CONFERENCE REPORT (SOFTCOPY)

Section A: Details of Presenter

1. Presenter's name : Mohd Azrul Hisham Bin Mohd Adib
2. ID / Matrix number : 01033
3. Faculty : Faculty of Mechanical Engineering

Section B: Details of Conference

1. Conference name : International Conference on Information and Science Application
2. Date : 26th ~ 29th April 2011
3. Venue : Shineville Resort, Jeju Island, Korea
4. Organiser : Kyeonggi University / Center for Industry Security
5. Title of paper : Analysis of echocardiography images using grid independent technique for patients with MVP
6. Author/s : Mohd Azrul Hisham Mohd Adib, Nur Hazreen Mohd Hasni, P. Oteh Abdul Razak

Section C: Conference Outcome

1. **Panel's comments :**

   Comments from the panel are how I make a grid independence process in the value of data to get the best size and how to analyze the valve size in a state of abnormal condition. In addition, the panel also suggested that try to produce a smaller grid size and data values or the number of patients. So, more comparisons can be made clearer by the results obtained.

2. **Networking (new contract / researches / collaboration) :**

   Get new contacts in related fields such as medical image reading area in graphical (participants from Italy) and the introduction of new software related to the cardio-biomechanics field (participants from Japan and the U.S.)

3. **Presenter's outcome :**

   By participating in this seminar, I gained a lot of benefits which I can identify the scientists from different backgrounds, areas of expertise and also expand the knowledge of being with them. Additionally, experience in presentation sessions, I find it very fascinating Q&A session which can be held in a very interesting moment.

Section D: Report Confirmation

1. Presenter's signature :
2. Date of submission : 12th May 2011

*** Attach a copy of research paper together with the report. Thank you.**

Analysis of Echocardiography Images Using Grid Independent Technique for Patients with Mitral Valve Problems (MVP)

Mohd Azrul Hisham Mohd Adib
Faculty of Mechanical Engineering, Universiti Malaysia Pahang, Pahang, Malaysia.
azrul@ump.edu.my
Nur Hazreen Mohd Hasni
Department of Surgical, Hospital Tengku Ampuan Afzan, Pahang, Malaysia.
P. Oteh Abdul Razak
Department of Cardiology, Hospital Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia.

***Abstract* – With echocardiography images collected by a transthoracic transducer, can be used to evaluate the mitral valve problems. Incorrect surgical of mitral valves failure will cause death and the surgical repair can be improved by knowing the correlations between backflow and the rigidity of mitral valve. In this study, a nearly method for identifying the mitral valve rigidity from two-dimensional (2D) images of echocardiography is presented. This method employs the grid independent technique. Systolic and diastolic stages of mitral valve condition were investigated by 10 patients with MVP. The results show linear correlation between degeneration of the valves and volume of backflow. The findings are the prediction of the behavior of the mitral valves and blood flow which can assist the medical practitioners in their decision on the patients' treatments.**

***Keywords* –** *Echocardiography; Mitral Valve; Degeneration; Systolic; Diastolic.*

I. INTRODUCTION

The advantages of low cost and no radiation present by echocardiography images are one of the most convenient diagnostic tools for heart valve diseases. Among the various echocardiographs, the images collected using a transthoracic transducer is important in analyzing the mitral valve diseases [2].

From echocardiography images we will get data for the patient who suffered from respiratory problems directly and more easily. The images produced are in video form. So it can be seen with more advanced on the movement of the heart valves and the doctors easy to identify the mitral valve problems from their patients. Nowadays the mitral valve problems treatments have two methods with repair and replacement technique. Usually the most popular technique is repair.

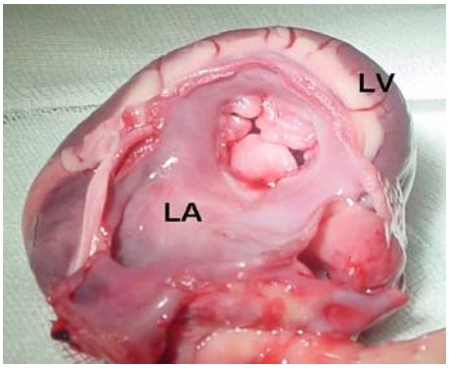


Figure 1. Prolapsed portion of the anterior leaflet of the mitral valve

Repair the mitral valve is considered choice of procedure. Echocardiography images using grid independent technique is one of method that can be applied to analyze mitral valve problems with understanding the correlation between backflow and mitral valve rigidity [5].

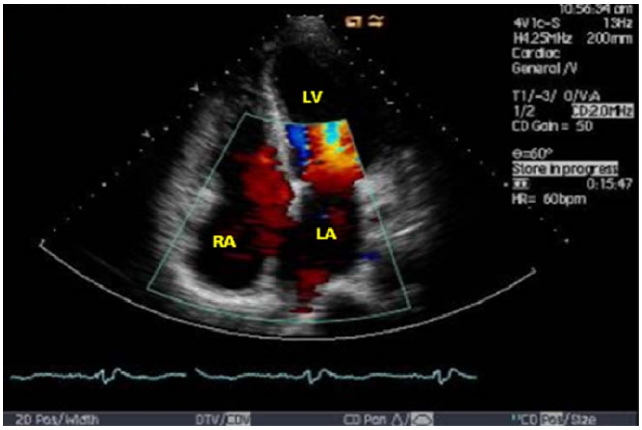


Figure 2. Echocardiography image for patient with MVP

II. METHOD

A. Population and Image Sequences

This study was tested on a group of 10 patients scanned for routine echocardiograms and stored in DICOM format including the echocardiography (ECG) image display. General data for 10 patients show in table 1. For each images, the end diastolic and systolic state were defined from the QRS complex using the ECG record [1]. The image sequences were analyzed using grid independent technique, show in figure 3. This method, which was based mitral valve deformation during the cardiac cycle. The correlations between the degeneration of the valves and volume of backflow for each of the images were calculated using equation 1 and equation 2.

TABLE 1. GENERAL DATA

Patient	Age	Gender	Surgery
1	43	Male	MVP + MR + CP
2	40	Male	MVP + MR
3	34	Female	MVP + MR
4	30	Male	MVP + MR + CP
5	49	Female	MVP + MR + CP
6	31	Female	MVP + MR + CP
7	29	Female	MVP + MR
8	33	Male	MVP + MR
9	44	Male	MVP + MR
10	27	Female	MVP + MR + CP

MVP - Mitral Valve Prolepse
MR - Mitral Valve Repair
CP - Crossed Propillopexy

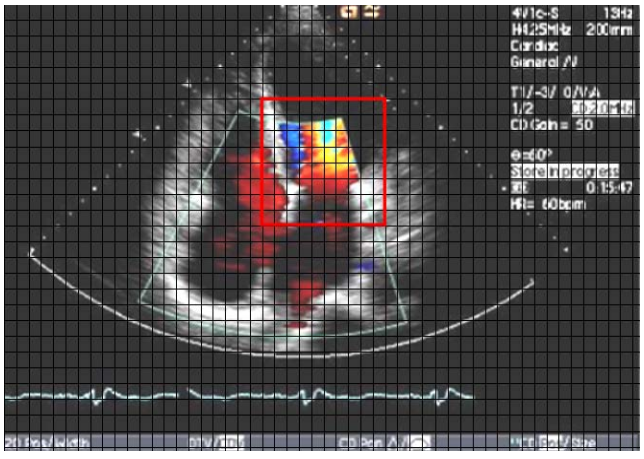


Figure 3. Grid-Independent Technique (8x8)

B. Grid Independent Technique

Independent grid technique is one of the methods in analysis the nature of a heart valve. This method has been applied previously. The process begins with getting an image up to the acquisition of data received. Figure 4 shows the flow diagram of how the grid method is carried out.

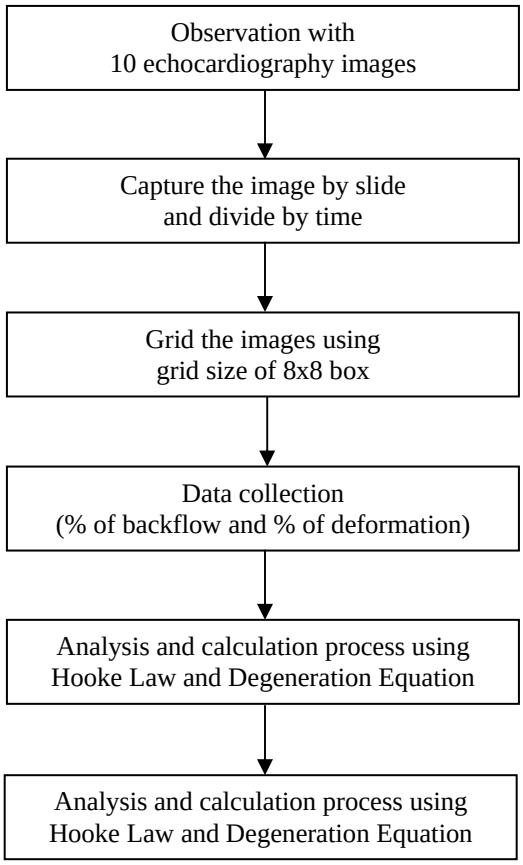


Figure 4. Flowchat of Grid Independent Technique where applied to investigate the mitral valve problem

The process start with observe on all the images of 10 patients who have MVP. The images obtained in video format and need to capture one by one, counter by time when the valve is in closed state. After that, the image of each patient will be grip over the time set. The process began with a set number of grid boxes based on the size of the echo images in (8x8). Each image must be computed on the percentage of the grid.

The process depends on the accuracy of grid in the proper calculations because the size of each box is too small. The aim this technique is getting the best data analysis. All the data obtained are in percentages as backflow percentage and the deformation of mitral valve when the valve closed. All the calculations based on equation 1 and 2.

C. *Equations and Critical Parameter*

Estimation of the mitral valves rigidity was based on Hooke's Law equation [4]:

$$E_{cal} = \frac{\sigma}{\varepsilon} = \frac{\left(\frac{F}{A}\right)}{\left(\frac{\delta}{L}\right)} \quad (1)$$

In equation 1, σ is the applied fluid pressure, L is the normal length of the mitral valve, and δ is the deformation of mitral valves after closing. These Young's Modulus, E will then be used to calculate the degeneration of the mitral valves using equation 2

$$Degeneration = \left(\frac{E_{cal}}{E_{normal}} \times 100\%\right) \quad (2)$$

In equation 2, degeneration is defined as the ratio of estimated E_{cal} against E_{normal} which is the normal rigidity of healthy mitral valves. The blood and properties of the mitral valve leaflets were obtained from the literature [3], shown as table 2.

TABLE 2. PARAMETERS OF MITRAL VALVE

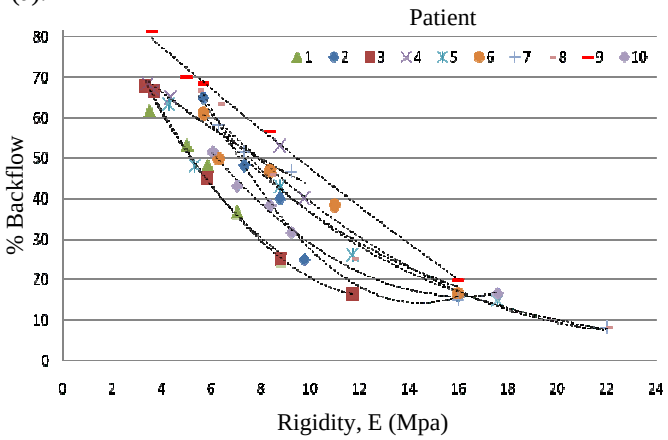
Characteristics	Value
Normal Mitral Valve Thickness (mm)	3.5 +/- 0.8
Diastolic Pressure (mmHg)	82
Systolic Pressure (mmHg)	132
Healthy Mitral Valve Rigidity (Mpa)	22.5
Normal Mitral valve area (cm^2)	4.0-5.0

III. RESULT AND DISCUSSION

Figure 5 shows the percentage of backflow against the mitral valve rigidity of the 10 patients who suffer from MVP. Figure 5a show the mitral valve in systolic state, where the backflow percentage change between the patients ranged from 10 percent and the highest level in this state more than 80% of backflow.

This contrasts with the figure 5b which shows the patient in diastolic state. The highest percentage in this state is less than 80%. This could be due to low blood pressure in cardiac cycle or in other words, the structure of the left ventricle is elastic. The patent of graph shows the mitral valve rigidity is always linearly proportional to the reduction of backflow directly.

(a).



(b).

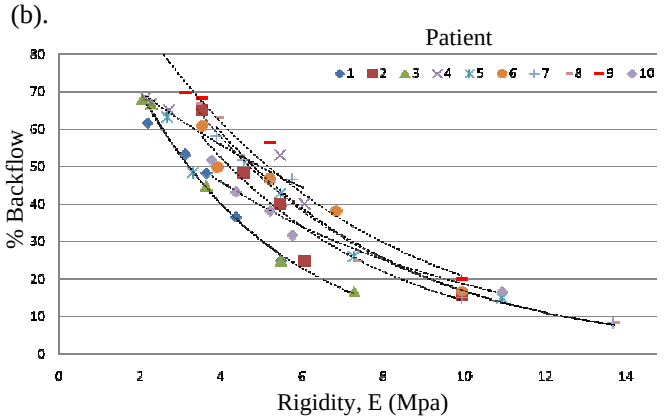
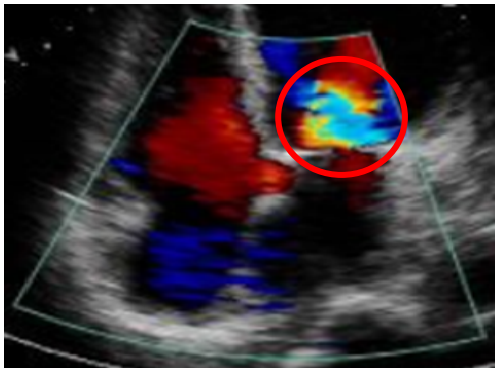


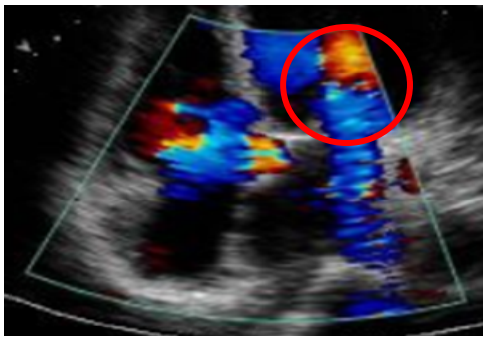
Figure 5. Backflow vs. rigidity of MV for a group of 10 patients with MVP during (a). systolic state, (b). diastolic states

Figure 6 shows the mitral valve problems on images of echocardiography for one patient who has MVP. Mitral valve movement during opening and closing is very fast, so we can see that if the valve cannot properly close that will cause backflow. This behavior also will cause mitral valve regurgitation (MR). The blue color show the backflow through mitral valve after the valve close. Behavior of mitral valve showed the lower rigidity of the mitral valve will increase the percentage of backflow.

(a).



(b).



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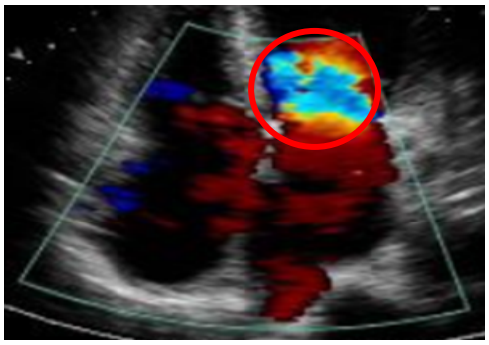
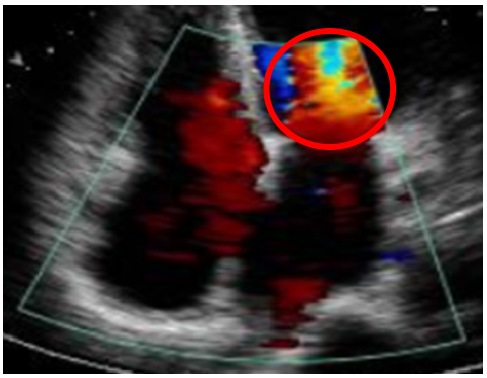


(d).



(e).

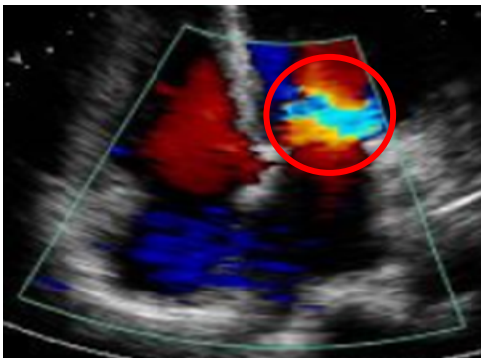


Figure 6. Images of echocardiography with MVP which cause backflow. Different patten of backflow by time (a). 1s, (b). 2s, (c). 3s, (d). 4s, (e). 5s

From figure 7, the distribution shows that most female are high risk for getting MVP. Through this figure, found almost 60% are female, compared to 40% of male. This is likely due to breathing problems faced by these groups is much higher than male.

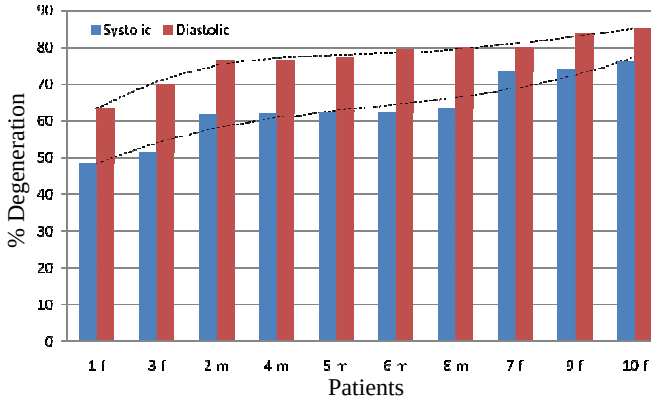


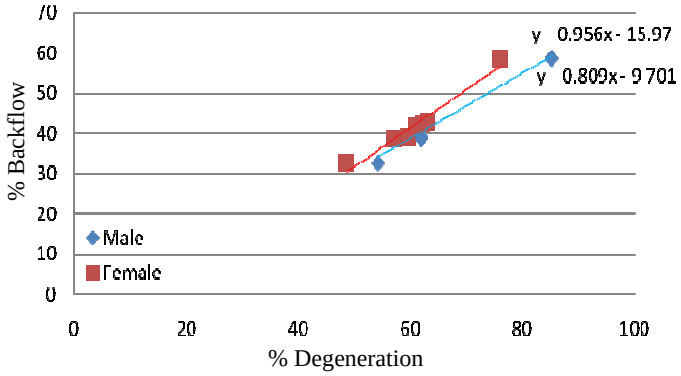
Figure 7. Distribution of 10 patients with different gender for the diastolic and systolic state

While the figure 8, indicating that the division between male and female in terms of percentage of backflow against degeneration of mitral valve. Figure 8a shows a linear change between the two genders in which the backflow increasing degeneration of the mitral valve will also be increased.

But in terms of percentage, it is clear that female have great potential for getting MVP because of the distribution graph of the percentage of female always higher then male percentage is almost 10 percent difference. If seen in figure 8b, it shows the overall percentage of diastolic state is slightly lower than in systolic state. This is due to pressure from the body with oxygen to the heart through the mitral valve is low at 80mmHg.

Then the results obtained from analysis by the independent grid technique, it is a bit much to help doctors make decisions about how to treat patients suffering from MVP. Besides that, it can study the behavior of mitral valve leaflet when the output rate of backflow through specific estimations.

(a).



(b).

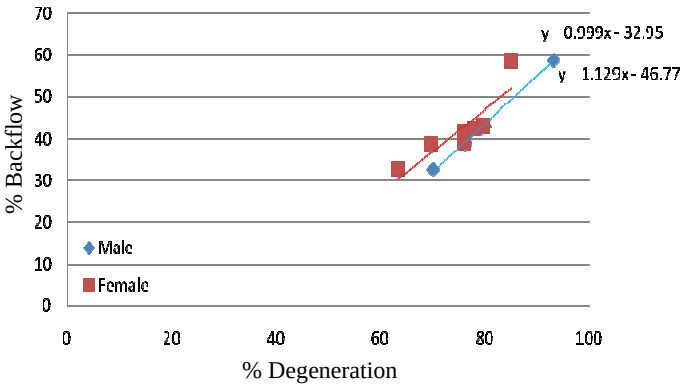


Figure 8. Backflow vs. degeneration with different gender during (a). systolic state, (b). diastolic state

IV. CONCLUSION

Overall, this study involved 10 patients with mitral valve disease or a related difference showed more than 10 percent of the average return flow between the two, systolic and diastolic state. These percentages are also significantly different between gender, male and female in a number of more easily obtained MVP. This finding is actually forecast the behavior of the mitral valve and blood flow in a variety of degenerative of mitral valve.

And the grid independent technique recorded is clear that method can also be used as an additional method for analyzing the mitral valve leaflets. Then the benefits to the medical practitioners in this study is they can decide better treatments for their patients in terms of the reinforcement or replacement of the valves.

ACKNOWLEDGMENT

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