Case Report

Initial Experience of Therapeutic Hypothermia after Cardiac Arrest with Surface Cooling Method in Thammasat Chalerm Prakiat Hospital: Two Cases Report

Akeruetai Suwannakin MD*,
Sombat Muengtaweepongsa MD**

** Internal Medicine Resident, Department of Medicine, Faculty of Medicine, Thammasat University, Pathumthani, Thailand*
*** Division of Neurology, Department of Medicine, Faculty of Medicine, Thammasat University, Pathumthani, Thailand*

Objective: *Therapeutic hypothermia is a recommended treatment by standard guidelines for patients after cardiac arrest but it is not distinguished in Thailand. The present report aimed to demonstrate feasibility of its use in Thailand.*
Case Report: *Two cases of patients after cardiac arrest treated with therapeutic hypothermia are reported. Surface cooling method with ArcticSun system was applied in both cases. Core temperature curve and serial laboratory parameters are also reported.*
Conclusion: *This initial experience of therapeutic hypothermia after cardiac arrest with surface cooling method implicates feasibility of its use in Thailand.*

Keywords: *Therapeutic hypothermia, Cardiac arrest, Surface cooling*

J Med Assoc Thai 2011; 94 (Suppl. 7): S190-S193
Full text. e-Journal: *http://www.jmat.mat.or.th*

Case 1

A 44 year-old man was brought in to the emergency department because of cardiac arrest. The duration of dispatch was about 15 minutes. Ventricular fibrillation was found in the initial EKG. After successful advanced resuscitation for 20 minutes with defibrillation and adrenaline, he remained coma with Glasgow Coma Scale 3-T ($E_1M_1V_T$). However, the vital signs showed restoration of spontaneous circulation (ROSC). Therapeutic hypothermia with surface cooling method by ArcticSun™ machine was started at 3 hrs after ROSC. Core temperature was assessed via rectal route. It took 4 hrs to bring core temperature down to the target at 33°C. Shivering was treated with pethidine, atracurium and midazolam. The target temperature was sustained for 24 hrs. Then, he was re-warmed at rate of 0.2°C per hour until core temperature reached 37°C (as shown in Fig. 1). Some clinical parameters were showed in Table 1 and serial basic laboratory data was showed in Table 2. Sedative drugs and muscle relaxant were gradually tapered down during re-warming phase. The patient regained consciousness after re-warming. The Glasgow coma score came back to 15. He was discharged home after eight days of admission.

Correspondence to:
Muengtaweepongsa S, Assistant Professor, Division of Neurology, Department of Medicine, Faculty of Medicine, Thammasat University, Pathumthani 12120, Thailand.
Phone: 0-2926-9756
E-mail: sombatm@hotmail.com

Case 2

A 84 year-old woman with Parkinson's disease,

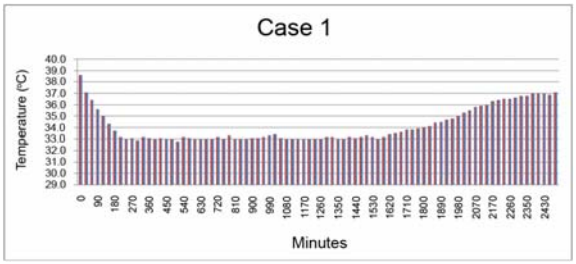

Fig. 1 The temperature curve of case 1

Table 1. Baseline parameter

	Case 1	Case 2
Initial Core Temperature	38.6°C	37.6°C
Initial Blood Pressure	107/64 mmHg	160/100 mmHg
Oxygen Saturation	94%	99%
EKG after ROSC	Normal sinus rhythm	Atrial Fibrillation
Initial Glasgow Coma Score	3	5
Baseline Arterial Blood Gas		
pH	7.45	7.48
pO_2	105	121
pCO_2	28	37
HCO_3	22.4	27.6

Table 2. Laboratory of Case 1

	Initial	12 hrs	24 hrs	48 hrs	72 hrs
CBC					
WBC cell/mm^3	20,600	18,700	17,200	14,700	13,000
Platelets cell/mm^3	224,000	224,000	195,000	189,000	266,000
PT/PTT	11.9/25.7	11.1/28.6	11.3/29.5	11.7/27.9	ND
BUN (mg/dl)	11	9	9	7	3
Cr (mg/dl)	1.1	1.0	0.8	0.6	0.7
Na^+ (mEq/l)	134	139	140	139	141
K^+ (mEq/l)	3.0	3.2	3.7	3.5	4.2
CO_2 (mEq/l)	19.4	16.7	17.7	18.1	21.1
CPK (mg/dl)	274	2,690	2,896	2,301	ND
CK/MB (mg/dl)	5.8	61.7	76.5	84.4	ND
Troponin T	0.083	1.25	1.35	0.42	ND
Glucose (mg/dl)	329	216	209	133	ND

hypertension, hypothyroidism and chronic atrial fibrillation with cardioembolic stroke (modified Rankin score of 2 before this event) got airway obstruction by foreign body then sudden cardiac arrest in front of the out-patient department. She was immediately moved to the treatment room at the OPD and advanced cardiopulmonary resuscitation was started. Restoration of spontaneous circulation was achieved after 20 minutes of CPR without any vasopressor. However, she still remained unconsciousness with Glasgow Coma Scale of 5 ($E_1M_3V_T$). Therapeutic hypothermia with surface cooling method by ArcticSun™ machine was started. Rectal temperature probe was placed for core temperature measurement. It took 6 hrs to bring core temperature down to the target at 33°C. Shivering was scarcely found but successfully be treated with pethidine and midazolam. The target temperature was sustained for 24 hrs. Then, she was re-warmed at rate of 0.2°C per hour until core temperature reached 37°C

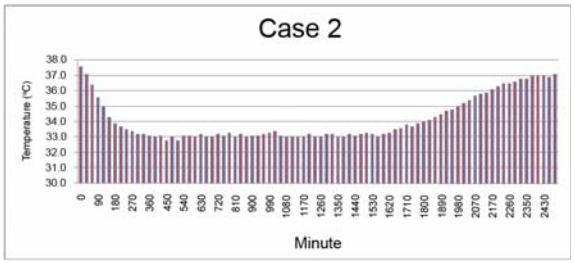

Fig. 2 The temperature curve of case 2

(as shown in Fig. 2). Some clinical parameters were showed in Table 1 and serial basic laboratory data was showed in Table 3. Sedative drugs were gradually tapered down during re-warming phase. The patient regained consciousness after re-warming. The Glasgow coma score was raised to 12 after re-warming. She was extubated 2 days later. Her motor and cognitive function was gradually getting better. She stayed in the hospital

Table 3. Laboratory of Case 2

	Initial	12 hrs	24 hrs	48 hrs	72 hrs
CBC					
WBC cell/mm^3	19,600	31,900	30,600	33,500	27,200
Platelets cell/mm^3	353,000	301,000	266,000	314,000	277,000
PT/PTT	17.3/24.7	22.1/25.1	29.9/31.4	33.8/43.5	41.3/43.7
BUN (mg/dl)	15	28	35	47	37
Cr (mg/dl)	0.9	1.1	0.8	1.0	0.9
Na^+ (mEq/l)	140	138	138	140	137
K^+ (mEq/l)	3.9	5.1	4.0	3.3	4.3
CO_2 (mEq/l)	20	17.3	29	24.4	26.6
CPK (mg/dl)	82	1,039	1,651	2,772	2,155
CK/MB (mg/dl)	3.71	23.6	40.9	111.3	40.2
Troponin T	0.01	0.05	0.04	0.03	0.02
Glucose (mg/dl)	197	68	59	111	68

for rehabilitation for few weeks and was discharged home with modified Rankin score of 3.

Discussion

Therapeutic hypothermia after cardiac arrest has been the class 1 recommendation by International Liaison Committee on Resuscitation since 2003[1]. In October 2010, American Heart Association announced the class 1 recommendation for therapeutic hypothermia after cardiac arrest in part 9 of the guidelines for cardiopulmonary resuscitation and emergency cardiovascular care[2]. The evidence of clinical benefit of therapeutic hypothermia after cardiac arrest derived from two major studies from Europe and Australia[3,4]. Therapeutic hypothermia after cardiac arrest has been successfully implemented in many countries, including some countries in Asia[5-7]. Unfortunately, therapeutic hypothermia after cardiac arrest is not well established in Thailand.

Several methods of therapeutic hypothermia have been tested. Surface and Endovascular Cooling methods are reliable. These two methods are the most commonly use for therapeutic hypothermia. Surface cooling is less invasive than endovascular method. Surface cooling provides acceptable hypothermic efficacy. For these reasons, surface cooling is the most common use as initial method for therapeutic hypothermia after cardiac arrest[8]. However, multimodality methods may be necessary to facilitate achievement of temperature target[9].

Shivering is the last resort defense mechanism to prevent hypothermia. To bring the core temperature down to target, shivering needs to be effectively defeated[10]. Pethidine or Meperidine raises shivering threshold. Pethidine is commonly available worldwide, therefore, is generally used to reduce shivering[11].

The authors' initial experience of therapeutic hypothermia after cardiac arrest with surface cooling method implicates feasibility of its use in Thailand. However, further study is needed to confirm its clinical benefit in Thai patients.

Potential conflicts of interest

None.

References

1. Nolan JP, Morley PT, Vanden Hoek TL, Hickey RW, Kloeck WG, Billi J, et al. Therapeutic hypothermia after cardiac arrest: an advisory statement by the advanced life support task force of the International Liaison Committee on Resuscitation. Circulation 2003; 108: 118-21.
2. Peberdy MA, Callaway CW, Neumar RW, Geocadin RG, Zimmerman JL, Donnino M, et al. Part 9: post-cardiac arrest care: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2010; 122 (18 Suppl 3): S768-86.
3. Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. N Engl J Med 2002; 346: 549-56.
4. Bernard SA, Gray TW, Buist MD, Jones BM, Silvester W, Gutteridge G, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. N Engl J Med

2002; 346: 557-63.
5. Bro-Jeppesen J, Kjaergaard J, Horsted TI, Wanscher MC, Nielsen SL, Rasmussen LS, et al. The impact of therapeutic hypothermia on neurological function and quality of life after cardiac arrest. Resuscitation 2009; 80: 171-6.
6. Kim YM, Kim JH, Park KN. Use of therapeutic hypothermia after cardiac arrest: A survey of the society of critical care medicine in South Korea. Resuscitation 2009; 80: 836.
7. Skulec R, Truhlar A, Knor J, Seblova J, Cerny V. Broad implementation of therapeutic hypothermia after cardiac arrest-Mission possible. Resuscitation 2010; 81: 779-80.
8. Alzaga AG, Cerdan M, Varon J. Therapeutic hypothermia. Resuscitation 2006; 70: 369-80.
9. Kamarainen A, Virkkunen I, Tenhunen J, Yli-Hankala A, Silfvast T. Induction of therapeutic hypothermia during prehospital CPR using ice-cold intravenous fluid. Resuscitation 2008; 79: 205-11.
10. Mahmood MA, Zweifler RM. Progress in shivering control. J Neurol Sci 2007; 261: 47-54.
11. Mokhtarani M, Mahgoub AN, Morioka N, Doufas AG, Dae M, Shaughnessy TE, et al. Buspirone and meperidine synergistically reduce the shivering threshold. Anesth Analg 2001; 93: 1233-9.

การรักษาด้วยการลดอุณหภูมิในผู้ป่วยห้องหัวใจหยุดเต้นด้วยการให้ความเย็นผ่านทางผิวหนัง รายงานประสบการณ์เบื้องต้นในผู้ป่วยสองรายที่ได้รับการรักษาในโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ

เอกฤทัย สุวรรณนาคินทร์, สมบัติ มุ่งทวีพงษา

วัตถุประสงค์*: การรักษาด้วยการลดอุณหภูมิในผู้ป่วยหลังหัวใจหยุดเต้นเป็นการรักษาที่ได้รับการยอมรับสูงตามคำแนะนำของแนวทางการรักษามาตรฐาน แต่การรักษาด้วยวิธีนี้ยังไม่เป็นที่รู้จักแพร่หลายในประเทศไทย การศึกษานี้รายงานการให้การรักษาด้วยการลดอุณหภูมิในผู้ป่วยหลังหัวใจหยุดเต้นในประเทศไทยเพื่อแสดงให้เห็นถึงความเป็นไปได้ของการให้การรักษาด้วยวิธีนี้ในประเทศไทย*

รายงานผู้ป่วย*: ผู้ป่วยหลังหัวใจหยุดเต้นสองรายได้รับการรักษาด้วยการลดอุณหภูมิ โดยการใช้วิธีการให้ความเย็นผ่านทางผิวหนังด้วยเครื่องลดอุณหภูมิ ArcticSun ได้รับการรายงานในการศึกษานี้ ข้อมูลทางคลินิกแผนภูมิอุณหภูมิแกนกลางตามช่วงเวลาต่างๆ ข้อมูลทางห้องปฏิบัติการที่สำคัญได้รับการรายงานไว้ด้วยในการศึกษานี้*

สรุป*: การรักษาด้วยการลดอุณหภูมิในผู้ป่วยหลังหัวใจหยุดเต้นน่าจะมีความเป็นไปได้ในทางปฏิบัติในประเทศไทย*