

Post-Resuscitation Care Practices Following Cardiac Arrest At Six Regional Interventional Cardiology Centers In The United States 2007-2011

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The International Cardiac Arrest Registry (INTCAR) – CARDIOLOGY Research Group*

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Introduction

- Although recently clarified by AHA-sponsored Guidelines [1-3], post-resuscitation cardiac arrest (CA) care in the United States varies widely between centers and regions
- We described standard practices, and evaluated variability in those practices among patients admitted to 6 busy United States PCI centers between 2007-2011.
- The utilization and techniques of therapeutic hypothermia were carefully described

Methods

- Six US Interventional Cardiology centers comprising the INTCAR-Cardiology research group retrospectively and prospectively evaluated 754 sequential cardiac arrest survivors admitted between 2007-2011. Data were de-identified and uploaded into a secure, web-based registry (INTCAR). [4]
- Data entry was locally IRB-approved at all centers, and statistical analysis was performed at Maine Medical Center.
- Demographics, hospital course, adverse events, and treatments were recorded and categorized by center.
- A multivariate logistic regression model was developed to analyze the associations of clinical and demographic factors with urgent cardiac catheterization.

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Results

International Cardiac Arrest Registry



DEMOGRAPHICS	ALL n=754	HOSPITAL #1 n=112	HOSPITAL #2 n=252	HOSPITAL #3 n=148	HOSPITAL #4 n=36	HOSPITAL #5 n=169	HOSPITAL #6 n=37
AGE (mean, SD)	60.9 ± 14.8	60.8 ± 17.2	63.0 ± 14.0	56.9 ± 14.2	60.8 ± 13.3	61.3 ± 14.4	60.3 ± 14.9
MALE (% ,#)	68 (513/754)	70.5 (79/112)	70.6 (178/252)	64.9 (96/148)	69.4 (25/36)	64.5 (109/169)	70.3 (26/37)
ARREST TO ROSC (mean minutes, SD)	23.6 ± 16.5	23.4 ± 15.2	24.2 ± 14.9	22.9 ± 18.3	23.4 ± 19.1	23.7 ± 18.5	22.4 ± 15.2
VT/VF (% ,#)	60 (435/727)	46.4 (51/110)	68.7 (169/246)	63.6 (91/143)	79.4 (27/34)	52.2 (82/157)	40.5 (15/37)
WITNESSED (% ,#)	82.3 (615/747)	80.7 (88/109)	79.8 (201/252)	85.8 (127/148)	86.1 (31/36)	83.1 (138/166)	83.3 (30/36)
BYSTANDER CPR (% ,#)	52.6 (389/740)	54.1 (59/109)	50.8 (128/252)	48.3 (71/147)	66.7 (24/36)	60.4 (96/159)	29.7 (11/37)
# COMORBIDITIES	2.2 ± 1.6	2.3 ± 1.5	2.2 ± 1.7	1.9 ± 1.6	1.5 ± 1.7	2.5 ± 1.7	2.5 ± 1.2
PRECEDING CHEST PAIN (% ,#)	33.9 (135/398)	30.6 (34/111)	28.2 (42/149)	35.2 (32/91)	60 (12/20)	47.1 (32/68)	33.3 (4/12)
STEMI (% ,#)	26.5 (198/746)	16.2 (18/111)	34.5 (87/252)	18.9 (28/148)	69.4 (25/36)	23.3 (38/163)	5.6 (2/36)
SHOCK ON ADM (% ,#)	39.1 (238/746)	34.5 (38/110)	30.3 (76/251)	28.4 (42/148)	27.8 (10/36)	33.9 (56/166)	44.4 (16/36)
TRANSFER (% ,#)	50.3 (371/738)	38.2 (42/110)	70.6 (178/252)	67.1 (98/148)	11.1 (4/36)	27.8 (44/158)	13.9 (5/36)
TRANSFER TIME	27.2 ± 16.5	24.2 ± 19.5	26.0 ± 13.5	30.8 ± 19.5	36.0 ± 18.2	31.4 ± 18.8	37.5 ± 10.6
TRANSFER DISTANCE	42.7 ± 37.1	23.2 ± 31.1	56.3 ± 36.4	60.1 ± 36.9	87.5 ± 77.8	17.1 ± 19.4	37.8 ± 34.0
CARDIAC CAUSE OF ARREST (% ,#)	74.8 (550/735)	50 (55/110)	88.9 (224/252)	48.3 (118/147)	97.2 (35/36)	64.9 (100/154)	50 (18/36)

COOLING PRACTICES	ALL n=754 % (#)	HOSPITAL #1 n=112	HOSPITAL #2 n=252	HOSPITAL #3 n=148	HOSPITAL #4 n=36	HOSPITAL #5 n=169	HOSPITAL #6 n=37
Therapeutic hypothermia	97.6 (736/754)	94.6 (106/112)	100 (252/252)	100 (148/148)	72.2 (26/36)	99.4 (168/169)	97.3 (36/37)
Prehospital hypothermia (EMS initiated)	4.9 (36/728)	0	12.7 (32/252)	0	0	1.9 (3/162)	2.8 (1/36)
---Ice packs	28.7 (211/736)	5.7 (6/106)	63.5 (160/252)	18.9 (28/148)	19.2 (5/26)	5.4 (9/168)	8.3 (3/36)
---Cold fluids	14.3 (105/736)	26.4 (28/106)	0	8/148 = 5.4%	0	69/168 = 41.1%	0
---Surface cooling	98.5 (725/736)	97.2 (103/106)	98 (247/252)	99.3 (147/148)	96.2 (25/26)	100 (168/168)	97.2 (35/36)
---Endovascular cooling	1.2 (9/736)	(0) 0/106	0.4 (1/252)	3.4 (5/148)	0	0.6 (1/168)	5.6 (2/36)
BLADDER THERMISTOR	36.5 (260/712)	94.7 (89/94)	23 (58/252)	29 (42/145)	92.3 (24/26)	28.6 (46/160)	2.9 (1/35)
ESOPHOGEAL THERMISTOR	44.7 (318/712)	5.3 (5/94)	76.6 (193/252)	60 (87/145)	7.7 (2/26)	0	88.6 (31/35)
OTHER THERMISTOR	18.8 (134/712)	0	0.4% (1/252)	11 (16/145)	0	71.4 (114/160)	8.6 (4/35)
SHIVERING	94.2 (693/736)	97.2 (103/106)	100 (252/252)	75 (111/148)	23.1 (6/26)	11.3 (19/168)	94.4 (34/36)
---RX NMB (PARALYTICS)	67.8 (499/736)	84.9 (90/106)	92.9 (234/252)	32.4 (48/148)	3.8 (1/26)	70.7 (118/168)	22.2 (8/36)
---RX MEPERIDINE	5.4 (40/736)	31.1 (33/106)	0.8 (2/252)	0	15.2 (4/26)	0.6 (1/168)	0
---RX COUNTERWARMING	7.3 (54/736)	46.2 (49/106)	0.4 (1/252)	2 (3/148)	0	0.6 (1/168)	0
---RX PROPOFOL	49.6 (365/736)	71.7 (76/106)	40.1 (101/252)	5.4 (8/148)	3.8 (1/26)	87.5 (147/168)	88.9 (32/36)
---RX BENZODIAZEPINES	59 (434/736)	46.2 (49/106)	94.4 (238/252)	83.1 (123/148)	11.5 (3/26)	9.5 (16/168)	13.9 (5/36)

CARDIAC PRACTICES, MRI, & EEG	ALL n=754 % (#)	HOSPITAL #1 n=112	HOSPITAL #2 n=252	HOSPITAL #3 n=148	HOSPITAL #4 n=36	HOSPITAL #5 n=169	HOSPITAL #6 n=37
CASE MIX: VT/VF	59.8 (435/727)	46.4 (51/110)	68.7 (169/246)	63.6 (91/143)	79.4 (27/34)	52.2 (82/157)	40.5 (15/37)
CASE MIX: STEMI	26.5 (198/746)	16.2 (18/111)	34.5 (87/252)	18.9 (28/148)	69.4 (25/36)	23.3 (38/163)	5.6 (2/36)
Cath prior to awakening	48 (362/754)	17.9 (20/112)	65.5 (165/252)	48.6 (72/148)	83.5 (30/36)	35.5 (60/169)	40.5 (15/37)
PCI prior to awakening	24.4 (184/754)	13.4 (15/112)	31.7 (80/252)	26.4 (39/148)	47.2 (17/36)	18.3 (31/169)	5.4 (2/37)
AICD PLACED	7.8 (57/730)	0.9 (1/111)	16.4 (41/250)	4.4 (6/136)	0 (0/36)	4.3 (7/161)	5.6 (2/36)
Permanent pacemaker	4.1 (30/729)	2.7 (3/108)	3.6 (9/249)	5 (7/140)	11.1 (4/36)	4.4 (7/158)	0 (0/35)
IABP	16.5 (124/753)	10.7 (12/112)	19.4 (49/252)	19.6 (29/148)	11.4 (4/35)	13.6 (23/169)	18.9 (7/37)
Temporary pacemaker	9.6 (72/750)	8 (9/112)	14.7 (37/252)	8.1 (12/148)	5.7 (2/35)	4.2 (7/166)	13.5 (5/37)
MRI	16.3 (122/749)	15.1 (12/111)	21.4 (54/252)	12.9 (19/147)	19.4 (7/36)	14.5 (24/166)	16.2 (6/37)
Any EEG	50.8 (378/744)	59.8 (67/112)	52.4 (132/252)	39.5 (58/147)	47.2 (17/36)	56.3 (90/160)	37.8 (14/37)
Continuous EEG	30.4 (224/738)	48.2 (53/110)	51.8 (130/251)	13.7 (19/139)	29.4 (10/34)	6.5 (11/169)	2.9 (1/35)

ADVERSE EVENTS	Percent (#)
ANY	83.8 (632/754)
Infection (any)	35.9 (271/754)
Pneumonia	26.5 (200/754)
Bleeding	10.1 (76/754)
Seizures	26.4 (199/754)
Electrolyte disturbance	60.5 (456/754)
Arrhythmia (hemodynamically significant)	38.2 (288/754)
Hyperglycemia	61 (460/754)
Fever	33.5 (248/741)
Early discontinuation of hypothermia	11 (80/727)

Efficiency of Cooling

Arrest to onset cooling: 176 (±140) minutes
Time to Target Temperature: 374 (±202) minutes

Factors Associated with Urgent Coronary Angiography

	Odds Ratio	Confidence Interval	P value
Age	1.004	0.98 - 1.03	0.7
PCI center	1.010	0.86 - 1.18	0.9
VT/VF	2.23	1.031 - 4.82	0.04
STEMI	7.41	3.40-16.13	<0.001

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Discussion

- Therapeutic hypothermia (TH) was routinely employed in encephalopathic CA survivors
 - 40% with PEA/Asystolic arrests, 39% in shock at presentation, and 26.5% with STEMI
 - EMS-initiated TH occurred infrequently (5%)
 - Patients were cooled primarily with surface cooling techniques, ice packs and cold fluids
 - Cooling began on average ~3 hours after the arrest, and took ~3 1/3 hours to reach 32-34°C
 - Most patients received neuromuscular blockade and sedation during hypothermia
- Adverse events occurred similar to published rates observed in other trials. [5]
- Wide variability in case-mix existed between centers.
- Multivariate logistic regression suggested STEMI and initial rhythm, but not age of the admission hospital, were strong predictors of urgent cardiac catheterization.
- Post-resuscitation care reflected AHA guidelines, but with significant variability in practices. Areas of variability should be targets for prospective research, to scientifically define best practices and standards of care.

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