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# “The Esophageal Cooling Device”: A New Way to Achieve Targeted Temperature Management



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### Abstract

Targeted temperature management (TTM) is a standard of care following cardiac arrest, but the therapy is often underutilized. Workflow interruptions and adverse events associated with existing TTM devices contribute to underutilization, which has prompted the development of new technologies. The purpose of this article is to summarize the rationale behind evaluating a new TTM device, the Esophageal Cooling Device (ECD).

**Keywords:** Targeted temperature management; Therapeutic hypothermia; Post cardiac arrest; Emergency room; Innovation adoption; Resuscitation protocols

### Introduction

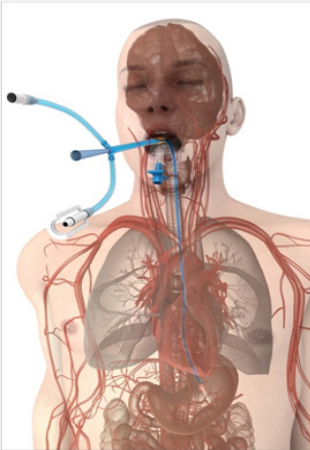
Targeted temperature management (TTM) has become a standard of care following cardiac arrest [1,2] and the benefits of this therapy are well established [3,4]. However, not all patients who should receive this therapy do. Studies have documented TTM underutilization at the hospital level [5,6] but have not extensively documented why some facilities fail to initiate TTM for some patients or never fully implement a TTM protocol at all. Given that TTM was first included in the American Heart Association Guidelines in 2005, ignorance of the practice is an unlikely explanation. Closer examination of the current technologies used to deliver TTM provides an alternative reason for underutilization.

Over the last decade, advanced TTM systems (i.e., those that incorporate servo-controlled temperature monitoring to automatically adjust therapy to patient needs) used one of two methods to affect heat transfer for cooling: intravascular convection and surface conduction. Intravascular methods use specially designed catheters that are inserted into the central venous system. This method promotes efficient heat transfer but patients are at risk of developing blood stream infections and blood clots [7,8] and TTM initiation can be significantly delayed, sometimes for hours, when a physician is not available to place the line. Surface devices use pads or

blankets to cover the patient and transfer heat through the skin. This configuration is non-invasive, but it is also less efficient. Surface cooling is associated with skin damage [9,10] and patient access is obscured. To place most surface devices, 2-3 nurses must work together to manipulate the patient and then must ensure that the device remains clean throughout the course of treatment. Thus, while there are several devices available to clinicians to effectively perform TTM, there is also an opportunity for improvement. This in turn has inspired the development of new technologies that are now available for implementation, either in conjunction with, or as a replacement for, existing TTM methods.

### Evaluating a New TTM Device

One such technology, the Esophageal Cooling Device (ECD; Advanced Cooling Therapy, Inc., Chicago, IL) was approved for marketing by the FDA in 2015. At that time, Peace Health St. Joseph Medical Center in Bellingham, WA, had successfully cooled over 700 PCA patients using a surface method. Patient outcomes were consistent with the literature; approximately 51% of patients were discharged from the ICU with good neurological outcomes, as measured by the modified Rankin Scale (mRS). However, the blanket-style system obscured patient access and sometimes interfered with nursing care.



**Figure 1:** The ECD (highlighted in blue) is placed in the esophagus and replaces a standard OG tube. Two outer lumens circulate water provided by an external heat exchanger and a central lumen connects to the suction canister.

The Department of Emergency Medicine evaluated the ECD on two key criteria: 1) that the clinical performance of the ECD was equivalent to the surface system in use, and 2) that staff members experienced less interference with clinical tasks. Results from published pre-clinical data [11-14], case studies [15-18], and prospective clinical evaluations [19] suggested that equivalent performance was attainable. The internal placement of the device, which replaces a standard OG tube (Figure 1), also suggested that reduced interference with clinical tasks was likely.

### Discussion

At the time of this writing, the Emergency Department Cardiac Cath Lab, and ICU have used the ECD to deliver TTM to 30 consecutive patients. The ECDs were placed by ER, ICU, and STAT nurses, who expressed satisfaction with the training burden required to demonstrate competence for correct insertion and use. The ECD connects to the same heat exchange unit that was already in use in the department (Blanketrol III, Cincinnati Sub-Zero, Cincinnati, OH), which helped accelerate the learning curve. In some instances, simple modifications were employed, such as restricting water outflow to make the device more rigid during placement or briefly deflating the ET tube balloon, for challenging insertions. Clinical staff members observed a rapid start to cooling (typically slightly over 1°C/hr) and stable maintenance temperatures ( $\pm 1^\circ\text{C}$  from target) throughout treatment, consistent with other clinical performance evaluations [20]. Nurses were also pleased with the flexibility the ECD offered, as cooling blankets could be added or removed as needed to best meet evolving patient needs during TTM. In addition, cardiologists responded favorably to the ECD because it caused almost no distortion in the catheterization laboratory. One shortcoming of the ECD is that it does not currently support feeding through the central lumen, though this feature will be included in future iterations [21].

### Conclusion

TTM is a well-established but often underutilized therapy that is highly beneficial for post-cardiac arrest patients. Workflow interruptions and adverse events associated with existing TTM devices contribute to underutilization, which has prompted the development of new technologies. However, the decision to modify an already successful TTM protocol should not be taken lightly. For the ECD, the combination of published clinical data and elements of the device design suggested an opportunity for improvement in the department's practice and the outcomes of an evaluation suggest that the ECD is a worthy addition to the post-resuscitation TTM protocols available to the emergency department.

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