Acute Retinal Arteriolar Emboli After Cardiac Catheterization

Andreas J. Kreis, MD; Thanh Nguyen, MBBS; Sophie Rogers, MEpI; Jie Jin Wang, MMed, PhD; C. Alex Harper, MD; David J. Clark, MBBS; H.M. Omar Farouque, MBBS, PhD; Tien Y. Wong, MD, PhD

Background and Purpose—There are concerns that cardiac catheterization may cause retinal embolization, a risk marker for cerebrovascular emboli and stroke. We describe the incidence of acute retinal embolism after cardiac catheterization.

Methods—One hundred unselected patients attending a tertiary referral center for diagnostic cardiac catheterization were recruited. Digital retinal photography (optic disc and macular fields) was performed precatheterization and within 3 hours postcatheterization. New retinal emboli were identified by a senior researcher and confirmed by a retinal specialist.

Results—There was one case of retinal embolus precatheterization. Two patients (incidence 2.02%; 95% CI, 0.25 to 7.11) developed new retinal arteriolar emboli after catheterization. No patient developed clinically apparent visual or neurological changes.

Conclusions—The risk of acute retinal embolism immediately after cardiac catheterization is 2%. This finding indicates that the retinal, and possibly the cerebral circulation, may be compromised more frequently than is clinically apparent as a complication of cardiac catheterization. (Stroke. 2008;39:000-000.)

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

Cardiac catheterization can cause cerebrovascular embolization and stroke.1,2 Although stroke in this setting appears to occur in only 0.3%,3 asymptomatic cerebral emboli are likely more frequent.1,4,5 Retinal emboli are directly detectable and may reflect concomitant cerebrovascular emboli.

To our knowledge, only one study has assessed a possible relationship between cardiac catheterization and retinal emboli.6 This study reported no newly developed retinal emboli 4 to 45 hours after cardiac catheterization in 97 patients recruited using retinal photography.6 Given the transient nature of some retinal emboli, they could disappear after a short period of time. We aimed to assess the incidence of retinal emboli within 3 hours after cardiac catheterization.

Materials and Methods
We recruited 100 unselected patients having symptom-driven diagnostic cardiac catheterization in the Cardiology Department at Austin Hospital, Melbourne. The Institutional Human Research Ethics Committee approved the study and informed consent was obtained from all participants. Cardiac catheterization was performed percutaneously in all patients using 5- or 6-French catheters for coronary angiography, and left ventriculography was performed in 91 patients. The majority of patients were on aspirin and 35% received a small intraprocedural heparin bolus at the discretion of the cardiologist. Obstructive coronary artery disease was defined as stenosis >70% of a major epicardial artery.

Digital retinal photographs were obtained after dilution with tropicamide (0.5%). Two photographic fields of each eye (optic disc and macula, Diabetic Retinopathy Study Protocol7) were taken. Preprocedure photographs were taken at a median of 1 hour (range, 30 to 180 minutes) before and postprocedure photographs taken within 3 hours after catheterization. Photographic grading was performed by a trained grader masked to patient identities and sequence of photographs. All retinal emboli cases were adjudicated by a senior researcher (JJW) and a retinal specialist (AH).

Results
The mean age of the study sample was 70 (±10) years. Obstructive coronary artery disease was diagnosed in 62%. Other clinical and procedural characteristics are described in the Table. A retinal embolus (cholesterol) was detected precatheterization in one patient (1.00%; 95% CI, 0.03 to 5.45) and remained evident at the same location postprocedure. Two patients were found to have retinal emboli that were detected postcatheterization (2.02%; 95% CI, 0.25 to 7.11), one located in the right superior temporal arteriole after the first bifurcation (cholesterol type) and the other along the course of right superior temporal arteriole after the first bifurcation (fibrin–platelet type). Both patients were on aspirin before the procedure, received a bolus of heparin, and had obstructive coronary artery disease. Neither had aortic valve disease nor prolonged catheterization procedures. None

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From the Centre for Eye Research Australia (A.J.K., T.N., S.R., J.J.W., C.A.H., T.Y.W.), Royal Victorian Eye and Ear Hospital, University of Melbourne, Melbourne, Australia; the Centre for Vision Research (J.J.W.), Westmead Millennium Institute, University of Sydney, Sydney, Australia; the Department of Cardiology (D.J.C., H.M.O.F.), Austin Hospital and University of Melbourne, Melbourne, Australia; and the Singapore Eye Research Institute (T.Y.W.), Yong Loo Lin School of Medicine, National University of Singapore, Singapore.
Correspondence to Tien Y. Wong, MD, PhD, Centre for Eye Research Australia, University of Melbourne, 32 Gisborne Street, Victoria 3002, Australia.
E-mail twong@unimelb.edu.au
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of these patients had visual or neurological compromise on clinical assessment by the ophthalmology fellow (AJK).

**Discussion**

We detected 2 new retinal emboli (2%) out of 100 patients who had undergone diagnostic cardiac catheterization within 3 hours after the procedure. This contrasts to a recent report by Thyer et al who examined 97 patients and detected no new emboli between 4 and 45 hours after catheterization. This discrepancy in findings may be due to the transient nature of some emboli and the difference in photography timing between the 2 studies. Our study complements Thyer’s study by demonstrating that acute retinal emboli may occur immediately after catheterization. We speculate that because most emboli are transient, they could disappear after a slightly delayed postprocedural period. The transient nature of some retinal emboli is well recognized through embolic amaurosis fugax in which the emboli cannot be visualized after episodes of partial or complete monocular vision loss that last seconds to minutes followed by complete visual recovery.8

The source of the particulate retinal emboli after cardiac catheterization in this study is unknown and may include aortic atheroma dislodged by catheter manipulation or thrombus formation on guidewires and catheters within the central circulation.4,9 A limitation of our study is the use of only 2 retinal photographic fields, which could have underestimated the proportion with pre-existing or procedure-related retinal emboli. The proportion of patients with pre-existing emboli in our sample (1.0%) is lower than that reported by Thyer et al (5.2%).6 who assessed 5 retinal fields covering greater numbers of retinal vessels.

In the general population, the presence of asymptomatic retinal emboli is associated with an increased risk of stroke.10–12 The prognostic implications of retinal embolization after cardiac catheterization are less certain.

**Summary**

The incidence of acute retinal embolization was 2.02% within 3 hours postprocedure among patients having undergone diagnostic cardiac catheterization. The retinal and cerebral circulation may be compromised as a complication of cardiac catheterization more frequently than what is clinically detected.

**Acknowledgments**

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**Disclosures**

None.

**References**


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**Table. Characteristics of the Study Sample Undergoing Cardiac Catheterization**

<table>
<thead>
<tr>
<th>Demographic Factors</th>
<th>Study Sample (N=100 Patients)</th>
<th>New Emboli Cases (N=2 Patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>70 (10.5)</td>
<td>69 (7.1)</td>
</tr>
<tr>
<td>Male gender</td>
<td>74</td>
<td>100</td>
</tr>
<tr>
<td>Body mass index, (kg/m²)</td>
<td>30 (5)</td>
<td>29 (8.5)</td>
</tr>
<tr>
<td>Overweight</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Obese</td>
<td>36</td>
<td>50</td>
</tr>
<tr>
<td>Hypertension</td>
<td>71</td>
<td>50</td>
</tr>
<tr>
<td>Diabetes</td>
<td>27</td>
<td>100</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>68</td>
<td>100</td>
</tr>
<tr>
<td>Current smoker</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Left ventricular systolic impairment</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>Obstructive coronary artery disease</td>
<td>62</td>
<td>100</td>
</tr>
<tr>
<td>Femoral arterial access</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Radial arterial access</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Left ventriculography</td>
<td>91</td>
<td>100</td>
</tr>
<tr>
<td>5-French catheters</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>

Data are mean (SD) or proportion.

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