ESC Heart & Brain Workshop

Structural heart disease and stroke

P. Lanzer, Mitteldeutsches Herzzentrum, Standort Bitterfeld

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BAYER

Boehringer Ingelheim

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Medtronic
Further, Together

Agenda

Stroke Facts

Struktural Heart Disease and Stroke

- Congenital Heart Disease
- Heart Disease with Thromboembolic Potential

Interventions and Stroke

Conclusions

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Stroke Facts

EU by Age (100.000/y)

Age	Austria		Belgium		Cyprus		Czezh Republic		Denmark		Finland		France		Germany		Greece		Iceland		Ireland		Italy		Luxembourg		Malta	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
25–34	13	10	19	12	10		7	30	15	23	12	19	9	14	9	21	11	11			21	14	8	15	18	16	10
35–44	26	20	37	23	20		14	60	30	46	24	37	18	28	17	42	21	23			42	27	16	31	36	32	20
45–54	153	69	139	84	83		119	194	80	201	74	131	49	131	60	215	98	107			99	124	63	146	103	153	81
55–64	324	172	312	186	229		347	351	184	384	191	253	109	316	152	533	288	212			92	295	154	366	231	381	203
65–74	877	613								987	653	630	364	899	588									988	721	1126	789
75–84	1631	1376								1708	1391	1105	837	1696	1395									852	1584	1870	1637
85 +	2005	1801								2009	1784	1325	1113	2096	1857									314	2087	2098	2021

Age	The Netherlands										Switzerland		UK		Estonia										lovakia		Slovenia	
	Men	Women									Men	Women	Men	Women	Men	Women									Men	Women	Men	Women
25–34	11	12									8	6	16	9	27	12									7	4	21	11
35–44	21	25	26	17	93	39	24	15	16	13	17	12	32	18	54	25	37	27	54	29	35	17	34	25	14	9	41	22
45–54	119	93	123	69	362	149	132	57	122	65	58	49	129	94	367	133	455	205	367	141	268	138	250	103	156	58	194	139
55–64	284	175	287	148	842	390	298	143	294	164	171	110	301	209	877	407	1155	587	877	332	670	332	613	289	469	183	612	296
65–74	847	565	905	530	2299	1431	804	498	841	535	515	329	845	652	1858	1171	2563	1645	1824	907	1404	882	1255	800	1132	631	1467	858
75–84	1567	1265	1796	1359	3769	3193	1413	1207	1579	1287	1074	822	1512	1453	2641	2473	3963	3539	2607	1680	2029	1659	1619	1459	1568	1102	2344	1754
85 +	1889	1657	2234	1887	4262	4153	1682	1647	1943	1767	1401	1158	1809	1925	2953	3284	4656	4757	2953	2070	2320	2081	1706	1792	1654	1251	2784	2244

All 101-239
25-34 yo 12-47
85+yo 1754-4656

All 63-159
25-34 yo 5-21
85+yo 1153-4757

Truelsen T et al. Eur J Neurol 2006;13:581-59/The European Registers of stroke (EROS) Investigators. Stroke 2009;40:1557-15638

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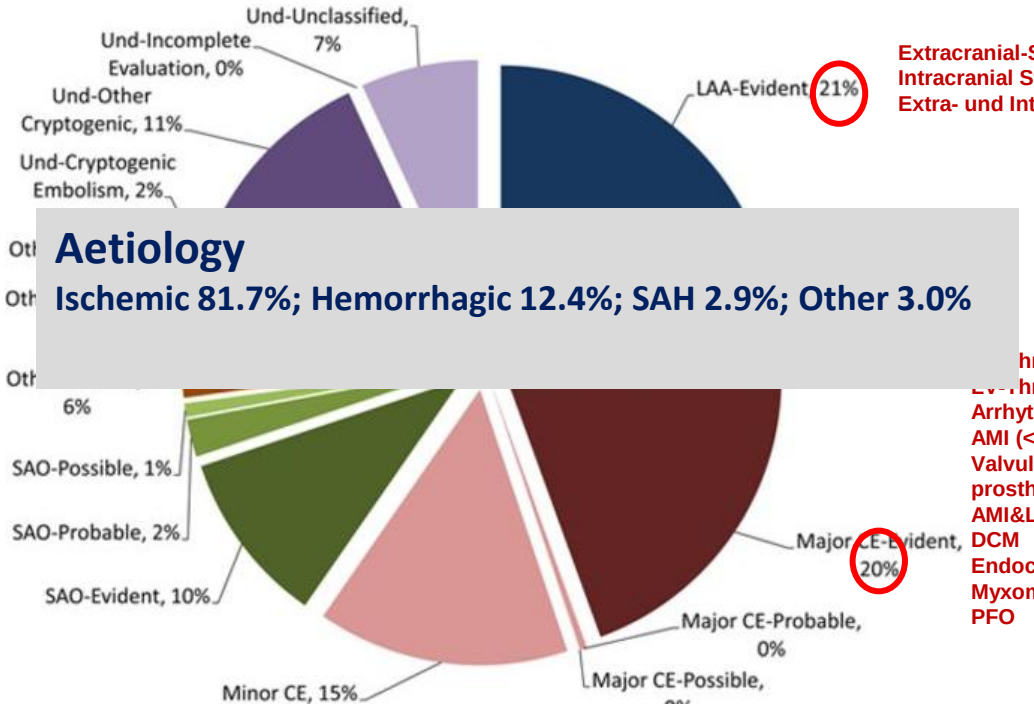
Cardiovascular Diseases with Thromboembolic Potential

ESUS
ca. 35% Afib?



Extracranial-Stenoses (62%)
Intracranial Stenoses (28%)
Extra- und Intracranial Stenoses (10%)

Aetiology
Ischemic 81.7%; Hemorrhagic 12.4%; SAH 2.9%; Other 3.0%

hrombus
Thrombus
Arrhythmias
AMI (<1Monat)
Valvular Heart disease (native, prosthetic)
AMI&LVEF<28%
DCM
Endocarditis
Myxoma, Fibroelastoma
PFO

Hakan Ay et al. Stroke. 2014;45:3589-3596

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Structural Heart Disease

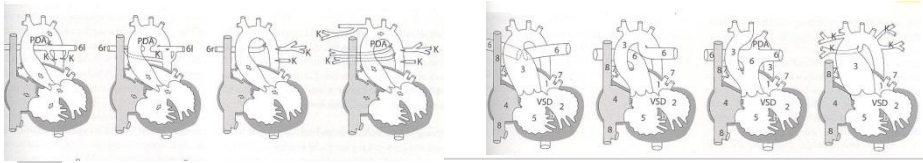
Definition

SHD refers to congenital or acquired cardiac defects affecting the non-coronary components of the heart.

CHD

Main Defects

Individual Variants …..



Blum et al. Springer, 2016

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CHD - Incidence

≈1% of live birth; the most common congenital malformation

Congenital defect	Incidence
VSD	15-30%
Fallot Tetralogy	10-15%
ASD	7-10%
Patent Ductus arteriosus – Botalli	5-10%
Aortic isthmus stenosis	6%
Transposition of great vessels	6%
Pulmonal artery stenosis	6%
Aortic valve stenosis	4%
Tricuspid valve atresia	1-2%
Cor triatriatum	0,1-,04%

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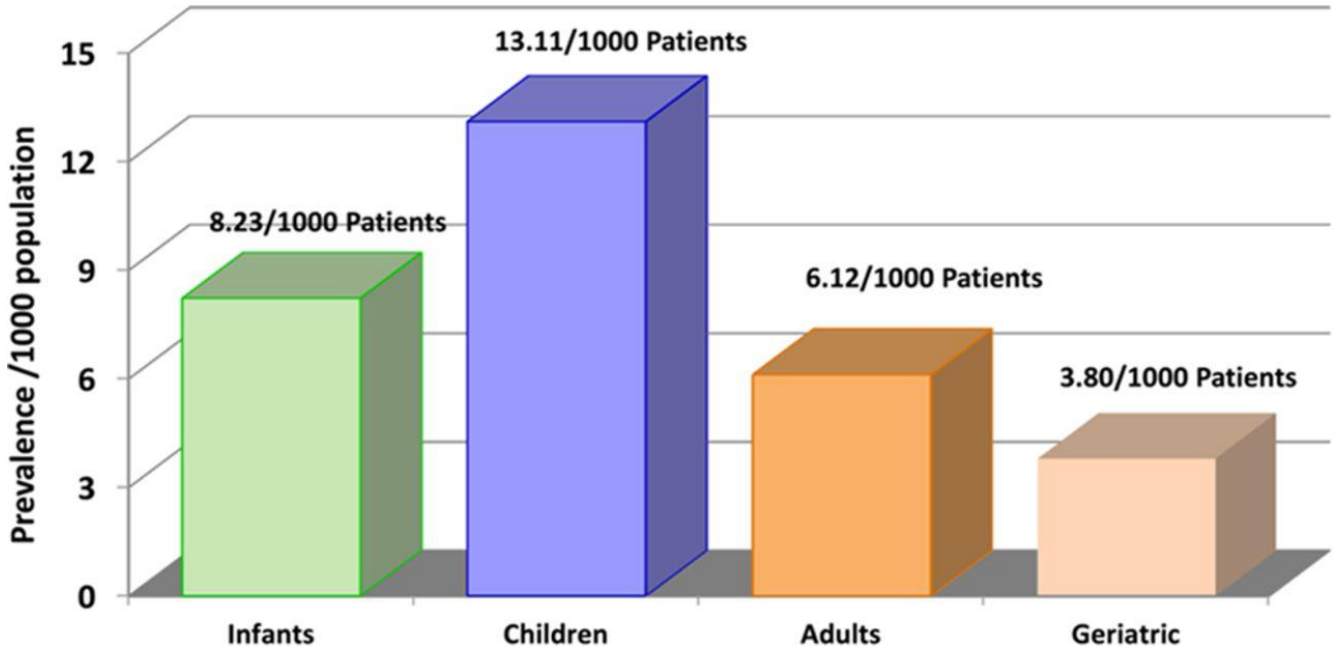
CHD - Incidence



Marelli A et al. Circulation 2016;133:1951-1962

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CHD and Stroke Risk Factors

General

- Age
- Heart failure
- Myocardial infarction
- Diabetes mellitus
- Arterial hypertension
- Arrhythmias

CHD-related

- Previous shunt operations
- Residual/unclosed septal defects
- Left-sided mechanical valves
- Arrhythmias
- Endocarditis
- Hypoxaemia
- Secondary erythrocytosis
- Iron deficiency
- Associated syndromes
- Heart failure

Pathophysiology

Embolic (Surgery, Procedures, Prosthetic valves, Foreign bodies, Endocarditis); Paradoxical embolism (Pulmonary AVMs, Veno-venous collaterals, CHD with r-l shunt, Septal defects**)**

Hemorrhagic (Hypertension, NOAC, Aneurysms, intracranial AVMs)

Giannakoulas G, Ntiloudi D. Heart 2017 Sep 4. pii: heartjnl-2017-311997

CHD and Stroke Risk Factors

Risk factors:	Stroke	Control	OR (ischaemic stroke)	
Atherosclerotic risk factors:	n=56	n=112	1/8 1/4 1/2 1 2 4 8	OR (95% CI, p-value)
Hypertension	30%	29%		1.04 (0.52, 2.10, p=0.91)
Hypercholesterolaemia	16%	18%		0.88 (0.37, 2.09, p=0.77)
Diabetes	5%	3%		2.06 (0.40, 10.5, p=0.39)
Smoking (current/former)	39%	38%		1.08 (0.56, 2.07, p=0.82)
Family history	25%	21%		1.29 (0.60, 2.76, p=0.51)
Total number risk factors (0-5)	1 (0-2)	1 (0-2)		1.07 (0.80, 1.41, p=0.66)
CHD-related risk factors:				
Prior palliative procedure	18%	7%		2.83 (1.05, 7.63, p=0.04)
Left-sided mechanical valve	23%	13%		2.12 (0.92, 4.89, p=0.08)
Residual septal defect	25%	15%		1.86 (0.84, 4.13, p=0.13)
Total number risk factors (0-3)	1 (0-1)	0 (0-1)		2.77 (1.52, 5.03, p=0.001)

Jouke P Bokma et al. Heart doi:10.1136/heartjnl-2017-311620

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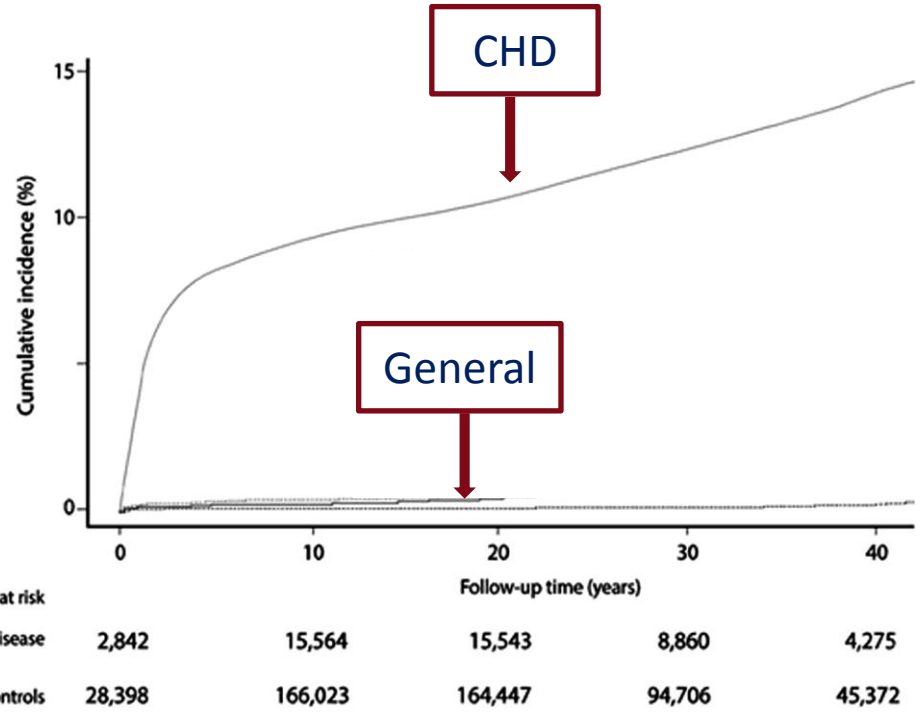
CHD - Cumulative Stroke Incidence by Age (Young Adults)



Number at risk					
Congenital heart disease	2,842	15,564	15,543	8,860	4,275
Controls	28,398	166,023	164,447	94,706	45,372

Mandalenakis Z et al. JAHA 2016;5:e003071

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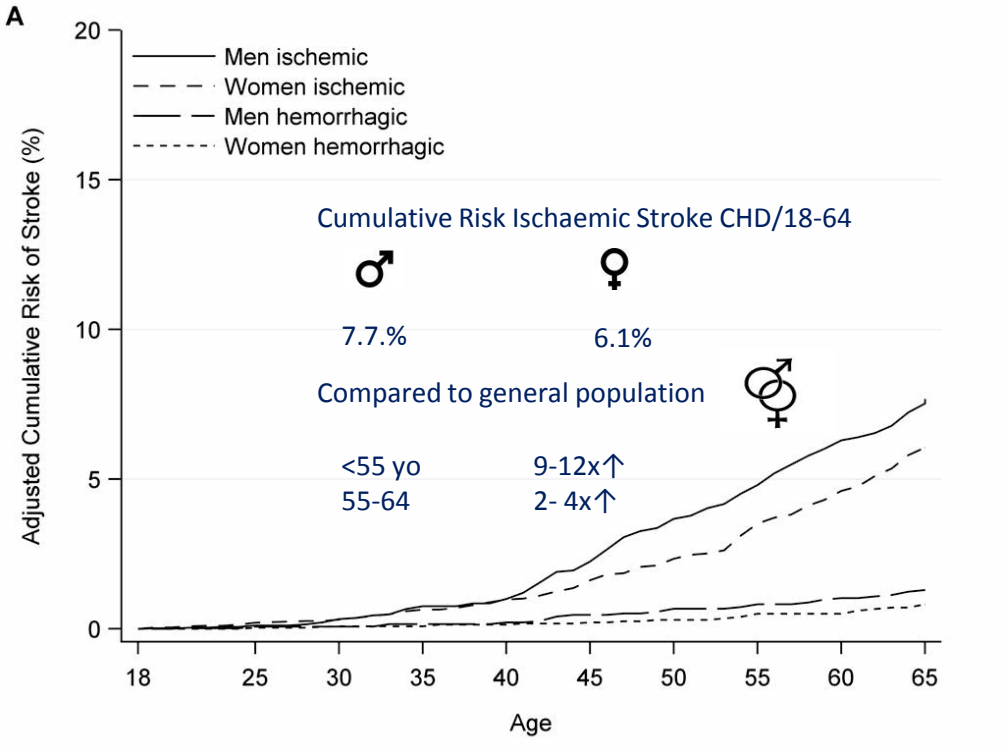
CHD and Stroke Incidence by Adults



Lanz J et al. Circulation 2015;132f:2385-94

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CHD – Classification (Marelli)

Marelli 1

AVCD, TOF, Univentricular Heart, Transposition complex, , Truncus arteriosus, Hypoplastic heart syndrome

Marelli 2

ASD, VSD, PDA, Aortic coarctation, Ebstein's anomaly

Marelli 3

Unspecified defect of septal closure

Marelli 4

Anomalies pulmonary artery/valve, Congenital tricuspid disease, Congenital AS/AI, Congenital MS/MI, Anomalies great veins

Marelli 5

Other unspecified anomalies of the heart/aorta/circulation

Marelli et al. Circulation, 2007;115:163-172

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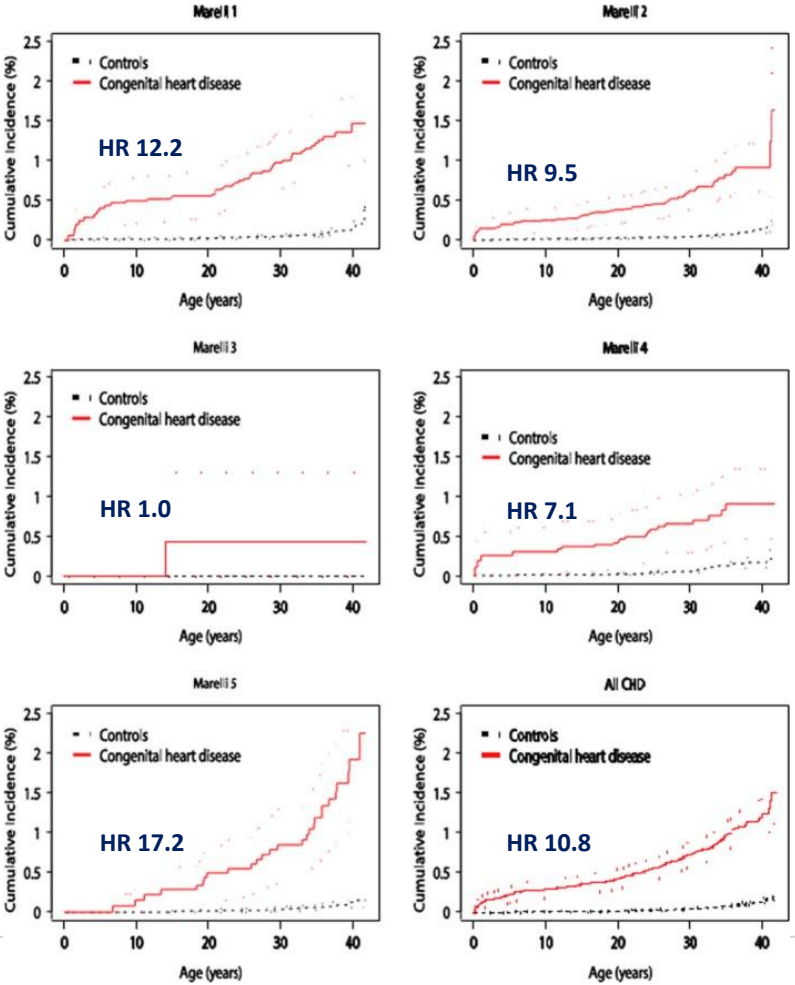
CHD and Stroke Incidence by Marelli Class



Mandelenakis et al. J Am Heart Assoc 2016 Feb; 5(2): e003071

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CHD and Stroke Incidence by Defect

CHD Diagnosis	Ischemic Stroke in CHD Patients/Total CHD Patients	Ischemic Stroke in Controls/Total Controls	HR (95% CI)	*P* Value
Total CHD	140/25 985	137/259750	10.76 (8.49–13.63)	<0.001
Atrial septal defect or patent foramen ovale	3/879	3/8790	10.00 (2.02–49.55)	0.004
Ventricular septal defect	5/2924	20/29 215	2.50 (0.94–6.65)	0.068
Tetralogy of Fallot	2/699	9/6687	2.20 (0.47–10.16)	0.315
Atrioventricular septal defect	0/162	0/1619	—	—
Common arterial trunk	1/200	4/2000	3.33 (0.35–32.05)	0.297
Ebstein's anomaly	0/108	0/1079	—	—
Transposition of great vesselsc	1/238	2/2379	4.85 (0.14–11.87)	0.997
Double inlet ventricle	5/1326	11/13 258	4.49 (1.56–12.93)	<0.001
Patent ductus arteriosus	1/2377	11/23 766	0.93 (0.17–7.23)	0.947
Hypoplastic left heart syndrome	0/54	0/540	—	—
Coarctation of aorta	9/1823	6/18 204	12.86 (4.79–34.56)	<0.001

Mandalenakis Z et al. JAH 2016;5:e003071

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CHD and Personalized Stroke Risk

geb.: 30.12.2011

Hauptdiagnose:

Q27.8 Aortopulmonale Kollateralen (MAPCA) bds.

Nebendiagnosen:

Q20.8 Funktionell univentrikuläres Herz bei Mitralatresie, Rechter Doppelausstromventrikel (DORV), Aortenisthmusstenose (ISTA), Malposition der grossen Gefässe (MGA)

Z95.88 Z.n. PDA-Ligatur und -Resektion, ISTA-Resektion, Rekonstruktion des Aortenbogens (End-zu-Seit-Anastomose), Verschluss der Pulmonalarterie unterhalb der Bifurkation und Anlage eines mBT-Shunts (3,5 mm GoreTex) rechts am 06.01.2012

- Z.n. sekundärem Thoraxverschluss am 08.01.2012
- Z.n. Re-OP mit Resektion einer hochgradigen Subaortenstenose und Erweiterung (Rinderperikardpatch) des rechtsventrikulären Ausflusstraktes am 18.01.2012

I44.2 Post-OP AV-Block III°

Z95.0 Z.n. Implantation eines VVI-Schrittmachers (St. Jude Medical Microny II SR+, Ser-Nr. 4125-33846), Anlage epikardialer Ventrikelelektroden und sekundärer Thoraxverschluss am 20.01.2012

Z92.8 Z.n. Herzkatheteruntersuchung mit Ballonangioplastie der linken Pulmonalarterie und des Aortenisthmus am 23.05.2012

Z92.4 Z.n. Resektion des mBT Shunts, Anlage einer bidirektionalen Glennanastomose und Wechsel des Schrittmacheraggregates (VVI-> DDD) am 28.06.2012

- Z.n. Herzkatheteruntersuchung am 16.02.2015

I80.88 Verschluss der V. jugularis interna rechts (Dg. 02/2015)

- Z.n. Abbruch der geplanten Komplettierung der univentrikulären Palliation am 28.05.2015
- Z.n. Herzkatheteruntersuchung mit Stentimplantation im Bereich der linken Pulmonalarterie, Verschluss der großen venovenösen Kollaterale links (Amplatzer Vascular Plug, 12mm, 2 Stck.) am 24.09.2015

E83.58 Nephrocalcinose

- Strabismus convergens

- **aktuell:**
- Herzkatheteruntersuchung mit Coilembolisation von aortopulmonalen Kollateralen bds. am 22.05.2017

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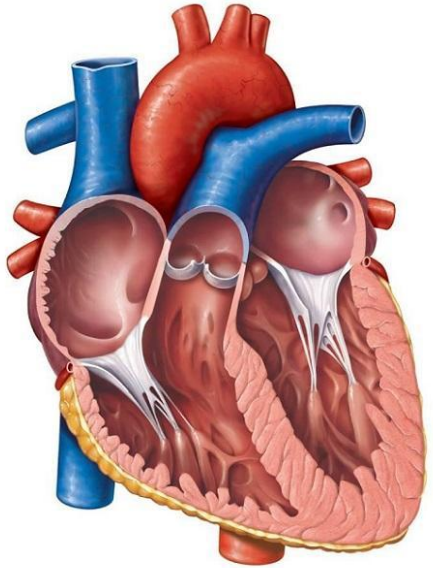
HD with Thromboembolic Potential

Valvular HD
Regurgitation
Stenosis



Cardiomyopathy
Dilatative
Hyperthrophic

Arrhythmogenic Disease

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HD with Thromboembolic Potential

n total = 402

Cardiac Source of Embolism	Total Patients	
Arrhythmia without structural heart disease	89 (22.1%)	
Atrial fibrillation		88
Atrial flutter		1
Isolated structural heart disease	81 (20.1%)	
Ischaemic heart disease		35
Acute myocardial infarction		3 (thrombus 2)
Left ventricular aneurysm		7 (thrombus 3)
Left ventricular ejection fraction < 40%		12
Akinesia/dyskinesia ≥ two segments		13 (thrombus 3)
Dilated cardiomyopathy		24 (thrombus 5)
Mitral annular calcification		14*
Cardiac tumour		4
Aortic prosthetic valve		4
Endocarditis		2
Atrial septal aneurysm with patent foramen ovale		2
Rheumatic mitral valve disease		1
Mitral valve prolapse		1
Calcified aortic stenosis		1
Moderate mitral valve regurgitation		1

Arboix A, Alio J. Curr Cardiol Rev 2010;6:150-161

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HD with Thromboembolic Potential

Structural heart disease and atrial arrhythmia	232 (57.7%)	
Atrial fibrillation		230
Atrial flutter		2
Hypertrophic hypertensive cardiac disease		120
Rheumatic mitral valve disease		49 (thrombus 7)
Ischaemic heart disease		19
Left ventricular aneurysm		3 (thrombus 1)
Left ventricular ejection fraction < 40%		9
Akinesia/dyskinesia ≥ two segments		7 (thrombus 1)
Mitral annular calcification		26†
Dilated cardiomyopathy		13 (thrombus 2)
Mitral valve prolapse		4
Mitral prosthetic valve		3 (thrombus 2)
Lipomatous hypertrophy of the atrial septum		2
Hypertrophic cardiomyopathy		2
Atrial septal aneurysm and patent foramen ovale		2
Severe mitral regurgitation		2

HD with Thromboembolic Potential

Cardiac Source of Embolism	Total Patients	
Atrial fibrillation	318 (79.1%)	
Lone atrial fibrillation		88
Associated with structural cardiac disease		230
Hypertensive left ventricular hypertrophy	120 (29.8%)	
Associated with atrial fibrillation		118
Associated with atrial flutter		2
Left ventricular systolic dysfunction	91 (22.6%)	
Sinus rhythm		59
Atrial fibrillation		32
Rheumatic mitral valve disease	50 (12.4%)	
Mitral annular calcification	40 (9.9%)	
Mitral valve prolapse	5 (1.2%)	
Atrial septal aneurysm with patent foramen ovale	4 (1%)	
Degenerative heart valve disease	4 (1%)	

Arboix A, Alio J. Curr Cardiol Rev 2010;6:150-161

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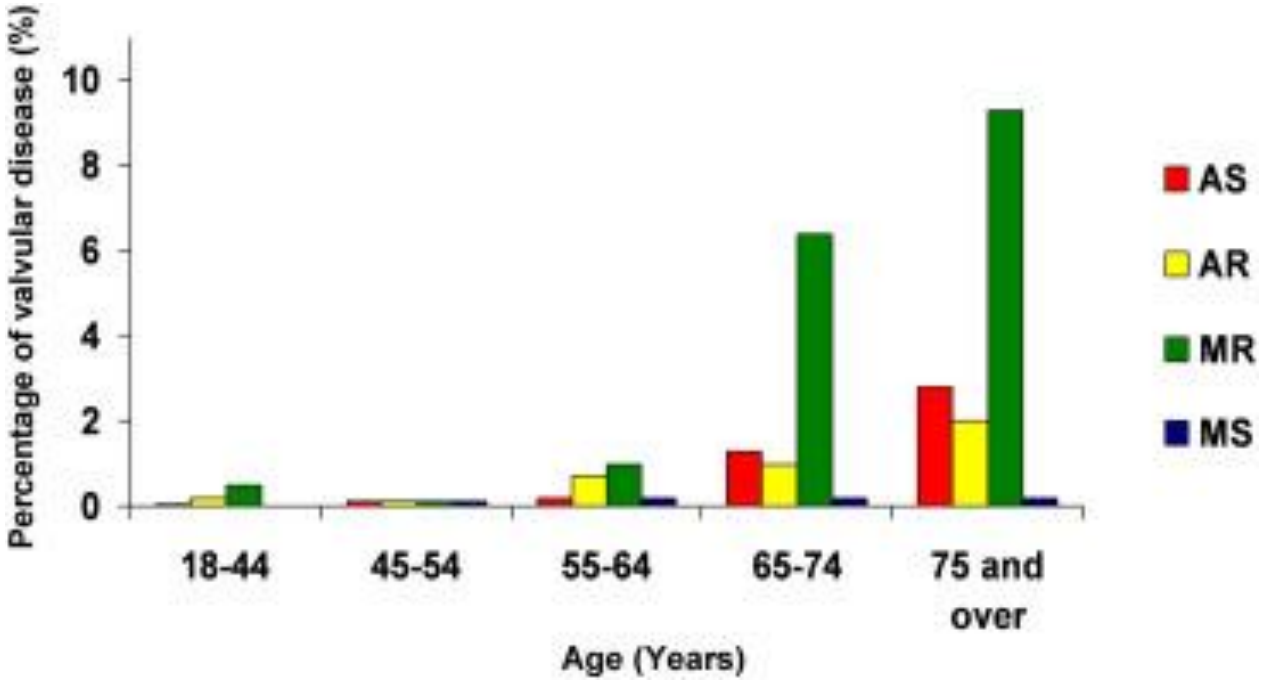
Valvular HD – Incidence (EU)



Iung B, Vahanian A. Can J Cardiol 2014 Sep;30(9):962-70

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Valvular HD and Stroke Risk

VHD plus Other Stroke Risk Factor	Patients n =729
	No. %
Hypertension	509 (69.8)
Congestive heart failure	335 (46.0)
Intermittent atrial fibrillation	179 (24.6)
Persistent atrial fibrillation	145 (19.9)
Angina pectoris	280 (38.4)
Myocardial infarction	178 (24.4)

Time After Diagnosis VHD	CVE	
	%	95% CI
6 mo	2.9	1.6–4.1
1 y	4.9	3.3–6.6
2 y	8.0	5.9–10.1
3 y	11.2	8.7–13.8
5 y	17.5	3.9–21.3
7 y	23.1	18.2–28.7

Petty GW et al. Stroke 2000;31:2628-2635

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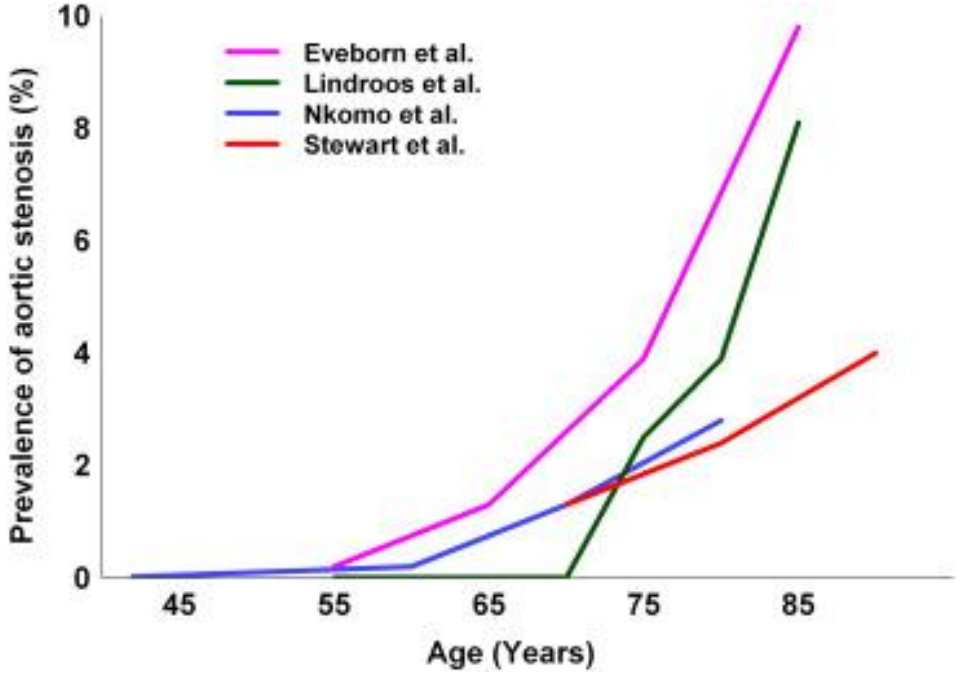
AS - Prevalence



Iung B, Vahanian A. Can J Cardiol 2014 Sep;30(9):962-70

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AS – Stroke Risk Factors

Table 3. Hazard Ratios for First-Ever Ischemic Stroke in Nonoperated Patients During 4.3 Years of Follow-Up

	Nonoperated			
Characteristic	HR Univariate (95% CI)	*P* Value	HR Adjusted (95% CI)	*P* Value
CHA_2DS_2-VASc (per 1 increase)	1.3 (1.0–1.8)	0.099	...	...
Baseline hypertension	1.1 (0.5–2.3)	0.835	...	...
Age 65–74 y	1.4 (0.4–4.3)	0.584	...	...
Age ≥75 y	4.0 (1.4–11.1)	0.008	4.5 (1.6–12.6)	0.004*
Female sex	0.8 (0.6–2.8)	0.610	...	...
Clinical covariates				
Body mass index (per 1 kg/m²)	1.1 (1.0–1.2)	0.027	1.1 (1.0–1.2)	0.009*
Diastolic BP (per 10 mm Hg)	1.3 (0.9–1.9)	0.116	...	...
Atrial fibrillation*	2.7 (0.9–7.8)	0.069	...	...
Simvastatin/ezetimibe vs placebo	0.7 (0.3–1.6)	0.436	...	...
Medicine				
Diuretics	1.8 (0.8–3.9)	0.148	...	...
β-Blockade	1.5 (0.7–3.3)	0.287	...	...
Echocardiographic parameters				
LA systolic volume (per doubling)	2.2 (1.0–4.9)	0.046	1.8 (0.8–4.2)	0.152†
LA diastolic volume (per doubling)	1.8 (1.0–3.3)	0.038	1.6 (0.9–2.8)	0.133†
LV ejection fraction (per 10% increase)	1.1 (0.7–1.8)	0.737	...	...
Aortic valve area index (per 1 cm²/m²)	0.1 (0.01–1.2)	0.066	...	...

Greve AM et al. Stroke 2014;45:1939-1946

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AS/AVR – Stroke Risk Factors

Table 4. Hazard Ratios for First-Ever Stroke in Patients After AVR: During 4.3 Years of Follow-Up

	Post-AVR			
Characteristic	HR Univariate Stroke (95% CI)	*P* Value	HR Univariate Stroke/Death (95% CI)*	*P* Value
CHA_2DS_2-VASc (per 1 increase)	1.5 (1.0–2.2)	0.078	1.4 (1.1–1.9)	0.014
Baseline hypertension	2.5 (0.9–7.1)	0.096	1.9 (1.0–3.7)	0.050
Age 65–74 y	11.6 (1.5–90.0)	0.019	2.2 (0.9–5.5)	0.076
Age ≥75 y	7.9 (0.9–70.4)	0.065	4.8 (2.0–11.6)	<0.001
Female sex	0.8 (0.3–2.2)	0.645	1.9 (0.9–4.0)	0.100
Clinical covariates				
Body mass index (per 1 kg/m²)	1.1 (1.0–1.2)	0.277	1.1 (1.0–1.1)	0.169
Diastolic BP (per 10 mm Hg)	1.1 (1.0–1.1)	0.158	1.0 (1.0–1.0)	0.707
Atrial fibrillation	1.8 (0.4–8.1)	0.422	2.1 (0.8–5.4)	0.126
Simvastatin/ezetimibe vs placebo	0.6 (0.2–1.7)	0.326	0.5 (0.2–0.9)	0.030
Medicine				
Diuretics	1.8 (0.6–5.6)	0.310	1.3 (0.7–2.6)	0.432
β-Blockade	0.2 (0.1–1.3)	0.089	1.2 (0.6–2.4)	0.618
Echocardiographic parameters				
LA systolic volume (per doubling)	1.5 (0.6–4.3)	0.411	1.8 (1.0–3.5)	0.067
LA diastolic volume (per doubling)	1.1 (0.6–2.3)	0.701	1.3 (0.8–2.0)	0.278
LV ejection fraction (per 10% increase)	1.1 (1.0–1.2)	0.031	1.0 (1.0–1.0)	0.606
Aortic valve area index (per 1 cm²/m²)	2.1 (0.1–35.3)	0.601	1.3 (0.2–9.4)	0.774

Greve AM et al. Stroke 2014;45:1939-1946

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Aortic VHD and Stroke

BASE-LINE CHARACTERISTICS OF THE SUBJECTS WITH NORMAL AORTIC VALVES, THOSE WITH SCLEROTIC VALVES, AND THOSE WITH STENOTIC VALVES.

CHARACTERISTIC	NORMAL AORTIC VALVES (N=3919)	AORTIC SCLEROSIS (N=1610)	AORTIC STENOSIS (N=92)	P VALUE FOR TREND
Mean ±SD age — yr	72.1±5.2	74.7±6.0	75.8±6.1	<0.001
Sex — no. (%)				
Female	2372 (60.5)	818 (50.8)	45 (48.9)	<0.001
Male	1547 (39.5)	792 (49.2)	47 (51.1)	
Current smoking — no. (%)	452 (11.6)	191 (11.9)	13 (14.1)	0.43
History of hypertension — no. (%)	1724 (44.0)	833 (51.7)	47 (51.1)	<0.001
History of diabetes — no. (%)	446 (11.4)	211 (13.1)	6 (6.5)	0.90
Coronary heart disease — no. (%)	673 (17.2)	383 (23.8)	22 (23.9)	<0.001
Renal insufficiency — no. (%)*	182 (4.8)	123 (8.1)	16 (17.8)	<0.001
Impaired ability to perform activities of daily living — no. (%)†	1039 (26.6)	526 (32.8)	28 (30.8)	<0.001

*Data were missing for 131 patients with normal aortic valves, 88 patients with aortic sclerosis, and 2 patients with aortic stenosis.

†Data were missing for 7 patients with normal aortic valves, 4 patients with aortic sclerosis, and 1 patient with aortic stenosis.

. EVENT RATES IN THE THREE GROUPS.

EVENT	NORMAL AORTIC VALVES (N=3919)	AORTIC SCLEROSIS (N=1610)	AORTIC STENOSIS (N=92)	P VALUE FOR TREND
	number (percent)			
Death from any cause	583 (14.9)	353 (21.9)*	38 (41.3)*	<0.001
Death from cardiovascular causes	238 (6.1)	162 (10.1)*	18 (19.6)*	<0.001
Myocardial infarction†	217 (6.0)	123 (8.6)‡	9 (11.3)‡	<0.001
Angina†	358 (11.0)	160 (13.0)	17 (24.3)*	0.001
Congestive heart failure†	337 (8.9)	192 (12.6)*	21 (24.7)*	<0.001
Stroke†	238 (6.3)	122 (8.0)§	10 (11.6)§	0.003

*P<0.001 for the comparison with the group with normal aortic valves.

†The rates were calculated for subjects at risk for new events.

‡P<0.01 for the comparison with the group with normal aortic valves.

§P=0.02 for the comparison with the group with normal aortic valves.

Age - >65y, n total – 5621 both sexes

Otto CM et al. NEJM 1999;341:142-7

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Mitral Stenosis and Stroke

Age distribution in 82 patients with mitral stenosis

Age(yr)	Cerbral embolism		Total	AF*
	Present	Absent		
10~19	0	3	3	0
20~29	1	7	8	4
30~39	0	15	15	4
40~49	5	19	24	16
50~59	5	12	17	13
60~69	5	3	8	8
70~79	3	3	6	5
80~89	0	1	1	1
Total	19	63	82	51

n = 23%

Correlation between atrial fibrillation and cerebral embolism in mitral stenosis

	Cerebral embolism		Total
	Present	Absent	
AF*	16(34.0)#	31(66.0)	47(100)
NSR**	3(8.6)#	32(91.4)	35(100)
Total	19(23.2)	63(76.8)	82(100)

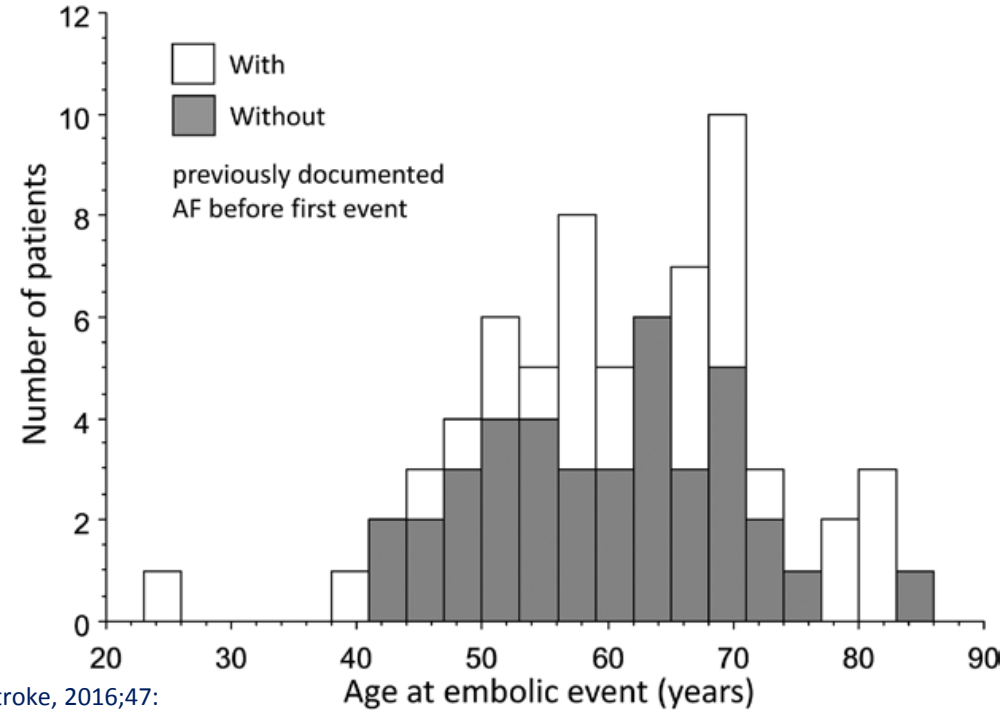
AFib = 84%

AFib = 62%

Kwon O et al. Kor J Int Med 1986;1:60-66

ESC Council Stroke

HCMP and Stroke



Haruki S et al. Stroke, 2016;47:

ESC Council Stroke

HCMP and Stroke

Patient Characteristics of Studied Patients With Hypertrophic Cardiomyopathy Without Documented Atrial Fibrillation According to the Presence or Absence of Embolic Events

Characteristic	Patients With Embolic Events (n=39)	Patients Without Embolic Events (n=392)	*P* Value
Female sex	23 (59.0)	145 (37.0)	0.012
Age at diagnosis, y	55.8±11.2	49.5±16.6	0.022
Family history of sudden death	5 (12.8)	44 (11.2)	0.791
Left ventricular outflow tract obstruction	12 (30.8)	84 (21.4)	0.256
Left ventricular midcavitary obstruction	6 (15.4)	39 (9.9)	0.276
Apical hypertrophy	4 (10.3)	133 (33.9)	0.004
Apical aneurysm	1 (2.6)	20 (5.1)	0.709
Left atrial dimension	41.6±7.5	36.5±6.8	<0.001
Maximum left ventricular wall thickness	18.9±3.6	19.9±4.7	0.215
Unexplained syncope	9 (23.1)	48 (12.2)	0.098
Nonsustained ventricular tachycardia	14 (35.9)	129 (32.9)	0.841
Follow-up duration, y	10.4±8.7	10.2±7.3	0.859

Results are given as the mean±SD or number (%).

Haruki S et al. Stroke, 2016;47:

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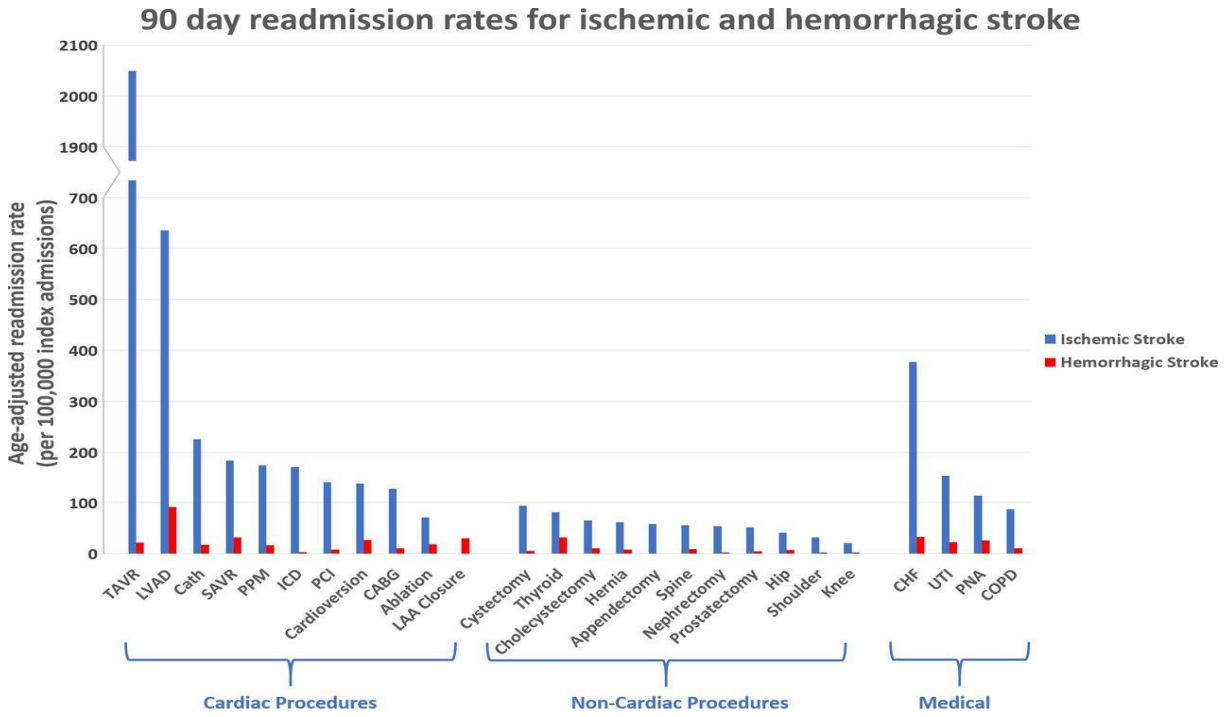
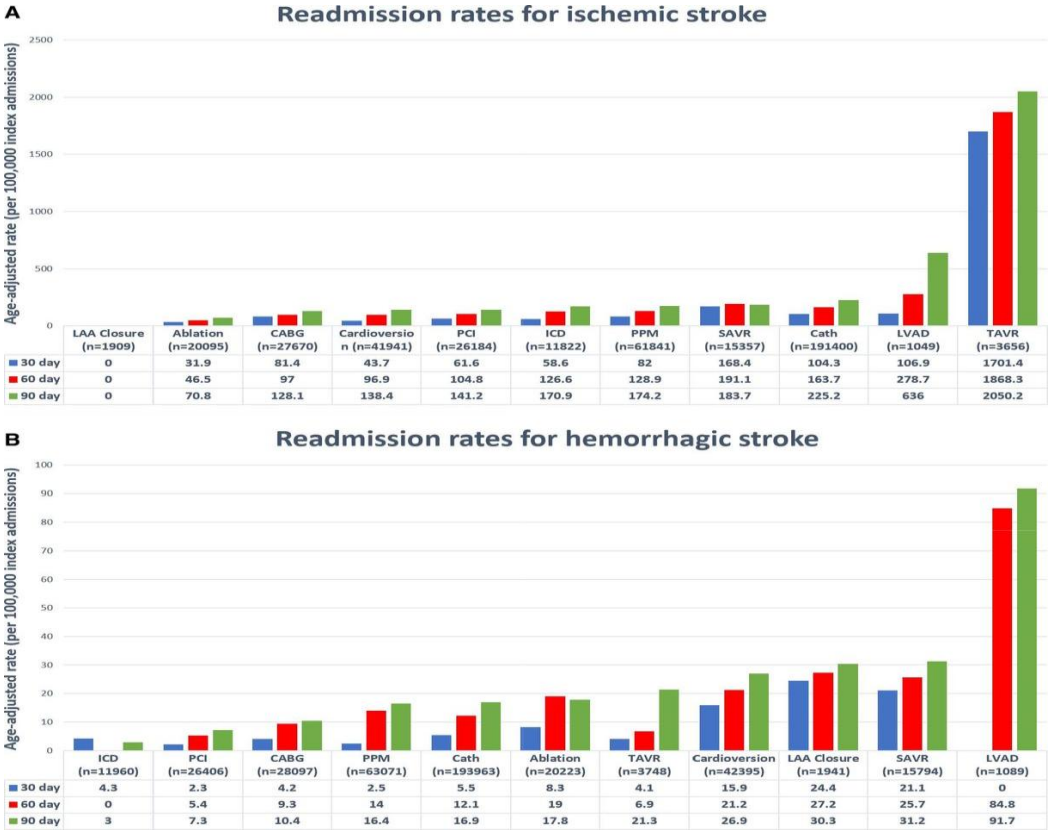
Assorted Interventions and Stroke



Stein L et al. J Am Heart Assoc 2017;6:e006900

ESC Council Stroke

Cardiovascular Intervention and Stroke



Stein L et al. J Am Heart Assoc 2017;6:e006900

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CAS and Stroke

Trial	Overall randomized patients, n	Any stroke/death, %	Any stroke, %	Disabling/major stroke, %	Non-disabling/minor stroke, %
ACT-I	1,453	2.9	2.8	0.5	2.4
CAVATAS	504	10.0	7.2	3.6	N/R
CREST	2,502	4.4	4.1	0.9	3.2
EVA-3S	527	9.4	9.1	2.6	6.0
ICSS	1,713	8.4	7.6	2.0	4.6
SAPPHIRE	334	N/R	3.6	1.2	3.0
SPACE	1,200	7.4	7.2	4.1	N/R
SPACE 2	513	2.5	N/R	N/R	N/R

Cassesse et al. in Lanzer P, Springer, 2018

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TAVR/SAVR and Stroke

Stroke at 30 days (no. of patients (%))									
	Overall Stroke			Major Disabling Stroke			Minor Non-Disabling Stroke		
	TAVR	SAVR	p	TAVR	SAVR	p	TAVR	SAVR	p
PARTNER 1B (n=358)	12 (6.7)	-	-	9 (5.0)	-	-	3 (1.7)	-	-
PARTNER 1A (n=699)	19 (5.5)	8 (2.4)	0.04	13 (3.8)	7 (2.1)	0.20	3 (0.9)	1 (0.3)	0.34
PARTNER 2B (n=560)	25 (4.5)	-	-	17 (3.0)	-	-	6 (1.1)	-	-
PARTNER 2A (n=2032)	64 (6.4)	65 (6.5)	0.94	32 (3.2)	43 (4.3)	0.20	23 (2.3)	18 (1.8)	0.43
US CoreValve (n=747)	19 (4.9)	22 (6.2)	0.46	15 (3.9)	11 (3.1)	0.55	4 (1.0)	12 (3.4)	0.03
NOTION (n=280)	4 (2.8)	4 (3.0)	0.94	1.4	3.0	0.37	2 (1.4)	0 (0)	0.17
SAPIEN 3i (n=1077)	29 (2.7)	57 (6.1)	-	11 (1.0)	41 (4.4)	-	18 (1.7)	16 (1.7)	-
SAPIEN 3HR (n=583)	8 (1.4)	-	-	5 (0.9)	-	-	-	-	-

Endris, Tuzcu in Lanzer P, Springer, 2018

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Conclusions

CHD is a major lifelong independent stroke predictor

HD with thromboembolic potential is variable dependent stroke predictor ; Atrial fibrillation is an overriding major risk factor

Stroke is a relevant complication of some cardiovascular interventions;

Prioritize prevention and on-site management!

Stroke managment is the next frontier in cardiology

ESC Council Stroke