

# Portable Döppler Modified As a Basic Diagnostic Instrument in Medicine

Panayotis Fantidis\*

*PhD. Cardiovascular Surgeon/ Retired, Spain*

\***Corresponding author:** Panayotis Fantidis, PhD, Cardiovascular Surgeon/ Retired, C/ Sierra Nevada 126, Cotos de Monterrey/ Venturada. 28729 Madrid, Spain, E-mail: pfantidis@yahoo.es, Tel: +34659007066

**Citation:** Panayotis Fantidis (2022) Portable Döppler Modified As a Basic Diagnostic Instrument in Medicine. J Vasc Surg Res 3: 102

## Abstract

A limitation of portable Doppler used to date is that the numerical value of the pressures in each arterial studied segment does not appear on the Doppler screen.

This seemingly insignificant limitation is of great importance because if the numerical values of systolic, diastolic, mean (and end diastolic) pressures, obtained in each arterial segment, appear on the screen, then, it would allow us to make the index pressure in each of the carotid arteries/pressure in the radial artery of the arm, which would allow knowing if there is stenosis in any of the carotid arteries and the degree of compromise of cerebral perfusion that may derive from this stenosis

According to the guidelines of the American College of Cardiology, if myocardial perfusion pressure is normal, it is indicative of a low risk of myocardial infarction. Myocardial perfusion pressure is the difference between systemic diastolic pressure and left ventricular end-diastolic pressure. These pressures could be measured and displayed on our modified Doppler screen

These measurements could be done quickly, cheaply, safely, reliably, without complications or risks, in all the subjects who visit their family doctor and nurse, if we had on the Doppler screen the numerical values of the systolic and diastolic pressures of each of the carotid arteries

The modification that we propose is very easy to do with very low economic investment. Our modified Doppler will be so simple to use, that it will be used by nurses and family doctors, who will be the ones who will establish the suspected diagnosis. This will have an enormous positive impact, and great value in the prevention and early treatment of myocardial ischemia, carotid artery atherosclerosis, and peripheral vascular diseases, with the subsequent positive medical, economic, social and professional repercussions.

**Keywords:** Portable Döppler Modified; Limitations; Numerical values of systolic; Diastolic and end diastolic Pressures; Appear on the screen

## Introduction

The portable Doppler or also called pocket Doppler, for many years now has been a very useful work tool among Cardiovascular Surgeons and Vascular Surgeons. Until now, its use was limited to carrying out arterial (the most frequent) and/or venous explorations, fundamentally of the lower limbs.

It is necessary to remember that ischemic STROKE is an insidious disease, which occurs without suspicious symptoms, and when symptoms appear it is when ischemia has affected the function of a part of the brain to a greater or lesser degree. STROKE is the first cause of death in women and the second in men, and has serious social, family and economic repercussions.

Because ischemic STROKE is an insidious disease, it is of vital importance not to limit itself to make an early diagnosis of STROKE, but to be able to routinely control the state of the carotid arteries in all patients who visit their family doctor and nurse, by taking the pressures in the common carotid artery, and the internal carotid artery on both the right and left sides of the neck (CAsP), simultaneously with the measurement of blood pressure in both upper limbs of the patient (ULP).

The question that arises is, why do we have to take CAsP and ULP? It is widely known that the so-called ANKLE/ARM INDEX is usually used to assess the degree of blood perfusion in the lower limbs. Obtaining the systolic blood pressure in the tibial artery in the ankle, for example, simultaneously with that of the radial artery of the arm, the so-called ANKLE/ARM index can be made, which if it is less than 0.9, indicates stenosis in a artery of the limb lower.

So I have hypothesized that if we know the value of the pressures in the target segment of the carotid artery tree and that of the radial artery of the arm, then we can make an index, similar to that of the ankle/arm, which would allow us to know the status of brain perfusion.

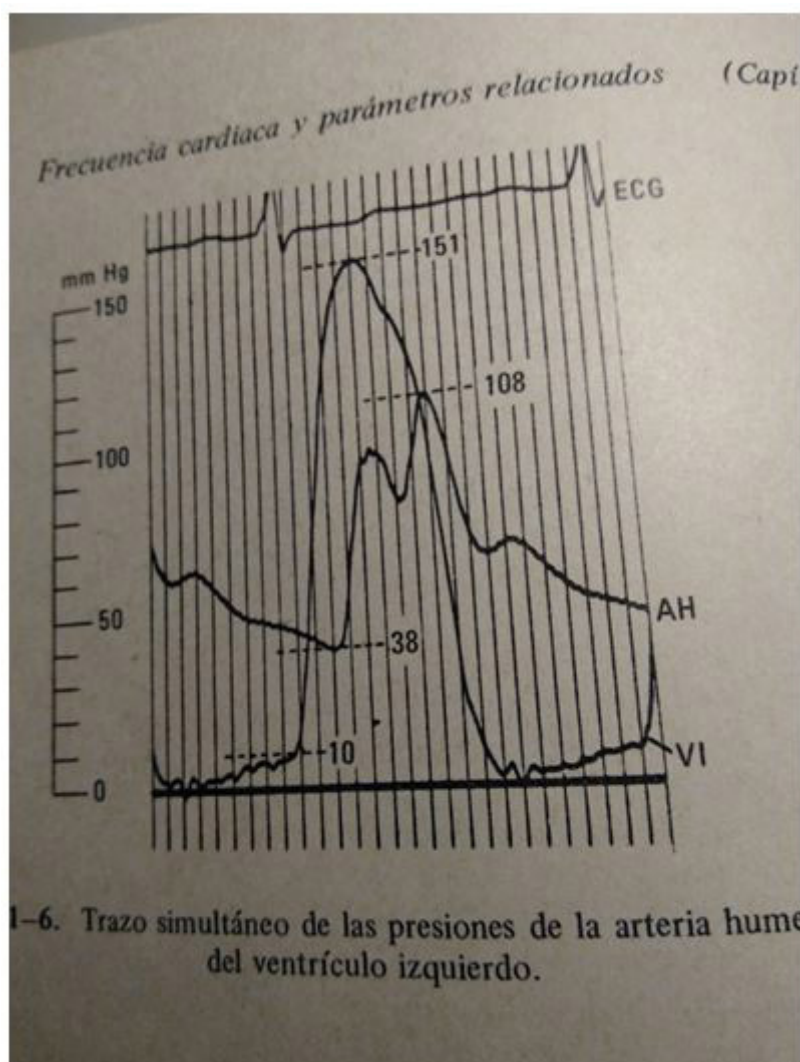
It is widely known that cuffs with manometers are required to take pressure measurements. But, there are arteries, like the carotid arteries, in which cuffs cannot be used to measure their pressure, because, for obvious anatomical reasons, we cannot put a cuff around the neck, to measure CAsP.

The limitation of portable Doppler used to date is that on the screen of the portable Doppler, the numbers that indicate the heart rate and the recording of the arterial pressure curves obtained in each arterial segment appear, but the numerical value of the systolic and diastolic pressures in each arterial segment does not appear on the Doppler screen.

This seemingly insignificant limitation is of great importance because if the numerical values of the pressures, systolic, diastolic, mean (and end diastolic) pressures, obtained in each arterial segment, appear on the screen, then, it would allow us to make the index pressure in each of the carotid arteries/pressure in the radial artery of the arm, which would allow knowing if there is stenosis in any of the carotid arteries and the degree of compromise of cerebral perfusion that may derive from this stenosis.

This could be done quickly, cheaply, safely, reliably, without complications or risks, in all the subjects who visit their family doctor and nurse, if we had on the Doppler screen the numerical values of the systolic and diastolic pressures of each of the carotid arteries.

It is classically known that both pressures, systolic and diastolic, can be measured in the pulse pressure tracing (graphic record of the pressure curve) by means of a graduated card with calibrated scales (see figure). Many years, pressure monitoring equipment and other parameters, except Doppler, has been equipped with a direct reading meter for pressures, which allows the display of numbers corresponding to systolic, diastolic, mean, and end diastolic pressures on the screen.



**Figure Legend:** Systolic and diastolic pressures can be measured in the pulse pressure tracing by means of a graduated card with calibrated scales. Simultaneous tracing of pressures in the brachial artery (AH in the figure), and left ventricle (VI in the figure). Pressure monitoring equipment, as our modified Doppler, can be equipped with a direct reading meter for pressures.

The aim of this manuscript is to suggest that, equipping the Doppler with a direct reading meter for pressures, which is a small and simple technical modification that requires a very low economic investment and can be made to the portable Doppler used until now, we can have a “new” portable Doppler that will have very positive repercussions in the exercise of the medical profession, and very positive economic and social consequences.

## Discussion

### Minimal modifications of the portable Doppler model HADECO SD-45 or similar:

- A) Replace one of the two pencil-shaped probes with a coin-shaped probe. There is currently a coin-shaped probe on the market.
- B) On the Doppler screen, in addition to the pressure curve, the numerical data of the systolic, diastolic, mean and end diastolic blood pressure must appear.
- C) Currently it is technically easy to achieve the objective set out in point B; The Doppler will be equipped with a direct reading meter for pressures, that already exists on the market, and there is a large number of equipment, such as hemodynamic study monitors, intensive care monitors, etc., who are using it regularly.

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## Medical and Social Repercussions of the Modified Doppler

With the use of the modified pocket Doppler that we propose and without the use of cuffs, it will be possible to carry out the:

### I) Evaluation of the Arterial and Venous Tree

I.1). The diagnosis of systemic arterial hypertension without cuffs and noises caused by the inflation of the cuff, which in many patients produces the so-called “white coat” syndrome, which consists of a more or less sudden rise in blood pressure caused by the mere fact of taking the pressure measurement, such as is done to date.

I.2). Taking pressures, much easier, comfortable and safe, without the use of cuffs in the radial or brachial artery, and in those of the lower and upper limbs:

I. 2.1.) Lower limbs (from the common femoral arteries to the tibial ones), and determine the:

The common femoral artery-brachial index.

The superficial femoral-brachial index,

The popliteal artery-brachial index,

The pedal artery-brachial index

The posterior tibial-brachial index

I.2.2) -Upper limbs (from the brachial artery to the superficial palmar arch and the interdigital arteries), and simultaneously measure the blood pressure in each segment of them and compare it with the contralateral, which would allow evaluating:

A) If there are anatomical lesions in the right brachiocephalic trunk: the blood pressure in the right upper limb will be lower than in the contralateral.

B) If there is stenosis, or coarctation in the aortic arch: blood pressure in the left upper limb will be lower than in the contralateral.

C) If there is involvement of the interdigital arteries, which would suggest probable Raynaud’s disease, or patient with diabetes (the latter requires further research).

I.2.3). Much more important and innovative, taking pressure in the carotid arteries and making the:

The right common carotid-arm index

The right internal carotid-arm index

The left common carotid-arm index

The right internal carotid-arm index

I.3) All of the above will allow the diagnosis of well-founded suspicion of arterial vascular disease of both the arteries of the lower and upper limbs, as well as the carotid arteries on both sides (right side and left side of the neck).

The indices of carotid arteries-arm will have a transcendental importance in the prevention of STROKE. The patients, in whom the suspected diagnosis is established with our modified Doppler of partial obstruction of any of the carotid arteries, will be referred to the corresponding specialist, who will assess and establish the appropriate medical and/or surgical treatment.

## **II) The Modified Pocket Doppler as a Substitute for the Stethoscope.**

For this purpose, only the coin-shaped probe would be used. This probe would be placed first in the so-called mitral focus, then in the tricuspid focus, later in the aortic focus and finally in the pulmonary focus. In each one of the foci of the heart, the noises of several cardiac cycles, caused by the opening and closing of each of the heart valves, would be heard, and simultaneously the graphic record of the same would be made.

The foregoing would allow us to know, through the characteristics of the sound and those of the graphic record, the functioning of each of the heart valves. The graphic record in combination with the listening of the heart sounds in each cardiac focus, would provide us with more than enough data to establish the suspected diagnosis about whether or not there is valulopathy and which valve or valves are affected.

## **III) The Modified Pocket Doppler and Assessment of the Global Coronary Blood Flow**

Coronary flow depends on perfusion pressure and coronary resistance. In turn, myocardial perfusion pressure is the difference between systemic diastolic pressure (Normal values; 70-95 mmHg, mean value 80 mmHg), and left ventricular end-diastolic pressure (Normal values; 5-12 mmHg, mean value 9-10 mmHg).

To obtain these pressures the pencil-shaped transducer, is placed in the aortic focus and the coin-shaped one under the left breast.

If the diastolic pressure in the aorta decreases (in severe aortic insufficiency, arteriovenous fistulas, very high fever), it could favor or precipitate the development of myocardial ischemia.

Elevated end-diastolic pressure decreases myocardial perfusion pressure, which can lead to myocardial ischemia. Likewise, myocardial ischemia and myocardial hypertrophy cause a greater increase in end-diastolic pressure, which further compromises perfusion pressure.

According to the guidelines of the American College of Cardiology, if myocardial perfusion pressure is normal, it is indicative of a low risk of myocardial infarction (Reference 1).

## **iv) The Use of the Modified Doppler in Pregnant Women**

The use of fetal Doppler is more and more frequent in order to monitor the heart rate of the fetus on an outpatient basis, both by the midwife and by the pregnant woman herself.

With the Doppler modified by us, the coin-shaped transducer will be placed in the pregnant woman's abdomen and the other in the pregnant woman's radial artery.

## **Conclusions**

For the first time the indices of common carotid arteries/radial artery, and internal carotid arteries / radial artery of the arm, will be made, which would be of great medical, economic, social, and scientific importance.

In the same way, examination of the function of the heart and evaluation of cardiac perfusion pressure by family doctors and nurses would be of great importance in the early diagnosis of heart valve dysfunction, in the evaluation of heart function, and in the prevention and early diagnosis of myocardial ischemia.

It would be the first time that the arterial pressure of the fetus would be routinely known during the whole intrauterine life.

The simultaneous measurement in the pregnant woman and in the fetus of both the systolic and diastolic blood pressures and the heart rate, will allow the disappearance of confusions about such heart rate or such pressure, belongs to the fetus or to the pregnant woman.

### **Potential Market**

In addition to specialists in Cardiovascular Surgery, Angiology and Vascular Surgery, Neurologists, and Cardiologists, Gynecologists, all Family Physicians and Nurses in Health Centers could become regular users of the modified Doppler proposed by us.

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## References

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