

HYPERVENTILATION AND BLOOD PRESSURE IN OBSTETRIC PATIENTS

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SUMMARY

After a short review of the technical details of sphygmomanometry and of its history, the authors demonstrate that in normal human females, both pregnant and non pregnant, a short period of hyperventilation significantly reduces the values of systolic and diastolic blood pressure. This fact is particularly important in cases with borderline elevations of blood pressure, as it enables to differentiate between patients needing a more detailed work-up and patients with a transient rise without morbid implications.

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The evaluation of blood pressure is one of the most meaningful measurements of body functions in obstetric practice; if early rises are underestimated, a timely diagnosis of gestosis may be missed, while an erroneous reading of increased blood pressure often leads to unnecessary harassments for a healthy woman. The serendipitous discovery that the tomb of Professor Scipione Riva Rocci (fig. 1), the inventor of modern sphygmomanometers, is situated in a small village a few miles away from our Hospital and the almost contemporary publications of some letters to the Editor on the Journal of the American Medical Association^(1, 2, 6, 9, 12) on hyperventilation and blood pressure induced us to evaluate the so called "hyperventilation test" in a series of pregnant patients. Parallel to this work, a methodological, physiological and historical study on blood pressure measurement has been performed, the results of which have been the object of a postgraduate thesis⁽¹⁶⁾ and will be published elsewhere in the near future.

According to the observations reported in the letters quoted above, a more or less pronounced drop of blood pressure may be expected after hyperventilation if the blood pressure was abnormally high as a consequence of emotional distress; on the contrary, the blood pressure should remain unchanged, when it was elevated as a consequence of organic disease.

MATERIAL AND METHODS

The hyperventilation test was performed on 50 healthy gravidas admitted to the Department of Obstetrics and Gynaecology of the University of Genova School of Medicine (age: 20 to 45 years; gestational age: 9 to 42 weeks). The same test was also performed on 50 non pregnant healthy women of comparable age.

Blood pressure measurements were performed with strict adherence to the standard technique⁽⁸⁾; moreover, gross subjective errors in distinguishing the Korotkoff sounds were excluded by submitting the examiners (both the authors and a senior medical student) to a hearing test⁽¹⁹⁾.



Fig. 1. — Photographs of the vault (A) of the family Riva Rocci in the cemetery of San Michele di Pagana (Genova, Italy) and of the tombstone (B) of Professor Scipione Riva Rocci located on the left side from the entrance (English translation: Dott. Prof. Scipione Riva Rocci, Clinician Scientist, Inventor of the Sphygmomanometer in 1896, Almese Aug. 7th 1863; Rapallo March 15th 1937). For further historical details we refer to the recent paper by Booth J.: *A Short History of Blood Pressure Measurement*, Proc. roy. Soc. Med., 70, 793, 1977.

The hyperventilation test was performed by measuring the blood pressure as follows:

a) After an average period of two hours of rest, blood pressure was measured on both arms with the woman in the sitting position.

b) The patient was invited to hyperventilate for two minutes; the blood pressure was measured again on the left arm, or on both arms if there was a marked difference in the previous measurements.

RESULTS

In both series of patients (pregnant and not pregnant) there was no significant ($p > 0.05$) difference between the blood pressure (systolic and diastolic) measured on the left and on the right arm. Therefore, for the evaluation of the hyperventilation test, only the blood pressure read-

ings obtained on the left arm have been considered.

Table 1. — Mean blood pressure (left arm, sitting position), mmHg.

	Initial systolic	Initial diastolic	After hyperventilation systolic	After hyperventilation diastolic
pregnant subjects (n = 50)	117,1	71,9	107,3	66,1
non pregnant subjects (n = 50)	108,5	66	100,1	59,6

Statistical evaluation was performed by means of the Student's "t" test for paired data.

After hyperventilation, among the pregnant subjects there was a mean reduction of systolic pressure of 9.8 mmHg ($p < 0.01$) and of diastolic pressure of 6.3 mmHg ($p < 0.01$). After hyperventilation among non pregnant subjects there was a mean reduction of systolic pressure of 8.4 mmHg ($p < 0.01$) and of diastolic pressure of 6.3 mmHg ($p < 0.01$). The differences between the reductions observed in pregnant subjects and those observed in non pregnant subjects were not significant ($p > 0.05$).

COMMENTS AND CONCLUSIONS

Our results indicate that in normal human females, both pregnant and non pregnant, a short period of hyperventilation significantly reduces the values of systolic and diastolic blood pressure. This fact has an obvious relevance in cases with borderline elevations of blood pressure, as it enables the physician to differentiate between patients needing a more detailed work-up and patients with a transient rise without morbid implications. It is understood that technical imperfections, due to the measuring method or to the instruments, should be carefully looked for,

because they are a common source of dangerous misunderstandings as repeatedly pointed out in the past^(7, 11) and again in recent times^(3, 4, 5, 10, 14, 17).

The mechanism by means of which elevated blood pressure, without underlying organic disease, is reduced after hyperventilation is poorly understood. Mechanical and hydrodynamic effects of accelerated respiratory movements do not seem to be relevant⁽¹⁵⁾; rather, it is more likely that the hypotensive effect is mediated through chemical (reduced arterial CO₂) or nervous influences on the sympathetic or parasympathetic centers⁽¹⁸⁾.

Work is in progress on a larger sample of individuals (including patients with various forms of hypertensive disease) in order to establish with greater precision the merits and limitations of the "hyperventilation test"; however, on the basis of the present preliminary investigation, we feel that the test should be used routinely during antenatal care, particularly in cases of borderline elevations of arterial pressure.

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