European Journal of Internal Medicine 25 (2014) 550–555

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Original Article

Epidemiology of infective endocarditis in a tertiary-center in Jerusalem: A 3-year prospective survey

M. Korem [a,1], S. Israel [b,1], D. Gilon [c], A. Cahan [a], A.E. Moses [a], C. Block [a], J. Strahilevitz [a,*]

[a] Department of Clinical Microbiology and Infectious Diseases, Hadassah–Hebrew University Medical Center, POB 12000, 91120 Jerusalem, Israel
[b] Internal Medicine Department, Hadassah–Hebrew University Medical Center, Jerusalem, Israel
[c] Heart Institute and Department of Medicine, Hadassah–Hebrew University Medical Center, Jerusalem, Israel

ARTICLE INFO

Article history:
Received 27 November 2013
Received in revised form 25 April 2014
Accepted 20 May 2014
Available online 12 June 2014

Keywords:
Endocarditis
Epidemiology
Outcomes
Mortality

ABSTRACT

Background: Epidemiological features of infective endocarditis have changed during the last decades because of increases in the prevalence of health care exposure and of *Staphylococcus aureus* bloodstream infection. Consequently, the role of surgery is evolving. We aim to provide a contemporary profile of epidemiological, microbiological, and clinical features of infective endocarditis in a tertiary medical center, and identify predictors of mortality.

Methods: A prospective observational cohort study of consecutive adult patients with definite endocarditis according to the modified Duke criteria. Data were collected from January 1, 2009 through October 31, 2011 following a predefined case report form designed by the ICE-PCS.

Results: Among 70 endocarditis episodes, 25.7% involved prosthetic valves and 11.5% were device related. Forty-four percent of episodes were health-care associated. The predominant causative microorganism on native valve, prosthetic valve and device related endocarditis was *Staphylococcus aureus* (33.3%). Viridans group streptococci accounted for the majority of community-acquired endocarditis (36.1%). At least one complication occurred in 50% of the episodes. One third of the patients who had an indication for surgery were operated upon. Six month case fatality ratio was 40%. Sixty-five percent of patients with a contraindication to surgery died, compared with 9% and 28.5% who were treated surgically and medically, respectively. In multivariable analysis, age was a predictor of mortality.

Conclusion: Compared with other series, we observed more health-care associated endocarditis, and a higher mortality. Nearly half of all deaths were in patients who had a contraindication to surgery. Careful evaluation of contraindications to surgery is warranted.

1. Introduction

The incidence of infective endocarditis (IE) has been estimated to be 3–10 episodes per 100,000 person-years in different surveys [1,2] with increased incidence in recent years [2,3]. Epidemiological features of IE have changed during the last decades because of an increase in the prevalence of health care exposure [4,5], an increasing incidence of bacteremia due to *Staphylococcus aureus* [6–8], a decreasing incidence of rheumatic heart disease, and an increased incidence of degenerative valvular lesions associated with an aging population [9–12]. In some series, *S. aureus* has emerged as the most common cause of IE and rates of viridans streptococci have decreased [10,11,13,14]. This apparent change may partly be due to referral bias in specialized centers, since streptococcal endocarditis still predominates in population-based surveys of IE [15]. Although lower case fatality rates have been observed over the last three decades, overall estimates remain as high as 20–25% [14].

The objective of this prospective observational cohort study was to describe the epidemiological and clinical features of IE in a contemporary patient population as encountered by our hospital, and identify predictors of mortality.

2. Materials and methods

2.1. Patient selection

Hadassah-Hospital, Jerusalem, Israel is a 1105-bed, tertiary-care teaching hospital with an active cardiothoracic surgical department, serving a population of ~800,000. Adult patients (≥18 years) who were hospitalized in our center from January 1, 2009, through October 31, 2011, were included in the analysis if they met the modified Duke

* Corresponding author at: Department of Clinical Microbiology and Infectious Diseases, Hadassah Ein-Kerem, 91120 Jerusalem, Israel. Tel.: +972 50 894 6353; fax: +972 2 641 9545.
E-mail address: jstrahilevitz@hadassah.org.il (J. Strahilevitz).
[1] M.K. and S.I. contributed equally to this work.

http://dx.doi.org/10.1016/j.ejim.2014.05.011
0953-6205/

criteria for definite IE [16]. The mean number of annual admissions during the study period was 73,549.

2.2. Data collection

Data were collected during the index hospitalization using the predefined case report form designed by the International Collaboration on Endocarditis — Prospective Cohort Study (ICE-PCS) survey, in which our institution participates [17]. Clinical characteristics including demographics, co-morbid conditions, preexisting valvular conditions, details regarding the current episode of IE including source of acquisition, microbiology and echocardiography findings, complications, management, and outcome, were collected. Follow-up data were censored on 30 June 2012 using medical records and national death indices.

2.3. Definitions

Definitions of the variables included in the ICE-PCS case report form have been reported in detail elsewhere [6,18].

Nosocomial IE was defined as IE that developed in a patient who was hospitalized for more than 48 h before the onset of signs or symptoms consistent with IE. Non-nosocomial health care-associated IE was defined as IE diagnosed within 48 h of admission in an outpatient with extensive health care contact as reflected by criteria described before [6]. Health care-associated IE was defined as nosocomial IE or non-nosocomial health care-associated IE. Community acquired IE was defined as IE diagnosed at the time of admission (or within 48 h of admission) in a patient who did not fulfill the criteria for health care-associated infection.

3. Statistics

Statistical analysis was performed using the SPSS software system (SPSS) version 20 for Windows. Descriptive results are presented as means ± standard deviation (SD). The Chi-square test was used to analyze the associations between categorical clinical variables. The independent samples *t*-test was used to analyze the associations between a continuous variable and a categorical variable with two categories. The mean annual incidence rate of IE was calculated as number of episodes of definite IE per 100,000 population per year. We used as the denominator the adult population (≥18 years of age) in Jerusalem served by our medical center, as derived from the Israeli Central Bureau of Statistics. Survival analysis was carried out using the Kaplan–Meier procedure for categorical variables and Cox proportional hazards for ordinal variables. All tests were 2-sided, and statistical significance was determined at the 0.05 level.

4. Results

4.1. Epidemiology

There were 70 episodes of definite IE, representing an annual incidence rate of 6.3 per 100,000 person-years (5 fulfilled pathological criteria, 49 fulfilled two major criteria and 16 fulfilled one major and three minor criteria). Baseline characteristics and predisposing factors are shown in Table 1. Thirty seven events (52.8%) involved native valves, 18 events (25.7%) involved prosthetic valves, 8 events (11.5%) were cardiac device related, and one event involved the myocardial wall in the path of a regurgitant jet. The site of infection was unknown in 6 patients. Of the 27 (38.6%) patients with a prosthetic valve, 18 had prosthetic valve endocarditis (PVE), 4 native valve endocarditis (NVE), 1 cardiac device infective endocarditis (CDIE), and in 4 the location of IE was unknown. The distribution of valve involvement and additional differences between NVE and PVE are shown in Table 1.

Diabetes mellitus and congestive heart failure (CHF) were common findings among the patients (38.5% and 48.6%, respectively). The latter was found more frequently among PVE cases. The predisposing conditions among patients with NVE were degenerative valves (n = 22/37, 59.4%), followed by rheumatic heart disease (n = 3/37, 8%), and intravenous drug abuse (n = 1/37, 2.7%).

Sixty eight (97.1%) and 46 (65.7%) patients had transthoracic and trans-esophageal echocardiography examination, respectively. Fifty three patients had a vegetation, and 7 had worsening valvular regurgitation. Echocardiographic criteria of IE were present in all NVE patients and in 22 of 27 patients with non-NVE.

Table 1
Baseline characteristics of patients with infective endocarditis.

Variable	All patients	Patients with NVE	Patients with PVE	*p* value
No. of episodes[a]	70	37 (52.8%)	18 (25.7%)	
Male to female ratio	1.9:1	2.7:1	1.25:1	0.2
Mean age ± SD	64.7 ± 15.1	64.2 ± 16.6	64.3 ± 7.1	0.1
Diabetes mellitus	27 (38.5%)	15 (40.5%)	7 (38.8%)	0.91
Cancer	14 (20%)	9 (24.3%)	4 (22.2%)	0.9
Congestive heart failure	34 (48.6%)	10 (27%)	12 (66.7%)	0.05
Intra-cardiac device	17 (24.3%)	2 (5.4%)	9 (50%)	0.0001
Prosthetic valve	27 (38.6%)	4 (10.8%)	18 (100%)	0.000000002
Previous IE	5 (7.1%)	2 (5.4%)	3 (16.7%)	0.17
Predisposition for bacteremia[b]	14 (20%)	9 (24.3%)	2 (11.1%)	0.25
Source of acquisition[c]				0.74
Community acquired	36 (51.4%)	20 (54.1%)	10 (55.6%)	
Health care-associated	31 (44.3%)	17 (45.9%)	7 (38.9%)	
Nosocomial[d]	21 (30%)	9 (24.3%)	7 (38.9%)	
Non-nosocomial[e]	10 (14.3%)	8 (21.6%)	0	
Valve infected				
Mitral	28 (40%)	15 (40.5%)	13 (61.1%)	0.10
Aortic	17 (27.1%)	14 (40.5%)	3 (22.2%)	0.11
Tricuspid	3 (5.4%)	3 (8.1%)	0	0.21
Pulmonic	1 (1.4%)	1 (2.7%)	0	0.48
Aortic and mitral	2 (2.8%)	2 (5.4%	0	
Mitral and tricuspid	1 (1.4%)	1 (2.7%)	0	

NVE: native valve endocarditis; PVE: prosthetic valve endocarditis.
[a] 15/70 episodes are not included: 8 cardiac device related, 1 myocardial wall, and 6 unknown site.
[b] Presence of short or long term intravenous catheter or AV fistula.
[c] The source of acquisition was unknown in three cases.
[d] The source of acquisition was unknown in two cases, three cases were cardiac device related.
[e] The source of acquisition was unknown in one case, and one case was cardiac device related.