The edge-to-edge (E-to-E) technique (also called Alfieri stitch) has been introduced by us in the armamentarium of mitral valve repair in the early 1990s, as a simple method to conveniently correct mitral regurgitation (MR) in the presence of complex lesions [1].

The current role of the E-to-E repair in the surgical treatment of MR has been recently analyzed in a review article, where the technical aspects of the operation, the indications, and the surgical results are extensively reported [1].

Many years ago, we predicted that the E-to-E repair, due to its simplicity, could open the perspective of percutaneous correction of MR [2]. The prediction became reality, and nowadays the E-to-E concept is the basis of the currently most widespread and successful catheter-based method of correcting MR. From a historical perspective, this is perhaps the greatest merit of the E-to-E technique.

A number of catheter-based methods to approximate the free edge of the leaflets at the site of the regurgitant jet have been developed over the years.

The mitral clip currently used in the clinical practice represents the evolution of early grasping prototypes and the final result of numerous developments in technology [3].

1. Lessons from surgical experience

Patients with prolapse/flail of a single segment of one leaflet can be optimally treated with the E-to-E technique associated with annuloplasty. This type of surgical repair in this anatomical setting offers long-term results which are better or at least comparable to those provided by other methods of mitral valve reconstruction in terms of freedom from reoperation and recurrence of significant MR [4].

Similar results can be obtained in patients with bileaflet prolapse when the prolapse is involving facing segments [1].

The E-to-E technique is also conveniently used in the setting of advanced dilated cardiomyopathy with functional MR. When substantial apical tenting is present (coaptation depth >1 cm), the Alfieri stitch, added to the undersized annuloplasty, increases the durability of mitral repair, providing a higher freedom from recurrence of MR compared with that of patients submitted to isolated undersized annuloplasty [5].

The E-to-E repair is not carried out in the presence of multiple lesions and/or regurgitant jets. Contraindications also include MR in the context of rheumatic valve disease.

In our entire surgical experience, clinically significant mitral stenosis has never been detected immediately after the operation or later in the follow-up. Artificially created double-orifice valves follow a physiologic behavior during exercise with a good valvular reserve in response to the increased cardiac output [6].

The absence of annuloplasty definitely leads to accelerated failure of mitral valve repair. As a matter of fact, the surgical experience reveals that freedom from reoperation is remarkably lower when annuloplasty is, for some reasons, omitted [2]. The reduction of the annular size increases the coaptation surface of the leaflets and prevents subsequent annular dilatation. In a computational model, we have been able to demonstrate that a reduced annular dimension produces beneficial effects on the stresses exerted on the connecting suture and on the entire valve structures [7].

In summary, the E-to-E repair is applicable and effective in appropriately selected patients with organic (degenerative) and functional MR. The newly created double-orifice configuration is able to restore a competent valve without a restrictive effect on the transvalvular flow at rest and during exercise. A concomitant annuloplasty represents a key factor for the long-term durability of the E-to-E repair.

2. The current role of the mitral clip

To define the role of the mitral clip procedure in the current clinical practice, the surgical experience with the Alfieri stitch has to be considered, particularly with regard to patient selection and postoperative outcome. In addition, the data from the EVEREST (Endovascular Valve Edge-to-Edge REpair Study) studies and from the rapidly growing clinical experience in Europe have to be carefully evaluated [8,9].

It has been clearly shown that the mitral clip procedure is relatively safe and generally well tolerated even by patients in poor clinical conditions, with serious comorbidities and/or severe left ventricular dysfunction. On the other hand, the
clip reduces MR less effectively than mitral valve surgery, and late recurrence or worsening of MR is more likely to occur after the procedure. It has to be recognized, however, that in morbid patients with severe MR, some reduction of MR provides meaningful clinical benefit. The applicability of the mitral clip procedure is limited, since precise echocardiographic criteria have to be respected to make a patient eligible [8]. A less rigorous adherence to the criteria of eligibility could allow increased applicability [9]. Mitral valve repair after an unsuccessful mitral clip procedure has been reported in many patients [10], although the preferred surgical option cannot always be maintained and valve replacement is occasionally necessary.

Considering all the above information, the ideal candidate for the mitral clip procedure today is the inoperable or high-risk symptomatic patient with severe MR (organic or functional), fulfilling the echocardiographic criteria of eligibility. Along with rapid advancements in technology and progresses in imaging modalities, indications are expected to expand in the future (Fig. 1).

Improvements in the first-generation device will take place and some of the intrinsic limitations of the current system will be abolished. Furthermore, new sophisticated imaging modalities will be introduced and facilitate the procedure. Importantly, an effective catheter-based annuloplasty method (not available at present) will enhance the effectiveness and the durability of the clip procedure.

3. Conclusion

The Alfieri stitch has been reproduced using a clip inserted percutaneously to approximate the free edge of the mitral leaflets at the site of the regurgitant jet.

The clip system is today by far the most effective and widespread method to correct MR with a catheter-based intervention, and the validity of the E-to-E principle has been confirmed.

The surgical experience accumulated with the E-to-E repair is dictating the patient selection for the clip procedure, and is providing information over the expected late outcome.

On the basis of the surgical data, excellent long-term results can be expected following the application of the clip, if a concomitant effective percutaneous annuloplasty is carried out.

References


Ottavio Alfieri*
Paolo Denti
San Raffaele Hospital,
Via Olgettina 60, 20132 Milan,
Italy

*Corresponding author. Address:
University of Medicine Vita e Salute San Raffaele of Milan,
Department of Cardiac Surgery San Raffaele Hospital Milano,
Via Olgettina 60, 20132 Milan, Italy.
Tel.: +39 02 2643 7109;
fax: +39 02 2643 7125

E-mail addresses: ottavio.alfieri@hsr.it,
alfieri.ottavio@hsr.it (O. Alfieri)