

Antibiotic Prophylaxis in Dental Procedures: Responsibilities of Nurses, Pharmacists and Dentists

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Abstract:

Antibiotic prophylaxis is a critical practice in dental procedures, particularly for patients with certain medical conditions that increase the risk of infective endocarditis or other infections. Dentists play a primary role in identifying patients who require prophylactic antibiotics based on their health history, specific cardiac conditions, or implant presence. They are responsible for determining the appropriate antibiotic regimen, ensuring it is prescribed correctly, and informing patients of the importance of adhering to the treatment plan prior to procedures. This collaborative approach ensures that the risks of potential infection are minimized, facilitating safer dental care. Nurses and pharmacists also hold significant responsibilities in the implementation of antibiotic prophylaxis. Nurses are often the first point of contact in the dental office and must be knowledgeable about patient histories to help flag those who require prophylaxis. They play a crucial role in educating patients about the importance of taking antibiotics as prescribed. Pharmacists, on the other hand, are responsible for dispensing the antibiotic medication and providing guidance on proper usage and possible side effects. They must also communicate any potential drug interactions or contraindications to the prescribing dentist. This teamwork across disciplines is vital for optimizing patient outcomes and ensuring the success of prophylactic interventions in dental settings.

Keywords: Antibiotic Prophylaxis, Dental Procedures, Infective Endocarditis, Patient Education, Interprofessional Collaboration, Nurses' Responsibilities, Pharmacists' Roles, Dentists' Duty, Infection Prevention, Medical History.

Introduction:

Antibiotic prophylaxis in dental procedures remains a pivotal aspect of patient care, particularly for individuals with increased risk of adverse outcomes from dental infections. The tension between preventing infective endocarditis, a serious infection of the heart's inner lining, and the growing concern about antibiotic resistance necessitates a well-coordinated approach among healthcare professionals, including dentists, nurses, and pharmacists[1].

Recent years have witnessed a surge in the debate surrounding the necessity and implementation of antibiotic prophylaxis in dentistry. The American Heart Association (AHA) and other governing bodies have periodically revised their recommendations, leading to variability in practices among healthcare providers. The guidelines generally stipulate that prophylactic antibiotics should be considered for patients who are at a higher risk for developing infective endocarditis or other significant systemic infections following invasive dental procedures. Such patients typically include those with a history of infective endocarditis, certain congenital heart defects, and valve replacements. The guidelines are predicated on the understanding that dental procedures may introduce bacteria from the oral cavity into the bloodstream, posing a risk to susceptible individuals [2].

Herein lies the conundrum that healthcare providers face: While prophylactic antibiotics can prevent potential complications in at-risk populations, overuse of these medications may contribute to the further development of antibiotic resistance. This issue is compounded by the fact that not all dental procedures pose equal risks, which leads to perplexing scenarios when determining the necessity of prophylaxis. Understanding these nuances is crucial to averting both systemic health concerns and the broader public health challenge of antibiotic resistance [3].

In this ecosystem of antibiotic prophylaxis, each healthcare professional plays a distinct and complementary role. Dentists are primarily responsible for the identification of patients who may benefit from prophylaxis, evaluating their medical history, and making informed decisions based on established guidelines. Moreover, they are charged with determining the timing and choice of antibiotic, often adhering to empirical protocols that streamline patient care [4]. Nurses serve a vital function in managing and observing patients before, during, and after dental procedures. They provide vital education regarding the prophylactic measures being taken and the importance of adherence to any pre- and post-procedure antibiotic regimens. Additionally, nurses must be adept at recognizing any signs of potential adverse reactions to antibiotics, thereby ensuring patients receive timely and appropriate interventions [5].

The role of pharmacists is equally critical in this collaborative framework. Pharmacists not only ensure the availability of the prescribed antibiotics but also engage in patient education surrounding the correct usage, potential side effects, and the importance of completing the prescribed course. Their expertise in pharmacology equips them to offer insights into drug interactions, which is particularly salient for patients taking multiple medications. Furthermore, pharmacists are instrumental in monitoring antibiotic usage trends, alerting healthcare teams to potential overprescribing which could exacerbate antibiotic resistance [6].

Moreover, the collaborative nature of healthcare delivery systems underscores the significance of communication among dentists, nurses, and pharmacists. Inconsistencies in antibiotic prophylaxis protocols may lead to gaps in patient care, prompting a need for cohesive strategies that involve interdisciplinary teams. Such discussions should extend beyond clinical implications to consider patient education, efficacy of current guidelines, and the future direction of antibiotic use in dentistry [7].

Ethical considerations play a central role in the decision-making processes involved in antibiotic prophylaxis. From a patient-centered perspective, healthcare providers must weigh the potential benefits of antibiotic use against the risks, advocating for a judicious and evidence-based approach to prescribing practices. By articulating the justifications for or against prophylaxis, and fostering open dialogues with patients, providers can ensure that patients are well-informed participants in their care plans [8].

Understanding Infective Endocarditis and Its Implications:

Infective endocarditis (IE) is a significant and complex cardiovascular disorder characterized by the inflammation of the endocardium, which is the inner lining of the heart chambers and valves. This condition most commonly arises from a bacterial infection, though it can also be caused by fungi and, in rare cases, by other microorganisms. Understanding the etiology, pathophysiology, risk factors, clinical manifestations, diagnostic procedures, treatment approaches, and broader implications of infective endocarditis is crucial for medical professionals and the general population alike, as it impacts morbidity and mortality rates globally [9].

The onset of infective endocarditis is predominantly linked to microorganisms that enter the bloodstream (bacteremia). Factors such as dental procedures, intravenous drug use, and the presence of indwelling catheters can facilitate this entry. The condition is classified into two main categories: acute and subacute infective endocarditis. Acute IE typically develops rapidly, often caused by aggressive organisms such as *Staphylococcus aureus*, and can lead to severe illness or death within days to weeks. Subacute IE, on the other hand, progresses more insidiously, frequently associated with less virulent organisms, like *Streptococcus viridans*, especially in individuals with pre-existing heart conditions [9].

Several risk factors increase the likelihood of developing infective endocarditis. Individuals with pre-existing heart conditions—such as congenital heart defects, prosthetic heart valves, or a history of rheumatic heart disease—are particularly susceptible. Additionally, other lifestyle factors such as intravenous drug use, immunocompromised states, and the presence of chronic illnesses contribute significantly to the risk profile. Furthermore, certain medical procedures, including dental work, can introduce bacteria into the bloodstream, leading to potential infection [10].

The pathophysiological process underlying infective endocarditis involves several sequential events. Following bacteremia, microorganisms adhere to damaged heart tissue or abnormal endothelial surfaces. Once anchored, they reproduce, forming vegetations—masses of bacteria, platelets, and fibrin—that can disrupt normal heart function. The vegetations can also dislodge and result in emboli, which can travel to other organs and cause devastating complications, such as stroke, organ failure, or myocardial infarction. Additionally, the immune response to infection can further damage heart tissues and lead to the dysfunction of the heart valves [11].

The clinical symptoms of infective endocarditis can vary widely depending on the type of organism involved, the patient's health status, and the presence of underlying conditions. Common symptoms include fever, chills, night sweats, fatigue, and a new or changed heart murmur. Patients may also present with signs indicative of embolic phenomena, such as petechial hemorrhages (small red or purple spots on the skin), Janeway lesions (painless erythematous lesions on the palms and soles), and Osler nodes (painful nodules on the fingers or toes). The varied presentation can sometimes complicate and delay diagnosis [12].

Diagnosing infective endocarditis requires a high index of suspicion and the utilization of different diagnostic tools. The Duke criteria, which incorporate clinical, microbiological, and echocardiographic findings, are commonly utilized to establish the diagnosis. Blood cultures are particularly important in identifying the causative organism, while echocardiography (either transthoracic or transesophageal) is pivotal in visualizing vegetations and assessing valve function. Laboratory testing may also reveal anemia, elevated inflammatory markers, and other abnormalities associated with infection [13].

Once diagnosed, the treatment of infective endocarditis usually requires hospitalization for intravenous antibiotic therapy, which is tailored based on the identified organism and its susceptibility profile. The duration of antibiotic treatment typically ranges from four to six weeks, depending on the infection's severity and the patient's response to therapy. In some instances, surgical intervention is necessary to repair or replace damaged heart valves, particularly in cases of severe valvular dysfunction, persistent infection, or embolic complications. Management of infective endocarditis thus requires a multidisciplinary approach, often involving cardiologists, infectious disease specialists, and cardiothoracic surgeons.

The implications of infective endocarditis extend beyond individual patients, impacting healthcare systems and community health. The condition remains a significant cause of morbidity and mortality, particularly in high-risk populations. Preventive measures are critical in reducing the incidence of IE, especially in individuals with known risk factors. Recommendations from various health organizations include prophylactic antibiotics before high-risk dental and surgical procedures. Education around maintaining good dental hygiene, avoiding intravenous drug use, and understanding the risks associated with indwelling devices are also vital components of prevention [13].

Guidelines for Antibiotic Prophylaxis: Current Recommendations:

Antibiotic prophylaxis refers to the preventive use of antibiotics to reduce the risk of infections, particularly in patients undergoing surgical procedures or those who are at high risk for certain infections. The practice has evolved significantly over the years, driven by advances in medical science, a better understanding of infection control, and growing concerns over antibiotic resistance [14].

Antibiotic prophylaxis is primarily employed to prevent infections in patients who are at an elevated risk due to underlying health conditions, surgical interventions, or invasive procedures. The rationale for using prophylactic antibiotics is founded on the premise that preventing an infection is more effective and less costly than treating one after it has developed. In surgical settings, for instance, the use of antibiotics can significantly lower the incidence of surgical site infections (SSIs), which are associated with increased morbidity, prolonged hospital stays, and higher healthcare costs [15].

However, the indiscriminate use of antibiotics can lead to adverse consequences, including the emergence of antibiotic-resistant bacteria, which poses a significant public health challenge. Therefore, the guidelines for antibiotic prophylaxis are designed not only to maximize the benefits of prophylactic antibiotics but also to minimize the risks associated with their use [16].

Current Recommendations

The current recommendations for antibiotic prophylaxis vary depending on the specific medical or surgical context. Key organizations, including the American Heart Association (AHA), the American Dental Association (ADA), and the Centers for Disease Control and Prevention (CDC), provide guidelines that reflect the latest evidence-based practices [17].

1. Cardiac Procedures

For patients with certain cardiac conditions, prophylactic antibiotics are recommended to prevent infective endocarditis during procedures that may introduce bacteria into the bloodstream. The AHA guidelines specify that prophylaxis is necessary for patients with:

- Prosthetic heart valves
- History of infective endocarditis
- Certain congenital heart defects
- Cardiac transplant recipients who develop heart valve disease

The recommended antibiotics include amoxicillin, or in cases of penicillin allergy, clindamycin or azithromycin. Prophylaxis is typically administered one hour before the procedure and may be repeated if the procedure lasts longer than two hours [17].

2. Dental Procedures

The ADA guidelines align closely with those of the AHA, emphasizing the need for antibiotic prophylaxis in patients at risk for infective endocarditis. However, routine prophylaxis is not recommended for all dental procedures. For example, procedures involving the manipulation of the gingival tissue or periapical region of teeth warrant prophylaxis, while routine anesthetic injections or the placement of removable prosthodontic appliances do not [18].

3. Orthopedic Surgery

In orthopedic surgery, particularly joint replacement procedures, antibiotic prophylaxis is crucial for preventing SSIs. The CDC recommends administering prophylactic antibiotics within one hour before the incision, with cefazolin being the first-line agent for most patients. For those with a history of beta-lactam allergies, alternatives such as vancomycin or clindamycin may be used [18].

4. Urological Procedures

For patients undergoing urological procedures, particularly those involving the placement of urinary catheters or instrumentations, antibiotic prophylaxis is recommended to prevent urinary tract infections (UTIs). The choice of antibiotic typically depends on local resistance patterns, but common agents include nitrofurantoin and trimethoprim-sulfamethoxazole.

5. Gastrointestinal Procedures

In gastrointestinal procedures, such as colorectal surgeries, the use of prophylactic antibiotics is supported by evidence indicating a reduction in SSIs. The CDC guidelines recommend a combination of antibiotics, typically involving a cephalosporin and metronidazole, to cover both aerobic and anaerobic bacteria [18].

6. Obstetric Procedures

In obstetrics, the use of prophylactic antibiotics during cesarean sections is recommended to reduce the risk of post-operative infections. The CDC suggests administering a single dose of cefazolin prior to the incision, which has been shown to decrease the incidence of SSIs significantly [19].

7. Limitations and Special Considerations

While the aforementioned guidelines provide a framework for antibiotic prophylaxis, it is essential to consider individual patient factors, including allergies, comorbidities, and local antibiotic resistance patterns. Additionally, the timing of antibiotic administration is critical; antibiotics should be given within the appropriate window to ensure optimal tissue levels at the time of potential contamination [19].

The Challenge of Antibiotic Resistance

One of the most pressing concerns surrounding antibiotic prophylaxis is the potential for antibiotic resistance. The overuse and misuse of antibiotics have led to the emergence of resistant strains of bacteria, complicating the treatment of infections. This reality underscores the importance of adhering to established guidelines to ensure that prophylactic antibiotics are used judiciously [19].

Healthcare providers are encouraged to engage in shared decision-making with patients, discussing the risks and benefits of antibiotic prophylaxis. Education on proper antibiotic use and adherence to infection control practices are also critical components in combating antibiotic resistance [19].

Role of Dentists in Identifying High-Risk Patients:

Dentistry, often perceived merely as a practice focused on the aesthetics of the smile and the health of the teeth, extends far beyond these traditional boundaries. One of its less recognized yet profoundly significant roles is that of identifying high-risk patients, particularly in the context of their overall health. Dentists are frontline health care providers who can detect systemic diseases, oral manifestations of medical conditions, lifestyle-related risks, and psychosocial factors that contribute to a patient's health profile [20].

High-risk patients in dentistry may refer to individuals who are predisposed to poor oral health outcomes or who exhibit medical conditions that could be exacerbated by dental issues. This category can include patients with chronic diseases such as diabetes, cardiovascular diseases, HIV/AIDS, or those undergoing certain medical treatments like chemotherapy. Additionally, lifestyle factors such as smoking, excessive alcohol consumption, and poor dietary habits also play a significant role in determining a patient's risk level [20].

The identification of these high-risk patients is critical because such individuals may not only require more frequent dental visits but also tailored interventions that address their unique needs and challenges. Furthermore, the mouth is often a reflection of the body's overall health, and dental professionals are uniquely positioned to spot signs of systemic diseases that may not yet have been diagnosed by other health care providers [20].

The Dentist's Role in Identifying Risk Factors

1. Comprehensive Medical History

The first step in identifying high-risk patients is through taking a thorough medical history. Dentists are trained to ask pertinent questions that can reveal relevant health issues, medications, allergies, and family history of systemic

diseases. This initial assessment allows the dentist to not only understand the dental needs of the patient but also to detect any potential medical conditions that could impact or be impacted by oral health [21].

2. Oral Examination and Diagnostic Tools

Regular oral examinations can reveal early signs of diseases that affect both dental and overall health. For instance, periodontal disease has been linked with coronary artery disease and diabetes, while certain oral lesions may indicate the presence of cancer or autoimmune diseases. Dentists utilize various diagnostic tools, including X-rays and biopsies, to identify abnormal findings. Early detection in routine dental visits can lead to timely referrals to medical professionals for further evaluation [21].

3. Evaluating Lifestyle Factors

Dentists also play a pivotal role in assessing lifestyle factors that contribute to an individual's oral and overall health risk. Tobacco use, for example, is a significant factor in both periodontal disease and oral cancer. By discussing tobacco cessation and providing resources, dentists can help mitigate these risks. Furthermore, the evaluation of dietary habits can lead to discussions about nutrition, which is increasingly recognized as essential for maintaining good oral health and overall well-being [21].

4. Psychosocial Assessment

The relationship between mental health and oral health is gaining increasing recognition. Conditions such as depression and anxiety can lead to neglect of personal care, including dental hygiene practices. Dentists often interact with patients in ways that allow them to assess signs of mental health issues. Identifying patients who may be experiencing psychological distress is essential, as these individuals may require additional support and collaborative care involving mental health professionals [22].

Implications of Identifying High-Risk Patients

The implications of identifying high-risk patients in dentistry are manifold. Firstly, early intervention can significantly alter health trajectories, leading to better health outcomes. For instance, patients with diabetes can benefit from regular dental care that helps manage their condition alongside their oral health, reducing their susceptibility to complications such as periodontal disease [22].

Secondly, the identification of high-risk patients fosters interprofessional collaboration. Dentists can refer patients to other health professionals, creating a network of care that integrates dental and medical needs. This multidisciplinary approach can enhance patient outcomes and streamline the management of chronic illnesses. With the rise of integrated health care models, the role of dentists as integral members of the health care team is more crucial than ever [23].

Finally, understanding the patient's risk factors allows for the customization of preventive strategies. High-risk patients may benefit from additional preventive measures, such as fluoride treatments, sealants, or more frequent cleanings. This tailored approach not only addresses immediate oral health issues but also promotes long-term health habits that can mitigate future risks [23].

Nurses' Responsibilities in Patient Assessment and Education:

Antibiotic prophylaxis refers to the preventive use of antibiotics to reduce the risk of infection in patients who are susceptible due to various medical conditions, surgical procedures, or other health care interventions. As vital members of the healthcare team, nurses play a crucial role in assessing patients for the appropriate use of prophylactic antibiotics and educating them about the implications of their use [24].

Before delving into the responsibilities of nurses, it is essential to understand what constitutes antibiotic prophylaxis. It is predominantly employed in surgical settings, although it may also apply to other clinical scenarios, such as dental procedures, immunocompromised states, and prior history of infections like endocarditis. The goal of antibiotic prophylaxis is to prevent bacterial infections that could lead to complications or detrimental outcomes, particularly in high-risk individuals. Commonly used prophylactic antibiotics include beta-lactams, such as penicillin, and clindamycin for patients with penicillin allergies. Ultimately, deciding when and how to apply prophylactic measures hinges on a thorough assessment of patient-specific factors [25].

One of the primary responsibilities of nurses is to conduct comprehensive assessments to determine patients' eligibility for antibiotic prophylaxis. This assessment process includes gathering a thorough patient history, which encompasses prior surgeries, existing comorbid conditions, allergies, and other factors that may heighten infection risk. For example, patients undergoing orthopedic surgery, particularly total joint replacements, may require prophylaxis to protect against surgical site infections. Nurses must evaluate the patient's unique circumstances and consult evidence-based guidelines to identify which patients would benefit from prophylactic antibiotics [26].

In addition to the medical history, nurses must assess any potential contraindications to antibiotic prophylaxis. These may include allergies to certain antibiotic classes or pre-existing conditions, such as renal impairment, that could complicate the use of antibiotics. Furthermore, an assessment of the social and environmental factors that could contribute to infection risks is essential. For instance, assessing a patient's living conditions or occupational

exposure may provide insight into their likelihood of developing infections. Nurses should integrate this information into individualized care plans to ensure optimal patient outcomes [27].

Following the assessment, it is vital for nurses to educate patients about the purpose, benefits, risks, and proper use of antibiotic prophylaxis. Effective communication can empower patients to engage actively in their care and understand the significance of adhering to prescribed prophylactic measures. Nurses should start by explaining what antibiotic prophylaxis entails, detailing how and when the antibiotics will be administered, and emphasizing their role in preventing potential infections.

Moreover, patients should be informed about the potential risks of antibiotic usage, including side effects and the potential development of antibiotic resistance. The nurse's role extends beyond mere dissemination of information; it involves instilling a sense of caution in patients, encouraging them to complete their courses of antibiotics if prescribed, and helping them recognize that misuse could lead to adverse health effects not only for themselves but also for the broader community [28].

To facilitate understanding, nurses can utilize various educational strategies tailored to the patients' learning styles. These might include oral explanations, written materials, visual aids, and teach-back methods to ensure comprehension of the information provided. Nurses should encourage patients to ask questions and express concerns, fostering an open dialogue that promotes better patient engagement and compliance with prophylactic protocols [29].

After the administration of prophylactic antibiotics, nurses are tasked with the responsibility of monitoring and evaluating the patient's response and outcomes. This aspect of care is critical to ensuring that the prophylactic intervention is effective in preventing infections. Nurses should diligently observe for any signs of infection or adverse reactions to the antibiotics. Regular assessment and documentation of vital signs, laboratory results, and other relevant health indicators are paramount in identifying any emerging complications quickly [30].

In cases where patients exhibit signs of infection despite prophylactic measures, a thorough review of the patient's treatment plan is necessary to identify potential gaps in care, such as inadequate dosing or timing of antibiotic administration. Additionally, nurses have the responsibility to reassess the evidence-based guidelines and adapt their approaches as needed to ensure that care remains aligned with current best practices [31].

In the context of antibiotic prophylaxis, nurses have a unique role in advocating for antibiotic stewardship. This encompasses promoting the judicious use of antibiotics to mitigate the public health concern of antibiotic resistance. Nurses can promote stewardship initiatives by discussing the importance of not over-prescribing antibiotics and ensuring that prophylaxis is strictly reserved for patients who genuinely require it [32].

Nurses can participate in multidisciplinary teams to develop and implement antibiotic stewardship protocols within their healthcare institutions. By collaborating with physicians, pharmacists, and infection control specialists, nurses can help advance practices that reduce unnecessary antibiotic use, ultimately contributing to improved patient outcomes and a decrease in the prevalence of resistant strains of bacteria [33].

Pharmacists' Role in Medication Management and Counseling:

Pharmacists are essential healthcare professionals entrusted with the responsibility of ensuring safe and effective medication use. Their role has evolved significantly over the years, transitioning from purely dispensary-based functions to comprehensive medication management and counseling. This shift has been driven by a growing recognition of the need for patient-centered care, the increasing complexity of medication regimens, and the challenges associated with medication adherence [33].

Medication management refers to the process of overseeing and optimizing a patient's medication therapy to achieve the best possible health outcomes. This includes various activities, such as medication reconciliation, monitoring for adverse drug reactions, assessing therapeutic outcomes, and ensuring adherence to prescribed regimens. Pharmacists are uniquely positioned to perform these tasks due to their extensive knowledge of pharmacology, therapeutics, and patient care [34].

One of the primary roles of pharmacists in medication management is conducting medication reviews. Pharmacists assess a patient's complete medication list to identify potential drug interactions, duplications, and contraindications. This evaluation is crucial, especially for elderly patients or those with multiple comorbidities who may be taking several medications. Through this process, pharmacists can recommend modifications or alternative therapies to improve safety and efficacy [35].

Furthermore, pharmacists play a crucial role in monitoring medication therapy. They are trained to recognize signs of adverse drug reactions and therapeutic failures, allowing them to intervene before significant harm occurs. For instance, if a patient reports a dramatic change in their condition after starting a new medication, the pharmacist can evaluate the situation, discuss concerns with the prescribing physician, and suggest adjustments as necessary [36].

In addition to medication management, counseling forms a cornerstone of a pharmacist's role. Pharmacists provide essential information about medications, including their purpose, dosing, administration routes, potential side

effects, and interactions with other drugs and foods. This counseling is not limited to initial education upon dispensing but is an ongoing process that adapts to the evolving needs of patients [37].

Effective counseling empowers patients, equipping them with the knowledge necessary to participate actively in their own healthcare. A pharmacist may explain to a patient how to properly use an inhaler to manage asthma, or discuss the importance of adherence to an anticoagulant regimen to prevent thromboembolic events. By demystifying medication use, pharmacists enhance patients' understanding and confidence, which are vital components for improving adherence rates [38].

Moreover, pharmacists are instrumental in addressing medication-related questions and concerns. They often serve as the first point of contact for patients seeking clarification about their prescriptions. Whether it's clarifying dosing instructions or discussing possible side effects, pharmacists prioritize clear communication. This accessibility fosters trust and encourages patients to voice concerns about their medications, which can lead to timely interventions.

Medication adherence, defined as the extent to which patients take medications as prescribed, is a critical factor influencing clinical outcomes. Unfortunately, poor adherence remains a pervasive issue, leading to exacerbated health problems and increased healthcare costs. Pharmacists have taken the lead in implementing strategies to enhance adherence through both counseling and tailored interventions [38].

Pharmacists can identify barriers that patients face in adhering to their medication regimens. These barriers may include complex dosing schedules, side effects, and financial constraints. By conducting thorough assessments and engaging in motivational interviewing, pharmacists can develop individualized adherence plans tailored to each patient. For instance, they may suggest simplifying a medication regimen, coordinating refills to reduce the frequency of pharmacy visits, or identifying cost-effective alternatives or patient assistance programs to alleviate financial burdens [39].

In addition, pharmacists often participate in disease management programs, particularly for chronic conditions such as diabetes, hypertension, and asthma. Within these programs, pharmacists conduct follow-up consultations to monitor progress, reinforce adherence strategies, and provide ongoing education. Research has shown that these interventions, led by pharmacists, can significantly improve health outcomes and enhance patients' quality of life [40].

As healthcare becomes increasingly collaborative, the importance of interprofessional relationships cannot be overstated. Pharmacists are integral members of healthcare teams that comprise physicians, nurses, dietitians, and other providers. They contribute valuable insights regarding medication use that can lead to more informed clinical decision-making.

For example, in a primary care setting, pharmacists can help optimize medication therapy for patients with chronic diseases by collaborating closely with physicians. Through comprehensive medication management, pharmacists ensure that prescribed therapies align with the latest evidence-based guidelines while monitoring for any potential risks or adverse effects. This collaboration enhances the overall quality of care provided to patients and can reduce hospital readmission rates [40].

Additionally, pharmacists are increasingly involved in managing medication therapy in specialized settings such as hospitals, clinics, and long-term care facilities. They participate in rounds with medical teams to provide real-time medication expertise, contributing to more holistic patient management strategies. This integration of pharmacists into daily clinical activities reinforces the significance of pharmacy services within the broader healthcare framework [41].

Interprofessional Collaboration: Enhancing Patient Care:

The realm of healthcare is an intricate ecosystem where various professions converge to offer comprehensive services to patients. Among these, the field of dentistry plays a pivotal role in not only maintaining oral health but also influencing overall wellbeing. Interprofessional collaboration (IPC) in dental care is essential for ensuring holistic patient outcomes. As healthcare systems evolve, the integration of various professional expertise becomes increasingly crucial in addressing the complex needs of patients, particularly in the context of oral health [41].

Understanding Interprofessional Collaboration

Interprofessional collaboration refers to a coordinated approach where professionals from multiple disciplines work together towards a common goal, effectively sharing knowledge, expertise, and responsibilities in patient care. In dentistry, this collaboration often involves not only dental practitioners—such as dentists, dental hygienists, and dental assistants—but also medical professionals, nutritionists, pharmacists, and social workers. The mutual exchange of information and resources enriches the treatment process and enhances health outcomes, making IPC a vital approach in modern healthcare systems [42].

The Significance of IPC in Dental Care

The need for interprofessional collaboration in dental care can be attributed to several factors:

1. **Complex Patient Needs:** Today's patients frequently present with multifaceted health concerns that intersect dental, medical, and social parameters. For instance, a diabetic patient may require careful dental management to prevent complications related to their condition. Effective collaboration enables dental professionals to integrate medical knowledge into their practice, ensuring comprehensive care [43].
2. **Holistic Health Care:** There is a growing recognition of the link between oral health and overall health. Conditions such as cardiovascular disease, diabetes, and even certain cancers have been linked to poor oral health. An interprofessional approach facilitates early detection and intervention, ultimately improving health outcomes.
3. **Patient-Centered Care:** Modern healthcare emphasizes the importance of patient-centered care, which prioritizes the preferences and needs of patients. Interprofessional teams can better communicate and tailor treatment plans that consider not only dental health but also lifestyle factors, mental health, and nutritional needs.
4. **Reducing Health Disparities:** IPC can address health disparities that are prevalent in underserved populations. Collaborative care models can help identify socioeconomic barriers affecting dental health, allowing for intervention strategies that promote equitable access to care [44].
5. **Enhanced Skill Sets:** Each professional brings a unique skill set to the table. When dental hygienists, dentists, physicians, and other healthcare providers collaborate, they can offer a more diverse range of services. For instance, dietitians can provide nutritional advice to patients, enhancing the overall treatment outcomes [45].

Benefits of Interprofessional Collaboration

The benefits of interprofessional collaboration in dental care extend beyond improving patient outcomes. Some of the notable advantages include:

1. **Improved Communication:** Enhanced interprofessional communication fosters the sharing of information that can significantly reduce medical errors and ensure continuity of care [46].
2. **Comprehensive Treatment Plans:** Collaborative efforts lead to the development of more comprehensive treatment plans. By leveraging the expertise of various specialists, teams can formulate targeted strategies that address the root causes of health issues.
3. **Increased Patient Satisfaction:** Patients who receive care from interprofessional teams often report higher satisfaction levels. This satisfaction can stem from the holistic approach, the sense of being heard, and the personalized nature of the care received.
4. **Professional Development:** Working alongside professionals from other disciplines allows for ongoing professional development and learning. Each member of the team gains new insights, skills, and perspectives that can enhance their practice.
5. **Cost-Effectiveness:** An interprofessional approach has the potential to streamline processes, reducing redundant tests and treatments, ultimately saving costs for both healthcare providers and patients [46].

Challenges to Successful IPC in Dental Care

Despite its numerous benefits, implementing interprofessional collaboration in dental care does not come without challenges. Some of these challenges may include:

1. **Structural Barriers:** Many healthcare systems are still organized in silos, where healthcare providers focus on their respective domains rather than collaborating. This division can hinder effective communication and teamwork [47].
2. **Cultural Differences:** Different professions often have their own cultures, language, and ways of approaching patient care. These differences can create misunderstandings or conflicts that may impede collaboration.
3. **Role Clarity:** Lack of clarity regarding the roles and responsibilities of each professional can create overlap or gaps in care delivery. It is essential for teams to establish clear roles to ensure cohesive service provision.
4. **Financial Constraints:** Initiating and maintaining collaborative initiatives can be expensive. Many organizations may lack the funding to support interprofessional training or staffing.
5. **Time Management:** In fast-paced clinical environments, finding time for collaboration amidst heavy workloads can be a significant hurdle. Providers must prioritize collaboration in their practice to ensure its success [47].

Pathways to Enhancing IPC in Dental Care

To overcome these challenges and enhance interprofessional collaboration in dental care, stakeholders can consider several initiatives:

1. **Education and Training:** Incorporating interprofessional education (IPE) into the curricula of dental and healthcare training programs can empower future professionals with the collaborative skills necessary for effective teamwork [48].
2. **Structured Collaboration Models:** Organizations can implement structured collaborative care models that delineate roles, establish communication protocols, and define the decision-making process among team members.
3. **Continuing Professional Development:** Providing ongoing training and workshops that focus on enhancing IPC skills and understanding team dynamics can foster a culture of collaboration.
4. **Creating Shared Goals:** Developing shared goals and objectives can unify team members around common values and outcomes, promoting a more cohesive approach to patient care.
5. **Fostering a Collaborative Culture:** Healthcare leaders should advocate for a culture that values collaboration among all team members. Encouraging open communication and mutual respect can help bridge professional divides.
6. **Engagement of Stakeholders:** Engaging various stakeholders—such as policy-makers and community representatives—in the planning and implementation of interprofessional initiatives ensures that diverse perspectives are considered [48].

Challenges and Future Directions in Antibiotic Prophylaxis:

Antibiotic prophylaxis entails the administration of antibiotics to prevent infection in individuals at high risk. It has been a critical component in various medical fields, including surgery, dentistry, and immunocompromised patient management. While antibiotic prophylaxis serves as an essential tool in infection prevention, it faces increasing challenges that complicate its effectiveness and implementation [49].

Challenges in Antibiotic Prophylaxis

1. Antibiotic Resistance

One of the foremost challenges in antibiotic prophylaxis is the rise of antibiotic resistance. The inappropriate or overuse of antibiotics has fostered an environment where bacteria can evolve resistance mechanisms. In some cases, this phenomenon can render standard prophylactic regimens ineffective, compromising their intended purpose. According to the World Health Organization (WHO), antibiotic resistance is a global health crisis that threatens the efficacy of treatments for common infections, surgical procedures, and various medical interventions. Consequently, healthcare professionals must now navigate the delicate balance between administering prophylactic antibiotics and preserving their efficacy [50].

2. Emergence of Superbugs

Closely related to antibiotic resistance is the emergence of so-called "superbugs." These are bacteria that have acquired resistance to multiple antibiotics, often leading to infections that are difficult to treat. In some instances, patients receiving prophylactic antibiotics may inadvertently contribute to the selection of these resistant strains. For example, the use of antibiotics before surgery is intended to prevent postoperative infections. However, if the selected antibiotic does not effectively target the flora present in the specific patient, it may lead to the survival of resistant bacteria, creating a cycle of increasing infection risk [51].

3. Changing Guidelines and Recommendations

The guidelines for antibiotic prophylaxis are constantly evolving, influenced by factors such as emerging research, shifts in resistance patterns, and the introduction of new medical technologies. This evolution increases the complexity of prescribing antibiotics prophylactically as healthcare providers must stay informed and incorporate the latest recommendations into their practices. Furthermore, conflicting guidelines—especially across different medical specialties—can lead to confusion among practitioners. For instance, dental guidelines for endocarditis prophylaxis may differ from those applied in orthopedic surgery, further complicating clinical decisions [52].

4. Patient Compliance and Adherence

Patient compliance is another significant challenge in the effective implementation of antibiotic prophylaxis. Successful prophylaxis relies on patients taking prescribed antibiotics as directed. Factors influencing adherence include patients' understanding of the necessity of prophylaxis, potential side effects, and the perceived severity of their underlying condition. Research indicates that a lack of knowledge about the importance of prophylactic antibiotics contributes to poor adherence rates. Consequently, healthcare providers must navigate educational barriers to ensure that patients understand both the benefits and risks associated with prophylaxis [53].

5. Economic Considerations

Finally, economic factors also play a considerable role in the administration of antibiotic prophylaxis. The cost of antibiotics, diagnostic testing for drug sensitivity, and the implications of hospital-acquired infections due to ineffective prophylaxis can strain healthcare budgets. Furthermore, insurance coverage for prophylactic procedures may vary, leading to disparities in access to appropriate care. As healthcare systems grapple with rising costs,

antibiotic prophylaxis could be deprioritized, especially in outpatient settings where access to specialty care is limited [54].

Future Trends in Antibiotic Prophylaxis

Despite the challenges outlined above, the future of antibiotic prophylaxis also presents exciting opportunities. As the medical community seeks innovative solutions, several trends are emerging that may redefine antibiotic usage and infection prevention strategies [55].

1. Precision Medicine

Precision medicine, which tailors medical treatment to the individual characteristics of each patient, holds significant promise for antibiotic prophylaxis. By utilizing genetic insights, biomarkers, and advanced diagnostic tools, healthcare providers may better identify which patients are at highest risk for infection and what specific antibiotics are likely to be effective for them. This targeted approach could reduce unnecessary antibiotic use, thereby mitigating the risk of resistance and improving patient outcomes [56].

2. Advancements in Microbiome Research

Ongoing research into the human microbiome has opened new avenues for understanding how our resident bacteria impact health, disease, and infection susceptibility. By examining the complex interactions within the microbiome, researchers may develop alternative prophylactic strategies that focus on maintaining or restoring microbial balance, rather than relying solely on antibiotics. For example, probiotics and prebiotics may serve as preventative measures against certain infections, offering a potential pathway towards safer and more effective infection control [57].

3. Development of Novel Antimicrobial Agents

The pharmaceutical industry is increasingly focused on the development of novel antimicrobial agents that can outsmart resistant bacteria. Innovative drug classes, such as bacteriophage therapy, and agents that disrupt bacterial communication (quorum sensing) are under investigation as potential weapons against resistant infections. As new drugs enter the market, they may provide additional prophylactic options, helping to maintain the efficacy of antibiotic prophylaxis in an era increasingly defined by resistance [58].

4. Improved Education and Awareness

Enhanced education and awareness campaigns directed at both healthcare professionals and patients may facilitate better understanding and adherence to prophylactic protocols. By highlighting the importance of appropriate antibiotic use and correct medication practices, these initiatives can cultivate a culture of compliance and responsibility among both providers and recipients of care. Leveraging technology, such as mobile health applications, can also empower patients to better manage and understand their treatment plans [59].

5. Multidisciplinary Approaches

The complexity of infection control necessitates a collaborative approach that brings together multiple healthcare disciplines. Surgeons, dentists, pharmacists, and infectious disease specialists must work together to develop cohesive protocols that minimize the use of prophylactic antibiotics while maximizing their effectiveness. This collaboration can lead to standardization of guidelines across disciplines, fostering clearer communication and better patient outcomes [60].

Conclusion:

In conclusion, antibiotic prophylaxis in dental procedures is a vital component of patient care, particularly for those at increased risk of infections such as infective endocarditis. This study highlights the critical roles played by dentists, nurses, and pharmacists in ensuring the effective implementation of prophylactic measures. Dentists are primarily responsible for assessing patient risk factors, prescribing appropriate antibiotics, and communicating essential information to patients. Nurses contribute by conducting thorough patient assessments and providing education that promotes adherence to the prescribed regimens. Pharmacists further enhance patient safety by managing the pharmacological aspects, including medication dispensing and counseling on potential interactions and side effects. The successful implementation of antibiotic prophylaxis relies on seamless interprofessional collaboration among these healthcare providers, which ultimately leads to improved patient outcomes and reduced risk of complications. Challenges remain in standardizing practices and ensuring consistent communication among caregivers. Ongoing education, research, and the development of comprehensive protocols will be essential in navigating these challenges and optimizing care in dental settings. By fostering a unified approach to antibiotic prophylaxis, the healthcare team can ensure that patients receive the highest standard of care while minimizing the risks associated with dental procedures.

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