



REVIEW ARTICLE

Insights into the background of autonomic medicine



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Abstract Knowledge of the physiology underlying the autonomic nervous system is pivotal for understanding autonomic dysfunction in clinical practice. Autonomic dysfunction may result from primary modifications of the autonomic nervous system or be secondary to a wide range of diseases that cause severe morbidity and mortality. Together with a detailed history and physical examination, laboratory assessment of autonomic function is essential for the analysis of various clinical conditions and the establishment of effective, personalized and precise therapeutic schemes. This review summarizes the main aspects of autonomic medicine that constitute the background of cardiovascular autonomic dysfunction.

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PALAVRAS-CHAVE

Fisiologia autonómica;
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Reflexo quimiorreceptor;
Avaliação autonómica;
Teste de *tilt*

Introdução à medicina autonómica

Resumo O conhecimento subjacente à fisiologia do sistema nervoso autónomo é fundamental para se entender a disfunção autonómica na prática clínica. A disfunção autonómica pode resultar primariamente de modificações do sistema ou, secundariamente, a uma série de patologias conducentes a morbilidade ou mortalidade. Juntamente com a colheita detalhada da história clínica e do exame objetivo, a avaliação autonómica laboratorial torna-se essencial na análise de algumas condições clínicas e no estabelecimento de esquemas terapêuticos mais eficazes, refinados e personalizados. Assim, nesta revisão sumarizam-se os aspetos mais relevantes da fisiologia autonómica subjacente a disfunção autonómica cardiovascular.

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Introduction

Attempts to bridge the gap between basic and clinical science, known as the translational approach to medical knowledge, contribute to better clinical practice, enabling a comprehensive interpretation of pathophysiological mechanisms, more accurate diagnosis and establishing more effective treatment. Advances in autonomic research in recent years and the development of implantable devices that affect autonomic tone mean there is a growing need to understand the scientific basis of autonomic medicine, in order to improve management of autonomic dysfunction in cardiology.

This review aims to provide a basis for understanding autonomic failure in cardiovascular disease. The first section deals with the basic aspects of autonomic function, while the second covers the most important reflexes. The third section describes the most common methods of autonomic evaluation.

The autonomic nervous system

Almost all bodily functions are dependent on the autonomic nervous system (ANS), which exerts precise control over visceral functions (Figure 1). However, the mechanisms through which the ANS exerts this control are not well understood.

Although the ANS is able to hide its own dysfunction, disautonomy, also known as autonomic failure, can occur due to functional failure, a physical defect in the nervous network, and as a result of the aging process. In these conditions, the system becomes over-activated, the resulting allostatic overload being believed to contribute to various diseases, including hypertension, atrial fibrillation and other cardiac arrhythmias, ischemic heart disease, obesity, diabetes, atherosclerosis, sleep apnea, metabolic syndrome and congestive heart failure.¹⁻¹⁴

The ANS is one of the two major divisions of the peripheral nervous system (the other being the somatic nervous system). The ANS functions mainly through negative feedback mechanisms and via reflex arcs, using specific neuronal pathways in the periphery and a specific central organization to perform precise and flexible actions. In the present text, we will use Langley's neuroanatomical terminology and the terms sympathetic, parasympathetic and enteric will only refer to the motor portion of the autonomic reflex arc (Figure 2). This arc also includes integrative centers located in the central nervous system (CNS) (the central autonomic network) to which sensory information is conveyed from peripheral sensors located in specific reflexogenic areas.^{6,12,14,15}

Visceral afferent pathways

Afferent pathways are the interface between the visceral organs and the CNS. Most afferent fibers are unmyelinated, but myelinated fibers can also conduct autonomic sensory information.¹⁵ There are two types of visceral afferents, primary afferent fibers and enteric afferent fibers. The latter respond to chemical and mechanical events and their cell bodies are located in the gastrointestinal tract walls.^{15,16} Primary afferent inputs are carried orthodromically to the spinal cord, brain stem or prevertebral sympathetic ganglia. The degree to which these afferent neurons are physiologically specific is determined by the responses evoked by chemical or mechanical stimulation.¹⁵⁻¹⁷ Most of these afferents transmit information from the viscera to the CNS,^{4,18-20} but some also make contact with sympathetic preganglionic neurons in the prevertebral ganglia.²¹ These anatomical relations indicate that in addition to their central actions, visceral primary afferents (and also enteric afferent fibers) may also play a role in peripheral regulatory reflexes, mainly those that are active in pathological conditions through positive feedback mechanisms.²¹

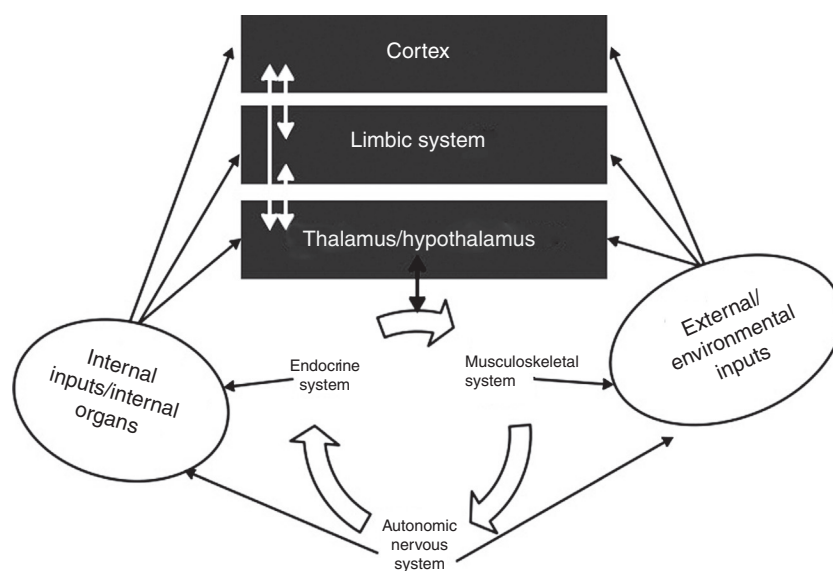


Figure 1 The interactions between the autonomic nervous system, the brain, the body and the environment. Adapted from Jänig.¹⁶

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