ICD Implantation After Resuscitation from Cardiac Arrest – Are We Selecting the Right Patients?

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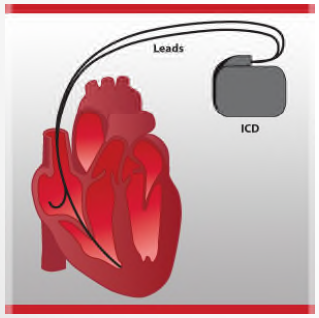

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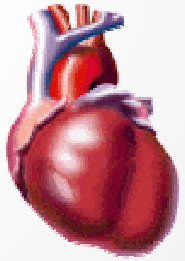

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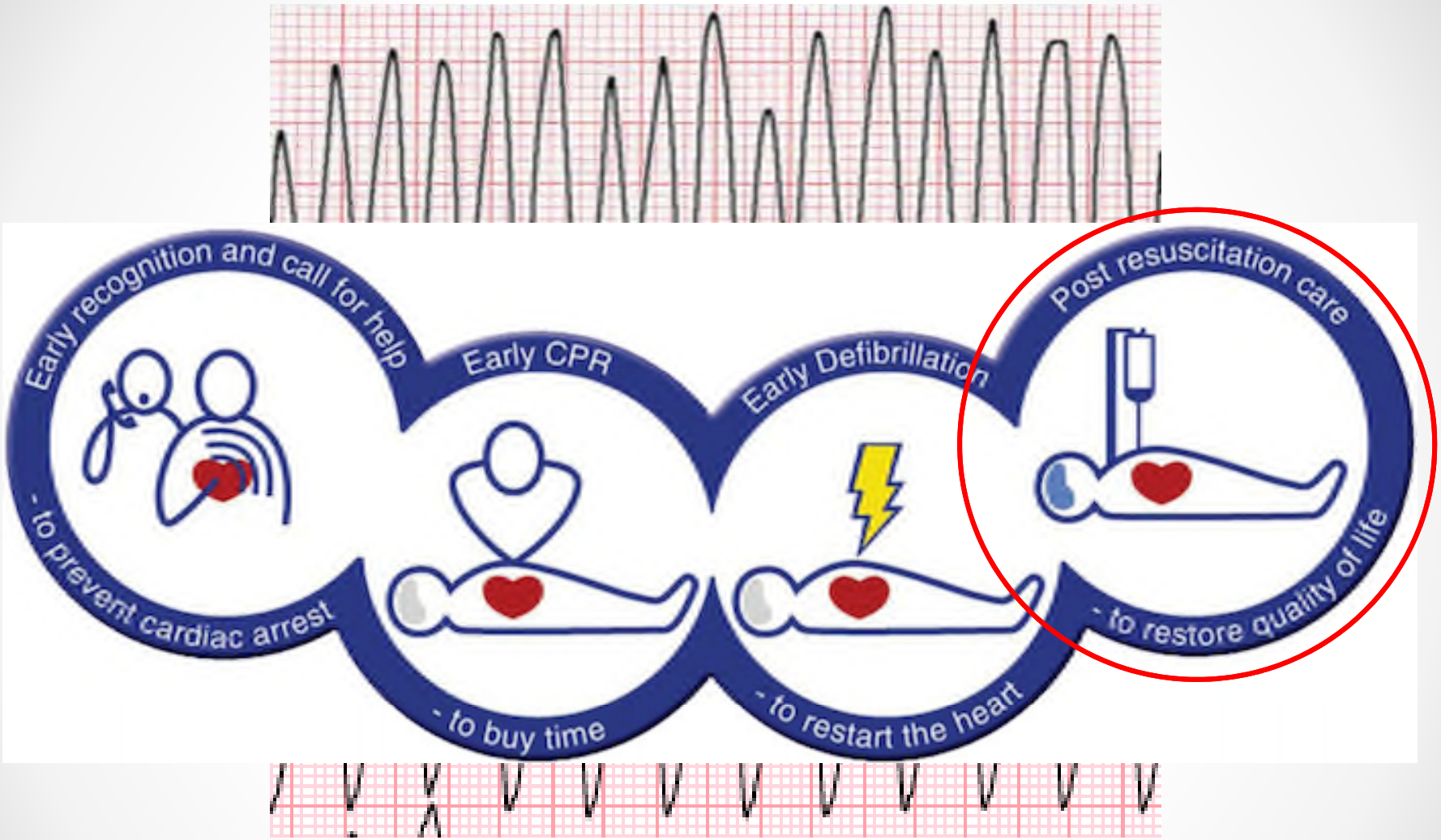
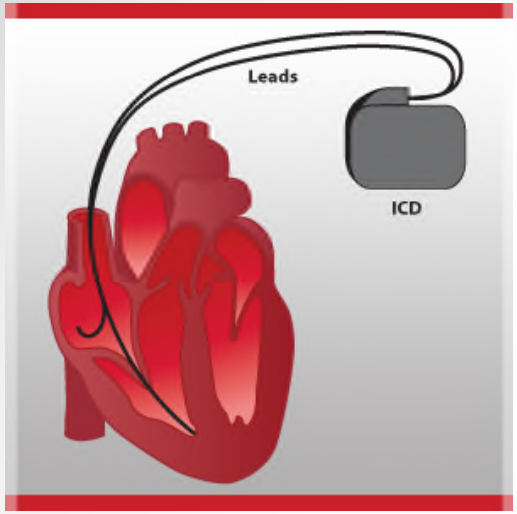
Disclosure

- Nothing to declare


Early recognition and call for help
- to prevent cardiac arrest
Early CPR
- to buy time
Early Defibrillation
- to restart the heart
Post resuscitation care
- to restore quality of life



Implantable Cardioverter Defibrillator

Patients with IHD
➔ SCD

Guidelines:
primary prophylaxis

Healthy citizen
➔ SCD as debut of IHD

Guidelines

Implantable cardioverter defibrillator in patients with left ventricular dysfunction

Recommendations	Class[a]	Level[b]	Ref.[c]
ICD therapy is recommended to reduce SCD in patients with symptomatic HF (NYHA class II–III) and LVEF ≤35% after ≥3 months of optimal medical therapy who are expected to survive for at least 1 year with good functional status:			
– Ischaemic aetiology (at least 6 weeks after myocardial infarction).	I	A	63,64
– Non-ischaemic aetiology.	I	B	64,316, 317

HF = heart failure; ICD = implantable cardioverter defibrillator; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; SCD = sudden cardiac death.

[a]Class of recommendation.

[b]Level of evidence.

[c]Reference(s) supporting recommendations.

axis

ESC GUIDELINES

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c death

Secondary prophylaxis

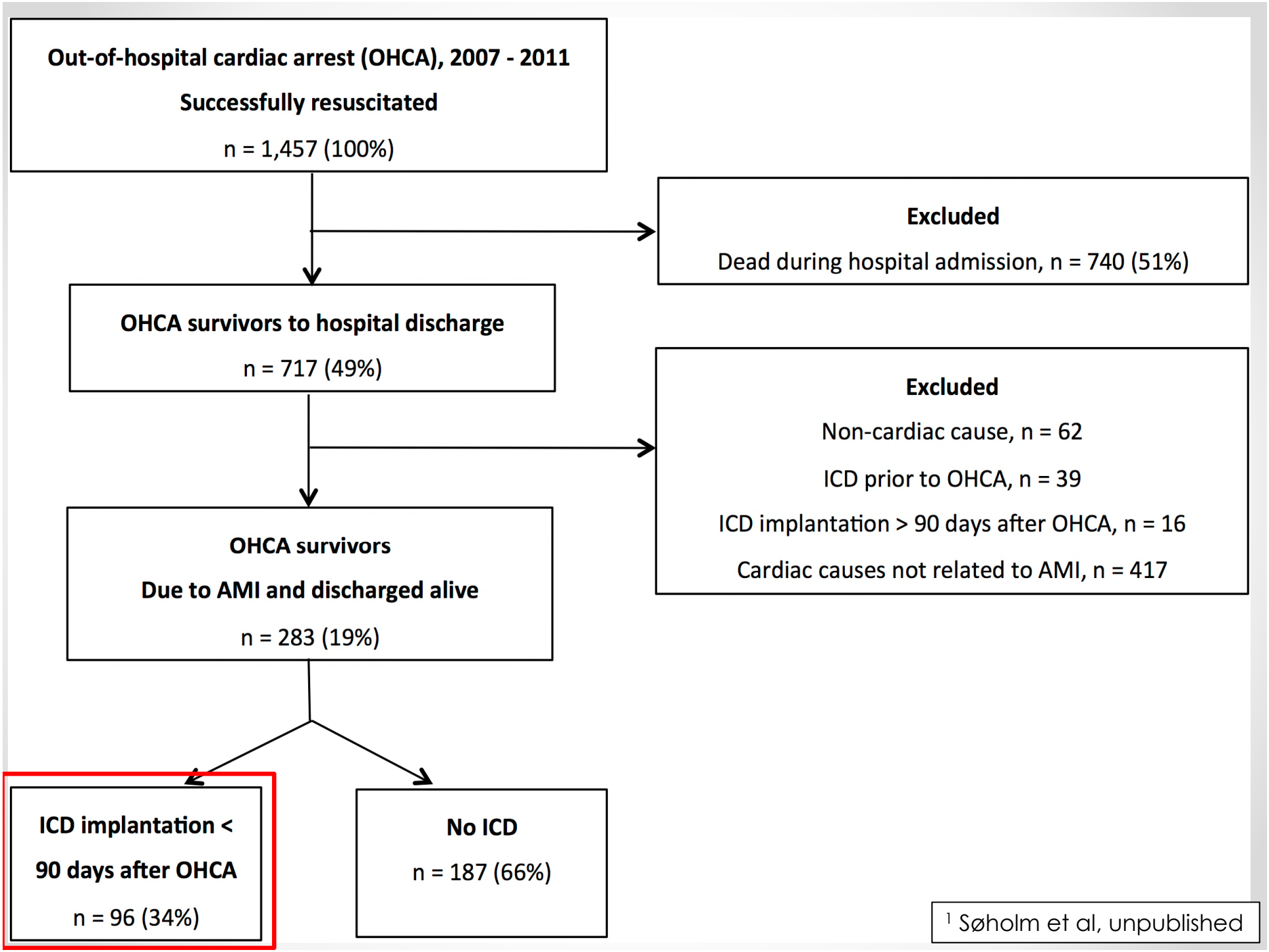
ICD for the secondary prevention of sudden cardiac death and ventricular tachycardia

ICD implantation or temporary use of a WCD may be considered <40 days after myocardial infarction in selected patients (incomplete revascularization,[d] pre-existing LVEF dysfunction, occurrence of arrhythmias >48 h after the onset of ACS, polymorphic VT or VF).	IIb	C	170, 273
ICD implantation for the primary prevention of SCD is generally not indicated <40 days after myocardial infarction.	III	A	274, 275

Purpose

Consecutive out-of-hospital cardiac arrest (OHCA) patients discharged alive from hospital due to acute myocardial infarction. Divided in patients with and without post-arrest ICD implantation < 90 days from OHCA

- Demographics
- Survival
- Comorbidity
- ICD therapy


Out-of-hospital cardiac arrest (OHCA), 2007 - 2011
Successfully resuscitated
n = 1,457 (100%)
Excluded
Dead during hospital admission, n = 740 (51%)
OHCA survivors to hospital discharge
n = 717 (49%)
Excluded
Non-cardiac cause, n = 62
ICD prior to OHCA, n = 39
ICD implantation > 90 days after OHCA, n = 16
Cardiac causes not related to AMI, n = 417
OHCA survivors
Due to AMI and discharged alive
n = 283 (19%)
ICD implantation <
90 days after OHCA
n = 96 (34%)
No ICD
n = 187 (66%)
[1] Søholm et al, unpublished

	ICD n = 96 (34%)	No ICD n = 187 (66%)
Age (mean ±SD)	63 ± 10	62 ± 12
Sex (male), n (%)	84 (88%)	158 (84%)
Cardiovascular comorbidity, n (%)		
- Chronic ischemic heart disease	35 (36%) *	28 (15%)
- Chronic heart failure	17 (18%) *	7 (4%)
- Type 2 diabetes	15 (16%)	20 (11%)
- Hypertension	52 (54%) *	69 (39%)
- Hypercholesterolemia	33 (34%)	51 (28%)
- Active smoking	49 (52%)	83 (45%)
Comorbidity index ≥ 3, n (%)	13 (14%)	15 (8%)
Cardiac arrest circumstances		
- Shockable rhythm, n (%)	91 (95%)	165 (88%)
- Public, n (%)	59 (62%) *	90 (49%)
- Witnessed arrest, n (%)	93 (98%) *	168 (90%)
o By EMS	13 (14%)	29 (16%)
- Bystander CPR, n (%)	67 (72%)	132 (73%)
- Time to ROSC, min (IQR)	17 (10 – 23)	16 (8 – 23)
- Time to EMS, min (IQR)	7 (5 – 10)	6 (4 – 9)
In hospital		
- Admitted ICU, n (%)	77 (82%)	147 (79%)
- STEMI, n (%)	49 (51%) *	148 (80%)
- CAG, n (%)	92 (96%)	178 (95%)
o CAG acute (< 24 hrs.)	35 (36%) *	161 (86%)
o PCI performed	51 (53%) *	152 (81%)
o CABG performed	22 (23%) *	15 (8%)
- TNT/TNI/CKMB quartiles	2 (1 – 3) *	3 (2 – 4)
- TTM, n (%)	67 (71%)	141 (76%)
At hospital discharge		
1. Favorable neurological outcome, n (%)	93 (97%) *	152 (81%)
2. LVEF discharge, % (IQR)	35 (25 – 45) *	45 (35 – 50)
3. LVEF < 35%, n (%)	39 (42%) *	44 (25%)

Factors associated with ICD implantation

	Univariate		Multivariable	
	OR (95 % CI)	*p-value*	*OR (95 % CI)*	*p-value*
Age at arrest (per 5 years)	1.01 (0.91 – 1.13)	0.9	0.98 (0.81 – 1.19)	0.8
Sex (male)	1.29 (0.62 – 2.65)	0.5	0.65 (0.20 – 2.06)	0.5
High comorbidity burden (CCI ≥ 3)	1.80 (0.82 – 3.95)	0.1	0.31 (0.06 – 1.60)	0.2
LVEF < 35% at hospital discharge	2.24 (1.31 – 3.83)	**0.003**	3.33 (1.29 – 8.60)	**0.01**
Revascularization (PCI or CABG)	0.27 (0.13 – 0.53)	**< 0.001**	0.16 (0.05 – 0.56)	**0.004**
TNT/TNI/CKMB quartile 1 vs. 4	5.46 (2.09 – 14.2)	**< 0.001**	7.10 (2.21 – 22.8)	**< 0.001**
Favorable neurological outcome at discharge	10.1 (2.37 – 43.0)	**0.002**	3.89 (0.69 – 22.1)	0.1
Shockable primary rhythm	2.34 (0.77 – 7.18)	0.1	2.39 (0.27 – 20.8)	0.4

Events and ICD therapy

- Time to ICD-implantation: median 20 days

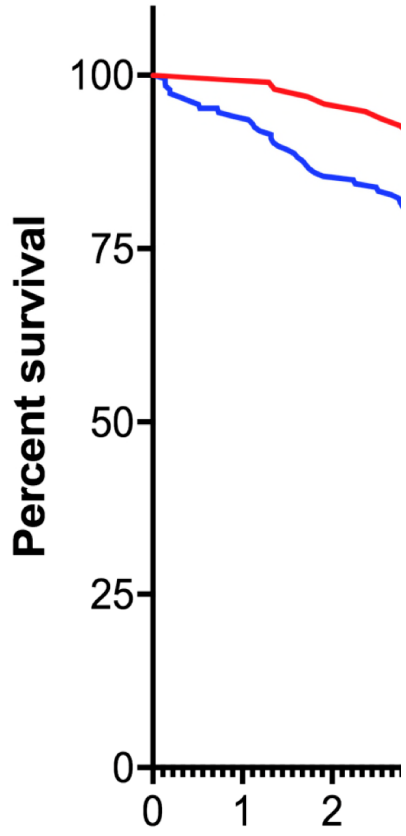
ICD shock:

- No. of patients with shock: 24%
- < 90 days after OHCA: 52%
- >1 shock event: 30%
- Inappropriate shock: 25%

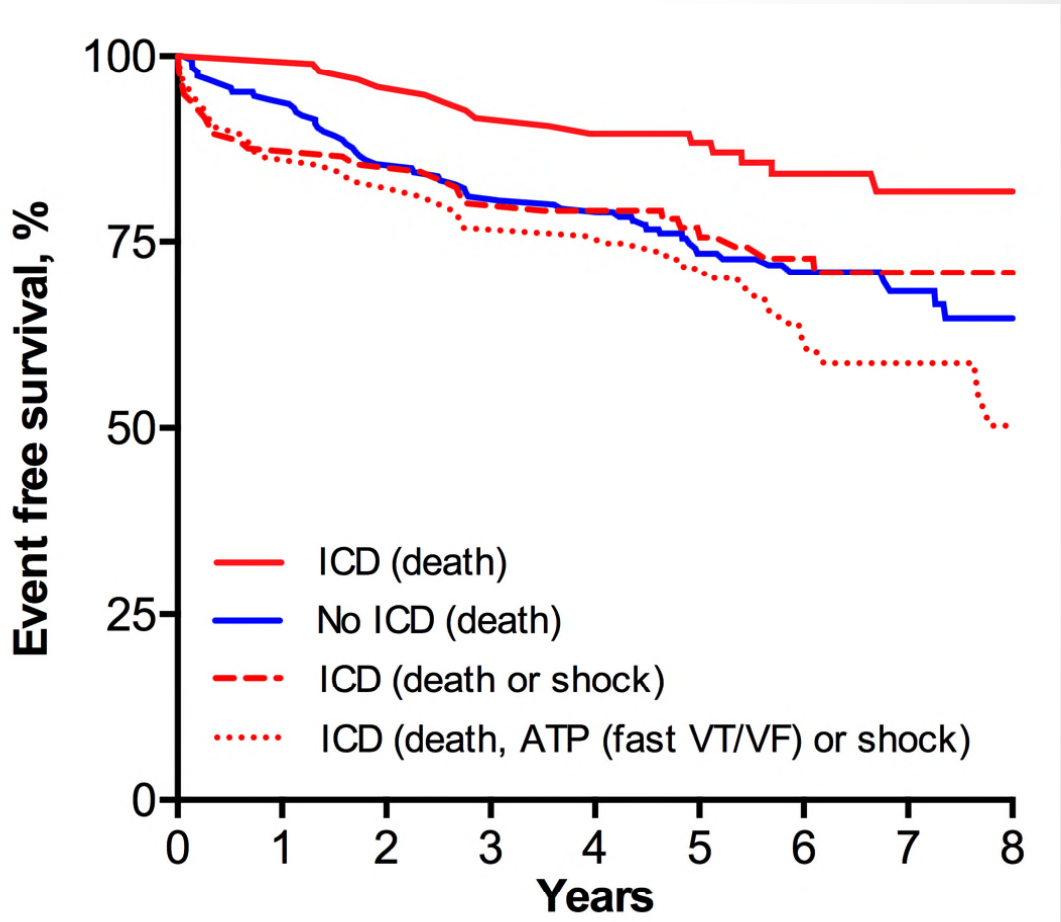
ATP:

- No. of patients with ATP: 28%
- < 90 days after OHCA: 33%
- > 1 ATP event: 59%
- Inappropriate ATP: 24%

Long-term outcome



No at risk:		
ICD	95	91
No ICD	186	158



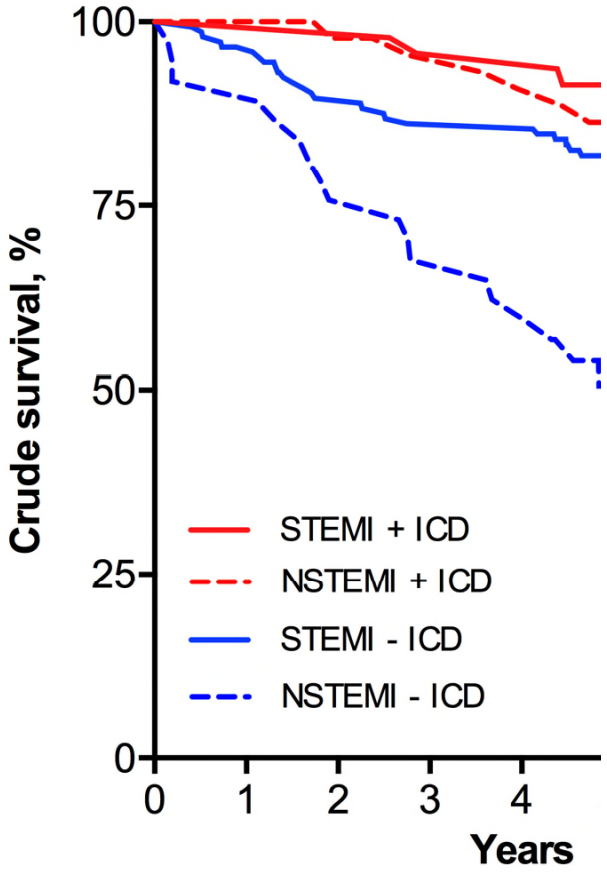
No at risk:					
ICD	96	91	85	50	11
No ICD	187	158	147	75	22

Cox-regression analyses

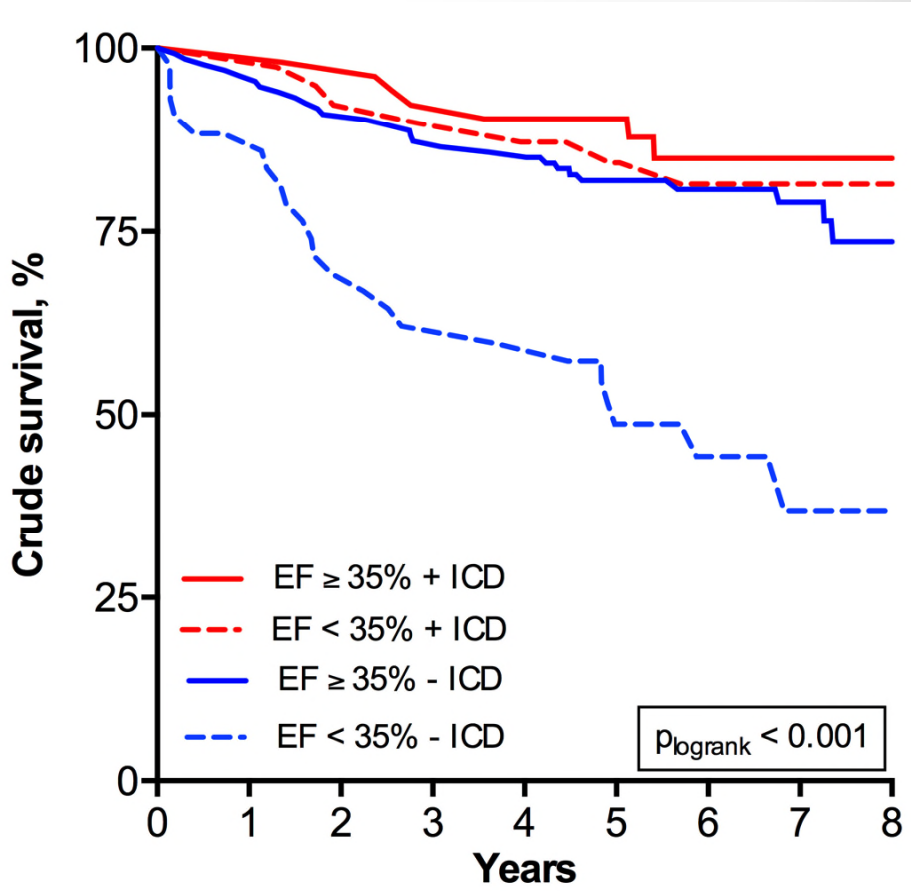
	Multivariate (all patients) n = 266		**Multivariate (all patients) – first event (shock or death)** n = 266	
	HR (95 % CI)	*p-value*	*HR (95 % CI)*	*p-value*
ICD implantation post-arrest	0.41 (0.22 – 0.75)	**0.004**	1.14 (1.71 – 1.14)	0.6
High comorbidity burden (CCI ≥3)	1.95 (0.98 – 3.91)	0.06	2.54 (1.38 – 4.68)	**0.003**
Age at arrest (per 5 years)	1.37 (1.20 – 1.56)	**< 0.001**	1.30 (1.16 – 1.46)	**< 0.001**
STEMI	0.84 (0.48 – 1.50)	0.6	0.96 (0.58 – 1.60)	1.0
LVEF < 35% at hospital discharge	2.11 (1.27 – 3.52)	**0.004**	2.22 – 1.42 – 3.49)	**< 0.001**
Favorable neurological outcome at discharge	0.88 (0.47 – 1.64)	0.7	0.90 (0.49 – 1.65)	0.7

Revascularization (PCI or CABG), TNT/TNI/CKMB quartile, Sex, Shockable primary rhythm, Bystander CPR , Time to ROSC were not significant in univariate analyses and therefore omitted from the multivariate analysis.

Subgroups



No at risk:			
STEMI + ICD	49	46	
NSTEMI + ICD	47	43	
STEMI - ICD	148	125	
NSTEMI - ICD	39	27	



No at risk:				
EF ≥ 35% + ICD	52	49	29	0
EF < 35% + ICD	39	36	29	8
EF ≥ 35% - ICD	134	120	73	11
EF < 35% - ICD	43	26	15	4

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Thankyou

Survival following resuscitated OHCA due to AMI was significantly higher in patients who had an ICD implanted which may suggest extenting guidelines to consider ICD for survivors after acute MI.

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