

Ejection Fraction <35% - Anaesthetic Experience of 236 Cases: A Retrospective Study

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ABSTRACT

Background: 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: The aim of this study was to find out the characteristics of patients, identifying of the risk factors, better understanding of pathophysiology, pre-operative optimization of the patients, uses of stable drugs & anesthetic techniques, reduces intraoperative or early postoperative complications & perioperative morbidity, mortality.

Methods: In this retrospective study we described our experiences of 236 cases of very low ejection fraction (20% - 35%) from 1st July 2014 - 30th June 2017. We reviewed their medical history and noted age, sex, type of operation & anesthesia, pattern of operation either elective or emergency, preoperative investigation and preparation, as well as details of anaesthetic management, were also recorded.

Results: General anaesthesia was performed in 176 (74.58%) cases and rest of 60(25.42%) cases were regional where spinal 42(17.80%) cases & epidural 18(7.62%) cases. The age of the patients were in the range of 20 to 70 years, with majority of the patients were in 60 to 69 years age group. The majority of the patients about 46.19% were in LVEF 26 - 30% group, 36.01% patients were in 31 - 35% group and rest of 17.80% patients were in 20 - 25% group. Average duration of operation incase of general anesthesia 66.5(±2.28SD) min and incase of regional 44.2(±3.25SD) min. The mortality rate only 1.27%.

Conclusions: Preoperative patient optimization, intraoperative haemodynamic stability and postoperative care have contributed to the success of very low ejection fraction patients in our hospital.

Key Words: Anesthetic management, Ischaemic heart disease, heart failure, LVEF <35%

Introduction

Ejection fraction (EF), is a measurement that indicates how well heart is functioning and in diagnosing as well as tracking the heart failure (HF). The normal range of EF varies from 55 to

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70%. Low ejection fraction, is called when ejection fraction is fall below 55%. It means heart is not functioning as well as it could. If EF 35% or below, then it is called very low ejection fraction which is very high risk group for developing dangerous arrhythmia and going into heart failure. Heart failure with reduced ejection fraction (HFrEF) known as systolic heart failure¹. The heart can't pump with enough force to push enough blood into circulation. Heart failure with preserved ejection fraction (HFpEF) is called diastolic heart failure.^{2,3,4} The left ventricle loses its ability to relax normally (because the muscle has become stiff). The heart can't properly fill with blood during the resting period between each beat. In diastolic heart failure, heart muscle contracts normally but the ventricles do not relax as they should during ventricular filling or when the ventricle relax⁵. 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 <35% could be at the risk of life threatening irregular heartbeats. Any arrhythmia in these patients needs prompt treatment if not it may lead to sudden cardiac arrest and sudden death.

Major surgery stresses the cardiovascular system in the perioperative period. This stress leads to an increase in cardiac output which can be achieved easily by normal patients, but which results in substantial morbidity and mortality in those with cardiac disease. Postoperative events which cause death include myocardial infarction (MI), arrhythmias, and multiple organ failure secondary to low cardiac output.

Administering anaesthesia to patients with preexisting cardiac disease is an interesting challenge. Patients with very low ejection fraction require identification of risk factors, preoperative evaluation and optimization, medical therapy, monitoring, and appropriate anesthetic technique and drugs. The goals of anaesthetic management in these patients include avoidance of drug induced myocardial depression, prevention of arrhythmias and maintaining adequate cardiac output.

We conduct a retrospective analysis of 236 cases of very low ejection fraction to identify the trends according to patient's age, sex, type and pattern of operation, anaesthetic management and the outcome of patients in our hospital.

Methods

In this retrospective study we reviewed medical records of 236 cases of very low ejection fraction (EF 20% - 35%) conducting from 1st July 2014 - 30th June 2017 at BIRDEM General Hospital, Shahbagh, Dhaka. As per the hospital policy all drugs used and events that occurred peroperatively were recorded manually and a copy of the preoperative assessment and anaesthesia notes written by the concerned authority were preserved.

We noted age, sex, type & pattern of operation. Preoperative preparations like premedication, fasting and routine investigations such as CBC, platelet count, electrolytes, serum glucose, BUN, serum creatinine, PT, APTT, INR, liver function tests, urinalysis, ECG, chest radiograph and 2D Echocardiogram, 24 hours holter monitoring, coronary angiogram, details of anaesthesia management either general anesthesia or regional anesthesia or combined (general & regional) anesthesia, monitoring and the outcome were also recorded.

Results

236 patients who were EF <35% underwent non-cardiac surgery at the study hospital from 1st July 2014 to 30th June 2017 were in the age bracket of 20 to 70 years, with majority of the patients were in 60 to 69 years age group.

In relation with sex 68.64% patients were male and 31.36% patients were female. Average body weight was 66.30 (± 9.44 SD) kg. Among the study group 69.07% patients were diabetic where rest of 30.93% patients were non-diabetic. About 55.51% operation were elective and rest of 44.49% operation were emergency.

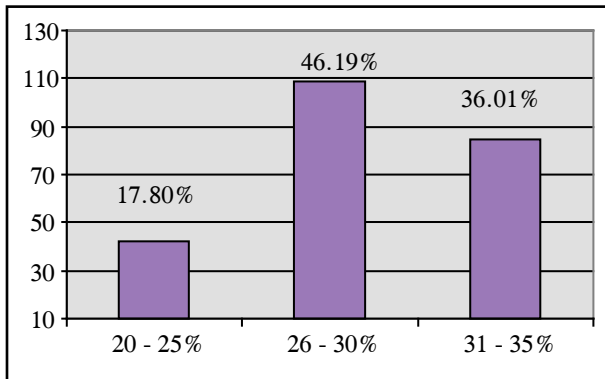


Fig-1: Bar diagram of relation with LVEF

In relation with left ventricular ejection fraction (LVEF) the majority of the patients about 46.19% were in EF 26 - 30% group, 36.01% patients were in EF 31 - 35% group and rest of 17.80% patients were in EF 20 - 25% group (Fig - 1).

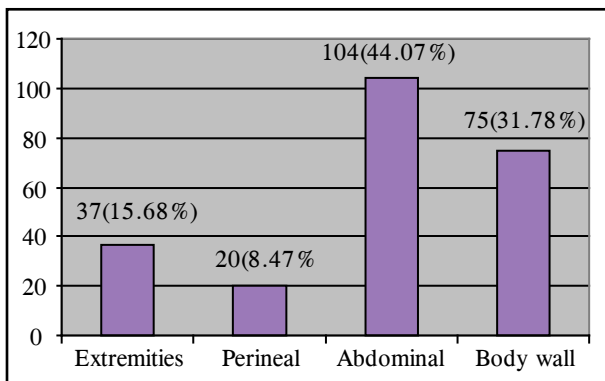


Fig-2: Bar diagram of relation with type of operation

In relation with type of operation there was predominance of abdominal operation with 44.07%, where 31.78% were body wall, 15.68% were extremities and rests of 08.47% were perineal operation (Fig - 2). Average duration of operation incase of general anesthesia 66.5(±2.28SD) min and incase of regional 44.2(±3.25SD) min. The mortality rate only 1.27% (1st POD 2 cases and 3rd POD one case).

Preoperative Status

The most of the patients 123(52.12%) were ASA Class IV where 113(47.88%) were in class III and 158(66.95%) patients were NYHA class II and rest

of 78(33.05%) were NYHA class III (Fig - 3). MET value of all patients were 4 - 6.

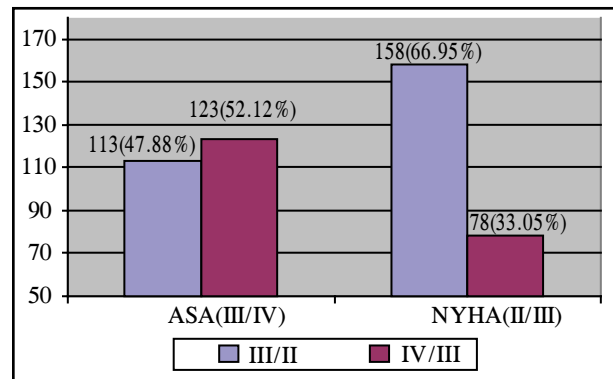


Fig-3: Bar diagram of relation with ASA & NYHA

Preoperatively we assessed the cardiac risk for elective cases by following the new 2014 Joint Task Force European Society of Cardiology (ESC)/ European Society of Anesthesiology (ESA) guidelines on perioperative assessment and management of cardiac risk in non-cardiac surgery⁶ has upgraded previous recommendations regarding preoperative evaluation of patients scheduled for non-urgent non-cardiac interventions. It was previously widely accepted that the Lee index, or "revised cardiac risk" index is the gold standard for predicting cardiac complications after non-cardiac surgery.⁷ The Lee index was designed to predict post-operative cardiac events, defined as myocardial infarction, pulmonary oedema, ventricular fibrillation or cardiac arrest, and complete heart block. The score is comprised of six independent factors, which all add 1 point to the risk index: type of surgery, history of ischaemic heart disease (IHD), history of HF, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative creatinine > 2 mg/dl. The incidence of cardiac events is predicted to be 0.4%, 0.9%, 7%, and 11% for patients with an index of 0, 1, 2, and 3 or more points, respectively.⁸ While still accepting its value as a good discriminator between patients with low vs. high risk for cardiac events after mixed non-cardiac surgery, it seems that it is not as viable as a predictor of death or cardiac events in vascular non-cardiac surgery.⁹

Another important factor in the preoperative evaluation of the risk is the operation itself. Depending on the type of surgery to be performed, the risk for cardiac events (cardiac death and myocardial infarction) is divided into three categories: low (<1%), intermediate (1-5%), and high (>5%).¹⁰

Another important preoperative prognostic factor is the patient's functional capacity, which is measured in metabolic equivalents (METs). Measuring it is not usually necessary, as it can be approximated based on daily activities. One MET is equal to the basal metabolic rate. The capacity to climb two flights of stairs or run a short distance (>4 METs) indicates a good functional capacity, which, by itself, offers a good postoperative prognosis, regardless of additional risk factors and even in the presence or stable IHD.¹¹

The 2014 ESC/ESA Guidelines on non-cardiac surgery offers a 7 step algorithm that can be summarized⁶:

1. In urgent surgery there is no time for cardiac testing or specific treatment. The cardiologist should provide recommendations for managing perioperative risk, monitoring cardiac events and continuation of chronic cardiovascular therapy.
2. In the case of unstable cardiac conditions (unstable angina, AHF, arrhythmias, symptomatic VHD, recent MI), treatment options should be discussed by a multidisciplinary team, involving all perioperative care physicians.
3. The risk of the surgical procedure should be estimated; if the risk is low, surgery should be done as planned, taking into consideration patient risk factors and starting therapy according to cardiologist's recommendation;
4. If the risk is moderate to high, functional capacity assessment should be performed, based on which further decisions are to be made; if it is >4 MET, the overall prognosis is good, and procedures should be continued;
5. If the functional capacity is ≤ 4 MET, and intermediate-risk surgery is planned, a non-invasive stress-testing is indicated.
6. If high risk surgery is planned, the revised cardiac risk index is helpful; if the Lee index is ≤ 2 , in addition to the above, rest echocardiography and biomarkers should be considered.
7. If the Lee index is >2, a non-invasive testing should be done; interpretation should be done in a multidisciplinary team and preoperative invasive interventions should be undergone if necessary, as described here in above.

Anaesthetic Management

The anaesthetic choice, in most of the cases (176) were general anaesthesia. For the rest of 60 cases were regional where spinal 42 cases & epidural 18 cases. Pre medication one hour before surgery consisted of midazolam hydrochloride 1mg I/V for all elective cases in addition to all other medications that the patients were receiving on a regular basis. In general anaesthesia induction was done with Propofol (1 mg/kg) in 152(86.36%) cases & with etomidate (0.2 mg/kg) in 24(13.64%) cases, Inj. fentanyl was given @ 2.5 μ gm/kg for all cases. Neuro muscular blockade was maintained with Atracurium 0.5 mg/kg. Anaesthesia was maintained with 50 - 60% N₂O in oxygen supplemented with fresh gas flow of 2 l/min and continuous infusion of Propofol@ 20-30 ml/ hour. Analgesia was maintained with 25 μ gm fentanyl every 30 minute interval. In regional anaesthesia 42 cases were done by spinal with 0.5% ultracain heavy 1.5 ml (7.5 mg) at the level of L4/L5 level and rest of 18 cases were done by epidural anaesthesia at the same level with 0.5% plain bupivacaine 8 - 10 ml bolus and then 0.125% bupivacaine with 2 μ gm fentanyl per ml solution through epidural catheter @ 4 - 8 ml/hour continuous infusion through syringe pump.

Intraoperative monitoring included heart rate, continuous electrocardiogram, non-invasive blood pressure, oxygen saturation and ABG in all cases. Intra operative hypotension was controlled with single or double bolus IV injection of 5 - 10 mg ephedrine hydrochloride (24 cases), to keep the mean arterial pressure (MAP)>60 mmHg. During this period intravenous fluid administered was

normal saline and ringer lactate-based crystalloid. Intraoperative and post-operative haemodynamic parameters were recorded on 5 minute interval initially then 10 minute interval and upto two hour basis from the intraoperative & post-operative charting (Fig - 5).

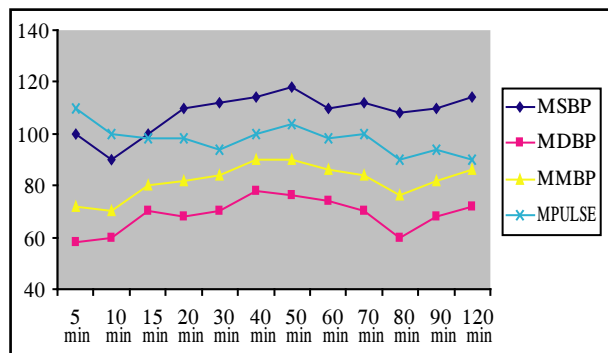


Fig-5: Hemodynamic parameter

At the end of operation, neuromuscular blockade was reversed with IV injection of neostigmine (0.05 mg/kg) with atropine (0.025 mg/kg) and all patients were extubated smoothly.

Postoperative Care

Patients were transferred to surgical ICU. The most common problem in post operatively was pain & it was about 80% cases. The rescue analgesia was provided with IV morphine (4 - 6 mg) for 190 cases, IV tramadol (50 mg) 28 cases and continuous epidural analgesia for rest of 18 cases with 0.125% bupivacaine with 2 µgm fentanyl per ml solution through epidural catheter @ 4 - 8 ml/hour. Another common problems in postoperative period were premature ventricular contraction (PVC) and tacky-arrhythmia and it was about 67% cases & was treated with 100% oxygen, sedation and analgesia. Specific antiarrhythmic drugs inj. amiodarone loading infusions: 150 mg over the first 10 minutes (15 mg/min), followed by 360 mg over the next 6 hours (1 mg/min) & maintenance infusion: 540 mg over the remaining 18 hours (0.5 mg/min) was needed in 28 cases.

Because upto half of postoperative myocardial infarctions present without pain¹², the physician must be alert for arrhythmias, hypertension, hypotension, or altered mental status that may

herald painless postoperative infarctions. The risks of postoperative hypertension, arrhythmias, and congestive heart failure persist for at least 2 days, and the risks of myocardial infarction persist for 5 to 6 days after surgery. It should be noted that postoperative myocardial infarctions have about a 50% mortality rate even with modern medical care.^{13,14} But in our institute only 3 patients (two in 1st POD & one in 3rd POD) died and the mortality rate only 1.27%. Key points for the success of our practice were maintaining haemodynamic stability, proper monitoring during perioperative period, used of stable drugs and postoperative adequate analgesia.

Discussion

Ischemic heart disease (IHD) is a leading cause of morbidity and mortality in the world and of perioperative complications in cardiac patients. Patients with IHD require identification of risk factors, preoperative evaluation and optimization, medical therapy, monitoring, and appropriate anesthetic technique and drugs. Risk factors influencing perioperative cardiac morbidity are recent myocardial infarction (MI), congestive cardiac failure, peripheral vascular disease, angina pectoris, diabetes mellitus (DM), hypertension, hypercholesterolemia, dysrhythmias, age, renal dysfunction, obesity, sedentary life style, and smoking.

Most common cause of peri-operative morbidity and mortality in cardiac patients is ischaemic heart disease (IHD). IHD is number one cause of morbidity and mortality all over the world.¹⁵ 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^{16,17} achieve complete anaesthesia and thus avoid general and neuroaxial related hypotension and arrhythmias that may be detrimental in patients with low ejection fraction.

The main perioperative objective in cardiac patients is to prevent myocardial ischemia by optimizing oxygen delivery and oxygen consumption, and treating accordingly if such an imbalance should occur. This is much more important than the type of anaesthesia or the anaesthetic agent choice. For example, tachycardia is deleterious both by increasing the myocardial oxygen demand and by lowering oxygen transport and thus heart rate should be maintained within 20% limits of normal values. Similarly, it has been shown that decreases by >20% in mean arterial pressure or mean arterial pressure (MAP) values <60 mmHg for durations of >30 minutes pose a greater risk for postoperative complications that include myocardial infarction, stroke and death.^{18,19} The benefits of neuroaxial anaesthetic techniques (spinal or epidural) are also debatable, as it can also induce sympathetic blockade.²⁰

A recent systematic review showed that compared with general anaesthesia, neuroaxial anaesthesia may reduce the 0-to-30-day mortality for patients undergoing a surgery with an intermediate-to-high cardiac risk.²¹

Neuroaxial anaesthesia alone (but not when associated with general anaesthesia) can therefore be considered as the anaesthetic technique of choice following careful assessment of the risk/benefit ratio for each patient.⁷ Similarly, neuroaxial analgesia is also associated with better post-operative outcome and should therefore be considered as the technique of first choice (following careful assessment of individual risk/benefit profile).⁶ Care should be given to frequent association in cardiac patients of drugs that impede coagulation; complications can be tragic, so risk-benefit ratio should be calculated.²² Patients with cardiac disease present for anaesthesia every day. Since their perioperative courses are associated with greater morbidity and mortality, it is

important to provide a haemodynamically stable anaesthetic. This requires knowledge of the pathophysiology of the disease, and of the drugs and procedures and their effects on the patient.

Cardiac risk in non-cardiac surgeries is best tackled by a perioperative team approach. Close collaboration and shared decision-making among the patient, primary caregiver, cardiologist, surgeon, and anesthesiologist is key to ensuring proper implementation of current evidence-based guidelines. However, current evidence regarding much of what we do deeply lacks the rigor of multiple, prospective randomized controlled trials. As the U.S. healthcare system finds itself grappling with the goals of better patient care that is cost effective, further studies on the use of novel perioperative testing and interventions will be needed. Future research focusing on patient outcomes is needed to further clarify the proper care of these patients.

Conclusion

In conclusion, patients with very 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.

Conflict of interest: none

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