



Combined coronary artery bypass grafting and orthopedic fixation in a patient with multiple comorbidities: a case report

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Background: Coronary artery disease is a prevalent cardiovascular condition and the leading cause of morbidity and mortality worldwide. The management of orthopedic injuries requiring surgical fixation is particularly complex in patients with comorbidities such as diabetes mellitus and hypertension (HTN). Coordinating the sequence, timing, and execution of coronary artery bypass grafting (CABG) and orthopedic fixation requires careful consideration of the patient's overall health, surgical risks, and recovery potential.

Case presentation: A 55-year-old male presented with a right distal tibial fracture following a fall. His medical history included HTN, type 2 diabetes mellitus, and Kyrle's skin disease. During his hospital stay, he was diagnosed with non-ST-segment elevation myocardial infarction. Severe multivessel Coronary artery disease was confirmed by catheterization. After interdisciplinary consultation, simultaneous CABG and open reduction and internal fixation of the tibial fracture were performed. He was discharged in good condition and showed positive recovery during a 1-month follow-up.

Discussion: This case highlights the complexities of managing patients with multiple comorbidities who require both cardiac and orthopedic surgeries. This simultaneous approach allows for efficient treatment, leading to a shorter hospital stay and recovery period. This report supports the feasibility and benefits of simultaneous surgery in complex clinical scenarios, although further studies are required to establish broader guidelines.

Conclusion: Our case emphasizes the importance of a multidisciplinary approach for managing patients with multiple comorbidities who require concurrent surgical intervention. Preoperative planning and speciality coordination ensured optimal outcomes. Further research is needed to develop standardized guidelines for intraoperative care of patients undergoing simultaneous procedures.

Keywords: CABG, comorbidities, case report, internal fixation, tibia

Introduction

Coronary artery disease (CAD) remains a prevalent cardiovascular condition and a leading cause of morbidity and mortality worldwide^[1]. The management of orthopedic injuries, particularly those requiring surgical fixation, presents additional complexities, especially in patients with multiple comorbidities such as DM and HTN^[2]. The decision-making process regarding the sequence, timing, and coordination of coronary artery bypass grafting (CABG) and orthopedic fixation necessitates careful consideration of the patient's overall health status, surgical risks,

HIGHLIGHTS

- **Simultaneous surgical approach:** The patient underwent both coronary artery bypass grafting and open reduction and internal fixation (ORIF) of a tibial fracture simultaneously. This approach was chosen after interdisciplinary consultation and allowed for efficient treatment, reducing the overall hospital stay and recovery period.
- **Management of multiple comorbidities:** The patient had several comorbidities, including hypertension, type 2 diabetes mellitus, and Kyrle skin disease, which complicated the management of his orthopedic injury and cardiovascular condition. The case emphasizes the importance of a multidisciplinary approach and thorough preoperative planning to optimize outcomes in such complex scenarios.
- **Positive outcome and feasibility:** Despite the complexities, the patient was discharged in good condition and showed positive recovery during a 1-month follow-up. This case supports the feasibility and potential benefits of performing simultaneous surgeries in patients with multiple comorbidities, highlighting the need for further research to establish standardized guidelines for such procedures.

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and recovery potential. Our goal is to provide insights into the complex relationship between patient safety, surgical priorities, and the vital role that interdisciplinary care plays in maximizing

therapeutic outcomes in difficult clinical settings. To achieve positive results, this study emphasizes the significance of a multidisciplinary approach, careful preoperative preparation, and cautious intraoperative management. The work has been reported in line with the Surgical CAse Report (SCARE) 2023 criteria^[3].

This case report highlights the complex nature of the decision-making process, challenges in perioperative management, and team collaboration that resulted in a challenging course for patients with severe multivessel CAD, distal tibial fracture, coexisting HTN, T2DM, and Kyrle disease. The CABG procedure and orthopedic fixation were simultaneously completed to provide better treatment to the patient, avoid further surgery, and decrease the recovery time. Five days after the operation, the patient was discharged with a good general appearance, normal laboratory test results, and clean wounds with no signs of infection.

Case presentation

A 55-year-old male patient presented to the emergency department (ED) with right distal tibial pain after a fall. He denied chest pain, dyspnea, or palpitations. The patient had no history of loss of consciousness or syncope. He is a nonsmoker. His medical history included HTN, T2DM, and Kyrle skin disease. His medication regimen prior to the event consisted of acetylsalicylic acid (100 mg once daily), metformin (850 mg twice daily), atorvastatin (40 mg once daily), candesartan (8 mg once daily), esomeprazole (20 mg once daily), and alfacalcidol (0.25 mcg once daily).

On initial examination, the patient was not in acute distress and had stable vital signs. The patient had tenderness and swelling of the distal tibia. Initial plain radiographs at the ED showed a right distal third spiral tibial shaft displaced fracture (Fig. 1).

The patient received enoxaparin (40 mg subcutaneous injection once daily) and acetaminophen (1 g intravenously, three times daily). A cast was applied and the patient was scheduled for surgery. Consultation with a dermatologist for his skin condition revealed no contraindications for surgery.

During his hospital stay, the patient developed burning epigastric pain, vomiting, and nausea, which were treated as diabetic ketoacidosis (DKA) in the ICU. Arterial blood gases (ABGs) were ordered, with results showing a random blood sugar of 530 (normal 70–140), pH 7.2 (normal 7.35–7.45), PaCO₂ 15 mmHg (normal 35–45), HCO₃ 7.3 mmol/l (normal 22–28), and an anion gap of 31 mmol/l (normal 8–12). He was administered 1000 cc normal saline (N/S) over 1 h, 1000 cc N/S over 2 h, 1000 cc N/S over 4 h, and then 1000 cc N/S every 6 h, along with IV insulin infusion adjusted according to random blood sugar readings. He continued to receive enoxaparin (40 mg subcutaneous injection once daily) and ceftriaxone (1 g IV twice daily).

Three days later, the patient suddenly complained of a pleuritic chest pain. An urgent ECG showed sinus tachycardia with right bundle branch block (RBBB), positive troponin (132 ng/l) (normal <30), and D-dimer level of 789 ng/ml (normal 0–250), leading to high suspicion of pulmonary embolism (PE). Urgent chest computed tomography (CT) pulmonary angiography was performed.

The CT angiogram was normal except for an incidental hydatid cyst in the left lobe of the liver (Fig. 2). A repeat ECG showed ST-segment elevation in the anterior septal leads with reciprocal changes; therefore, he was transferred to the critical care unit (CCU) of another hospital for urgent catheterization.

Upon admission to the secondary hospital, ECG showed NSTEMI in the lateral leads, with inferior and septal Q waves. After 5 min, the ECG changed to LBBB with a negative Sgarbossa criteria. These drugs were administered, and the patient was



Figure 1. Presurgical emergency radiographs of right leg; (A) anteroposterior and (B) lateral view.

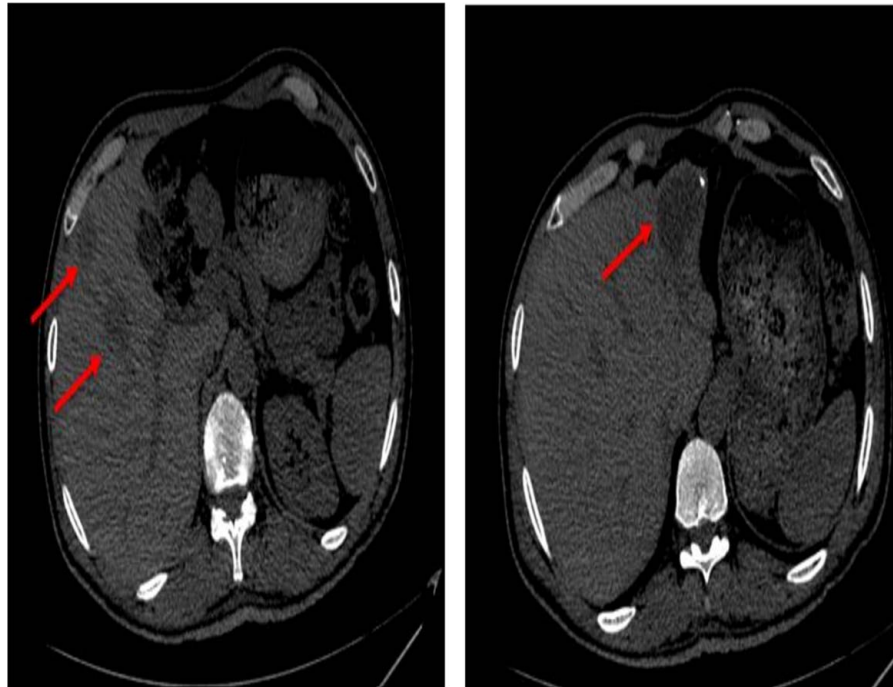


Figure 2. CT of the liver without IV contrast showed few well-defined hypodense hepatic lesions, the largest of about 4 × 3.5 cm showing few peripheral calcifications seen at the left lobe; suggestive of hydatid cysts. CT, computed tomography.

prepared for catheterization on the second day: acetylsalicylic acid (100 mg once daily), rosuvastatin (20 mg once daily), enoxaparin (60 mg once daily), esomeprazole (40 mg once daily), candesartan (8 mg once daily), bisoprolol (5 mg once daily), ceftriaxone (2 g once daily), azithromycin (500 mg once daily), insulin glargine (20 units once daily), and aspart (5 units three times a day). On the second day of admission, long-acting mononitrate (20 mg twice daily) was administered and catheterization was performed.

The patient was found to have severe multivessel CAD with 80% stenosis in the mid-segment of the left anterior descending (LAD) artery, 95% stenosis at the origin of the diagonal 1 (D1) artery, 80% stenosis in the mid-segment of the circumflex (Cx) artery at the M1 bifurcation, 90% stenosis in the distal segment of the Cx artery, 80% stenosis in the proximal segment of the marginal 1 (M1) branch, 90% stenosis in the proximal segment of the ramus artery, and mid-segment total occlusion (chronic total occlusion) of the right coronary artery (RCA) (Fig. 3). It is recommended to undergo CABG.

An orthopedic consultation was conducted, and after discussing the case with the cardiologist, they decided to perform ORIF along with CABG simultaneously. Nine days after admission to the secondary hospital, CABG was performed using a saphenous vein graft.

During the surgery, CABG took ~5 h, and ORIF of the tibial fracture took 20 min under general anesthesia.

A lower limb tourniquet was applied, scrubbing and draping were performed, the anteromedial approach was performed, the fracture edges were refreshed, the fracture was reduced, and fixation was performed using a lag screw. A 9-hole light-duty DCP plate 3.5 was placed with eight screws (four proximal and four distal) (Fig. 4). Intraoperative complications were not observed. Postoperatively, the patient was transferred to the CCU, sedated, intubated, and placed on mechanical ventilation.

The patient was closely monitored, and received follow-up care.

During his stay in the CCU, the patient developed headache, left eye pain, blurred vision, and ptosis. Consultations with an ophthalmologist revealed third nerve palsy. A brain CT showed a well-defined sellar mass lesion measuring 1.4×1.35×1.3 cm with relative sella enlargement (Fig. 5 A). These findings were suggestive of pituitary macroadenoma, and MRI with intravenous contrast was advised for better evaluation (Fig. 5 B, C). An endocrinologist was consulted and the patient was managed as an outpatient. Five days after the operation, the patient was discharged with a good general appearance, and normal laboratory test results (white blood cells (WBCs): 8.3×10³ (normal 5–10×10³), mean corpuscular volume (MCV): 85 fl (normal 80–100), blood urea nitrogen (BUN): 18 mg/dl (normal 4.7–23.4), creatinine: 0.63 mg/dl (normal 0.4–1.2), magnesium: 1.83 mg/dl (normal 1.6–2.5), sodium: 137 mEq/l (normal 132–148), potassium: 4.2 mEq/dl (normal 3.9–5.7), chloride: 106 mmol/l (normal 96–109) except hemoglobin (Hb): 9.7 g/dl (normal 14–18), and clean wounds with no signs of infection.

After a 1-month follow-up, the patient reported no complaints. The wound healed well with no signs of inflammation, the neurological examination was intact, and the patient had a good range of motion. Radiography showed good alignment and stable fixation (Fig. 6). The patient remained nonweight bearing. The patient was advised to follow-up for 4–6 months postoperatively regarding his tibial fracture, in addition to follow-ups for 1–6 months for his cardiac condition postoperatively, and then continue follow-up annually.

Discussion

This report describes a 55-year-old man with a medical history of HTN, T2DM, and Kyrle disease. The patient had a right leg

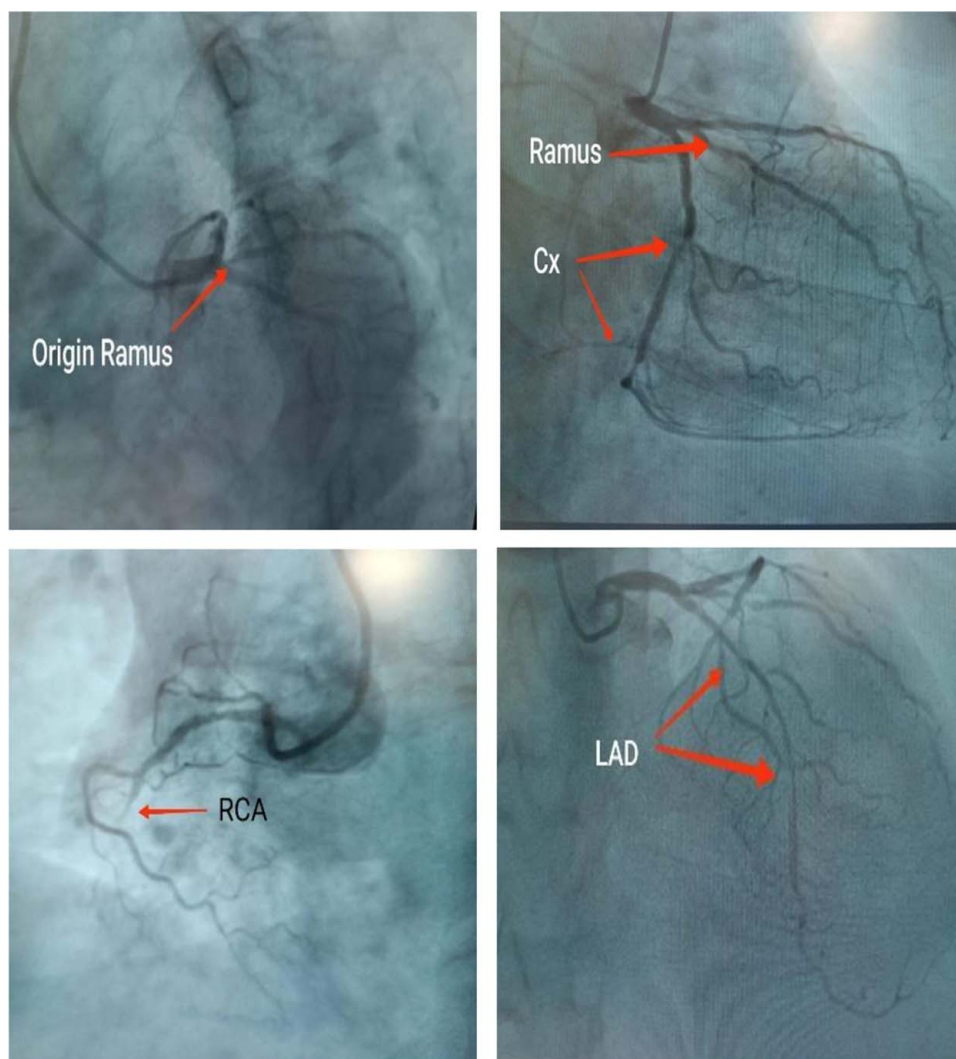


Figure 3. Coronary angiogram showing multiple coronary artery stenosis and occlusion.

fracture was subsequently identified as NSTEMI. The patient underwent surgery to address both the heart condition and the leg fracture.

Taking care of patients with health issues requires an approach that simultaneously addresses all problems. This patient had HTN and T2DM, which are known risk factors for heart disease^[4, 5]. Effective management of these conditions involves controlling blood pressure and blood sugar levels to minimize the risk of heart complications.

The patient showed signs of troubled breathing during activity, which is a common indicator of underlying CAD. After the procedure, blockages were observed in the heart arteries, with the left anterior descending artery being 80% blocked and the right coronary artery being completely blocked. The decision to opt for CABG over coronary intervention (PCI) was influenced by the level of calcification in the arteries and the complexity of the blockages^[6, 7]. CABG is often recommended for patients with blockages and complex conditions because of its long-term ability to prevent serious heart issues^[8].

The patient's right leg had a fracture at the end of the shin bone that required surgery. The decision to perform both leg and heart

bypass surgeries was made to treat both issues promptly. Research has demonstrated that combining many surgical procedures can be done safely, leading to shorter hospital stays and quicker recovery times^[9, 10]. However, this approach requires planning before surgery and close monitoring to minimize the risks related to extended procedures and anesthesia exposure.

The ideal procedure for treating a tibial shaft fracture is intramedullary nailing, which is generally considered the gold standard because of its high success rate and ability to promote early weight-bearing and mobilization^[11]. However, in this case, the decision was made to use a tibial plate for the fixation. This choice is influenced by the need to perform both cardiac and orthopedic surgeries simultaneously, and the tibial plate procedure requires only 20–25 min, making it a more time-efficient option^[12]. External fixation is the third option. While external fixation can be effective, it involves placing a cast above the knee, which carries a significant risk of knee stiffness and other complications, such as pin tract infections and delayed union^[11,12]. Given these potential drawbacks, the tibial plate was deemed to be the most appropriate choice under these circumstances.



Figure 4. Postoperative radiographs; anteroposterior and lateral views of the right leg and ankle.

Addressing both cardiac and orthopedic issues simultaneously ensures that all patients' health concerns are managed in a coordinated manner. This holistic approach can lead to better overall outcomes and reduce the risk of complications arising from untreated conditions^[13]. In cases where both conditions are severe and require urgent intervention, performing surgeries together can be life-saving. For instance, a patient with a critical heart condition and severe fracture may not be able to withstand the delay of treating one condition at a time. Delaying treatment for either condition could lead to a worsening of the patient's overall health. For example, untreated fractures can lead to nonunion or malunion, whereas untreated cardiac issues can result in further cardiac events^[14]. Performing both surgeries simultaneously can reduce the number of hospital visits and overall time spent in the hospital. This can be particularly beneficial for patients with limited mobility or those living far from medical facilities. A combined approach necessitates collaboration among various specialties such as cardiology, orthopedics, and anesthesiology. This multidisciplinary teamwork can enhance the quality of care and ensure that all aspects of patient health are considered. Combining surgeries can streamline the recovery process, allowing patients to heal from both procedures simultaneously. This can reduce the overall recovery time and the physical and emotional stress associated with multiple separate surgeries.

After surgery, the patient developed third nerve palsy, likely due to a pituitary gland tumor found on a brain CT scan. This unexpected discovery required consultation with endocrinology specialists and ongoing follow-up care, as needed. Third nerve palsy, headaches, and visual issues are among the symptoms that pituitary tumors can produce^[15, 16]. Managing this condition involved working with endocrinologists to address any imbalances and to plan potential surgeries or medical treatments. The emergence of symptoms after surgery underscores the importance

of thorough neurological evaluation before surgery.

The reason for performing CABG and ORIF simultaneously was the acuity of both pathologies. CABG was selected over PCI because of the complexity and extent of the lesions, as indicated in studies showing long-term results in multivessel disease^[8]. It was imperative to conduct ORIF concurrently to prevent tibial fracture stabilization delays, which may result in problems such as nonunion or malunion^[17, 18]. The subsequent identification of a macroadenoma causing third nerve palsy emphasizes the significance of preoperative evaluation and the necessity of a collaborative approach in intricate cases.

This scenario highlights the possibility and advantages of performing simultaneous surgeries in patients with complicated conditions, which could lead to shorter recovery periods and hospital stays. This collaborative approach allows for the care of patients' health issues, ensuring that all medical requirements are handled simultaneously. However, the scope of this study was constrained by its focus on one patient, which may not apply to all individuals with health conditions. Moreover, the discovery of a macroadenoma unexpectedly adds complexity to our understanding of the results after surgery. It is essential to conduct studies to confirm the effectiveness and safety of simultaneous surgeries in patients with various underlying health issues.

The case involved multiple comorbidities and simultaneous surgeries (CABG and ORIF), making it difficult to isolate the effects of each intervention on patient outcomes. The discovery of an incidental hydatid cyst and pituitary macroadenoma added complexity to this case. The follow-up period of 1-month is relatively short, which may not capture the long-term outcomes or complications that could arise from the surgeries or the patient's comorbid conditions. Additionally, the report was based on a single patient's experience, which limits the ability to draw broader conclusions or recommendations for clinical practice.

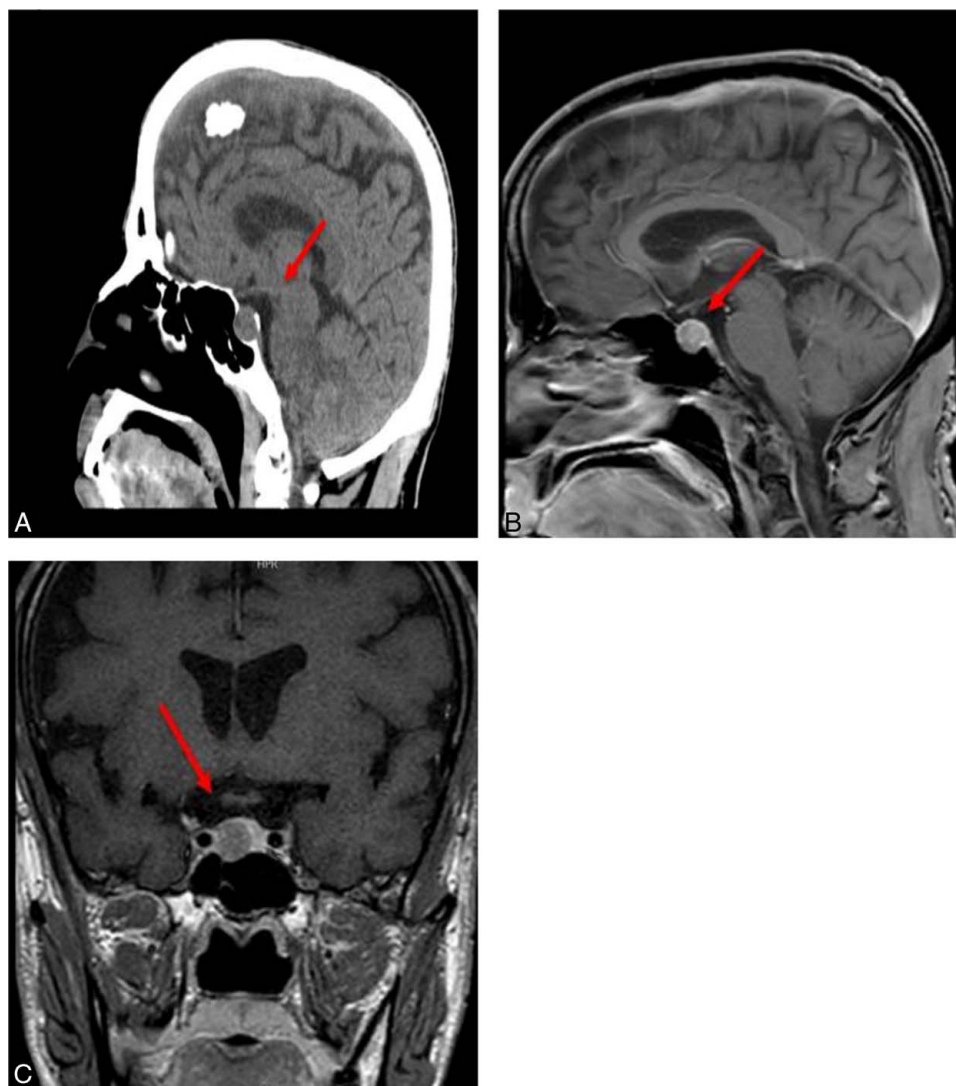


Figure 5. Brain CT without contrast (A) and pituitary MRI (B) and (C) showed a well-defined sellar mass lesion measuring about 1.4×1.35×1.3 cm with relative sellar expansion representing pituitary macroadenoma. CT, computed tomography.

Performing joint surgery such as CABG and ORIF of a tibial fracture carries several risks, as both procedures are complex on their own. Those are some possible complications: the stress of surgery can lead to a heart attack, especially in patients with pre-existing heart conditions^[19], both the chest incision from CABG and the site of orthopedic fixation are at risk of infection and the stress of a major cardiac surgery can delay the healing of orthopedic injuries^[20]. Irregular heartbeats can occur postoperatively and may require additional treatment^[21]. There is a risk of significant bleeding during and after surgery, which may require transfusion or reoperation^[21].

Successful management of this patient illustrates the significant role of multidisciplinary collaboration in complex medical cases. The ongoing efforts of cardiology, orthopedics, and endocrinology groups are instrumental to the patient's comprehensive care. Complete preoperative evaluation and exact planning, one of which was the arrangement of the necessary blood products, ensured optimal preparation for the surgeries to be performed. This is the holistic approach that medical researchers are referring to, which shows that multidisciplinary care provides better

patient outcomes and leads to lower complications in surgical settings^[22, 23].

Conclusion

This scenario highlights the difficulties and factors to consider when caring for patients with health conditions that require heart and bone surgeries simultaneously. It is crucial to adopt an approach that involves medical specialties and thorough planning before surgery to ensure positive results in such intricate situations. Further research is needed to establish guidelines related to the intraoperative care of patients undergoing simultaneous procedures involving different surgical specialties.

Ethical approval

This study is a case report, and our institution does not require ethical approval for such research, but they require obtaining the consent of the patient and the doctor supervising the case.



Figure 6. Radiograph at 1-month follow-up evaluation; AP and L views of the right leg and ankle.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

R.N., H.J.M.W., and M.Y.H.A.: writing the manuscript; N.N., B.A., B.M., M.Q.: imaging description; H.J.M.W.: reviewing and editing the manuscript.

Conflicts of interest disclosure

The authors declare is no conflict of interest.

Research registration unique identifying number (UIN)

Not applicable.

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Data availability statement

Data available upon request.

Provenance and peer review

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