

# Transcatheter Closure of PMVSD using Amplatzer Asymmetric PMVSD Occluder: Our Experience

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# Background

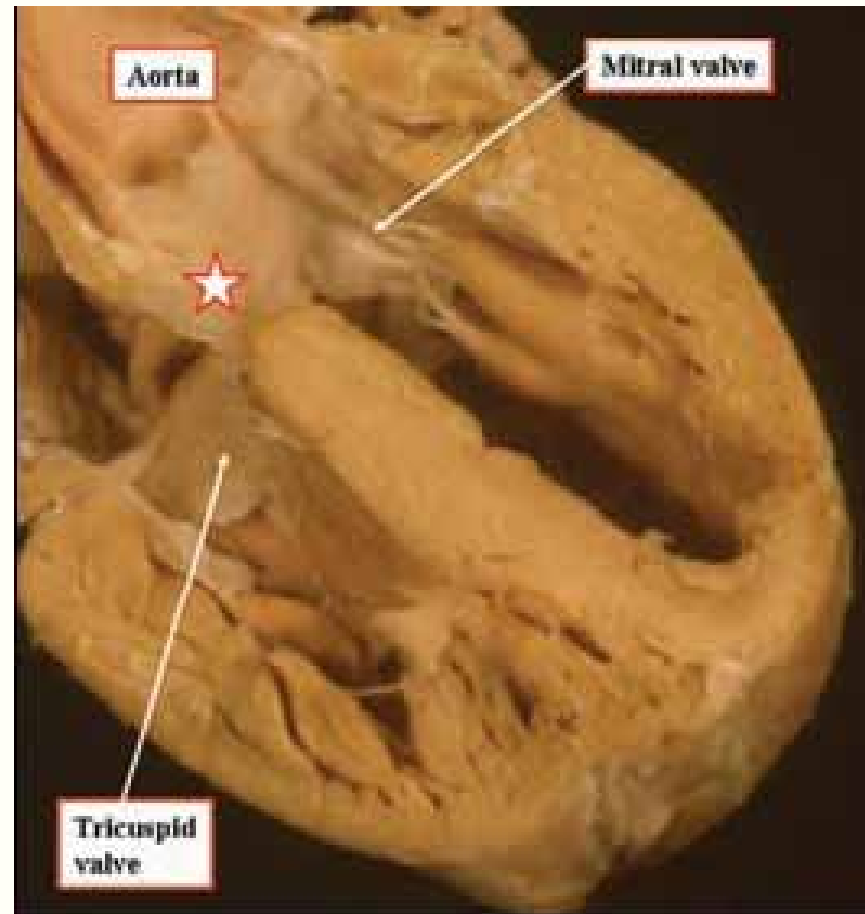
- Isolated VSD is the commonest CHD
- 80% of all VSDs are perimembranous
- Surgery remains the mainstay of treatment
- Very low mortality
- Why a need for an alternative strategy?

# Why is there a need?

- Finite morbidity associated with Sx
  - Patient discomfort
  - Bleeding
  - Residual shunt
  - Aortic regurge
  - Neurological sequele of CPB
  - Thoracotomy scar
  - Infection
  - AV valve regurge
  - CHB

# What makes it challenging?

- Proximity of the defect to
  - the aortic valve
  - the tricuspid valve
  - the bundle of His



# Our Experience

- Started in February 2004
- Proctored by Dr Hijazi
- Till date > 90% of closures have been done using AAPMVSDO
- ADO I, ADO II and muscular VSD device have been used in < 10%

# Early Lesson Learnt

Patient evaluation and selection is the most important step towards a successful outcome

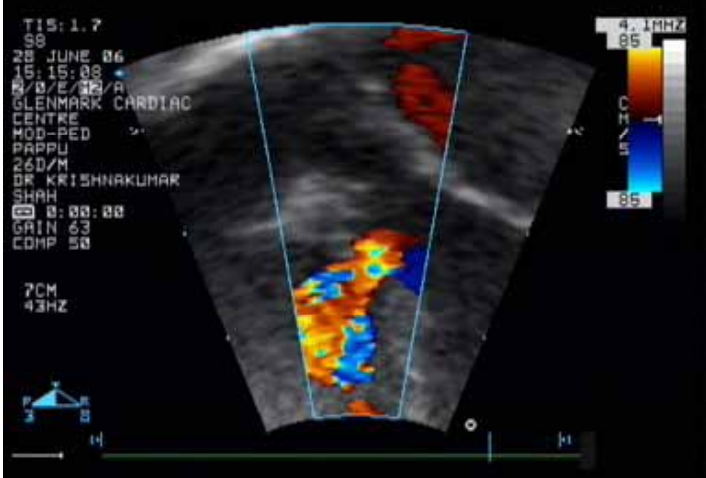
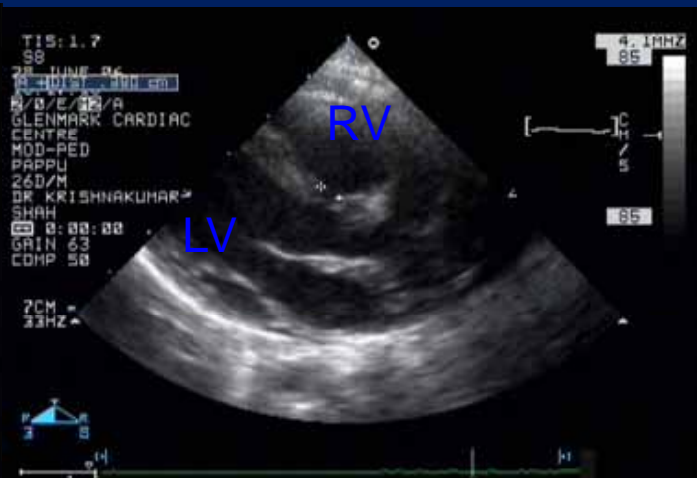
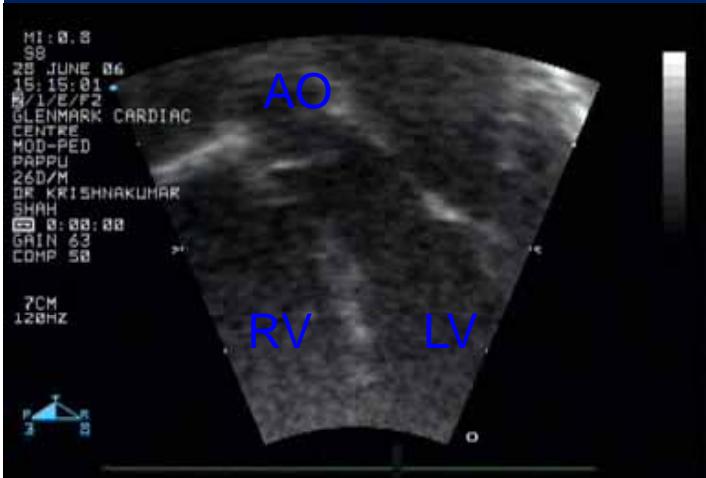
# Patient Evaluation Protocol

- History and Physical examination
  - Repeated LRTI, SOB/fatiguability, failure to thrive, H/O IE
  - LV apex, MDM at the apex
- ECG: Axis, LV potentials, conduction abnormality
- X-ray: Heart size and plethora
- Comprehensive 2DE/CD

# Echo evaluation

- Subcostal, apical and parasternal views
- Size of the defect
- Separation from the aortic valve
- Aortic valve prolapse, AR
- TV aneurysm, TR
- M-mode for LA and LV dimensions
- Spectral Doppler for PAP estimation



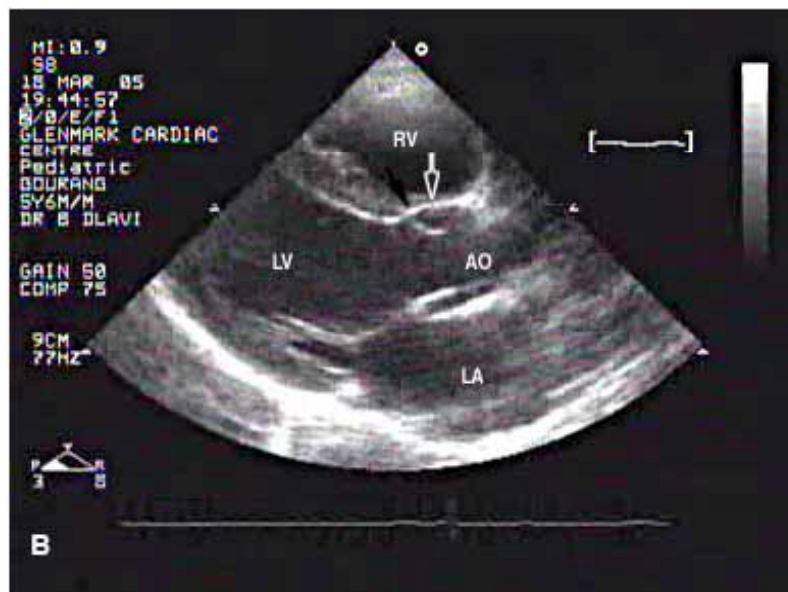
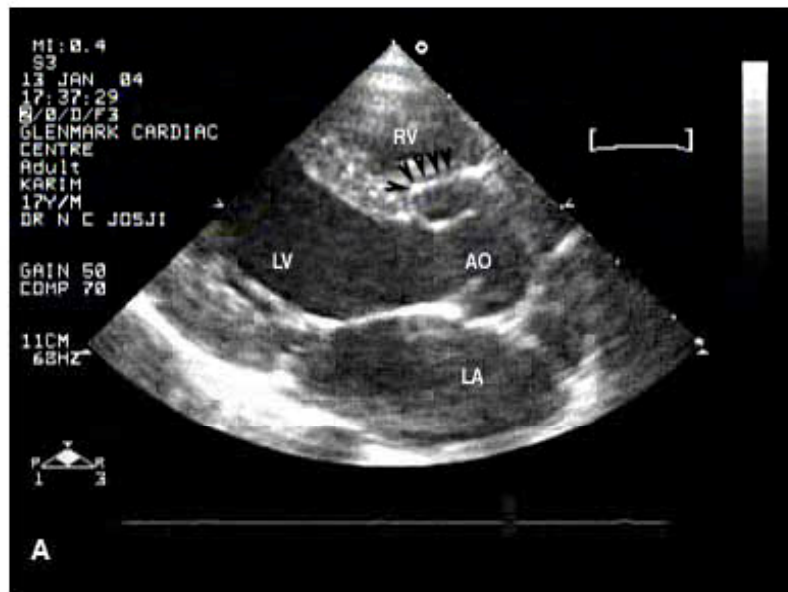


# Patient Selection

- Children > 12 Kgs
- Symptomatic state
- Hemodynamically significant shunt
  - Apical MDM
  - LVIDD – Z score of > 2
  - Qp:Qs > 1.5:1
- Separation from aortic valve > 2 mm
- VSD size < 14 mm

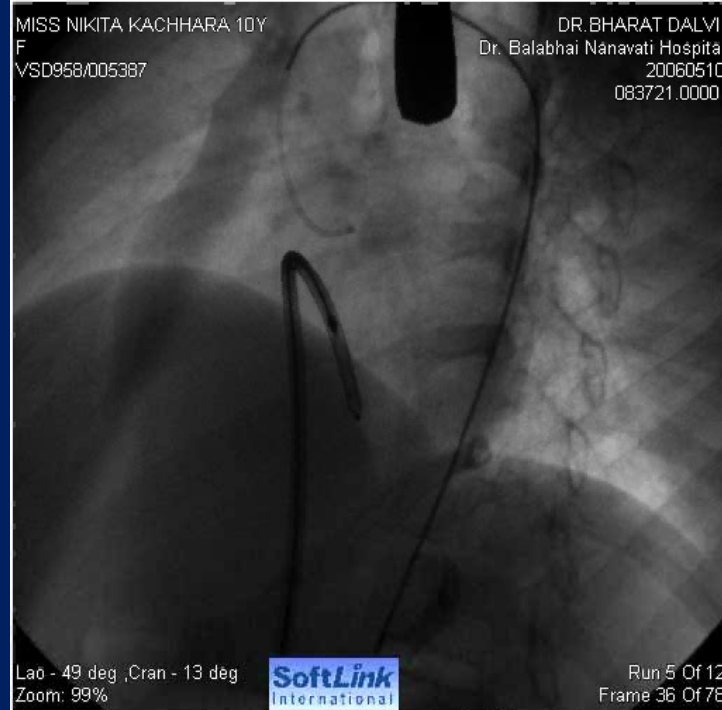
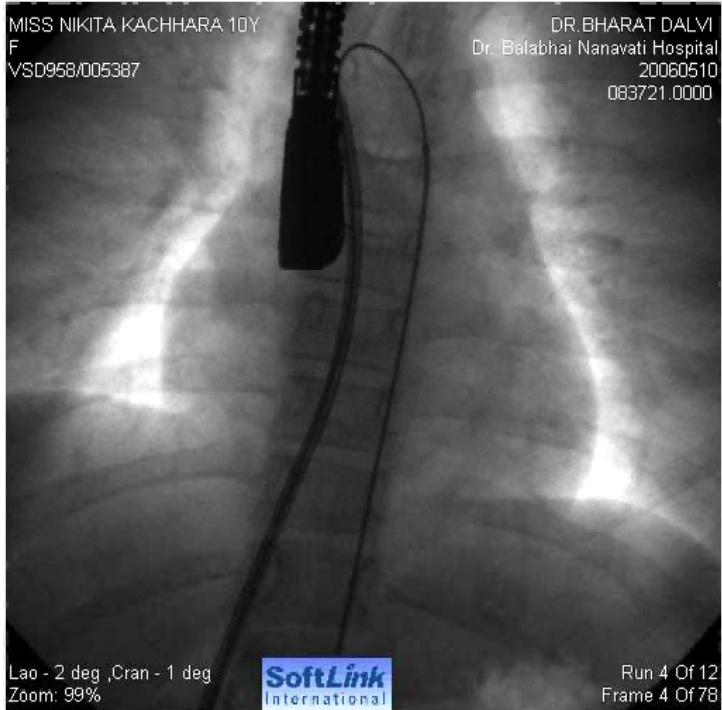
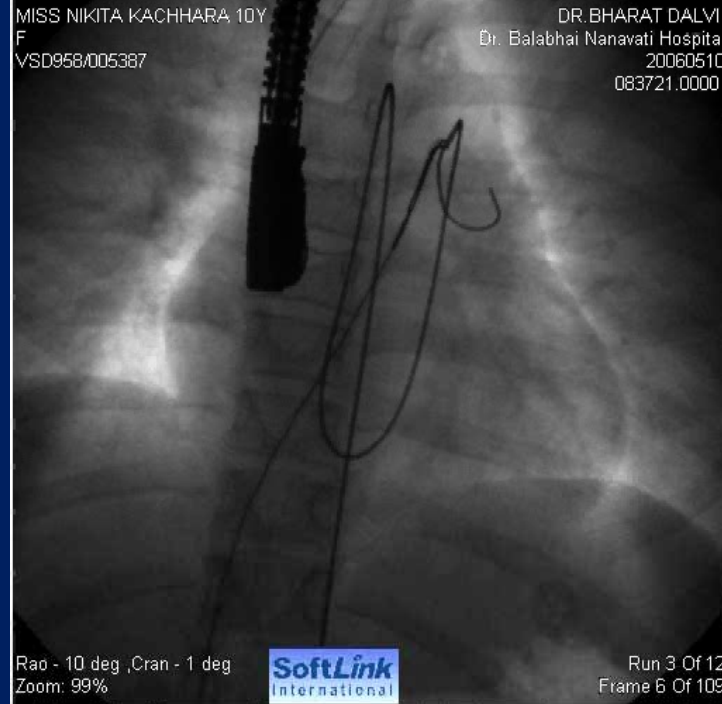
# Exclusion Criteria

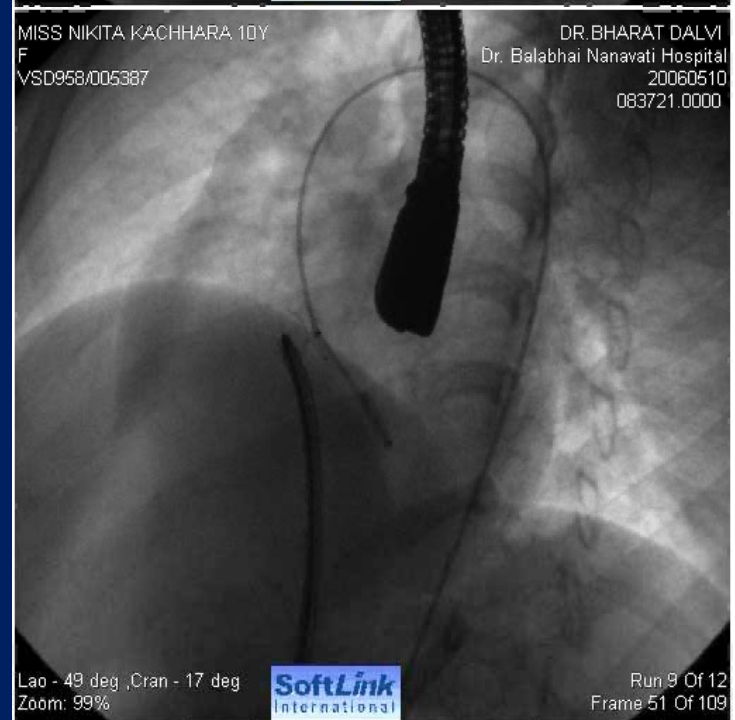
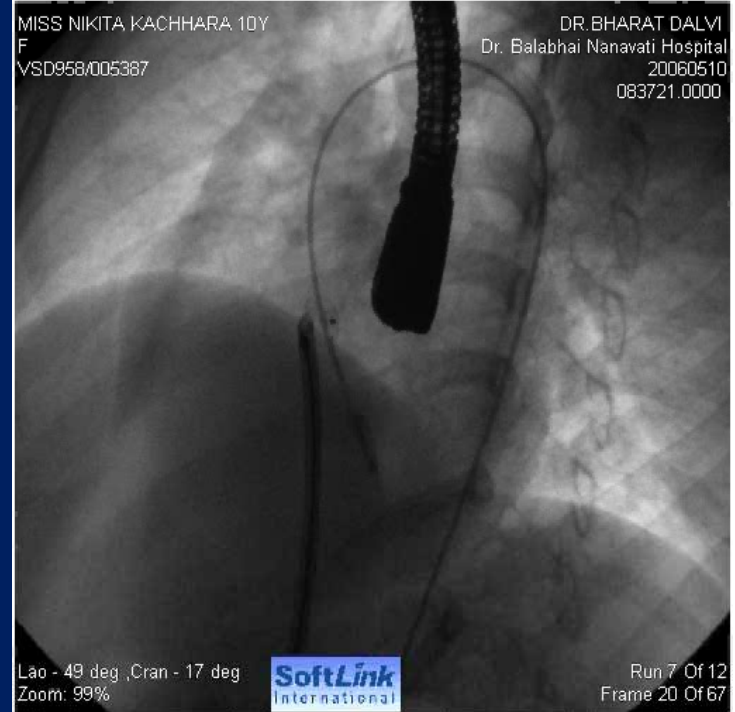
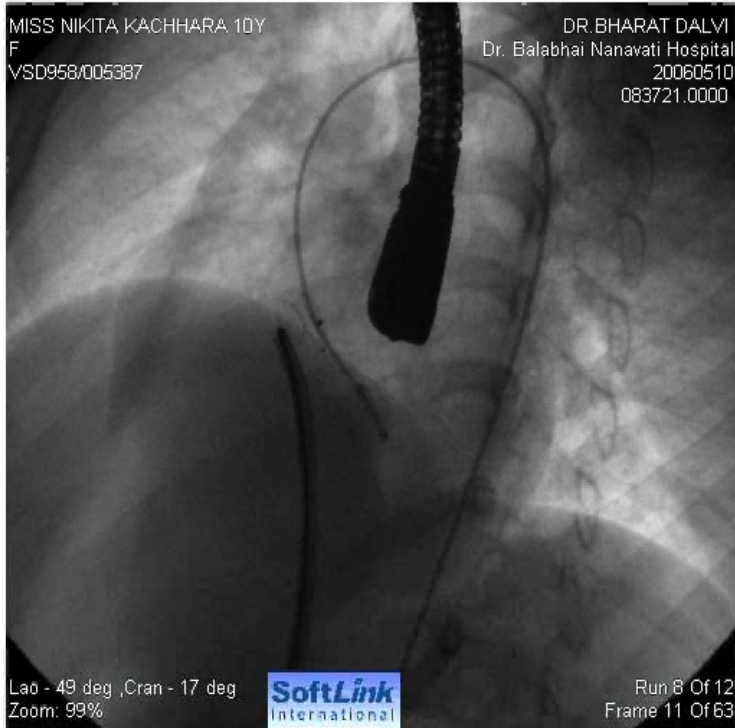
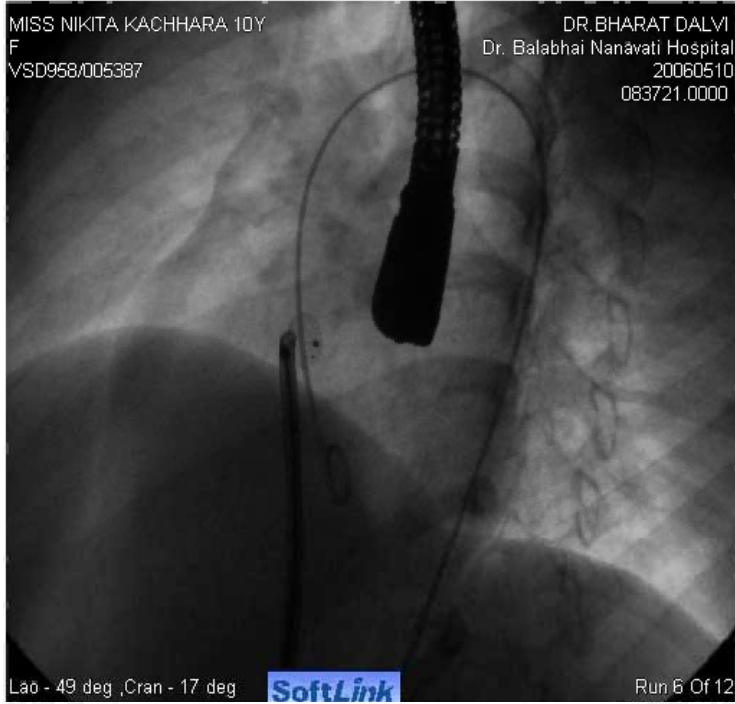
- Down's syndrome
- With inlet extension
- Irreversible pulmonary vascular disease
- Significant aortic valve prolapse
- LV to RA shunt
- H/O infective endocarditis
- Pre-existing conduction disturbances



# Procedure

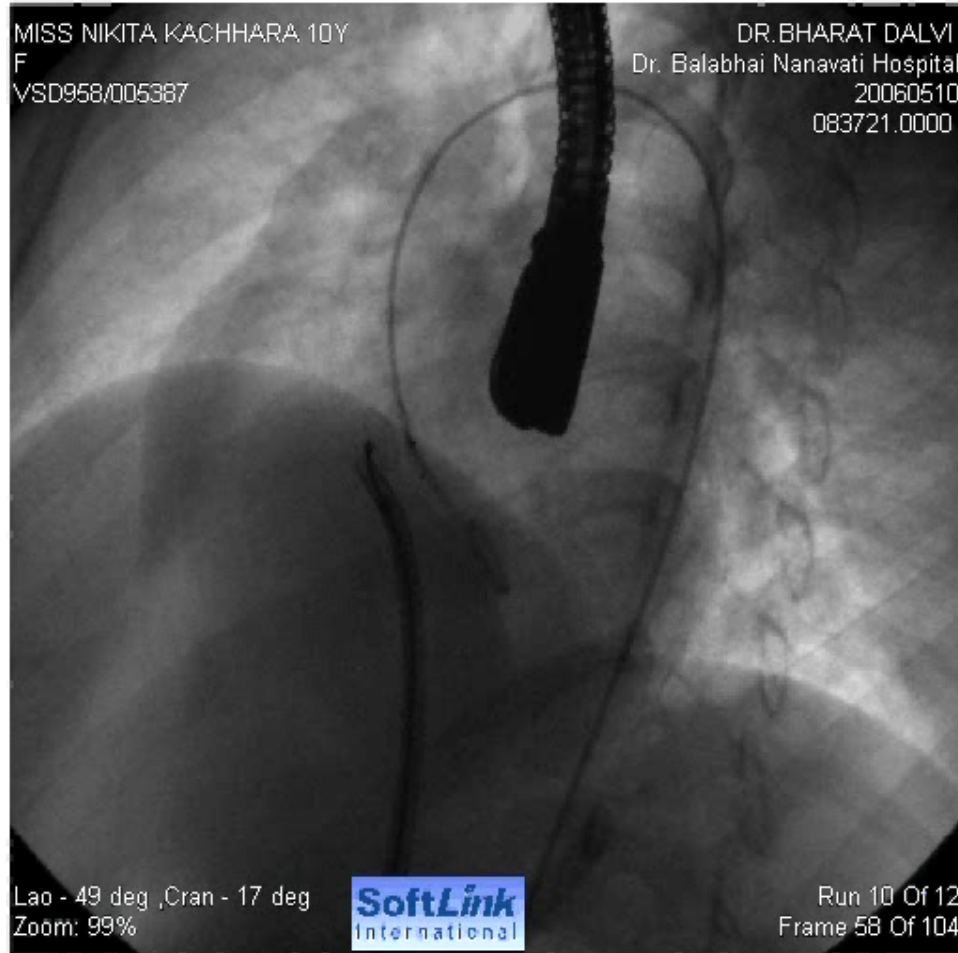
- Under GA with TEE guidance
- Hemodynamics, oximetry & angiography
- Device size based on TEE diameter
- Preparing the delivery sheath
- Loading the device
- Deployment of device under TEE and angiographic guidance
- Aspirin 5 mg / Kg / day for 6 months





MISS NIKITA KACHHARA 10Y  
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VSD958/005387

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Dr. Balabhai Nanavati Hospital  
20060510  
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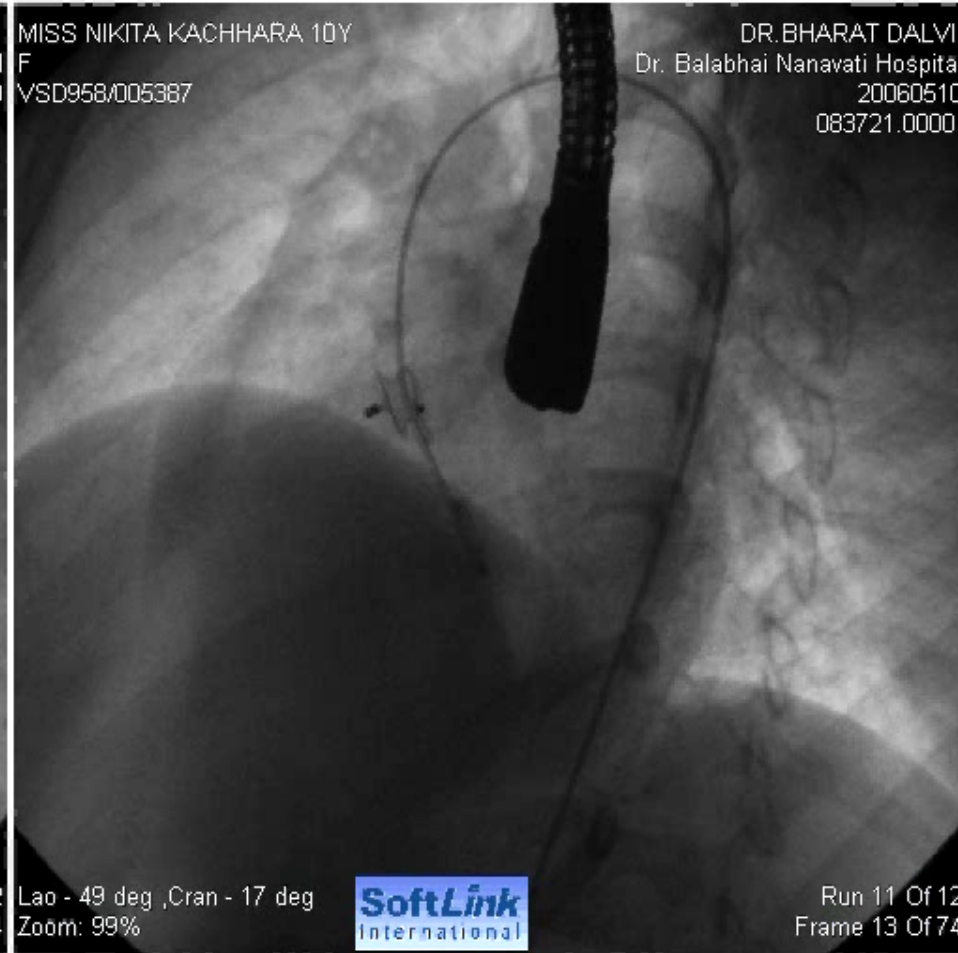
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Zoom: 99%

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Run 10 Of 12  
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Lao - 49 deg ,Cran - 17 deg  
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International

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MS.P FATIMA F^9y

DR. S SHARMA  
BOMBAY HOSP. CATH LAB  
2004020914

393 VSD

Lao - 60 deg ,Cran - 21 deg  
Zoom: 99%

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International

Run 2 Of  
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MS.P FATIMA F^9y

DR. S SHARMA  
BOMBAY HOSP. CATH LAB  
20040221091417

393 VSD

Lao - 47 deg ,Cran - 18 deg  
Zoom: 99%

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International

Run 18 Of 21  
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MAST KASHIF J KAZI 10Y  
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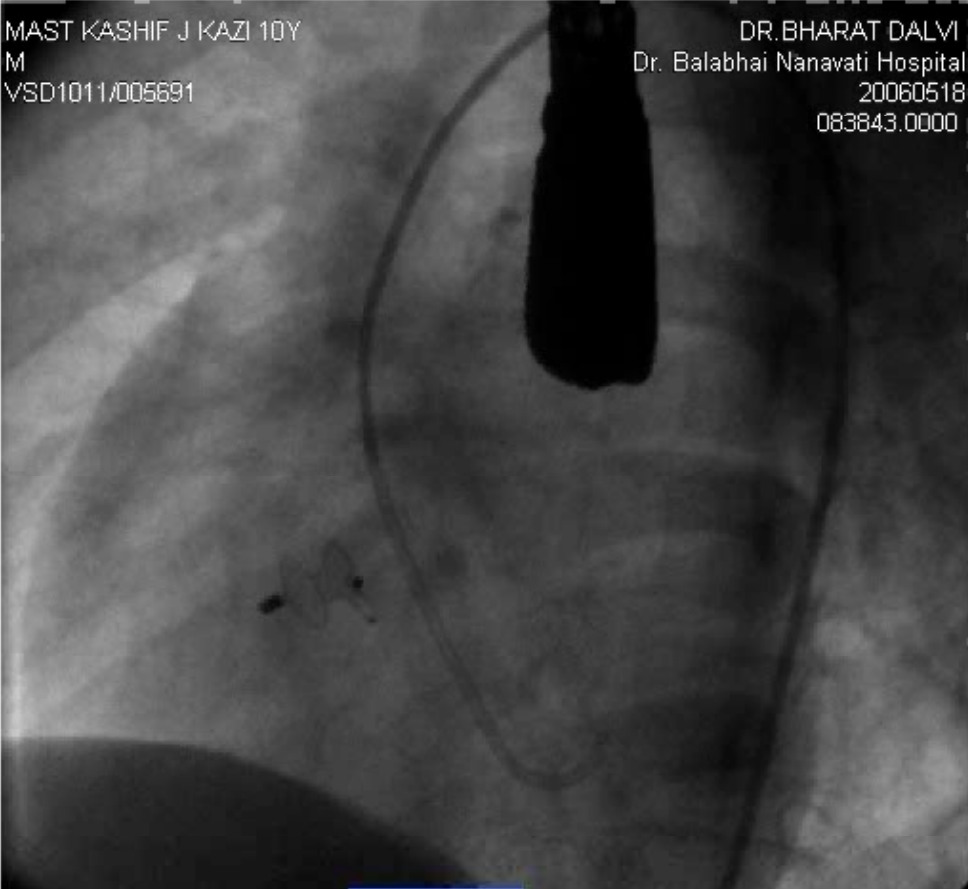
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Run 1 Of  
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Lao - 50 deg ,Cran - 20 deg  
Zoom: 99%



Run 20 Of 21  
Frame 8 Of 62

## Patient related variables (n=69)

- Age : 3 – 24 yrs (10 yrs)
- Weight : 16 – 56 Kg (28.5 Kg)
- NYHA class I – 31, class II - 38
- MDM at the apex : 44/69
- CTR > 50% : 35/69
- ECG abnormality : 1 (IRBB)

# Patient related variables

- TEE VSD size : 4-11.4 mms (6.5mm)
- Separation from AV : 2-9 mms (3.8 mms)
- Aortic valve prolapse : 10
- Trivial AR in 5; Mild AR in 2
- Presence of TV aneurysm : 27
- Qp:Qs : 1.3 to 2.5 (1.7)

# Procedure related variables

- Device diameter: 6-14 mm (8mm)
- Procedure time =  $132.4 \pm 30.4$  mins
- Fluoroscopy time =  $21.6 \pm 10.7$  mins
- Procedural success in 64/69 (92.8%)
- No residual shunt on pre-discharge echo 54/64 (84%)

# Procedural (acute) complications

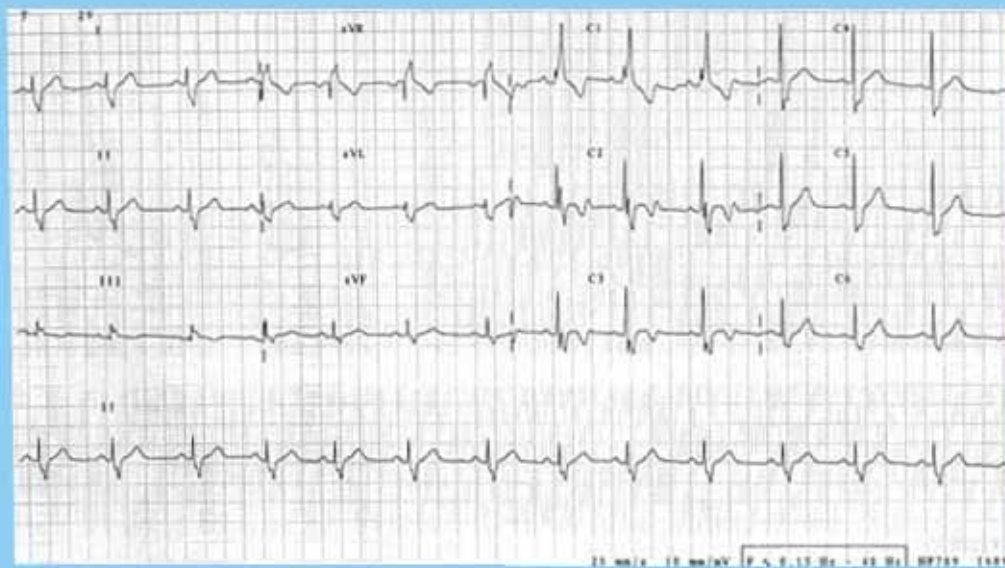
- Anaphylactic reaction to contrast - 1
- Failure to deploy - 4
- Silent thromboembolism to left vertebral artery - 1
- Device embolization - 1
- Device (LV disk) entrapment in MV apparatus - 1
- Hemolysis - 1

# Procedural (acute) complications

- Predischarge ECG:
  - IRBBB: 3
  - RBBB: 2
  - LAHB: 3
- Predischarge Echo:
  - Neo AR: 1 (trivial)
  - Neo TR: 2 (moderate – 1, trivial-1)



Before procedure



24 hours after



MI: 1.0  
S8  
21 MAY 04  
18:34:37  
B/D/E/F1  
GLENMARK CARDIAC  
CENTRE  
Pediatric  
FATIMA  
BY/F  
DR S SHARMA

GAIN 50  
COMP 75

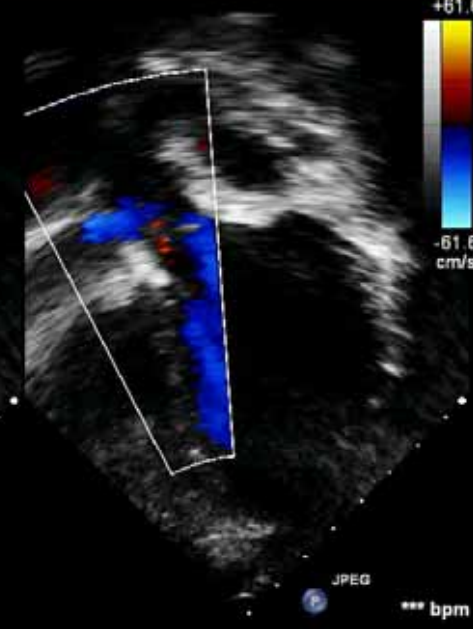
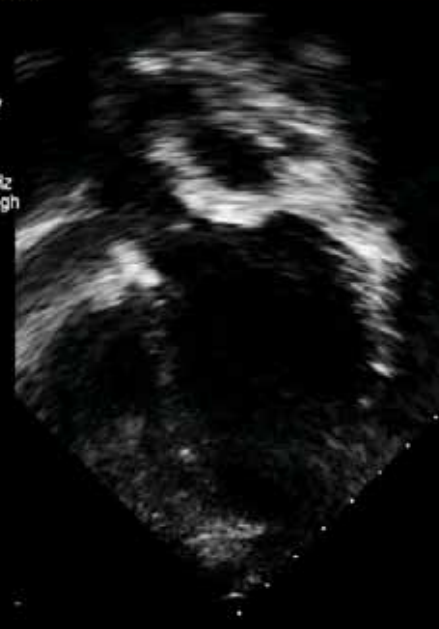
12CH  
121HZ



PHILIPS PALLAVI 24Y/F 21/07/2008 06:12:49PM TIS2.2 MI 1.2  
DR B V DALVI S5-1/Adult

FR 22Hz  
15cm

2D  
55%  
C 50  
P Low  
HPen  
CF  
66%  
2.5MHz  
WF High  
Med



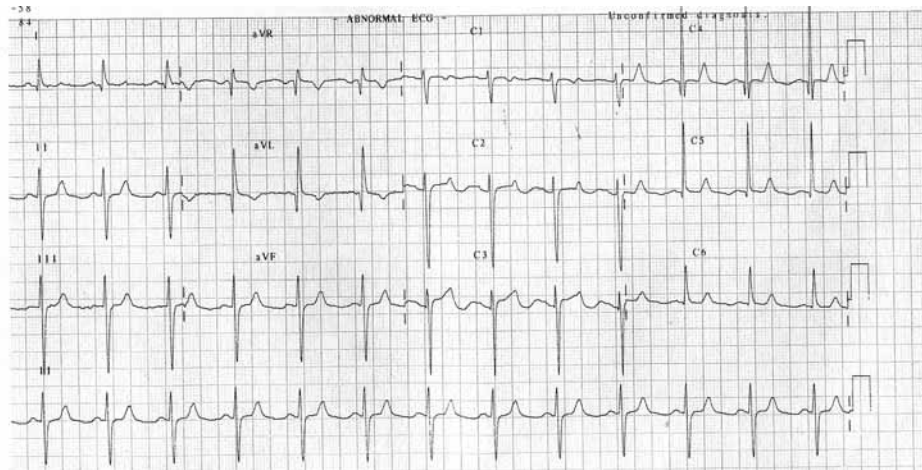
JPEG  
\*\*\* bpm

# Follow up

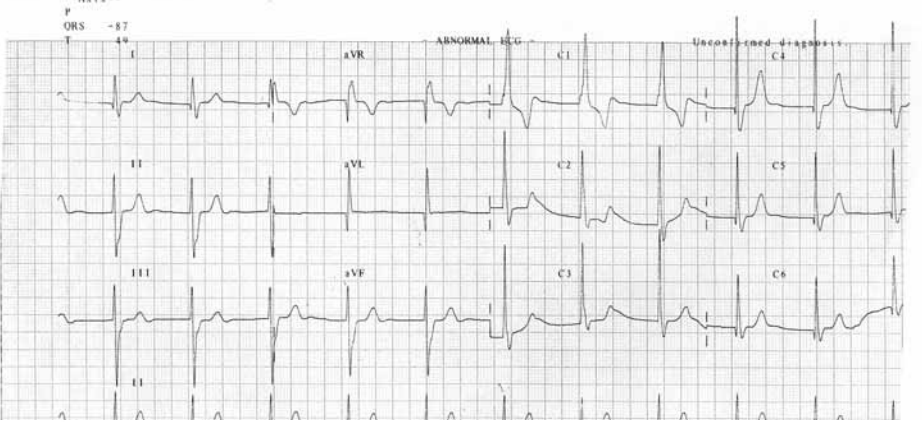
- Clinical: Symptoms, murmur
- ECG: Conduction abnormalities
- X-ray: Heart size and vascularity
- Echo: LV size on M-mode
  - Device position
  - Residual shunt
  - Aortic and tricuspid valves
  - LVOT
  - Thrombus and PE

# Follow up

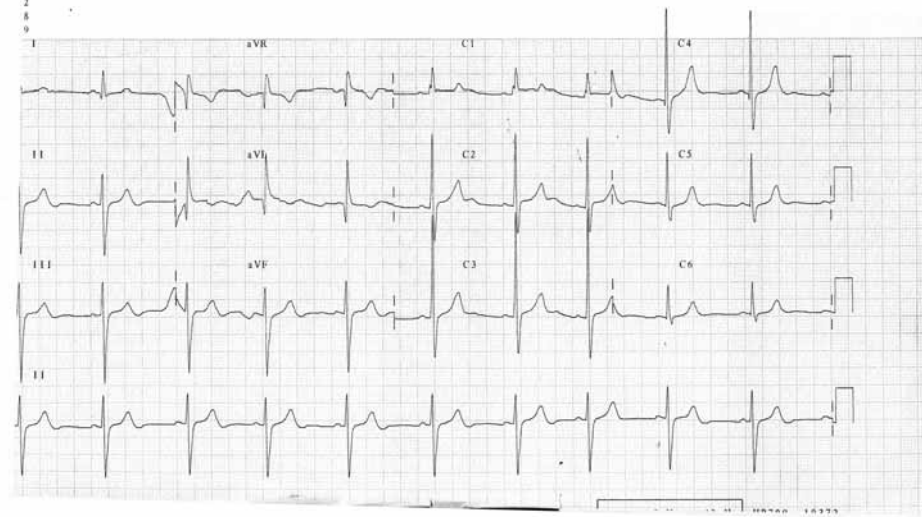
- Follow up: 6 to 90 months
- TR increased in one by two grades : Device surgically removed
- All in NYHA class I
- 7 have a short ESM
- Delayed conduction changes in 2. No CHB
- No device migration, embolization
- Neo TR in 4. Neo AR in 2.
- No thrombus or PE



**Baseline**



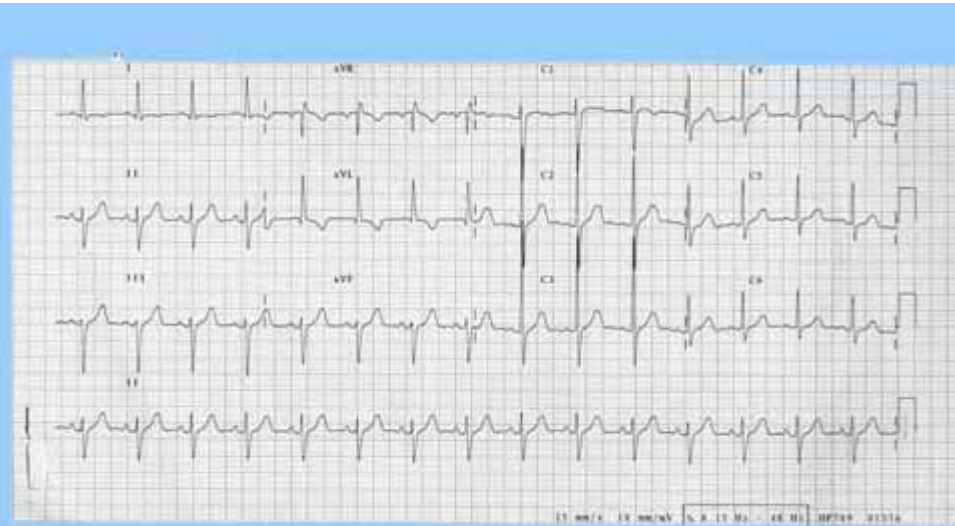
**24 hrs later**



**6 weeks FU**



Before procedure



24 hours after



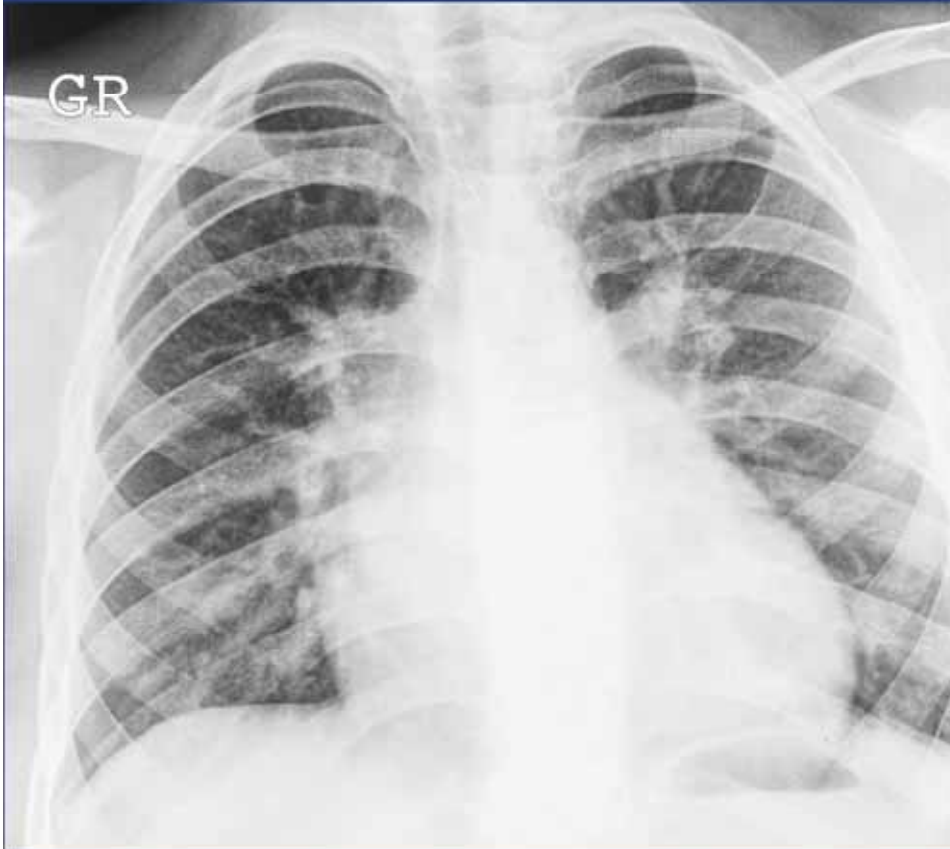
48 hours after



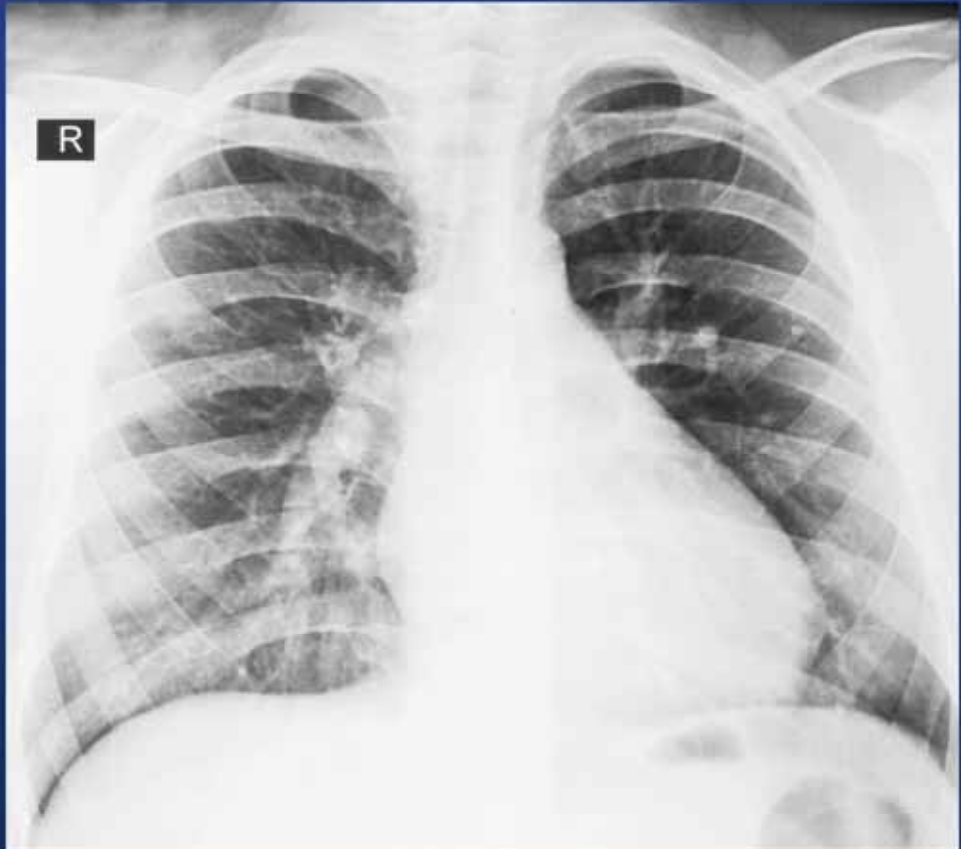
6 weeks later

# Why no CHB in our series

- Age
- Down's syndrome were excluded
- Those with inlet extension not included
- VSD size measured at the point of exit
- Device chosen was 1 mm > than the minimum jet diameter
- LUCK

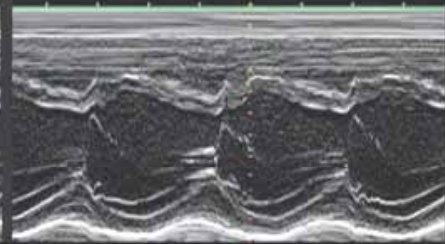


Before



1 year after

TIS:0.0  
S3  
GLENMARK CARDIAC 49HZ 11CM  
CENTRE 2/0/R/F3  
Pediatric  
ASHOK  
11V/M  
DR N VITHALANI  
30 JUNE 05  
19:00:17



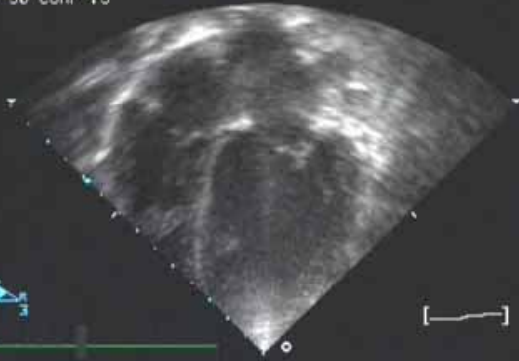
MI:0.4  
S3  
30 JUNE 05  
19:01:35  
0/0/E/F3  
GLENMARK CARDIAC  
CENTRE  
Pediatric  
ASHOK  
11V/M  
DR N VITHALANI

GAIN 50  
COMP 75

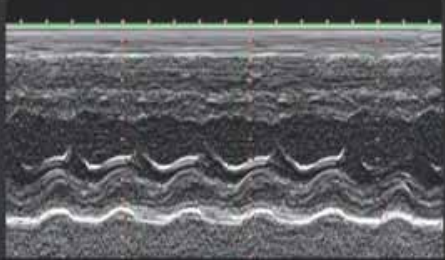
11CM



MI:0.6 53 ASHOK GLENMARK CARDIAC  
30 JUNE 05 19:02:03 11V/M CENTRE  
0/0/E/F3 14CM DR N VITHALANI Pediatric  
GAIN 50 COMP 75



MI:0.6 TIS:0.1  
S3  
GLENMARK CARDIAC 50HZ 12CM  
CENTRE 2/0/R/F3  
Adult  
ASHOK  
11V/M  
DR N VITHALANI  
00 0:00:00  
11 AUG 05  
12:04:41



MI:0.6  
S3  
11 AUG 05  
12:05:01  
0/0/D/F3  
GLENMARK CARDIAC  
CENTRE  
Adult  
ASHOK  
11V/M  
DR N VITHALANI

00 0:00:00

GAIN 50  
COMP 70

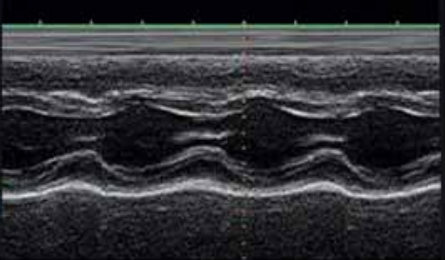
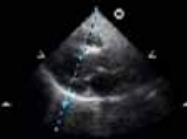
12CM



MI:0.6 53 ASHOK GLENMARK CARDIAC  
11 AUG 05 12:02:40 11V/M CENTRE  
0/0/D/F3 12CM DR N VITHALANI Adult  
GAIN 50 COMP 70 60HZ 00 0:00:00



MI:1.6 TIS:0.9  
S3  
GLENMARK CARDIAC 47HZ 15CM  
CENTRE 2/0/R/H5  
Adult  
ASHOK  
12V/M  
DR B DALVI  
00 0:00:00  
09 AUG 06  
15:14:15



MI:1.6  
S3  
09 AUG 06  
15:14:35  
0/0/C/H5  
GLENMARK CARDIAC  
CENTRE  
Adult  
ASHOK  
12V/M  
DR B DALVI

00 0:00:00

GAIN 50  
COMP 70

12CM



MI:1.6 53 ASHOK GLENMARK CARDIAC  
09 AUG 06 15:13:06 12V/M CENTRE  
0/0/C/H5 15CM DR B DALVI Adult  
GAIN 50 COMP 70 25HZ 00 0:00:00





Study	Bass et al	Thanopoulos et al	Pedra et al	Miro et al	Fu et al
Year	2003	2003	2004	2005	2006
No. of patients	27	10	10	54	35
Age in yrs	1.25 - 32	1.5 - 12	6 - 32	0.5 - 61	1.2 - 54.4
Weight	8.5-80 kg	11-49 kg	19-80 kg	6-77 kg	8-110 kg
Qp:Qs	1.6	1.93±0.29	1.5-5.5(2)	1.7±0.6	(1.8)
Device size (mm)	4-12	4-8	8-18	6-18	6-16
Successful implant	93%	100%	100%	94%	91%

Study	Bass et al	Thanopoulos et al	Pedra et al	Miro et al	Fu et al
Residual shunt	8%	0%	10%	17%	4%
CHB	0	0	0	3+2	1
AR	2	0	0	1	12%
LBBB/RBBB	1	3 TLBBB	1	NR	NR
Hemolysis	0	0	0	2	2
Others	1	0	LVOTO-2	0	2

# Conclusions

- AAPMVSDO continues to remain a good alternative to surgery in a select group
- Patient selection is at the heart of a successful program
- CHB is a major concern
- Better patient selection
- Avoiding oversizing
- Improvement in device design

Discarding this microengineering marvel  
altogether – “Height of skepticism”