How to repair a Myxomatous Mitral valve: Posterior and Bi-leaflet Prolapse

Myxomatous mitral valve disease is the most common cause of mitral regurgitation requiring surgical correction encountered in most Western countries today. There is a spectrum of chordal and leaflet disease from Fibro-Elastic deficiency, with isolated chordal disease, through to extensive, often gross, leaflet disease seen with the Barlow's end of the spectrum. Most can be repaired by correcting chordal abnormalities as well as controlling the height of the posterior leaflet (PML) and the shape and size of the mitral annulus.
Essential to any repair is a pliable anterior mitral leaflet (AML) large enough to fill the mitral orifice and without chordal elongation or rupture. It is important to remember that Barlow's type valves usually have normal length chords and do not require any neochords to be attached to the AML unless there is a superimposed chordal rupture (occasional) or elongation (rare). Any resection of the anterior leaflet should be avoided as this will scar and impair pliability of the AML. Fibrosis, calcification, or infection of the AML will require more complex techniques to repair, and if extensive may be better managed with valve replacement.
The greatest hindrance to valve repair is mitral annular calcification (MAC). If limited it can be left or resected, but if extensive and into the posterior leaflet it will require resection with patching. This may leave insufficient PML to form a caption zone and therefore require replacement.
It is important to remember the aim of the repair: To control the PML to create a coaption zone of at least 1cm with the AML and maintain this with annuloplasty control of valve size and shape.

Pre-op
Transoesophageal echocardiography (TOE) is the gold standard in assessing the mitral valve, and should be performed pre-operatively to allow surgeon to plan operation and provide informed consent to the patient. Review films with your cardiology colleagues, it educates both you and them. Trans thoracic echo (TTE) poorly assesses amount of regurgitation and leaflet pathology and should not be used as sole investigation before recommending surgery to your patient. Assess leaflets for size, pliability, and redundancy, and chords for elongation or rupture. Compare annular size to AML size. Observe direction of regurgitant jet and whether posterior, central, or anterior.
Coronary angiography is important, not just to exclude coronary disease, but gives best assessment of MAC and lets you know position of circumflex coronary and its branches.
A CT Aortogram is important if considering minimal access surgery with femoral cannulation, to assess risks of peripheral cannulation.

Operation
Review TOE. Involve cardiology if uncertain of any features.
Incision and cardiopulmonary bypass as you are familiar and comfortable with. A cardioplgia strategy that suits length of operation and allows for a possible second cross clamp period. If early in your experience use a superior bi-atrial incision that gives the greatest exposure before progressing to smaller incisions.

Valve Inspection.
Confirm chordal lengths/ruptures and measure length of “normal” chords to the PML (often at P1). Assess leaflets for size and pliability. Assess any PML segments taller than 2cm, which will need their height corrected to avoid possible Systolic Anterior Motion (SAM). Check for MAC

Repair Technique
1. Identify and measure length of normal PML chord
2. Identify **all** PML leaflet taller than 2cm and/or with elongated or ruptured chords, leaving a tall segment will create a new prolapse.
3. Determine number of chords needed to replace ruptured/elongated chords and control tall segments (6-8mm apart, usually 4-5 **each half** of PML). Don't just focus on chordal abnormalities.
4. Create neochordal loops with No. 5 GoreTex suture(s)
5. Attach to posteromedial and/or anterolateral papillary muscles, tied over pledgets using knot pusher. General rule is for chords not to cross midline of P2, so often need two sets of loops, one for each papillary muscle head.
6. Attach loops to atrial aspect of PML 1.5cm from the annulus, with 5/0 Ticron taken through twice.
7. Stabilize annulus with rigid band or ring sized on AML. Don't undersize, usually use 34-40mm ring or band. I prefer a band (Medtronic-Colvin Future) as this avoids scarring between base of AML and ring, which can impair long term leaflet pliability. A full ring should be used if unsure of strength of trigonal anchoring sutures.

Result
Mitral valve functions as single mobile AML coapting against a posteriorly placed PML with large >1cm coaption zone

What can go wrong
This technique is objective and very reproducible but errors are still possible. The strength of this technique is that there are no irreversible steps and all can be redone or even changed to another technique.
Assess repair with TOE once off bypass and heart has recovered function and rhythm, and any air bubbles have cleared.
Leaving tall PML segments will create a new prolapse.
Solution: add extra chords
SAM is almost impossible but can still occur. This can happen if the loops are too tall, but easy to fix by shortening neochordal loops with suture around knot at base on papillary head. Use this to fold knot down onto papillary muscle which will shorten complete set of loops
If PML too restricted.
Two options, either use smaller ring or re-attach chords further from annulus.
AML prolapse. This can happen if there is elongated chords to AML (can be hard to assess at start if extensive flail PML). Correct by adding neochords to edge of AML involved.

Patients recover well following repair surgery. I routinely remove the left atrial appendage, but still warfarinise for at least 6 weeks post operatively, if no contra-

indications, and longer if atrial arrhythmias. Pre discharge TTE to confirm repair, as well as assess LV function and exclude pericardial effusion.