



Percutaneous or surgical treatment of post infarction VSD: The UK National Registry

Dr Joel Giblett MD
Liverpool Heart and Chest Hospital

On behalf of the UK PIVSD
investigators



TCT

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Disclosure Statement of Financial Interest

I, [Joel Giblett](#) DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

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Introduction

- Post infarction ventricular septal defect (PIVSD) is a rare but life-threatening complication of acute myocardial infarction¹
- Mortality following surgical repair remains high²
- Evidence for percutaneous treatment of PIVSD is confined to small case series³
- This registry sought to investigate current practice in the UK and characterize patients treated with either technique

Study Design

Design

- **DESIGN:** Retrospective observational registry, with *detailed case note review* in each centre
- **PRIMARY OBJECTIVE:** To evaluate 5-year all-cause mortality in both surgical repair and percutaneous closure
- **SECONDARY OBJECTIVE:** To evaluate survival to hospital discharge, analyze contemporary trends in treatment of PIVSD, and assess predictors of survival

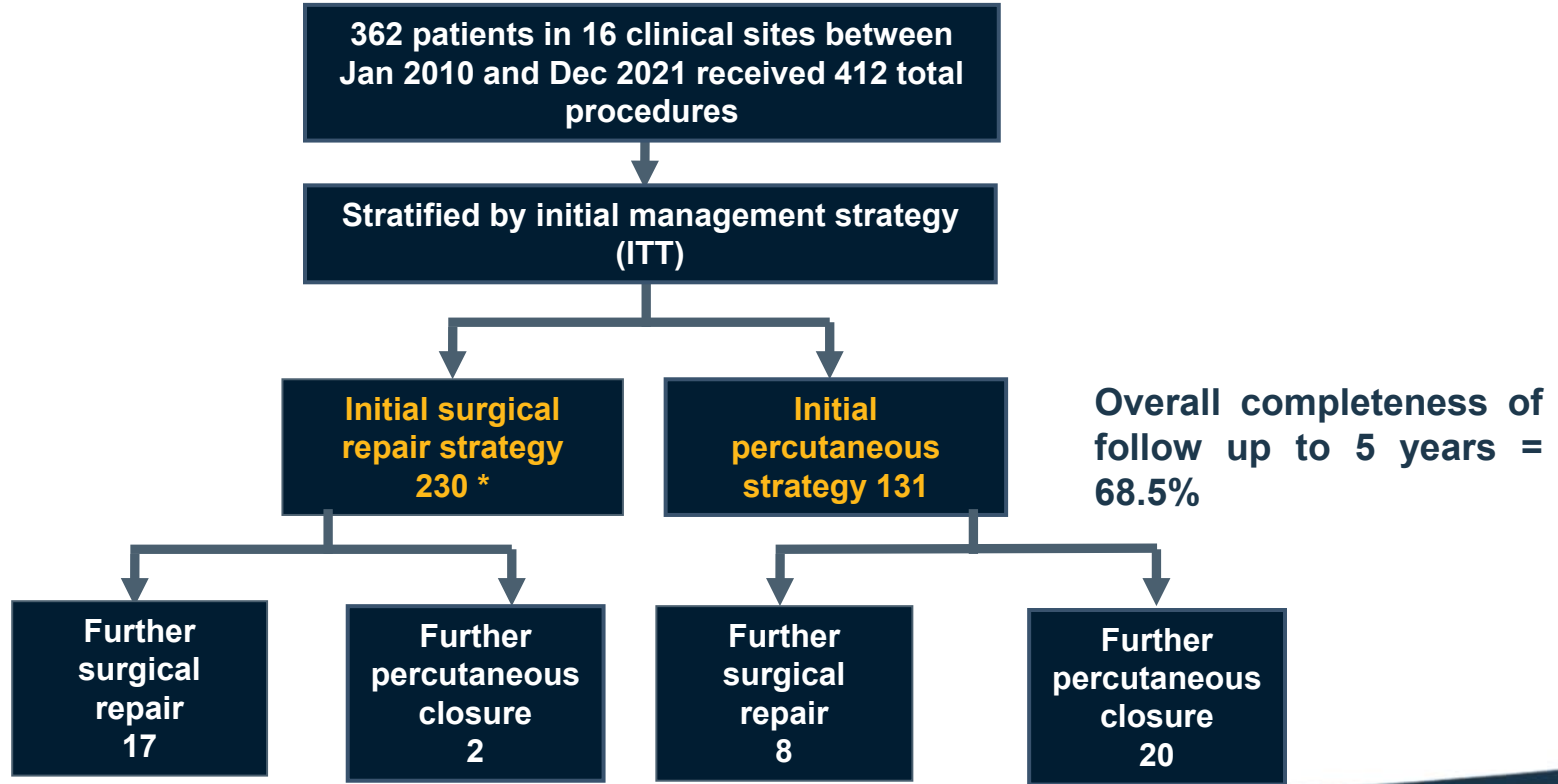


Centers and Investigators

- **Freeman Hospital**
 - David S. Crossland
- **Guy's and St. Thomas' Hospital**
 - Brian R. Clapp
- **Leeds General Infirmary**
 - James R. Bentham
- **Liverpool Heart and Chest Hospital**
 - John P. O'Neill
 - Rod H. Stables
 - Suneil K. Aggarwal
 - Bilal H. Kirmani
 - D. Mark Pullan
- **Keele University**
 - Mamas A. Mamas
 - Andrija Matecic
- **Kings College Hospital**
 - Ritesh Kanyal
 - Jonathan Byrne
 - Philip MacCarthy
- **Nottingham University Hospital**
 - William H.T. Smith
 - Jakub Marczak
- **Queen Elizabeth Hospital**
 - Sudhakar George
 - Joe De Giovanni
- **Royal Infirmary of Edinburgh**
 - David B. Northridge
 - Jack Andrews
- **Royal Papworth Hospital**
 - Leonard M. Shapiro
 - David Jenkins
 - Choo Y. Ng
 - Shreenidhi Venuraju
 - Tobias MacCarthy
 - Jonathan Vibhishanan
- **Royal Stoke Hospital**
 - Robert Butler
 - Megan A. Butler
- **Royal Surrey County Hospital**
 - Nicholas Buttinger
 - David Hildick Smith
- **University Hospital Bristol**
 - Wan Cheol Kim
 - Mark S. Turner
- **University Hospital Southampton**
 - Nicholas Hayes
- **Morrison Hospital and University Hospital of Wales**
 - Ayush Khurana
- **Wythenshawe Hospital**
 - Mamta Buch

Co-Chief Investigators: Patrick A. Calvert and Joel P. Giblett

Study Flow Chart



* One patient had an Initial surgical repair prior to time period of study

Results

Patient Characteristics

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
Age (years), median (IQR)	72 (64, 77)	67 (61, 73)	<0.001
Female sex, %	35.1	28.1	0.167
Body mass index (kg/m ²), median (IQR)	28 (25, 31)	26 (24, 30)	0.010
Comorbidities, %			
Hypertension	46.6	55.0	0.124
Diabetes mellitus	19.8	16.0	0.356
Chronic lung disease	9.2	10.8	0.616
Prior or current smoking	42.0	61.0	<0.001
Hypercholesterolaemia	30.5	37.7	0.172
Prior cerebrovascular incident (thromboembolic or haemorrhagic)	3.1	3.5	0.834
Creatinine (mg/dL), median (IQR)	1.2 (0.9, 1.6)	1.3 (1.0, 1.8)	0.707

Results

AMI Characteristics

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
Territory of myocardial infarction			0.023
Anterior	43.5	32.2	
Inferior	55.7	63.0	
Lateral	0.8	0.4	
Posterior	0.0	4.3	
Vessels with coronary artery disease			0.437
0	0.0	0.9	
1	47.1	39.0	
2	30.3	36.8	
3	21.0	22.5	
4	1.7	0.9	
Initial AMI treatment, %			0.413
None	56.2	58.8	
PCI	41.5	38.2	
CABG	0.8	0.0	
Thrombolysis	1.5	3.1	
PCI to infarct-related artery, %	41.5	38.7	0.596

Results

Hemodynamic State

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
NYHA class (worst prior to repair), %			0.457
1	3.1	4.8	
2	17.1	12.2	
3	32.6	30.1	
4	47.3	52.8	
Cardiogenic shock, %	51.9	62.8	0.044
Dialysis/filtration (prior to repair), %	6.1	10.8	0.134
Mechanical circulatory support (prior to repair), %			0.050
None	32.8	22.9	
Intra-aortic balloon pump	66.4	74.0	
Impella Device	0.8	0.0	
Extracorporeal membrane oxygenation	0.0	2.2	
IABP + ECMO	0.0	0.9	

Results

Defect Characteristics

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
Defect size* (mm), median (IQR)	18 (14, 22)	20 (15, 27)	<0.001
Defect site, %			0.192
Anterior	21.1	18.8	
Inferior	53.9	64.2	
Apical	25.0	16.2	
Mid septum	0.0	0.4	
Other	0.0	0.4	
LV systolic function (on procedural TOE or last echo before repair)			0.165
Normal (EF >50%)	33.8	26.6	
Moderate (EF 31-49%)	43.8	54.1	
Severe (EF <30%)	22.3	19.2	
RV function (on procedural TOE or last echo before repair)			0.007
Normal (EF >50%)	32.8	18.1	
Dilated RV	16.4	21.2	
Dilated RV with impaired function	50.8	60.6	

Results

Time to presentation and repair; decision making

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
Time - AMI to presentation (days), median (IQR)	2 (0, 7)	2 (0, 7)	0.850
Time - AMI to VSD repair (days), median (IQR)	9 (6, 14)	9 (4, 22)	0.179
Multidisciplinary Team discussion, %			<0.001
None	15.3	51.9	
Documented informal discussion	38.2	25.5	
Formal Heart Team review	46.6	22.5	

Results

Percutaneous Procedures

Characteristic	
General anaesthesia, %	93.1
Imaging support, %	
Fluoroscopy only	3.9
TTE	3.1
TOE	93.0
ICE	0.0
Arterial access, %	
None	1.6
Femoral	91.5
Radial	3.9
Axillary	1.6
Brachial	0.8
Radial and femoral	0.8
Venous access, %	
None	5.5
Femoral	35.9
Jugular	57.8
Both	0.8
Inotropic support, %	45.0
AV loop, %	84.7
Balloon sizing, %	11.5
Largest device size (mm), median (IQR)	24 (20, 24)
Fluoroscopy time (minutes), median (IQR)	30 (19, 44)

Characteristic	
Number of device placements attempts, %	
0	4.0
1	73.8
2	17.5
3	3.2
4	1.6
No. successful attempts, %	
0	13.7
1	84.7
2	0.8
3	0.0
4	0.8
First successful attempt, device type, %	
Unsuccessful	9.2
Amplatzer™ P.I. Muscular VSD Occluder	64.1
Amplatzer™ Muscular VSD Occluder	12.2
Amplatzer™ Atrial Septal Occluder (ASO)	6.9
Occlutech™ PmVSD Occluder	3.8
Other	3.8
Immediate shunt reduction, %	
No reduction	11.2
Partial reduction	69.6
Complete reduction	19.2

Results

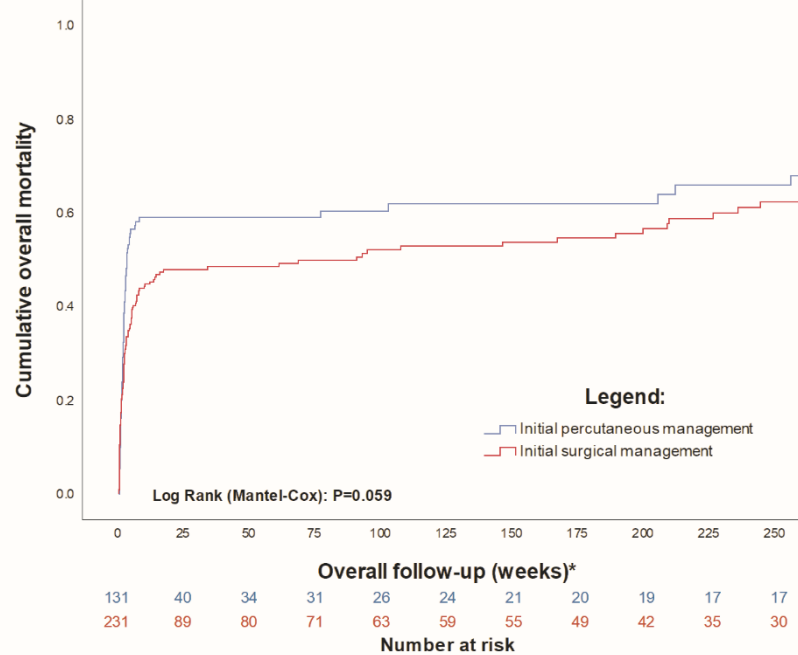
Surgical Procedures

Characteristic	
Intraoperative transoesophageal echocardiography, %	100.0
Intraoperative intra-aortic balloon pump, %	77.1
Concomitant CABG, %	51.9
Concomitant valve procedure, %	
None	92.6
Mitral valve procedure	4.8
Tricuspid valve procedure	1.3
Aortic valve procedure	1.3
Concomitant VAD placement, %	1.7
Weaned to Extracorporeal membrane oxygenation	1.3
Surgical technique, %	
Patch	93.4
Oversewing/exclusion	4.8
Percutaneous device placed	0.4
Patch and Exclusion	1.3
Immediate shunt reduction, %	
No reduction	1.8
Partial reduction	31.7
Complete reduction	66.5
Cardiopulmonary bypass time (minutes), median (IQR)	155 (119, 213)

Results

5-year cumulative mortality

A Overall mortality: Initial percutaneous vs. initial surgical management



Results

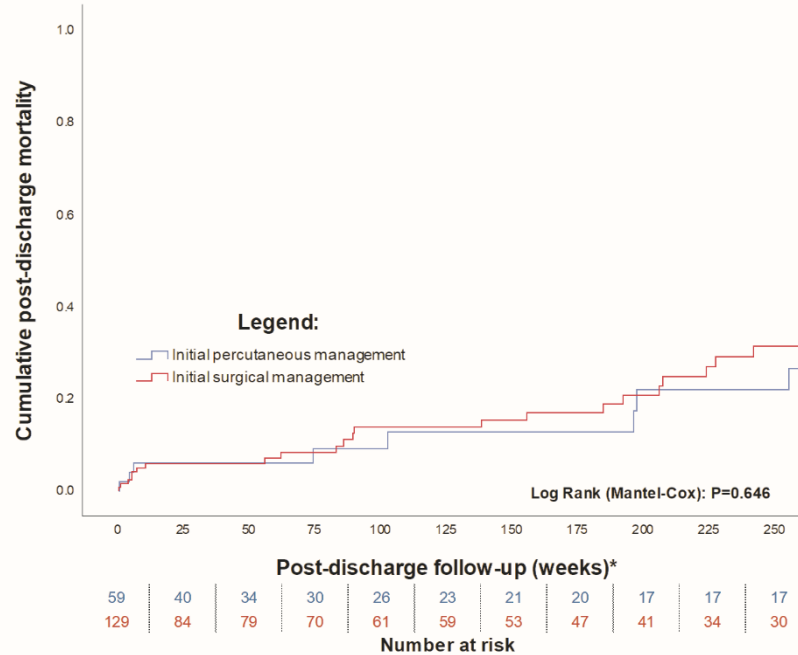
Survival to hospital discharge and selected procedural complications

Characteristics	Initial percutaneous management (N=131; 36.2%)	Initial surgical management (N=231; 63.8%)	P-value
In Hospital Mortality, %	55.0	44.2	0.048
Stroke, %	0.8	5.6	0.021
Device embolization, %	7.6	n/a	/
Surgical patch dehiscence, %			/
No patch dehiscence	n/a	82.3	
Partial patch dehiscence	n/a	13.4	
Complete patch dehiscence	n/a	4.3	
Any repeat intervention, %			<0.001
None	78.6	90.9	
Percutaneous closure	5.4	6.5	
Surgical closure	15.3	0.9	
Both percutaneous and surgical closure	0.8	1.3	
Cardiac transplantation	0.0	0.4	
New pacemaker/ICD, %	1.5	6.9	0.023
Pneumonia, %	8.4	23.4	<0.001
Cardiac tamponade, %	5.3	6.1	0.779

Results

Landmark analysis from hospital discharge

B Post-discharge mortality: Initial percutaneous vs. initial surgical management



Results

Cox regression analysis for association with all cause 5-year mortality

Variables	Univariate Cox analysis		Multivariate Cox analysis	
	Hazard Ratio (95% CI)	P-value	Adjusted Hazard Ratio (95% CI)	P-value
Percutaneous management ¹	1.31 (0.99, 1.73)	0.063	1.44 (1.01, 2.05)	0.042
Centre volume	1.00 (0.99, 1.01)	0.801	1.00 (0.99, 1.02)	0.759
Patients with multiple procedures	0.59 (0.38, 0.93)	0.023	0.61 (0.37, 1.03)	0.063
Time from AMI to VSD repair ²	0.97 (0.96, 0.99)	<0.001	0.99 (0.98, 0.99)	0.037
Age	1.02 (1.01, 1.04)	0.004	1.02 (1.00, 1.03)	0.075
Female sex	0.92 (0.68, 1.24)	0.587	0.79 (0.57, 1.11)	0.176
Diabetes Mellitus	1.10 (0.77, 1.57)	0.595	0.91 (0.61, 1.37)	0.665
Hypertension	1.31 (0.99, 1.73)	0.056	1.31 (0.97, 1.78)	0.077
PCI to IRA	1.20 (0.91, 1.59)	0.195	1.18 (0.88, 1.59)	0.270
Creatinine ³	1.03 (1.02, 1.05)	<0.001	1.03 (1.01, 1.05)	0.002
Number of vessels with coronary artery disease	1.14 (0.96, 1.35)	0.146	1.22 (1.01, 1.47)	0.043
NYHA class	1.35 (1.13, 1.62)	0.001	1.13 (0.92, 1.37)	0.241
Cardiogenic shock	2.25 (1.67, 3.04)	<0.001	1.97 (1.37, 2.84)	<0.001
RV dysfunction	0.94 (0.68, 1.30)	0.694	0.88 (0.60, 1.29)	0.522

Limitations

- Retrospective observational study
- Significant selection bias
- Some patients were only offered percutaneous treatment once surgical repair deemed unfeasible
- Involvement of heart team decision making was inconsistent
- Prospective studies are needed to evaluate optimal method and timing of treatment

Discussion

- Largest registry of percutaneous cases with more than double the previous series and the first to offer comparison with surgical cases
- Mortality is high with any treatment option
- Signal of increased mortality with percutaneous treatment compared to surgical repair (but with the above strong caveats)
- Cardiogenic shock was the most powerful predictor of mortality in the analysis
- Timing of procedure remains contentious and needs further investigation

Conclusion

- Both percutaneous and surgical management are complementary in real world clinical practice and offer significant survival advantage compared to historical data on medical therapy
- No difference between treatments in landmark analysis
- Shared decision making through the heart team is key for patients
- Further prospective studies are important in order to guide treatment decisions