

Case Review: Anesthesia Technologist Insights Related to the CABG Procedure



MIKAYLA HOWORKA
OKLAHOMA CITY
COMMUNITY
COLLEGE

INTRODUCTION

This case study analyzes the medical history and surgical intervention of a 51-year-old male patient diagnosed with coronary artery disease caused by a calcified coronary lesion. The surgical procedure is a coronary artery bypass graft involving three vessels. The patient has no known allergies (NKA) and is classified as an ASA 4 (American Society of Anesthesiologists Physical Status Classification). He stands at a height of 183 centimeters (72 inches) and weighs 104.6 kilograms (about 230 pounds). The Mallampati score is 2,

indicating a moderate view of the patient's airway during pre-operative examination. Additionally, the patient's thyromental distance is greater than three finger breadths, and the patient demonstrates a full range of motion in the neck.

The patient's review of systems shows a calcified lesion due to coronary artery disease (CAD) and primary hypertension. Furthermore, it was found that the patient had nearly complete occlusion, with the coronary artery being almost 100% blocked.

PATHOPHYSIOLOGY

The basics of CAD include its risk factors and impact on the cardiovascular system. CAD is a condition where the coronary artery becomes restricted or blocked, causing the heart muscle to receive insufficient blood and oxygen supply. "It typically involves the formation of plaques in the lumen of coronary arteries that impede blood flow" (Shahjehan & Bhutta, 2023). The 'plaques' are a collection of fat that accumulate over time. A multitude of adjustable and

non-adjustable risk factors can cause the build-up of plaque. According to the American Heart Association (2021), the most common risk factors are high cholesterol and blood pressure, family history, smoking, and diet. Some can be avoided, but others cannot (American Heart Association, 2021).

The progression of CAD depends on each individual. "The hallmark... is the development of atherosclerotic plaque" (Shahjehan & Bhutta, 2023). For some, it may start in their early childhood; for others, it may occur much later. Plaque build-up is the beginning stage of CAD, where the heart's arteries begin to harden. Plaque can be considered a fatty, sticky substance that will start accumulating on the arteries and cause them to narrow. "Over time, the plaque could grow in size or become stable..." (Shahjehan & Bhutta, 2023). The stability of the plaque indicates that it has calcified, as the diagnosis states for the 51-year-old patient. Just because it becomes stable does not mean that it will go away.

Per the American Heart Association (2021), typical symptoms include shortness of breath, angina, lethargy, and dizziness. In this case, the patient started to experience shortness of breath and slight chest pain, likely related to exerting themselves at work (American Heart Association, 2021). When the demand for oxygen increases, the heart will beat faster to compensate, and the respiratory rate will also increase. With a narrowed coronary artery, not enough oxygenated blood can pass through to meet the demands of the heart, thus resulting in chest pain and shortness of breath. However, when the exertion decreases, so does the need for oxygen. Therefore, the symptoms will subside.

Additionally, reduced blood flow can cause a myriad of physiological changes. When the heart constantly works harder than it needs to, this presents a problem. Following the Cleveland Clinic, without appropriate intervention, CAD can lead to arrhythmias, heart failure, and myocardial infarction (Cleveland Clinic, 2023). Not only will CAD weaken the heart, but can present with these complications if not treated appropriately. The most significant obstacle to combat is a myocardial infarction or heart attack. It is a known medical emergency with high risk and can be fatal.

The most significant obstacle to combat is a myocardial infarction or heart attack. It is a known medical emergency with high risk and can be fatal.

As a result of the previously stated, this patient's heart is working in overdrive; calcified plaque has affected their cardiac function by reducing the blood flow to the heart. If not for the willingness of the patient to seek professional help and the early intervention of the physicians, the progression of the condition might have resulted in more severe complications or a more challenging treatment path.

SURGICAL PROCEDURE

As previously stated, the patient was scheduled to have a coronary artery bypass graft of four vessels due to a calcified coronary lesion. Although the patient was recently diagnosed with CAD and primary hypertension, they have had no prior surgeries and no other medical history to report. The patient said they started experiencing slight chest discomfort and shortness of breath at work about one month prior to this surgery.

The surgery aims to re-route blood and oxygen flow to the heart. According to Jaffe (2020), coronary artery bypass graft (CABG) is the most common cardiac surgery (Jaffe, Schmiesing, & Golianu, 2020). This procedure is accomplished with a collection of steps: preparation, harvesting grafts, cardiopulmonary bypass (CPB), connecting grafts,

and closure and recovery. For this patient, we induced them under general anesthesia. Then, an arterial line was secured in the left radial artery, while a central line was secured in the right internal jugular. The arterial line was placed to receive real-time, continuous monitoring of the patient's blood pressure. The central line allows the anesthesiologist to give or infuse drugs rapidly. Once complete, the patient is essentially ready for surgery.

The surgeon used the left saphenous vein and the left internal mammary vein as grafts to attach to the heart. This will direct blood flow from the aorta to the part of the coronary artery that is not diseased, thus bypassing it and restoring blood flow. The heart is then exposed "... through a median sternotomy, with the patient typically supported on full CPB" (Jaffe, Schmiesing, & Golianu, 2020, p. 390). During induced asystole, the heart was protected with hypothermia and antegrade cardioplegia. The surgeon let the perfusionist

know they were finished, and the patient's heart was allowed to proceed with beating to see if the grafts were successful. Once it was deemed the heart was restored, CPB was terminated, Heparin was reversed, and the chest was closed.

PHARMACOLOGY

From start to finish, numerous drugs are given to the patient to prepare them for surgery, keep them hemodynamically stable during surgery, and keep them comfortable after surgery. For pre-operative medications, the patient was given amlodipine, atorvastatin, losartan, nitroglycerin, and aspirin. Amlodipine, or Norvasc, is a calcium channel blocker with arterial vasodilation actions and is mainly used for treating hypertension. Atorvastatin or Lipitor is a hypolipidemic drug that can be used "... for the treatment of clinically evident coronary heart disease" (Hitner, 2022, p. 437). Losartan is an angiotensin receptor blocker (ARB). ARBs produce vasodilation and decrease peripheral resistance and blood pressure. Nitroglycerin mainly causes vasodilation (or dilation of the veins). Aspirin is a nonopioid analgesic with many uses, such as reducing inflammation and working as an anticoagulant. According to Hitner, it is essential for treating heart disease (Hitner, 2022).

Induction medications are administered once the patient is brought to the operating room. Versed was one of the first, which is a benzodiazepine typically used for sedation. Lidocaine is a local anesthetic used for many things. Still, for this patient specifically, it was used to decrease the burning sensation of propofol and to be injected into the skin for the arterial line placement. Fentanyl (an opioid) is given for the discomfort that comes from laryngoscopy and intubation. Next comes propofol and etomidate. Both drugs fall under the class of intravenous anesthetics known as hypnotic sedatives. The main difference between them is that propofol can be used for induction and maintenance, while etomidate cannot be used for maintenance. Quickly after, rocuronium is administered. Rocuronium is one of many non-depolarizing muscle relaxants. In this case, the patient does not need complete paralysis, just enough muscle relaxation for intubation. Its blockade is short, and its duration of action is ideal for this case. Once properly intubated, isoflurane is turned on via the vaporizer for the rest of the case to maintain general anesthesia. Isoflurane produces bronchodilation effects and minimal cardiac depression, which is ideal for this patient. To finish off induction, the patient is given an antibiotic called cefazolin to help fight infection post-surgery.

The same induction medications are used during maintenance except for rocuronium and lidocaine. Additional medications are Amicar, norepinephrine, dobutamine, Heparin, and Cardene. Amicar is a coagulant that "...inhibits fibrinolysis activation in situations when excessive clots dissolution is occurring" (Hitner, 2022, p. 404). Norepinephrine is given periodically to increase blood pressure and heart rate. Dobutamine is an adrenergic drug that will increase the force of the heart's contractions. Heparin is especially important for this surgery. Heparin is an anticoagulant that prevents thrombin formation, preventing the clotting chain of events from occurring. According to Choi and Lewis (2016), anticoagulation is essential to prevent thrombus formation in the CPB circuit and avert acute disseminated intravascular coagulation during bypass (Choi & Lewis, 2016). Cardene is like amlodipine in that it is a calcium channel blocker. Its primary pharmacological effect is vasodilation.

Since this patient is not getting extubated in the operating room upon completion of the surgery, there are only a few medications that the anesthesiologist will give for pain management and comfort of the patient. Hitner (2022) indicates that dexamethasone is a corticosteroid that is efficient in preventing postoperative nausea and vomiting (PONV) (Hitner, 2022). Ondansetron is also given to aid in the prevention of PONV. Ondansetron is an antiemetic.

ANESTHESIA TECHNOLOGIST ROLE

The anesthesia technologist (AT) is vital in supporting the anesthesiologist through surgeries. This CABG surgery was no different. In preparation, the AT set up and checked the anesthesia gas machine and systems and monitored well before the surgery if circumstances required replacement. Then, all ASA standard monitors, intubation equipment, arterial line and central venous pressure (CVP) line supplies, and any other equipment or supplies the anesthesiologist indicated.

The AT assisted with induction by helping transfer the patient to the operating table, placing proper monitoring devices on them, and making them as comfortable as possible. While the anesthesiologist is intubating the patient, the AT prepares the patient's arm for arterial line placement. Quickly after, the AT performed a sterile scrub to assist the anesthesiologist with the CVP line. This can be particularly stressful, as everything must remain sterile until the line is secured.

During maintenance, the anesthesiologist cannot leave the


operating room to run labs or grab supplies. This is where the AT comes in. Labs are essential during cardiac surgery. “Blood gases, hemoglobin, potassium, ionized calcium, and glucose measurements should be immediately available” (Butterworth, Mackey, & Wasnick, 2022, p. 453). The perfusionist runs most of the labs, but there are a few that the AT can do outside the operating room. Outside of running labs, the AT checks in on the anesthesiologist and ensures they have everything they need.

There were not any complications during the surgery, but there are a few things that an AT should anticipate happening. Blood loss can occur, although rare. The patient gives blood in advance for complications, so the AT must be prepared to get extra equipment for a blood transfusion. Hemodynamic collapse is always a possibility. Sometimes diagnostic tests will show one thing, but when the surgeon gets to operate on the patient, they find something else or worse. If the patient had severe CAD, their heart would have been much weaker than expected and could collapse before CPB was initiated or terminated. Other heart complications can occur, like ischemia, tamponade, dysrhythmias, coagulopathy, and cardiac failure (Jaffe, Schmiesing, & Golianu, 2020). Ultimately, the AT should be prepared for the worst and know where the necessary equipment is located in case of complications.

COMPLICATIONS/POSTOPERATIVE MANAGEMENT

No complications arose during this patient’s surgery. The patient stayed intubated and sedated when leaving the operating room and was transported to an intensive care unit (ICU) bed. There, they will be extubated. In the ICU, they will continue monitoring the patient and managing pain.

CONCLUSION

In conclusion, patients diagnosed with CAD and demonstrating symptoms associated with its pathophysiology often require CABG surgery. It is important to note that CAD is a chronic disease process that may not always exhibit clinical symptomatology early on, often necessitating surgical intervention in advanced stages following diagnosis. Diagnostic testing revealed nearly 100% blockage of the coronary artery, indicating the necessity of CABG surgery. The procedure involved harvesting the left saphenous and left internal mammary arteries to redirect blood flow from the aorta to areas of the heart with significantly reduced blood flow. Remarkably, the patient maintained relative hemodynamic stability throughout the surgery, requiring only medications to adjust for the body’s response to cardiopulmonary bypass (CPB). The outcome of the surgery was successful, with no complications arising. With the patient’s heart now functioning optimally, a hopeful outlook for an extended and improved quality of life lies ahead. 

References

- American Heart Association. (2021, July 23). Coronary artery disease - coronary heart disease. [www.heart.org](https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease/coronary-artery-disease). <https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease/coronary-artery-disease>
- Butterworth, J. F., Mackey, D. C., & Wasnick, J. D. (2022). Morgan & Mikhail’s clinical anesthesiology (7th ed.). McGraw Hill.
- Choi H, & Lewis C (2016). Cardiopulmonary bypass: anticoagulation. Freeman B.S., & Berger J.S.(Eds.), Anesthesiology Core Review: Part Two Advanced Exam. McGraw Hill. <https://accessanesthesiology.mhmedical.com/content.aspx?bookid=1750§ionid=117320006>
- Cleveland Clinic. (2023, October 13). What’s draggin’ your heart down? Cleveland Clinic. <https://my.clevelandclinic.org/health/diseases/16898-coronary-artery-disease>
- Hitner, H. (2022). Pharmacology an introduction (8th ed.). McGraw-HillEducation.
- Jaffe, R. A., Schmiesing, C. A., & Golianu, B. (2020). Anesthesiologist’s Manual of Surgical Procedures (6th ed.). Wolters Kluwer.
- Shahjehan, R. D., & Bhutta, B. S. (2023, January 9). Coronary artery disease - statpearls - NCBI bookshelf. Coronary Artery Disease. <https://www.ncbi.nlm.nih.gov/books/NBK564304/>

Take the
QUIZ
on the
next page!

Continuing Education Quiz

PAGE 1 of 2

To test your knowledge on this issue's article, provide correct answers to the following questions on the form below. Follow the instructions carefully.

- 1. What is the surgical procedure performed on the 51-year-old male patient with coronary artery disease (CAD)?**
 - A) Coronary angioplasty
 - B) Coronary artery bypass graft (CABG)
 - C) Heart valve replacement
 - D) Cardiac ablation
- 2. What is the patient's Mallampati score, indicating the view of the patient's airway during pre-operative examination?**
 - A) 1
 - B) 2
 - C) 3
 - D) 4
- 3. What is the primary purpose of the left saphenous vein and left internal mammary vein in the surgical procedure?**
 - A) To remove calcified plaque from the coronary artery
 - B) To induce asystole in the heart
 - C) To redirect blood flow from the aorta to the coronary artery
 - D) To administer cardioplegia to the heart
- 4. What is the primary purpose of dexamethasone and ondansetron, medications given for pain management after surgery?**
 - A) To reduce blood pressure
 - B) To prevent postoperative nausea and vomiting (PONV)
 - C) To induce sedation
 - D) To promote wound healing
- 5. What is the primary function of Amicar, a medication used during the surgical procedure?**
 - A) Vasodilation
 - B) Anticoagulation
 - C) Inhibition of excessive clots dissolution
 - D) Prevention of arrhythmias
- 6. What is the primary purpose of Heparin, a medication used during the surgical procedure?**
 - A) Vasodilation
 - B) Anticoagulation
 - C) Inhibition of excessive clots dissolution
 - D) Prevention of postoperative nausea and vomiting (PONV)
- 7. What is the primary purpose of the coronary artery bypass graft (CABG) procedure?**
 - A) To remove calcified plaque from the coronary artery
 - B) To induce asystole in the heart
 - C) To redirect blood flow from the aorta to areas of the heart with reduced blood flow
 - D) To administer cardioplegia to the heart
- 8. What is the primary purpose of the central line secured in the right internal jugular during the surgical procedure?**
 - A) To monitor the patient's blood pressure in real-time
 - B) To administer medications rapidly
 - C) To induce sedation
 - D) To prevent postoperative nausea and vomiting (PONV)
- 9. What is the primary pharmacological effect of Cardene, a medication used during the surgical procedure?**
 - A) Vasodilation
 - B) Antiarrhythmic
 - C) Anticoagulation
 - D) Hypotension
- 10. What medication can be given to treat PONV**
 - A) Ondansetron
 - B) Epinephrine
 - C) Vasopressin
 - D) Heparin

Continuing Education Quiz

To apply for Continuing Education/ Contact Hours:

- 1) Provide all the information requested on this form.
- 2) Provide correct answers to this issue's quiz in the box to the right
- 3) Mail this form along with \$10 Member or \$20 Non-Member (check or money order, payable to ASATT) to:
ASATT
6737 W Washington St, Ste 4210
Milwaukee, WI 53211

The answers to the Summer2024 "Case Review: Anesthesia Technologist Insights Related to the CABG Procedure" Quiz 1 are: (circle answers)

- | | |
|------------|-------------|
| 1. A B C D | 6. A B C D |
| 2. A B C D | 7. A B C D |
| 3. A B C D | 8. A B C D |
| 4. A B C D | 9. A B C D |
| 5. A B C D | 10. A B C D |

Quiz 1

Name: _____

ASATT Number: _____

Street Address: _____

Phone Number: _____

City: _____ State: _____ Zip: _____

Signature: _____ Date: _____

ACHIEVE 80% IN THIS QUIZ TO EARN ONE (1) CONTINUING EDUCATION CREDIT.