The significance of ventricular septal flattening in patients with suspected pulmonary hypertension

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Conflict of interests

- None to declare

Background

Prevalence of ventricular septal flattening in pulmonary arterial hypertension (PAH)

- Case series of PAH

  4/9 had ventricular septal flattening (VSF)[1]

- National US registry of PAH.

  187 patients. 59% with VSF[2]

- Single center PAH cohort.

  51 patients 90% with VSF[3]

1. Goodman DJ et al. Am J Cardiology 1974 2. Rich S et al. Ann Intern Med 1987 3. Bossone E et al. J Am Soc Echocardiogr 1999

Background
Significance of VSF in PAH patients

- VSF is related to hypotensive response to calcium channel blockers[1].
- The degree of septal displacement correlates with mean right atrial pressure[2].
- VSF predicts increased mortality [3].

[1]Ricciardi MJ et al. Chest. 1999 [2]Hinderliter AL et al. Circulation 1997
[3]Raymond RJ et al. J Am Coll Cardiol. 2002.

Aims

- What is the distribution of different types of pulmonary hypertension in patients with VSF?
- What is the significance of VSF in patients with suspected PH?

Hypothesis

- We assume VSF is a sign of
  RV pressure > LV pressure.

- We hypothesize that patients with VSF will be more likely to have pre- capillary PH and its accompanying clinical, echocardiographic and hemodynamic features.

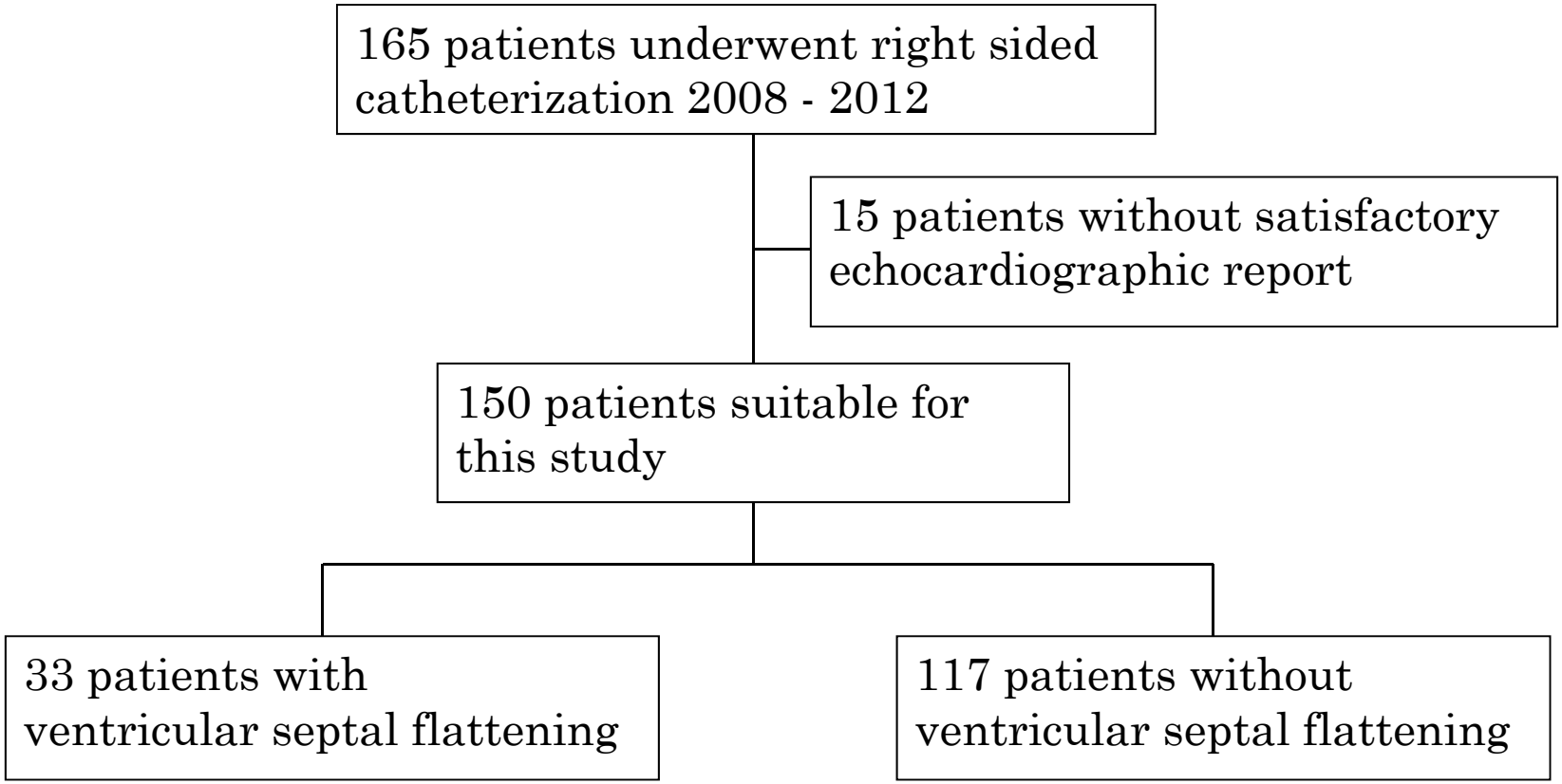
Methods

- Patients who were evaluated in Tel Hashomer medical center for PH and underwent right sided catheterization

- Retrospective data collection included:
  - Medical history
  - Lab results
  - Echocardiography
  - Right sided hemodynamic measurement
  - Final diagnosis confirmation – Prof. Ben-Dov, Dr Segev, Dr. Segel.

.

Results


165 patients underwent right sided catheterization 2008 - 2012
15 patients without satisfactory echocardiographic report
150 patients suitable for this study
33 patients with ventricular septal flattening
117 patients without ventricular septal flattening

Clinical Characteristics			
	No flattening	Flattening	p
Age (years)	64.6±15.1	58.0±17.0	**0.050**
Male gender	30%	24%	0.525
Overweight (BMI>30Kg/m^2)	44%	24%	**0.036**
Ischemic heart disease	22%	15%	0.376
Hypertension	69%	54%	0.116
Diabetes	39%	33%	0.532
Dyslipidemia	59%	30%	**0.002**
Obstructive sleep apnea	19%	3%	**0.026**
Chronic lung disease	21%	39%	**0.035**
Past pulmonary embolism	8%	30%	**0.001**

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Echocardiography			
	No flattening	Flattening	p
Ejection fraction (%)	58.1±8.8	58.6±6.2	0.750
Peak E wave (cm/sec)	**101.8±35.3**	81.1±30.8	**0.013**
Peak A wave (cm/sec)	75.7±41.6	71.0±30.8	0.603
E/e' septal	17.1±13.5	14.5±6.2	0.326
E/e' lateral	**13.0±9.7**	7.9±3.7	**0.005**
LV mass index (gr/m^2)	**93.4±28.4**	82.2±17.3	**0.023**
LA diameter (mm)	**41.0±7**	36.8±10	**0.028**
LA area (cm^2)	22.9±6.1	20.6±6.9	0.107
LA enlargement: area criteria	**73%**	43%	**0.003**
Abnormal LV filling pattern	58%	100%	**0.002**

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Abnormal LV filling pattern	58% (31/53)	**100% (16/16)**	**0.002**

Hemodynamics			
	No flattening	Flattening	p
Mean PAP (mmHg)	36.4±14.2	51.6±17.2	**0.001**
Mean PAP >25mmHg	73%	97%	**0.004**
PCWP>15mmHg	61%	37%	**0.019**
Trans pulmonary gradient>12mmHg	58%	97%	**0.001**
Cardiac index (Fick, L/min/m^2)	2.5±0.9	2.0±0.6	**0.001**
Stroke volume (Fick, ml)	60.7±21.9	41.9±14.1	**0.001**
Pulmonary vascular resistance (Wood's units)	4.4±3.7	11.0±6.6	**0.001**
Pulmonary vascular resistance>3 wood's units	52%	97%	**0.001**
Mean RA pressure (mmHg)	11.2±7.5	10.5±6.3	0.611

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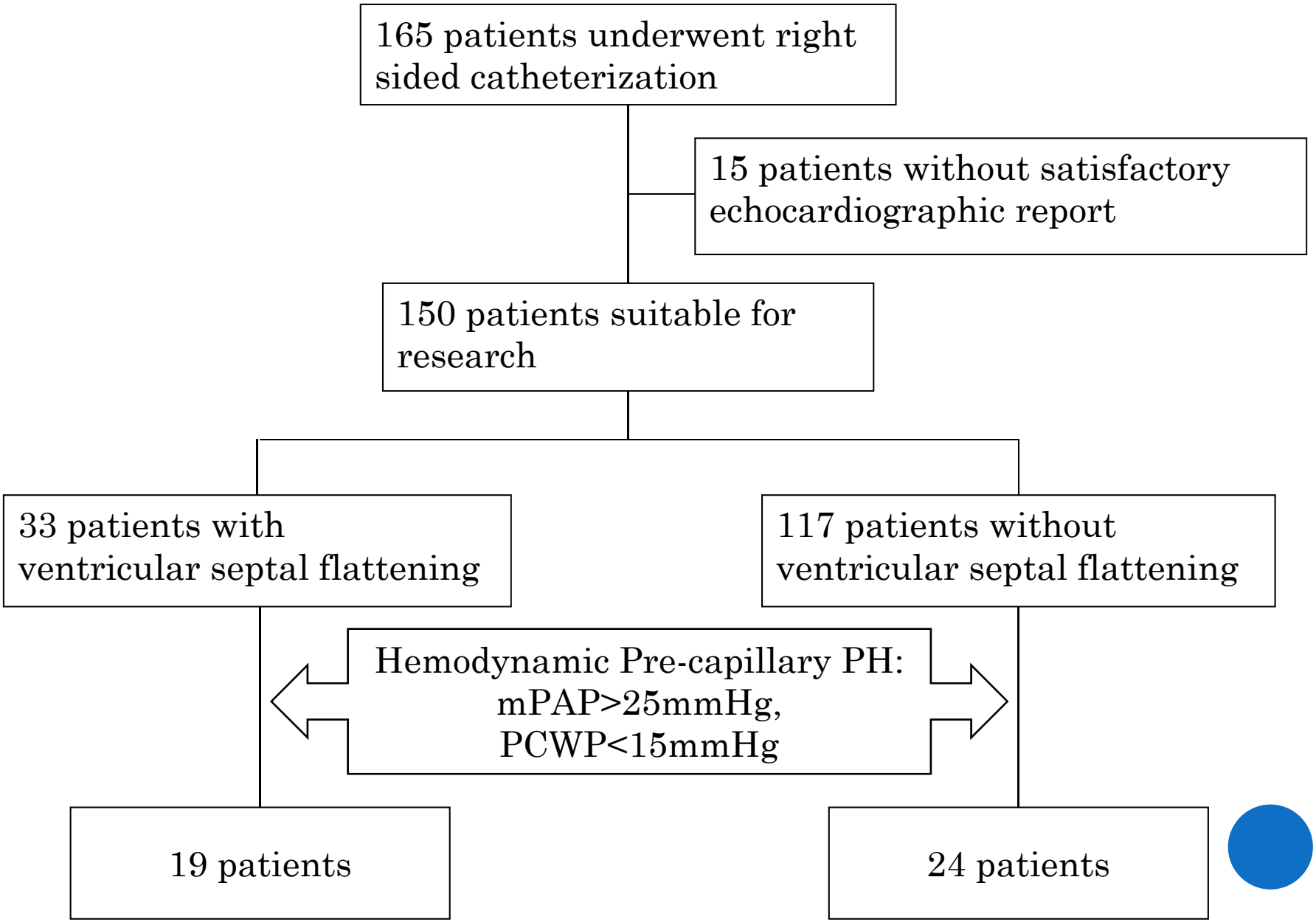
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Hemodynamic Pre-capillary PH:
mPAP>25mmHg,
PCWP<15mmHg
19 patients
24 patients

Hemodynamics: Pre-Capillary PH Subgroup

	No flattening	Flattening	p
Mean PAP (mmHg)	40±13.6	55±20.3	0.012
PCWP (mmHg)	11.1±4.0	9.2±3.4	0.098
Trans-pulmonary gradient>12mmHg	92%	100%	0.198
Cardiac index (Fick, L/min/m^2)	2.6±0.7	2.0±0.7	0.027
Stroke volume (Fick, ml)	55.7±18.9	40.5±14.0	0.009
Pulmonary vascular resistance (Wood's units)	7.0±4.9	13.7±7.0	0.002
Pulmonary vascular resistance>3 Wood's units	79%	100%	0.039
Mean RA pressure (mmHg)	8.2±6.6	8.5±3.7	0.836

Final Diagnosis

	No flattening		Flattening		p
	%	N	%	n	
No PH	16%	19	3%	1	
No PH but CHF	3%	4	3%	1	
Class I – PAH	14%	16	39%	13	
Class II – left heart disease	47%	55	18%	6	
Class III – lung disease	1%	1	0%	0	
Class IV –thromboembolic	4%	5	21%	7	
Class V - miscellaneous	3%	3	0%	0	
Out of proportion PH	10%	12	12%	4	
Sum of I, III, IV, V, Out of proportion*	**32%**	**37**	**73%**	**24**	**0.001**
Unknown/other	2%	2	6%	2	

*sum of patients diagnosed as PH with pre- capillary component

Limitations

- Broad definition of VSF possibly including several entities.
- Selected population
- Retrospective analysis
- Time lag from echocardiography to catheterization
- Different echocardiography protocols and documentation
- Change in PH definition and classification over the years

Conclusions

- VSF can indentify patients with non cardiac PH.
- VSF is a specific (97%) marker of PH with elevated pulmonary vascular resistance (but sensitivity 35%).
- In pre- capillary PH patients, VSF is associated with a more severe hemodynamic profile.
- In the presence of VSF an abnormal LV filling pattern should not be interpreted as a marker of LV disease.

Conclusions

All patients with unexplained VSF should be referred to specialized PH clinics and right heart catheterization should be considered.

Thank you!