over 80 years of age.[2] Given the greater comorbidities and cardiac risk factors, patients greater than 70 years old (9%) had higher mortality rates than did a younger age group (3.8%) after 6 months postoperation.[10] Age was also found to be a major risk factor for early and late postoperative cognitive dysfunction in patients >65 years old.[9]

Although the differences in mortality rates between general and regional anesthesia remains unclear,[7] there were reports of associated hemodynamic and neurological changes in aging patients postsurgically following the administration of general anesthesia.[14,9,15] In order to lessen or avoid these complications, anesthetic methods should be appropriately tailored to this specific special population. As subarachnoidal blockade provides reliable anesthesia and analgesia for lower extremities and perineal surgery, it was selected for our patient who had sustained a hip fracture. Although surgical anesthesia was not achieved in a usual and customary time frame in our patient, subarachnoidal sensory blockade ultimately became apparent at the desired dermatomal level without noticeable intra- and postoperative complications. The delay in blockade did not prompt us to proceed to general anesthesia as we had a definitive end point (free flow of CSF) both prior to as well as following local anesthetic

inection to avoid the aforementioned adverse effects and the delay might be explained by the anatomical and physiological changes of advanced age.

In regional anesthesia, age is well-described as one of the factors that influences effective analgesia onset and duration. Aging has an impact on pharmacokinetics and pharmacodynamics. One prospective double-blind study reported an almost 50% decrease in minimum effective local anesthetic volume required for brachial plexus block in patients older than 65 years.[12] These patients also have smaller cross-sectional areas of the brachial plexus compared with younger patients.[12] Similar findings were shown following epidural analgesia, in which patients >70 years used lower median effective concentrations (EC50) of ropivacaine to attain complete motor blockade in the perineum or lower limbs.[6]

There are numerous factors affecting the achievement of successful spinal anesthesia including baricity of anesthetic solutions, position of the patient during and immediately following injection, drug dosage, barbotage, and site of the injection. Other minor factors include the age of the patient, CSF fluid, curvature of the spine, drug volume, intraabdominal pressure, needle direction, and patient height.[4] In our case, age of the patient seemed to have the greatest impact in the observed delay of sensory blockade. Advanced age also possibly affects CSF fluid and curvature of the spine.

The ultimate sensorimotor block follwoing subarachnoid anesthesia essesntially requires a reduced dose of local anesthetics (hence, local anesthetic toxicity is rarely a concern) and is often more complete when compared with an epidural block. With higher cephalad spread of local anesthetics in the elderly,[4] lower doses of medications are required for blockade. Volume and flow of CSF are significantly reduced in the elderly,[16] which may lead to faster and more extended diffusion of local anesthetics to the target nerves. However, it is still unclear whether the speed of local anesthetic distribution and rate of onset of motor block are associated with aging.[4] A study of 124 patients ranging from 15 to 92 years old who had undergone spinal anesthesia showed the most rapid drug spread in the oldest group (>80 years old).[13] In contrast, Hibayashi *et al*. found a wider spread of local anesthetics in adolescents aged 12–16 years, undergoing block at the same subarachnoid injection sites as adults.[3] As our patient is in an extreme age group, >100 years old, the observed delayed sensory block may not be consistent with what the other studies in younger elderly subjects have shown.

Increasing age is associated with a reduction in peripheral nerve function, production of myelin sheath protein, and subsequently nerve conduction velocity.[11] Thus, the delayed effects of local anesthetics in our patient might be related to these factors. Another possible factor of delayed local anesthetic distribution in this patient might be related to limited intrathecal space size due to her severe spinal stenosis, scoliosis, or degenerative joint disease. Decreases in the size of the spinal cord and changes in the diameter of the vertebral canal are also associated with aging.[11] These spinous changes probably obstructed our midline needle approach that subsequently required multiple attempts for spinal block in our patient.

Additionally, the recognized side effects following spinal block, including, hypotension should be more considered in the elderly. Age-associated autonomic nervous system changes and decreased baroreceptor sensitivity due to chronic high blood pressure may worsen hemodynamic changes after blockade. More elderly patients with oxygen desaturation were reported following spinal anesthesia.[5] Spinal block decreased systolic and diastolic blood pressure and subsequently reduced cerebral blood flow velocity.[8] As such, cognitive function in elderly surgical patients should be carefully evaluated and monitored perioperatively. There was no observed significant hemodynamic changes in the presented patient.

CONCLUSION

A delayed spread and onset of action of local anesthetics following subarachnoid blockade in extremely elderly patients can be expected, and may be secondary to various anatomical and physiological causes. As shown in this case report, up to 45 min may be required for the anesthetic effect to occur. Patience and expected delays for the onset of sensory-motor block after a subarachnoid blockade is suggested, prior to converting to general anesthesia.

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