**How to Cite**:
Alshebel, A. Y., Alduaybi, M. A., Alharbi, S. S., Alajmi, N. A. A., Alkhadrawi, M. A., Al Owias, M. I. Z., Al Rashedi, A. A., Alqahtani, A. S., & Alanezi, B. S. (2022). Endocarditis: An overview of serious cardiac disease for healthcare professionals. *International Journal of Health Sciences*, *6*(S10), 2055–2068. https://doi.org/10.53730/ijhs.v6nS10.15307

# Endocarditis: An overview of serious cardiac disease for healthcare professionals

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***Abstract*---Background:** Infective endocarditis (IE) is a severe cardiac condition primarily caused by various pathogens, including bacteria and fungi, that invade the bloodstream and affect heart valves. Historically linked to rheumatic fever, the epidemiology of IE has evolved, with healthcare-associated infective endocarditis (HCAIE) now representing a significant portion of cases due to increased use of intravenous devices. Despite advances in diagnosis and treatment, mortality rates remain high, emphasizing the need for a comprehensive understanding of IE. **Aim:** This article aims to evaluate

International Journal of Health Sciences E-ISSN 2550-696X © 2022.
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*Manuscript submitted: 27 Nov 2022, Manuscript revised: 01 Jan 2022, Accepted for publication: 13 Jan 2022*

the epidemiological trends of IE, discuss the latest diagnostic and management guidelines, and explore future directions to improve treatment outcomes. **Methods:** A thorough review of recent literature, epidemiological data, and current guidelines related to IE was conducted, analyzing global trends, causative agents, risk factors, and changing prevention strategies. **Results:** The incidence of IE has increased significantly, from 478,000 cases in 1990 to over 1 million in 2019, with a corresponding rise in mortality. Staphylococcus aureus has emerged as the leading pathogen, particularly in healthcare settings, while the epidemiology varies across regions, especially in developing countries. **Conclusion:** The multifaceted nature of IE requires a multidisciplinary approach for effective management. While recent guidelines recommend targeted prophylactic measures, discrepancies exist in practice, particularly in low-resource settings. Further research is essential to develop tailored strategies for diverse populations and enhance the global response to this life-threatening condition.

***Keywords*---**Infective endocarditis, healthcare-associated infective endocarditis, Staphylococcus aureus, epidemiology, diagnosis, management.

## Introduction

Infective endocarditis (IE) is a debilitating condition induced by a variety of pathogens, predominantly bacteria, fungi, or other microorganisms that infiltrate the bloodstream, affecting either native or prosthetic valves, intracardiac devices within the heart, and, infrequently, non-functional embryonic remnants located in the right atrium [1,2]. Historically, rheumatic fever served as the principal precursor to IE and has remained a prevalent risk factor in developing nations [3]. The epidemiological landscape of IE has shifted significantly over the past decade, with healthcare-associated infective endocarditis (HCAIE) now constituting 25%-30% of recent cases, attributable to the increased utilization of intravenous lines and intracardiac devices. It is estimated that IE impacts approximately 3-10 individuals per 100,000 person-years, with its incidence noted to be escalating in certain regions globally [5]. In the United States, the occurrence of IE is estimated at about 15 cases per 100,000 individuals, with a notable increase in its incidence recently. Despite advancements in diagnostic and microbiological methodologies, the mortality associated with IE remains alarmingly high, with an in-hospital mortality rate reaching up to 22% and a 5-year mortality rate of 45% worldwide [1,6]. Regarding etiological agents, Staphylococcus has supplanted Streptococcus as the predominant cause of IE in developed healthcare systems over the years; however, the trend in developing countries remains ambiguous due to insufficient data [7]. Timely clinical suspicion and rapid diagnosis are crucial for enhancing patient outcomes and mitigating the morbidity and mortality linked to IE. Following diagnosis, IE is addressed by a multidisciplinary team skilled in infectious diseases, cardiology, and cardiac surgery [8]. The intricate and unpredictable clinical manifestations and trajectories of IE pose significant diagnostic and therapeutic hurdles, with varying capacities for

response observed across different regions [5]. There is a notable deficiency in comprehensive reports detailing the global disease burden of IE. This review aims to examine the disparities in epidemiological trends, the latest guidelines for diagnosis and management, and future advancements aimed at overcoming the diagnostic and therapeutic challenges associated with treating IE.

**Epidemiological Transition:**

Epidemiological studies have been performed worldwide, primarily concentrating on incidence rates due to the infrequency of infective endocarditis (IE). A 2008 survey in France revealed an incidence of 34 new cases of IE per million people annually, with a predominance of male cases [9]. This finding aligns with a similar study in England, which reported an annual incidence of 36 cases per million [10]. Research conducted in Australia, the United States, and Italy demonstrated yearly incidence rates ranging from 40 to 80 cases per million population [11,12,13]. Notably, mortality rates were significantly elevated during the initial three months of hospitalization, varying between 15% and 25% [9,11,12,13]. Overall, the annual incidence rate of IE is estimated at 3 to 10 cases per 100,000 inhabitants, with a total mortality rate of approximately 30% within one month of diagnosis [14,15].

Results from a global burden of disease study by Chen et al. in 2019 indicated a notable increase in both incidence and mortality associated with IE over the previous decade [5]. Specifically, the incidence rose from 478,000 cases in 1990 to 1,090,530 in 2019, while the mortality increased from 28,750 to 66,320 in the same period. The study documented a consistent upward trend annually, highlighting a growing global burden of disease with significant variations across genders, age groups, and geographical regions [5]. Consequently, intensified efforts to mitigate the burden of IE appear both rational and necessary. In recent years, the prevalence of endocarditis has been increasingly associated with healthcare settings, accounting for approximately 25% to 30% of all cases, likely due to the heightened use of intracardiac devices and intravenous lines [16]. Moreover, the widespread use of opioids in the United States has altered the demographic profile of IE, with a notable rise in cases among injection drug users [17]. The primary organisms responsible for endocarditis include Staphylococcus aureus (approximately 26.6%), Streptococcus viridans (18.7%), other Streptococci (17.5%), and Enterococci (10.5%) [9]. As a result of this epidemiological transition, Staphylococcus has supplanted Streptococcus viridans as the leading etiological agent of IE in developed healthcare systems [6]. In cases of native valve infective endocarditis (NVIE), methicillin-susceptible Staphylococcus aureus (MSSA) has emerged as the predominant causative organism, while methicillin-resistant Staphylococcus aureus (MRSA) is more prevalent in healthcare-associated infective endocarditis (HCAIE). This shift is likely attributable to an aging population, the decline of rheumatic heart disease (RHD) as a traditional major risk factor due to effective antibiotic treatment of rheumatic fever, and advancements in device management, particularly in cardiac patients [6]. However, due to insufficient data regarding epidemiological transitions in developing countries, the extent of the epidemiological burden of IE in these regions remains unclear.

**Changing Preventive Guidelines and Challenges:**

Prior to the release of the National Institute for Health and Care Excellence (NICE) guidelines in 2008 and the American Heart Association (AHA) guidelines in 2007, patients classified as belonging to moderate or severe risk categories who underwent surgical interventions, particularly dental procedures, were routinely administered prophylactic antibiotics. This typically involved a single oral dose of amoxicillin (3 grams) administered one hour before the procedure [18]. In cases where patients exhibited intolerance to amoxicillin, oral clindamycin (600 mg) was suggested as an alternative prophylactic agent. However, the use of clindamycin is associated with serious adverse effects, such as infections caused by Clostridioides difficile, which can be life-threatening for some individuals [19]. Retrospective studies conducted between 1997 and 2007 raised questions regarding the efficacy of prophylactic antibiotics in preventing IE, as the rationale for antibiotic administration was predominantly grounded in low-quality evidence, including preclinical animal studies yielding positive results, case-control studies, expert opinions, and clinical experiences, rather than robust data from randomized prospective clinical trials [18]. This sparked the hypothesis that prophylactic measures might not be universally necessary.

Consequently, the guidelines were revised in 2007 by the AHA and in 2008 by NICE, recommending antibiotic prophylaxis exclusively for specific populations with a history of particular heart conditions—such as congenital heart defects, valvular heart diseases, previous episodes of IE, prosthetic heart devices, and cardiac transplant recipients—undergoing specific dental procedures that disrupt the oral mucosa, gingiva, and areas surrounding the apex of the teeth [18]. In contrast to the aforementioned studies, Dayer MJ et al., based on a UK population, identified a positive correlation between the increased incidence of IE and the relaxation of prophylactic measures for patients not classified as high-risk [20]. Conversely, research by Garg et al. indicated no significant relationship between the cessation of antibiotic prophylaxis and the anticipated rise in IE prevalence over a thirteen-year period [21]. Similarly, another study corroborated these findings [22]. After the introduction of the revised guidelines, both studies noted a consistent decline in the clinical decision-making process regarding the prescription of prophylactic antibiotics for moderate and high-risk patients [21,22]. This trend raises significant concerns, as the lack of adherence at the physician level and noncompliance at the patient level fundamentally undermine institutional recommendations. Nevertheless, it is crucial to note that all of these recommendations are primarily found on data derived from developed nations. Information regarding IE is sparse in developing countries, particularly in Asia [23]. Due to the inadequacy of evidence in this area, it is challenging to uniformly apply and adhere to recommendations aimed at mitigating the morbidity and mortality associated with IE. To address these critical knowledge gaps and the deficiency of demographic data, both retrospective and prospective observational studies must be conducted. The findings from these studies could be instrumental in refining and improving the effectiveness of the guidelines.

**Approach to the Diagnosis of Infective Endocarditis:**

Recent years have seen the introduction of numerous diagnostic guidelines and criteria for infective endocarditis (IE), notably the Beth Israel criteria proposed by Von Reyn (1981), the original Duke Criteria (1994), the widely accepted Modified Duke Criteria (2000), and the latest modified criteria from the European Society of Cardiology (ESC) in 2015 [24,25]. Both U.S. and European recommendations acknowledge that while the Duke classification has undergone extensive validation, it possesses limitations in clinical practice and should not supplant clinical judgment [26]. Achieving a rapid and precise diagnosis in suspected cases of IE presents a central challenge. Once IE is suspected, the diagnostic assessment must commence without delay. The diagnostic approach is typically divided into two phases: (1) initial evaluation and therapy, and (2) definitive diagnosis and therapy [24,27].

**Multidisciplinary Team Approach:**

The diagnosis and management of IE necessitate the involvement of multiple disciplines. A singular primary healthcare provider or specialist may lack the capacity to deliver timely and adequate care [28]. The multidisciplinary team (MDT) approach seeks to enhance coordination and collaboration among various specialties, thereby improving decision-making and patient management [29]. This collaborative approach is particularly crucial in reference centers, as patients referred by primary care providers or smaller hospitals may present with complications requiring prompt intervention. Consequently, a swift and effective protocol for the endocarditis team and the referring center is essential. Regular team meetings should be conducted to discuss cases and work towards enhancing the management of IE patients [30]. The team's responsibilities also encompass promoting research and raising awareness among primary healthcare providers and medical students through discussion sessions. The establishment of an MDT is a multi-step process [31], feasible only in large tertiary care centers with significant patient volumes and accessible referring centers. This process involves leadership development, problem identification, team member recruitment, protocol formulation, and the scheduling of regular meetings [32]. The MDT typically includes primary care physicians, cardiologists, cardiac surgeons, electrophysiologists, microbiologists, histopathologists, infectious disease specialists, radiologists, and imaging specialists such as echocardiographers, CT, and MRI technicians. Studies have shown that employing an MDT approach significantly reduces the time to surgical intervention, subsequently improving patient prognosis [33]. Evidence supports the MDT approach as the most effective method for reducing mortality in IE through the implementation of dedicated multidisciplinary teams. A 2019 study conducted by the University of Missouri Hospital and Clinics aimed to standardize and enhance care for IE patients, demonstrating the importance of quality improvement and team development tools in establishing MDTs for IE [34]. This study was the first to outline MDT development for IE using quality improvement tools within the U.S. context, serving as a model for other institutions seeking to develop their own MDTs [34]. Effective treatment of IE, guided by the clinical experience and judgment of the MDT, is anticipated to improve patient survival rates and lower hospital mortality.

**Imaging:**

Imaging is integral to the diagnosis and management of IE, with imaging findings forming significant criteria within the modified Duke criteria that facilitate early detection of complications [35]. Echocardiography stands out as the most researched and commonly employed technique for the initial evaluation of IE. Other imaging modalities include CT, positron emission tomography-computed tomography (PET CT), and MRI. The choice of imaging technique is informed by established efficacy, the stage of diagnosis or disease, valve type, complications, and availability [36]. Transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) are the two primary echocardiographic modalities. TTE is non-invasive and requires less technical expertise, making it the preferred initial step in the evaluation of IE as it yields valuable diagnostic and severity assessment information [35,37]. TEE is indicated in specific IE cases where TTE results are positive or inconclusive, or where complications are suspected, particularly in prosthetic valve endocarditis, due to its superior imaging quality. However, TEE is invasive and typically necessitates some form of sedation [38]. For suspected native valve endocarditis, TTE has a sensitivity ranging from 50% to 90% and a specificity of 90%. In contrast, for suspected prosthetic valve endocarditis, TTE sensitivity is lower, at 40% to 70%, compared to TEE, which boasts a sensitivity of 85% to 90%. Nevertheless, TTE is valuable for assessing ventricular size and function, hemodynamic severity of valve lesions, and diagnosing anterior prosthetic aortic valve abscesses, which may be challenging to visualize with TEE [38]. Diagnosing IE associated with prosthetic valves and cardiovascular implantable electronic devices is complicated by altered anatomy and acoustic shadowing due to material density [35,39]. Therefore, cardiac CT may be warranted for further evaluation if echocardiographic results are inconclusive or if there is suspicion of cardiac complications such as pseudoaneurysms, abscesses, and fistulae. Coronary CT angiography (CTA) may be needed to investigate potential vegetation dislodgement, and brain MRI may be indicated for assessing neurological complications [36,39,40].

Cardiac CT serves a supportive role in conjunction with echocardiography for the diagnosis of IE. Advancements in CT technology, particularly enhanced temporal and spatial resolution, have led to increased utilization of this modality for IE screening [41]. Common indications for cardiac CT include patients with contraindications to TEE and those with a high suspicion of IE but suboptimal echocardiographic findings due to calcifications or prosthetic valves [41]. Cardiac CT has also been integrated into the 2015 ESC modified diagnostic criteria for IE [42]. Feuchtner et al. reported that 4-dimensional (4D) CT has a sensitivity of 96% and specificity of 97% in detecting vegetations based on findings from a study involving patients undergoing surgery with various cardiac valves [43]. Bruun et al. found that CT provided more precise anatomical details regarding the perivalvular extent of abscesses and pseudoaneurysms compared to TEE [44]. However, CT may miss smaller vegetations and valve leaflet perforations associated with IE and is inadequate for evaluating hemodynamics and function. Conversely, echocardiography allows for the visualization of blood flow, suggesting that the two modalities may serve as complementary techniques.

When comparing the latest guideline recommendations regarding the role of imaging in the assessment and management of suspected IE patients, the AHA guidelines designate TEE as the first-line test for patients with a prosthetic valve and suspected IE. The AHA guidelines also advise repeating TEE within 3 to 5 days, or sooner if prosthetic valve endocarditis is suspected. The ESC recommendations stipulate that TEE should always be conducted in suspected prosthetic valve endocarditis due to its superior sensitivity and specificity in this context compared to TTE. The timing and method (TTE or TEE) of repeat tests depend on initial findings, microorganism type, and initial therapeutic response. The European Association of Nuclear Medicine's 2018 report emphasized the significance of multimodality imaging in diagnosing IE in addition to echocardiography [26]. Multimodality imaging, incorporating CT, MRI, radiolabeled white blood cell (WBC) single-photon emission computed tomography (SPECT)/CT, and 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography (PET)/CT, is emerging as an important supplementary diagnostic approach for patients with suspected IE and those with suspected prosthetic valve endocarditis [26]. Both ESC and AHA acknowledge the importance of cardiac CT in evaluating suspected IE and assert that these advanced imaging techniques should not replace echocardiography but rather serve as additional tools for patients in whom the diagnosis is complicated or uncertain. Furthermore, the latest ESC and AHA guidance on IE management advocates for a collaborative approach, termed the “Endocarditis team” [26].

**Microbiology:**

Microbiological testing is crucial for diagnosing infective endocarditis (IE) using modified Duke's criteria, with blood cultures being the gold standard alongside serology and PCR. Guidelines vary on the number and timing of blood cultures; the AHA and ESC recommend at least three sets from different sites, while the British Society for Antimicrobial Chemotherapy (BSAC) suggests two sets for acute cases and three sets spaced apart for subacute cases. A standard incubation period of five days is generally sufficient for cultivating most causes of endocarditis, including Candida species, with previous recommendations for prolonged incubation of HACEK organisms now outdated due to advances in diagnostics. Blood culture-negative endocarditis occurs in 2% to 41% of cases, with common causes including Coxiella burnetii and Bartonella species. In culture-negative scenarios, alternative diagnostic methods like serology and PCR may be utilized. Culturing valvular tissue is also recommended to inform treatment choices based on antimicrobial susceptibility. Procalcitonin (PCT) is a potential biomarker for systemic bacterial infections but has limited reliability for diagnosing IE. Conversely, C-reactive protein (CRP) may show better accuracy in diagnosing IE, particularly through serial measurements during treatment to assess prognosis, though it should be combined with other clinical variables. Ongoing research is necessary to identify more reliable biomarkers for IE, as both PCT and CRP currently lack sufficient specificity and sensitivity.

**Management and Treatment Updates:**

Infective endocarditis (IE) is a persistently evolving condition with continually changing epidemiology and management strategies. Therapeutic decisions must

consider individual patient characteristics, specific pathogens, and the associated risk of sequelae. Clinicians should maintain a high index of suspicion for IE in patients with risk factors, including artificial heart valves, damaged heart valves, congenital heart defects, implanted heart devices, a history of endocarditis, and intravenous (IV) drug use, even when clinical presentations are nonspecific. A multidisciplinary approach is essential in the diagnosis and treatment of IE, emphasizing the importance of early and accurate diagnosis alongside prompt antimicrobial therapy to minimize complications and avoid surgical interventions. The cornerstone diagnostic tools remain echocardiography and blood cultures, with adjunctive imaging such as cardiac CT and nuclear imaging enhancing sensitivity in inconclusive cases. The rise of antibiotic resistance, particularly with Staphylococcus aureus, necessitates the exploration of alternative antibiotic therapies, including newer antibiotics and combination regimens. Long-standing debates on the use of antibiotic prophylaxis continue, while evidence suggests that surgical intervention can improve survival rates for patients with major complications. The decision to operate must carefully weigh the associated risks and benefits, especially given the high-risk profile of many patients. Furthermore, ongoing research aims to refine clinical diagnostic criteria, enhance surgical techniques, and investigate the use of outpatient oral antibiotics for penicillin-sensitive streptococcal endocarditis.

**Antibiotic Treatment:**

Before the introduction of antibiotics, IE was universally fatal. Current treatment protocols involve administering antibiotics targeted at the organisms identified in blood cultures. Recommendations for antibiotic regimens for common organisms show minimal variation. In many cases, empirical therapy may not be necessary, especially for patients without acute symptoms, and can often be delayed until blood cultures are obtained, as a precise microbiologic diagnosis is critical. Antibiotic regimens are typically administered intravenously, considering the patient's renal function. Generally, treatment for native valve endocarditis lasts for four weeks, while prosthetic valve endocarditis requires six weeks, with exceptions for cases involving left-sided vegetations or drug-resistant organisms. The treatment duration is calculated from the first day of negative blood cultures, with at least two sets collected every 24 to 48 hours until the bloodstream is clear of infection. Following antibiotic therapy, the IV catheter used for administration should be removed promptly. A new baseline should be established for valve appearance, severity of valve regurgitation, and left ventricular function, along with laboratory tests (e.g., white blood cell count, erythrocyte sedimentation rate, and CRP) after completing antibiotic treatment. Complete resorption of valvular vegetations post-treatment is rare.

**Outpatient Parenteral Antibiotic Therapy (OPAT):**

Outpatient parenteral antibiotic therapy (OPAT) is an effective option for patients with microorganisms that respond well to antibiotics and who exhibit an uncomplicated clinical course. Evidence supports OPAT as a viable means to complete treatment for IE, including prosthetic valve endocarditis. A study by Rajaratnam et al. indicated that OPAT, when carefully implemented with a multidisciplinary team, benefits both patients and the healthcare system.

However, a retrospective analysis of OPAT in a UK center (2006-2010) highlighted a relatively high rate of adverse events, underscoring the need for robust protocols and policies for patient selection and follow-up.

**Oral Antibiotic Therapy:**

Current guidelines from the American Heart Association (AHA) and the European Society of Cardiology (ESC) recognize limited scenarios where oral antibiotics may be suitable for treating IE. Recent clinical studies have suggested favorable outcomes for partial oral antimicrobial regimens in clinically stable patients without complications. A recent randomized multicenter trial involving 400 adults with left-sided endocarditis due to Enterococcus faecalis, Staphylococcus aureus, or coagulase-negative staphylococci found that switching from intravenous to oral antibiotic treatment was non-inferior to continuing IV therapy. Additionally, a systematic review by Al-Omari et al. (2014) documented cure rates of 75-100% for susceptible organisms treated with oral regimens. A larger retrospective study by Mzabi et al. (2016) also demonstrated that switching to oral treatment after seven days of parenteral therapy did not significantly increase the risk of relapse or reinfection. If future studies validate these findings, incorporating oral antibiotic therapy into standard treatment for IE could lead to reduced healthcare costs and lower risks of complications associated with prolonged intravenous access.

**Surgical Treatment:**

Timely surgical intervention in selected patients significantly improves survival rates and reduces hospital mortality associated with IE. Evidence from the European heart survey indicates that surgery is performed in approximately 50% of IE patients, with common indications including congestive heart failure (60%), refractory sepsis (40%), embolic complications (18%), and large vegetation size (48%). Surgical mortality in active IE ranges from 6-25%, with long-term survival rates around 70%. Early valve surgery is indicated for patients who do not respond to antimicrobial therapy, necessitating surgical intervention before completing the antimicrobial course. The timing of surgery hinges on the urgency of indications and the patient's risk factors. According to the 2016 American Association for Thoracic Surgery (AATS) guidelines, surgery is recommended for patients with severe heart failure, significant valve dysfunction, prosthetic valve infections, or persistent sepsis despite adequate antibiotic therapy lasting longer than 5-7 days. Patients with invasive Staphylococcal infections or early prosthetic valve endocarditis require prompt surgical intervention, as delaying surgery increases the risk of disease progression and complications. The AATS guidelines emphasize that immediate or emergency surgery is warranted in patients with mobile vegetations greater than 10 mm who exhibit clinical evidence of embolic phenomena despite appropriate antibiotic therapy. High-risk groups, particularly those with left-sided IE caused by resistant organisms, or persistent bacteremia, necessitate immediate surgical intervention, even before completing the full course of antibiotics. Post-surgical patients are at increased risk for recurrent IE and should receive education on recognizing concerning symptoms and the importance of early medical consultation. Additionally, healthcare providers should be alerted to the need for blood culture sampling before starting empirical antibiotic therapy for these patients. Patient education regarding dental hygiene,

avoiding unnecessary medical procedures, and the use of antibiotic prophylaxis during invasive interventions is critical.

## Conclusion

Infective endocarditis remains a critical public health concern, characterized by significant morbidity and mortality despite advances in medical science. The shifting epidemiology, particularly the rise of healthcare-associated cases and the predominance of Staphylococcus aureus, underscores the need for enhanced clinical awareness and prompt diagnosis. Multidisciplinary management, as well as adherence to updated guidelines, is paramount to improving patient outcomes. However, challenges persist, especially in developing regions where data on IE is scarce. Addressing these gaps through targeted research and improved healthcare infrastructure will be crucial for mitigating the impact of this serious condition. Enhanced collaboration among healthcare professionals, patients, and policymakers is vital for implementing effective preventive and therapeutic strategies tailored to diverse patient populations.

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**الملخص:**

**الخلفية :**يُعتبر التهاب الشغاف المعدي (IE) (بطانة القلب) حالة قلبية خطيرة تُسببها بشكل أساسي مجموعة من العوامل الممرضة، بما في ذلك البكتيريا والفطريات، التي تغزو مجرى الدم وتؤثر على صمامات القلب. تاريخياً، كان مرتبطًا بالروماتيزم، وقد تطورت وبائيات التهاب الشغاف المعدي، حيث يمثل التهاب الشغاف المرتبط بالرعاية الصحية (HCAIE) الآن جزءًا كبيرًا من الحالات بسبب زيادة استخدام الأجهزة الوريدية. على الرغم من التقدم في التشخيص والعلاج، تظل معدلات الوفيات مرتفعة، مما يبرز الحاجة إلى فهم شامل لالتهاب الشغاف.

**الهدف :**يهدف هذا المقال إلى تقييم الاتجاهات الوبائية لالتهاب الشغاف، ومناقشة أحدث الإرشادات التشخيصية والعلاجية، واستكشاف الاتجاهات المستقبلية لتحسين نتائج العلاج.

**الطرق :**تم إجراء مراجعة شاملة للأدبيات الحديثة والبيانات الوبائية والإرشادات الحالية المتعلقة بالتهاب الشغاف، مع تحليل الاتجاهات العالمية والعوامل المسببة وعوامل الخطر واستراتيجيات الوقاية المتغيرة.

**النتائج :**زادت حالات التهاب الشغاف بشكل ملحوظ، من 478,000 حالة في عام 1990 إلى أكثر من مليون حالة في عام 2019، مع ارتفاع متزامن في الوفيات. وقد برزت بكتيريا المكورات العنقودية الذهبية كالعامل الممرض الرئيسي، وخاصة في البيئات الصحية، بينما تختلف الوبائيات عبر المناطق، خاصة في الدول النامية.

**الخاتمة :**الطبيعة متعددة الجوانب لالتهاب الشغاف تتطلب نهجًا متعدد التخصصات للإدارة الفعالة. بينما توصي الإرشادات الحديثة بتدابير وقائية مستهدفة، توجد تناقضات في الممارسة، وخاصة في البيئات ذات الموارد المحدودة. من الضروري إجراء المزيد من الأبحاث لتطوير استراتيجيات مصممة خصيصًا لمجموعات سكانية متنوعة وتعزيز الاستجابة العالمية لهذه الحالة المهددة للحياة.

**الكلمات المفتاحية :**التهاب الشغاف المعدي، التهاب الشغاف المرتبط بالرعاية الصحية، المكورات العنقودية الذهبية، الوبائيات، التشخيص، الإدارة.