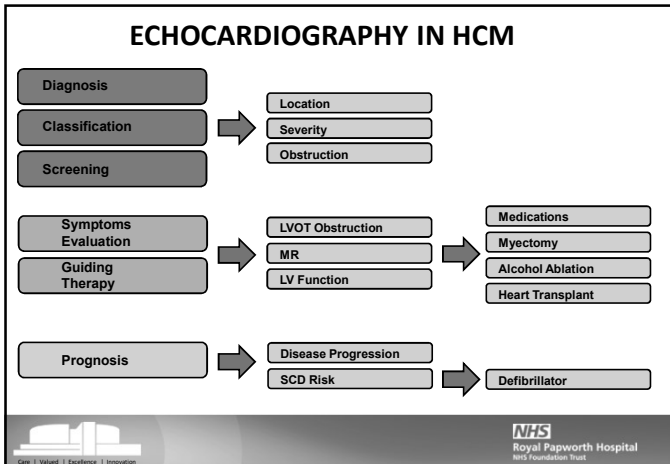
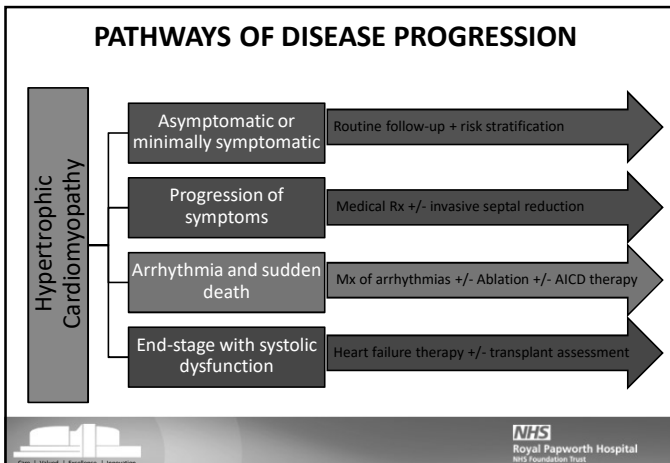


Echocardiography in Hypertrophic Cardiomyopathy: Contemporary Approaches to Management

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HCM AND OBSTRUCTIVE PHYSIOLOGY

Resting LVOTO ($\geq 30\text{mmHg}$)
7.4%/year \rightarrow NYHA III/IV

No resting/ provokable LVOTO ($< 30\text{mmHg}$)
1.6%/year \rightarrow NYHA III/IV

- Major cause of symptoms
- \uparrow risk of progressive symptoms + death
- Target for medical and interventional therapy

No resting LVOTO ($< 30\text{mmHg}$)
Provokable gradient ($\geq 30\text{mmHg}$)
3.2%/year \rightarrow NYHA III/IV

70% of the HCM population have obstructive physiology

Maron MS et al JACC 2016;67:1399-1409

HCM AND OBSTRUCTION

- 1) Medical therapy (beta-blocker/calcium-channel blocker/disopyramide)
- 2) Septal ethanol ablation
- 3) Surgical myectomy
- 4) Dual-chamber pacemaker

INDICATIONS
LVOTO $\geq 50\text{mmHg}$
NYHA Class III/IV despite optimal medical therapy

ECHOCARDIOGRAPHY
Patient selection
Procedural guidance
Assessment of complications

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INTERVENTIONAL IMAGING IN HCM

Role of imaging in septal ethanol ablation (SEA)

- intra-procedural contrast TTE (Class I indication)

Role of imaging in surgical myectomy (SM)

- pre-operative assessment
- intra-operative guidance (Class I indication)
- identification of complications

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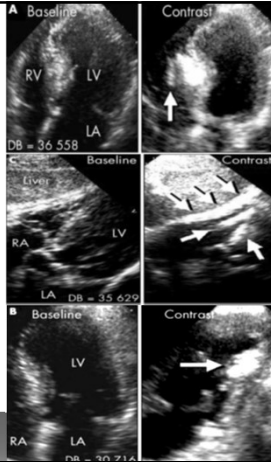
- Identify perfusion of myocardial segments remote from the targeted areas
- Up to 25% of patients demonstrate extra-septal perfusion
- Tends to occur if septal perforator is large (>2.0mm)

****Images in multiple views to identify those remote areas**

-A4CH, A5CH, A2CH, A3CH

-PLAX, PSAX, Subcostal

****7-11% of all procedures are altered based on information obtained from MCE**



BENEFITS OF CONTRAST ECHO IN SEA

- ↓ intervention times
- ↓ ethanol doses
- ↓ rate of PPM-implant post-procedure
- ↑ procedural success rate (LVOT gradient reduction >50%)

Table 2 Comparison of MCE and PBO-guided percutaneous septal ablation

Variable	With MCE (N = 150/150)	No MCE (N = 20/30)	P value
Maximum creative kinase-MB rise (IU/L)	45 ± 13	94 ± 42	<0.01
DPO-Fluorimide implantation rate (%)	5%	17%	.05
Follow-up success rate (LVOTG reduction >50%)	94%	64%	<0.01
LVOTG (post) at 8 months (mm Hg)	9 ± 17	27 ± 24	<.01

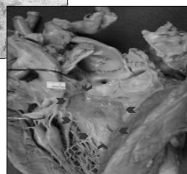
MCE, Intracardiac contrast echocardiography; PBO, percutaneous balloon ablation; LVOTG, left ventricular outflow tract gradient.



Faber L et al. JASE 2000;13:1074-1079



SURGICAL MYECTOMY



- Performed via transaortic approach
- Allows concomitant CABG and mitral valve repair/replacement if necessary
- Intra-operative assessment
- Immediate assessment post CPB to assess adequacy of resection and identify early complications

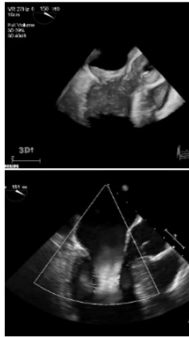


MITRAL VALVE ASSESSMENT

Mitral regurgitation in obstructive HCM

- classically posteriorly-directed
- occurs in mid- to late systole
- secondary to SAM

A non-posterior jet of MR suggests intrinsic mitral valve disease



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MITRAL VALVE ASSESSMENT

Structural abnormalities of the mitral valve are common

Elongated mitral valve leaflets

Degenerative changes

- mitral annular calcification

Leaflet trauma

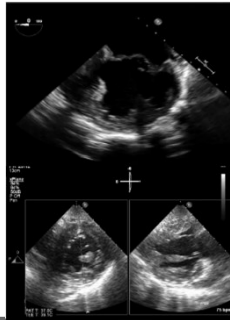
Myxomatous mitral leaflets

Papillary muscle abnormalities

- hypertrophied PM's
- direct insertion of PM into AMVL

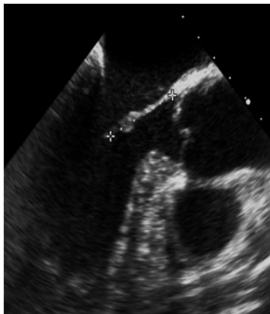
Restrictive chordal and leaflet abnormalities

- shortened calcified chordae
- abnormal chordal insertions
- thickened/tethered leaflets



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MITRAL VALVE ASSESSMENT



ANTERIOR MITRAL VALVE LEAFLET LENGTH

ME-120 view, in diastole

Elongated leaflets result in displacement of the SAM-septal contact point distally – extended muscular resection

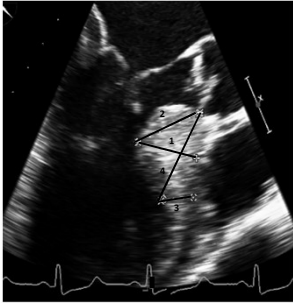
Potential for mitral-septal contact even after myectomy - $\approx 35\text{mm}$ \rightarrow consider plication, especially if MWTH $<20\text{mm}$



Maron MS et al. Circulation 2011;124:40-47

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INTRA-OPERATIVE MEASUREMENTS

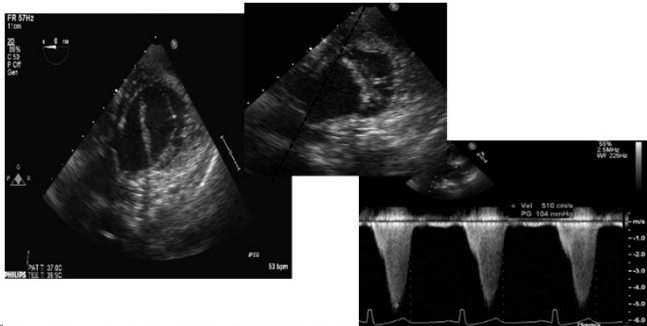


- ME-3CH-VIEW, END-DIASTOLE**
- 1 = maximal wall thickness
 - 2 = distance maximal wall thickness to RCC
 - 3 = distal narrowing
 - 4 = distance distal narrowing to RCC



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INTRAOPERATIVE ECHO ASSESSMENT: GRADIENT



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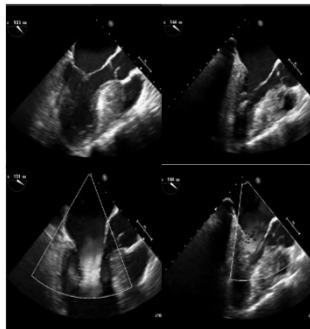
POST-OPERATIVE ASSESSMENT – ADEQUACY OF RESECTION

Residual LVOT obstruction and SAM

- Morphology of LVOT in 2D
- Residual thickness of basal septum

Assessment of LVOT by color Doppler

- Laminar or turbulent flow
- Residual mitral regurgitation

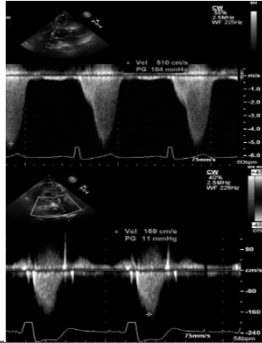


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POST-OPERATIVE ASSESSMENT – ADEQUACY OF RESECTION

LVOT-gradient in deep transgastric view

- gradient >20mmHg after CPB
→ results in significant remaining gradient in the long-term
- provocative maneuvers (induce VPBs, nitro, isoproterenol)



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POST-OPERATIVE ASSESSMENT – COMPLICATIONS

- Ventricular septal defect
- resection too deep
- systolic flow into the RV
- Septal perforator flow
- denuded septal vessels
- flow into the LVOT in diastole
- Aortic valve (?significant AR)



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CONCLUSIONS

Imaging plays a crucial role in patient selection, procedural planning, and optimising outcomes

Intraprocedural imaging minimises the risk of complications, and allows early identification of suboptimal results/complications

Imaging identifies high-risk features and poor prognostic markers to tailor appropriate therapy



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