CRITICAL REVIEW FORM:
THERAPY ARTICLES

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Citation: Prekker ME, RIschall M, Carlson M, et al. Extracorporeal membrane oxygenation versus conventional rewarming for severe hypothermia in an urban emergency department. *Acad Emerg Med. 2023;30:6-15*

Study Objective: "To describe outcomes and process of care measures among ED patients with severe hypothermia who were selected for ECMO rewarming and compare them to patients who underwent conventional (non-ECMO) rewarming.

Study Methodology: Retrospective cohort analysis of ED patients with severe hypothermia (defined as a core body temperature less than 28°C) due to outdoor exposure over a 14-year period in an urban, county hospital and Level I trauma and burn center with 480 beds and approximately 105,000 annual ED visits.

GUIDE	COMMENTS
I. Are the results valid? yes	
A. Did experimental and control groups begin the study with a similar prognosis (answer below)?	
1. Were patients randomized?	No. This is a retrospective analysis of a cohort of patients from 2007-2021.
2. Was randomization concealed (blinded)? In other words, was it possible to subvert the randomization process to ensure that a patient would be "randomized" to a particular group?	No, ED physicians selected the treatment modality loosely based upon an institutional guideline. (*selection bias*)
3. Were patients analyzed in the groups to which they were randomized?	Yes. There was no randomization, but there was an intention-to-treat analysis that kept a few patients in the groups they fell into despite not completing treatment.
4. Were patients in the treatment and control groups similar with respect to known prognostic factors?	No CI's reported for baseline characteristics however most appeared statistically insig. except Male Sex 76% ECMO vs. 63% Card. Arrest: 84% ECMO vs. 37% Temp $\leq$ 24C 44% ECMO vs 21% Most had unwitnessed cardiac arrest.
5. Were patients aware of group allocation?	No since conditions to qualify for the study were cardiac arrest, Hypothermia <28C which would make anyone not capable to consent for the study.

6. Were clinicians aware of group allocation?	Yes. It was largely a discretion of the ED physicians as to which group these patients would be assigned.
7. Were outcome assessors aware of group allocation?	Yes. No blinding of chart reviewers. Kappa score for agreement on type of rewarming was 0.80 which is good but reflects a single item on their chart review data form.
8. Was follow-up complete?	No. Outcomes were measured to the time of patients hospital discharge. No long term follow up provided.
What are the results?	Primary Outcome: Hospital survival was not statistically significant 68% (ECMO group) vs 74% (conventional internal rewarming group) (NO CI's were reported) Cardiac Arrest subgroup *Hospital Survival* ECMO 71% vs. 29%, ARR 42%, (95% CI 4% to 82%) NNT= 1/ARR=2.3 H*ospital Survival with a Good Neurologic Outcome* ECMO 62% vs. 29%, ARR 33%, (95% CI −6% to 72%). 1/ARR 3.03 however CI crosses 0 and likely reflects small sample sizes. ECMO group had shorter duration of CPR 106min vs 241 on control group ECMO group had higher incidence of ROSC , 100% vs 29 on control group. ECMO had a more rapid rate of rewarming 2.3 degrees C. Vs 1.4 degrees C /hr of control group
1. How large was the treatment effect?	As above
2. How precise was the estimate of the treatment effect? (CI's?)	Non precise. The CI's for clinically important differences were either very wide (4%-82%) or crossed 1 (-6%-72%) This likely is a reflection of the small sample size.
III **How can I apply the results to patient care?**	
1. Were the study patients similar to my patients?	**Probably,** I have yet to treat any patient with severe hypothermia and in cardiac arrest, but very applicable to my future geographical area of practice. This was a US based study. Homelessness and substance use very prevalent in our population. There was a disproportionate number of males.

2. Were all clinically important outcomes considered?	**Yes**, The most patient-centered outcome survival with a reasonable neurological outcome was included. No cost assessment, impact analysis on the rest of the ED when these patients need to be treated was reported.
3. Are the likely treatment benefits worth the potential harm and costs?	ECMO patients were more likely to have hemorrhage, cannula site complications, DVT, stroke though sample size makes it difficult to assess harms. I'd say so especially if the hospital is located in the geographical area where freezing cold temperatures are expected during winter months. it seems reasonable to train ED physicians and intensivists.

Limitations: The authors did a great job identifying the following limitations

-Potential bias in physicians selecting and assigning treatment modalities with use of clinical judgement based on the perceived likely prognosis. ECMO group has higher proportion of cardiac arrest victims 84% vs. 37%, were more likely to have Temp of <24C (44% vs. 21%) and more likely to have a shockable rhythm76% vs. 43%

-Chart reviewers could have been but, were not blinded predisposing to reporting bias

-Technical challenges in deployment of ECMO and internal rewarming catheters etc., limits the efficacy of measuring the true value of rewarming rate. Also, over 40% of ECMO patients got multi-modal forms of rewarming which could skew results.

-Even though the study duration was 14 years (very long), the subjects were few, lowering the power of the study s is reflected in wide or non-reporting of CI's. Also, resuscitation science has had other advances over those 14 years. What role could that have played?

-The study may not be generalized to other clinical settings with less resources. Would require multispecialty team approach from the get go when these subsets of patients arrive in the ED. Many EDs especially those in rural hospitals may not necessarily be adequately staffed.

Clinical Bottom Line:
AV ECMO in properly selected patients with severe hypothermia may have higher rates of hospital survival with good neurologis outcomes. Additional studies are warranted however should I fall through the ice…(you get to finish the statement Ngassa)

*interestingly
**   -longest CPR duration in a survivor hypothermic cardiac arrest was 238min (apprx 4hr)!!! this calls for investing on LUCAS for sure.**