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ANAESTHETIC MANAGEMENT OF THE PATIENT WITH LOW EJECTION FRACTION

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ABSTRACT

The number of patients with elderly age and heart failure presenting for surgery continues to rise, due to increase in life span, and anaesthesiologists are called upon to provide quality, safe care in the operating room for the patients with low ejection fraction (EF). EF is an important measurement in determining how well the heart is pumping out blood and in diagnosing as well as tracking the heart failure (HF). Normal EF varies at 55% to 70%, while EF 40% to 55% may indicate damage perhaps from previous heart attack, but may not indicate HF. However, measurement under 40% may show evidence of HF or cardiomyopathy; and patient with EF < 35% may be at the risk of life threatening irregular heartbeats. Such patients are considered to be at high risk for anaesthesia as life threatening irregular heartbeats lead to sudden cardiac arrest and sudden death. Objectives in the anaesthetic management of these patients include maintaining forward flow, promoting adequate heart rate, avoidance of arrhythmias and maintaining stable condition in the postoperative period. Sometimes anaesthesia requires invasive cardiovascular monitoring; ultimately the skill with which anaesthesia technique is selected and delivered determines the outcome of the patient. Here we present a case of 80 year old man with chronic obstructive pulmonary disease (COPD), and EF 47% who successfully underwent right side inguinal hernia repair under regional anaesthesia technique with modified hernia block.

Keywords: *Heart Failure, Ejection Fraction, Regional Anaesthesia, Hernia Block, Hernia Repair*

INTRODUCTION

EF is an important measurement in determining how well the heart is pumping out blood and in diagnosing as well as tracking the heart failure (HF). Normal EF varies at 55 to 70%. Heart failure with preserved ejection fraction (HFpEF) has overtaken heart failure in the setting of reduced ejection fraction (HFREF; also known as systolic heart failure (Lindenfeld *et al.*, 2010). Approximately half of the patients with HF will have an EF 40-50%; heart failure with preserved ejection fraction (HFpEF) or heart failure with normal ejection fraction (HFNEF), diastolic heart failure (Rigolli and Whalley, 2013; Yancy *et al.*, 2006; Sanders, 2007) . In diastolic heart failure, heart muscle contracts normally but the ventricles do not relax as they should during ventricular filling or when the ventricle relax (Borlaug and Pauls, 2011). Heart failure under 40% indicates HF with reduced left ventricular ejection fraction (HFREF) referred to as systolic heart failure; heart muscle does not contract effectively and less oxygen rich blood is pumped out to the body.

Patient with low EF; EF < 35% could be at the risk of life threatening irregular heartbeats ^(3, 4). Any arrhythmia in these patients needs prompt treatment if not it may lead to sudden cardiac arrest and sudden death. The goals of anaesthetic management in these patients include avoidance of drug induced myocardial depression, prevention of arrhythmias and maintaining adequate cardiac output.

CASES

An 80 year- old gentleman weighing 51kg presented to surgical out- patient department (OPD) with chief complaint of pain and swelling in the right inguinal region since 1 month. Patient had similar complaints 15yrs back for which he had undergone hernia repair at that time. So the surgeons concluded the present swelling as recurrent inguinal hernia and planned hernia repair.

Pre -operatively, apart from exertional dyspnea (grade-II), he was asymptomatic. Physical examination revealed moderate built, pulse rate of 70 min⁻¹irregularly irregular, blood pressure recorded as 120/78

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mm Hg and oxygen saturation at room air was (SpO₂)95%, with no rise in jugular venous pressure (JVP). His lungs revealed diminished air entry on the left side and cardiac examination showed irregularly irregular rhythm with loud P₂. Chest radiograph showed emphysematous chest. ECG revealed occasional ectopic. Two-dimensional Echocardiography (2D-Echo) with color Doppler revealed normal left ventricular (LV) wall thickness with low normal ventricular systolic function, impaired LV relaxation, small LV cavity, and ejection fraction 47%. His hemoglobin was 13.3g%, blood chemistry and serum electrolytes, troponins within normal limits. Arterial blood gas (ABG) on room air was pH of 7.42, PaO₂ 62 mmHg, PaCO₂ 44mmHg, bicarbonate 23.7molL⁻¹ and arterial oxygen saturation (SaO₂) 95%. Cardiologist evaluated and opined diastolic dysfunction with stable cardiac status and the patient as a high risk case for surgical intervention. He was pre-medicated with Ranitidine 150mg orally on the night before the surgery. The patient was taken to the operation theatre with American Society Anesthesiologists (ASA) Grade III physical status, with informed consent. In the operation theatre, a good intravenous (IV) access was secured with a wide bore cannula. Standard monitors were placed. The surgery planned under right sided Ilioinguinal and iliohypogastric nerve block (modified hernia block).

After aseptic preparation Ilioinguinal and iliohypogastric nerve block (modified hernia block) attempted. Initially, right anterior superior iliac spine identified and mark was made 2cm medial and 2cm superior from it. After infiltration of site with local anesthetic, a small puncture was made in the skin with a sharp 23G hypodermic needle to allow subsequent negotiation of 20G blunt needle. Needle was inserted through the puncture site perpendicular to the skin. Increased resistance was met as the needle encountered the external oblique muscle; a loss of resistance was appreciated as the needle passed through the muscle to lie between it and the internal oblique muscle. After the initial loss of resistance and negative needle aspiration for blood 2ml of local anesthetic mixture, (0.5% bupivacaine + 2% lignocaine, 1:200000 adrenaline) was injected. The needle was then, advanced further to encounter another resistance, the internal oblique muscle. Again loss of resistance was appreciated, once the needle passed through the internal oblique muscle, to lie between it and transverses abdominus muscle. With the second loss of resistance, another 2ml of local anesthetic was administered. The needle was then withdrawn to the skin and redirected at a 45 degrees medially, to again pierce the external and then internal oblique muscles. After each loss of resistance, 2ml of local anesthetic solution again administered. The needle then returned to skin and inserted 45 degrees laterally and procedure repeated. Thus a total of 12 ml of local anesthetic solution placed in a fan like distribution between the external and internal oblique and the internal and transverses abdominus muscles. Subsequently, genitofemoral nerve block was supplemented to ilioinguinal and iliohypogastric nerve block for enhancing the efficacy of regional block. Genitofemoral nerve block was performed immediately proximal to the pubic tubercle on the line joining anterior superior iliac spine with pubic symphysis with 5ml of LA agents in both the directions. Further, 5ml of LA was loaded and handed over to the assistant, assisting the surgeon for injecting at the neck of the hernia sac by the surgeon before opening the sac in order to avoid discomfort to the patient, due to retraction during surgery. 28ml of LA (14 ml 0.5% Bupivacaine and 14 ml 2% lignocaine with 1:200,000 adrenaline) was used for the entire procedure. Fifteen minutes after completion of the block, the skin of the lower abdominal wall and inguinal region was assessed for anesthesia and confirming the adequacy of block surgery was started. Intra-operatively oxygen saturation, ECG, NIBP monitored. Surgical procedure lasted for 2 hr and 15 minutes without any significant changes in heart rate, blood pressure. Post operatively, patient was observed in the post operative recovery room for 1 hr and then shifted to the surgical intensive care unit (SICU). Pain relief achieved with Diclofenac sodium (Justin) suppository 100 mg BD and Inj Tramadol 50 mg IV BD for 2 days, remaining part of postoperative stay was uneventful.

DISCUSSION

Progressive aging of the population and prolongation of life expectancy have led to rising prevalence of heart failure (HF) (Lindenfeld *et al.*, 2010). Normal EF varies at 55% to 70%, and EF 40% to 55% may indicate damage perhaps from previous heart attack, but may not indicate HF. Measurement of EF under

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40% may show evidence of HF or cardiomyopathy. Patients with EF < 35% (very low EF) may be at the risk of life threatening irregular heartbeats (arrhythmias) leading to sudden cardiac arrest and sudden death (Zheng *et al.*, 2001; Buxton *et al.*, 2010). HF may exist with preserved ejection fraction (HFpEF) also termed as diastolic heart failure (Yancy *et al.*, 2006). Diastolic dysfunction is central to the pathophysiology of HFpEF, slowing of ventricular relaxation and diastolic stiffness ultimately impairs ventricular filling (Borlaug & Pauls, 2011). HF may also be associated with reduced ejection fraction (HFREF) referred as systolic heart failure. Systolic heart failure (systolic dysfunction) results in decrease in myocardial contractility, and is usually global, associated with reduced left ventricular ejection fraction. Measurement of EF below 40% may show evidence of HF or cardiomyopathy. Heart failure with preserved EF is associated with high mortality rate, comparable to that of patients with reduced EF (Bursi *et al.*, 2006). EF < 35% (and very low EF) may expose patient to the risk of life threatening irregular heartbeats. Preoperative heart failure is an important risk factor for post operative complications. Any arrhythmia can lead to sudden cardiac arrest and sudden death hence, it needs prompt treatment. Regional anaesthesia used alone or in combination with general anaesthesia has advantage of reducing after load which can improve cardiac output. However, hypotension must be prevented to avoid myocardial hypo perfusion. Peri-operative goals in these patients include maintaining forward flow, promoting adequate heart rate without inducing (or exacerbating) ischemia, avoidance of arrhythmias and maintenance of stable condition in the postoperative period. However, regional anaesthetic technique (modified hernia block), with ilioinguinal nerve, iliohypogastric nerve along with genitofemoral nerve block (Gultekin *et al.*, 2007; Ozgun *et al.*, 2002), achieve complete anesthesia and thus avoid general and neuraxial related hypotension and arrhythmias that may be detrimental in patients with low ejection fraction.

Conclusion

In conclusion, these patients with low EF are considered to be at high risk for anaesthesia due to life threatening irregular heartbeats, advancing to sudden cardiac arrest and sudden death. The goals of perioperative management in these patients include maintaining of forward flow, adequate heart rate and avoidance of arrhythmias. During initial evaluation, this patient's advanced age added with low ejection fraction seemed to be severe enough to avoid major surgery. However, with proper pre-operative evaluation and anaesthesia plan he successfully underwent major surgery under modified hernia block.

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