Surgical therapy of organic mitral valve disease: Strategy and outcomes

Tomsic, A.

PART III

TECHNICAL ASPECTS OF MITRAL VALVE SURGERY

Increasing surgical expertise and technical modifications have made mitral valve repair feasible in a wide variety of diseases and, nowadays, valve repair is successfully performed even in very complex cases. Nevertheless, several controversies persist to date, ranging from the optimal selection of repair techniques in specific lesions to the problem of elevated post-repair gradient following an otherwise successful valve repair.

In the case of posterior mitral valve leaflet prolapse, several techniques are available to address this lesion. In general, these techniques can be divided into resection and non-resection techniques. Two recent meta-analyses have allegedly demonstrated superiority of chordal replacement over leaflet resection techniques [1, 2]. Such results do, however, need to be interpreted with caution and put into proper clinical perspective. To achieve the desired goal of reconstructive mitral valve surgery, including restoration of normal leaflet motion, leaflet prolapse as well as excessive leaflet tissue need to be addressed. Excessive leaflet tissue in height (redundancy of leaflet tissue from the annular edge to leaflet free edge plane) as well as excessive tissue in width (redundancy of leaflet tissue in the horizontal plane) need to be appropriately corrected.

Resection and non-resection techniques are not fully interchangeable as the chordal replacement techniques are unable to address excessive leaflet tissue in width. Residual excessive leaflet motion has, in a virtual mitral valve model [3], been shown to result in excessive leaflet stress and might predispose to late repair failure. Therefore, it needs to be addressed at the time of valve repair [4]. With posterior leaflet lesions, the presence and extent of (I) excessive leaflet tissue in height, (II) excessive leaflet tissue in width and (III) abnormal leaflet motion will guide the optimal repair strategy and secure the best results. Generic division into distinctive repair groups with ensuing head-to-head comparison is thus unlikely to provide relevant clinical information but is more likely to result in an unjustified preference for the utilization of a single repair technique. The debate should rather be focused on the utilization of various repair techniques for a specific indication.

An important observation made by the meta-analyses comparing leaflet resection and non-resection techniques was the significantly higher post-repair mitral valve gradient following valve repair with leaflet resection techniques [1, 2]. Non-resection techniques have been proposed to better preserve diastolic leaflet motion while leaflet resection techniques have been proposed to provide diastolic blood flow obstruction. In light of these findings, a prospective randomized clinical trial comparing the results of mitral valve repair with leaflet resection or leaflet preservation (The CAMRA CardioLink 2 trial) is currently being performed [5]. Such observations and results, however, need to be critically assessed before definitive conclusions can be made. The contribution of posterior leaflet motion on diastolic blood flow is less than the contribution of anterior leaflet motion. Moreover, the technical execution of posterior leaflet resection likely plays a crucial role in the preservation of diastolic leaflet movement. In the absence of excessive leaflet tissue, excessive resection of the leaflet free edge might indeed hinder diastolic leaflet opening and result in unwanted flow obstruction and higher post-repair gradients [6, 7]. Even in the presence of excessive leaflet tissue, similar can be expected if excessive leaflet resection is performed. On the other hand, it cannot be expected that a properly sized leaflet resection in the presence of excessive leaflet tissue will result in similar problems. Leaflet resection with subsequent restoration of leaflet continuity might cause leaflet stiffening at the level of the suture line. Nevertheless, this is probably unlikely to have clinically significant consequences.

The problem of elevated post-repair gradients and the clinical consequences hereof have recently gained widespread interest. In addition to the previously mentioned speculation that leaflet resection might result in higher post-repair gradients, controversies regarding the effect of the type of annuloplasty device implanted (in particular full-ring versus partial flexible band) on post-repair gradients have recently emerged [8-10]. Again, the observations being made need to be understood in the light of the limitations of the studies performed. Importantly, previous studies have shown that, in normal hearts, the diastolic mitral valve annular area is primarily related to the length of the posterior annular perimeter that lengthens during diastole [11]. As annuloplasty devices are sized to systolic valve configuration and lack elasticity, the posterior annular perimeter will not be able to lengthen in diastole, preventing the physiologic attenuation of mitral annular area to occur. This is clearly unrelated to the type of device implanted. More importantly, the effect of annuloplasty device on anterior leaflet motion should be

appreciated as the type of device implanted might restrict the diastolic opening angle and hereby obstruct diastolic blood flow [12]. In addition to the risk factors for elevated post-repair gradients, the clinical importance hereof needs to be re-evaluated [13].

The type of repair technique used to perform valve repair in specific lesions might additionally have an important effect on post-repair gradients. Several studies have demonstrated a negative effect of the edge-to-edge technique on post-repair gradients [6, 9]. On the other hand, in case of complex lesions such as commissural prolapse, the edge-to-edge technique might provide a technically appealing alternative, avoiding other, more complex maneuvers and lowering the risk of unsuccessful repair. However, even in the setting of commissural prolapse, concerns on the appropriateness of this technique have been raised [14]. Alternatively, papillary muscle head repositioning can be performed, providing that the continuity of the subvalvular apparatus is preserved [15]. The patient- and valve-related results of this technique remain, however, scarcely studied.

Mitral annular calcification remains a challenging entity despite growing surgical expertise. In patients with degenerative mitral valve disease it can be expected that the weight of the problem will decrease as a result of earlier referral for surgery. In these patients, annular calcification is a multi-phase process that is believed to develop as a result of excessive mechanical stress exerted by the annulus [16]. Early surgery might therefore constrain disease progression by reducing excessive annular stress and thus eliminating the underlying pathological substrate. Nevertheless, a proportion of patients will present with advanced annular calcification. A repair-all strategy in these patients is questionable as even in experienced centres the results of valve repair for complex valve abnormalities might not be superior to the results of valve replacement [17]. The repair all strategy in these patients needs further evaluation.

In reconstructive mitral valve surgery, the underlying disease might render native leaflet tissue unsuitable for a durable valve repair to be performed. This is commonly seen in patients with infective endocarditis where valve replacement remains performed in many cases. In selected patients, however, leaflet patch reconstruction might offer an alternative to valve replacement. In such cases, destructed native leaflet tissue is replaced by autologous or heterologous tissue. However, the materials used differ from native leaflet tissue and have been shown to be prone to retraction and calcification [18-20]. Moreover, in the case of heterologous materials, an immune response to the implanted tissue can occur and result in repair failure [21, 22]. While valve repair with

patch techniques offers a promising alternative to valve replacement, patch degeneration can limit the expected clinical benefit of valve repair and has, in the case of certain patch materials, even been shown to result in an unacceptably high rate of valve reintervention [21]. Therefore, new patch alternatives as well as critical evaluation of their performance in the setting of reconstructive valve surgery are needed.

These aspects of reconstructive mitral valve surgery will be studied and discussed in the following chapters.

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