more favourable anatomy, percutaneous balloon valvuloplasty can be performed safely and with satisfactory results in over 85% of these patients\[11\]. It is also possible that repeat PMV can be performed in these patients with acceptable risks and results. In our own single centre experience in about 390 procedures repeat percutaneous balloon valvuloplasty was performed in 17 cases (mean age 65 ± 13 years) without any increase in the rate of acute complications (no death, no embolic event, no tamponade) and with acceptable haemodynamic results (valve area >1.5 cm\(^2\) in 15 patients). In elderly patients, mitral valve replacement is often associated with an increase in morbidity and mortality during surgery and at follow up. Therefore by avoiding the apparent risk of mitral valve replacement a suboptimal haemodynamic result of percutaneous balloon valvuloplasty resulting in an improvement of one NYHA class, which is achieved even in degenerated and calcified valves, may be of clinical significance and sufficient for mid-term improvement in these patients. In addition, the costs of a repeat percutaneous balloon valvuloplasty are considerably lower compared to mitral valve replacement.

In summary, percutaneous balloon valvuloplasty should be considered as the first option in patients with restenosis after surgical commissurotomy or percutaneous balloon valvuloplasty. Open commissurotomy should be performed only in selected patients in whom direct visualization of the mitral valve seems to be advantageous, e.g. patients with severe subvalvular disease, calcification, or thrombus who are judged to be candidates for plastic procedures rather than mitral valve replacement. In all cases where mitral valve replacement is considered the somewhat better haemodynamic results should be weighted against the increased peri- and postoperative risk, especially in elderly patients.

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References

replacement in patients with aortic valve disease and congestive heart failure. The authors’ experience of homografts has previously been reported in a number of papers addressing the question of the superiority of such grafts[1–3].

The current paper of Grocott-Mason et al[1] (referred to hereafter as the present paper) points out a number of issues concerning the optimal choice of a valve substitute and procedure. Which procedure will provide (1) the probability of the best early and late mortality, (2) the greatest freedom from the risk of thromboembolism and from hazards of anticoagulation, (3) the most durable valve so that reoperation can be avoided, and (4) the most physiological haemodynamic performance — and how can one know?

Survival, representing a definite end-point, is easy to assess. Available data about the other principal end-points, e.g. causes of death, valve- and anticoagulant-related complications, haemodynamics and durability, are less precise. In order to provide appropriate and reliable data, the reports must at least be based on outcomes defined according to specific criteria and recorded prospectively at regular intervals, both linearised and actuarial rates of the risks should be accessible, and the intended level and the quality of anticoagulant therapy should be stated[4]. If the aim is to compare the outcome of the use of different valves and of different valve modifications, these considerations are especially important. Moreover, comparative studies should be randomised. Unfortunately, a large number of studies, including the present one, do not fulfil these basic criteria. No advanced statistical multivariate analysis will compensate for deficiencies in the study design.

Operative mortality

The operative mortality associated with aortic valve replacement has decreased substantially over the years, but it is not negligible especially in patients in advanced NYHA[5]. In their paper, Grocott-Mason et al. report the experience with an aortic homograft performed by a single surgeon. No doubt in the hands of an experienced single surgeon this is not a complicated procedure, either primarily or as a reoperation. However, homograft implantation is more prone to technical errors that may affect both the immediate and long-term outcome and may not provide consistent results in the hands of most surgeons. This is especially relevant in the case of a reoperation due to homograft failure. The remarkably low early mortality of 3·4% in the series of patients of the present study[3] should be compared with the 25% mortality at reoperation reported from a randomised controlled study comparing mechanical and bioprostheses[6].

Morbidity associated with artificial heart valves and anticoagulant therapy

In the case of artificial heart valves, the type of mechanical valve has an important impact on the risk for valve-related morbidity; the incidence rates of events with ball valves, tilting discs and bileaflet valves have been estimated as 2·5, 0·7 and 0·5 per 100 patient-years, respectively[7]. The ball valve prosthesis, which was used in the present study, represents an old concept and is not in great use today. The last generation of mechanical prostheses have improved performance and lower thrombogenicity.

Moreover, the intended level of and the adequacy of the anticoagulation therapy are important factors for valve-related morbidity. Today individual risk stratification has introduced refinements with variations in the intensity of oral anticoagulation and possibly with concomitant use of antiplatelet agents. Patient education, self-monitoring and dose adjustment have been shown to further improve both compliance and anticoagulant control[8].

It is therefore conceivable that a bileaflet mechanical valve in the aortic position in combination with high-quality anticoagulation and antithrombotic treatment will result in substantially lower complication rates. In younger patients with aortic valve disease this should be considered as the gold standard with which the outcome with newer valves including homografts should be compared.

Older patients are at increased risk for both thromboembolism and anticoagulant-related haemorrhage and these complications become major determinants of the long-term outcome. In these situations a bioprosthesis is preferable. Such valves are less thrombogenic and do not always necessitate anticoagulant treatment. All bioprostheses degenerate but the degeneration is less pronounced in higher age-groups and in the aortic position[6,9].

Durability of bioprostheses

Initially the durability of many bioprostheses, including both porcine and pericardial valves, was disappointing. The occurrence of early structural failure, especially in the mitral position, gave reason to question the use of bioprostheses. The design of some pericardial bioprostheses has successfully
endured the test of time. In the aortic position in older patients (>65 years), a few pericardial bioprostheses have yielded good results in large prospective series of patients, with adequate follow-up in both European countries and the U.S.A.\textsuperscript{[10–12]}. It was hypothesized that the time course of failure of a homograft was slower than that of other tissue valves, especially in a young population. However, this was not the case and homografts proved to degenerate just like other bioprostheses\textsuperscript{[1,2]}. These experiences apply to antibiotic-sterilized homografts. Today cryo-preserved valves and so-called homovitals are preferred under the assumption that these methods of preservation will provide satisfactory valve function in the long-term also. However, as to the question of the superiority of homografts preserved with newer techniques over other valve substitutes — this remains to be answered. The present paper contributes little to the knowledge about their durability. In that study cryopreserved valves and homovitals constituted only 21% of the homografts. They were implanted during recent years and therefore have a shorter follow-up. The question also remains whether or not delayed tissue degeneration occurs slowly over time or increases abruptly at some time point as observed 8–10 years after implantation of antibiotic-sterilized homografts. In retrospect, many newly designed biological valves have shown disappointing long-term durability\textsuperscript{[6,9,13]}. 

**Haemodynamics**

One rationale for the use of homografts in the present study was that a putatively superior haemodynamic profile would be of particular benefit for patients with pre-operative heart failure. Even if homografts have excellent haemodynamics at implantation, given that technical problems at operation are avoided, they will deteriorate. Consequently the haemodynamic profile will also deteriorate. Within 5 years approximately 10 to 15% of the patients will have clinically evident tissue failure. After 10 years 40% will have tissue failure and 20% will undergo reoperation\textsuperscript{[2,5]}. The idea of superiority of the haemodynamic profile of homografts over that of pericardial valves has to be questioned\textsuperscript{[14]}. Pericardial bioprostheses provide better haemodynamics in small sizes as compared to stented porcine bioprostheses\textsuperscript{[15]}. Nevertheless, if valid the haemodynamic arguments for homografts are applicable only in a very small annulus. In such a situation the beneficial effect of a simple annular enlargement procedure has been well documented for the stented bioprosthesis\textsuperscript{[16]}.

**How does one know?**

The literature provides extensive documentation of the properties and use of individual prostheses, with different proposed and hypothetical advantages. The available data are based on studies using varying study protocols and definitions, including different patient populations and with varying lengths of follow-up. The sparsity of comparative and randomized studies in this field is a shortcoming in cardiovascular surgical research. In the search for the optimal valve substitute there is a strong need for such investigations.

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**References**


White coat effect. Innocuous or adverse phenomenon?

See page 1715 for the article to which this Editorial refers.

Pathophysiological research supports the hypothesis that the ‘white coat’ effect, i.e. the difference between ‘office’ blood pressure and blood pressure measured outside the office has prognostic relevance: (1) by reflecting hyper-reactivity to stressful stimuli, a large pressor response to office blood pressure measurements may imply the occurrence of intermittent blood pressure elevations throughout the day and night, which in animals has been shown to lead eventually both to a sustained hypertensive state and to organ damage[1]; (2) intermittent blood pressure elevations cause great blood pressure variability, which favours organ damage, both in animals[2] and in man[3,4]; (3) hyper-reactivity to stress is brought about by the sympathetic nervous system whose over-stimulation can directly cause left ventricular hypertrophy, arterial wall thickening, atherosclerosis, insulin resistance and dyslipidaemia, thereby facilitating alterations to cardiovascular structure and metabolism, of unquestionable prognostic relevance, independent of their effect on blood pressure[5].

Some data from pathophysiological studies disagree with the prognostic relevance of the white coat effect, however. For example, hyper-reactivity to one stressful stimulus my co-exist with normal or even hyporeactivity to other stressful stimuli[6], presumably because the response to every given stress depends on patients’ background and experience with that particular stress. Furthermore, either because within individuals the response to different stresses can be highly diversified and because its genesis also involves central, reflex and local factors independent of stress, blood pressure variability shows no relationship with the white coat effect[7]. And finally, the difference between office and home or ambulatory blood pressure does not correlate with the blood pressure rise induced by the doctor in patients with beat-to-beat blood pressure monitoring[8], while showing a close inverse relationship with the daytime blood pressure values[9]. Thus its origin involves stress but also, and to a noticeable degree, multifield mechanisms that modulate cardiac and vascular functions in daily life.

The uncertainties that exist at the pathophysiological level assign to the clinical setting the task of determining whether or not the ‘white coat’ effect has any prognostic value. They also assign to this setting the task of determining the prognostic value of ‘white coat hypertension’, i.e. the condition (perhaps better defined as ‘isolated office hypertension’)[10] in which blood pressure is made abnormal by the white coat effect in the office (≥140/90 mmHg) while remaining normal at home or in the daytime. In neither case, however, have conclusive data been obtained[11], leaving the physician unguided when deciding whether or not individuals, who persistently show blood pressure elevation by conventional but not by self or ambulatory measurements, require antihypertensive treatment. The problem is an important one because both the ‘white coat’ effect and ‘white coat’ hypertension are common in the population[12]. And because the decision not to treat an office blood pressure elevation may have legal consequences, given the epidemiological and trial evidence of the prognostic importance of lowering office blood pressure values.

The paper by Strandberg and Salooma in this issue[13] scores on this point by reporting prospective data on more than 500 middle-aged subjects followed for more than 20 years. The results show that patients originally characterized by a large ‘white coat’ effect and/or by white coat hypertension had a mortality rate two to three times greater than those having a small ‘white coat’ effect or no office hypertension at all. The suggestion is thus clear, that neither condition can be regarded as ‘innocent phenomena’.