A recurring task in the work of a clinical cardiologist is to quantify the degree of mitral regurgitation in patients with valvular incompetence. Its relevance in establishing surgical indications and providing a prognosis for patients with several types of cardiovascular disease makes the attempt to improve the measurement of regurgitant flow in these patients essential. Several clinical signs and invasive/noninvasive methods have recently been used to this end.

The introduction of Doppler color flow mapping several years ago enabled the visualization of cardiac flow. The different types of flow found in the cardiac cavities—normal anterograde flow, shunting, and regurgitant jets—have different characteristics. From this perspective, studying regurgitant jets has obvious diagnostic and prognostic relevance. However, hopes that it would be relatively simple to measure regurgitant lesions with this technique soon proved false. All the methods used to measure the severity of valvular regurgitation by measuring the jet or attempts at reconstructing the jet from several planes have proven difficult. It is now clear that the appearance of turbulent jets depends on factors different from regurgitant flow, while the influence of instrument settings, driving pressure and so-called wall jets is well known. From the point of view of hydrodynamics they have intrinsically different magnitudes because the regurgitant jet includes extra fluid belonging to the receptor chamber and the amount depends on the driving pressure for a given regurgitant volume.

In any case, the clinical use of semi-quantitative measurements of regurgitant flow—which enable analyzing the jet, even by simple visual estimation—is undeniably useful and can be validly compared to far more refined methods. Thus, it continues to be the most commonly used method in our setting, not only for the rapid measurement of valvular regurgitation, but also for prognosis by using both the measurement of the jet’s dimensions and the visual estimation mentioned, where the operator combines a series of already known data into the evaluation process.

On the other hand, theoretical work on fluid behavior and the need for a quantitative approach (more comprehensive and reliable measurements) have led to the study of two new methods for measuring regurgitant flow: momentum analysis and flow convergence. Both techniques enable calculating maximum flow, regurgitant flow/beat, and regurgitant flow. It must be mentioned again that, in all these cases, the calculations not only reflect the severity of valvular regurgitation, but also the patient’s current hemodynamic situation, which can vary.

Momentum is the physical parameter that provides the best description of jet patterns. Two methods have been used to calculate this. The first uses the property of dynamic similarity of the jet. This method involves intrinsic difficulties in practice, the first of which, breathing, can be overcome; second, there is the phenomenon of intrinsic flows that impinge on the measurement area; and, third, there are also practical difficulties involved in aligning the Doppler beam with the central jet, which is hindered by cardiac motion and turbulence. The calculation of Um (central velocity of the jet) seems even more difficult to solve and, in the case of wall jets—which are involved in a considerable number of patients—early transfer of momentum before it is fully developed makes it unquantifiable.

The second method for quantifying momentum—where the information on velocity coded in the pixels has a proportional weight, in contrast to the binary...
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accepted that convergent flow area is barely affected by the local geometry of the valve, which in many cases, is different from the shape described by the theory of conservation of mass, the instantaneous flow through the orifice can be calculated as the product of the velocity of one of these isolines multiplied by its surface area. Based on this, the concept of regurgitant orifice was introduced in the 1990s, from which, similar to what occurred regarding valvular stenosis, the magnitude of the regurgitant valve lesion can be calculated relatively independently of the hemodynamic situation. This interesting idea has clear clinical and surgical implications and continues to be of undeniable conceptual value, leading to useful contributions and new approaches to calculation and follow-up. Its measurement is simple and has excellent correlation with the regurgitation fraction, both in the mitral and tricuspid valves, and is also demonstrably more stable than volume measurements regarding clinical follow-up.

However, there are problems inherent to the method for calculating the regurgitant orifice, for example, the local geometry of the valve, which in many cases, is different from the theory described by theJournal of the American College of Cardiology, Vol. 78, No. 7, 2016

REFERENCES


