Coronary Catheterisation Does Not Lead to Retinal Artery Emboli in Short-Term Follow-Up of Cardiac Patients

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Background and Purpose—There is emerging evidence that coronary catheterization can cause cerebrovascular embolism. We aimed to assess the proportion of cardiac patients with retinal emboli before coronary catheterization and the proportion with newly developed retinal embolism shortly after coronary catheterization.

Methods—Ninety-seven patients attending Westmead Hospital for coronary catheterization between December 2005 and February 2006 were recruited. Medical history, physical examination, and pre- and postcatheterization photography of 5 retinal fields was performed. The proportion of patients with new retinal emboli was assessed by comparing post- and precatheterization retinal photographs.

Results—Before catheterization, retinal emboli were observed in 5 patients (5.2%) and were significantly associated with higher body mass index ($P=0.007$). The presence of angiographic coronary artery disease was not significantly associated with preexisting retinal emboli. In 97 patients, we found no new emboli within the 16-hour (median: range 4 to 45 hours) postcoronary catheterization period.

Conclusions—Asymptomatic retinal emboli are relatively common in patients being assessed for coronary artery disease. We found no evidence suggesting coronary catheterization contributes to retinal embolism shortly after the procedure.

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Key Words: catheter ■ coronary ■ coronary artery disease ■ embolus ■ retina ■ stroke

The risk of stroke attributable to cardiac catheterization is reported at between 0.11% and 0.38%.$^{1,2}$ However, Busing$^3$ showed a high incidence (15%) of asymptomatic cerebrovascular embolism postcatheterization by comparing pre- and postcoronary catheterization brain magnetic resonance. Bruno$^4$ reported a 10-fold increase in stroke incidence among men with retinal emboli in a 3.4-year follow-up study. Detection of retinal embolism after catheterization may allow the early detection of patients at risk for cerebrovascular embolism.

Previous studies have reported rates of retinal emboli between 55% and 100% after heart bypass procedures,$^5,6$ and between 1.25% and 13.2% for carotid stenting procedures.$^7$ The corresponding rate after cardiac catheterization remains unknown. In this study, by comparing high quality pre- and postcardiac catheterization retinal photographs, we aimed to assess the proportion of cardiac patients with retinal emboli before and after cardiac catheterization, respectively.

Materials and Methods
The study was approved by the Westmead Hospital Human Research Ethics Committee, and all participants gave informed consent. We recruited 97 consecutive patients attending Westmead Hospital for planned cardiac catheterization. After pupil dilation with tropicamide 1.0%, patients had pre- (median 6 hours, range 1 to 431) and post- (16 hours, 4 to 45) cardiac catheterization photographs taken of 5 retinal fields according to the Diabetic Retinopathy Study protocol (Field 1: optic disc; Field 3: temporal to the fovea; Fields 4 and 5: upper and lower temporal arcades and Field 6: nasal to the optic disc).$^8$ Retinal photographic grading was performed masked to patient identity.

Cardiovascular risk factors, current medications, seated blood pressure (BP), body mass index (BMI), and fasting glucose level were recorded. Hypertension (stage II) was defined as systolic BP $\geq$ 160 mm Hg, diastolic BP $\geq$ 100 mm Hg, or on self-report corroborated by current antihypertensive use. Diabetes was defined by either self-report and current use of diabetic medications or if fasting glucose was $\geq$ 7.0mmol/L. Dyslipidaemia was defined when self-report was corroborated by current use of cholesterol lowering agents.

Coronary artery disease (CAD) was assessed by 2 experienced cardiologists. The maximal stenoses for the left anterior descending, right coronary, and circumflex arteries were recorded. Patients were classified into 3 groups: no CAD, minor CAD (stenosis <50%), and severe CAD (stenosis $>$50%). All patients received aspirin therapy postprocedure, and 8 patients (8.2%) who had significantly longer procedures received heparin.
Demographics and Associations of the Study Sample in Comparison With the Blue Mountains Eye Study (BMES)

<table>
<thead>
<tr>
<th>Demographic Factors</th>
<th>Current Study</th>
<th>BMES Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Emboli</td>
<td>Without Emboli</td>
</tr>
<tr>
<td></td>
<td>(n=5)</td>
<td>(n=92)</td>
</tr>
<tr>
<td>Age, y, mean (SD)</td>
<td>69.0 (10.3)</td>
<td>63.3 (9.9)</td>
</tr>
<tr>
<td>Systolic blood pressure, mean (SD)</td>
<td>143.6 (22.9)</td>
<td>132.0 (22.1)</td>
</tr>
<tr>
<td>Diastolic blood pressure, mean (SD)</td>
<td>73.8 (16.6)</td>
<td>68.9 (10.3)</td>
</tr>
<tr>
<td>Body mass index, mean (SD)</td>
<td>35.6 (9.0)</td>
<td>29.0 (5.0)</td>
</tr>
<tr>
<td>Male gender, n (%)</td>
<td>2 (40.0)</td>
<td>68 (73.9)</td>
</tr>
<tr>
<td>Hypertension, n (%)</td>
<td>4 (80.0)</td>
<td>52 (56.5)</td>
</tr>
<tr>
<td>Diabetes, n (%)</td>
<td>3 (60.0)</td>
<td>30 (33.0)</td>
</tr>
<tr>
<td>Dyslipidemia, n (%)</td>
<td>3 (60.0)</td>
<td>67 (75.3)</td>
</tr>
<tr>
<td>Current smoker, n (%)</td>
<td>0 (0)</td>
<td>26 (29.2)</td>
</tr>
<tr>
<td>Past smoker, n (%)</td>
<td>1 (20.0)</td>
<td>41 (46.1)</td>
</tr>
<tr>
<td>Any coronary artery disease, n (%)</td>
<td>4 (80.0)</td>
<td>73 (84.9)</td>
</tr>
<tr>
<td>Severe coronary artery disease, n (%)</td>
<td>4 (80.0)</td>
<td>66 (76.7)</td>
</tr>
</tbody>
</table>

Statistical Analysis System (SAS, version 8.2, SAS Institute) was used for statistical analyses. $\chi^2$ and Student t test were used to assess differences in mean values for discrete and continuous variables, respectively. Data were compared with results from the Blue Mountains Eye Study, a large survey of eye diseases in an Australian urban population aged 49 years and older.9

**Results**

From December 2005 to February 2006, 97 consecutive patients undergoing cardiac catheterization (69 diagnostic and 28 interventional) were recruited.

Precatheterization retinal emboli were diagnosed in 5 patients (5.2%). Preexisting retinal emboli were significantly associated with higher BMI ($P=0.007$), though other associations were not statistically significant (Table). Four of the 5 emboli detected before catheterization were present after catheterization, though no new emboli were detected.

**Discussion**

We believe that this study is the first to use retinal photography to detect retinal emboli before and after cardiac catheterization. Our finding that cardiac catheterization did not cause new retinal emboli in this sample is reassuring for cardiac catheterization patients. Our findings suggest that, although cardiac catheterization has been reported to cause cerebrovascular embolism,1–3 it appears unlikely to cause retinal embolism. Retinal embolism may not correlate with cerebral embolism after cardiac catheterization. Mead10 and Anderson11 found that carotid disease is the chief risk factor for ischemic eye events over other embolic risk factors such as atrial fibrillation. This may explain the zero rate of retinal emboli in our study in contrast to the 15% incidence rate of cerebral emboli found by Busing.3

Using an a priori assumption that retinal emboli would occur at a similar rate to cerebral embolization (15%),3 we set our sample size to approximately 100 participants. As we did not find any new retinal emboli in 97 patients we feel that this negative finding is unlikely to be attributable to chance alone, although no 95% confidence interval can be estimated.

We found that 5.2% of cardiac patients had asymptomatic retinal emboli before coronary catheterization, which is substantially higher than the reported prevalence of 1.4% found in a general older Australian population9 (Table). This finding suggests that patients undergoing cardiac catheterization may also have an increased risk of stroke, as retinal emboli are known to predict higher stroke risk.4,12

**Summary**

Although patients undergoing coronary artery disease assessment have a relatively high prevalence of asymptomatic retinal emboli at presentation, cardiac catheterization did not cause additional retinal emboli in this study sample.

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**Disclosures**

None.

**References**


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