Surgery for infective endocarditis complicated by cerebral embolism: A consecutive series of 375 patients

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Objective: To determine the influence of silent and symptomatic cerebral embolism on outcome of urgent/emergent surgery after acute infective endocarditis (AIE).

Methods: From a total of 1571 patients with AIE admitted to our institution between May 1995 and March 2012 about one-quarter (375 patients; mean age, 61.8 ± 13.6 years) presented with cerebral embolism confirmed by cranial computed tomography. Isolated aortic valve endocarditis was present in 165 patients (44%), 132 patients (36%) had isolated AIE of the mitral valve, and 64 (17%) patients had left-sided double valve endocarditis.

Results: Although the majority of patients presented with neurologic symptoms, 1 out of 3 patients experienced a so-called silent asymptomatic cerebral embolism or transient ischemic attack (n = 135). The rate of silent embolism was equivalent in patients with isolated aortic valve versus isolated mitral valve endocarditis (37% vs 34%; $P = .54$). Comparing patients with silent embolism versus symptomatic embolism, 18 patients with silent embolism versus 12 patients with symptomatic embolism developed postoperative hemiparesis ($P = .69$). Three versus 4 had severe postoperative intracerebral bleeding ($P = .71$). Median follow-up of survivors with cerebral embolism was 4.1 years (935 cumulative patient-years). Hospital mortality was 21.4% versus 19.6% ($P = .68$), with a long-term survival of 45% ± 5% versus 47% ± 4% at 5 years ($P = .83$) and 40% ± 6% versus 32% ± 5% at 10 years ($P = .86$). Independent risk factors of mortality were age at surgery ($P < .01$), chronic obstructive pulmonary disease ($P = .01$), preoperative requirement of catecholamines ($P = .02$), dialysis ($P < .01$), and duration of cardiopulmonary bypass ($P < .01$).

Conclusions: Survival after surgery for AIE is significantly impaired once cerebral embolism has occurred; however, it does not differ in patients with symptomatic versus silent cerebral embolism. Routine computed tomography scans are therefore mandatory due to the high incidence of asymptomatic cerebrovascular embolism—which appears to be equally as dangerous as symptomatic embolism. (J Thorac Cardiovasc Surg 2014;147:1837-46)

Cerebrovascular embolic events in the setting of acute infective endocarditis (AIE) are frequent and have been proposed to impair short- and long-term survival.[1,2] In particular, hemorrhagic transformation of septic embolic cerebral lesions during full heparinization for cardiopulmonary bypass or after mechanical valve replacement is rare but feared because it increases the risk of devastating intracranial hemorrhage.

Cerebrovascular manifestations of AIE often cause the first symptoms; that is, transient or persistent hemiparesis or hemiplegia or even unspecific headache, meningitis, altered level of consciousness, or severe seizures. According to the current practice guidelines for the management of AIE,[3,4] preoperative cerebral imaging should be obtained to rule out septic embolic lesions, which carry a high risk for hemorrhagic transformation. However, asymptomatic so-called silent cerebral embolism has been previously described and its influence on short- and long-term outcome compared with symptomatic embolism is controversial. Asymptomatic lesions may be missed if routine preoperative computed tomography (CT) scans are not obtained, and fatal neurologic injury due to hemorrhagic transformation may cause excessive early mortality. Moreover, risk factors identifying patients who are at the highest risk for cerebral embolism may pose an additional decision: should CT scans should be obtained even in asymptomatic patients?[5]

With our study we intended to determine the incidence of cerebral embolism in cardiac surgical patients with AIE and to investigate the predictors of unfavorable short- and long-term outcome after surgery for infective endocarditis complicated by cerebral embolism.

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Abbreviations and Acronyms
AIE = acute infective endocarditis
CT = computed tomography

PATIENTS AND METHODS

A review of our institutional database identified 1571 consecutive patients who underwent operation for infective endocarditis from May 1995 through March 2012. Clinical data were derived from our institutional database and patient records. The local ethics committee did not require additional individual patient consent.

Infective endocarditis was diagnosed by the modified Duke criteria[6] and vegetations were classified by transthoracic or transesophageal echocardiography. Vegetations were measured in a minimum of 2 planes and the maximum length of the vegetations was used. Blood cultures were routinely taken on admission and at the first postoperative day. Routine preoperative cranial, thoracic, and abdominal CT scans were performed in all patients admitted with the diagnosis of AIE to preoperatively rule out septic embolic lesions. Overall, 375 patients (24%) presented with confirmed cerebral embolism. Mean age was 61.8 ± 13.6 years. Two hundred sixty-six patients were men (70.9%). A detailed summary of the clinical data is presented in Table 1.

Antibacterial Therapy

In all patients, empiric antibiotic treatment was immediately initiated after diagnosis. A preoperative antibiotic therapy was initiated in 1260 out of 1571 patients (80%) and in 338 out of 375 patients (89%) with cerebral embolism. In the remaining patients antibiotic treatment was initiated immediately after surgery according to antibiotic resistance testing.

Operative Methods

According to current guidelines, indications for surgical intervention are large vegetations ≥ 10 mm (n = 261; 69.6%), prosthetic valve endocarditis (n = 90; 24%), abscess formation, fungal infection, *Staphylococcus aureus* endocarditis (n = 143; 38.1%), congestive heart failure (n = 53; 14.1%), or failure of medical treatment.[3]

In patients requiring aortic valve replacement, most patients received either a stented bioprosthetic valve (n = 141) or a stentless bioprosthetic valve (n = 30). A homograft was used in 11 patients, and 11 patients received a mechanical valve. In 7 patients, a reconstruction of the native valve was possible (3.8%).

Among all patients with cerebral embolism, urgent mitral valve surgery was required in 222 out of 375 patients (59.2%) and the patients received mostly valve replacement with a biological (n = 134) or a mechanical (n = 60) valve. In 15 patients, the mitral valve was amenable for repair. Concomitant repair of the tricuspid aortic valve was necessary in 22 patients, whereas 9 patients required tricuspid valve replacement. Other concomitant procedures were coronary artery bypass grafting in 66 patients (18%), replacement of the ascending aorta in 17 patients (5%), and partial arch replacement in 3 patients (1%). Further operative details are listed in Table 2.

Follow-up

Our institutional database is continuously and prospectively maintained by research personnel. Follow-up data for long-term survival or adverse

TABLE 1. Baseline patient characteristics

Variable	All patients (n = 1571)	Cerebral embolism (n = 375)	No cerebral embolism (n = 1196)	*P* value
Age, y	61.6 ± 14.8	61.8 ± 13.6 (12-88)*	61.5 ± 15.2	.78
Female, %	477 (30)	109 (29)	368 (31)	.56
LVEF, %	56.1 ± 12.6	56.7 ± 12.0	55.9 ± 12.7	.44
Risk factors				
Hypertension	971 (62)	233 (62)	738 (62)	.95
History of smoking	445 (28)	109 (29)	336 (28)	.74
Diabetes	519 (33)	128 (34)	391 (33)	.62
COPD	184 (12)	40 (11)	144 (12)	.52
Hyperlipidemia	430 (27)	87 (23)	343 (29)	.04
Preoperative dialysis	109 (7)	25 (7)	84 (7)	.91
LCO preoperative	170 (11)	53 (14)	117 (10)	.02
Logistic EuroSCORE, mean	36.2 ± 25.8	43.1 ± 25.4	34.0 ± 25.6	<.01
Affected valve				
Single aortic	732 (47)	165 (44)	567 (47)	.26
Single mitral	487 (31)	132 (36)	355 (30)	.05
Aortic and mitral	223 (15)	64 (17)	159 (13)	.07
Kissing mitral†	201 (13)	51 (14)	150 (13)	.60
Tricuspid valve	108 (7)	12 (3)	96 (8)	<.01
Pulmonary valve	24 (2)	2 (1)	22 (2)	.09
Vegetation size, mm				
<5	300 (19)	37 (10)	263 (22)	<.01
≥5 to <10	276 (18)	72 (19)	204 (17)	.35
≥10	940 (60)	261 (70)	679 (57)	<.01
N/A	55	5	50	—
Prosthetic valve endocarditis	383 (24)	90 (24)	293 (25)	.89
Previous cardiac surgery	435 (28)	102 (27)	333 (28)	.84

Values are presented as mean ± SD or n (%). *LVEF*, Left ventricular ejection fraction; *COPD*, chronic obstructive pulmonary disease; *LCO*, low cardiac output syndrome; *N/A*, not applicable. *Range. †Endocarditis affecting the anterior leaflet of the mitral valve as well as the aortic valve.