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RAPID COMMUNICATION

Atrial fibrillation after surgery for esophageal carcinoma: Clinical and prognostic significance

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Abstract

AIM: To retrospectively evaluate the clinical relevance, perioperative risk factors, outcome of different pharmacological prophylaxis, and short-term prognostic value of atrial fibrillation (AF) after surgery for esophageal carcinoma.

METHODS: We retrospectively studied 63 patients with AF after surgery for esophageal carcinoma in comparison with 126 patients without AF after esophagectomy during the same time. Postoperative AF incidence was related to different clinical factors possibly involved in its occurrence and short-term survival.

RESULTS: A strong relationship was observed between AF and postoperative hypoxia, history of chronic obstructive pulmonary disease (COPD), postoperative thoracic–gastric dilatation, age older than 65 years, male sex and history of cardiac disease. No difference was observed between the two groups with regard to short-term mortality and length of hospital stay.

CONCLUSIONS: AF occurs more frequently after esophagectomy in aged and male patients. Other factors contributing to postoperative AF are history of COPD and cardiac disease, postoperative hypoxia and thoracic–gastric dilatation.

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Key words: Esophageal carcinoma; Atrial fibrillation; Surgery

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INTRODUCTION

Atrial fibrillation (AF) is a frequently occurring arrhythmia after esophageal procedures. It has been suggested that AF may be generally related to a worse prognosis and a longer postoperative hospital stay[1]. Reports on the effectiveness of alternative strategies to control AF are contradictory[2,3]. Therefore identification of all high-risk populations will allow targeted use and hence more cost-effective and successful application of these methods can be achieved.

The purpose of the present study was to retrospectively evaluate the clinical relevance, perioperative risk factors, outcome of different pharmacological interventions, and short-term prognostic value of AF after surgery for esophageal carcinoma.

MATERIALS AND METHODS

Patients

From 1998 to the end of 2003, a total of 63 consecutive patients had AF after surgery for esophageal carcinoma in our institution. AF was defined as a sustained or repetitive electrocardiographically documented arrhythmia requiring antiarrhythmic therapy[4]. During the same time of surgery, 126 patients without postoperative AF after esophageal carcinoma resection were randomly chosen as the control group. A retrospective chart review was performed on all the patients with and without AF. Patients were identified by search of registry database and hospital medical records. Records were reviewed by two independent researchers to confirm the diagnosis of AF.

There were 63 AF patients, 55 males and 8 females with an average age of 64.7 (range, 51-83) years. The onset of AF occurred on the first postoperative day in 22 patients (34.9%), on the second postoperative day in 30 patients (47.6%), on the third postoperative day in 7 patients (11.1%), and on the fourth postoperative day, and later in 4 patients (6.4%). The control group consisted of 126 patients, 94 males, and 32 females with an average age of 57.2 (range, 32-79) years. Patients with a known history of atrial dysrhythmias or those receiving digoxin were excluded from analysis.

Methods

Postoperative AF incidence was related to different pre-

Table 1 Preoperative factors associated with postoperative AF (%)

Group	Age older than 65 years	Male sex	Cardiac diseases	COPD	Hypertension	Diabetes mellitus
AF	39.68 (25/63)[b]	87.30 (55/63)[a]	19.05 (12/63)[a]	46.03 (29/63)[b]	9.52 (6/63)	14.29 (9/63)
Control	21.43 (27/126)[b]	74.60 (94/126)	7.14 (9/126)	11.11 (14/126)	5.56 (7/126)	12.70 (16/126)

[a]$P<0.05$, [b]$P<0.01$ *vs* control group.

Table 2 Intraoperative and postoperative factors associated with postoperative AF (%)

Group	Right thorax approach	Anastomosis at the neck	Anastomosis below the aortic arch	Anastomosis above the aortic arch	Hypotension in operation	Postoperative fever	Postoperative hypoxia	Thoracic–gastric dilatation
AF	11.11 (7/63)	22.22 (14/63)	14.29 (9/63)	63.49 (40/63)	7.94 (5/63)	14.29 (9/63)	25.40 (16/63)[b]	31.75 (20/63)[b]
Control	7.94 (10/126)	11.90 (15/126)	10.32 (13/126)	77.78 (98/126)	7.14 (9/126)	8.73 (11/126)	4.76 (6/126)[b]	18.25 (23/126)[b]

[b]$P<0.01$ *vs* control group.

operative, intraoperative, and postoperative clinical factors possibly involved in its occurrence and short-term survival. The demographic data that were analyzed included patients' age, sex, history of cardiac disease, chronic obstructive pulmonary disease (COPD, defined as $FEV_1 \leqslant 70\%$ predicted and FEV_1/FVC ratio $\leqslant 70\%$ in pulmonary function tests), diabetes mellitus, and hypertension. Intraoperative and postoperative factors examined were surgical approach (via the left or the right thorax), site of anastomosis (at the neck, above or below the aortic arch), hypotension in operation (defined as systolic blood pressure lower than 6 kPa, persisting for more than 5 min), postoperative fever (defined as body temperature higher than 38.5 °C, persisting for more than 3 d), hypoxia (defined as aortic blood oxygen saturation lower than 93%, persisting for more than 1 h before the onset of AF), thoracic-gastric dilatation before the onset of AF confirmed by chest X-ray, 30-d mortality rate and length of hospital stay.

Statistical analysis

Statistical analysis was performed with the SPSS software version 10.0. Intergroup difference was determined using Student's t test and Fisher's exact test. χ^2 test was used to analyze categorical data. To identify which factors could predict AF, univariate, and stepwise multiple logistic regression analysis was used. $P<0.05$ was considered statistically significant.

RESULTS

A higher incidence of AF was found in male patients older than 65 years, with a history of cardiac diseases and COPD than that in the control group patients (Table 1). There was no significant difference in patients with a history of hypertension and diabetes mellitus between the two groups. AF patients had a higher incidence of postoperative hypoxia and thoracic-gastric dilatation than the control group (Table 2). There was no significant difference in surgical approach, anastomosis site, intraoperative hypotension and postoperative fever between the two groups.

Results from the univariate analysis for the association of each factor with AF are summarized in Table 3. The factors associated with increased risk for AF on multivariate analysis included postoperative hypoxia, history of COPD, thoracic-gastric dilatation, age older than 65 years, male sex and history of cardiac disease. The incidence of AF was not dependent on the history of hypertension and diabetes mellitus, intraoperative hypotension, surgical approach, anastomosis site, and postoperative fever.

In the AF group, 15 patients who did not receive any antiarrhythmic drug therapy in the early stage of AF were given oxygen and sedation therapy. Only one of the 15 patients (6.67%) had sinus rhythm spontaneously within 24 h. All the other 62 patients were treated with antiarrhythmic drugs such as cedilanid, isoptin, propafenone and amiodarone. It was considered successful if the heart rhythm changed to sinus rhythm in 24 h after the treatment. Otherwise, other antiarrhythmic drugs were used. The outcome of antiarrhythmic therapy is presented in Table 4.

Death within 30 d after the surgery occurred in 2 AF patients with a mortality of 3.2% (2/63), and in 2 patients of the control group with a mortality of 1.6% (2/126) ($P>0.05$). The overall mortality in our patients was 2.1% (4/189). None of these deaths were directly attributed to AF. The average length of hospital stay was 10.65 ± 0.87 d for the AF group and 9.98 ± 0.96 d for the control group ($P>0.05$).

DISCUSSION

AF after esophagectomy remains one of the most frequent complications. The cause for postoperative AF is unclear. However, previous studies have shown different results, sometimes contradictory with regard to the clinical significance of various factors for AF after esophagectomy[1,5]. We found that postoperative hypoxia, history of COPD, thoracic-gastric dilatation, age older than 65 years, male sex, and history of cardiac disease were predictors of postoperative AF. We considered that only clinically significant

Table 3 Univariate analysis of risk factors for postoperative AF

Risk factors	*P*
Postoperative hypoxia	<0.001
COPD	0.001
Thoracic-gastric dilatation	0.009
Age more than 65 y	0.009
Male sex	0.017
History of heart disease	0.038
Postoperative fever	0.051
History of hypertension	0.062
Surgical approach	0.143
Anastomosis site	0.189
History of diabetes mellitus	0.412
Intraoperative hypotension	0.475

Table 4 Outcome of AF after drug treatment

Prophylaxis	Cases	Successful antiarrhythmic cases (%)
Cedilanid	51	18 (35.29)
Isoptin	17	2 (11.76)
Propafenone	21	11 (52.38)
Amiodarone	20	20 (100.00)

AF defined by electrocardiography had an association with hemodynamic changes. A possible limitation of our study is that continuous electrocardiographic monitoring was not employed to detect asymptomatic AF, as our study was designed to evaluate clinically significant AF, which was the focus of patients' complaints and needed therapeutic interventions. Our conclusions, therefore, do not apply to the occurrence of asymptomatic AF after the surgery for esophageal carcinoma.

We did not find differences in survival rate and length of hospital stay between patients who developed AF and those who did not in the early postoperative period. We found that some pharmacological interventions were effective for AF after esophagectomy, but symptomatic management without drug treatment was not effective, suggesting that AF, if treated promptly, is fairly tolerated in all the patients. The peak incidence of AF on the second day after surgery, with more than 80% of events occurring during the first three postoperative days, is consistent with the findings of a previous study[6]. We speculate that AF after esophagectomy is precipitated by the resolution of inflammatory response following blunt or sharp surgical trauma to sympathovagal nerve fibers supplying the heart for 1-4 d postoperatively, which alter the autonomic modulation of atrial myocardial cells to endogenous catecholamines.

The identification of reliable predictors of AF after esophagectomy may help us to develop corresponding preventive strategies. The presence of postoperative hypoxia and history of COPD were associated with the development of AF in our study. It has been well established that due to diminished cardiopulmonary reserve, patients with COPD and hypoxia are more prone to perioperative complications following noncardiac thoracic surgical procedures in general[7,8]. The definition of COPD might vary between different authors and our definition was based on the pulmonary function testing, and some authors' definition is based on the presence or absence of bronchodilator treatment[4].

The association between postoperative thoracic-gastric dilatation and AF found in our analysis has not been previously demonstrated. We speculate that it may correlate with hypoxia, physical influence on the heart from the dilated stomach, and the uncomfortable feeling of patients for the thoracic-gastric dilation. It is not surprising that advanced age is a strong predictor of postoperative AF, because at the age of 75, only approximately 10% of normal sinus node pacemaker cells remain[9]. It is well known that age-related cardiac structural changes, such as increased fibrous and adipose tissue in the sinoatrial node, and focal interstitial deposits of amyloid in the atria, and atrial dilations may play a significant role in the genesis of arrhythmia[10]. The age is closely related with AF[11].

The association between male sex and AF might be explained by the effect of sex on immune response. One hypothesis for the cause of postoperative AF is atrial or pulmonary vein inflammation[12]. After trauma, male patients have an increased proinflammatory immune response compared to female patients[13], and this might lead to increased AF after surgical trauma. The association of cardiac disease with AF has been demonstrated inconsistently by other investigators[14]. The common occurrence of AF after cardiac surgery supports the association of cardiac disease with AF after thoracic surgery. The lack of association between hypertension and AF in our analysis is also noteworthy. Other investigators have shown this association, but their analysis is limited to patients with lung cancer[15].

In conclusion, AF is associated with postoperative hypoxia, history of COPD, thoracic-gastric dilatation, age older than 65 years, male sex, and history of cardiac disease. The identification of patients with a high risk for AF will allow more direct application of pharmacological and alternative methods of prophylaxis.

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