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Letter to Editor

# Modified Parameter of 2D Echocardiographic Wilkins Score for Assessment of Rheumatic Mitral Valve Stenosis -

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## INTRODUCTION

The Mitral Valve (MV) is the most commonly and severely affected (65% - 70% of patients) by rheumatic process by stenosis and/or regurgitation [1]. Percutaneous Balloon Mitral Valvuloplasty (BMV) was introduced in 1984 by Inoue et al [2]. For the treatment of selected patients with mitral stenosis. BMV is a minimally invasive, nonsurgical procedure that has been established in several clinical studies to be a safe and effective therapeutic modality in selected patients with Mitral Stenosis (MS) [3] and is equivalent to or even better than surgical commissurotomy [4]. Unfavourable results of BMV are largely due to unfavourable morphology of the valve apparatus, particularly leaflets calcification and subvalvular apparatus involvement. A mitral valve score has been proposed about two decades ago, based on morphologic assessment of mitral valve apparatus by two-dimensional (2D) echocardiography to predict successful balloon dilation of the mitral valve. Several other scores have been developed in the following years in order to more successfully predict balloon dilatation outcome [5,6]. As regard the subjective nature of the Wilkins score [5,6] for assessment of rheumatic Mitral valve stenosis by 2D echocardiography, I present a novel objective and quantitative echocardiographic parameter for precise selection of patient best treated by BMV in addition to Wilkins score, through measuring free 2D strain and strain rate of both papillary muscles of mitral valve.

### Patients and Methodology

**Exclusion criteria:**

- Patients with Coronary Artery Disease (CAD) and apparent LV wall motion abnormalities.
- Patients with LV systolic dysfunction (EF% < 50%).
- Patients with cardiac rhythm or conduction disturbances such as atrial fibrillation or artificial pacing.
- Patients with concomitant moderate or severe mitral regurgitation, aortic stenosis and aortic regurgitation.

**Each person included in the study was subjected to:**

- Careful history taking and thorough physical examination.
- Standard twelve-lead electrocardiogram: For assessment of cardiac rhythm and features suggesting chamber enlargement and CAD.
- Basic echocardiographic measurement.
- Patients were monitored through a single-lead electrocardiogram.

The left atrial diameter, left ventricular end-systolic and end-diastolic diameters, left ventricular fractional shortening percentage, the thickness of the Inter Ventricular Septum (IVS), and the Posterior Wall (PW) were measured according to the recommendations of the American Society of Echocardiography [7]. The LV ejection fraction was calculated by Simpson's biplane method of disks. Conventional MS indices, such as maximum mitral valve Pressure Gradient (PG) and mean mitral valve pressure gradient (MG) were calculated. Mitral Valve Area (MVA) was measured by mitral orifice planimetry in parasternal short axis view, and by the Doppler derived Pressure Halftime Method (PHT) and the average area was calculated by the mean value of two measurements.MS severity was calculated based on hemodynamic data, using MVA, MG and Pulmonary Artery Systolic Pressure (PAP) as follows: mild MS (MVA > 1.5 cm2, MG < 5 mmHg, or PAP < 30 mmHg), moderate MS (MVA1.0 - 1.5 cm2, MG 5 - 10 mmHg, or PAP 30 - 50 mmHg), and severe MS (MVA < 1.0 cm2, MG > 10 mmHg, or PAP > 50 mmHg). PAP was measured by adding10 mmHg, considering the diameter of the inferior venacava and level of its collapse resulting from respiration, to the value measured by evaluating the Bernoulli equation, which is simplified from tricuspid insufficiency velocities. The valvular insufficiency was evaluated by colour flow Doppler imaging. Measurement of the 2D strain and strain rate: 2D echocardiography images (transmit/receive 1.9/4.0 MHz) were obtained from LV apical LAX,4C, and 2C view switch frame rates of 50 - 90 frames/s. Digital data were stored and analyzed off-line. LV endocardial surface was traced manually, and the speckle tracking width was modified so as to cover the whole LV wall thickness to obtain curves. Peak LV Longitudinal Systolic Strain (LSS) and Strain rate (LSSr) were calculated for apical LAX, 4C, and 2C views, and Global LV Systolic Strain (GLSS) and Strain rate (GLSSr) were calculated by averaging the three apical views, Longitudinal myocardial strain of papillary muscle PMs was evaluated using the free strain method from apical four chamber view for Anterolateral PM (APM) and apical long axis view for Posteromedial PM (PPM) [8]. Patients in whom PM views were visually clear in both systole and diastole were considered eligible for the assessment. Free strain method enables the measurement of user defined custom local velocities, displacement and deformation using unlimited directional chords display technic. This workflow measures strain within the myocardial region, free of restraints on the location or direction of the measurements, which can be radial, longitudinal, and circumferential. Free strain is thought to be an easy, quick and practical method of measuring myocardial deformation. This method may be particularly preferable in measuring the deformation of PMs since these structures are relatively separate from the LV myocardium and are not included in the commercially available LV strain models [8]. In order to measure the longitudinal strain by using the free strain method, a region of interest should be selected by clicking two points manually. The first point was selected from the base of the PM at its attachment zone to the LV wall. The second point was selected from the tip of the PM with special attention to keep a 3-5 mm distance from the chordae in order to avoid artefact. All STE acquisitions were performed at frame rates between 50 - 70 Hz frames per second. The average value of strain was taken from the three consecutive beats. The peak systolic values were recorded for GCS, GLS and longitudinal S of APM and PPM [8]. All the echocardiographic studies were performed by one echo cardiographer and for intra-observer variability, a sample of 2D strain and strain rate measurements was randomly selected and examined by the same observer in two different days and intra-class correlation coefficients for the same observer were calculated.

### Rational for the study protocol

I supposed that the addition of 2D speckle tracking strain and strain rate parameters of both papillary muscles of the mitral valve may increase the value of the traditional Wilkins score of rheumatic mitral valve stenosis assessment specially in the area of grey zone where the Wilkins score is 9 to 11 over 16 as to precisely decide if the surgery is superior to the percutaneous balloon mitral valvuloplasty. So if the papillary muscle free strain and strain rate cut off values were measured and decided where below those values might carry good indication for balloon valvuloplasty and values higher than these cut off values may encourage toward surgery. The rational for assessment of 2D speckle tracking free strain and strain rate of both papillary muscles is that rheumatic affection of the papillary muscles and the underlying fibrosis that may affect the mitral valve apparatus including subvalvular part could involve and extend toward the both papillary muscles which subsequently hinder the free geometric changes and deformation during function of mitral valve.

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