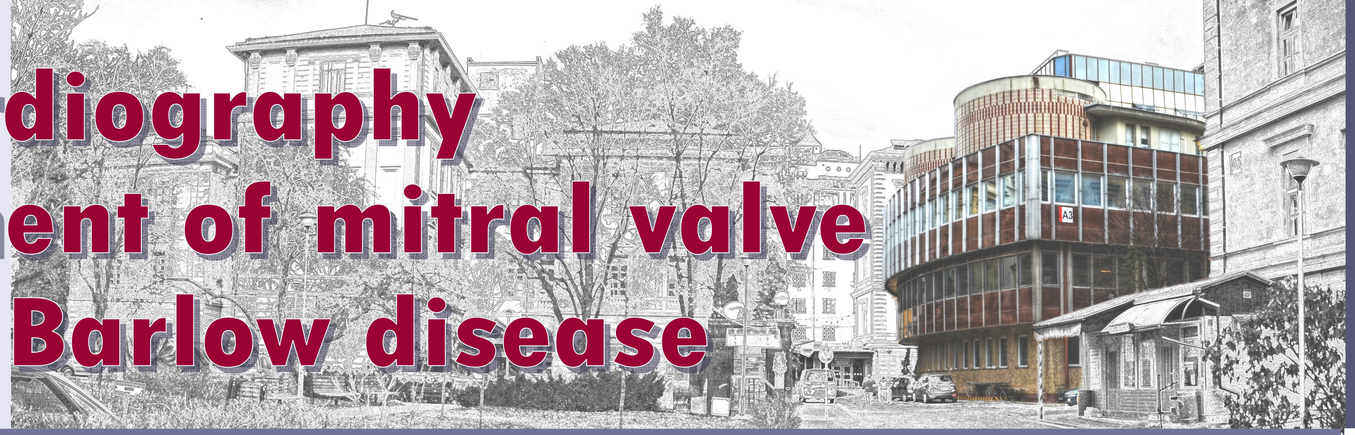
3D echocardiography in assessment of mitral valve kinetics in Barlow disease



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■ Introduction

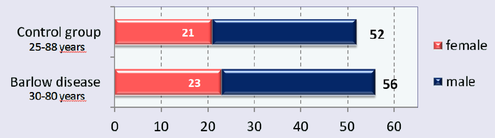
Barlow disease is genetically based abnormality of the mitral valve presented as a floppy valve with tissue redundancy, myxoid degeneration and atypical kinetics of valve leaflets described as "billowing". Morphology of mitral valve in Barlow disease is extremely variable (Fig. 1-4). Exact definition of Barlow disease, based on quantification of specific morphological features, as well as exact criteria for the timing of valve surgery are still missing.

■ Aim of the study

To define and quantify specific morphological features of Barlow disease.

■ Study group

Comprised 56 patients with Barlow disease and significant mitral regurgitation who underwent cardiac surgery in our centre in the years 2008-2013. Control group consisted of 52 healthy individuals.



■ Methods

TEE approach with 3D acquisition of the mitral valve was used in all of them. Bicommissural and anteroposterior diameters of mitral annulus in end-diastole and end-systole (Fig.5) and chordae length in early and end-systole were measured using multiplanar reconstruction. Mitral valve quantification (MVQ) program was used for analysis of end-diastolic and end-systolic mitral annulus height and in patients with Barlow disease for the assessment of "billowing volume", too (Fig. 6). Student t-test was used for statistical analysis.

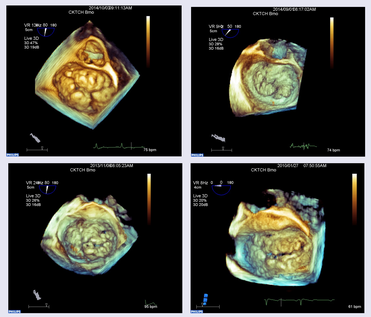


Fig. 1.-4. Barlow disease

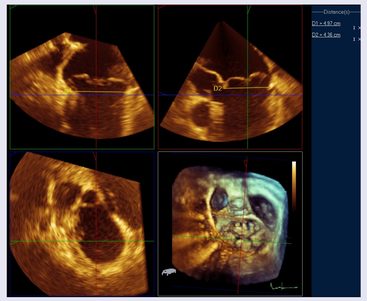


Fig. 5. Measuring of bicommissural and anteroposterior diameters using multiplanar reconstruction

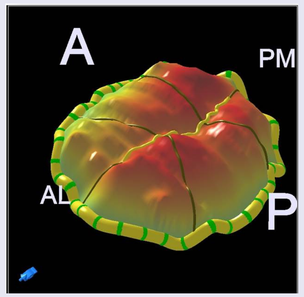
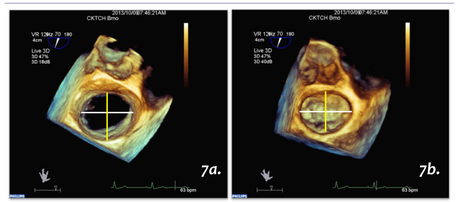
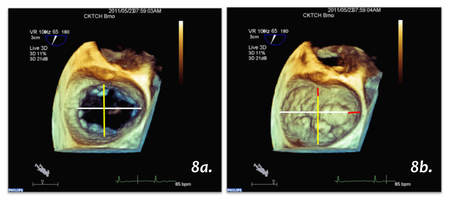


Fig. 6. MVQ program - model of mitral valve



Diastole		Systole
35.96	Bicommissural Ø [mm] +0.94%, p=0.32	36.12
27.60	Anteroposterior Ø [mm] +6.7%, p=0.25	28.94

Fig. 7. Bicommissural and anteroposterior diameter - Controls



Diastole		Systole
41.33	Bicommissural Ø [mm] +17.5%, p<0.001	48.80
35.93	Anteroposterior Ø [mm] +11.7%, p=0.04	39.39

Fig. 8. Bicommissural and anteroposterior diameter - Barlow disease

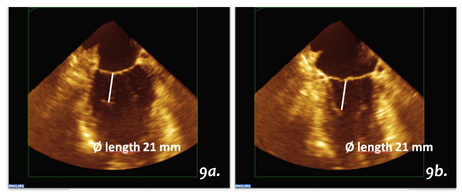


Fig. 9. Chordae length - Controls

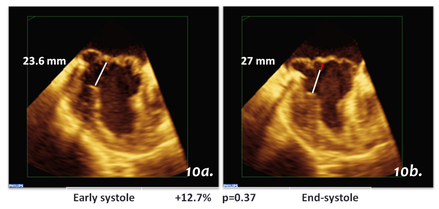
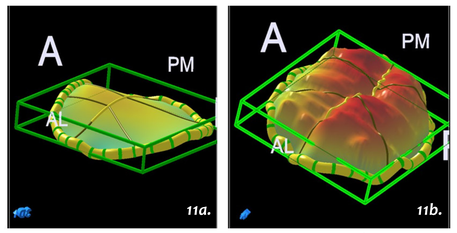


Fig. 10. Chordae length - Barlow disease



Controls		Barlow disease
4.75	diastole [mm] +1.7%, p=0.42	7.58
4.83	end-systole [mm] +20%, p<0.001	9.11

Fig. 11. Mitral annulus height

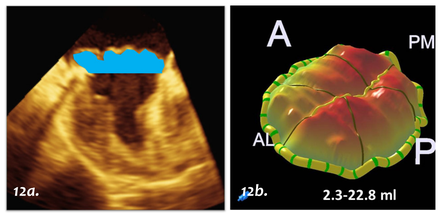


Fig. 12. Billowing with blood retention

■ Results

1. Bicommissural and anteroposterior diameters in Barlow disease were significantly higher as compared to those in normal population. Moreover, in Barlow diasese there was significant increase of both diameters in end-systole (Fig.7a,b and 8a,b).
2. Chordae length is constant in healthy individuals, in Barlow diasese there was an average 12,7 % increase in end-systole (statistically not significant). (Fig. 9a,b and 10a,b).
3. In Barlow disease mitral annulus height is significantly increased as compared to the healthy controls and it varies significantly during cardiac cycle reaching the maximum in end-systole. In healthy individuals it shows only small variations during cardiac cycle (Fig.11a,b).
4. Volume of billowing contains blood retained outside the circulation (amount varying form case to case). This blood retention impacts the circulation in a similar way as aneurysm of the left ventricle (Fig.12a,b).

EDV-ESV = SV + regurgitation volume + volume of billowing

■ Conclusions

Main features for identification of Barlow disease include:

- **Endsystolic dilatation of mitral annulus (both bicommissural and anteroposterior diameters)**
- **Increased mitral annulus height as compared to the healthy population**
- **Significant endsystolic increase of mitral annulus height**
- **Blood retention beneath the leaflets (variable volume) as a consequence of the mitral valve billowing with corresponding impact on the hemodynamics. Individual stroke volume in Barlow disease is decreased not only by the regurgitant volume but also by the retention volume in the space of billowing.**

No conflict of interests.

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