Poster #494

Evaluation of Therapeutic Hypothermia Following Return of Spontaneous Circulation After Cardiac Arrest

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Background

- After cardiac arrest, patients are at risk for neurologic injury.
- In 2002, two landmark studies found that therapeutic hypothermia (TH) increased favorable neurologic outcomes and decreased mortality in patients with out-of-hospital ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT) arrest.[1,2] Since then, additional studies have found favorable outcomes in patients with asystole or pulseless electrical activity (PEA) arrest.[3,4]
- The 2010 American Heart Association Guidelines recommend therapeutic hypothermia after VF/VT arrests (Class I) and suggest TH after PEA/asystole arrest (Class IIb).[5]

Objectives

- Primary objective:
  - To assess the association between TH and favorable neurologic outcomes
- Secondary objectives:
  - To assess the association between TH and discharge location (home, rehabilitation facility, long-term-care, death)
  - To characterize the use of analgesia, sedation and paralytic agents during TH

Methods

- Approved by University of Maryland IRB
- Retrospective, single center, observational study
- Study period: January 1, 2008 – June 30, 2012
- Inclusion criteria:
  - Adult patients (≥ 18 years)
  - Patients with return of spontaneous circulation (ROSC) for >20 minutes after cardiac arrest from any rhythm
  - In-hospital or out-of-hospital cardiac arrest
- Statistical methods
  - Crude associations were assessed using the Student's t-test
  - Adjusted associations were assessed with multivariable logistic regression controlling for arrest type, patient age, time to ROSC, gender, and smoking status

Results

Table 1. Patient demographics

* Denotes p<0.001

	All (n = 816)	TH (n = 67)	No TH (n = 749)
Age (mean, range)	56 (18-94)	53 (19-87)	57 (18-94)
% male	60%	66%	58%
In-hospital arrest (n, %)	760 (93)	49 (73)*	710 (95)*
Out-of-hospital arrest (n, %)	56 (7)	18 (27)*	39 (5)*
VF/VT arrest (n, %)	144 (18)	11 (16)	133 (18)
PEA/asystole arrest (n, %)	623 (76)	53 (79)	570 (76)
Witnessed arrest (n, %)	749 (92)	54 (81)*	694 (93)*
Time to ROSC (mean, range)	12.4 min (1-199)	25 min (1-199)*	11.1 min (1-100)*
Comorbidities:			
CAD (n, %)	203 (25)	16 (24)	187 (25)
DM (n, %)	216 (26)	20 (30)	196 (26)
CM (n, %)	112 (14)	5 (7)	100 (13)
ESRD (n, %)	105 (13)	12 (18)	100 (13)
Smoker (n, %)	209 (26)	20 (30)	189 (25)

Results

Figure 1. Arrests with ROSC and use of therapeutic hypothermia by year (*2012 data only includes 6 months)

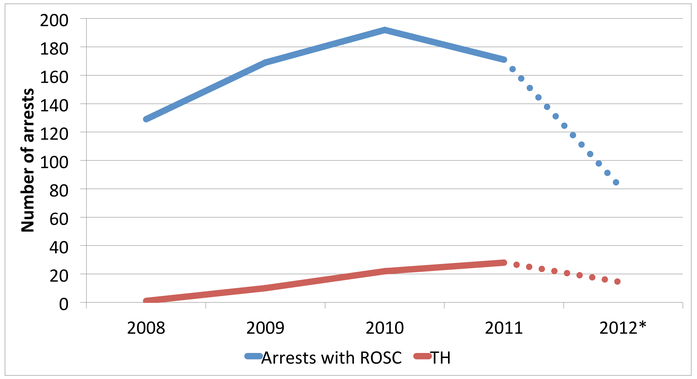

Table 2. Neurologic outcomes based on initial rhythm or arrest location and use of TH

		CPC 1-2 (n, %)	CPC 3-4 or Death (n, %)
VF/VT	TH (n=11)	1 (9)	10 (91)
	No TH (n=133)	38 (29)	94 (71)
PEA/Asystole	TH (n=53)	10 (19)	43 (81)
	No TH (n=570)	124 (22)	445 (78)
In-hospital	TH (n=49)	5 (10)	44 (90)
	No TH (n=710)	189 (27)	519 (73)
Out-of-hospital	TH (n=18)	1 (6)	17 (94)
	No TH (n=39)	1 (3)	38 (97)

Table 3. Discharge outcome based on initial rhythm or arrest location and use of TH

		Home/Rehab (n, %)	LTC/Death (n, %)
VF/VT	TH (n=11)	2 (18)	9 (82)
	No TH (n=133)	36 (27)	95 (71)
PEA/Asystole	TH (n=53)	14 (26)	39 (74)
	No TH (n=570)	123 (22)	444 (78)
In-hospital	TH (n=49)	9 (18)	40 (82)
	No TH (n=710)	188 (26)	518 (73)
Out-of-hospital	TH (n=18)	1 (6)	17 (94)
	No TH (n=39)	2 (5)	37 (95)

Table 4. TH vs. no TH in subset of patients with in-hospital arrests lasting >3 minutes (Total n = 617)

		Adjusted OR (95% CI)**
VF/VT	Good neurologic outcome	0.23 (0.03-1.98)
	Discharge to home or rehab	0.67 (0.13-3.62)
PEA/Asystole	Good neurologic outcome	1.74 (0.76-4.01)
	Discharge to home or rehab	2.56 (1.15-5.68)*

**Odds ratios adjusted for patient age, time to ROSC, gender, smoking status

Results

Table 5. TH characteristics

	Total n = 67
Time to target temperature (mean, range)	244 minutes (0-720)
Temperature during TH (mean, range)	32.7°C (28.7-34.4)
Duration of TH (mean, range)	20 hours (2-35)

Table 6. Pharmacologic agent usage during therapeutic hypothermia

	Total n = 67
Analgesia (n, %)	45 (67)
Fentanyl bolus (n, %)	10 (22)
Fentanyl infusion (n, %)	28 (63)
Sedation (n, %)	53 (79)
Propofol infusion (n, %)	40 (75)
Dexmedetomidine infusion (n, %)	2 (4)
Midazolam infusion (n, %)	9 (17)
Benzodiazepine bolus (n, %)	8 (15)
Paralysis (n, %)	28 (41)
Vecuronium bolus (n, %)	8 (28)
Vecuronium infusion (n, %)	5 (16)
Cisatracurium bolus (n, %)	1 (4)
Cisatracurium infusion (n, %)	16 (57)

Conclusions

- At baseline, TH patients had more out-of-hospital cardiac arrests, less witnessed arrests, and a longer average time to ROSC.
- Use of TH has increased over time since implementation of the UMMC guidelines in 2007.
- The odds of a good neurologic outcome is associated with receiving TH, but this association was not statistically significant.
- There was a statistically significant association between good discharge outcomes and TH for inpatient non-shockable arrests when controlling for age, time to ROSC, smoking status and gender.
- TH was achieved within an average of 4 hours for an average of 21 hours with a mean temperature of 32.7°C, which is within guideline recommendations.
- Most TH patients received sedation and analgesia with propofol and fentanyl infusions. Less patients received any paralysis during TH.

Discussion

- Strengths of our study included a comparator group that was similar at baseline, an analysis of pharmacologic agents, and use of a single rater for CPC.
- The study was limited by the retrospective design, small sample sizes in select groups, the use of chart review to determine patient outcomes, and possible prescriber bias given the lack of randomization.
- Future directions:
  - The results of our study support continued use of our institutional protocol which includes patients with both in-hospital and out-of-hospital arrests with both shockable and non-shockable rhythms.
  - Future analysis can include details of the hypothermia such as speed of cooling, ideal temperature and cooling methods.
  - Other variables to analyze are the impact of BMI, sedation methods and use of paralysis.