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Case Report

Subarachnoid anaesthesia for emergency caesarean section in a parturient with thyroid storm: a case report

Azubuike O. Nwaneri, Alfred T. Aggo*

Department of Anaesthesia, University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers state, Nigeria

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***Correspondence:**
Dr. Alfred T. Aggo,
E-mail: alfred.aggo@uniport.edu.ng

ABSTRACT

A 35-year-old multiparous woman, at 36 weeks of singleton gestation with a history of poorly controlled hyperthyroidism, presented in obstructed labour and thyroid storm (Burch-Wartofsky score: 50); she was anxious, agitated, pyrexic, tachycardic, hypertensive, with pedal oedema, atrial fibrillation and bearing live foetus. Following intravenous hydrocortisone and oral digoxin, while on Oxygen supplementation, she had an emergency Caesarean section under subarachnoid block, plus titrations of intravenous labetalol and propofol. Intraoperatively, her haemodynamic parameters remained stable and a live foetus was extracted with APGAR scores of 5 and 7 at 1 and 5 minutes of birth, respectively. Postoperatively, she received multidisciplinary management in the intensive care unit (ICU) culminating in her recovery and discharge. This report highlights the anaesthetic challenges and the critical significance of judicious subarachnoid anaesthetic technique, in the management of a patient with the combination of thyroid storm and obstructed labour in poor-resourced setting.

Keywords: Caesarean section, Subarachnoid anaesthesia, Thyroid storm

INTRODUCTION

Hyperthyroidism is a clinical condition resulting from excessive thyroid hormone synthesis and secretion, and is confirmed by the laboratory finding of elevated levels of free tri-iodothyronine (FT3) and tetra-iodothyroxine (FT4). Failure to control hyperthyroidism results in inappropriate activation of tissues by thyroid hormones, precipitating thyrotoxicosis-a clinical entity characterized by fatigue, irritability, heat intolerance, fever, weight loss, diarrhoea, anxiety, excessive sweating, tachycardia, palpitations, elevated blood pressure and murmurs; untreated thyrotoxicosis progresses to a thyroid storm which is an acute life-threatening emergency. While hyperthyroidism affects about 0.1-0.4% of pregnancies and is mainly due to Grave's disease, thyroid storm has a reported mortality rate of 20-30%.[1,2] Occurring in an emergency perioperative obstetric setting, thyroid storm poses a significant challenge to the attending Anaesthetist as a result of constraints of insufficient time for proper preoperative patient evaluation and optimisaton.

CASE REPORT

A 35-year old multiparous woman, booked with the University of Port Harcourt Teaching Hospital (UPTH) for antenatal care, presented to the labour ward at 36 weeks of singleton gestation, with a 72-hour history of drainage of liquor and 4-hour history of strong, intermittent lower abdominal pain. About four years earlier, she was diagnosed to have hyperthyroidism, for which she was placed on treatment with tablet carbimazole by the endocrinologist. In the index pregnancy her antenatal care began from 13 weeks of gestation and she was co-managed by the endocrinology and cardiology teams due to the diagnosis of pregnancy induced hypertension with hyperthyroidism. Patient rejected the prescription on carbimazole, which she had stopped taking since she was

confirmed pregnant, for fear of adverse effects, but was compliant with her antihypertensive medications (oral propranolol 40 mg daily and oral methyldopa 500 mg twice daily). Following clinical examination by the obstetric team, a diagnosis of obstructed labour with prolonged rupture of foetal membranes in a patient with known hyperthyroidism was made.

At preoperative review, she admitted experiencing fever and palpitations, but denied associated heat intolerance, weight loss, vomiting, diarrhoea or insomnia. She had just taken tablet carbimazole 10 mg which was recommenced same day, as well as tablet propranolol 40mg and tablet methyldopa 500 mg, orally. Her weight during her last antenatal visit 5 days earlier was 86 kilograms. Physical examination revealed a mildly agitated parturient in intermittent painful distress from strong uterine contractions, with exophthalmos and lid retraction; she was anicteric, acyanosed, not pale, but febrile (37.9°C), and mildly dehydrated, with bilateral mild pitting pedal oedema.

She had a pulse rate of 126 beats per minute, of moderate volume, with an irregularly irregular rhythm, blood pressure of 160/90 mmHg, a gallop rhythm (4^{th}, 1^{st} and 2^{nd} heart sounds), but no bibasilar crackles. Her respiratory rate was 28 cycles per minute, arterial haemoglobin oxygen saturation (SpO_2) was 96% on room air, and she had a foetal heart rate of 156 beats/mimute. Her airway examination findings were a Mallampati score of III, inter-incissor gap of 6 cm, and no loose tooth or dentures; however, an anterior neck mass was present measuring 10×12 cm, which moved with deglutition; the mass was neither tender nor adherent to the overlying skin, without differential warmth and without auscultable bruits.

Ancillary laboratory investigations showed a packed cell volume of 32% and no proteinuria, but atrial fibrillation on electrocardiogram. A diagnosis was made of obstructed labour with prolonged preterm rupture of foetal membrane in thyroid storm (Burch-Wartofsky score=50); she was assigned American Society of Anesthesiologists physical status score of IVE and speedily transferred to the operating room.

The pre-anaesthetic induction parameters read SpO_2 98% on oxygen, pulse 124 beats/minute, blood pressure 155/82 mmHg and respiratory rate 28 cycles/minute. Following intravenous 100 mg hydrocortisone, tablet digoxin 0.25 mg administered orally with little water, and preloading with 650mls of 0.9% normal saline via 16G intravenous cannula, a subarachnoid block was performed aseptically in the sitting position at the L3/L4 intervertebral level with 10 mg hyperbaric bupivacaine 0.5%, using a 25-gauge Quincke spinal needle that was advanced through a 21-gauge hypodermic needle introducer, after skin infiltration with 3 ml of plain lidocaine 1%.

Meticulous attention was paid to blood pressure and electrocardiogram throughout the procedure. Intraoperatively, she received supplemental oxygen at 4 litres per minute via intranasal prongs, intravenous labetalol 10 mg in two divided doses of 5mg and intravenous propofol 40mg in four divided doses of 10 mg, at 5 minutes interval between doses, for additional beta blockade and sedation; oxytocin 5 international units (IU) bolus was administered at foetal extraction, with additional 10 IU via 500 ml 0.9% normal saline infusion for uterotonic effect. The newborn APGAR scores were 5 and 7 at the 1^{st} and 5^{th} minutes, and subsequently improved with resuscitation to 9 at the 10^{th} minute of birth.

Surgery lasted 45 minutes. Her intraoperative vital parameters ranged SpO_2 95%-98%, temperature 37.3°C-37.9°C, pulse rate 108-126 beats/minute, systolic blood pressure 140-160 mmHg and diastolic blood pressure 65-85 mmHg. The estimated blood loss and urine output were 450 ml and 200 ml, respectively; she received a total of 1500 mls of 0.9% normal saline. Postoperatively, she was transferred to the ICU, where she received multifaceted management from the intensivists, obstetricians, endocrinologists and cardiologists.

Immediate postoperatively, her thyroid function test done showed reduced thyroid-stimulating hormone (TSH) and markedly elevated T3 and T4 levels, for which the anti-thyroid regimen was continued. Her postoperative pain management followed a local multi-modal protocol comprising slow intravenous 8-hourly 30 mg pentazocine and intravenous 900mg paracetamol. She recovered adequately, was shifted to the post-natal ward after 3 days and discharged home on the 7^{th} postoperative day following counselling.

Table 1: Patient's clinical parameter scores by Burch-Wartosfsky's criteria.

System	Clinical parameter	Assessment	Burch-Wartofsky score
Central nervous	Agitation	Mild	10 points
Metabolic	Fever	Temperature 37.9 ºC	10 points
Cardiovascular	Tachycardia	Pulse rate 126b/m	15 points
	Congestive cardiac failure	Mild bilateral pitting pedal oedema	5 points
	Atrial fibrillation	Present	10 points
Total			50 points

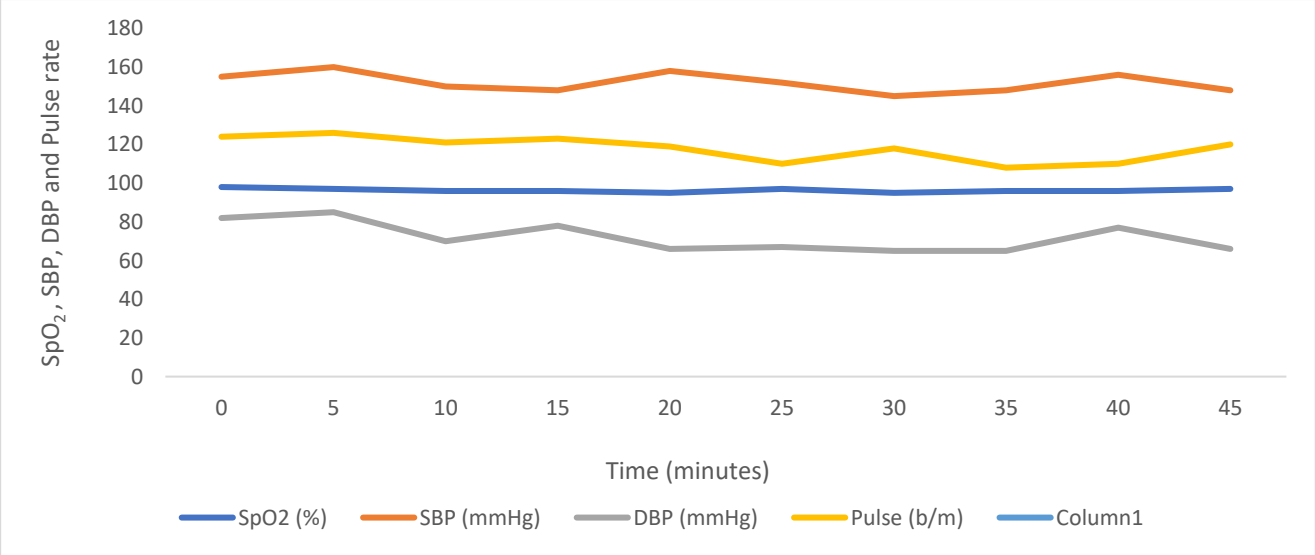

Figure 1: Intraoperative haemodynamic parameters.

DISCUSSION

Thyroid storm is a life-threatening endocrinopathy arising due to excessive levels of circulating free tri-iodothyronine (FT3) and tetra-iodothyroxine (FT4). This extremely rare endocrine emergency comprises an acute exaggeration of the clinical manifestations of thyrotoxicosis, which entails thermo-regulatory, central nervous, cardiovascular and hepato-gastrointestinal systems dysfunction.[3] Pathophysiologically, certain mechanisms cascade to thyroid storm:[4] (a) acutely raised T3 and T4 release by the thyroid gland, (b) increased plasma FT3 and FT4 secondary to illness-induced decrease in binding proteins, (c) sympathetic hyperactivity triggered by excessive release of catecholamines from the adrenal gland, and (d) heightened cellular responses to T3 and T4, induced by hypoxaemia, acidosis and infection. Certain factors are known to trigger the precipitation of one or the orchestration of a combination of two or more of these mechanisms, and include labour, major surgery (thyroid and non-thyroid), major trauma, cessation of antithyroid medication, infection, iodide ingestion/exposure, and amiodarone.[4]

Without prompt and aggressive intervention, thyroid storm in labour cascades rapidly to 200% morbi-mortality, through the pathophysiological pathways of cardiorespiratory failure, encephalopathy, hepatic and renal dysfunction, secondary to hyperthyroidism-induced sympathetic hyperactivity and hypermetabolism. As a result of the associated significantly increased risk of foeto-maternal mortality, it poses unique anaesthetic challenges, particularly during emergency caesarean section, due to limited time for optimization. Therefore, an indepth understanding, by the attending Anaesthesiologists, of the pathophysiology as well as of the outcome of the interplay between the anaesthetic modality of choice and thyroid storm is necessitated. Importantly, the maintenance of a secured, patent and functional airway, ensuring normovolaemia with haemodynamic stability, adequate oxygenation and ventilation, anxiolysis, sufficient analgesia, optimal abdominal muscle relaxation, obtundation of sympathetic hyperactivity and prevention of iatrogenic peripheral conversion of T4 to T3 are goals considered critical to achieving desirable perioperative outcome, in the anaesthetic management of this patient.

For a patient undergoing an emergency Caesarean, who is deemed 'full stomach', general anaesthesia with tracheal intubation to ensure airway security, and controlled ventilation, is judicious**;** however, the association of tachyarrhythmias and hypertension due to sympatho-adrenal response to laryngoscopy, tracheal intubation and extubation had been documented; such haemodynamic upheaval is deleterious to an existing grave cardiac physiology. In scientific literature, difficult tracheal intubation is reported to be 8 times higher in the obstetric patient, compared to the general population.[5,6] Also, physiological alterations in late pregnancy and labour predispose to an accompanying rapid desaturation, hypoxia and aspiration risk, the occurrence of which invariably will further complicate an already deranged cardiac function; considering these, a subarachnoid block was chosen as the anaesthetic technique.

The block was instituted with 10mg hyperbaric bupivacaine in this patient, strategically to achieve the triple goals of adequate analgesia, abdominal muscle relaxation for ease of surgical access. and mitigation of end-organ adverse effects of adrenergic stimulation via centroneuraxial pharmacological sympathectomy; that there is enhancement of both alpha and beta adrenergic activity, making adrenergic blockade an important component in the treatment of thyroid storm had been reported by Klubo-Gwiezdzinska et al.[7] The titration of sub-clinical doses of propofol and labetalol added clinical benefits. Agitation and sedation are inversely related,

hence, the achievement of rapid onset and offset of sedation by intravenous propofol was strategic to attenuation of agitation; in addition, the α- and β-adrenoceptor antagonist effects of labetalol are complementary to the sympathetic and baroreflex inhibitory efficacy of propofol.[8] Overall, there was a benefit of attainment of fairly stable haemodyamic parameters intraoperatively (Figure 1).

Preventing peripheral conversion of T4 to T3 using a combination of propranolol and glucocorticoids is of strategic importance in the management of thyroid storm.[9] However, in low- and middle income-countries where parenteral propranolol is unlikely to be readily available, hydrocortisone can be used, as was done in this patient. While clinical judgement remains indispensable to the diagnosis of thyroid storm, the scoring system of Burch and Wartofsky (Burch-Wartofsky point scale)[10] provides an important guideline in distinguishing between an unlikely thyroid storm (score <25), impending thyroid storm (score 25-44), and thyroid storm (score ≥45); thus, it enables prompt recognition of impending or actual thyroid storm and initiation of treatment intervention. In this patient the Burch-Wartofsky score (Table 1) was calculated from the presence of: (a) anxiety and agitation (10 points), fever (temperature 37.9 ºC=10 points), tachycardia (pulse rate 126b/min=15 points), mild pedal oedema (5 points) and atrial fibrillation (10 points).

Pain is known to trigger sympathetic hyperactivity and secondarily increased thyroid hormone level; thus, postoperative pain relief is necessitated.[11] This was achieved with parenteral 8-hourly pentazocine and paracetamol, in accordance with hospital local protocol, with the avoidance of non-steroidal anti-inflammatory drugs (NSAIDs) which can raise FT3 and FT4 levels in plasma, through displacement from their binding sites on thyroid binding globulin.[12] Postoperative multidisciplinary management of thyroid storm patient in the ICU is a crucial requirement for invaluable close monitoring and inputs from the relevant specialties; this is usually warranted by the multisystemic affectation. Proper patient counseling on treatment compliance, including education on early identification of symptoms of hyperthyroidism, are important in preventing disease recurrence and mortality.

CONCLUSION

Although associated with high mortality rate, prompt diagnosis and aggressive perioperative multidisciplinary intervention involving preoperative optimization, judicious anaesthetic technique, meticulous intraoperative monitoring and postoperative care in an intensive care setting, coupled with an in-depth knowledge and understanding of thyroid storm pathophysiology in labour, can achieve successful outcome, while counseling is necessary for preventing recurrence.

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