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Scoping Review of Dental Management in Patients with Cardiovascular Disease: Roles of Local Anesthesia, Echocardiographic Assessment, Emergency Medical Support, nursing care, Clinical Pharmacology, and Laboratory Medicine

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Abstract

Dental management of patients with cardiovascular disease (CVD) presents unique challenges that require interdisciplinary awareness and clinical adaptation. Cardiovascular conditions such as ischemic heart disease, arrhythmias, and anticoagulant use may complicate routine dental care and elevate procedural risks. This scoping review aims to map and synthesize recent evidence (2015–2024) on dental care practices for patients with CVD, focusing on five domains: local anesthesia, echocardiographic assessment, emergency medical support, clinical pharmacology, and laboratory medicine. A comprehensive literature search was conducted across databases including PubMed, Scopus, and Web of Science. Studies were included if they addressed dental procedures in CVD patients and related to any of the five thematic domains. Data were charted and thematically analyzed following the PRISMA-ScR framework. Sixty-seven studies were included. Local anesthesia with vasoconstrictors was deemed generally safe in stable cardiac patients when used judiciously. Echocardiographic assessments, though infrequent, aided risk stratification in medically complex cases. Emergency preparedness was often insufficient, with limited access to AEDs or trained staff. Continuation of direct oral anticoagulants during dental procedures was widely supported, although clinician coordination was critical. Laboratory tests such as INR and renal function assessments were useful in managing bleeding and drug clearance risks. Dental care for patients with cardiovascular disease demands tailored protocols, multidisciplinary collaboration, and improved clinical infrastructure. In Saudi Arabia, integrating emergency preparedness, medication reconciliation, and national guidelines into dental practice is essential to improve patient safety and standardize care.

Keywords: *Cardiovascular disease, dental management, local anesthesia, echocardiography, emergency preparedness, anticoagulants, clinical pharmacology, laboratory medicine.*

Introduction and Objectives

Cardiovascular disease (CVD) presents significant challenges in dental management due to the

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complex interplay between oral procedures and cardiac health. As CVD remains a leading cause of morbidity and mortality worldwide, dental practitioners are increasingly encountering patients with conditions such as coronary artery disease, arrhythmias, heart failure, and those with implanted cardiac devices or on long-term antithrombotic therapy (Jowett & Cabot, 2022). The safety and effectiveness of dental interventions in this population depend heavily on a multidisciplinary approach that integrates cardiologic, anesthetic, pharmacologic, and emergency considerations.

Local anesthetics, particularly those containing vasoconstrictors like epinephrine, can provoke transient hemodynamic fluctuations, necessitating careful selection, dosage adjustment, and technique optimization in cardiac patients (Batohi & Sidhu, 2015). In parallel, echocardiographic assessment—especially when patients have compromised cardiac function—has emerged as a valuable tool to stratify procedural risk and guide treatment planning (Modin et al., 2018).

Moreover, emergency preparedness is paramount during dental procedures involving high-risk cardiac patients. This includes the presence of trained personnel, defibrillators, oxygen, and medications such as nitroglycerin and aspirin (Jowett & Cabot, 2022). Clinical pharmacology also plays a central role, particularly in managing patients on anticoagulants or antihypertensive drugs. While recent guidelines suggest that many dental procedures can be safely performed without interrupting direct oral anticoagulants (Scottish Dental Clinical Effectiveness Programme [SDCEP], 2019), individualized risk assessment remains essential.

Laboratory medicine, including the monitoring of international normalized ratio (INR), renal function, and cardiac biomarkers like troponin or B-type natriuretic peptide (BNP), further informs the dental management of CVD patients, especially in invasive or prolonged interventions (Modin et al., 2018).

Given these complexities, this scoping review aims to synthesize the body of literature from 2015 to 2024, examining key domains that shape the dental care of patients with cardiovascular disease. The specific objectives are:

1. **To map and synthesize the existing literature (2015–2024)** on dental management practices for patients with CVD, focusing on safety, efficacy, and interdisciplinary coordination.
2. **To identify and evaluate the role of local anesthesia** in dental procedures for CVD patients, particularly regarding hemodynamic effects, vasoconstrictor safety, and anesthetic technique modifications.
3. **To explore the integration of echocardiographic assessment** in the dental setting as a tool for preoperative risk stratification and treatment planning.
4. **To assess emergency preparedness measures** in dental clinics treating high-risk cardiac patients, including equipment readiness and staff training.
5. **To review pharmacological considerations**, especially the management of antithrombotic and antihypertensive medications in the context of dental interventions.
6. **To examine the contribution of laboratory medicine**, including the use of INR and cardiac biomarkers, in evaluating procedural safety and guiding clinical decision-making.

7. **To highlight knowledge gaps** and suggest directions for future research and clinical guidelines that support multidisciplinary dental care for patients with cardiovascular disease.

Methods

This scoping review followed the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews) guidelines. A comprehensive literature search was conducted to identify studies published between January 2015 and May 2024 that explored dental management in patients with cardiovascular disease (CVD). Eligible studies included original research articles, clinical guidelines, case reports, and systematic reviews. The inclusion criteria focused on studies discussing at least one of the following domains: local anesthesia, echocardiographic assessment, emergency medical support, clinical pharmacology, or laboratory medicine in the context of dental care for individuals with CVD.

Electronic databases including PubMed, Scopus, Web of Science, and Google Scholar were searched using a combination of keywords such as 'cardiovascular disease,' 'dental management,' 'local anesthesia,' 'echocardiography,' 'anticoagulants,' and 'emergency preparedness.' Reference lists of relevant articles were also reviewed to capture additional sources. The initial search yielded 214 records. After removing duplicates and screening titles and abstracts, 93 full-text articles were assessed for eligibility. Ultimately, 67 studies met the inclusion criteria and were included in the synthesis.

Data from each study were charted using a standardized form that captured authorship, year of publication, study design, target population, cardiovascular condition, dental procedure type, and relevant outcomes. Findings were synthesized thematically and organized according to the five core domains of interest.

Results

The scoping review identified a total of 67 relevant studies published between 2015 and 2024 that addressed the intersection of dental care and cardiovascular disease (CVD). The literature was categorized into five major themes: local anesthesia, echocardiographic assessment, emergency medical support, clinical pharmacology, and laboratory medicine. The findings revealed a growing interdisciplinary awareness in dental practice, with increasing emphasis on individualized risk assessment, emergency preparedness, and collaborative care models.

Local anesthesia in patients with CVD remains a subject of considerable discussion. Several studies emphasized the safety of using lidocaine with epinephrine when administered at low doses and with proper aspiration techniques, particularly for patients with stable cardiovascular conditions. However, in individuals with arrhythmias or poorly controlled hypertension, alternatives such as plain mepivacaine or the use of articaine without vasoconstrictors were preferred. Across the reviewed studies, there was consensus that local anesthetic choice must be tailored to the patient’s cardiovascular status and medical history.

Echocardiographic assessment was addressed in studies that explored preoperative planning for dental surgery in patients with significant cardiac risk. While echocardiography is not standard in routine dental care, it was frequently cited in hospital-based or medically complex cases to evaluate left ventricular function, valvular disease, and prosthetic heart valves.

Echocardiographic data were especially useful in patients with congestive heart failure or those undergoing extractions and implant placement under sedation.

Emergency medical support was identified as a critical yet underutilized component of dental clinics serving cardiac patients. Fewer than 40% of dental offices reviewed in practice audits were equipped with automated external defibrillators (AEDs) or trained in advanced cardiac life support. Several studies recommended the implementation of basic cardiac emergency protocols, including routine checks of blood pressure and oxygen saturation, having emergency kits available, and regular simulation training for staff.

Clinical pharmacology emerged as a major theme, especially regarding the perioperative management of anticoagulant and antiplatelet therapy. The literature supported continued use of direct oral anticoagulants (DOACs) for most minor dental procedures, including simple extractions and periodontal therapy, with attention to timing relative to drug half-life. However, cases involving multiple extractions or surgical interventions often warranted consultation with cardiology or hematology. Additionally, the review found reports of adverse interactions between commonly prescribed dental antibiotics (e.g., metronidazole) and warfarin, further underscoring the importance of interprofessional communication.

Laboratory medicine was discussed in relation to patient safety and risk stratification. Studies highlighted the importance of INR monitoring in patients on vitamin K antagonists and the use of creatinine clearance for assessing DOAC metabolism in elderly or renally impaired individuals. Some authors advocated for baseline assessments of cardiac biomarkers (e.g., troponin, BNP) in patients with recent cardiac events prior to elective dental procedures, though this practice remains uncommon outside of tertiary care centers.

Theme	**Key Findings**	**Number of Articles Reviewed**
Local Anesthesia	Safe use of lidocaine with epinephrine in stable patients; alternatives recommended for high-risk cases.	16
Echocardiographic Assessment	Useful in preoperative planning for complex cases; assesses LV function and valve disease.	9
Emergency Medical Support	Emergency readiness lacking in many clinics; need for AEDs and trained staff emphasized.	11
Clinical Pharmacology	Continuation of DOACs usually safe; drug interaction awareness critical.	21
Laboratory Medicine	INR and renal function testing important; biomarkers occasionally used in tertiary care.	10

Summary of key themes in dental management of CVD patients

Discussion

This scoping review highlights the growing complexity and interdisciplinary demands of dental

care for patients with cardiovascular disease (CVD). The included studies from 2015 to 2024 reveal that while awareness has increased, standardized protocols and collaborative clinical models remain inconsistently implemented across dental settings.

One of the most frequently discussed domains was the use of **local anesthesia** in CVD patients. While lidocaine with epinephrine continues to be widely used, there is strong evidence supporting dose limitation and proper aspiration techniques to minimize cardiovascular stress (Batohi & Sidhu, 2015). Clinicians are encouraged to assess the patient's cardiac stability before selecting vasoconstrictors, especially in patients with arrhythmias or recent myocardial infarction (Yagiela, 2017).

Echocardiographic assessment, although not routinely employed in general dental clinics, has been increasingly utilized in medically complex cases to assess left ventricular function and valvular pathology (Derman et al., 2021). These assessments can aid in determining procedural risk and the need for medical clearance, particularly in patients undergoing surgical extractions or sedation.

The domain of **emergency medical support** emerged as a critical area of concern. Despite widespread acknowledgment of its importance, many dental practices lack automated external defibrillators (AEDs), oxygen delivery systems, and trained staff capable of responding to cardiac events (Alzahrani et al., 2020). This gap is particularly concerning given that dental procedures can trigger acute stress responses in CVD patients, increasing the likelihood of complications such as angina, arrhythmias, or hypertensive crises (Jowett & Cabot, 2022).

In terms of **clinical pharmacology**, the safe continuation of direct oral anticoagulants (DOACs) during minor dental procedures was supported by multiple guidelines and studies, provided that procedures carry a low risk of bleeding (SDCEP, 2019). However, interprofessional consultation is still advised for patients undergoing multiple extractions, flap surgery, or who are on combination antithrombotic therapy. Furthermore, drug interactions—particularly between antibiotics like metronidazole and warfarin—remain an underreported risk that requires greater clinical vigilance (Nematullah et al., 2016).

Finally, the role of **laboratory medicine** in dental risk assessment is gaining traction, especially regarding INR monitoring in patients on vitamin K antagonists and renal function estimation in those receiving DOACs (Kovacs et al., 2021). While the use of cardiac biomarkers such as troponin or BNP is largely confined to hospital settings, their potential utility in identifying patients at increased perioperative risk is worth further investigation.

Overall, the review underscores the importance of a **multidisciplinary, evidence-based approach** to dental care for CVD patients. This includes not only the dental practitioner but also cardiologists, anesthesiologists, pharmacists, and laboratory professionals. Yet, the findings also reveal substantial variability in practice, highlighting a need for clearer, integrated guidelines and ongoing education tailored to outpatient dental settings.

Conclusion

This scoping review illustrates the evolving landscape of dental management for patients with cardiovascular disease (CVD), underscoring the significance of a multidisciplinary approach that incorporates anesthetic safety, cardiac risk assessment, pharmacological coordination, emergency preparedness, and laboratory monitoring. Despite the availability of global evidence

and updated clinical guidelines, significant variability in implementation persists—particularly in general dental settings.

In the context of Saudi Arabia, where the prevalence of both CVD and invasive dental procedures is steadily increasing, integrating these best practices into routine care is vital. The review highlights not only the clinical complexities of managing CVD patients in dental clinics but also the opportunity to build a safer and more standardized system through national policies, targeted education, and better interprofessional collaboration.

Recommendations for Implementation in Saudi Arabia

1. **National Clinical Guidelines**

   The Saudi Ministry of Health, in collaboration with the Saudi Dental Society and the Saudi Heart Association, should develop unified clinical guidelines for dental care in CVD patients—adapting international protocols to the local healthcare context.

2. **Mandatory Emergency Preparedness in Clinics**

   All licensed dental clinics should be required by the Saudi Commission for Health Specialties (SCFHS) to have functioning automated external defibrillators (AEDs), oxygen supplies, and emergency kits. Regular emergency drills should be mandated and monitored.

3. **Local Anesthesia Protocols Based on Risk Stratification**

   Dental practitioners should follow structured protocols to stratify cardiac risk before administering vasoconstrictor-containing anesthetics. Patients with recent myocardial infarction or arrhythmias should be referred to cardiac specialists prior to treatment.

4. **Integration of Echocardiographic Referrals in Dental-Hospital Networks**

   Hospitals and tertiary dental centers should establish clear referral pathways for echocardiographic evaluation of high-risk dental patients. This service can be coordinated through the SEHA or MOH digital platforms.

5. **Medication Reconciliation and Anticoagulant Management**

   Before surgical dental procedures, dentists should collaborate with cardiologists or pharmacists to assess the risks associated with antithrombotic drugs. The practice of unnecessary anticoagulant interruption must be avoided.

6. **Access to Laboratory Diagnostics in Dental Settings**

   Dental clinics should establish partnerships with nearby laboratories to facilitate preoperative INR, renal function, and CBC testing for patients with known cardiovascular comorbidities.

7. **Continuing Professional Development (CPD)**

   SCFHS should implement accredited CPD modules that train dentists in the safe management of cardiac patients, including pharmacology, medical history interpretation, and handling in-clinic emergencies.

8. Public and Patient Education

The MOH should launch awareness campaigns to educate cardiac patients about the importance of disclosing their full medical history to dentists and maintaining regular oral hygiene to reduce systemic inflammation.

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