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Original Article

Preoperative atrial histological changes are not associated with postoperative atrial fibrillation

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Abstract

Background: Atrial fibrillation (AF) remains the most common complication of cardiac surgery. Prophylactic therapies have been studied, but their utility has been limited by the inability to accurately identify patients who will develop this complication. Recent studies have suggested that atrial myolysis and lipofuscin pigmentation are associated with post-coronary artery bypass grafting (CABG) AF. We sought to determine whether there is an association between preoperative atrial histology and subsequent post-CABG AF. **Methods:** Samples of right atrial appendage were obtained from 94 patients undergoing CABG. Tissue was formalin fixed and paraffin embedded. Sections 4 μm thick were cut, stained with hematoxylin and eosin, and examined for the following parameters: fibrosis, myolysis, inflammation, nuclear size, pericardial exudates, lipofuscin pigment, arteriolar hypertrophy, contraction banding, mesothelial hyperplasia, and atrial diverticula. Results were graded as absent, mild, moderate, or severe by two independent observers who were blinded to the clinical outcomes. Univariate and multivariate analyses were carried out. **Results:** Thirty-six (38%) patients developed AF. No correlation was found between the 10 features assessed, including myolysis and lipofuscin pigmentation, and the development of AF. **Conclusion:** Simple morphology of right atrial appendages does not predict the development of postoperative AF.

Keywords: Atrial fibrillation; Atrial histology; Coronary artery bypass surgery; Myolysis; Lipofuscin

1. Introduction

Atrial fibrillation (AF) is a common occurrence after cardiac surgery [1]. Cox's [2] theory for the development of AF states that both an abnormal substrate and a trigger are required to develop AF. Following cardiac surgery, many potential triggers exist, but the atrial substrate remains poorly defined. Like other forms of AF, the postoperative variety is associated with advancing age, and many changes have been described in "normal" atria as the age of the subject increases [3–5]. Patients with chronic AF demonstrate morphological abnormalities, but only limited data as to whether patients at risk of developing postoperative AF have a proarrhythmic substrate that can be identified by light microscopy exist.

The objective of our study was to determine whether there is a relationship between preoperative atrial morphology and the development of postoperative AF.

2. Materials and methods

The study was approved by the Hospital Ethics Committee, and written informed consent was obtained

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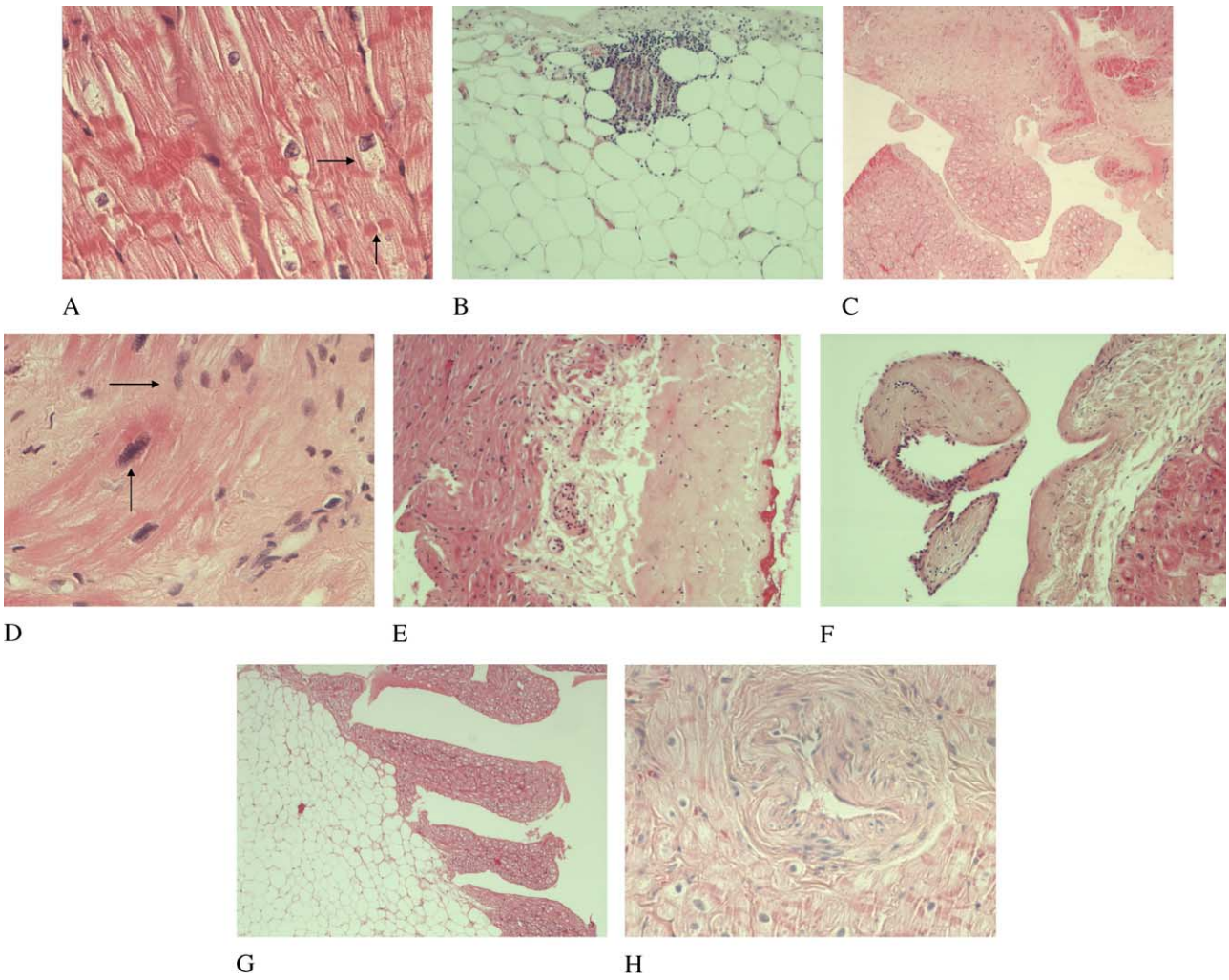

Fig. 1. (A) Myolysis with associated lipofuscin pigment (horizontal arrow); contraction banding (vertical arrow). (B) Granulomatous inflammation in pericardial fat. (C) Fibrosis. (D) Nuclear hypertrophy with Grade 1 (horizontal arrow) and Grade 2 nuclei (vertical arrow). (E) Pericardial exudate. (F) Mesothelial hyperplasia. (G) Atrial diverticula. (H) Arteriolar hypertrophy. Hematoxylin and eosin stains. Original magnifications: x20 (A and D), x10 (B, C, E, F, G, and H).

from all patients. A cohort of 94 patients in sinus rhythm undergoing first-time coronary artery bypass grafting (CABG) was recruited. Patients with impaired left ventricular systolic function (EF<45%), valvular heart disease, and diabetes mellitus were excluded. Samples of right atrial appendage were taken prior to commencement of cardiopulmonary bypass, and the tissue was bisected and placed directly into 10% formalin and Bouin's fixative simultaneously. Tissue was embedded into paraffin in the routine fashion, cut into 4-μm sections and stained with hematoxylin and eosin (H&E).

The atria were examined for the following histological parameters modified from Ad et al., as set out in Table 1,

Table 1
Atrial parameters studied and grading system

Myolysis	Absent	Mild	Moderate	Severe
Inflammation	Absent	Mild	Moderate	Severe
Fibrosis	Absent	Mild	Moderate	Severe
Nuclear size	Grade 1	Grade 2		
Pericardial exudates	Absent	Present		
Mesothelial hyperplasia	Absent	Present		
Lipofuscin pigment	Absent	Mild	Moderate	Severe
Diverticula	Absent	Present		
Arteriolar hypertrophy	Absent	Present		
Contraction banding	Absent	Present		

Table 2
Interobserver variability for the 10 parameters analyzed

Parameter	% Agreement	Phi	Kappa	S.D.
Myolysis	96	0.962	0.931	0.048
Inflammation	100	1.0	1.0	0.0000
Fibrosis	94	0.806	0.809	0.072
Nuclear size	78	0.518	0.511	0.121
Pericardial exudate	98	0.951	0.949	0.05
Mesothelial hyperplasia	100	1.0	1.0	0.0000
Lipofuscin	100	1.0	1.0	0.0000
Diverticula	90	0.791	0.79	0.089
Arteriolar hypertrophy	92	0.85	0.79	0.089
Contraction banding	98	0.948	0.947	0.053

Percentage agreement is the number of cases that both investigators agreed on.