

The role of ultrasound examination in disease of the thoracic aorta

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Introduction

Stroke and transient ischaemic attacks are often the consequence of a disease of the aortic arch, especially in elderly patients. The thoracic aorta is a common site of embolising atheromas (1-5); in addition, the dissecting complication of aortic aneurysms can extend to the origin of the cerebral feeding arteries (6,7). A recent extensive meta-analysis of a large number of studies clearly showed that when the transverse aortic diameter exceeds 3.4 cm, it is positively and strongly related to the incidence of cervical artery dissections (8). Given the possible link between aortic disease and sudden neurological symptoms, during the past three decades ultrasound techniques have been extensively used to achieve an anatomical characterisation of the aortic arch, to define the presence of atherosclerotic debris, and to diagnose aneurysmal disease and/or its dissecting complications.

Aortic aneurysms

Ultrasound examination of the ascending aorta is feasible both by transthoracic and transoesophageal echocardiography, but the yield of the two techniques is quite different. The first reports on applications of transthoracic echocardiography (TTE) for the diagnosis of aortic disease date back to the early 1970s (9). Subsequently, the diagnostic accuracy of transoesophageal echocardiography (TEE) proved superior to that of TTE in detecting aortic aneurysmal disease and its complications; sensitivity and specificity ranged from 94 to 100% (10-12). Indeed, TTE was extensively shown to be less reliable than TEE examination due to the poor acoustic thoracic windows both from parasternal and jugular approaches. Aortic dissection is an acute medical emergency with a high mortality; early recognition and appropriate treatment is crucial to improving survival. Ultrasound examination of the aorta is recommended by American College of Emergency Physicians guidelines as a first level test (13) and given the superiority of the technique, TEE has become the preferred US modality for urgent evaluation of a patient with a suspected acute complication of an aneurysm of the thoracic aorta. Although desirable, TEE is not always readily available as the initial test, particularly in unstable patients with suspected aortic dissection in an acute setting soon after hospitalisation in the emergency room. On the other hand, data collected in limited case series (14,15) indicate that even TTE performed by emergency room physicians can allow reliable diagnosis of aortic dissections and can be a valuable resource especially in the presence of a haemodynamically unstable patient and/or in the presence of an acute cerebral ischaemia, when the findings of the cardiac examination can prompt rapid and often life-saving therapeutic decisions.

Aortic debris

Atheroma of the aortic arch is an important and poorly recognised factor in the aetiology of stroke (16). The risk of stroke is correlated with the presence and thickness of the atherosclerotic lesion and with the coexistence of an atherosclerotic plaque (17). The progressive enlargement of the elderly population is associated with an increasing prevalence of systemic and aortic atherosclerotic disease.

In addition, during the last two decades the astonishing increase in the number of coronary angiographies for diagnostic and therapeutic purposes and the increase in coronary by-pass grafting surgical procedures has increased the risk of mechanical dislodgement of embolic material from aortic plaques by surgical ma-

nipulation or catheter movements through the aortic arch (18). Detecting the presence of aortic debris and characterising its severity, particularly in patients older than 60 years, makes it possible to draw a more accurate profile of individual risk of embolic events. Aortic plaques are most often seen in elderly patients with hypertension, hypercholesterolaemia and a history of smoking (19). Screening for atherosclerotic lesions of the aorta in the cardiac surgical population may become even more important than in the general elderly population because most cardiac surgical patients are at greater risk of clinically significant aortic atherosclerosis (20). It has been reported, for example, that in patients undergoing surgery for aortic stenosis, the stroke rate triples (reaching 16%) in those showing complex arch atheroma (i.e., a thicker plaque with protrusion of mobile debris or ulceration or both) (20,21). Thorough knowledge of aortic anatomy thus can help us to choose the most appropriate management strategy, such as axillary cannulation, less traumatic cannula tips, balloon occlusion, soft cross clamps, circulatory arrest with aorta grafting, variations of “no touch” techniques and the recently introduced transapical valve replacement with off-pump grafting (20). Transoesophageal echocardiography has been reported to allow accurate assessment of the degree of arteriosclerosis in the thoracic aorta (10). The presence of complex arch atheromas on TEE appears to be associated with an increased risk of perioperative stroke (20). However the mid and distal segments of the ascending aorta are often obscured by interposition of the tracheal tree. Unfortunately this “blind spot” on the aorta is the portion most often manipulated during surgery. Intraoperative epi-aortic ultrasound has been shown to be more sensitive than either palpation or TEE for detecting aortic plaques (22), but it is not routinely used because most surgical teams consider the traditional method of palpation equally reliable (23). Despite technical limitations and caveats aortic atheroma and stroke risk can be reasonably screened for preoperatively with the standard TEE and the routine use of ultrasound guidance in cardiac surgery may improve postoperative outcomes in this patient population. According to the guidelines of the American Echocardiography Society (24), the indication of TEE for evaluating the cardiovascular source of an embolic event in a patient who has a normal TTE and normal ECG and/or a history of atrial fibrillation/flutter is uncertain.

Different investigators have found a positive and significant correlation between atherosclerotic plaque dimension and embolic activity measured by transcranial Doppler monitoring (18,25,26). While all studies in subjects undergoing coronary angiographies (18,25,27) failed to demonstrate any correlation between emboli counts and clinical events, a positive and significant correlation has been found between transcranial microembolic signals and the risk of cerebral ischaemic complications among patients undergoing cardiac surgery (28). Therefore, in these subjects, an integrated evaluation (i.e., TEE plus TCD monitoring) may provide a more useful and accurate predictive index of embolic risk.

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