



Managing Cardiovascular Complications in Diabetic Patients: Paramedic and Internal Medicine Perspectives.

**Abeer Attia Mobarek,¹ Hassan Mohammed Sandokji,² Abdulaziz Alkhaldi,³
Abdullah Fayez Badawi,⁴ Ghadah Musaad Almutiri,⁵ Abdullnasser Ateeq Hussin
Alyami,⁶ Hassan Turki Hamel Alharith,⁷ Ibrahim Turki Hamel Alharith,⁸ Mohsen
Mohammed Saleh Alalhareth,⁹ Dafer Saleh Mohamed Al Ali,¹⁰ Rajeh Misfer Saeed
Alyami,¹¹ Mayouf Hussain Saleh Al Faraj,¹² Abdullah Ahmad Abdullah Alselah,¹³
Mohammed Salem Alqashanin,¹⁴ Abyan Saleh M Alyami¹⁵**

1-5-Prince Sultan Military Medical City Ministry Of Defense Riyadh, Kingdom Of Saudi Arabia

6-12-Bir Asker Ambulance Center, Saudi Red Crescent Authority, Najran, Kingdom Of Saudi Arabia

13-Saudi Red Crescent Authority Asir Region Kingdom Of Saudi Arabia

14-Tathleeth General Hospital Bisha, Moh, Kingdom Of Saudi Arabia

15-Jubail Ambulance Center Red Crescent Authority Kingdom Of Saudi Arabia

Abstract:

Cardiovascular complications are a leading cause of morbidity and mortality in diabetic patients, primarily due to accelerated atherosclerosis and related conditions such as coronary artery disease (CAD), stroke, and peripheral artery disease (PAD). Effective management of these complications requires a collaborative approach between paramedics and internal medicine specialists. Paramedics play a crucial role in the pre-hospital setting by providing rapid assessment, stabilization, and early interventions such as oxygen therapy, glucose control, and cardiac monitoring. Internal medicine professionals manage the acute phase in hospitals through advanced diagnostics, treatments like thrombolysis or percutaneous coronary intervention (PCI), and ongoing care such as blood glucose regulation and cardiovascular rehabilitation. This integrated approach improves survival rates, prevents complications, and promotes long-term management of cardiovascular risk factors in diabetic patients.

Keywords:

Diabetes, Cardiovascular Complications, Paramedics, Internal Medicine, Myocardial Infarction, Stroke, Pre-Hospital Care, Thrombolysis, Insulin Therapy, Atherosclerosis, Blood Glucose Control, Coronary Artery Disease.

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Introduction

Cardiovascular disease (CVD) is the leading cause of death in individuals with diabetes, accounting for nearly 70% of deaths among diabetic patients. Diabetes, especially type 2 diabetes, significantly increases the risk of developing cardiovascular complications, such as myocardial infarction (heart attack), stroke, and peripheral artery disease (PAD). The chronic hyperglycemia associated with diabetes leads to accelerated atherosclerosis, hypertension, and dyslipidemia, creating a complex and dangerous environment for cardiovascular health.

Effective management of cardiovascular complications in diabetic patients demands a coordinated and multidisciplinary approach. Paramedics often serve as the first responders during cardiovascular emergencies, playing a pivotal role in pre-hospital stabilization, early intervention, and rapid transport. Their timely actions can be life-saving, as they address both the acute cardiovascular issue and the underlying diabetic condition, such as hyperglycemia or hypoglycemia, which can complicate the emergency.¹

Once the patient reaches the hospital, internal medicine specialists take over, focusing on advanced diagnostics, acute interventions, and long-term care strategies. Collaboration between paramedics and internal medicine professionals is essential for optimizing patient outcomes. This article explores the critical roles of paramedics and internal medicine teams in managing cardiovascular complications in diabetic patients, highlighting how early intervention, patient stabilization, and comprehensive long-term management can mitigate the impact of these complications.

This article provides a detailed overview of how paramedics and internal medicine professionals collaborate in managing cardiovascular complications in diabetic patients, including early intervention, patient stabilization, and long-term care strategies.²

Pathophysiology of Cardiovascular Complications in Diabetic Patients

Diabetes, particularly type 2 diabetes, significantly increases the risk of cardiovascular complications due to its complex effects on metabolic and vascular functions. Chronic hyperglycemia, insulin resistance, and systemic inflammation are key drivers that promote atherosclerosis, endothelial dysfunction, and other mechanisms leading to cardiovascular disease (CVD). The major cardiovascular complications in diabetic patients include coronary artery disease (CAD), stroke, heart failure, and peripheral artery disease (PAD).

1. Atherosclerosis and Endothelial Dysfunction

Atherosclerosis is the primary pathological process behind most cardiovascular complications in diabetic patients. Chronically elevated blood glucose levels damage the endothelium (the inner lining of blood vessels), leading to endothelial dysfunction, which is characterized by impaired vasodilation and increased vascular permeability. Endothelial injury triggers an inflammatory response, with increased production of pro-inflammatory cytokines and adhesion molecules. This promotes the accumulation of lipids, monocytes, and other inflammatory cells in the arterial walls, forming atherosclerotic plaques. Over time, these plaques can rupture, causing thrombosis and obstructing blood flow to vital organs like the heart and brain.

- **Coronary Artery Disease (CAD):** Diabetic patients have a higher risk of developing CAD due to accelerated atherosclerosis in the coronary arteries, which supply blood to the heart. This results in myocardial ischemia, leading to conditions such as angina and heart attacks.

2. Insulin Resistance and Dyslipidemia

Insulin resistance, a hallmark of type 2 diabetes, exacerbates cardiovascular risk by contributing to dyslipidemia—abnormal levels of lipids in the blood. In diabetic patients, insulin resistance leads to elevated levels of low-density lipoprotein (LDL) cholesterol, decreased levels of high-density lipoprotein (HDL) cholesterol, and increased triglycerides. These lipid abnormalities promote the formation and progression of atherosclerotic plaques, increasing the risk of coronary artery disease and other cardiovascular events.

3. Hypertension

Hypertension is commonly associated with diabetes and acts synergistically with hyperglycemia to accelerate vascular damage. High blood pressure exacerbates endothelial dysfunction, increases arterial stiffness, and promotes the development of atherosclerosis. Diabetic patients often suffer from poorly controlled hypertension, which increases the risk of stroke, heart failure, and peripheral vascular disease.

4. Oxidative Stress and Inflammation

Chronic hyperglycemia leads to increased production of reactive oxygen species (ROS) and advanced glycation end products (AGEs), which cause oxidative stress and damage to vascular tissues. The accumulation of AGEs in blood vessels promotes inflammation, endothelial dysfunction, and vascular stiffness. This pro-inflammatory state, driven by elevated cytokines and immune cell activation, further accelerates atherosclerosis and cardiovascular damage.³

5. Hypercoagulability and Platelet Dysfunction

Diabetic patients exhibit a hypercoagulable state, meaning their blood has an increased tendency to clot. Elevated blood glucose levels and insulin resistance promote abnormal platelet aggregation and coagulation factor activation. This increases the risk of thrombosis, which can lead to acute cardiovascular events such as myocardial infarction or ischemic stroke.

6. Autonomic Neuropathy

Diabetic autonomic neuropathy, a complication of long-standing diabetes, affects the autonomic control of the cardiovascular system. This can result in resting tachycardia (elevated heart rate), orthostatic hypotension (sudden drops in blood pressure when standing), and silent myocardial ischemia (heart attacks without chest pain). Autonomic neuropathy complicates the diagnosis and management of cardiovascular events, as symptoms may be atypical or absent.

7. Peripheral Artery Disease (PAD)

Peripheral artery disease is another major cardiovascular complication in diabetic patients, characterized by the narrowing or blockage of arteries in the lower extremities due to atherosclerosis. This condition reduces blood flow to the legs and feet, leading to symptoms such as claudication (pain while walking), and, in severe cases, non-healing ulcers or gangrene. Diabetic patients with PAD are at an increased risk of limb amputation and cardiovascular mortality.

Role of Paramedics in Pre-Hospital Management

Paramedics play a critical role in the early recognition and management of cardiovascular complications in diabetic patients, often being the first point of contact during a medical emergency. In the pre-hospital setting, paramedics are responsible for rapid assessment, stabilization, and early intervention, which can significantly impact patient outcomes. Their prompt actions in managing cardiovascular events such as heart attacks, strokes, and diabetic-related complications can reduce mortality and morbidity, ensuring the patient arrives at the hospital in the best possible condition.⁴

1. Rapid Assessment and Diagnosis

Paramedics are trained to quickly assess diabetic patients presenting with cardiovascular symptoms. A comprehensive assessment includes:

- **Identifying Symptoms:** Diabetic patients with cardiovascular complications may exhibit typical or atypical symptoms, such as chest pain, shortness of breath, dizziness, confusion, or even silent myocardial infarction (heart attack without chest pain). Paramedics must be vigilant for both classic and less obvious signs.
- **Vital Signs Monitoring:** Continuous monitoring of blood pressure, heart rate, respiratory rate, and oxygen saturation is crucial in identifying cardiovascular instability.
- **Blood Glucose Monitoring:** Since hyperglycemia or hypoglycemia can worsen cardiovascular outcomes, paramedics routinely check blood sugar levels to rule out or treat hypoglycemia (low blood sugar) or hyperglycemia (high blood sugar) that may contribute to cardiovascular events.

2. Immediate Interventions

Once a diagnosis is suspected, paramedics initiate several key interventions to stabilize the patient and prevent further deterioration. These interventions often follow established protocols such as Advanced Cardiac Life Support (ACLS) or pre-hospital guidelines for diabetic emergencies:

- **Oxygen Therapy:** Supplemental oxygen is given to patients with suspected cardiovascular compromise, particularly those experiencing shortness of breath or low oxygen saturation levels. Oxygen helps to relieve ischemic stress on the heart.
- **Cardiac Monitoring:** Paramedics use portable electrocardiogram (ECG) machines to detect any arrhythmias, ischemia (insufficient blood flow to the heart), or signs of an evolving myocardial infarction. A 12-lead ECG allows paramedics to identify conditions like ST-elevation myocardial infarction (STEMI) in the field.
- **Medications:**
 - **Aspirin:** Administered to reduce blood clot formation and improve blood flow in patients with suspected heart attacks or strokes.
 - **Nitroglycerin:** Used to relieve chest pain and improve blood flow to the heart by dilating the coronary arteries. It is typically given to patients with angina or suspected myocardial infarction, provided their blood pressure allows.
 - **Glucose Administration:** In cases of hypoglycemia, paramedics administer glucose via oral gel, intravenous (IV) dextrose, or glucagon to quickly raise blood sugar levels.
 - **Intravenous Fluids:** Administered to stabilize blood pressure, particularly in hypotensive patients, and improve tissue perfusion.

3. Advanced Cardiac Life Support (ACLS) and Resuscitation

Paramedics are trained in **Advanced Cardiac Life Support (ACLS)**, which is critical during life-threatening cardiovascular emergencies such as cardiac arrest. ACLS interventions include:

- **Defibrillation:** For patients in cardiac arrest due to ventricular fibrillation or pulseless ventricular tachycardia, paramedics use an automated external defibrillator (AED) or manual defibrillator to deliver electrical shocks to restore normal heart rhythm.
- **Airway Management:** In cases of severe respiratory distress or cardiac arrest, paramedics secure the airway using bag-valve masks (BVMs) or endotracheal intubation to ensure adequate ventilation.
- **Advanced Medication Administration:** Paramedics may administer ACLS drugs like epinephrine, amiodarone, or atropine in cases of cardiac arrest, arrhythmias, or shock.

4. Blood Glucose Control in Diabetic Patients with Cardiovascular Complications

Diabetic patients experiencing cardiovascular complications often present with altered blood glucose levels, which can worsen the clinical scenario. Paramedics must address dysglycemia (either hyperglycemia or hypoglycemia) promptly, as it can aggravate myocardial ischemia or complicate stroke management.

- **Hypoglycemia:** Low blood sugar can mimic or exacerbate cardiovascular symptoms, including confusion, dizziness, or unconsciousness. Paramedics administer glucose intravenously or glucagon intramuscularly to restore normal blood sugar levels.
- **Hyperglycemia:** High blood sugar levels, especially in the context of diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemic state (HHS), require paramedics to initiate IV fluids and provide appropriate supportive care to prevent dehydration and metabolic imbalances while en route to the hospital.

5. Communication and Coordination with Hospital Teams

Clear and effective communication between paramedics and hospital-based internal medicine teams is essential for ensuring seamless patient care. During transport, paramedics relay critical information to the receiving hospital, including:

- **Patient History and Initial Assessment:** A detailed report on the patient's symptoms, vital signs, blood glucose levels, and ECG findings allows hospital teams to prepare for immediate intervention upon arrival.
- **Interventions Administered:** Hospital teams need to know what medications, treatments, and procedures have already been provided in the field to avoid duplication and expedite further care.

This handoff is vital in ensuring continuity of care and preparing the emergency department or internal medicine team for advanced diagnostic procedures such as angiography or thrombolysis.

6. Triage and Transport Decisions

Paramedics play a key role in determining the appropriate destination for patients experiencing cardiovascular complications. In some cases, patients need to be transported directly to specialized facilities, such as:

- **STEMI Centers:** For patients experiencing a heart attack, paramedics may transport them directly to a hospital with a cardiac catheterization lab, where they can undergo percutaneous coronary intervention (PCI).
- **Stroke Centers:** For patients with suspected stroke, time is critical. Paramedics assess patients using stroke scales (such as the FAST or Cincinnati Prehospital Stroke Scale) and may transport them to a comprehensive stroke center equipped for rapid diagnosis and treatment, including thrombolysis or mechanical thrombectomy.

Paramedics are on the front lines of managing cardiovascular complications in diabetic patients, providing critical pre-hospital care that can significantly affect outcomes. Their ability to rapidly assess, stabilize, and intervene in cardiovascular emergencies is crucial for reducing the risk of mortality and minimizing long-term damage. Effective collaboration between paramedics and hospital-based internal medicine teams ensures that diabetic patients receive timely, comprehensive care, from the pre-hospital setting to long-term management.⁵

Role of Internal Medicine in Managing Cardiovascular Complications in Diabetic Patients

Once the patient is stabilized and transferred to the hospital, internal medicine specialists take over care, focusing on diagnosing the underlying cause of the cardiovascular complication, providing treatment, and managing long-term risks.

1. Advanced Diagnostics

- ❖ **Electrocardiogram (ECG):** Confirm the presence of arrhythmias, ischemia, or infarction.
- ❖ **Blood Tests:** Assess cardiac markers like troponin, blood sugar levels, lipid profiles, and kidney function.
- ❖ **Imaging:** Use of echocardiograms, coronary angiography, or CT angiograms to evaluate the extent of heart or vascular damage.

2. Acute Care

- ❖ **Thrombolysis:** Administer clot-busting drugs for patients with confirmed myocardial infarctions if they cannot receive immediate angioplasty.
- ❖ **Percutaneous Coronary Intervention (PCI):** Internal medicine teams, often working with cardiologists, may perform PCI to open blocked arteries.

- ❖ **Management of Stroke:** For patients with ischemic stroke, internal medicine specialists may administer tissue plasminogen activator (tPA) or perform mechanical thrombectomy.
- ❖ **Heart Failure Management:** Diabetic patients with heart failure are treated with diuretics, ACE inhibitors, beta-blockers, and possibly aldosterone antagonists.

3. **Blood Glucose and Lipid Control**

- ❖ **Insulin Therapy:** Blood glucose control is crucial for preventing further cardiovascular damage. Sliding scale insulin or continuous insulin infusions may be used.
- ❖ **Lipid Management:** Statins or other cholesterol-lowering medications are prescribed to reduce the risk of future cardiovascular events.

4. **Multidisciplinary Collaboration**

- ❖ **Cardiology Consultation:** Internal medicine physicians frequently collaborate with cardiologists to provide comprehensive care for diabetic patients with cardiovascular complications.
- ❖ **Endocrinology:** Consultation with endocrinologists to optimize diabetes management and minimize the risk of recurrent cardiovascular events.
- ❖ **Rehabilitation and Lifestyle Counseling:** Internal medicine teams work on long-term care strategies including dietary changes, exercise programs, and smoking cessation for patients.

Long-Term Management and Follow-Up

Managing cardiovascular complications in diabetic patients goes beyond acute care. Both paramedics and internal medicine professionals play roles in the prevention of future complications and chronic disease management.

1. **Risk Factor Modification**

- ❖ **Weight Loss:** Encouraging weight management through dietary changes and physical activity.
- ❖ **Hypertension Control:** Strict blood pressure control using ACE inhibitors, ARBs, or calcium channel blockers.
- ❖ **Cholesterol Management:** Ensuring that patients stay on lipid-lowering therapy.
- ❖ **Regular Monitoring:** Close follow-up with internal medicine teams to monitor for recurrence of cardiovascular issues and optimize diabetes control.

2. **Cardiac Rehabilitation**

- ❖ Internal medicine teams often refer patients to cardiac rehabilitation programs, which include supervised exercise, education, and counseling to improve heart health.

3. **Patient Education**

- ❖ Educating patients on recognizing the symptoms of cardiovascular complications early and managing their diabetes effectively to prevent future incidents.

Conclusion

The management of cardiovascular complications in diabetic patients requires an integrated approach, with paramedics playing a crucial role in the pre-hospital setting and internal medicine teams providing advanced care in the hospital. Paramedics are often the first to assess, stabilize, and initiate life-saving interventions, including oxygen therapy, glucose management, cardiac monitoring, and administration of critical medications like aspirin and nitroglycerin. Through rapid assessment and communication with hospital teams, paramedics ensure that diabetic patients with cardiovascular complications receive timely and appropriate care. Internal medicine professionals continue this care with advanced diagnostics, interventions, and long-term management of both cardiovascular risk and diabetes control.

The collaboration between paramedics and internal medicine is essential in improving outcomes and reducing morbidity and mortality in this high-risk population.

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