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General Anesthesia Management with LMA in Patients with a Diagnosis of Closed Fracture of the Proximal Tibia with Cardiomegaly

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Abstract. Tibial fracture is the most common type of lower extremity fracture. Management of closed proximal tibial fracture with cardiomegaly requires effective anesthetic management by considering the patient's hemodynamics and heart condition. The selection of the right anesthetic is needed to avoid postoperative cardiomegaly complications. The purpose of this case report is to describe the anesthetic management in a patient with a closed proximal tibial fracture who will undergo ORIF surgery using general anesthesia with LMA with comorbid cardiomegaly. The method used in this case study is a descriptive observational method using a single case study approach. Patient data can be collected in several ways: through detailed patient history obtained through interviews, observation, thorough physical examination, and regular recording of vital signs every 30 minutes. The data collection process takes place before surgery, during surgery, and in the postoperative period. The conclusion of this case study is that considerations for administering anesthesia to patients with closed proximal tibial fracture with comorbid cardiomegaly must consider the condition of their heart.

1 Introduction

A fracture is characterized as the disruption of the continuous outer layer of the bone. The discontinuity can be complete when both cortices affect each other and incomplete when only one cortex is involved. As a result, this condition is a bone failure due to direct or indirect loads with a high level of impact. Fractures can also result in the destruction of structures that are connected to each other (eg ligaments, tendons, etc.).

Fracture classification can be divided into two categories, namely closed fractures and open fractures. A closed fracture if there is no connection between the fracture and the outside world. On the other hand, an open fracture is a fracture that penetrates the skin and

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muscles that allows infection where germs from the outside environment enter deeper wounds, until they break (1).

A tibial fracture refers to a break that happens in the tibia located near the knee. The tibia is the bone that makes up the distal portion of the knee joint at the upper end of the tibia. While tibial fractures are significant injuries, they happen in only approximately 1.2% of all fractures (2). Tibial fractures can happen in individuals of any age. These fractures can be categorized into diaphyseal, proximal, and distal types. Research discussing the incidence of proximal tibial fractures is still rare. There are several studies that show that deep proximal tibial fractures occur in 10–32 per 100,000 people per year. In cases of tibial fractures, there are various treatment options, including pin placement, plate fixation, or external fixation (3). Proximal tibial fractures are common in men, while they are more common in women as they age. Proximal tibial fractures are most commonly observed in individuals within the fourth to sixth decades of life. High-energy trauma, such as motor vehicle accidents, frequently leads to proximal tibial fractures in males. In contrast, females typically sustain fractures from low-energy activities like falling, jogging, or cycling (4).

Open reduction and internal fixation (ORIF) are considered one of the standard treatments for acute injuries (5). Early open reduction and internal fixation (ORIF) is widely used to achieve satisfactory results (6). Fractures can be treated using open reductive external fixation (OREF) or open reductive internal fixation (ORIF). Open Reduction Internal Fixation (ORIF) is one of the various treatment methods that uses surgery to restore the position of damaged bones. Open Reduction Internal Fixation (ORIF) aims to restore the function of stabilization and movement of the bone, so that patients can move immediately after surgery. Open Reduction Internal Fixation (ORIF) is a form of surgery involving internal fixation that is performed when the fracture does not allow reduction to the category that uses closed reduction to obtain a suitable condition for the fracture fragments (7). If the fracture site is known, ORIF is performed to repair the broken bone. The surgical decision is adjusted according to the diagnostic findings of the X-ray examination, and synchronized with clinical symptoms such as pain in the area of the broken bone.

Surgery for proximal tibia fractures generally uses spinal anesthesia but can also use general anesthesia when the patient has contraindications for spinal anesthesia. In this case study, the patient had contraindications for spinal anesthesia, namely cardiomegaly. Handling tibia fractures in patients with cardiomegaly may require several changes. The choice of anesthesia, fluid and electrolyte management, strict circulatory monitoring, and reduced mobility to prevent cardiac overload are examples. In this case, patients with comorbid cardiomegaly were avoided using spinal anesthesia to avoid fluid overload. Cardiomegaly has been associated with malnutrition-inflammation and has been reported as a symptom of fluid overload. Albuminuria, anemia, and fluid overload are possible problems in patients with cardiomegaly. Fluid overload is associated with a rapid decline in kidney function and a high risk of cardiovascular disorders (8). So, the choice of general anesthesia technique in this case study is the right choice. The purpose of this case study is to provide comprehensive management of general anesthesia for LMA in patients with a diagnosis of closed proximal tibia fractures with comorbid cardiomegaly.

2 Method

The method used in this case report is a descriptive observational method using a single case study approach. The descriptive observational method is used to explain the patient's condition during anesthesiology and nursing care as a whole. This method is suitable for

explaining how the patient's clinical condition, such as cardiomegaly, can be correlated with the medical actions taken. The data collection stage is comprehensive and longitudinal and includes three phases: preoperative, intraoperative, and postoperative in order to provide a better anesthesia plan to improve patient safety and reduce perioperative risk. Patient data can be collected in several ways: through a detailed patient history obtained through interviews, observation, a thorough physical examination, and regular recording of vital signs, namely every 15 minutes.

Interviews to find out several important aspects, such as the main complaint felt, medical history, drug use, history of allergies, and so on. Observation and physical examination are carried out to identify symptoms or changes that may indicate a medical problem. Surveillance of cardinal indicators encompasses arterial pressure, pulse rate, respiratory cadence, oxygen saturation, and body temperature. The data collection process takes place before surgery, during surgery, and in the postoperative period. The goal is to gain a comprehensive insight into the patient's physiological response to the above conditions and intervention procedures with general anesthesia. After the data is collected, the next step is to analyze it, the data analyzed includes laboratory tests, radiology and vital signs, and data from the results of interviews then compare patient data with normal data. After collecting primary and secondary patient data, we analyze the data to find the priority of anesthesia health problems that are most important to handle. The purpose of analyzing data is to be able to provide appropriate intervention to patients, gain a better understanding of the patient's physical condition, and make more rational choices to support the actions given.

The subject of this case study is a 54-year-old male patient diagnosed with a closed proximal tibia fracture with comorbid cardiomegaly who underwent ORIF surgery on August 30, 2024. The patient has given his consent to be the subject of the case study. Observations were made by directly observing the patient's physical condition, reactions, attitudes, and behavior, to obtain a more comprehensive picture. The examination includes various diagnostic procedures such as physical examination, laboratory examination, and radiology. This is intended to strengthen the diagnosis and determine the appropriate treatment steps.

3 Case History

We report a case of closed proximal tibia fracture with cardiomegaly. The result was a successful ORIF procedure under general anesthesia (LMA) with isoflurane volatile agent for intra-anesthetic maintenance. Authorization for disclosure of this case study was duly acquired from the patient. A 54-year-old man came to the Emergency Department on August 29, 2024 with complaints of pain in the upper shin of the right leg after slipping in front of the house while walking, then when he slipped the patient's foot hit a rock. The patient's weight was 63 kg and height 167 cm, with a Body Mass Index (BMI) of 22.6 indicating ideal body weight. On initial physical examination at the Emergency Department, the general condition was moderately ill, consciousness compost mentis. Blood pressure 153/87 mmHg, pulse 97x/minute, respiration 18x/minute, temperature 36.9°C, and oxygen saturation (Spo2) 98%. The patient was diagnosed with Closed Proximal Tibia Fracture.

Blood tests showed hemoglobin L 10.2 g/Dl, hematocrit L 31.3%, leukocytes H 14,050/mm3, MCV L 61.0 fl, MCH L 19.9 pg, and RDW H 16.1%. Radiology examination showed cardiomegaly (Figure 1). Based on anamnesis, clinical examination, and

radiological findings, the patient was diagnosed with Closed Proximal Tibia Fracture so ORIF had to be performed. The patient was scheduled for surgery on August 30, 2024 at 19.00 WIB.

On August 30, 2024, the patient had been fasting since 13.00. The patient was given Cefazolin 2gr premedication at 18.30 in the inpatient room. While in the IBS in the preoperative room, the results of the hemodynamic examination showed blood pressure of 190/108 mmHg, Pulse 121x/minute, temperature 36.5°C, Spo2 98%, RR 15x/minute. The patient was given an infusion of RL 20 tpm. The premedication drugs given were Ondansetron IV 4mg, Atropine sulfate 0.25mg, and Ranitidine 50mg. Preoperative monitoring includes hemodynamic monitoring which includes monitoring blood pressure, pulse, oxygen saturation, MAP, temperature, and also monitoring the patient's fluid/electrolyte needs. The objective of perioperative hemodynamic regulation is to achieve optimal equilibrium of arterial pressure and cardiac output (9).

Intraoperative anesthesia considerations using GA with LMA using volatile agent isoflurane for intraanesthesia maintenance. The induction drugs given were Fentanyl as IV analgesic 100mcg, Propofol as IV sedation 100mg. Intubation was performed 2 minutes after administration of propofol 100 mg, followed by interventional pre-oxygenation to 100% using face mask No. 3 and bagging for 2 minutes. Intubation using LMA No. 3 and 10 cc fixation was then connected to the anesthesia machine, During the intra-anesthesia phase, 2 liters of oxygen, 1.5 liters of N20, 2% isoflurane, and 20tpm RL infusion were given. During intraoperatively, the patient experienced a decrease in blood pressure of 55/46 mmHg and was treated with 20mg Ephedrine and 1.5% isoflurane. In elderly patients, low blood pressure frequently occurs following the onset of general anesthesia, and it is important to prevent this condition to reduce perioperative complications (10).

Postoperatively, the patient was fitted with a pen (Figure 2). The patient was extubated and given an infusion of Ondansetron 8 mg, and Dexketoprofen 50 mg, when extubated the patient's breathing was spontaneous but not yet conscious, and was monitored in the recovery room. While in the recovery room, the patient's hemodynamic examination found blood pressure 144/95mmHg, pulse 113x/minute, RR 15x/minute, Spo2 99%.

Table 1. Laboratory Examination Results

Inspection	Results
Hemoglobin	10.2 g/dL
Hematocrit	31.3%
Leukocytes	14,050 /mm3
Platelets	247,000/mm3
Erythrocytes	5.13 million / uL
MCV	61.0 fl
MCH	19.9 pg
MCHC	32.6 g/dL
RDW	16.1%
PPT	15.2 seconds
APTT	35.4 seconds
Random blood glucose	143.0 mg/dL
Urea	30.81 mg/dL
Creatinine	1.36 mg/dl

MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Hemoglobin; MCHC: Mean Corpuscular Hemoglobin Concentration; RDW: Red Cell Distribution Width; PPT: Prothrombin Time Parameters; APTT: Activated Partial Thromboplastin Time.

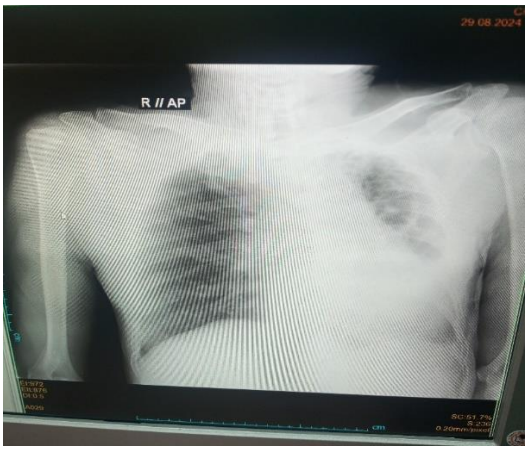

Figure 1Radiology Cardiomegaly

Figure 2X-Ray Examination of The Proximal Tibia Immediately After Surgery.

4 Discussion

Tibial fractures rank as the most frequently occurring fractures in the lower limb. The structure of the subcutaneous bone renders it vulnerable to injury, typically due to high-energy impact. As a long tubular bone, the tibia is capable of bearing significant weight. However, it tends to be unstable when subjected to axial and rotational fractures, and usually necessitates stabilization in adults (11). The tibia possesses a triangular shape, featuring a broadened metaphyseal section and a tapering distal end (12). Knee fractures may lead to prolonged disability and a higher risk of death. Closed proximal tibial fractures can be managed through surgical intervention with open reduction and internal fixation (ORIF) or through non-surgical methods using a patch or brace. In instances of minimally

displaced fractures, particularly in patients lacking transport via ambulance or presenting with comorbid conditions, conservative management is typically administered (13). There are two ways to treat fractures, namely conservative or operative. The conservative method treats fractures by closed reduction or reduction, where the reduction is in the opposite direction of the fracture. After reduction, immobilization is performed to prevent movement of the fracture fragments and facilitate bone fusion. In the operative approach, the fractured area is opened and internal fixation is applied (14). If inadequately managed, fractures of the proximal tibia may precipitate functional impairment and precipitate premature osteoarthritic degeneration of the knee articulation (15).

In this case study, the management of tibial fractures presented additional problems for patients with cardiomegaly. Cardiomegaly impairs the patient's capacity to endure surgical stress and heightens the likelihood of adverse outcomes during convalescence. The risk of cardiac decompensation during physiological stress, such as surgery or trauma, is increased as a result of the enlarged heart and decreased cardiovascular function. Thus, a special approach to anesthesia, fluid control, and close monitoring during surgery and recovery may be required for patients with cardiomegaly.

In patients with cardiomegaly, several adjustments may be required to manage tibial fractures. These include the choice of anesthesia, fluid and electrolyte management, close monitoring of blood circulation, and reduced mobility to prevent cardiac overload. Therefore, the cardiomegaly condition suffered by this patient presents additional problems that require a multidisciplinary approach to managing tibial fractures. Understanding the types and frequencies of tibial fractures can also help clinicians determine better interventions for patient outcomes, while considering comorbid conditions that affect patient management and recovery.

Anesthesia for patients undergoing ongoing procedures includes a large number of patients with significant variations in older patients, recurrent illnesses, and certain types of surgery (16). Orthopedic anesthesiology continues to develop as a subspecialty practice with specialized equipment and techniques. General anesthesia is a method of anesthesia that has been successfully used in many orthopedic procedures (17)(18). In this case, the patient had cardiomegaly and the anesthetic consideration given was to use LMA general anesthesia. Cardiomegaly can increase anesthetic complications in this case. Risks that need to be considered include hypertension, hypotension, and tachycardia. In order to prevent complications and ensure patient safety, a comprehensive preoperative evaluation is needed by evaluating the patient's medical history, conducting a physical examination, and supporting examinations such as laboratory tests, optimizing the patient's physical condition by monitoring and monitoring the patient's vital signs closely during intraoperatively. According to Malekshoar et al. (2024)(19) to maintain the airway, the use of LMA instead of ETT is more effective because it receives the best lung dynamics, stabilizes the peak and plateau lung pressures, and maintains respiratory oxygen and carbon dioxide tensions. In this case, LMA seems to be used effectively for various age groups, genders, comorbidities, and body weights of patients. For major operations such as ORIF, the LMA method may still be a better choice.

Cardiomegaly is characterized by the enlargement of the heart due to dilation and a reduction in the contraction ability of the ventricles or both ventricles. The phrase "cardiomegaly" represents the increase in heart size that can be observed on a chest X-ray. Cardiomegaly occurs when the heart is larger than 50% of the internal diameter of the rib cage. This condition can be caused by several conditions including kidney disease, heart failure, hypertension, congenital abnormalities, infections, and cardiac myopathies (20). Cardiomegaly occurs due to mutations in genes that alter the structural components of the

sarcomere and desmosome (21). In patients with cardiomegaly who require medical surgery (eg, proximal tibial fracture surgery), the choice of anesthesia must also take into account the cardiac situation. To avoid cardiovascular complications, it is important to provide anesthesia with caution in patients with cardiomegaly undergoing meningeal surgery (eg, fictive proximal tibial fracture). Cardiomegaly often indicates cardiac dysfunction, and therefore the anesthetic chosen must minimize the impact on the cardiovascular system.

The accumulation of dissolved electrolytes and water in the body beyond physiological levels is called fluid excess. This excess fluid accumulates in the spaces between cells, which can expand and lead to interstitial edema. It can thus lead to accumulation of macroscopic fluids in the abdomen (pleural effusion) or in the abdomen (ascites). Cardiomegaly, a condition caused by an overload of fluid, is historically recognized for its features, including decreased cardiac output, elevated cardiac filling pressures, increased excretion of sodium and fluid, and excessive constriction of blood vessels. It starts with diminished cardiac output and an inability to uphold normal fluid levels, leading to the activation of neurohormonal systems. Consequently, this triggers an excessive buildup of fluids and impaired heart function (22).

Management is extensively employed as a crucial element of perioperative oversight in individuals undergoing surgical procedures (23). Fluid therapy is an essential part of routine therapy and contributes to the maintenance or reduction of blood volume. The primary goal of fluid management is to maximize stroke volume, optimize preload and ensure adequate organ perfusion (24). Perioperative fluid stewardship must be tailored to the individual, factoring in the nature of the surgical intervention as well as critical considerations such as intravascular volume homeostasis and both acute and chronic comorbid conditions (25). Fluid intake that exceeds the heart's capacity to pump blood adequately, causing fluid retention and increasing the burden on the cardiovascular system is called excessive fluid intake. This can lead to swelling, increased venous pressure, or even congestive heart failure in cases of cardiomegaly. Excessive fluid intake should not be tolerated in patients with cardiomegaly (enlarged heart) because this condition can weaken existing cardiac function. Cardiomegaly often occurs due to heart disease in which the heart is unable to pump efficiently. If too much fluid is taken into the body, the already enlarged and possibly weakened heart will have difficulty pumping the excess blood. This can cause fluid to accumulate in the lungs. In several clinical scenarios, including cardiac problems and critical illness, there is a correlation between morbidity and mortality due to fluid overload. It causes disruption to almost every organ system. Knowledge of the patient's basic pathophysiology, volume status goals, appropriate therapeutic choices, and maintenance and modulation of tissue perfusion are all necessary to properly manage the patient with fluid overload (26).

The primary objective of the maintenance phase of general anesthesia is to preserve surgical insensibility while safeguarding physiological homeostasis at levels that support organ viability, prevent distress, and avert tissue harm (27). Maintenance can be achieved with inhalation or intravenous anesthetic agents. In this case, LMA general anesthesia was used to provide full control during surgery. To maintain hemodynamic stability during intraoperatively, initial intervention was given volatile agent maintenance isoflurane with a MAC concentration of 2%, oxygen 2L, N2O 2L, and fluid management given to in this case was by giving fluids through RL infusion 20tpm. In this case, the patient had cardiomegaly, therefore fluid loading should be avoided. Optimal intraoperative management is essential to minimize perioperative complications and improve the success of surgical outcomes in patients undergoing fracture surgery (28). During intraoperatively,

the patient's blood pressure increased and decreased but could be managed. The patient's blood pressure when it increased was 186/107mmHg, pulse rate 115x/minute, this can occur due to several things, one of which is because the patient is experiencing pain, this is overcome by administering volatile maintenance agent isoflurane with a MAC concentration of 2.5%, and N20 to 2L which aims to reduce the patient's blood pressure to normal. MAP management during the surgical phase is one of the focuses of intervention to maintain patient hemodynamics. In this case the patient experienced cardiomegaly, therefore when the patient experienced a decrease in blood pressure to 55/46, this was overcome by providing a reduction in volatile maintenance agent isoflurane with a MAC concentration of 1.5% and N2O 1.5L, and ephedrine 20mg was given which aims to increase blood pressure. The mechanism of hypotension can occur due to too deep anesthesia. When hypotension occurs, fluid loading cannot be given considering the presence of cardiomegaly in the patient.

Postoperatively, the patient was extubated while still under anesthesia and the patient's breathing was spontaneous and adequate. One of the most common and worrying complications in the recovery room is oxygen desaturation (29). Patient recuperation is a phase of continuous patient observation and intervention, focused on reinstating airway reflexes and attaining equilibrium in respiratory and cardiovascular function (30). When transferred to the recovery room, the patient was still under anesthesia, hemodynamic monitoring showed blood pressure 144/95mmHg, pulse 113, Spo2 98%, the patient was given 5L of oxygen and given an infusion of RL drip Ondansetron 8mg, and dexketoprofen 50mg. The patient's hemodynamics were monitored every 15 minutes. Surveillance of cardinal indicators encompasses arterial pressure, pulse rate, respiratory cadence, oxygen saturation, and body temperature. After 15 minutes in the recovery room, the patient had regained consciousness from the effects of anesthesia. The patient remained in the recovery room until the effects of anesthesia wore off. In this case, the measuring tool used to determine whether the patient had recovered from the effects of anesthesia and was ready to move to the ward was by using the Aldrete Score. Muscle activity, respiration, circulation, consciousness, and color are the five parameters in the Aldrete scoring system that indicate physiological recovery from anesthesia. Each category receives a score of 0, 1, or 2, and the highest possible score is 10. Patients who score 8 or higher can be discharged from the PACU (31). When transferred to the basal room, the Aldrete Score for this patient is 9.

In this case, the patient's complex medical condition, such as cardiomegaly, can affect anesthetic management, so LMA may not be used generally in all patients with similar conditions, depending on the severity of cardiomegaly and individual physiological responses. Some limitations in this case are only using 1 subject, lack of long-term monitoring, and variability in anesthetic response. It is hoped that further researchers can develop research with better statistical methods with the number of observations not only in single patients and can conduct long-term monitoring. A broader and more in-depth research approach is expected to produce more comprehensive information that can help improve the quality of anesthetic management in patients with complex medical conditions.

5 Conclusion

Consideration of anesthesia in patients with closed proximal tibia fractures with cardiomegaly comorbidity must consider the condition of the heart. Fluid therapy is an important part of perioperative care, but in patients with cardiomegaly, large amounts of

fluid are not allowed because it can weaken existing heart function, so maintaining the patient's hemodynamic stability and optimizing anesthetic management is essential.

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