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Chapter

Introductory Chapter: Endocarditis

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1. Introduction

Endocarditis a very complex and diverse set of problems and can include infectious and non-infectious diseases of the heart. The spectrum of problems includes vegetations on valves, fistulas and abscess cavities, and infections that develop on prosthetic materials such as pacemaker and defibrillator leads, prosthetic valves, intra-cardiac catheters, heart pumps, and any other type of intra-cardiac foreign material. The diagnosis and management of these problems can be quite challenging and will typically require an integrated multi-disciplinary team. Nevertheless, with advances in the therapies that are being offered to older and sicker patients, offset by advances in both the medical and surgical management of infectious cardiac problems, the number of cases continue to grow with still major risks for morbidity and mortality. In addition, the global concerns for substance abuse and the risks for the use of contaminated needles has led to a significant increase in associated infectious complications. Without a doubt, endocarditis in the setting of substance abuse is not only a significant medical and surgical problem – but a difficult social problem as well. The financial and ethical implications of endocarditis further highlight the emphasis of a team-based approach to the diagnosis and management.

Unfortunately, even minor invasive procedures have been shown to increase to risk of infections of native or prosthetic valves [1]. Typically, endocarditis was associated with blood-stream infections in the setting of dental procedures, but it is becoming more recognized that even minor procedures, such as gastrointestinal endoscopy, can increase risk for cardiac infections and might prompt a broader reevaluation of the role of prophylactic antibiotics prior to such procedures. Evidence, especially in higher-risk patients such as those with bicuspid aortic valves and mitral valve prolapse, is suggesting that the risk for bloodstream infection might be greater than historically believed [2].

The growing incidence of endocarditis also parallels the growing social problems of modern society as is seen in the evolving epidemiology of patients presenting with infections of their heart, heart valves, and intra-cardiac devices and structures. As mentioned, the global drug abuse epidemic – combined with the increasing utilization of cardiac procedures in older and sicker patients with advanced co-morbidities, reflects the need for a more wide-spread recognition of this problem. Fortunately, advances in diagnostic –especially imaging technology and microbiology serology testing – and surgical techniques can improve outcomes in those who present with even advanced disease. As such, the goal of this book is to emphasize and review some of the evolving concepts in the diagnosis, presentation, epidemiology, and management options of endocarditis.

2. Epidemiology

As discussed above, the areas of greatest focus are currently the implications of the global intravenous drug abuse (IVDA) epidemic and the growing utilization of cardiac implantable devices (CID). Both of these very different set of problems has each contributed to a substantial increase in the incidence of endocarditis and, particularly, involving right-sided cardiac structures such as the tricuspid valve. While there is extensive literature and guidelines for the diagnosis and management of left-sided disease (i.e. aortic and/or mitral valves), the literature for the diagnosis and treatment of right-sided disease is still evolving and will reviewed in several of the chapters of this text. It is not just the medical difficulties in the management of IVDA associated endocarditis that continues to be a problem, but the social and ethical implications for re-infections in patients who continue to abuse drugs or fail to pursue appropriate definitive therapy [3, 4]. The recognition of this growing problem is only slowly being better understood [5]. In addition, as mentioned, with the growing utilization of advanced cardiac therapies and implants, there is also a growing risk and incidence of device-related infectious complications [6, 7]. Unfortunately, the increasing use of such devices is expanding at a rate that is exceeding the healthcare systems ability to better understand how to prevent, diagnosis, and treat such device related infections [8–10]. However, with the development and expansion of "Heart Team" to better guide therapies and management, there exist increasing opportunities to improve outcomes by incorporating a team-based approach to the management of these very difficult problems.

3. Diagnosis

Positive blood cultures are the *sine quo non* in establishing a diagnosis of endocarditis. In addition, the original Dukes Criteria has been used for many years to further help make the diagnosis [11]. Advances in ultrasound imaging has shown to be extremely useful in the management of patients and guiding therapy [12]. Transthoracic and transesophageal imaging are considered first-line tests to evaluate for suspected endocarditis. Current major international society guidelines and appropriateness criteria support their liberal use [2, 12] – the role of other modalities, such as 3D echocardiography, computed tomography (CT), magnetic resonance imaging, and positron-emission tomography (PET) continues to expand [13, 14]. Nevertheless, such diagnostic tools should be readily available and aggressively used, including non-cardiac imaging of the neuro-axis and body structures, to ensure the scope of what is typically a systemic problem is completely defined. Furthermore, any change in the clinical picture or concerns for disease progression or failure of medical therapies should prompt a timely reassessment with repeat imaging.

4. Therapy

Without a doubt the cornerstone to early managed is focused on targeted antibiotic therapies, diagnosis of the primary problem, evaluation for secondary complications (such as embolic complications, like stroke), and engagement of a multi-disciplinary team of physicians and healthcare providers, who, by definition have both an interest and expertise in endocarditis to help define a treatment plan. As with any treatment plan, the recipe for success must consider if and when

surgery should be performed (and which operation – not an easy decision process) and how some of the contributing co-morbidities can be attenuated to minimize the risks for recurrence. While it is easy to focus on the initial diagnosis and managed, often an index hospitalization, long-term success requires close follow-up to monitor for compliance to optimize the opportunity an overall successful treatment plan. Because of the challenges of many of the socio-economic problems that patients with endocarditis often face, and are addressed in some of the chapters of this text, full engagement by the entire healthcare team will need to make sure that any and all obstacles to treatment success are removed, if possible. An extensive medical and surgical plan that does not consider the socio-economic variables that are often unique to each patient are probably at risk for treatment failure.

One of the most important decisions in the management of endocarditis is determining the role of surgery – and not just if surgery should be performed, but when, what operation, choices of valves, risks for complications, barriers to follow-up (i.e. need for life-long anticoagulation if mechanical valves are used), and maybe even where and by whom. Such decision making cannot and should not be performed in the vacuum of specific guidelines and indications for surgery but also must consider the entire evolving clinical picture. Regardless of the direction of the care plan, recognition of the impact on timing of therapies is of critical importance. As with most medical problems, delays in therapy might make the problem worse and hence require not just a broad understanding of the evolving literature regarding the timing of surgery, but the importance of timely evaluation of problems, regardless of how trivial they may appear and constant re-assessment of the treatment plan to ensure the original plan is working as planned as does not need to be revised [15–18].

A common theme in many of these chapters is the decision-making process and role for surgery. A point that requires further emphasis is the role for early surgery and how this concept needs to cage every aspect of a larger treatment plan, specifically [19]:

1. Early surgery is recommended in patients with highly-resistant organisms and, in particular, fungal infections.

2. Worsening heart failure (especially acute) due to valvular dysfunction.

3. New or worsening cardiac complications – such as root abscesses, fistulas, heart block, and evidence of new/worsening annular involvement.

4. Surgery is indicated with failure of medical therapy, such as persistent bacteremia or septic symptoms (fever, tachycardia) greater than 5–7 days in the absence of another causes in the setting of targeted antibiotic management.

5. Growing vegetations despite appropriate antibiotic therapy – especially with evidence of recurrent embolic complications.

6. Large and/or mobile vegetations (>1 cm) and/or with severe valve regurgitation – even in the absence of heart failure signs and symptoms.

Unfortunately, such decision-making and indications often mandates surgery in less than optimal conditions – such as patients who are still actively infected, have sustained recent systemic or cerebral embolic complications, or are risk for long-term reinfection due to compliance or concerns of co-existing and incompletely addressed or defined comorbidities. Such is the realities of this disease process

and all providers must recognize that sometimes earlier intervention, even if in less-than-ideal surgical conditions, might be ultimately better for the patient in the long run.

Similar considerations are used to guide the management of prosthetic valve endocarditis [20]. Despite the challenges of re-operative surgery in a "septic" patient, it must be appreciated that medical therapies alone are rarely successful, the best opportunity for a cure often requires complete removal of all prosthetic material and replacement.

5. Social implications

The pandemic of intravenous drug abuse has resulted in a substantial increase in the incidence of endocarditis. There is at least a twofold increase in the number of heroin users from 2006 to 2013 [21]. The medical, social, and economic implications are obviously substantial. The role of infected needles, infected drugs, skin contamination, or some combination all contribute to the risk for endocarditis. Acute infections are further challenged by other substantial comorbidities, such as untreated Hepatitis B/C and the Human Immunodeficiency Virus (HIV) [22]. As a consequence of long-standing narcotic use/abuse, infected patients will often chronic pain syndromes and drug tolerance that can make symptom management difficult. In addition, mental health and personality disorders also challenge how these patients are treated – the mental and emotional fatigue placed upon the healthcare team can be substantial and might be used to influence the decision-making process for an individual patient. It is critical to consider all of these co-variates in the context of decision-making, need for compliance, and potential long-term therapy implications. For example, while replacement with biologic valves may predispose to early structural degeneration and need for additional surgery, their use might be a better longer-term strategy than subjecting a potentially non-compliant patient with untreated Hepatitis to life-long anticoagulation. In other words, even if the acute infectious problem is "cured", many of the decisions regarding the management of endocarditis – including the re-infection prevention opportunities – reflect that endocarditis can often be viewed as a life-long problem [23]. The ethical considerations of both acute and chronic disease management, as discussed in this chapter on the ethics of recurrent drug use/abuse, clearly demonstrates that long-term success often is as much a function of the overall team approach to the problems (rarely is endocarditis a singular problem) including the contributing factors, such as substance abuse. The tragic reality, however, is that while the ethics of the social approach to endocarditis often plays a substantial role in the management of individual patients, the foundation for such biases might be inherently flawed. Furthermore, there must be an understanding that despite everything being "done right" many patients, as a function of incurable comorbidities, much like complications of advanced cancers, patients might still die with and from endocarditis.

6. Conclusions

Improvements in diagnostic tools and an increasing understanding of the scope of associated problems have led to an increase in the recognition and management complexity of infectious endocarditis. Challenging social problems, advanced co-morbidities, and complex infections emphasize the role for early and aggressive management by a well-integrated and comprehensive multi-disciplinary team.

Hopefully, while each chapter in this text will stand on its own, taken together, the goal of this project is to help emphasize the importance of collaborative Team work and consideration for all of the contributing co-morbidities, and a comprehensive plan are critical to the short and long-term treatment successes [24, 25].

It cannot be emphasized enough that the goal of this volume is to lend valuable perspectives into some of the rapidly evolving topics and challenges surrounding the treatment of endocarditis – including management of complications, role and time of surgery, and the holistic approach to what often evolves into a life-long problem. Hopefully, with a greater understanding and emphasis on Teamwork, improvements in prevention, diagnosis, and treatment will result in better outcomes for all.

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