Viewpoint

Is Your "Dry" Patient Really Not Congested? Physiological Basis and Clinical Use of Valsalva's Maneuver in Heart Failure

Renata R. T. Castro[1,2]
Universidade Iguaçu,[1] *Nova Iguaçu, RJ – Brazil*
Ipanema Health Club,[2] *Rio de Janeiro, RJ – Brazil*

Introduction

In 2003, Nohria et al. published a manuscript considered a game-changer in acute heart failure (HF) treatment.[1] As by this manuscript, patients admitted with heart failure should be clinically classified into four hemodynamic profiles defined by the presence or absence of congestion and hypoperfusion. Congestion was defined by "recent history of orthopnea and/or physical exam evidence of rales, jugular venous distension, hepatojugular reflux, ascites, peripheral edema, left-ward radiation of the pulmonic heart sound, or a square wave blood pressure response to the Valsalva maneuver."

More than 20 years after this publication, the Valsalva maneuver continues to be routinely used during clinical evaluation of patients admitted to the advanced heart failure service at the Brigham and Women's Hospital (personal experience), where profiles were created and validated.[1] However, despite the fact that clinical profile determination has become a routine procedure,[2] few physicians have incorporated the Valsalva maneuver in their practices. To date, no study has compared the accuracy of the different clinical methods available for assessing congestion in patients with HF. Therefore, we should not categorize a patient as "dry" before all possibilities of congestion are excluded. It is possible that patients are being categorized as dry when, in fact, they have congestion that would only be identified by the Valsalva maneuver. Correct determination of hemodynamic profile is pivotal, as the existence of congestion and/or hypoperfusion guides the management of patients admitted with heart failure decompensation. This manuscript aims to review the physiological bases of the Valsalva maneuver, justifying and encouraging its use in clinical practice.

Valsalva Maneuver

Antonio Maria de Valsalva[3] originally described the Valsalva maneuver in the 18th century. The maneuver, characterized by the expiratory effort against fixed resistance of the glottis, with closed nasal cavities and mouth, would allow the expelling of purulent secretion from the middle ear of the nasopharynx through the eustachian tube.

Two studies were published in the 1950s[4,5] describing the hemodynamic consequences of the Valsalva maneuver and its use to detect pulmonary congestion. The Valsalva maneuver increases intrathoracic pressure and the resistance to venous return of blood to the heart. The reduction in venous return leads to a reduction in end-diastolic volume, systolic volume and systolic blood pressure[6] during the maneuver (Figure 1).

In patients with congested lungs, the increase in intrathoracic pressure during the Valsalva maneuver forces blood from the pulmonary circulation into the left atrium, leading to higher-end diastolic volume, higher systolic volume and a sustained increase in systolic blood pressure during the maneuver (Figure 2).

Bedside sphygmomanometry during the Valsalva maneuver is easily performed, requires little training and elicits evaluation of lung congestion. The first step to assess hemodynamic responses to the Valsalva maneuver is to measure the patient's blood pressure in the supine position. After that, the cuff should be inflated and maintained at 15 mmHg above the systolic blood pressure. Valsalva maneuver should be performed for 10-15 seconds while the stethoscope is kept over the brachial artery. The pattern of Korotkoff sounds auscultated during the maneuver defines the presence or absence of pulmonary congestion. In patients with no lung congestion, Korotkoff sounds may be heard during the beginning of the maneuver and will disappear throughout the expiratory effort (Figure 1). In patients with lung congestion, blood pressure remains at supra-systolic levels throughout the maneuver. The auscultation of Korotkoff sounds while the cuff is inflated above systolic levels is called the square wave of the Valsalva maneuver and indicates an abnormal response compatible with lung congestion (Figure 2).

Variations in blood pressure and heart rate induced by the Valsalva maneuver are mediated by the arterial baroreflex and used for the diagnosis of cardiovascular dysautonomia. This analysis requires the use of equipment that allows continuous blood pressure recording. Therefore, its use at the bedside in non-specialized services is not feasible. Thus, the detailed description of the use of the Valsalva maneuver for cardiovascular autonomic evaluation is beyond the scope of this article. However, interested readers can find other articles addressing this topic.[7,8]

Conclusion

Appropriate characterization of the hemodynamic profiles of patients with heart failure is crucial to guiding their correct management. The Valsalva maneuver is a simple bedside test that physicians can easily perform to address congestion in heart failure patients.

Keywords

Valsalva Maneuver; Heart Failure; Physical Examination.

Mailing AddressCorrespondência: Renata R. T. Castro •
Universidade Iguaçu – Rua Abilio Augusto Tavora, 2134. Postal Code 26260-045, Nova Iguaçu, RJ – Brazil
E-mail: castrorrt@gmail.com
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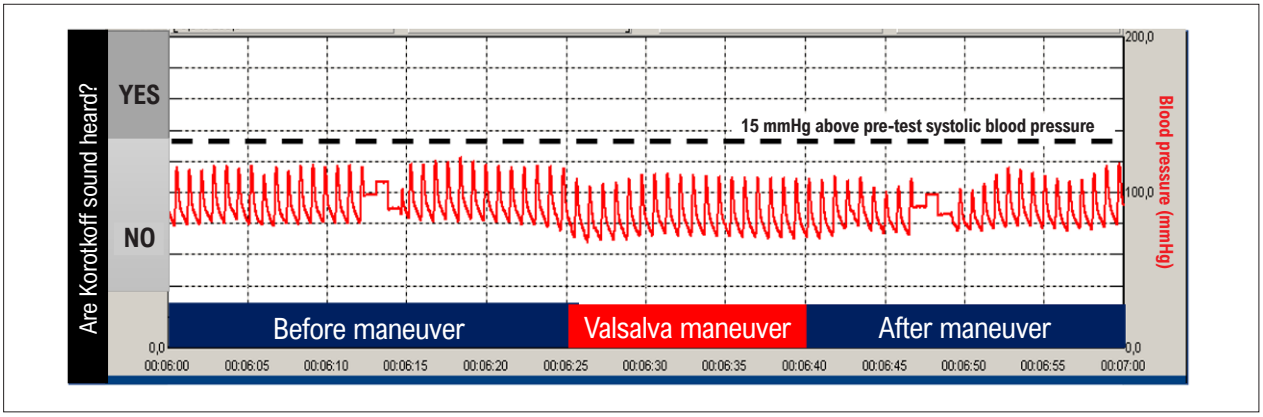

Figure 1 – *Blood pressure response to Valsalva maneuver in a patient without lung congestion.*

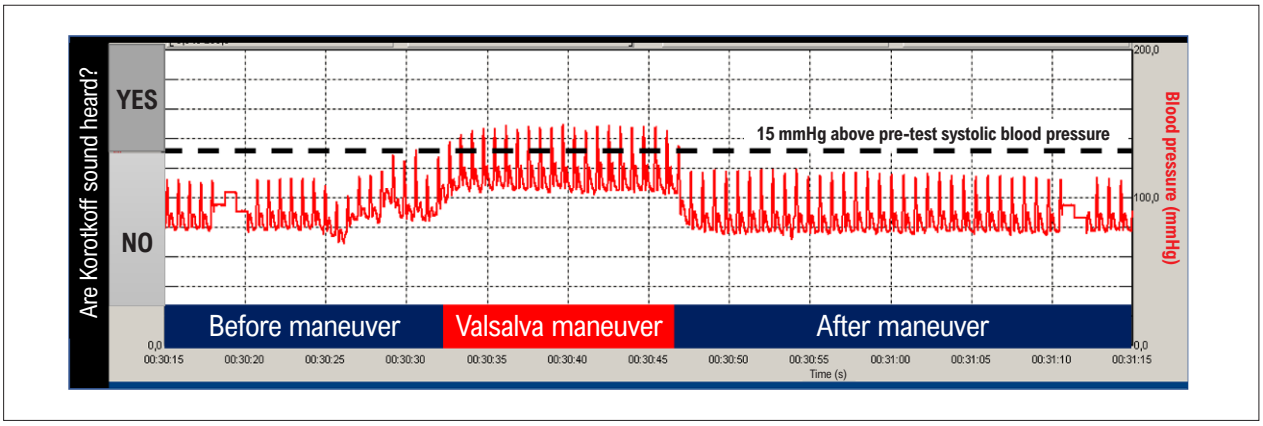

Figure 2 – *Blood pressure response to Valsalva maneuver in a patient with lung congestion.*

Author Contributions

Conception and design of the research; Acquisition of data; Analysis and interpretation of the data; Statistical analysis; Obtaining financing; Writing of the manuscript and Critical revision of the manuscript for content: Castro RRT.

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Ethics approval and consent to participate

This article does not contain any studies with human participants or animals performed by any of the authors.

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