Clinical autonomic testing and posture: are we doing the right things?

The investigation of autonomic cardiovascular function has several important goals and fields of clinical application. First, it allows determination of the presence of parasympathetic and sympathetic dysfunction, which characterizes primary and secondary autonomic failure syndromes, as well as enabling quantification of the degree of severity of the dysfunction [1]. Secondly, it allows the assessment of autonomic control of the circulation in various cardiovascular diseases (such as congestive heart failure and myocardial infarction), thus providing information of key importance in determining the clinical severity and prognosis of these pathological conditions [2,3]. Finally, evaluation of autonomic cardiovascular function has therapeutic implications, allowing not only definition of the mechanism of action of drugs commonly employed in the management of autonomic disorders, but also it may serve to guide the physician in the choice of more suitable pharmacological approaches in a given patient [1].

The intriguing results of a study performed by Singer et al. [4], presented in this issue of Clinical Science, with the aim of evaluating the effects of posture on blood pressure and heart rate responses to the Valsalva manoeuvre, offer the chance to consider the methodological and physiological problems related to the assessment of autonomic control of cardiovascular function in human beings. One of the methodological problems to be faced in the evaluation of cardiovascular effects using laboratory tests (such as the Valsalva manoeuvre, hand-grip exercise and cold-pressor test) concerns the poor reproducibility of the blood pressure and heart rate responses to these interventions within each individual. This was shown some years ago by our group in a study [5], in which the haemodynamic responses to the cold-pressor test or hand-grip exercise, performed with the same subjects, under standardized conditions, twice within each experimental session, differed markedly in magnitude (i.e. variation coefficients for blood pressure and heart rate responses ranging from 5.4–22.3% and from 21–68% respectively). Another important limitation concerns the lack of relationship among the haemodynamic responses elicited in the same subject by different laboratory tests. Indeed, in our own experience, little or no correlation has been observed between heart rate (or blood pressure) responses to hand-grip exercise and those of the cold-pressor test [5]. Taken together, these data allow two important conclusions to be drawn, namely that (i) the haemodynamic responses to autonomic tests are characterized by a limited within-subject reproducibility, and (ii) individual cardiovascular responses to a given test may vary according to the laboratory test used, thus making data interpretation difficult. The results of the work of Singer et al. [4], however, do not seem to be influenced by the above-mentioned limitations. This is because the authors, in the context of a study designed and performed according to rigorous methodological criteria, paid particular attention to the reproducibility problem, testing the Valsalva manoeuvre twice in each of the postural positions. In addition, the Valsalva manoeuvre represents a well-accepted tool for clinical autonomic testing, which does not necessarily need to be complemented by other diagnostic procedures [1].

Assessment of cardiovascular responses to the Valsalva manoeuvre is based on the evaluation of the blood pressure and heart rate responses to this intervention. The novel findings of Singer et al. [4] present evidence that postural changes may affect these responses; orthostatic position enhancing the blood pressure reduction occurring in phase II, and the blood pressure overshoot typical of phase IV. Although the Valsalva ratio was virtually unaffected by the postural change, baroreflex sensitivity underwent a marked reduction during orthostasis. It is likely that this alteration depends on deactivation of the arterial baroreceptors, which are displaced approx. 20–30 cm above the heart in upright posture [6]. It may also depend, however, on the orthostasis-dependent reduction in venous return to the heart and, thus, on central venous pressure, resulting in cardiopulmonary receptor deactivation [6]. Although receptors located within the cardiac chambers (‘cardiac receptors’) and the arterial pulmonary vascular tree (‘pulmonary receptors’) do not seem to exert, at least in humans, any major influence on sinus node activity [6], this reflexogenic area participates at the regulation of: (i) sympathetic vasoconstrictor tone in the kidney and in skeletal muscle, (ii) renin release from the kidney, and (iii) vasopressin and atrial natriuretic peptide secretion. As a result, the cardiopulmonary receptor reflex may be involved not only in homoeostatic blood volume control but also (although to a lesser extent) in the regulation of blood pressure [6].

To summarize, therefore, with regard to evaluation of the haemodynamic responses to autonomic tests. The heart rate and blood pressure changes induced by the Valsalva manoeuvre have been (and they are still) considered as indices of vagal and sympathetic cardiovascular influences respectively. Although this simplification can, overall, be regarded as acceptable for heart rate responses (which, however, depend also on sym-
pathetic influences and \( \beta \)-adrenoceptor responsiveness to circulating catecholamines [7]), a word of caution is needed regarding the assumption that blood pressure changes are faithful mirrors of sympathetic neural responses. Indeed, recent studies have shown this to be invariably not the case. For example, systemic infusion of insulin, although markedly enhancing sympathetic activity, does not modify blood pressure values [8]. In addition, acute cigarette smoking, although inhibiting sympathetic nerve traffic to skeletal muscles, triggers a marked blood pressure increase, which is largely due to a nicotine-induced vasoconstriction [9]. It thus appears that changes in sympathetic and vascular tone do not invariably go hand-in-hand. These considerations, however, do not detract from the importance of the results of Singer et al. [4], and, in general, to the information that can be obtained via use of the Valsalva manoeuvre. They indicate rather that careful performance of the test, coupled with awareness of its intrinsic limitations, may allow us to refine our diagnostic approach to autonomic disorders.

**REFERENCES**