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Right-sided endocarditis: clinical and echocardiographic characteristics

T. Lejko-Zupanc, M. Kozelj¹, I. Kranjec¹, F. Pikelj

Clinical and echocardiographic characteristics of patients treated for right-sided endocarditis are presented. Of 205 patients with infective endocarditis, 13 had involvement of the right heart structures. The predisposing factors for right-sided infective endocarditis in our group of patients were either severe debilitating disease (4 patients), or congenital heart disease (2 patients). In the majority of patients the disease was linked to invasive medical procedures such as central intravenous lines, pace-maker and an abortion in one case. None of the patients was an intravenous drug user. The tricuspid valve was affected in eight patients and pulmonary valve in three. In one patient, the endocardium at the right side of the ventricular septal defect was involved. One patient had a pace-maker electrode infection. Pulmonary embolisms were the major complication of the disease. A transthoracic echocardiogram confirmed the diagnosis in all patients with tricuspid valve infective endocarditis, while vegetations were present in only one patient with pulmonary valve infective endocarditis. Four patients died. Right-sided infective endocarditis in non drug addicts is a severe disease with high mortality rate, and should be suspected in patients with pulmonary embolism and signs of infective endocarditis, especially in those with a predisposing condition, even if they are not intravenous drug addicts. *J Clin Basic Cardiol* 1999; 2: 81–4.

Keywords: infective endocarditis, right heart, echocardiography

Although right-sided infective endocarditis (IE) is mainly a disease of intravenous drug abusers, it can occur also in non-drug addicts [1]. Regional differences seem to exist in the clinical spectrum of the disease [2]. In addition to intravenous drug abuse, several disease states, such as alcoholism, immunodeficiency states, permanent pacemakers, central venous lines and some congenital heart diseases predispose to this condition [3–5]. The incidence of right-sided IE ranges from 5 to 10 per cent in different series [6, 7]. The aim of the study was to study clinical and echocardiographic characteristics of right-sided IE in our patients and compare them with those in previously published series.

Patients and Methods

Over a 12-year period, 205 patients were treated for IE in the University Medical Centre Ljubljana. Thirteen patients had a documented involvement of the right side of the heart. The diagnosis of IE was based on the Duke Endocarditis Service criteria, and the patients meeting these criteria were classified as definite, probable and possible IE [9]. Infection involving the right side of the heart, including the pace-maker's electrode in the right cardiac chambers, was defined as isolated right-sided IE. Patients with concomitant involvement of the aortic and/or mitral valve were excluded from the study.

Our patients were studied for the presence of preexisting heart disease or anomaly, predisposing condition or port of entry for the causative microorganism, clinical course and outcome of the disease, and echocardiographic characteristics. Blood cultures were drawn according to the recommendations of Duke Endocarditis Service [8] and processed at the Institute of Microbiology of the Medical Faculty Ljubljana. In every case the antibiotic treatment was not instituted before the blood cultures were drawn. Both patients with negative blood cultures received multiple courses of antibiotics prior to admission to our department. In only one patient was the diagnosis of suspected infective endocarditis entertained be-

fore the results of the blood cultures or echocardiography were obtained and empirical treatment was started immediately. In other patients initial broad spectrum antibiotic coverage was started. No serological examinations were done in patients with negative blood cultures.

Complete echocardiographic examinations (M-mode, two-dimensional echocardiography, Colour flow Doppler and CW Doppler) were performed through a transthoracic (TTE) or transesophageal (TEE) approach using standard techniques and the VingMed 750 echocardiographic equipment. We examined the whole heart, not only the right chambers. We considered positive echocardiogram for IE with the evidence of endocardial involvement:

- Vegetation: oscillating intracardiac mass, on valve or supporting structures, or in the path of regurgitant jets in the absence of an alternative anatomical explanation
- Abscess
- A new valvular regurgitation [8]

TEE was performed in only two patients. We used a multi-plane transesophageal probe. The patients did not receive extra intravenous medication before TEE procedure. In patients who died an autopsy was performed.

Results

In our series of 13 patients with right-sided IE, there were eight men and five women, ranging in age from 19 to 77 years, (mean age 48 yrs.). Clinical data are presented in Table 1. Eleven patients had definite and two possible IE by Duke Endocarditis Service criteria for IE. The tricuspid valve was affected in eight patients, and the pulmonary valve in three. In two patients, IE occurred on the valve previously damaged by congenital pulmonary stenosis or tricuspid prolapse, in one patient on the pace-maker electrode, and in one at the parietal endocardium of the right ventricle at the ventricular septum defect (VSD). Other coexisting cardiac malformations included ASD, patent foramen ovale, and Chiari's network.

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Table 1. Clinical characteristics of patients with right-sided infective endocarditis

pt	sex	age	site of IE	preexisting heart disease or anomaly	predisposing factor	microorganism	complications	Duke criteria	outcome
1	M	45	TV	PFO		<i>S. pneumoniae</i>	septic sacroileitis	definite	cured, TR
2	M	45	TV	TVR, Chiari network	mlg. disease	blood culture neg.	pulmonary embolism	possible	cured, mild TR
3	F	38	TV	Chiari network	artificial abortion	<i>S. agalactiae</i>	pulmonary embolism	definite	cured, mild TR
4	M	64	TV	none	mlg. disease	<i>S. viridans</i>	pulmonary embolism	definite	cured, mild TR
5	M	77	TV	none	i.v. catheters	blood culture neg.	pulmonary embolism	possible	cured, severe TR
6	F	47	TV	none	IUD, i.v. catheters	<i>S. aureus</i>	pulmonary embolism, MOF	definite	cured, TR
7	M	28	PV	none	none	<i>S. aureus</i>	pulmonary embolism, septic osteomyelitis	definite	cured
8	F	19	PV	PV stenosis	none	<i>S. aureus</i>	pulmonary embolism, MOF, paravalv. abscess	definite	+
9	M	59	PV	ASD II	none	<i>E. faecalis</i>	pulmonary embolism	definite	+
10	M	64	PM electrode	PM	none	<i>S. epidermidis</i>	pulmonary embolism	definite	surgery, cured
11	F	60	TV	none	cirr. hep. ethyl.	<i>C. albicans</i>	sy. v. cavae sup.	definite	surgery, +
12	M	50	TV	none	cirr. hep. ethyl.	<i>S. viridans</i>	MRSA septic shock	definite	+
13	F	33	VSD	VSD	none	<i>S. suis</i>	none	definite	surgery, cured

TV = tricuspid valve, PV = pulmonary valve, TR = tricuspid valve regurgitation, PM = pace-maker, MRSA = methicillin resistant *S. aureus*, IUD = intrauterine device, MOF = multiple organ failure, PFO = patent foramen ovale

Four patients had a history of an invasive procedure, such as artificial abortion, or placement of central venous line, intrauterine device, or permanent pace-maker. Four patients suffered from a debilitating or malignant disease (decompensated ethylic cirrhosis in two patients, essential thrombocytemia in one patient and carcinoma of the larynx in one patient). One patient presented with no history of preexisting heart disease or predisposing factor for IE. None of the patients gave a history of intravenous drug use.

Various microorganisms were isolated from the blood: *S. aureus* in three cases, various types of streptococci in six cases, *E. faecalis* in one case, *S. epidermidis* in one case, and *C. albicans* in one case. Blood cultures were negative in two patients.

Medical treatment consisted of long term (> 2 weeks), iv. high dose sensitivity-proven antibiotics. In patients who survived, the duration of treatment was usually 4 weeks.

Pulmonary embolisms, which occurred in nine of the 13 patients, were the main complication of the disease. In most patients, chest X-rays were not characteristic of pulmonary infarction, but showed various infiltrates in the lungs. Other complications included septic sacroileitis, multiple organ failure, paravalvular abscess, septic shock and obstruction of the tricuspid orifice by large vegetation.

In one patient urgent surgical intervention was required because of obstruction of the tricuspid valve by large vegetation.

The patient with pace-maker electrode infection was treated early in course of the disease by surgical removal of the electrode. We did not notice any oscillating masses at the entrance of the superior Vena cava into the right atrium. The surgery confirmed the vegetations were attached only on the pace-maker electrode in the right atrium. The patient with VSD was operated a few months after antimicrobial treatment of IE (Table 1).

Four patients (30.7 %) died; at autopsy, clinical diagnosis was confirmed, and right-sided IE was identified as a direct cause of death. Patient 8 died of cardiac tamponade as a consequence of ruptured paravalvular abscess, patient 9 succumbed to intractable congestive heart failure and patient 11 died postoperatively due to decompensation of hepatic cirrhosis. Although in patient 9 the operation was considered, the operation was not performed due to rapid deterioration and sudden death of the patient. In patient 12, septic shock due to MRSA superinfection rather than IE was identified as a direct cause of death (Table 1).

In all patients but two, echocardiograms were compatible with the major echocardiographic criteria, including an oscillating intracardial mass (Figure 1) and a new valvular regurgitation (Table 2). In two patients, the echocardiogram met the minor criteria for IE, including a changed Doppler signal and increased transpulmonary pressure gradient. As demonstrated by the follow-up echocardiograms, the vegetations decreased in size and became brighter in all survivors treated medically. In eight patients, the vegetation was associated with a new tricuspid regurgitation, and in two, with pulmonary regurgitation. In two patients with tricuspid valve IE, Chiari's network was seen in the right atrium.

Discussion

The clinical course of right-sided IE in our series differed in several relations from that reported in other series from North America and Europe. None of our patients was an intravenous drug user, which is not surprising since intravenous drug abuse does not yet seem to constitute a major health risk in this country. The precise number of intravenous drug abusers in Slovenia is not known, but according to some unofficial estimates, it should be from 5,000 to 10,000. They use clean hypodermic needles because they are readily available in pharmacies at very low price. Although some studies consider in-

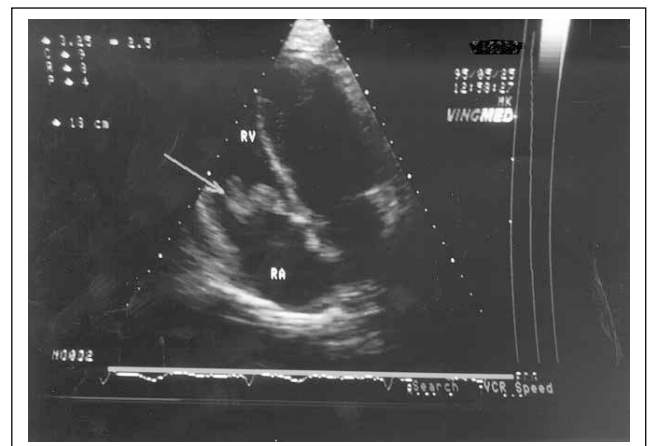


Figure 1. Apical four chamber recording showing a large vegetation on the tricuspid valve (arrow); RA = right atrium, RV = right ventricle

Table 2. Echocardiographic characteristics of patients with right-sided infective endocarditis

pt	site of IE	echocardiographic findings	major or minor echo criteria
1	TV	vegetation 1 cm, new TR	major
2	TV	asymmetric jet of TR	minor
3	TV	vegetation 0.5 x 0.7 cm, new TR	major
4	TV	vegetation 1.5 cm, new TR	major
5	TV	vegetation 0.5 cm, TR	major
6	TV	vegetation 2.1 cm, new TR	major
7	PV	PR	minor
8	PV	increasing pulmonary velocity	minor
9	PV	vegetation 3 cm	major
10	PM electrode	vegetation 3.1 cm on PM electrode	major
11	TV	vegetation 2 x 3 cm, new TR, tric. obstr.	major
12	TV	vegetation 1.5 x 3.0 cm, new TR	major
13	VSD	vegetation at VSD	major

TV = tricuspid valve, PV = pulmonary valve, TR = tricuspid regurgitation, PR = pulmonary valve regurgitation, PM = pace-maker

travenous drug abuse to be the most important risk factor for right-sided IE, in countries where drug abuse is not common, an underlying cardiac disease seems to play a more important role [10, 11]. In a series from India none of the 23 patients was drug addicted. Of the 23 patients only 16 had only involvement of the right-sided structures. Congenital anomaly (VSD and Fallot's tetralogy) and postoperative endocarditis were the main predisposing conditions. Overall in-hospital mortality was similar to our patients [2]. In another study from India 11 of 19 patients had congenital heart disease. In other patients the origin was mainly postpuerperal or staphylococcal sepsis. Mortality rate in this study was also high – 43 % [10]. Naidoo reported on 15 patients with right-sided endocarditis. None of them had an underlying heart disease. Postabortal sepsis was the most common port of entry. The mortality rate was 33.3 % [12]. We can assume that in non-addicts right-sided endocarditis is as severe as in left side involvement usually due to serious underlying condition or sepsis.

Six of our patients presented with uncorrected congenital heart disease or minor heart anomaly. Two patients had Chiari's network in the right atrium, one patient had secundum type ASD and one persistent foramen ovale. ASD and patent foramen ovale have never been listed among cardiac predisposing factors for IE [13]. So we can only speculate about the causal relationship between IE and these two conditions. With such a small population it can only be said that the relation of these characteristics with right-sided IE has probably been by chance. In most of our patients (8), IE affected normal tricuspid or pulmonary valves. In two cases, a previously diseased valve was involved (congenital pulmonary stenosis, tricuspid valve prolapse).

Four patients had a recognisable iatrogenic port of entry. Permanent pace-makers and central intravenous catheters have been generally implicated in the development of right-sided IE [14–16]. Abortions and deliveries are frequently reported as a cause of right-sided IE in underdeveloped countries [12]. This, however, does not apply to abortion performed in aseptic conditions, which was identified as a predisposing factor in one of our female patients. In the patient with an intrauterine device, the disease began with acute endometritis. Four patients suffered from debilitating or malignant diseases.

IE was the direct cause of death in only one patient; in the other three patients the unfavourable course of the disease was due to an underlying disease. The survivors showed a very favourable course. In most cases, a gradual decrease in

the size of the vegetation was noted. Surprisingly we noted also a decrease of severity of tricuspid regurgitation after the resolution of infection. We can explain this decrease with the fact that the majority of our patients suffered from pulmonary embolisms during the acute phase of the IE and the tricuspid regurgitation was more pronounced during that period.

In all our patients, a tentative diagnosis of IE based on clinical evidence was established before the echocardiographic examination was performed. In our series, transthoracic echocardiography (TTE) fulfilled either major or minor Duke Endocarditis Service criteria. TEE did not add any better information than TTE in our group of patients. We did not perform TEE in all patients because the diagnosis was clear enough by TTE. Transesophageal echocardiography (TEE) may prove especially useful in patients with clinical evidence of right-sided IE and normal TTE, or in patients with tricuspid valve IE failing to respond to therapy [17]. Multiplane TEE may prove far more sensitive in detecting pulmonary valve vegetations and masses on central intravenous catheters [18–22]. In most patients, TEE in the longitudinal plane affords accurate visualization of the pulmonary valve. The follow-up echocardiograms in patients with favourable course of IE showed a decrease in size of the vegetations. The vegetations became brighter and less mobile. Three patients with a fatal course had a very large vegetation more than 2 cm in size, which is considered to be a bad prognostic sign. These listed changes in echocardiographic studies were observed also by others [1, 23].

Right-sided IE shows regional differences concerning its causative and predisposing factors. The prognosis of isolated right-sided IE in young and otherwise healthy intravenous drug users seems to be favourable with mortality rates less than 5 per cent. The relatively high mortality in our patients, which attained 30.7 per cent, was most probably due to the specific characteristics of the series, such as a coexisting debilitating condition or other predisposing factors, or a preexisting heart disease or abnormality. Four patients died, but the follow-up of the survivors showed a quite favourable course. With the exception of one patient with tricuspid valve IE, none of the patients required urgent surgery; moreover, gradual decrease in the size of the vegetation and regression of tricuspid regurgitation occurred after appropriate antibiotic treatment. In our series, prolonged iv. antibiotic therapy was indicated because of coexisting debilitating diseases.

Conclusion

In Slovenia, right-sided IE occurs mostly in groups of patients with preexisting heart disease, in patients undergoing invasive procedures or surgery, and in patients with debilitating or malignant disease. *S. aureus*, that is reportedly the leading microorganism causing right-sided IE, was not identified as the most frequent pathogen in our patients. The spectrum of causative agents found in our group was heterogeneous. In non-drug addicts with right-sided IE, poor prognosis is most usually due to an underlying debilitating disease. It seems that in a country such as ours with a fairly developed health care system and with relatively small population of intravenous drug addicts right-sided endocarditis is a serious disease which in some cases may be medically acquired.

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