Acute thrombosis in an aortic prosthesis: all mechanical valves are not the same

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INTRODUCTION

With appropriate oral anticoagulation, thrombosis of a mechanical prosthesis is relatively uncommon in clinical practice. Improvements in valve design have resulted in better thromboresistance (Arom et al, 1989). Some groups have suggested a lower than standard level of anticoagulation for some mechanical valve types in certain clinical circumstances (Horstkotte et al, 1994). The thrombotic risk, albeit small, is ongoing, and the mortality is high for re-operation (Husebye et al, 1983). This article reports a patient with a 13-year-old 21 mm Hall-Kaster prosthesis in the aortic position who presented acutely with prosthetic valve thrombosis despite apparently adequate anticoagulation, emphasizing that the type of mechanical valve, in addition to its anatomical site, is an important consideration.

DISCUSSION

Thrombotic problems with existing mechanical prostheses

Modern mechanical valves are still some distance away from native valves. Thromboembolism is considerably more likely than with bioprostheses. Transoesophageal echocardiographic data (Malergue et al, 1992) demonstrate that actual thromboembolic event rates are higher than presently reported on clinical grounds. Zeien and Klatt (1990) found thrombus in 23% of patients with mechanical valves at autopsy.

A wide variety of mechanical valves exists. Tilting disc prostheses were developed in the 1960s in an effort to improve upon the haemodynamic performance of the old ball valves. The Hall–Kaster valve, later known as the Medtronic–Hall valve, was first used in 1977. It had a central pivot axis to further improve haemodynamic performance and a Teflon sewing ring to reduce fibrous overgrowth. Very few cases of Hall–Kaster valve thrombosis have been previously reported (Gagnon et al, 1984).

Factors affecting prosthetic valve thrombogenicity

There is considerable variability in thrombotic risk between individual patients, with both patient- and prosthesis-related factors contributing.

The patient: The most important patient-related factor in prosthetic valve thrombosis is inadequacy of anticoagulant therapy. A history of a subtherapeutic international normalized ratio (INR) or stopping anticoagulant therapy is found in many patients presenting with thrombosis (Horstkotte et al, 1993a). More recent data, however, suggest that patients with thromboembolic events are receiving anticoagulation therapy of the same intensity as event-free patients (Kvidal et al, 2000) and are compliant with anticoagulation.

Despite the INR on presentation, it is possible that poor control of INR may have contributed to the development of thrombosis in this case. Left ventricular size and thromboembolic history are likely to influence risk. Data on the influence of left atrial dilatation are conflicting (Barnhorst et al, 1976; Mitchell et al, 1986). The incidence of peripheral embolic events is particularly influenced by non-prosthesis-related factors.

The valve: Experience with the Medtronic–Hall prosthesis in three different centres (Starek et al, 1987) has shown a similar pattern in thrombotic complications, suggesting that prosthesis-related factors are of considerable importance. Previous studies have shown marked variability in the thrombogenicity of implanted devices (Horstkotte and Burckhardt, 1995). With the early caged ball and

CASE REPORT

A 65-year-old man presented with symptomatic aortic valve disease and underwent aortic valve replacement with a 21 mm Hall–Kaster valve. Warfarin was commenced, and an international normalized ratio (INR) of 2.5–4.0 was recommended. Twelve years later, the patient developed a large (10 cm) ascending aortic aneurysm not involving the descending aorta. Graft replacement of the ascending aorta was performed. Inspection of the prosthesis at that time revealed it to be clean and competent, although the aortic root was heavily calcified. Eight months later, the patient was re-admitted in extremis with acute dyspnoea. For the preceding 48 hours, the intermittent absence of valve clicks had been reported by the patient's daughter. The INR on admission was 2.5 and had ranged between 2.0 and 3.6 for the 3 months before presentation. It had not been below 2.0 for at least 4 years, but on six out of the last 20 visits to the anticoagulant clinic it had been between 2.0 and 2.5. Examination revealed cardiogenic shock with a to-and-fro murmur audible at the left sternal edge. Transoesophageal echocardiography revealed free aortic regurgitation and showed thrombosis of the valve elements. Emergency surgery was considered but deemed inappropriate since the patient was moribund. Thrombolysis was attempted but the patient deteriorated relentlessly. Post-mortem confirmed the clinical impression of prosthetic valve thrombosis with no evidence of primary mechanical failure, pannus overgrowth or endocarditis (*Figure 1*).

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disc prostheses, thromboembolic events were not uncommon despite full anticoagulation, but hinged bileaflet prostheses carry a lower risk. Valve position exerts a major influence on thrombotic risk. The mitral position confers at least a two-fold risk compared with the aortic position, and this risk is increased further with tricuspid prostheses (Horstkotte and Burckhardt, 1995).

Clinical decision-making regarding anticoagulation level

The optimal level of anticoagulation for mechanical prosthetic valves is still not clear. Geographical variability in anticoagulant policies (Butchart et al, 1988) reflects local experience particularly with older first generation prostheses. The rationale for low-intensity anticoagulation has been the higher haemorrhagic complication rate with higher-intensity anticoagulation while conferring marginal or no benefit in terms of additional protection against thromboembolism, but it has not yet achieved widespread acceptance. The major difficulty is in determining the level of anticoagulation at which benefit is gained without an unacceptably high risk of haemorrhagic complications, and the problem is compounded by heterogeneity in risk of thrombosis between patients. Piper et al (1995) proposed a semi-quantitative grading system for assessing thromboembolic risk for individual patients.

Prosthesis-specific anticoagulation intensity

A means of stratifying thrombotic risk for different valve types is needed. A large study demonstrated that an increase in INR from 2.5 to 3.0 eliminated all serious embolic events with a modest increase in minor bleeding events in a group with mitral Medtronic–Hall prostheses (Butchart et al, 1991). For the aortic position, the initial risk of embolic and bleeding events was already low. A similar change in average INR increased bleeding and was counterproductive overall. In 600 patients with a St. Jude Medical prosthesis, Piper et al (1995) reported data suggesting that an average INR of below 3.0 may be appropriate. Two studies, GELIA (Horstkotte et al, 1993b) and AREVA (Acar et al, 1996), which specifically investigated the relative merits of different levels of anticoagulation, examined selected valve types. Previous clinical trials addressing the issue of anticoagulation intensity for different prostheses grouped valve types and defined embolic and haemorrhagic events poorly. They are difficult to compare.

CONCLUSION

For all valve types, there is a need for further large-scale clinical trials to determine the optimum intensity of anticoagulation. Cardiologists and clinicians supervising anticoagulation should be aware that anticoagulation for older-type aortic or mitral prostheses is not the same as for the newer bileaflet valves. HM

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Figure 1. Cross-section at the level of the aortic root at post-mortem. Red thrombus is seen attached to the valve elements.