The measurement of the aortic blood flow (ABF) is being used more and more frequently, as complementary support for the hemodynamic monitoring in anesthesia and in intensive care [1,2]. An appropriate, objective, continuous and precise measure of the ABF value, contributes to obtaining useful and necessary information for real interpretations of the pre- and the afterload and the contractility variations.

Keeping in mind that at the same time these variables condition the flow regulation, they constitute a whole nucleus, where only its global integration in a hemodynamic profile will allow approaching the process of a correct diagnosis based on objective data [3].

The ultrasound techniques, Doppler effect alone [4] or associated with an Echo scanner [5], have been used to this purpose, for several decades. Transesophageal ultrasound has made it possible to solve some of the methodological problems. Based on the use of this modality and ultrasonography, several systems have been proposed for monitoring the ABF.

Our clinical experience is based on the daily use in the anesthesia and intensive care of over more than 10,000 patients monitored with a device developed at the Unit 280 of the INSERM in Lyon, France [6]. The Dynemo was the commercial version; the manufacturer (Sometec, Paris, France) of this, transferred the rights to Arrow Int. (Reading, PA, USA) and it is now marketed under the name Hemosonic 100.

The ultrasound signals generated by the system serve not only for measuring the ABF, but also for calculating other parameters so to appreciate for example, the quality of the left ventricle contractility [7].

The development of the ultrasound technique applied to the measurement of the ABF is in progress so as to improve the quality of information.

Because we are concerned about this fact, we approach this subject, presenting the follow points:
- A brief analysis of the ultrasound method for the measure of the ABF
- A comment about the errors that can be made with this technique
- An overview of some new solutions to old problems and some future perspectives
- A comment concerning the interest of the parametric association for the evaluation of the left ventricle contractility variation.
Aortic Blood Flow: Principle of Measurement

The Austrian physicist Christian Johann Doppler (Salzburg 1803-1853), describing the phenomenon that even today carries his name, introduced a method, allowing measurement of the velocity of moving particles in space. The measurement of the frequency variation between the length of an emitted sound wave and that measured on the beam reflected in the target, recovered by a sound-sensitive source, allowed the velocity to be calculated.

The mathematical expression of the Doppler principle is summarized in the following formula:

\[ V = \frac{C \times \Delta f}{2f_0 \times \cos \theta} \]

where \( \Delta f \) = frequency variation of the reflected wave; \( f_e \) = frequency of the emitted wave; \( \cos \theta \) = cosine of the angle of impact of the emitted wave and the reflected one on the longitudinal axis of displacement of particles in movement; \( C \) = speed of ultrasonic sound distribution in a specific middle (blood = 1520 m/s); \( V \) = speed of particles in movement.

If, thanks to a Doppler transducer, we know the emission and reception frequency of an ultrasound beam, we can easily calculate the velocity of displacement of a particle reflecting this beam. But, used alone, a Doppler system only allows measuring the velocity of a particle contained inside a pipe or a vessel, including the red cells.

The Doppler system does not measure a flow if we do not know or if we do not calculate the section of the pipe or of the vessel in which particles are circulating.

In the case of a container with a circular section it is enough to measure the diameter (D) to calculate the section:

\[ \text{Section} = D^2 \times \pi/4 \]

By definition, the flow (Q) in function of the time (t) is equal to the section (S) multiplied by the velocity (V).

\[ Q(t) = S(t) \times V(t) \]

Several systems have been proposed to measure flow by the transesophageal route (the Datascope, the Lawrence or the Abbott (ODM), actually EDM-Deltex, USA) [8], and all of them were provided only with a transesophageal Doppler probe.

None of these systems was able to satisfy the hopes of clinicians, because none of them integrated the measure of the aortic diameter and the blood velocity for the calculation of the flow. They used only an approximate value of the aortic section, estimated according to tables based on size, sex, weight and corporal surface,