

Case Report

Low-dose spinal anesthesia for emergency orthopaedic surgery in a geriatric patient with newly diagnosed primary overt hypothyroidism: A case report

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ABSTRACT



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Low-dose spinal anesthesia for emergency orthopaedic surgery in a geriatric patient with newly diagnosed primary overt hypothyroidism: A case report

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Hypothyroidism is relatively common comorbidity in elderly patients, due to structural and hormonal changes in the aging thyroid. Diagnosis of hypothyroidism, in this population, is considered challenging, since many symptoms are nonspecific and may be attributed to other common medical conditions. Anesthetic management of geriatric patients, with newly diagnosed hypothyroidism, presents a different set of challenges and requires specific perioperative care, due to the increased risk of perioperative complications. Herein, we report a successful case of low-dose spinal anesthesia, in 91-year-old geriatric male patient, with newly diagnosed overt primary hypothyroidism who underwent basicervical femoral neck fracture surgical treatment.

Keywords: spinal anesthesia, emergency orthopaedic surgery, geriatric patient, overt primary hypothyroidism.

INTRODUCTION

Primary hypothyroidism is the most frequent hormone insufficiency in elderly population.

It can be caused mainly by autoimmune thyroiditis, iodine deficiency, radioiodine ablation and surgery¹.

Diagnosis of hypothyroidism in the elderly is considered challenging, since many symptoms are nonspecific and may be attributed to other common medical conditions.

Also, slightly elevated serum thyroid-stimulating hormone (TSH) levels, at these patients, may be a normal characteristic of the aging process, rather than reflection of disease^{2,3}.

Elderly patients with untreated and undiagnosed hypothyroidism and comorbid disorders may be particularly susceptible to cardiac, respiratory, neurological and other complications and that can increase perioperative morbidity and mortality^{1,2,4}.

Anesthesia management, in elderly patients with newly diagnosed hypothyroidism, who are undergoing emergency surgery, may exacerbate underlying thyroid disorders, potentially precipitating to an increase of the perioperative risk⁴.

We report a successful case of low-dose spinal anesthesia, in 91-year-old geriatric male patient, with newly diagnosed primary overt hypothyroidism, who underwent basicervical femoral neck fracture surgical treatment.

CASE REPORT

A 91-year-old male (body weight: 80kg, height – 170 cm) presented to the emergency department of our hospital, with basicervical femoral neck fracture (bFNF), after a low-energy trauma. He was scheduled to undergo surgical treatment with proximal femoral nail antirotation.

Patient's past medical history involved amyloidosis, chronic atrial fibrillation, benign prostatic hyperplasia, gastroesophageal reflux disease and iron deficiency anemia. Ten months prior to admission, patient was hospitalized with severe COVID-19 infection and he was discharged with home oxygen treatment ($\leq 3l/min$). He had no prior surgical history. His medical drug regimens included furosemide, amiodarone, omeprazole, dutasteride, ferrous gluconate and rivaroxaban. Allergies and family history were unremarkable.

Preanesthetic visit and physical examination was performed a day after hospital admission. During the preoperative assessment, patient presented with fatigue, weakness, cognitive dysfunction, dry skin, macroglossia and puffy face. In his physical examination, respiratory auscultation revealed diminished respiratory sounds at the bases of both lungs, while at cardiac auscultation diastolic murmurs of the mitral and the tricuspid valves were detected. His preoperative functional capacity risk

assessment was classified as poor (<4 METs). A preoperative ECG showed a normal sinus rhythm, heart rate (HR) of 60 beats per minutes (bpm) and a Left Bundle Branch Block (LBBB). Echocardiography revealed left ventricular hypertrophy, left atrial dilatation, moderate mitral valve regurgitation (MR) and moderate to severe tricuspid regurgitation (TR) with a mild reduction of left ventricular ejection fraction (EF=55%). Preoperative chest X-ray (CXR) demonstrated interstitial thickening of the lungs. Preoperative evaluation exhibited a class IV physical status of American Society of Anesthesiologists.

Preoperatively, cessation of rivaroxaban and the bridging with LMWH were ordered. Due to patient's clinical features and signs, thyroid function tests were requested, since the surgical procedure was delayed until 48h after the last dose of rivaroxaban.

Blood test results showed a TSH level of 88.44 μ IU/ml (normal range: 0.35 – 4.94 μ IU/mL), free triiodothyronine (FT3) level of 1.04 pg/ml (normal range: 1.71–3.71 pg/mL), free thyroxine (FT4) level of 0.55 ng/dl (normal range: 0.7–1.48 ng/dl). Patient's preoperative laboratory results are shown in Table 1.

PARAMETERS	VALUES
White Blood Cell (WBC)/MI	6.900
Hemoglobin (Hgb) g/dl	12
Hematocrit (Ht) %	35,6
Platelets (PLT) / μ L	199.000
Prothrombin time (PT) sec	12,4
International Normalized Ratio (INR)	1,1
Partial thromboplastin time (aPTT) sec	40,1
Glucose (Glu) mg/dl	108
Urea (U) mg/dl	52
Creatinine (Cr) mg/dL	1,66
Potassium (K) mmol/L	4,5
Sodium (Na) mmol/L	143
Aspartate Aminotransferase (SGOT) units/lt	86
Alanine Aminotransferase (SGPT) units/lt	57
TSH (thyrotropin) μ IU/ml	81,44
Free T3 (FT3, tri-iodothyronine) pg/ml	1,04
Free T4 (FT4, thyroxine) ng/dl	0,55

Table 1. Patient's preoperative laboratory results.

Due to elevated thyroid hormones, discontinuation of amiodarone and administration of

50 μ g/day p.os of levothyroxine (T₄) were ordered, following endocrinology consultation,

which set the diagnosis of patient's overt primary hypothyroidism, ruling out the existence of myxedema coma (MC).

A thorough medical team approach involving discussion of the perioperative risks and benefits of the proposed emergency surgery and anesthesia was made with patient's family/caregivers.

The anesthetic plan involved performing spinal anesthesia, informing for the risk of subarachnoid block failure and the alternative option of general anesthesia. After patient's family/caregivers informed consent, patient arrived at the operating theater, two days after hospital admission. He was not premedicated before surgery. Standard monitoring {electrocardiogram, noninvasive blood pressure, peripheral oxygen saturation (SpO₂)} was applied. Patient presented for surgery hemodynamically stable (BP: 158/98 mmHg, HR: 63 bpm) with SpO₂: 93% (FiO₂: 21%). A face oxygen mask was placed at a flow rate of 6 L/minute. Two peripheral intravenous lines (18-gauge IV cannulas) were inserted and invasive blood pressure monitoring, through cannulation of right radial artery, was applied. Before lumbar puncture, prehydration with lactated Ringer's solution (0.5 ml/Kg) was administered, in order to minimize the vasodilating effects of sympathectomy, caused by spinal anaesthesia. Propofol (30mg) was administered, in order to minimize patient's discomfort during patient's positioning. Spinal

anesthesia was conducted with the patient in a sitting position. A pencil pointed 24-g x 90mm spinal needle was inserted successfully at L3-4 interspace, after two attempts. A dose of 7 mg levobupivacaine 0.5% (volume 2ml) was administered in the subarachnoid space. The cerebrovascular fluid was clear and the technique aseptic. The upper sensory level was assessed, using the loss of sensation to pinprick along the anterior axillary line bilaterally, every 5 min until the maximum level was reached (T11), whereas the degree of motor block was assessed, according to the modified Bromage scale (0 = no motor block, 1 = inability to raise the extended leg, 2 = inability to flex the knee, 3 = inability to flex ankle), every 5 min until 30 minutes after spinal anesthesia. At that time grade two of modified Bromage scale was reached. Then the patient was positioned in the fracture table.

Patient remained hemodynamically stable throughout the intraoperative period (mean Blood Pressure > 65mmHg, HR: 60-70 bpm). During surgery, SpO₂ values were normal ranging between 96% and 98%. Duration of surgery was 1hr 15min.

His postoperative recovery was uneventful (30 min) and then he was transferred safely to an orthopedic ward with an Aldrete Score of 10 (exit vital signs BP: 131/67 mmHg, HR: 65 bpm, SpO₂: 96%). A new endocrinology consultation was ordered postoperatively, in order to determine the medication dosing, the fre-

quency of administration and the time for patient's endocrinology re-evaluation. His remaining hospital stay was uneventful and he was discharged on the 5th postoperative day.

DISCUSSION

Primary hypothyroidism is a common thyroid dysfunction with an estimated prevalence of 0.37% and 3.8% for overt (clinical) and subclinical hypothyroidism, increasing to over 20% in elderly women above 75 years⁵. Hypothyroidism affects aged patients, between 85 and 89 years of age, with a high prevalence of 1 to 7%⁶. The study of Vacante M et al. describes the mean annual incidence of hypothyroidism as 35 cases per 10.000 surviving women and 6 cases per 10.000 surviving men¹.

Due to the absence of symptom specificity, the definition of hypothyroidism is based on statistical reference ranges of the relevant biochemical parameters and is increasingly a matter of debate⁷. Hypothyroidism is classified as primary, central or peripheral based on pathology in the thyroid, the pituitary or hypothalamus, or peripheral tissue, respectively⁵. Overt hypothyroidism is defined as elevated thyroid-stimulating hormone (TSH) concentration in combination with free thyroxine (fT4) concentration below the reference range. Subclinical hypothyroidism, commonly considered an early sign of thyroid failure, is defined by elevated TSH concentrations but fT4

concentrations within the reference range⁵. Also, the definitions of mild, moderate, and severe hypothyroidism are used commonly for therapeutic decisions, but those definitions somewhat subject to interpretation and may differ between experts or studies⁸. Mild hypothyroidism includes patients with subclinical hypothyroidism, moderate hypothyroidism refers to patients with overt hypothyroidism (elevated TSH, low free T4), while severe hypothyroidism includes patients with severe clinical symptoms of chronic hypothyroidism such as altered mentation, pericardial effusion, or heart failure, those with very low levels of total thyroxine (T4) (< 1.0 mcg/dL) or free T4 (< 0.5 ng/dL) or myxedema coma^{4,8}. According to biochemical parameters, our patient's primary overt hypothyroidism was categorized according to the severity of thyroid failure as moderate hypothyroidism.

Hypothyroidism, especially in elderly patients, may be presented with many symptoms that may be attributed to other common medical conditions¹. Cognitive impairment, cardiovascular, respiratory, gastrointestinal, and hematological disorders and eventually myxedema coma, which is a severe and life-threatening condition, can be present in hypothyroid undiagnosed patients^{1,3}. In general, elderly subjects suffering from hypothyroidism may show classic symptoms, but complaints are often less specific than those described by younger hypothyroid patients¹. In our case, preopera-

tively our patient was presented with an undiagnosed hypothyroidism and with informal complications of hypothyroidism, such as cognitive dysfunction, chronic atrial fibrillation, gastroesophageal reflux disease, iron deficiency anemia and also respiratory alterations. Those disorders preoperatively were attributed, from his family/caregivers, mainly to his advanced age.

Routine preoperative thyroid function testing is not recommended for all patients undergoing surgery, but should be included based on symptoms or clinical signs suggesting underlying thyroid disease⁴. Our patient presented enough clinical features of hypothyroidism that led us to order preoperatively thyroid function testing.

Although elective surgery is best postponed, until a euthyroid state is achieved, mild and moderate hypothyroid patients may undergo urgent surgery without delay, with the knowledge that minor perioperative complications might develop⁴. According to the study of Malhotra B et al, in an emergency surgery in suspected moderate hypothyroid elderly patient, levothyroxine should be started preoperatively at a dosage of 25-50 mcg/d⁴. Following endocrinology consultation our patient received 50µg/day p.os of levothyroxine (T₄), prior to surgery.

It must also be noted our patient, according to his medical history, suffered from amyloidosis. The study of Muchtar E et al demonstrates

that significant proportion of patients with light chain amyloidosis (AL amyloidosis) presented with subclinical and overt hypothyroidism, which carries a survival disadvantage and the also the authors of the study suggest a routine assessment of TSH in these patients⁹. Also, patient's medication included the use of amiodarone, which is one of the most commonly used antiarrhythmics. It contains a large proportion of iodine, which is, in addition to drugs intrinsic effect, the basis of the impact on thyroid function. It is believed that 15%-20% of patients treated with amiodarone develop some form of thyroid dysfunction which range from thyroid function test impairments to clinically evident disease, hypothyroidism or thyrotoxicosis¹⁰. In our case a cessation of amiodarone administration was ordered preoperatively. The study of Trohman RG et al showed that hypothyroidism may resolve or persist after cessation of amiodarone therapy. Although patients with or without underlying disease may resolve, persistent hypothyroidism despite amiodarone withdrawal is nearly always associated with underlying autoimmune thyroid disease¹¹.

Perioperative management of hypothyroid elderly patients can be very challenging. In non-elective surgery, an anesthetic plan, which takes the individual into consideration, should begin as soon as surgery is planned and thyroid dysfunction is detected⁴. It is well established that effects of thyroid dysfunction may

complicate surgical procedures and postoperative recovery. There are a few small studies, in the current literature, comparing surgical outcomes in mild, moderate and severe hypothyroid surgical patients versus euthyroid surgical patients^{4,12,13}. The study of Ladenson PW et al reported that for noncardiac surgery, intraoperative hypotension occurred at a higher rate in the hypothyroid group compared to the euthyroid group. Also hypothyroid patients had a higher rate of gastrointestinal and neuropsychiatric complications, while there were no differences noted in perioperative blood loss, duration of hospital stay, pulmonary complications, or death between groups^{4,12}. Another study compared the outcome of anesthesia and surgery in hypothyroid patients versus euthyroid patients. There were no differences noted in duration of surgery or anesthesia, in blood pressure intraoperatively, in need for vasopressors, in incidence of arrhythmias, pulmonary or myocardial infarction, sepsis, or time to hospital discharge¹³. The study concluded that in mild to moderate hypothyroidism, there is no evidence to justify deferring needed surgery^{4,13}.

When general anesthesia is performed in hypothyroid surgical patients, ketamine is an efficient induction agent regarding its sympathetic and positive inotropic properties¹⁴. Rapid-acting non depolarizing muscle relaxants could also be used, taking into consideration the delayed metabolism of hypothyroid pa-

tients. Maintenance of general anesthesia might include short-acting opioids with or without volatile anesthetics. Multimodal analgesia remains an excellent choice over opioids because of their prolonged effects¹⁴. Peripheral arterial catheterization is of great importance during surgery in hypothyroid surgical patients, because they are exposed to develop hypotension during general anesthesia, due to decreased cardiac output and baroreceptor responsiveness⁴. Decreased hypoxic and hyperbaric ventilatory drive, impaired renal clearance and hyponatremia increase sensitivity to sedatives and prolong the action of anesthetics and other medications, such as opioids^{4,15}. Atelectasis, pneumonia and delayed weaning might happen in the postoperative period¹⁶. Hypothyroidism delays gastric emptying, thus there is an increased risk for pulmonary aspiration¹⁴. Extravascular fluid shift can cause effusions, whereas coagulation disorders might increase the bleeding risk of the patient⁴.

In our case, we decided to perform spinal anesthesia with low-dose local anesthetic, in order to avoid the perioperative complications arising from general anesthesia, in a newly diagnosed hypothyroid geriatric patient.

There is evidence that spinal or epidural anesthesia could have low effects on thyroid hormones compared to general anesthesia; thus these methods should be taken into account in patients with thyroid function disorders, ac-

according to the type of surgical intervention needed^{1,17}. Previous studies showed that spinal anesthesia in the elderly has advantages compared to general anesthesia, such as avoidance of airway management and blood loss, reduction of deep venous thrombosis risk, and improvement of postoperative analgesia¹⁸. Conversely, general anesthesia has a faster induction and more stable hemodynamic state¹⁸. Spinal anesthesia seems to be most likely selected for orthopedic surgery of lower limb for elderly patients¹⁷. But, this anesthetic technique frequently causes hypotension and bradycardia and such cardiovascular changes serve as a major reason for increasing the rate of morbidity and mortality in elderly patients¹⁹. The increase of the age and the high level of the sensory block are the main reasons for hypotension after spinal anesthesia. Hypotension on the elderly patients >70ys recorded at 48%, which was higher than the patients aged <60ys by 4.2% after the use of 7 mg of 0.5% heavy bupivacaine¹⁹. Saber A et al demonstrated that the use of small dose (5 mg) of heavy bupivacaine 0.5% compared to higher intrathecal doses (10 mg), in spinal anesthesia provides hemodynamic stability without episodes of severe hypotension or bradycardia and also sufficient anesthesia, for lower limb fractures repair in the elderly surgical patients²⁰. Kim et al compared the effect of low-dose (6.5 mg) intrathecal heavy bupivacaine given in lateral decubitus compared to the ef-

fect of the same dose given in sitting position and they found no significant differences in the degree of the motor blockade and in hemodynamic changes between the two groups²¹.

In our case low dose anesthetic spinal anesthesia achieved excellent analgesia, efficient motor and sensory blockade, with minimal or no changes of blood pressure and heart rate, with no respiratory effect or any other adverse effects.

In conclusion, hypothyroid elderly patients who need urgent lower extremity surgery and there is not enough time until a euthyroid state to be achieved, spinal anesthesia seems to be an adequate anesthetic technique with lower perioperative risk compared to general anesthesia.

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