

Intraoperative use of transoesophageal echocardiography in routine mitral valve replacement – a justified standard

Zastosowanie echokardiografii przezprzełykowej w trakcie rutynowej wymiany zastawki mitralnej – usprawiedliwiony standard



Piotr Olszówka¹, Ahmed Azzu¹, Sivagnanam Karthikeyan²

¹Department of Cardiothoracic Surgery, University Hospital of Wales, Cardiff, UK

²Department of Cardiothoracic Anaesthesia, University Hospital of Wales, Cardiff, UK

Kardiochirurgia i Torakochirurgia Polska 2008; 5 (4): 460–462

Abstract

The role of intraoperative transoesophageal echocardiography (TEE) in valve replacement surgery is still not well established. The aim of presenting this case was to justify the standard use of TEE in routine valve replacement surgery.

A patient admitted for elective mitral valve replacement with coronary artery bypass grafting with known moderate aortic stenosis underwent surgery. The mitral valve was replaced with a St. Jude mechanical valve. The aortic valve was decalcified and a single coronary bypass graft was done. Bypass TEE revealed a short period when one leaflet of the prosthetic valve was stuck. The patient was weaned easily from cardiopulmonary bypass without inotropic support. Postoperative TEE in the theatre revealed both well mobile leaflets with an extra echo shadow above the valve in the left atrium. Re-exploration confirmed the presence of residual tissue across the valve. The intraoperative use of TEE plays an important diagnostic and therapeutic role in valve replacement surgery and should be widely implemented.

Key words: mitral valve replacement, intraoperative transoesophageal echocardiography.

Streszczenie

Rutynowe zastosowanie przezprzełykowej echokardiografii (TEE) śródoperacyjnej w trakcie zabiegów wymiany zastawek serca wciąż pozostaje dyskusyjne. Celem prezentacji niniejszego przypadku jest próba wskazania użyteczności śródoperacyjnej TEE w czasie rutynowej wymiany zastawki w pozycji mitralnej. Pacjentka z rozpoznaną złożoną wadą zastawki mitralnej, chorobą wieńcową oraz łagodną stenozą aortalną poddana została leczeniu operacyjnemu. W trakcie zabiegu w pozycję mitralną wszczepiono zastawkę mechaniczną St. Jude, zastawka aortalna została zdekalcyfikowana oraz został wykonany pojedynczy pomost aortalno-wieńcowy. TEE wykonana w trakcie krążenia pozaustrojowego ujawniła przejściowe zablokowanie jednego z płatków zastawki mechanicznej. Wyjście z krążenia pozaustrojowego przebiegło bez powikłań i bez wsparcia lekami inotropowymi. Pooperacyjne badanie TEE wykonane na sali operacyjnej ujawniło prawidłowo ruchome oba płatki zastawki mitralnej z dodatkowym cieniem echokardiograficznym powyżej zastawki, w lewym przedsionku. W trakcie ponownej reeksploracji wykazano obecność rezydualnej tkanki na poziomie zastawki mitralnej. Opisany przypadek wskazuje na użyteczność zastosowania śródoperacyjnej TEE jako narzędzia zarówno diagnostycznego, jak i terapeutycznego w trakcie operacji kardiochirurgicznej. Tym samym TEE w trakcie zabiegu kardiochirurgicznego winna być szeroko stosowana.

Słowa kluczowe: wymiana zastawki mitralnej, śródoperacyjna echokardiografia przezprzełykowa

Introduction

Intraoperative transoesophageal echocardiography (TEE) is a valuable tool with regard to cardiac surgery, particularly in valve repair [1-3] and complex congenital lesions surgery [4].

However, its routine application in valve replacement surgery is less clear. Recent studies have provided additional data on the importance of intraoperative TEE in valve replacement operations with an emphasis on the pre-bypass

Address for correspondence: Piotr Olszówka, Cardiothoracic Department, C5, University Hospital of Wales, Heath Park, CF14 4XW, Cardiff, UK, mobile phone : +44 (0) 787 261 46 30, Email: polszowka@gcm.pl

data [4-11]. Nevertheless, the American College of Cardiology/American Heart Association (ACC/AHA) Task Force, in its 2006 update for the clinical application of echocardiography, considered intraoperative TEE in valve replacement as only a class IIA indication, namely, a condition for which there is conflicting evidence and/or a divergence of opinion about the usefulness and/or efficacy of the procedure, but the weight of evidence and/or opinion is in favour of its usefulness and/or efficacy [12].

The preoperative TEE assessment may introduce important modifications into the surgical plan and the post-pump assessment, as well as providing quality control of the surgical result including the efficiency of the removal of air and the haemodynamic status in terms of effective intravascular volume and biventricular contraction [4].

We would like to report a case of a stuck prosthetic valve, detected by intraoperative TEE, despite an uneventful weaning from cardiopulmonary bypass (CPB).

Case

A 71-year-old woman was electively admitted to the hospital for surgical treatment of mild aortic stenosis, mixed mitral valve disease and coronary artery disease. She was in CCS class 1 and NYHA class 3. Her preoperative risk assessed by Parsonnet score was 23, by EuroSCORE 6 and by logistic EuroSCORE 4.52. Preoperative TTE revealed: good left ventricle function, calcified non-coronary cusp of aortic valve causing moderate aortic stenosis with mean gradient across the valve 28 mmHg. Mitral valve in preoperative assessment was calcified with mild stenosis and severe regurgitation. Coronary angiogram revealed occluded right coronary artery (RCA). Intraoperative pre-CPB TEE confirmed the results of preoperative TTE. During surgery single vein graft to distal RCA was anastomosed. Because of extended rheumatic mitral valve disease with severe calcifications, both leaflets were removed without sparing of subvalvular apparatus. The mitral valve was replaced with

a mechanical St. Jude prosthesis size 27 mm in the anti-anatomical position. Intraoperative assessment of the aortic valve revealed restricted movement of the non-coronary cusp due to severe calcifications causing moderate stenosis. During surgery calcifications were removed, restoring good leaflet movement in postoperative TEE. After completion of the heart surgery, the patient was weaned from CPB under no inotropic support without difficulty, and her haemodynamic condition was stable. However, when the prosthesis was assessed for the first time using TEE during weaning from CPB, one of the leaflets of the prosthesis was seen to be stuck in the closed position (Fig. 1). The next assessment after weaning from CPB revealed movement of both leaflets although there was an extra echo shadow above the valve in the left atrium (Fig. 2). CPB was instituted again, cardioplegia was given, and the left atrium was reopened. On inspection of the prosthesis, both leaflets were moving; however, on the side of the anterolateral commissure there was residual tissue (secondary chord) coming from the left ventricle across the valve. Normal valve function was restored by resection of the extra tissue. The further postoperative period was uncomplicated and the patient was discharged home 10 days after surgery.

Discussion

Intraoperative TEE during cardiac surgery permits immediate assessment of left ventricular function and native or prosthetic valve function and de-airing, immediate detection of aortic disease such as dissection or atheromatous changes of the aorta, and confirmation of the position of an intra-aortic balloon pump [1, 2]. In particular, recent adoption of frequent intraoperative assessment of valve repair using TEE may contribute significantly to the success and popularity of mitral valve repair [1, 3]. In recent years, the results of valve replacement have improved, and controversy persists as to whether routine intraoperative TEE is indicated in valve replacement, as opposed to its established indication in repair.

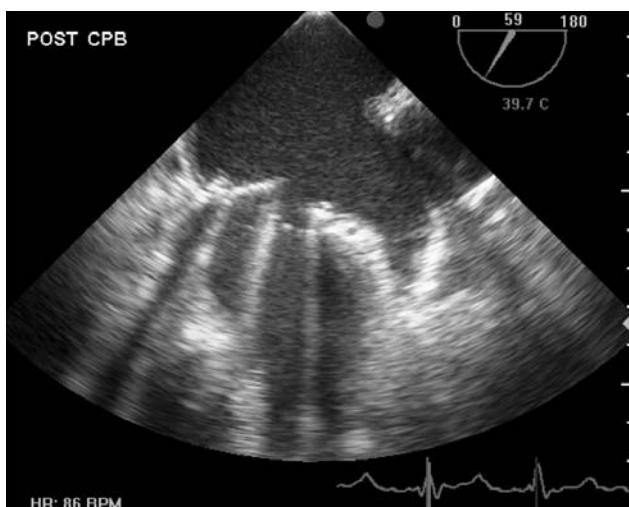


Fig. 1. One leaflet of St. Jude valve blocked in mitral position. TEE view

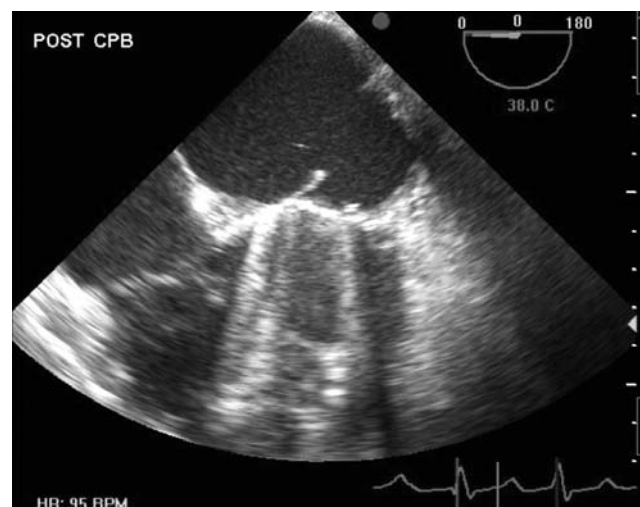


Fig. 2. Echo shadow in left atrium above prosthetic mitral valve. TEE view

Leaflet sticking due to residual tissue like that detected in the present case is believed to be rare [1-3], and this was the first case in our institution. Elsewhere, Kumano and associates [1] presented a case of blocked CarboMedics prosthesis in the mitral position. In their case weaning from CPB was under inotropic support also without any difficulty. In this case prosthetic valve dysfunction was due to residual tissue [1]. Similar complications were described by Shapira and associates in 3 cases [4]. Also Jaggars and associates [15] described a case of MVR in which one leaflet of a St. Jude Medical mitral prosthesis had become stuck, although the underlying cause of this valve dysfunction was not identified. In their case, weaning from CPB could not be achieved because the patient developed marked pulmonary hypertension. Upon assessment using TEE, they found a stuck leaflet, and operatively corrected the valve dysfunction.

Successful management in our case resulted from the use of TEE in the initial phase of operation, permitting assessment of the unexpectedly malfunctioning prosthetic valve immediately after the termination of CPB. Because patients may be haemodynamically stable despite prosthetic valve dysfunction undetected by the electrocardiogram, arterial pressure, or Swan-Ganz catheter monitoring, intraoperative TEE should be added to other routine assessments in valve replacement operations to prevent postoperative complications. Valves like St. Jude even with one leaflet blocked may provide periods of adequate cardiac output with transient periods of haemodynamic instability. Moreover, postoperative instability with an extra echo shadow above the prosthetic valve may suggest endocarditis requiring urgent redo operation.

According to Daniel and associates [16], complications associated with TEE occurred in 18 cases (0.18%) of 10,218; bleeding due to insertion occurred in only two, including a case where bleeding was caused by an oesophageal tumour. In our institution, TEE monitoring has started to be used routinely in the initial phase of cardiac surgery without complications. Insertion of the TEE probe should precede CPB with its associated systemic heparinization in order to avoid bleeding.

In conclusion, we emphasize the importance of performing routine intraoperative TEE in cardiac surgery from the initial phase of operation, for immediate management of unpredicted events.

References

1. Kumano H, Suehiro S, Shibata T, Hattori K, Kinoshita H. Stuck valve leaflet detected by intraoperative transoesophageal echocardiography. *Ann Thorac Surg* 1999; 67: 1484-1485.
2. Bryan AJ, Barzilai B, Kouchoukos NT. Transoesophageal echocardiography and adult cardiac operations. *Ann Thorac Surg* 1995; 59: 773-779.
3. Freeman WK, Schaff HV, Khandheria BK, Oh JK, Orszulak TA, Abel MD, Seward JB, Tajik AJ. Intraoperative evaluation of mitral valve regurgitation and repair by transoesophageal echocardiography: incidence and significance of systolic anterior motion. *J Am Coll Cardiol* 1992; 20: 599-609.
4. Shapira Y, Vaturi M, Weisenberg DE, Raanani E, Sahar G, Snir E, Battler A, Vidne BA, Sagie A. Impact of intraoperative transoesophageal echocardiography in patients undergoing valve replacement. *Ann Thorac Surg* 2004; 78: 579-583.
5. Deutsch HJ, Curtius JM, Leischik R, Borowski A, Huttarsch H, de Vivie ER, Hilger HH. Diagnostic value of transoesophageal echocardiography in cardiac surgery. *J Thorac Cardio Surg* 1991; 39: 199-204.
6. Sutton DC, Kluger R. Intraoperative transoesophageal echocardiography: impact on adult cardiac surgery. *Anaest Intensive Care* 1998; 26: 287-293.
7. Mishra M, Chauhan R, Sharma KK, Dhar A, Bhise M, Dhole S, Omar A, Kasliwal RR, Trehan N. Real-time intraoperative transoesophageal echocardiography. How useful? Experience of 5,016 cases. *J Cardiothorac Vasc Anesth* 1998; 12: 625-632.
8. Click RL, Abel MD, Schaff HV. Intraoperative transoesophageal echocardiography: 5-year prospective review of impact on surgical management. *Mayo Clin Proc* 2000; 75: 241-247.
9. Ionescu AA, West RR, Proudman C, Butchart EG, Fraser AG. Prospective study of routine perioperative transoesophageal echocardiography for elective valve replacement: clinical impact and cost-saving implications. *J Am Soc Echocardiogr* 2001; 14: 659-667.
10. Nowrangi SK, Connolly HM, Freeman WK, Click RL. Impact of intraoperative transoesophageal echocardiography among patients undergoing aortic valve replacement for aortic stenosis. *J Am Soc Echocardiogr* 2001; 14: 863-866.
11. Fujii H, Suehiro S, Shibata T, Hattori K, Watanabe H, Yoshikawa J. Value of intraoperative transoesophageal echocardiography in preventing serious complications during valvular surgery. A report of four cases. *J Heart Valve Dis* 2002; 11: 135-138.
12. American College of Cardiology; American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1998 guidelines for the management of patients with valvular heart disease); Society of Cardiovascular Anesthesiologists, Bonow RO, Carabello BA, Chatterjee K, de Leon AC Jr, Faxon DP, Freed MD, Gaasch WH, Lytle BW, Nishimura RA, O'Gara PT, O'Rourke RA, Otto CM, Shah PM, Shanewise JS, Smith SC Jr, Jacobs AK, Adams CD, Anderson JL, Antman EM, Fuster V, Halperin JL, Hiratzka LF, Hunt SA, Lytle BW, Nishimura R, Page RL, Riegel B. ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease. *J Am Coll Cardiol* 2006; 48: 1-148.
13. Fiane AE, Saatvedt K, Svennevig JL, Geiran O, Nordstrand K, Frøysaker T. The CarboMedics valve: midterm follow-up with analysis of risk factors. *Ann Thorac Surg* 1995; 60: 1053-1058.
14. rnandez J, Laub GW, Adkins MS, Anderson WA, Chen C, Bailey BM, Nealon LM, McGrath LB. Early and late-phase events after valve replacement with the St. Jude Medical prosthesis in 1200 patients. *J Thorac Cardiovasc Surg* 1994; 107: 394-407.
15. Jaggars J, Chetham PM, Kinnard TL, Fullerton DA. Intraoperative prosthetic valve dysfunction: detection by transoesophageal echocardiography. *Ann Thorac Surg* 1995; 59: 755-757.
16. Daniel WG, Erbel R, Kasper W, Visser CA, Engberding R, Sutherland GR, Grube E, Hanrath P, Maisch B, Dennig K, et al. Safety of transoesophageal echocardiography. A multicenter survey of 10,419 examinations. *Circulation* 1991; 83: 817-821.