statistics for windows, version 20.0. Armonk, NY) and Microsoft Excel 2010 of (Microsoft Corporation, Redmond, Washington, USA). Descriptive statistics (%age, mean, standard deviation, median, and Chi-square) and inferential statistics (t-test and Friedman) were used to analyze the data of patients and to find an association. The analyzed data were presented in the form of tables, graphs, and figures.

Results

There was no significant difference observed in parameters of sociodemographic profile, except the type of family in patients of control and experimental groups. The mean age was comparable in the control (55.86 ± 11.03) and experimental groups (55.70 ± 13.04). Most of the patients in the control (84%) and experimental groups (74%) were male. Majority of the patients in the control (76%) and experimental groups (54%) had joint family. More than half of the patients in the control (68%) and experimental groups (64%) were from rural area. Less than half (46%) of the patients in the control and More than one forth (26%) in the experimental groups had low socioeconomic status. Half (50%) of the patients in the control and less than half (46%) of the patients in the experimental groups were mild worker. More than half (54%) of the patients in the control and half (50%) of the patients in the experimental groups were nonvegetarian. Majority (46%) of the patients in the control and (52%) in experimental group were nonalcoholics. More than three-fifth (68%) of the patients in the control and three-fifth (60%) of the patients in the experimental groups were nonsmoker.

Table 1 depicts the comparison of clinical profile of control and experimental groups undergoing PCI. Majority

| Table 1: Comparison of clinical profile of control and experimental groups undergoing percutaneous coronary intervention (n=100) |
|---------------------------------------------------------------|
| Characteristics                                              | Control group (n=50), f (%) | Experimental group (n=50), f (%) | χ² (df) P |
|---------------------------------------------------------------|-----------------------------|---------------------------------|----------|
| Clinical diagnosis                                           |                             |                                 |          |
| CAD/ACS/MI                                                    | 31 (62.0)                   | 27 (54.0)                       | 4.72 (3) 0.91* |
| CAD/ACS/USA                                                   | 12 (24.0)                   | 19 (38.0)                       |          |
| CAD/DVD                                                       | 2 (4.0)                     | 3 (6.0)                         |          |
| CAD/TVD                                                       | 5 (10.0)                    | 1 (2.0)                         |          |
| Route of angioplasty                                          |                             |                                 |          |
| Radial                                                        | 26 (52.0)                   | 33 (66.0)                       | 2.03 (2) 0.36* |
| Femoral                                                       | 21 (42.0)                   | 15 (30.0)                       |          |
| Both                                                          | 3 (6.0)                     | 2 (4.0)                         |          |
| BMI                                                           |                             |                                 |          |
| Normal                                                        | 29 (58.0)                   | 20 (40.0)                       | 3.25 (2) 0.19* |
| Overweight                                                    | 17 (34.0)                   | 24 (48.0)                       |          |
| Obese                                                         | 4 (8.0)                     | 6 (12.0)                        |          |
| Hb                                                            |                             |                                 |          |
| Normal                                                        | 38 (76.0)                   | 32 (64.0)                       | 2.84 (2) 0.24* |
| Mild anemia                                                   | 3 (6.0)                     | 8 (16.0)                        |          |
| Moderate anemia                                               | 9 (18.0)                    | 10 (20.0)                       |          |
| History of previous angiography                               |                             |                                 |          |
| Yes                                                           | 19 (38.0)                   | 20 (40.0)                       | 0.04 (1) 0.84 |
| No                                                            | 31 (62.0)                   | 30 (60.0)                       |          |
| Any other illness present                                     |                             |                                 |          |
| Hypertension                                                  |                             |                                 |          |
| Yes                                                           | 18 (36.0)                   | 24 (48.0)                       | 1.48 (1) 0.22 |
| No                                                            | 32 (64.0)                   | 26 (52.0)                       |          |
| Back pain before angiography                                  |                             |                                 |          |
| Yes                                                           | 12 (24.0)                   | 15 (30.0)                       | 0.46 (1) 0.49 |
| No                                                            | 38 (76.0)                   | 35 (70.0)                       |          |
| Diabetes mellitus                                             |                             |                                 |          |
| Yes                                                           | 15 (30.0)                   | 12 (24.0)                       | 0.46 (1) 0.49 |
| No                                                            | 35 (70.0)                   | 38 (76.0)                       |          |
| Heart attack                                                  |                             |                                 |          |
| Yes                                                           | 9 (18.0)                    | 11 (22.0)                       | 0.25 (1) 0.62 |
| No                                                            | 41 (82.0)                   | 39 (78.0)                       |          |

*Yate’s corrected χ². Hb - Hemoglobin, BMI - Body mass index, CAD - Coronary artery disease, ACS - Acute coronary syndromes, MI - Myocardial infarction, TVD - Triple vessel disease DVD - Double vessel disease
of the patients in the control (62%) and experimental groups (54%) had CAD/acute coronary syndrome/myocardial infarction (MI) clinical diagnosis ($P = 0.91$). There was no significant difference between the control and experimental groups in parameters such as route of angioplasty, history of previous angiography, body mass index ($P = 0.19$), and the presence of any other illness.

The baseline data of laboratory investigations of control and experimental groups undergoing PCI are shown in Table 2. The independent $t$-test showed that both the groups are homogenous and comparable as per the laboratory investigations.

Table 3 depicts the comparison of level of anxiety between subjects of control and experimental group undergoing PCI before and after intervention using STAI scale. There was no significant difference in state anxiety between control and experimental groups before intervention ($P = 0.58$). The mean of state score was 42.86 ± 5.97 in the control group and 36.54 ± 5.97 in the experimental group after intervention. There was a significant difference in state anxiety between control and experimental groups after intervention ($P < 0.001$).

In the control group, bleeding occurred in three patients and no other vascular complication was found within 24 h

**Table 2: Baseline data of laboratory investigations of control and experimental group undergoing percutaneous coronary intervention ($n=100$)**

| Lab investigations     | Control group Mean±SD (range) | Experimental group Mean±SD (range) | $t$ (df) $P$ |
|------------------------|-------------------------------|-----------------------------------|-------------|
| Hb (g/dl)              | 12.95±2.02 (9.2–18.2)         | 12.55±1.56 (9.8–16.8)             | 1.12 (98) 0.26 |
| Platelet count ($\times 10^3/\mu L$) | 191.34±63.67 (71–359)         | 211.70±78.17 (75–433)             | −1.43 (98) 0.16 |
| Sodium (mEq/L)         | 138.16±6.59 (121–152)         | 136.26±4.00 (125–142)             | 1.74 (98) 0.86 |
| Potassium (mEq/L)      | 4.37±0.51 (4–6)               | 4.88±0.37 (3–5)                   | 0.83 (98) 0.41 |
| BUN (mg/dl)            | 34.46±19.51 (6–99)            | 29.83±11.11 (9–65)                | 1.46 (98) 0.15 |
| Creatinine (mg/dl)     | 0.94±0.30 (0.40–1.90)         | 0.88±0.19 (0.5–1.40)              | 1.05 (98) 0.29 |
| PT (s)                 | 15.76±3.185 (10–29)           | 15.20±2.5 (12–27)                 | 0.97 (98) 0.33 |
| INR                    | 1.04±0.12 (0.89–1.63)         | 1.08±0.15 (0.90–1.84)             | 0.91 (98) 0.33 |
| aPTT (s)               | 30.24±7.76 (2–68)             | 28.70±3.37 (16–40)                | 1.29 (98) 0.20 |
| RBS (mg/dl)            | 147.36±64.50 (85–346)         | 132.54±39.88 (70–306)             | 1.38 (98) 0.17 |

*SD* - Red blood cell, aPTT - Activated partial thromboplastin time, PT - Prothrombin time, INR - International normalized ratio, BUN - Blood urea nitrogen, Hb - Hemoglobin, SD - Standard deviation

**Table 3: Comparison of level of anxiety between subjects of control and experimental group undergoing percutaneous coronary intervention before and after intervention using State-Trait Anxiety Inventory scale ($n=100$)**

| State anxiety score  | Control group Mean±SD (range) | Experimental group Mean±SD (range) | $t$ (df) $P$ |
|----------------------|-------------------------------|-----------------------------------|-------------|
| Before intervention  | 43.84±5.79 (35–60)            | 44.28±5.08 (36–56)                | 0.59 (98) 0.58 |
| After intervention   | 42.86±5.97 (34–59)            | 36.54±5.97 (26–53)                | 5.29 (98) <0.001 |

*SD* - Standard deviation

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**Figure 1:** (a) showing Comparison of median pain score. (b) showing comparison of median comfort score of study participants of control and experimental group after percutaneous coronary intervention.
of PCI. In the experimental group, bleeding, ecchymosis, and superficial hematoma developed in 1 patient within 24 h of PCI. No late complication was observed in both the groups.

Table 4 depicts the comparison of activities of daily living before and after PCI between control and experimental groups using Barthel Index scale. A significant difference was observed between the mean Barthel Index scores of control and experimental groups at day 0 ($P = 0.002$), day 1 ($P < 0.001$), and day 30 ($P = 0.004$). This indicates that independence of performing activities of daily living was increased in the experimental group after intervention as compared to the control group.

Table 5 shows the comparison of postintervention knowledge regarding CAD and PCI between control and experimental groups using the modified CADE-QSV scale. There was a significant difference between the mean of modified CADE-QSV scores after intervention in the control ($33.84 \pm 9.31$) and experimental groups ($61.32 \pm 3.44$). This is suggestive of higher knowledge level in the experimental group as compared to the control group after intervention ($P < 0.001$).

**Discussion**

CAD is the topmost killer disease globally. In the present study, the mean age of patients in both the groups was 55 years. These findings were similar to a previous study in which the average age was 54.48 $\pm$ 12.91 years of the patients underwent angiography. Hence, this finding was congruent with the literature that CAD is common in the middle age group. A retrospective study reported

| Barthel index ADL score | Control group ($n_1=50$) | Experimental group ($n_2=50$) | $t$ (df) | $P$ |
|------------------------|--------------------------|-------------------------------|---------|-----|
| Before PCI ADL score   | 19.48±1.83 (10–20)       | 18.72±3.93 (2–20)             | 1.237 (98) | 0.219 |
| After PCI (score)      |                          |                               |         |     |
| Day 0                  | 6.04±2.89 (2–13)         | 8.08±3.47 (3–13)              | 3.191 (98) | 0.002 |
| Day 1                  | 11.30±4.18 (5–19)        | 15.42±3.59 (4–20)             | 5.28 (98) | 0.001 |
| Day 2                  | 17.36±1.98 (7–20)        | 17.46±2.93 (5–20)             | 0.20 (98) | 0.84  |
| Day 30                 | 19.44±0.86 (18–20)       | 19.86±0.49 (19–20)            | 2.99 (98) | 0.004 |

Maximum attainable score=0–20. SD - Standard deviation, PCI - Percutaneous coronary intervention, ADL - Activities of daily living

| Knowledge*              | Control group ($n_1=50$), f (%) | Experimental group ($n_2=50$), f (%) | Fisher exact value (df) | $P$ |
|-------------------------|---------------------------------|-------------------------------------|-------------------------|-----|
| Poor                    | 17 (34.0)                       | -                                   |                         |     |
| Average                 | 26 (52.0)                       | -                                   | 103.43 (3)              | <0.001* |
| Good                    | 7 (14.0)                        | 11 (22.0)                           |                         |     |
| Very good               | -                               | 39 (78.0)                           |                         |     |

*Mean±SD knowledge of patients, Control group 33.84±9.31 and experimental group 61.32±3.44, *Fisher exact test, Maximum attainable score=0–23. SD - Standard deviation

| Table 6: Comparison of satisfaction level of patients within and between control and experimental group (n=100) |
|---------------------------------------------------------------|---------------------------------------------------------------|
| Satisfaction score                                            | Control group ($n_1=50$) (comparison within group) |
|                                                               | Experimental group ($n_2=50$) (comparison within group) |
|                                                               | Comparison between control and experimental group, t-test (df) | $P$ |
| Before PCI                                                    | Mean±SD                                                      | Mean difference±SD, $t$-test (df) | $P$ |
| After PCI                                                     | Mean±SD                                                      | Mean difference±SD, $t$-test (df) | $P$ |
|                                                               |                                                               |                                                    |     |
| Mean±SD                                                       | Mean difference±SD, $t$-test (df)                             |                                                    |     |
| Before PCI                                                    | 66.84±6.29 (55–89)                                           | 2.96±3.57, 5.86 (49)                           | 0.01 |
| After PCI                                                     | 69.80±5.79 (61–89)                                           | 40.22±7.39, 38.49 (49)                         | <0.001 |

Maximum attainable score=5–125. PCI - Percutaneous coronary intervention, SD - Standard deviation

*Mean±SD knowledge of patients, Control group 33.84±9.31 and experimental group 61.32±3.44, *Fisher exact test, Maximum attainable score=0–23. SD - Standard deviation

In the present study, the mean age of patients in both the groups was 55 years. These findings were similar to a previous study in which the average age was 54.48 $\pm$ 12.91 years of the patients underwent angiography. Hence, this finding was congruent with the literature that CAD is common in the middle age group. A retrospective study reported
the occurrence of MI (12%–16%) in the young age group. Similarly, in this study, 8% of the patients in the control group and 12% in the experimental group were in the age group of 18–40 years. This may be associated with increased smoking, poor dietary habits, and insufficient physical activity in the younger generation.

In the present study, most of the patients were male. Similarly, the results of a previous study showed that more than half of the patients were male. This can be due to the increased prevalence of smoking and alcohol consumption in males than females in the Indian population.

A study conducted in Kerala did not show any difference in the CAD prevalence in urban and rural population. In the present study, more than half of the patients belonged to rural area. The reason for this can be the unavailability of hospital and catheterization laboratory settings in rural areas, less access to health-care facilities, ignorance to earlier symptoms of CAD, not enough money for treatment, and less knowledge about CAD and its risk factors. Similarly, a study was conducted in the USA, which shows the higher mortality in the rural population as compared to the urban population in southern regions. On the other hand, based on the finding of this study, it can be said that people residing in the urban area might be availing the services from other health-care institutes or private hospitals.

In the present study, it was found that more than half of the patients with CAD were from lower middle and lower class of socioeconomic status (as per the modified B.G Prasad scale). It may be due to the provision of free facilities and government services to the patients of low socioeconomic class in the hospital. Similarly, a previous study showed that coronary heart disease was found to be higher among people of lower socioeconomic status.

This study showed that radial approach was used in 59 patients. Similarly, in 2004, a meta-analysis of 12 randomized control trials concluded that the transradial approach was a safe alternative to femoral access for diagnostic and therapeutic procedures. This may be due to the reason that radial access has the potential advantages of reduced access site complications, rapid patient mobilization, and reduced costs.

Many patients undergoing PCI experience symptoms of anxiety. The present study revealed that majority of the patients had a moderate level of state anxiety in patients of both groups before intervention. After intervention, more than half of the patients had a moderate level of state anxiety in the control group whereas majority of the patients had a mild level of anxiety in the experimental group. This significant difference in the mean state anxiety score of the patients showed that the educational component of “PCI care program” was effective in reducing the anxiety among PCI patients. The results of a previous study showed that before PCI procedure, VAS anxiety scores were highest and concluded that better preprocedural information or pharmacological strategies may reduce anxiety in these patients.

In this study, it was noted that pain at the interventional site of PCI was less at 12 h in patients of experimental group as compared to the patients of control group. The present study also found that pain at the puncture site was significantly reduced in both the groups at different intervals of time (6 h, 12 h, and 24 h). Similarly, a previous study conducted by Cheng et al. showed that the level of puncture site pain was significantly higher at 3 h after procedure.

In the present study, it was observed that comfort level was higher in the experimental group than the control group after intervention within 12 and 24 h of PCI. This result was supported by a randomized control trial done by Rezaei et al. to assess the effect of changing position and early ambulation on patient’s level of comfort, and the authors concluded that longer duration in bed after PCI showed a lower level of comfort.

The patients may experience vascular complications after PCI. In literature, it was found that transradial approach leads to less vascular complications as compared to femoral approach. This study showed that four patients had bleeding in the control group and no other vascular complication was found after PCI within 24 h. Bleeding in the patients of control group may be present due to lack of knowledge about care or position provided to them after PCI or ignorance of patients to instructions given by health-care providers to them. In the experimental group, one patient had bleeding, ecchymosis, and superficial hematoma after PCI within 24 h. However, these vascular complications in the patients of experimental group were not due to early ambulation. It emphasized that early ambulation and position changed was safe to the patients. Similarly, the results of a previous study showed that the incidence of vascular complication in early ambulation group was not significant to late ambulation group (P = 0.442) and concluded that reducing
bed rest to 4 h or early ambulation after PCI was safe to the patients.\textsuperscript{16}

In this study, no significant difference was observed in performing activities of daily living among the patients of both the groups before PCI ($P = 0.219$). After PCI, independence in performing self-care activities was higher in the experimental group as reflected by the mean Barthel Index score at day 0, day 1, and day 30. It indicates that the components of this program such as demonstration, teaching, assistance, and guidance were effective in terms of making patient independent to perform their self-care activities after PCI during hospitalization. These findings of the study also focused on the need of continuous and supportive nursing care for the patients undergoing PCI, so that most of the patients can achieve independence in performing self-care activities. There is a paucity of hospital-based study to evaluate the effect of nursing interventions in the activities of PCI patients during hospitalization. A home-based study supported the findings of the present study. The results of this home-based study indicated a significant increase in daily physical activities of the intervention group whereas no changes were detected in the control group.\textsuperscript{17}

The present study showed a significant improvement in knowledge of patients of experimental group during the postinterventional period. Based on this finding, it can be stated that “PCI care program” was effective in terms of increasing knowledge of the patients undergoing PCI related to CAD and PCI. Similarly, a study conducted by Chair \textit{et al.} on knowledge of patients showed that there was a significant difference between the patients' knowledge before and after the teaching program before PCI procedure ($t = 28.9, P < 0.001$) and concluded that a preoperative teaching program would increase patients’ knowledge of the PCI procedure.\textsuperscript{18}

In the present study, a significant difference was observed between the mean satisfaction score in the control and experimental groups ($P < 0.001$). In previous studies, patients undergoing PCI procedure had a higher level of satisfaction due to teaching program, early ambulation, and early discharge from the hospital after PCI.\textsuperscript{14,16,18} Hence, it can be said that nurses has to take a lead role in identifying and meeting the informational needs of patients undergoing PCI by implementing “PCI care program” as a routine part of nursing care.

Implementation of the PCI care program resulted in reduced anxiety, level of pain, and discomfort; increased satisfaction level and knowledge; and improvement in performing activities of daily living without any vascular complication. The study concluded that this program was effective in terms of enhancing the image of nursing profession as well as institute. In the light of the findings of the present study, PCI care program of this research will help nurses in cardiac units for educating the patients about CAD and providing care before, during, and after PCI.

**Conclusion**

This study has shown improvement in various aspects of the patients undergoing PCI such as anxiety, activities of daily living, knowledge regarding CAD, comfort level, and satisfaction level by implementation of “PCI care program.” Therefore, this study is beneficial to the patients undergoing PCI.

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**Conflicts of interest**
There are no conflicts of interest.

**References**

1. Misra A, Nigam P, Hills AP, Chadha DS, Sharma V, Deepak KK, \textit{et al.} Consensus physical activity guidelines for Asian Indians. Diabetes Technol Ther 2012;14:83-98.
2. World Health Organization. Report of Global Health Observatory Data Repository. Report of a WHO Consultation. Geneva: World Health Organization; 2008.
3. Brunner L, Suddarth D, Smeltzer S. Brunner & Suddarth’s Textbook of Medical-Surgical Nursing. 11th ed. Philadelphia: Lippincott Williams & Wilkins; 2008. p. 713-33.
4. Gulani N, Billey A, Perino B, Keough V. Recovery patterns and lifestyle changes after coronary angioplasty: The patient’s perspective. Heart Lung 1998;27:253-62.
5. Raghav L, Waghmode P, Matin P, Pawar S. Clinical profile of patients undergoing coronary angiography with special reference to complications of coronary angiography. Int J Adv Med 2017;4:1170-4.
6. Mammi MV, Pavithran K, Abdu Rahiman P, Pisharody R, Sugathan K. Acute myocardial infarction in North Kerala – A 20 year hospital based study. Indian Heart J 1991;43:93-6.
7. Krishnan MN, Zachariah G, Venugopal K, Mohanan PP, Harikrishnan S, Sanjay G, \textit{et al.} Prevalence of coronary artery disease and its risk factors in Kerala, South India: A community-based cross-sectional study. BMC Cardiovasc Disord 2016;16:12.
8. Kulshreshtha A, Goyal A, Dabhadkar K, Veledar E, Vaccarino V. Urban-rural differences in coronary heart disease mortality in the United States: 1999-2009. Public Health Rep 2014;129:19-29.
9. Singh T, Sharma S, Nagesh S. Socio-economic status scales updated for 2017. Int J Res Med Sci 2017;5:5364.
10. Mendagudali R, Akka KD, Manjula R, Swati IA, Dayalaxmi TS, Ghattagi VC. Prevalence of coronary heart disease in rural population of Bagalkot, Karnataka, India. Int J Community Med Public Health 2015;2:581-6.
11. Agostoni P, Biondi-Zoccai G, De Benedictis M. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures: Systematic overview and meta-analysis of randomized trials. ACC Curr J Rev 2004;13:33.

12. Delewi R, Vlastra W, Rohling WJ, Wagenaar TC, Zwemstra M, Meesterman MG, et al. Anxiety levels of patients undergoing coronary procedures in the catheterization laboratory. Int J Cardiol 2017;228:926-30.

13. Cheng KY, Chair SY, Choi KC. Access site complications and puncture site pain following transradial coronary procedures: A correlational study. Int J Nurs Stud 2013;50:1304-13.

14. Rezaei-Adaryani M, Ahmadi F, Asghari-Jafarabadi M. The effect of changing position and early ambulation after cardiac catheterization on patients' outcomes: A single-blind randomized controlled trial. Int J Nurs Stud 2009;46:1047-53.

15. Saleh M, Abu Sa'aleek M, Nader S. The impact of prolonged bed rest after percutaneous coronary intervention in terms of vascular complications and other patients' outcomes. Middle East J Nurs 2016;10:9-15.

16. Cha NH, Sok S. Effects of position change on lumbar pain and discomfort of Korean patients after invasive percutaneous coronary intervention: A RCT study. J Phys Ther Sci 2016;28:2742-7.

17. Oliveira J, Ribeiro F, Gomes H. Effects of a home-based cardiac rehabilitation program on the physical activity levels of patients with coronary artery disease. J Cardiopulm Rehabil Prev 2008;28:392-6.

18. Chair S, Pang A. Patient education before undergoing percutaneous coronary intervention. Br J Card Nurs 2008;3:32-6.
Segementation of jet area to quantify the severity of mitral regurgitation by color Doppler echocardiography

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ABSTRACT
Mitral regurgitation (MR) is a disorder of mitral valve and it is one of the most common causes of cardiovascular morbidity and mortality. Mitral valve allows blood to flow from left atrium, to the left ventricle and Mitral Valve regurgitation results in poor apposition of the valvular leaflets, so that the heart's mitral valve doesn't close tightly, allowing blood to flow backward into the left atrium. Transthoracic Echocardiography (TTE) with Doppler is the widely used non-invasive technology for the detection and evaluation of severity of valvular regurgitation. Proximal isovelocity surface area (PISA) method has been widely accepted by clinicians as a means for grading MR severity. In this paper an alternate method to PISA to automatically quantify mitral valve regurgitation severity is proposed. This work attempts to automatically segment the jet region in color Doppler images using K-Means clustering. Further to quantify mitral regurgitation, jet area parameters and shape features are extracted from the segmented jet region which are then modeled using classifiers such as Support Vector machine (SVM) and Back Propagation Neural Network (BPNN). Quantifying MR with PISA calls for considerable expertise as a number of components must be taken into account to fully assess the severity of mitral regurgitation, however the results of the proposed method indicate that it could be used as an alternate method to automatically assess the severity of mitral regurgitation.

Keywords: BPNN, color Doppler, jet area parameters, K-means, mitral regurgitation, regurgitant jet, shape features, SVM

Introduction
Clinicians today prefer echocardiography with Doppler as a noninvasive detection modality for mitral regurgitation (MR). Physical examination of the patient coupled with the analysis of the echocardiogram can give cue to the clinician about the presence of MR. However, assessing its severity calls for diagnostic methods employs qualitative as well as quantitative metrics.

Proximal isovelocity surface area (PISA) method, which analyzes the proximal isovelocity hemispheric surface area of the flow convergence on the ventricular side, has been widely accepted by clinicians as a means for grading MR severity. Doppler-visualized PISA surface is assumed to be hemispheric in shape, and the quantity of blood flowing from the left ventricle (LV) to the left atrium (LA) during mid-systole can be calculated when the radius of the hemisphere shell and velocity at its surface are known. However, the shape of the Doppler-visualized PISA surface is not a hemisphere, but rather, a sphere flattened at the base. In general, hemisphere radius is measured which underestimates orifice area by approximately two-fold.

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