

## Stroke after Intraaortic Balloon Counterpulsation Associated with Mobile Atheroma in Thoracic Aorta Diagnosed Using Transesophageal Echocardiography

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We describe a patient who developed embolic stroke after coronary artery bypass grafting (CABG) associated with intraaortic balloon pump (IABP) insertion. Intraoperative transesophageal echocardiography (TEE) revealed marked irregular mass and disruption of the intimal surface of the thoracic aorta with overlying shaggy echogenic material on the intimal surface of the descending thoracic aortic lumen. This case of stroke after IABP insertion suggested that the balloon inflation fragmented some mobile components on the inner surface of the aorta, and this floating debris entered the systemic circulation. TEE might be able to predict the risk of stroke in such a patient. (*Chang Gung Med J* 2002; 25:612-6)

**Key words:** transesophageal echocardiography, intraaortic balloon pump, atherosclerotic debris.

The use of intraaortic balloon pump (IABP) has been well established and has been an effective treatment in perioperative support of surgical patients with severe left ventricular dysfunction. More recently, it works as a circulatory support during the high-risk coronary angioplasty procedures.<sup>(1-3)</sup> It has been estimated that 2-12% of cardiac surgery patients require IABP support during perioperative period, and most of these devices are placed during surgery.<sup>(4)</sup> Balloon related vascular complications are frequent,<sup>(5-8)</sup> and most complications are consequences of the insertion of the device; however, occasionally they are the result of its presence.<sup>(9)</sup> We report a patient who presented with neurological deficits suggestive of a stroke, with an intramural aortic atherosclerotic debris revealed on transesophageal echocardiography in the thoracic aorta secondary to the presence of an intraaortic balloon assist device.

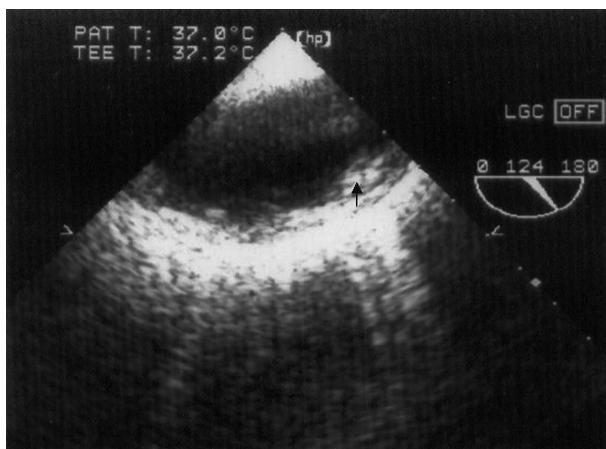
### CASE REPORT

A 67-year-old male patient was admitted for elective coronary artery bypass grafting for unstable angina with angiographic evidence of severe coronary artery disease. His medical history included repeated hospital admissions for congestive heart failure with a diagnosis of ischemic cardiomyopathy. Coronary artery catheterization revealed stenosis in all three coronary vessels, left ventricular ejection fraction (EF) of 30% with apical akinesis, and mild mitral regurgitation. Anesthesia was induced with 7.5 mg midazolam, 250 µg fentanyl, and sevoflurane. Intubation was facilitated by neuromuscular block with 15 mg pancuronium. A 5 MHz multi-plane transesophageal echocardiographic (TEE) probe was inserted. Intraoperative TEE before cardiopulmonary bypass (CPB) showed a marked irregular mass and disruption of the intimal surface of the

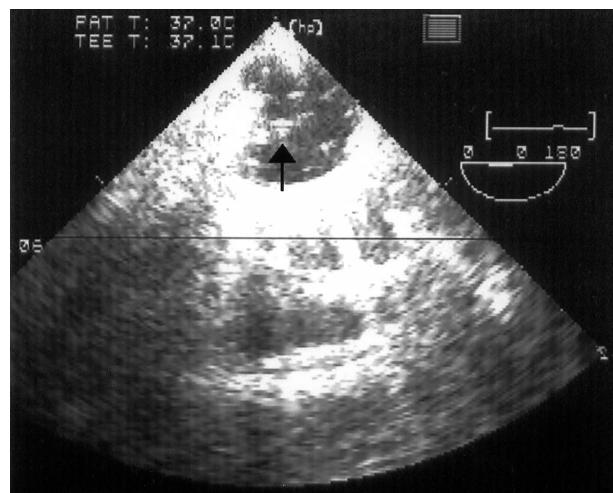
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**Fig. 1** Transesophageal horizontal plane of descending thoracic aorta 3 cm below left subclavian artery showing marked irregularities of the intimal surface of the thoracic aorta with overlying shaggy echogenic material (arrow) from the intimal surface into the aortic lumen.



**Fig. 2** Transesophageal transverse image of descending thoracic aorta demonstrates disrupted mobile debris (arrow) seen hanging from aortic luminal surface in the area of balloon inflation.

thoracic aorta with overlying shaggy echogenic material on the intimal surface into the aortic lumen (Fig. 1), with an EF of 35% and moderate mitral regurgitation. Nitroglycerin and dobutamine were administrated prior to cardiopulmonary bypass. After grafts of the three coronary arteries, two attempts to separate the patient from bypass did not succeed, despite maximum inotropic support. TEE then showed severe global hypokinesia of the left ventricle with an EF of 15%. An IABP was placed via the right femoral artery using the Seldinger's technique. Balloon inflation was set at the diastolic notch, and deflation began at midisovolumetric systole. TEE was used to confirm the presence of the guide wire in the thoracic aorta and to guide the position of the balloon catheter tip just distal to the left subclavian artery. The balloon was visualized in the proximal segment of the descending thoracic aorta. Visualization of the balloon in the distal transverse aorta prompted withdrawal of the device to past the point of origin of the left subclavian artery. Near total occlusivity of the aortic diameter by the intraaortic balloon was seen during diastolic inflation, but in the area of balloon inflation, some mobile components were seen hanging from the luminal surface of the aorta, which were not present on imaging before balloon placement (Fig. 2). The patient was then weaned from CPB with inotropic and IABP

support. On the first post-operative day, left hemiplegia with dysphasia was noted. Computerized tomography (CT) of the brain showed a new infarct in the right fronto-parietal region. The postoperative stroke was attributed to mobile artherosclerotic debris from the aortic atheroma plaque, triggered by IABP device. No further procedure was performed, and the patient recovered his motor functions after rehabilitation sessions.

## DISCUSSION

IABP has been used for a variety of disorders including myocardial infarction. Its complications are namely cardiogenic shock, intractable arrhythmias related to ischemia, unstable angina refractory to medical therapy, acute coronary insufficiency, severe left main coronary artery stenosis, myocardial failure in the face of sepsis, low cardiac output syndrome following open heart surgery, and prophylactically in high risk patients undergoing cardiac surgery or angioplasty.<sup>(10-12)</sup> It has proved to be very useful in stabilizing and supporting a failing heart. Its use, however, may lead to major complications, especially in patients with preexisting peripheral vascular disease. There have been several reports<sup>(13,14)</sup> on the utility of TEE in predicting strokes in older patients undergoing cardiac surgery. The incidence of stroke

or peripheral emboli after IABP is reportedly low, but certain groups of patients including those aged >65 years and those with history of strokes are at particularly high risk for IABP related embolism.<sup>(15)</sup>

Patients with atherosclerotic debris in the descending aorta and arch detected using TEE are at particularly high risk of stroke during cardiac surgery, whereas patients with a lesser degree of atherosclerosis are at lower risks. Similarly, TEE imaging of the aorta may help identify patients at high risk of embolization from an invasive aortic procedure such as cardiac catheterization or IABP placement. Invasive aortic procedures, such as catheterization or IABP placement may dislodge or rupture an atheroma and result in stroke, transient ischemic attack, or peripheral embolization. TEE is a sensitive technique for evaluating such atheroma plaques. Disrupted atherosclerotic plaques along the aortic luminal surface in the area of balloon inflation that are seen as freely mobile echo densities, may cause peripheral embolization and stroke during counterpulsation.

Several investigators have found a correlation between age, coronary artery disease, peripheral vascular disease, cigarette smoking, hypercholesterolemia, and atherosclerotic debris in the thoracic aorta.<sup>(16-18)</sup> Severe atherosclerosis of the descending aorta was directly related to atheroembolic events and most strongly associated with peripheral vascular disease and advanced age. In our patient with layered atheroma in the descending thoracic aorta, we noted a mobile component that developed during IABP. It is possible that trauma to the atherosclerotic plaque created plaque rupture with debris formation that was responsible for the appearance of a new mobile component. Since patients with mobile aortic debris are at high risk for embolization during IABP, it is important to identify these patients in order to reduce the risk of the invasive procedure.

TEE imaging of the aorta can be used to assess the risk of embolism from an invasive aortic procedure. When an invasive aortic procedure is planned in a patient with echocardiographically detected atherosclerotic aortic debris, especially mobile aortic debris, prior knowledge of the existing aortic atheromas might avert IABP placement. It is important to note that the patients who had strokes that following IABP had good prognoses.

## REFERENCES

- Maroko PR, Bernstein EF, Libby P, DeLaria GA, Covell JW, Ross JJ, Braunwald E. Effects of intraaortic balloon counterpulsation on the severity of myocardial ischemic injury following acute coronary occlusion. *Circulation* 1972;45:1150-9.
- Gold HK, Leinbach RC, Sanders CA, Buckley MJ, Mundth ED, Austen WG. Intraaortic balloon pumping for ventricular septal defect or mitral regurgitation complicated acute myocardial infarction. *Circulation* 1973;47: 1191-9.
- Bregman D, Parodi EM, Edie RN, Bowman FO, Reemtsma K, Malm JR. Intraoperative undirectional intraaortic balloon pumping in the management of left ventricular failure. *J Thorac Cardiovasc Surg* 1975; 79:1010-23.
- Naunheim KS, Swartz MT, Pennington DG, Fiore AC, McBride LR, Peigh PS, Barnett MG, Vaca KJ, Kaiser GC, Willman VL. Intraaortic balloon pumping in patients requiring cardiac operations. *J Thorac Cardiovasc Surg* 1992;104:1654-61.
- Kvilekval KH, Mason RA, Newton GB, Anagnostopoulos CE, Vlay SC, Giron F. Complications of percutaneous intraaortic balloon pump use in patients with peripheral vascular disease. *Arch Surg* 1991;126: 621-3.
- Iverson LIG, Hertinadahl G, Ecker RR, Young JN, Ennix CL, Lee J, Dunning C, Whisnant A, May IA. Vascular complications of intraaortic balloon counterpulsation. *Am J Surg* 1987;154:99-103.
- Todd GJ, Bregman D, Voorhees AB, Reemtsma K. Vascular complications associated with percutaneous intraaortic balloon pumping. *Arch Surg* 1983;118:963-4.
- Harvey JC, Goldstein JE, McCabe JC, Hoover EL, Gay WA, Subramanain VA. Complications of percutaneous intraaortic balloon pumping. *Circulation* 1981;64:114-7.
- Jacobs LE, Fraifeld M, Kotler MN, Ioli AW. Aortic dissection following intraaortic balloon insertion: recognition by transesophageal echocardiography. *Am Heart J* 1992;124:536-40.
- Scheidt S, Wilner G, Mueller H, Summers D, Lesch M, Wolff G, Krakauer J, Rubenfire M, Fleming P, Noon G, Oldham N, Killip T, Kantrowitz A. Intraaortic balloon counterpulsation in cardiogenic shock. *N Eng J Med* 1973;288:979-84.
- Foster ED, Olsson CA, Rutenburg AM, Berger RL. Mechanical circulatory assistance with intraaortic balloon counterpulsation for major abdominal surgery. *Ann Surg* 1976;183:73-6.
- Bonchek LI, Olinger GN. Intraaortic balloon counterpulsation for cardiac support during noncardiac operations. *J Thorac Cardiovasc Surg* 1979;78:147-9.
- Katz ES, Tunick PA, Rusinek H, Ribakove G, Spencer FC, Kronzon I. Protruding aortic atheromas predict

- stroke in elderly patients undergoing cardiopulmonary bypass: experience with intraoperative transesophageal echocardiography. *J Am Coll Cardiol* 1992;20:70-7.
14. Ribakove GH, Katz ES, Galloway AC, Grossi EA, Esposito RA, Baumann FG, Kronzon I, Spencer FC. Surgical implications of transesophageal echocardiography to grade the atheromatous aortic arch. *Ann Thorac Surg* 1992;53:58-63.
15. Sabri N. Complications of cardiac catheterization, coronary angiography and coronary interventions. *J Invas Cardiol* 1994;6:300-5.
16. Dean GK, Vincent Q, Mark FV, John JR, Marcia P, Kelly AS, Krishnaswamy C. Risk of catheter-related embolic in patients with atheroslerotic debris in the thoracic aorta. *Am Heart J* 1995;131:1149-55.
17. Fazio GP, Redberg RF, Winslow T, Schiller NB. Transesophageal echocardiography detected atherosclerotic plaque is a marker for coronary artery disease. *J Am Coll Cardiol* 1993;21:144-50.
18. Niboyannopoulos P, Joshi J, Athanasiou G, Oakley CM. Detection of atherosclerotic lesions in the aorta by transesophageal echocardiography. *Am J Coll Cardiol* 1993;71:1208-12.

# 藉著術中經食道心臟超音波影像發現胸主動脈內氣球幫浦的 脈動剝斷粥狀硬化物而造成術後腦中風：病例報告

何綺月 洪健朗 楊敏文 呂保平 林萍章<sup>1</sup>

我們描述一位鬱血性心臟衰竭病人在接受冠狀動脈繞道手術和放置主動脈內氣球幫浦而產生術後栓塞性腦中風。術中經食道心臟超音波影像顯示出胸主動脈內膜表面有明顯不規則及分裂的物質且發現有一些分裂物脫落；由這個放置主動脈內氣球幫浦後發生中風的病例顯示出，術後產生中風的高危險性與主動脈腔表面脫落的物質及胸主動脈上附著浮動的脂肪沉積有關。在放置主動脈內氣球幫浦後，藉著經食道心臟超音波可以偵測一些主動脈粥狀硬化的殘餘物來預測中風或者末梢血管阻塞的危險性，如果這些殘餘物質是浮動的，那腦中風危險性也會跟著提高。(長庚醫誌 2002;25:612-6)

**關鍵字：**經食道心臟超音波，主動脈內氣球幫浦，動脈內膜表面脫落。

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