

Respect or resect in Barlow disease.

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Abstract

Mitral regurgitation in Barlow disease may still be challenging to be repaired . Most often it involves the posterior leaflet . Many techniques and concepts are currently available ; the main goal being to restore a good surface of coaptation . Basic principles such a thorough analysis is still required whatever the approach to assess excess tissue height , width and prolapse . Nowadays it seems that two different ways of treating mitral prolapse coexist : the non resection one and the resection one . Both will be discussed and analysed . Similarly the use of artificial chordae seem to have a preponderant role to support the free edge and correct a prolapse . Native secondary chord transfer are easy and reliable but seem abandoned by many . Anterior leaflet prolapse is also dealt with and fewer options are available to address this leaflet . Then commissural prolapse is mentioned . It is an important area of the valve which should deserve better treatment than commissuroplasty . Finally a special entity will be described ; mitro annular disjonction . The approach is not or no longer an issue as only good long term results are important in an era where per cutaneous therapy is the only non invasive technique .

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Introduction

Mitral valve repair (MVR) is recognized as being the best treatment for severe mitral regurgitation, especially when degenerative[1] . Since the beginning of MVR, many options have been advocated. From the wide quadrangular resection by Carpentier to the triangular resection by the Mayo Clinic. Overall, the general trend is to resect, but less than previously - to avoid tension and not to plicate the annulus. Then came the option of not resecting at all, as opposed to resecting. It is sometimes obvious that in dystrophic mitral regurgitation with a thin ruptured chord no resection can be a good option as there is no excess tissue. On the contrary, a typical Barlow shows excess tissue, and even coexisting areas with prolapsed tissue and billowing tissue with no prolapse. MVR should not follow any dogma, but just make sense. The aim of any repair is to achieve a good surface of coaptation, with the smoothest surface possible. Coaptation height should be assessed in every repair at the end after weaning from by-pass as it is a key issue for long term durability.

« Resect or respect » concepts are not in opposition: they just do not apply to the same patients. Those who favor the “respect rather than resect” do resect whenever needed, and those who resect do “resect with respect” and do not plicate the annulus , which in the real world does not oppose as much as one would believe, one technique to the other. It seems also fair to mention that there are few long-term results with longitudinal follow up beyond 10 years, and that those published refer if not all to the resection philosophy.

The Resect with Respect Concept

Resection depends on the lesions found at echocardiogram and then during surgery. Barlow etiology concerns usually younger patients, with some various degrees of excess tissue and sometimes some annular and leaflet stiffening or calcification. The Posterior Leaflet (PL) is most frequently involved in around 65 to 75% of the cases; both leaflets, PL and Anterior Leaflet (AL), in 10 to 15% of the cases and the remaining involves the AL alone. The resection may apply to the PL most frequently but can be discussed in the AL as well.

Resection has many aims:

- 1) to reduce the amount of stiff, irregular, non-pliable excess tissue,
- 2) to reduce the surface of the leaflet, which is the major component of excess tension,
- 3) to eradicate annular and/or leaflet calcifications.

As already mentioned previously, the annulus is not plicated and subsequently resecting does not imply in any way the use of smaller rings as opposed to the non-resection strategy; the size of the annuloplasty ring being measured accordingly to the surface of the AL, not involved in the resection. Resection is sometimes mentioned, as a break off all ties strategy, but provided there has been a proper teaching and experience with this option, there are no such concerns; moreover it would look strange to favor no resection only to avoid a secondary lack of tissue! We have published elsewhere [1] that when facing a Barlow, there are 3 questions to be answered: is there any excess height, is there any excess width, and, finally, where is the prolapse located?

Posterior Leaflet

Εξέσος ηειγητ (φιγυρε1 α 2)

Excess height is the most common lesion of P2 and sometimes of P1 and P3. In a normal Mitral Valve (MV), P2 is only slightly higher than P1 and P3, if not at the same height. The excess height going along with billowing is the result of the pathological process. The good closure line should not be in the middle of the mitral orifice but divided at 2/3 for the anterior leaflet and 1/3 for the posterior leaflet, if not 3/4 and 1/4, and it should be regular. To achieve these goals, one has to reduce P2 height. The aim is to reduce the height by performing a resection of P2. Resection location takes place at the level of the pathological process, either at the free edge when chordae are ruptured or elongated, or at the annular level in case of billowing without prolapse or in case of annular calcification. Resection can be of various shapes: it can be triangular; it can be at the free edge transversally; it can follow a resection close to the annulus at the hinge of the leaflet which is then reattached after a regular or an irregular resection creating a sort of sliding plasty, or it can be very symmetrical using a resection and a double sliding such as in the “butterfly technique”. By doing a transverse resection (wrongly called “hair cut technique” [2]), only the excess height is being addressed. Some techniques, such as the sliding plasties or the butterfly technique [3], can address both the excess height and some excess width at the same time. Similarly, the triangular resection may, in limited and favorable pathologies, take care of both the excess height and the excess width.

If the free edge does not show any pathological process (no prolapse, no elongated or ruptured chordae but most often in such instances a billowing of P2), we then address the issue of leaflet height by reducing it at the annular level. We detach the leaflet from the annulus, resect some leaflet tissue and re attach the leaflet to the annulus without any transverse displacement. This is what we call a “false sliding”. We also use this maneuver in case of a pathological process at the annular level such as a calcified annulus which requires decalcification (Figure 2).

Excess width (figure 3)

Excess width was emphasized in our 2006 publication [2] when we advocated to use small triangular resections to treat excess width; the concept was later also reinforced by Perier [4]. As stated, the purpose of addressing excess width is to create a smooth surface of coaptation, by eliminating the folding of thickened tissue. In his discussion section, Perier confessed that up to 35 % of cases required triangular resection due to excess tissue in width [4]. In comparison, we usually resect the width in most of patients (around 75%). When the rough zone has been resected, the transverse excess tissue becomes obvious as the leaflet tissue folds

naturally, at the level of excess width . If the rough zone is left intact, any billowing tissue has both excess height and excess width. Resection is most often triangular with the base of the triangle being at the free edge. Should resection reach the annulus or not? Most reach the annulus and some stop in the middle; none has proven to be superior one to the other. How can a resection be assessed to avoid excess tension? In our opinion, the best criterion indicating that there is not too much resection, is to be able to apply the entire posterior leaflet without any tension along the posterior wall of the left ventricle (a physiological MV never shows such excess tissue as seen in a Barlow).

Prolapse treatment: Gore-Tex versus native chordae (figure 4)

After having resected excess tissue, the new P2 leaflet requires the free edge to be supported, treating thereby the prolapse component either with native chordal transfer or with artificial chordae. Several patients require both. First of all, secondary chordae are often, at the adequate length, when compared to the reference point. The reference point is sometimes not obvious , but rarely and sits at the level of P1 , close to the indentation in between P1 and P2 . Transferring and reattaching them relieves the burden of finding the adequate length which remains an issue when using multiple artificial chordae. We detach the secondary chordae along with some tissue of the ventricular aspect of the leaflet, allowing with a mattress suture of 5/0 monofilament to reattach it at the free edge level. Most often 2 or 3 transferred chordae are sufficient to support the free edge adequately. So far, we never saw such reimplanted chord failing neither at an early stage nor in a later reoperation for another purpose. The number of native or artificial chordae used per patient, in our experience, is rather small when compared to others (mean = 2, range: 1-4; [1]). The reason that our use of chordae, either artificial or native, is limited, is related to the fact that we address only the prolapse and do not intend to address other issues such as excess tissue at the same time.

In our experience the use of native chordae is always preferable to artificial substitutes, however artificial neo chordae are indicated whenever adequate native chordae are not available. When using artificial chordae we take great care not to cross P2 midline , chordae arising from the anterior papillary muscle remain at the level of P1 and at the lateral aspect of P2 , whereas those arising from the posterior papillary muscle remain at the level of P3 or at the postero medial aspect of P2 . We use routinely an interlocked suture to avoid the slippery effect of the artificial chordae and tie them under the tension of the water test to avoid any over correction This being said, others[5,6] use Gore-Tex chords on a regular basis, whether or not associated with resection techniques, and provide good long-term results [5] .

Anterior Leaflet

The AL can be involved either in combination with the PL, or separately. The AL is at the same time more straightforward as the PL, but still a challenge as long-term results of AL repair have been consistently worse than those of the PL. Only recently seems the gap to be filled. Given the important surface of the body of the AL, there could be a need to support more aggressively the free edge when dealing with a prolapse. We use 2 techniques, either papillary muscle repositioning, or artificial chordal support with Gore-Tex 5/0 sutures. Some, such as Tirone David[5] , use multiple loops of Gore-Tex, others as described by Fred Mohr, use predetermined loops coming from one attachment to the papillary muscle [6] . The aim, whatever the technique used, is to correct the prolapse to allow a good coaptation height. Care must be given to avoid overcorrection, which can decrease leaflet motion and create excess tension.

The second issue in Barlow of the AL is whether to resect or not. Carpentier had banned in most cases resection of the AL. As the pathological process includes excess tissue, it could in some cases be an option to remove excess tissue, creating a more suitable AL, and thereby reducing tension on the AL. However, great care must be taken as a restricted AL may create a disaster and an incompetent valve. Experience at this level is key, resection, if performed, should be small, triangular and not create any tension at any cost. Tension on the PL is not good but could be forgiving, whereas tension on AL, due to an inappropriate resection, could not.

Commissural area

The anterior and the posterior commissures are not at all alike. The anterior commissure is rarely involved, mostly as it is well supported by the trigone. On the contrary, the Posterior Commissure (PC) is free of any support and most likely its involvement is underestimated. There are obvious prolapses of the PC, and there are billowing which may seem innocuous but may be favoring with time a recurrent regurgitation due to its weakness.

Given that this area is all supported by many chordae arising from the posterior papillary muscle displacing downwards the adequate head, may correct very easily any posterior commissural prolapse. We have described this idea as a new surgical technique that we called Papillary Muscle Repositioning (PMR) in 2006 [7]. In our experience it is the method of choice to treat AL and PC prolapse, due to elongated chordae and irrespectively of the location of the lesion, with excellent clinical and echocardiographic long-term results.

Alternatively, artificial chordae cannot easily be used as it is the area of the valve which has as the greatest number of chordae. Many surgeons, referring to Carpentier use what they call a commissural plasty or “commissuroplasty” which is a complete closure of the posterior commissure, suturing together A3 to P3. This technique is very fast and simple. It does not promote any coaptation. Whether it is efficient in terms of durability remains to be confirmed. As a comment, Carpentier never closed the PC in Barlows, but described a similar technique in rheumatic patients, for whom the PC required to be reconstructed after complete decalcification reaching the annulus. The PC area was reconstructed by using inverted single sutures for 6 to 10 mm, thereby recreating the PC.

Annuloplasty

At the last stage of MVr, a conventional water test is always performed without annuloplasty ring and sutures. If the water test is not perfect, we seek for remaining problems, but we never rely on the annuloplasty to eradicate a residual leak.

We use annuloplasty rings in all patients (but alternatively, bands from one trigone to the other could be employed) measuring the size according to the unfolded anterior leaflet and always using the upper size in case of a doubt. In our view, an annuloplasty is mandatory to reshape the annulus and to decrease the tension on it. It should be stressed that annuloplasty does not promote coaptation. Coaptation should be achieved before any annuloplasty.

Finally, there are more and more concerns about the use of rings that are too small, creating dynamic mitral stenosis. In Barlow, rings and bands should be at least the same size as the anterior leaflet and probably slightly bigger.

Mitro annular disjunction

Mitro annular disjunction is an entity on its own which combines:

- 1) symmetrical end systolic regurgitation,
- 2) excess tissue of both anterior and posterior leaflets,
- 3) end systolic excursion of P2 out of the plane of the annulus, and
- 4) a very specific kink of the base of the Left Ventricle (LV) due to a lack of ventricular muscle reaching the MV annulus.

This entity is more frequently identified as before, and the two main features are, 1) the kink of the base of the LV just below the PL in end systole, and 2) the features of the regurgitant jet which is all along the closure line and centrally directed. Surgery is sometimes required despite mild to moderate regurgitation. Its syndrome can also be accompanied by malignant ventricular arrhythmias which may explain sudden deaths in relation with ventricular fibrillation. Such patients in their work up should undergo a Gadolinium MRI, searching for a ventricular scar despite normal coronary anatomy and even more specifically a papillary muscle scar. Surgery may eliminate the arrhythmic episodes but not in all cases. Some have suggested cryoablation of the papillary muscle and in other patients a permanent AICD implantation may be indicated.

In some cases, but not all, a simple annuloplasty may be sufficient as it suppresses end systolic motion and the kink of the base of the LV, which in turn eradicates the regurgitation, by bringing back both leaflets into the LV cavity in systole. In some cases, a true repair is required in order to reduce P2 height and avoid a post-operative SAM

Alfieri is currently using in such cases a modified Alfieri stitch, which is a complete running suture between A2 and P2 in the body of the leaflets, leaving 2 orifices at the level of A1-P1 and A3-P3, always associated to a complete ring annuloplasty.

Conclusion

The aims of each and every MVr, whatever the technique used, must be to restore a coaptation height between A2 and P2 of 8 to 10 mm, to restore coaptation depth, to respect leaflet mobility and to achieve a harmonious $2/3 - 1/3$ (even $3/4 - 1/4$) closure line.

The concept of « respect without resection » sounds very appealing as it is easy and fast to perform. Therefore, it has gained further popularity, especially with minimally invasive MV surgery approach .

Our personal opinion is that the « respect » technique's major drawback is related to the tension applied to the chordae as keeping all the pathological tissue necessarily increases the tension on them. In turn, this leads to early failures due to recurrent prolapse with or without chordal rupture or tear of the leaflet.

The coaptation height (which is measured in end systole in between A2 and P2) is never equal to the height of P2. This technique brings an asymmetrical coaptation with the tip of A2, and, therefore, a false sense of security given that one could believe that « the reserve of coaptation » of the new MV is very high.

Another issue with the concept of non-resection is the mandatory pulling of P2 downwards in the left ventricle, so that the indentations become wide open and require closure, as P2 is not at the same level as P1 and P3 anymore. As opposed to this technique the resection technique never open the indentations and their closure is not necessary .

Finally, the ultimate goal of all mitral repair strategies should be to decrease excess tension at each and every level of the mitral apparatus. We therefore believe that oversimplification applicable to all mitral repairs such as artificial chordae and ring annuloplasty is quite appealing but surely not realistic. Moreover, patients need to do well, early and later, in order to keep mitral repair as the gold standard [4]. Little is known about the long-term results of those advocating such simplification. Major recognized surgical teams in the world, showing results with a follow up of 10 years or more and with longitudinal echocardiographic data, use a variety of resection techniques as a key point in the treatment of most degenerative MV diseases (Cleveland Clinic, Mayo Clinic, Toronto General Hospital, Mount Sinai, . . . [8,9,10,11,12,13,14]), as we also do.

Figures

Figure 1 : Surgical strategy used in case of a pathological process at the free edge

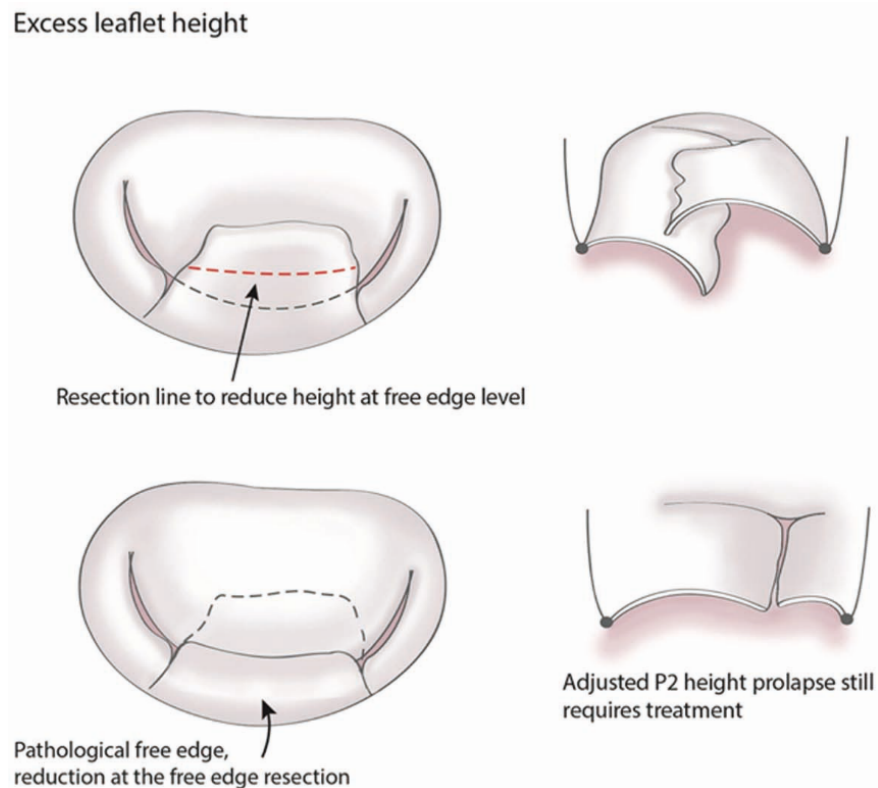


Figure 2 : Surgical strategy used in case of a pathological process at the annular level

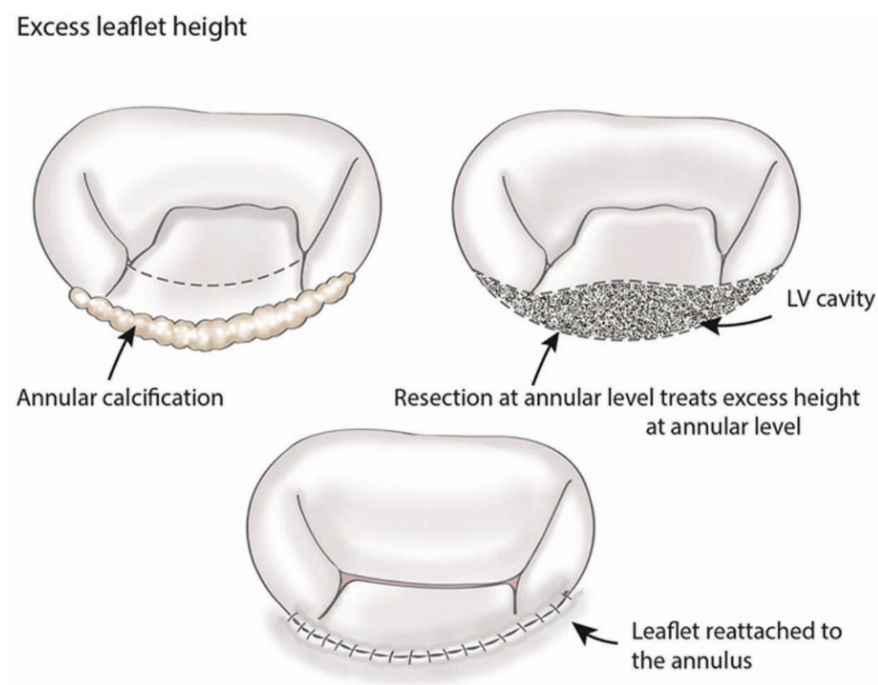
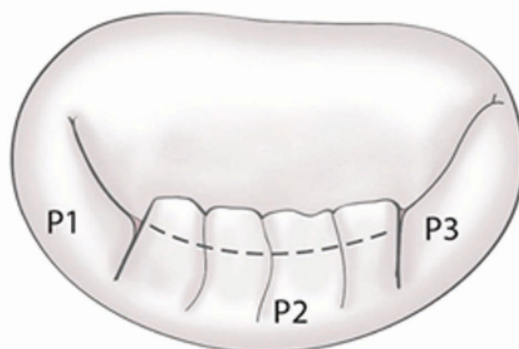
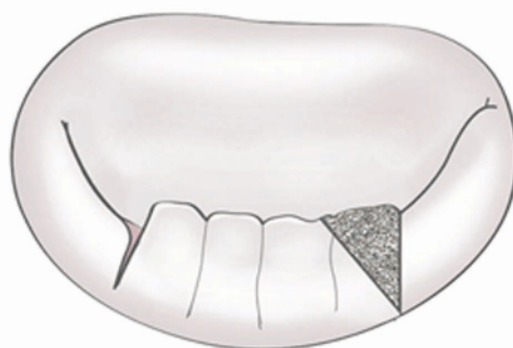


Figure 3 : Surgical strategy used in case of excess width

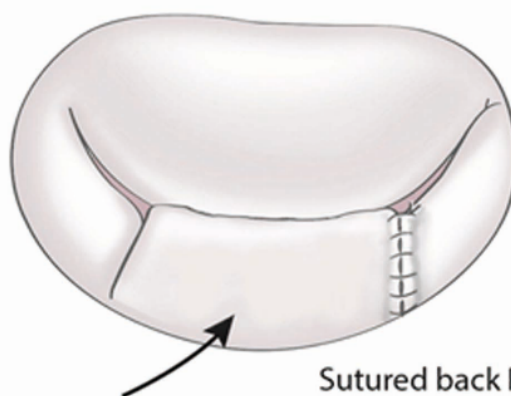
Excess leaflet width



Excess width of P2 issue



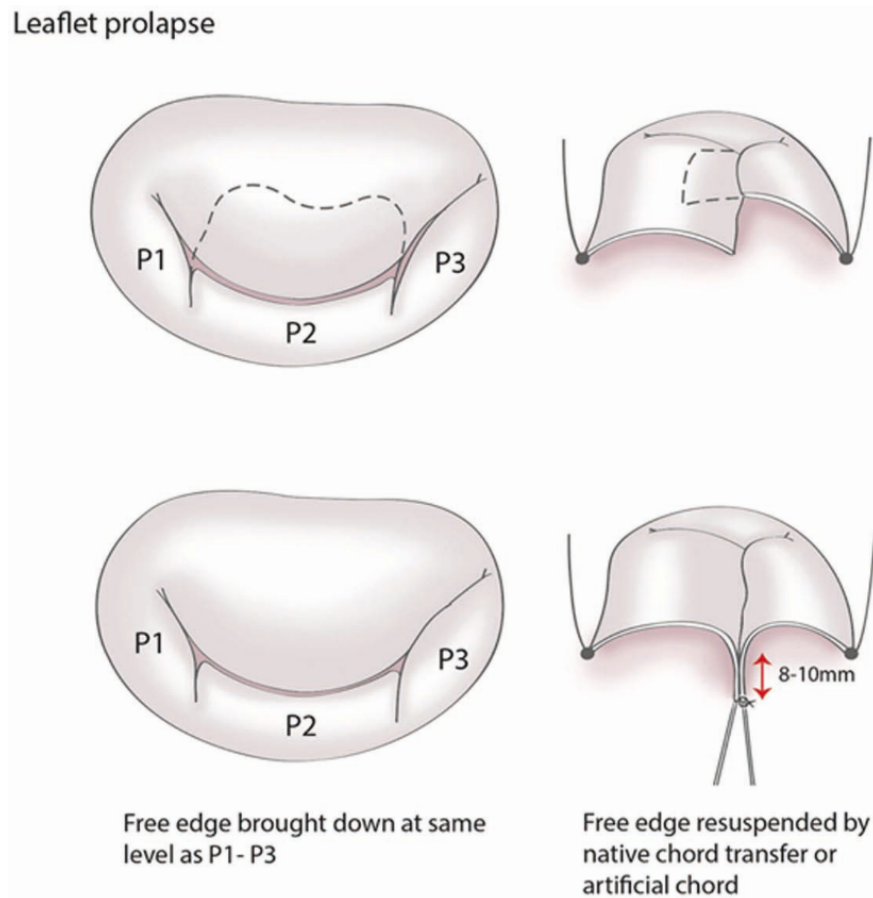
Triangular resection



P2 not under tension but less excess width

Sutured back P2 / P3 with less excess width

Figure 4 : Prolapse treatment



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