International Journal of Paramedicine

Published by the National EMS Management Association (USA)

RESEARCH REPORTS

PREHOSPITAL PROTOCOLS FOR TRANSCUTANEOUS PACING IN THE UNITED STATES: A CROSS-SECTIONAL DESCRIPTIVE ANALYSIS

Jacob Stebel, BA, NRP, CCP-C*[1,2,3]; Anxhelo Mara, CCP[4]; James T. White, MS, NRP, FP-C[5]; Susan J. Burnett, PhD, NRP, FAEMS[6]; Kathryn Chadason, FP-C[7]; Eva Sturgeon, FP-C[3]; Nelea K. Fong, BA, NRP[8]; Ian D. Ross, BS, NRP, FP-C[9]; Christopher M. Wanka, NRP, PA-C[10]; Peter Jung, RN, EMT-P, CCP-C[3]; Ariana Carranza Cedrón, BA[11]; Baruch Schwartz, BA, EMT[12]; Joshua Ross Rasco, BS[13]; Maria Rampersaud, NRP[2]; Evan R. Ashley, NRP, CCP-C[1]; Aditya C. Shekhar, MD, MBE[1]; Kevin Chason, DO, FACEP[1]; Judah A. Kreinbrook, BS[5]; Joshua Kimbrell, BA, NRP[1,2,11]

Author Affiliations: 1. Icahn School of Medicine at Mount Sinai, New York, NY, USA; 2. Department of Pre-Hospital Care, MediSys Health Network, Jamaica, NY, USA; 3. Emergency Medical Services, NewYork-Presbyterian Hospital, New York, NY, USA; 4. College of Medicine, Pennsylvania State University, Hershey, PA, USA; 5. School of Medicine, Duke University, Durham, NC, USA; 6. Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY, USA; 7. Air Methods, Greenwood Village, CO, USA; 8. Alameda County, Falck USA, Hayward, CA, USA; 9. School of Osteopathic Medicine, Rocky Vista University, Billings, MT, USA; 10. Capital Region Health, University of Maryland Medical System, Largo, MD, USA; 11. Albert Einstein College of Medicine, Bronx, NY, USA; 12. College of Osteopathic Medicine, Touro University, New York, NY, USA; 13. College of Osteopathic Medicine, Sam Houston State University, Conroe, TX, USA.

Recommended Citation: Stebel, J., Mara, A., White, J., Burnett, S., Chadason, K., Sturgeon, E., Fong, N., Ross, I., Wanka, C., Jung, P., Carranza Cedrón, A., Schwartz, B., Rasco, J., Rampersaud, M., Ashley, E., Shekhar, A., Chason, K., Kreinbrook, J., & Kimbrell, J. (2026). Prehospital protocols for transcutaneous pacing in the united states: A cross-sectional descriptive analysis. *International Journal of Paramedicine*. (15). 16-37. https://doi.org/10.56068/KEZH1027

Keywords: prehospital care, out-of-hospital cardiac arrest, emergency cardiovascular care, transcutaneous pacing, emergency medical services, EMS, paramedicine

Disclosures: The authors have no competing interests or relevant disclosures to report.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Presentation: An early version of this project was presented as a poster at the 2025 National Association of EMS Physicians conference.

Received: November 22, 2025
Accepted: March 11, 2026
Published: July 15, 2026

**Corresponding Author:*
jacob.stebel@gmail.com

ABSTRACT

Objectives: Transcutaneous pacing (TCP) has a Class IIb recommendation from the American Heart Association (AHA) for the treatment of hemodynamically unstable bradycardia. Recent studies highlight a high rate of treatment failure and known difficulties verifying electrical capture ("false electrical capture") and mechanical capture. This study aimed to characterize the current recommendations within US prehospital TCP protocols.

Methods: A convenience sample of 260 prehospital protocols were selected from publicly available resources. Two trained abstractors were assigned to each; pre-specified categorical variables and free-text responses were recorded. The latter were coded using content analysis. Responses were analyzed using descriptive statistics and reported as frequencies and proportions.

Results: 228 protocols completed paired abstraction, 177/228 (78%) were accessible and mentioned TCP. The most frequent indication was symptomatic bradycardia 172/177 (97%). Electrical capture was mentioned in 116/177 (66%) with false electrical capture discussed in only 8/177 (5%). Pulse palpation was the primary method for capture confirmation 123/177 (69%). Indications discordant with AHA guidelines included cardiac arrest 23/177 (13%) and seizures 18/177 (10%). Overall, 70/177 (40%) protocols were assessed to completely match, 65/177 (37%) partially match, and 41/177 (23%) did not match AHA guidelines for TCP.

Conclusions: Prehospital TCP protocol indications varied, with 77% partially or completely matching AHA guidelines for TCP. Nevertheless, guideline-discordant recommendations remained. False electrical capture was rarely mentioned. Further research should systematically assess TCP implementation including methods to assess and confirm capture, and whether guideline adherence in prehospital protocols improves outcomes and reduces TCP failure.

INTRODUCTION

Transcutaneous pacing (TCP) is a non-invasive cardiac pacing modality primarily used to treat hemodynamically unstable bradycardia. The 2018 ACC/AHA/HRS Guideline on the Evaluation and Management of Patients with Bradycardia and Cardiac Conduction Delay (2018 AHA Guideline) assigns a Class IIb recommendation to TCP supported by limited data for unstable bradycardia refractory to medical therapies as a bridge to transvenous pacing (Kusomoto et al. 2018). However, as noted in recent research, the treatment frequently fails; and in roughly 20% of patients, the patient may deteriorate into cardiac arrest following TCP (Smida et al. 2024). A multi-center observational effort published this year demonstrated that in 224/299 cases of transcutaneous pacing, 74.9% [69.6, 79.7] had no electrical capture observed from cardiac monitor files (Smida et al. 2026). A recent retrospective cohort study with an embedded case series found that of 23 cases receiving TCP, 19 (83%) had no evidence of electrical capture, with frequent artifact that appeared to be QRS-like, potentially arising from the device itself. This so-called "false electrical capture" has been noted by a TCP device manufacturer and appears to have misled the paramedics in these cases as all 19 patients had a documented palpable pulse during pacing (Kimbrell et al. 2024; Stryker Inc. 2018).

Possible solutions to address this significant concern have been proposed and include optimizing pad positioning, education on assessing electrical capture, and attention to mechanical capture methods (Moayedi et al. 2022, Cohen et al. 2022, Ettin & Cook, 1999, Holger et al. 2003, Tam, 2003).

Given the developing body of research on prehospital TCP, it is important to consider the contribution of practice patterns, guidelines, and evidentiary support present in prehospital protocols guiding prehospital care in the United States. As such, our aim is to evaluate prehospital TCP recommendations in a cross-sectional sample of EMS protocols, including the prevalence of false electrical capture, recommendations regarding electrical and mechanical capture verification, and adherence to existing guideline-based indications. We anticipate encountering appropriate indications for TCP, pulse palpation as a central method for confirmation of efficacy, and a limited discussion of false electrical capture. The expectation is indications will align with current guidelines.

METHODS

Study Design

We performed a cross-sectional descriptive study of TCP protocols using a convenience sample of available prehospital protocols in the US. The study was deemed non-human subjects research by an Institutional Review Board (STUDY-24-01043). We used the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) cross sectional checklist to guide this research (von Elm, et al. 2007).

Setting

This study was conducted using publicly available prehospital TCP protocols in the United States. Prehospital protocols provide a standardized quality of care in each operating area, with standing order protocols authorizing independent treatment and medication administration by credentialed prehospital clinicians without direct medical oversight

(Alonso-Serra et al. 1998, Cash et al. 2020, Cunningham et al. 2010). Prehospital protocols can span different geographic and regulatory levels: some may be state-wide or even encompass multiple states, while others are specific to individual agencies.

Data Sources and Collection

An initial eligibility list of all publicly accessible prehospital protocols was curated from emsprotocols.org and the mobile application Paramedic Protocol Provider® (PPP; AcidRemap, LLC, Lafayette, CA). We collected protocol titles from both sources and removed duplicates, with a final list of 585 protocols eligible for selection. We manually included all available statewide protocols (n=25) in alignment with prior literature and then included additional protocols via randomized selection. Following abstractor attrition, a total of 260 protocols were assigned (Figure 1). Additional information can be found below and in the supplement.

Ten abstractors with healthcare experience were recruited and trained. A pilot phase required the first author to review ten protocol abstractions from each abstractor for quality control. Abstractors first assessed if a protocol was accessible and if so, they searched within each protocol to find terms related to transcutaneous pacing, such as "transcutaneous," "pacing," and "bradycardia". Reasons for inaccessible protocols included those unable to be located or downloaded or those with password protection. If accessible, protocols were excluded if keywords were not found or if the protocol was not at the advanced life support level (e.g. first aid or basic life support only) (Figure 1).

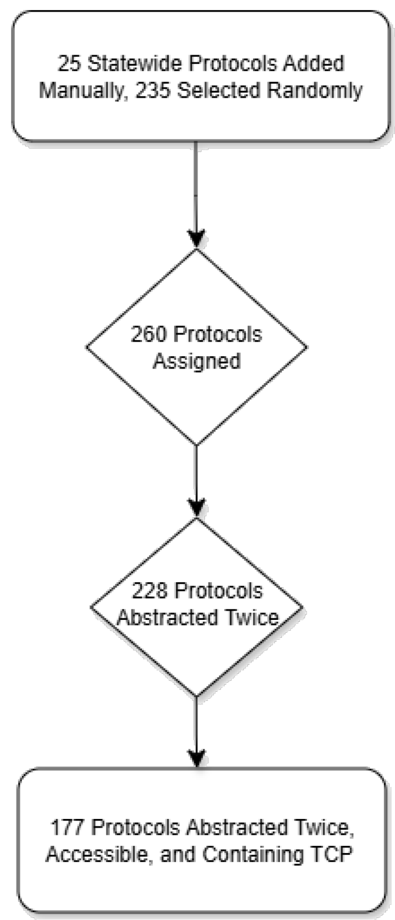

Figure 1. Diagram showing the pathway to final sample size.

The data abstraction form contained structured (pre-specified) variables and free-text variables. For free-text variables, abstractors were instructed to directly copy and paste all relevant text from the protocol, as well as to describe non-textual (e.g. pictorial) features regarding TCP indications, mentions of false electrical capture, and procedural recommendations. This method was chosen as false electrical capture can be described in a variety of ways, limiting simple methods such as text searches.

Each protocol was assigned to two abstractors. Informed by our preliminary work, assigning two abstractors allowed each protocol to receive two independent reviews, reducing the influence of individual abstractor interpretation or error and increasing data integrity. Discrepancies were reviewed by a senior author. Additional information regarding data collection is available in the supplement.

Variable Definitions and Measurement

For variables with a free-text field, we used quantitative content analysis, a methodology ideal for free-text data (Kostick et al. 2015). Two coders, J.A.K. and J.T.W. used a deductive-inductive approach to identify keywords and phrases from the free text variables. If discrepancies were identified between coders, authors J.M.K. and J.A.K. reviewed source data (e.g. protocol screenshots) to reconcile the discrepancy via consensus. To assess intercoder reliability (ICR) of the content analysis, a subset of 20 randomly selected protocols were re-coded by author J.A.K., allowing calculation of Krippendorff's Alpha, a measure of ICR (Krippendorff, 2018; Marzi et al. 2024). Detailed information is available in the supplement.

Comparison to a Reference Standard

To compare protocols to a reference standard, we selected the 2018 AHA Guideline, the most recent AHA guideline for bradycardia and cardiac conduction delay (Kusumoto et al. 2018). This guideline recommends the use of TCP for hemodynamically unstable bradycardia refractory to pharmacological therapy, using pharmacological therapy prior to TCP, and does not recommend TCP for unaccepted indications found in these data such as seizures or cardiac arrest (Sherbino et al. 2006). To characterize compliance with this reference standard for unstable bradycardia, we categorized protocols into one of three options - completely matched, partially matched, and does not match the 2018 AHA Guideline. If the listed indications and order of pharmacological therapy were in line with the guideline then it completely matched. If the listed indications were present with no listing of seizures or cardiac arrest but the order of therapy was not specified, or recommended TCP prior to pharmacological therapy, then it partially matched. The remainder were recorded as not matching.

Statistical Methods

Descriptive statistics were used to report frequencies and proportions for each pre-specified variable, as well as for counts of key words and phrases coded during content analysis.

RESULTS

Of the 260 protocols assigned for abstraction, 228 (88%) met criteria for pairwise abstraction, and 177/228 (78%) were accessible, mentioned TCP, and were fully abstracted. A US map of agency location for these 177 protocols is provided (see Figure 2).

Indications for TCP included symptomatic bradycardia in 172/177 (97%) protocols, altered mental status and hypotension, each in 124/177 (70%), inadequate perfusion in 120/177 (68%), and high-degree AV block in 69/177 (39%).

Electrical capture was mentioned in 116/177 (66%) of protocols in the sample. Of these, 68/116 (59%) did not describe characteristics of electrical capture, 39/116 (34%) described a wide QRS, and 28/116 (24%) described characteristics of the T-wave. False electrical capture was mentioned in 8/177 protocols (5%). Pulse palpation was the most common method to confirm mechanical capture in 123/177 (70%) protocols and ultrasound was only mentioned in 1 (0.5%).

Non-guideline-based indications for TCP included cardiac arrest in 23/177 (13%) protocols and seizures in 18/177 (10%). Anterior-posterior pad placement was recommended as primary configuration in 63/177 (36%), anterior-lateral or anterior-posterior in 23/177 (13%) and pad placement was not specified in 69/177 (39%). Only 4 protocols (2%) mentioned a procedure for the transfer of patient care for a patient receiving TCP from a prehospital to ED device. Results are available in Table 1 below.

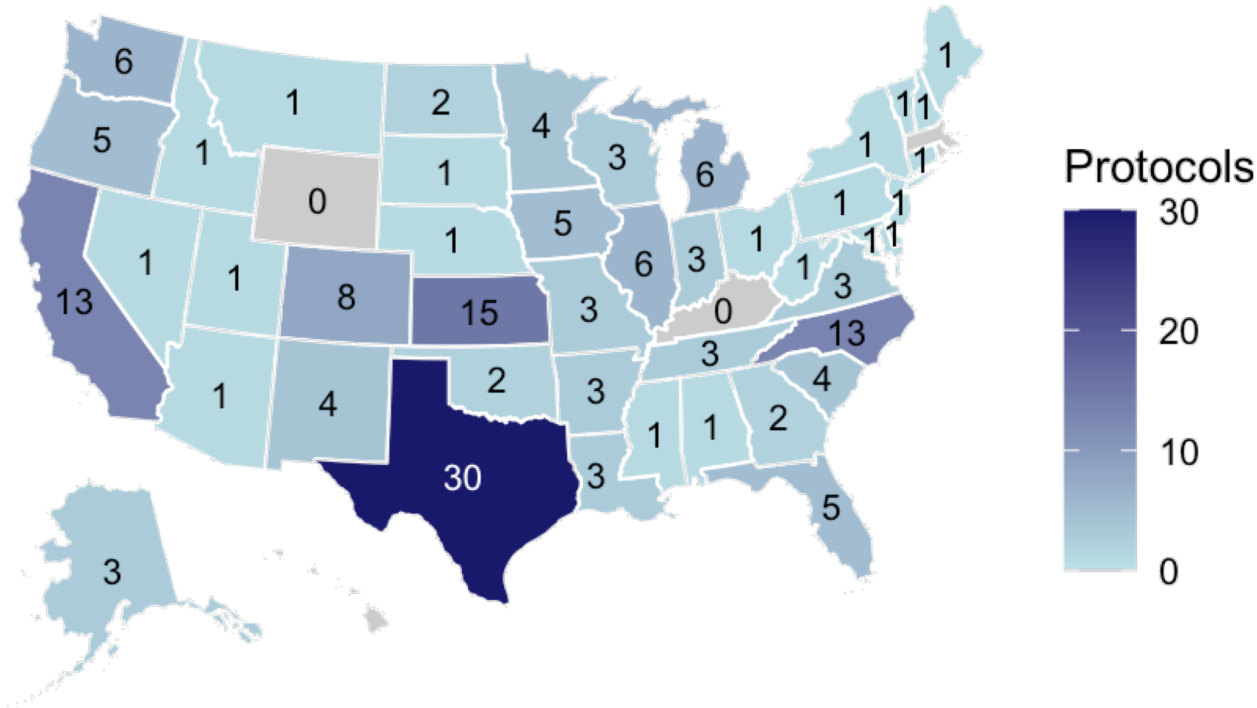

Figure 2. Protocols abstrated per state. A visual representation of the geography of protocols included in the analysis. Darker states have more abstracted protocols represented in the data set. States with zero (0) abstracted protocols are shown in gray (DC, HI, KY, MA, RI, WY). There were three (3) multi-state/ regional protocols also abstracted that are not depicted on this map.

Of 177 included protocols, 70/177 (40%) completely matched the 2018 AHA Guideline, mentioning hemodynamic instability, recommending TCP after pharmacological therapy, and not recommending use in cardiac arrest or seizures, 65/177 (37%) partially matched the 2018 AHA Guideline (no pharmacological therapy prior to TCP), and 41/177 (23%) of protocols included an indication that does not match the 2018 AHA Guideline as they recommended TCP for either cardiac arrest or seizures.

Intercoder reliability among the authors evaluating free text responses was assessed for 20 random protocols. Krippendorff's Alpha values for the coded responses ranged from disagreement to perfect agreement, with 26/40 (68%) exhibiting satisfactory agreement ($\alpha > 0.80$). Additional details are available in the supplement.

DISCUSSION

We identified variation in prehospital TCP protocols with regards to listed indications, recommended pad position, descriptions of electrical capture, mentions of false electrical capture, and recommendations for mechanical capture verification. These data provide a foundation for understanding how TCP is protocolized within prehospital practice.

We found few mentions of false electrical capture and reliance on pulse palpation (found in over 60% of protocols) for mechanical capture verification. Smida et al. in their recent observational work, also identified that most of their cases that did not have electrical capture stated that they had mechanical capture in the medical record. These data support the recent call of the 2025 AHA CPR & ECC Guidelines for research supporting best practices to distinguish true capture from false electrical capture and identify reliable

Indications for TCP (n=177)	
Symptomatic bradycardia	172 (97.2%)
Altered mental status	124 (70.1%)
Hypotension	124 (70.1%)
Inadequate perfusion	120 (67.8%)
High-degree AV block	69 (39%)
Cardiac Arrest (asystole, PEA)	23 (13%)
Seizure	18 (10%)
Suspected toxicity and overdose	12 (7%)
Tachycardia	4 (2%)
Absent radial pulses	4 (4%)
Internal pacemaker failure	2 (1%)
Electrolyte disturbance	2 (1%)

TCP Confirmation Method (n=177)	
Pulse palpation	123 (69%)
Signs of increased perfusion	45 (25%)
Blood pressure	41 (23%)
Pulse oximetry	13 (7%)
End-tidal capnography	11 (6%)
Auscultation	2 (1%)
Ultrasound	1 (1%)
Other	5 (3%)
None mentioned	49 (28%)

Concordance with 2018 AHA Guideline (n=177)	
Completely matches (indications, instability, TCP after medication, and no non-supported indications)	70 (40%)
Partially matches, without pharmacological therapy before TCP	65 (37%)
Does not match (non-supported indications)	41 (24%)

Recommended Pad Positioning (n=177)	
Anterior-posterior only	63 (36%)
Anterior-lateral or anterior-posterior	23 (13%)
Manufacturer recommendations	13 (7%)
Anterior-lateral only	9 (5%)
Not mentioned	69 (39%)

Sedation and Analgesia (n=177)	
Recommended	131 (74%)
Required	31 (18%)
Not mentioned	15 (9%)

Sedative and Analgesic Medications (n=162)	
Benzodiazepines	134 (76%)
Opiate/opioids	62 (35%)
Anesthetics/Hypnotics	55 (31%)
Not mentioned	31 (18%)

Any Mention of False Electrical Capture (n=8)	
Yes	8/177 (5%)
Picture provided in protocol	5/8 (63%)
Lack of broad T-waves	3/8 (38%)
Pacer spike depicted without matching SpO2 pleth wave	3/8 (38%)
Discrepancies between pacer rate and pulse oximetry derived rate	2/8 (25%)
EKG artifact	2/8 (25%)
Electrical capture without mechanical capture	2/8 (25%)
Partial or intermittent capture depicted	2/8 (25%)
Other false electrical capture mention	2/8 (25%)
Fusion complexes or complexes in absolute refractory period	1/8 (13%)

Table 1. The proportions of key characteristics within prehospital TCP protocols. Responses are not mutually exclusive.

methods for confirming initial and sustained capture with prehospital TCP (Wigginton, et al. 2025).

We identified that only 1 in 20 protocols mention false electrical capture. While this may also reflect the novelty of the concept, it is an important link in understanding prehospital TCP that should be addressed in prehospital care protocols. False electrical capture refers specifically to QRS-like artifact or pacer dissociation deceiving providers into maintaining the TCP intervention, with further confusion due to skeletal muscle contractions from TCP current influencing pulse palpation (Kimbrell et al. 2024). Importantly, a common manufacturer of TCP devices recognizes that pacer artifacts can deceive the user, and provides visual examples (Stryker, Inc., 2018). Their recommendation is to use a multi-modal approach, relying on pulse palpation and clinical examination for hemodynamic improvement. Though not unreasonable, there is some evidence suggesting the utility of point of care ultrasound (POCUS) (Cohen et al. 2022, Ettin & Cook, 1999, Holger et al. 2003, Tam, 2003). This is supported by a recent case report where POCUS was used to identify pseudo pulseless electrical activity, utilizing the device to adjudicate mechanical capture (Czerwiec et al. 2025). Such a hemodynamically driven approach matches the historical clinical trials which often lacked an associated ECG, instead starting at high currents and clinical exam, maximizing the chance of capture (Kreinbrook and Kimbrell, 2024). Given the poor performance of pulse palpation in cardiac arrest, the burden of proof might rest on this procedure, with POCUS or arterial line waveform as a reference standard (Cohen et al. 2022; Tibballs and Weeranatna, 2019).

Of concern, when compared to the 2018 AHA Guidelines as a standard, roughly 20% of protocols listed cardiac arrest or seizures as an indication for TCP. Though such protocols might be suggesting that seizure-like activity from EMS-witnessed arrest is an indication for TCP, there is no available evidence, to our knowledge, supporting this indication (Sherbino et al. 2006). In contrast, we found a roughly equal proportion which completely matched the 2018 AHA Guidelines as partially matched. Within our methodology, the difference pertained to the exact order of pharmacological versus electrical therapy. Currently, guidelines recommend pharmacological therapy first (Kusomoto et al. 2018). There is currently only one pilot randomized controlled trial which compared prehospital dopamine against TCP, limiting the available evidence in this space (Morrison et al. 2008). During review we found that many protocols recommended use of a TCP-first strategy if clinical instability was present without IV access or if a high-degree AV block was present, both reasonable interpretations based on pathophysiologic rationale. Nevertheless, more rigorous research is needed to understand if there are specific risks and benefits of the practice, especially as a previous pilot trial highlighted the rarity of the procedure, a barrier to clinical trials (Morrison et al. 2008).

To our knowledge, this is the first study to investigate prehospital TCP protocols and the first to investigate concordance of prehospital protocols with evidence-based guidelines. Several studies have examined prehospital protocol variability in other topics such as the use of the term "excited delirium," anaphylaxis, prehospital pain management, termination of resuscitation, elder abuse identification, differences in pediatric seizure management, prehospital hypoglycemia, post-arrest care, and prehospital ultrasound. These studies used variable methodologies, with some using a convenience sample of available statewide protocols (n=30-35), another using a convenience sample of protocols available on emsprotocols.org and identified via web search (n=104), another using a combination of cases from emsprotocols.org and those from the 50 most populous cities in the United States (n=185), and the largest using PPP to identify current practices in prehospital ultrasound (Fritz et al. 2024, Gunderson, et al. 2025, Li et al. 2023, Li et al. 2024, Namboodri et al. 2018, Ramgopal et al. 2021, Rostykus et al. 2016, Spigner et al. 2021, Warren & Toy, 2025).

Future studies of protocol variation should use rigorous methodology to ensure measurement quality; we found that protocols evaluated can offer contradictory instructions (e.g., conflicts between recommendations to initiate or cease TCP in one section of the protocol and recommendations to trial increased vasopressor therapy without TCP in another). In addition, some recommendations were specific in some treatment algorithms, and others noted more broadly "perform TCP". Further, researchers' preconceived opinions about clinical topics may influence interpretation.

We found high rates of variability in prehospital TCP protocols with roughly 20% continuing to recommend TCP in cardiac arrest or for seizures, both discordant with current evidence. There were also infrequent recommendations for anterior-posterior pad positioning, mentions of false electrical capture, and frequent recommendations for pulse palpation as a primary method for confirming mechanical capture. Future research should investigate whether prehospital protocol adherence with evidence-based guidelines is associated with patient-centered outcomes and further develop the scant evidence base surrounding TCP as a bridge to TVP devices.

LIMITATIONS

Several potential sources of bias were considered during the study design. First, prior studies of EMS protocols have repeatedly mentioned the lack of a central, standardized instrument to perform EMS protocol abstraction. We originally piloted a single abstractor designed and failed to reach sufficient inter-rater reliability. Though partly due to the difficulty of the topic, we found that protocols were often discordant and required granular review to ensure validity. As such, we revised the data extraction form to include fewer prespecified variables, expanded the methodology to include quantitative content analysis of free text-responses, and ensured that every protocol was reviewed twice with discrepancies resolved via senior author and/or consensus. Second, despite these attempts, content analysis of publicly available protocols within a short timeframe may be subject to measurement bias, as protocols could vary over time and the most up-to-date protocol version may not be updated on the publicly accessible sources. This is mitigated, in part, by the short two-month timeframe—in line with prior research detailing an ideal collection timeframe—and our methodology, as the abstractor downloaded each protocol at the time of review. Third, the potential for selection bias remains, as EMS agencies choosing to publish their protocols publicly may differ systematically from those who do not. Fourth, we recognize that although we incorporated some random selection to reduce selection bias, this study has utilized a convenience sample due to the manual addition of statewide protocols, non-pairing of others, and the early termination of study abstraction. Fifth, the original simple randomization resulted in a representative sample from the database which overrepresents certain states. This may influence results as some states may have statewide protocols that promulgate overall standards of care in the state, and frequently represented states may give outsize influence to individual agencies. One example of the former is in California: the Emergency Medical Services Authority has removed pediatric intubation from the paramedic scope of practice and thereby all protocols within the state. In other states such removal may not occur writ large, but still takes place in select agencies.

CONCLUSIONS

The most common indications for prehospital TCP protocols in the US are symptomatic bradycardia, altered mental status, hypotension, and inadequate perfusion. We identified minimal discussion of false electrical capture, detection, and associated risk. There was significant variability in pad position, recommendations for sedation, descriptions of false electrical capture, and mechanical capture confirmation methods.

Adding to the urgency of this work, the most recent 2025 AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care (2025 AHA CPR & ECC Guidelines) summarize the importance of addressing "...the need for improved methods to distinguish true electrical capture from false capture. Future research is needed to determine optimal pad placement and develop reliable methods for confirming initial and sustained capture, such as the practicality and preferred location of pulse palpation, hemodynamic findings, pulse oximetry characteristics, continuous ETCO2 monitoring, and ultrasound" (Wigginton et al. 2025).

Further attention to development of the evidence for prehospital TCP is needed; reliably determining true versus false electrical capture, and methods to determine sustained capture, followed by dissemination and implementation within guidelines and practice. Several protocols advised TCP for indications that do not match the 2018 AHA Guideline for bradycardia and that are not supported by evidence.

REFERENCES

Alonso-Serra, H., Blanton, D., & O'Connor, R. E. (1998). Physician medical direction in EMS. *Prehospital Emergency Care, 2*(2), 153–157. https://doi.org/10.1080/10903129808958861

Cash, R. E., Panchal, A. R., & Camargo, C. A. (2020). Towards a more uniform approach to prehospital care in the USA. *European Journal of Emergency Medicine, 27*(6), 400–401. https://doi.org/10.1097/MEJ.0000000000000769

Cohen, A. L., Li, T., Becker, L. B., Owens, C., Singh, N., Gold, A., Nelson, M. J., Jafari, D., Haddad, G., Nello, A. V., Rolston, D. M., Sison, C., & Lesser, M. L. (2022). Femoral artery doppler ultrasound is more accurate than manual palpation for pulse detection in cardiac arrest. *Resuscitation, 173*, 156–165. https://doi.org/10.1016/j.resuscitation.2022.01.030

Cunningham, C. A., Wesley, K., Peterson, T. D., Alcorta, R., Kupas, D. F., Nelson, J. A., Taillac, P., & Upchurch, J. (2010). The role of state medical direction in the comprehensive emergency medical services system: A resource document. Preho*spital Emergency Care, 14*(3), 404–411. https://doi.org/10.3109/10903127.2010.483152

Czerwiec, J., Sczurek, P., Diak, A., & Sobczyk, D. (2025). The use of ultrasound for diagnosing and guiding successful transcutaneous electrostimulation in pseudo pulseless electrical activity in a prehospital emergency setting: A case study. *Prehospital Emergency Care*, 1–4. https://doi.org/10.1080/10903127.2025.2569639

Ettin, D., & Cook, T. (1999). Using ultrasound to determine external pacer capture. *The Journal of Emergency Medicine, 17*(6), 1007–1009. https://doi.org/10.1016/S0736-4679(99)00132-8

Fritz, C. L., Schoenfeld, D. W., Hoyne, J. D., & Thomas, S. H. (2024). Use of term excited delirium in state EMS protocols over time. *JAMA Network Open, 7*(6), e2419183. https://doi.org/10.1001/jamanetworkopen.2024.19183

Gilbert, E. H., Lowenstein, S. R., Koziol-McLain, J., Barta, D. C., & Steiner, J. (1996). Chart reviews in emergency medicine research: Where are the methods? *Annals of Emergency Medicine, 27*(3), 305–308. https://doi.org/10.1016/S0196-0644(96)70264-0

Gunderson, C. A., Lopez, S. M., Lukose, K., & Akar-Ghibril, N. (2025). Discrepancies in anaphylaxis protocols across emergency medical services in the United States. *Annals of Allergy, Asthma & Immunology, 135*(1), 91–96. https://doi.org/10.1016/j.anai.2025.03.021

Holger, J. S., Lamon, R. P., Minnegan, H. J., & Gornick, C. C. (2003). Use of ultrasound to determine ventricular capture in transcutaneous pacing. *The American Journal of Emergency Medicine, 21*(3), 227–229. https://doi.org/10.1016/S0735-6757(02)42252-8

Kaji, A. H., Schriger, D., & Green, S. (2014). Looking through the retrospectoscope: Reducing bias in emergency medicine chart review studies. *Annals of Emergency Medicine, 64*(3), 292–298. https://doi.org/10.1016/j.annemergmed.2014.03.025

Kimbrell, J., Kreinbrook, J., Poke, D., Kalosza, B., Geldner, J., Shekhar, A. C., Miele, A., Bouthillet, T., & Vega, J. (2024). False electrical capture in prehospital transcutaneous pacing by paramedics: A case series. *Prehospital Emergency Care*, 1–9. https://doi.org/10.1080/10903127.2024.2321287

Kostick, K. M., Blumenthal-Barby, J. S., Wilhelms, L. A., Delgado, E. D., & Bruce, C. R. (2015). Content analysis of social media related to left ventricular assist devices. *Circulation: Cardiovascular Quality and Outcomes, 8*(5), 517–523. https://doi.org/10.1161/CIRCOUTCOMES.115.002032

Kreinbrook, J., & Kimbrell, J. (2024). Historical discrepancies in transcutaneous pacing trials: A call to overcome false electrical capture. *Pacing and Clinical Electrophysiology, 47*(7), 865–868. https://doi.org/10.1111/pace.15031

Krippendorff, K. (2019). Content Analysis: An Introduction to Its Methodology. *SAGE Publications, Inc*. https://doi.org/10.4135/9781071878781

Kusumoto, F. M., Schoenfeld, M. H., Barrett, C., Edgerton, J. R., Ellenbogen, K. A., Gold, M. R., Goldschlager, N. F., Hamilton, R. M., Joglar, J. A., Kim, R. J., Lee, R., Marine, J. E., McLeod, C. J., Oken, K. R., Patton, K. K., Pellegrini, C. N., Selzman, K. A., Thompson, A., & Varosy, P. D. (2019). 2018 ACC/AHA/HRS guideline on the evaluation and management of patients with bradycardia and cardiac conduction delay: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Circulation, 140*(8). https://doi.org/10.1161/CIR.0000000000000628

Li, T., Koloden, D., Berkowitz, J., Luo, D., Luan, H., Gilley, C., Kurgansky, G., & Barbara, P. (2023). Prehospital transport and termination of resuscitation of cardiac arrest patients: A review of prehospital care protocols in the United States. *Resuscitation Plus, 14*, 100397. https://doi.org/10.1016/j.resplu.2023.100397

Li, T., Koloden, D., Berkowitz, J., Luo, D., Luan, H., Gilley, C., Kurgansky, G., Howell, D., & Barbara, P. (2024). Variability of prehospital pain management protocols: A review of prehospital care protocols in the United States. *Open Access Emergency Medicine, 16*, 337–345. https://doi.org/10.2147/OAEM.S480680

Marzi, G., Balzano, M., & Marchiori, D. (2024). K-Alpha Calculator–Krippendorff's Alpha Calculator: A user-friendly tool for computing Krippendorff's Alpha inter-rater reliability coefficient. *MethodsX, 12*, 102545. https://doi.org/10.1016/j.mex.2023.102545

Moayedi, S., Patel, P., Brady, N., Witting, M., & Dickfeld, T.-M. L. (2022). Anteroposterior pacer pad position is better than anterolateral for transcutaneous cardiac pacing. *Resuscitation, 181*, 140–146. https://doi.org/10.1016/j.resuscitation.2022.11.009

Morrison, L. J., Long, J., Vermeulen, M., Schwartz, B., Sawadsky, B., Frank, J., Cameron, B., Burgess, R., Shield, J., Bagley, P., Mausz, V., Brewer, J. E., & Dorian, P. (2008). A randomized controlled feasibility trial comparing safety and effectiveness of prehospital pacing versus conventional treatment: 'PrePACE.' *Resuscitation, 76*(3), 341–349. https://doi.org/10.1016/j.resuscitation.2007.08.008

Namboodri, B. L., Rosen, T., Dayaa, J. A., Bischof, J. J., Ramadan, N., Patel, M. D., Grover, J., Brice, J. H., & Platts-Mills, T. F. (2018). Elder abuse identification in the prehospital setting: an examination of state emergency medical services protocols. *Journal of the American Geriatrics Society, 66*(5), 962–968. https://doi.org/10.1111/jgs.15329

Ramgopal, S., McCans, K., Martin-Gill, C., & Owusu-Ansah, S. (2021). Variation in prehospital protocols for pediatric seizure within the United States. *Pediatric Emergency Care, 37*(12), e1331–e1338. https://doi.org/10.1097/PEC.0000000000002029

Rostykus, P., Kennel, J., Adair, K., Fillinger, M., Palmberg, R., Quinn, A., Ripley, J., & Daya, M. (2016). Variability in the treatment of prehospital hypoglycemia: A structured review of EMS protocols in the United States. *Prehospital Emergency Care, 20*(4), 524–530. https://doi.org/10.3109/10903127.2015.1128031

Sherbino, J., Verbeek, P. R., MacDonald, R. D., Sawadsky, B. V., McDonald, A. C., & Morrison, L. J. (2006). Prehospital transcutaneous cardiac pacing for symptomatic bradycardia or bradyasystolic cardiac arrest: A systematic review. *Resuscitation, 70*(2), 193–200. https://doi.org/10.1016/j.resuscitation.2005.11.019

Smida, T., Kimbrell, J. M., Kreinbrook, J. A., Gan, G. H., Odom, W., Bouthillet, T., Walsh, B., Shukis, M., Scheidler, J., Martin, P. S., Moskowitz, A., Counts, C. R., & Bardes, J. (2026). The prevalence of sustained electrical capture during prehospital transcutaneous pacing: A multicenter observational study. *Resuscitation, 219*, 110934. https://doi.org/10.1016/j.resuscitation.2025.110934

Smida, T., Voges, L., Crowe, R., Scheidler, J., & Bardes, J. (2024). Prehospital transcutaneous cardiac pacing in the United States: Treatment epidemiology, predictors of treatment failure, and associated outcomes. *Prehospital Emergency Care*, 1–8. https://doi.org/10.1080/10903127.2024.2393768

Spigner, M. F., Benoit, J. L., Menegazzi, J. J., & McMullan, J. T. (2021). Prehospital protocols for post-return of spontaneous circulation are highly variable. *Prehospital Emergency Care, 25*(2), 191–195. https://doi.org/10.1080/10903127.2020.1754979

Stryker, Inc. (2018). *Pacing artifact may masquerade as capture*. https://www.stryker.com/content/dam/stryker/ems/resources/clinical-information/pacing-artifact-may-masquerade-as-capture.pdf

Tam, M. M. (2003). Ultrasound for primary confirmation of mechanical capture in emergency transcutaneous pacing. *Emergency Medicine, 15*(2), 192–194. https://doi.org/10.1046/j.1442-2026.2003.00438.x

Tibballs, J., & Weeranatna, C. (2010). The influence of time on the accuracy of healthcare personnel to diagnose paediatric cardiac arrest by pulse palpation. *Resuscitation, 81*(6), 671–675. https://doi.org/10.1016/j.resuscitation.2010.01.030

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., & for the STROBE Initiative. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. *Annals of Internal Medicine, 147*(8), 573–577. https://doi.org/10.7326/0003-4819-147-8-200710160-00010

Warren, J., & Toy, J. (2025). Current practices in prehospital ultrasound: A systematic evaluation of prehospital protocols within the United States. *Prehospital Emergency Care*, 1–7. https://doi.org/10.1080/10903127.2025.2574852

Wigginton, J. G., Agarwal, S., Bartos, J. A., Coute, R. A., Drennan, I. R., Haamid, A., Kudenchuk, P. J., Link, M. S., Panchal, A. R., Pelter, M. M., Del Rios, M., Rodriguez, A. J., Perman, S. M., Sanko, S., Kotini-Shah, P., & Kurz, M. C. (2025). Part 9: Adult advanced life support: 2025 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation, 152*(16_suppl_2). https://doi.org/10.1161/CIR.0000000000001376

SUPPLEMENTAL MATERIAL

Original Data Collection, Instrument Development, and Training

Our initial data collection instrument was developed and refined by consensus among senior authors. All abstractors were recruited, understood the project and underwent training prior to beginning abstraction. These initial attempts at data collection revealed concerns with data consistency. For one, we attempted to use a single abstractor system with each abstractor (researcher) entering data from their assigned protocols. Two, the original abstraction form had few free-text questions and focused on prespecified responses. However, following iterative training and a review of overall performance on several duplicated protocols, there was more variation than the authors were comfortable with and results were not reassuring that protocols were being abstracted similarly. We recognize the reason is not clear, and could have included deficient training, lack of a guide to follow, or simply an adjustment period. To address the issues with data quality, we revised our methodology and assigned two abstractors to independently review each protocol. We also updated our data collection form and developed an abstraction guide incorporating feedback from our trained researchers. Variables to be collected as free text were decided to be collected as such to prompt inclusion of more direct quotes and reduce abstractor interpretation into pre-specified responses. The variables were not mutually exclusive. Before re-launch, abstractors again received over an hour of training by author J.S. and this time completed a sample of ten protocol abstractions that were reviewed for completeness. Our abstraction form and guide are included as supplementary data for transparency.

Pre-specified variables included the protocol's state of origin, requirement for pre-TCP medical oversight consultation, recommendation for pad positioning, recommendation of analgesia or sedative, mention and description of electrical capture, and methods for confirming successful mechanical capture. Separate free-text variables collected listed indications, descriptions of false electrical capture, procedures for TCP failure, and recommendations for transitioning TCP care at the conclusion of EMS treatment. Screenshots of relevant protocol sections were uploaded and appended to the end of the abstraction form, ensuring version control and source data for intercoder reliability.

Protocol Selection and Assignment

Based on our experience with our preliminary data collection, we predicted that 250 protocols would be an ascertainable goal. We wanted to select most protocols randomly, and also ensure all statewide protocols were reviewed. We sought inspiration from methods established for emergency medicine chart review, using initial pilot protocol abstraction with blinded IRR (Gilbert et al., 1996; Kaji et al., 2014), this prompted our new strategy using two abstractors with a senior author providing a tiebreaker when needed to ensure data integrity.

Following the initial randomization of all protocols, any statewide protocols not included in the randomization were manually added to the top. An equal number of randomly selected protocols were excluded from the bottom to accommodate the manually added protocols keeping the total at 250 protocols for 10 abstractors. To assign 10 abstractors to 250 protocols, five blocks of 50 protocols were created. These five original blocks were then each duplicated, for a total of 10 blocks. A unique abstractor was assigned to each of the 10 blocks, for a total of two abstractors assigned to each protocol.

Although deadlines were shared with abstractors, we allowed additional time if requested. Despite follow up and personal outreach, some abstractors were unable to complete all assigned protocols. Protocols not attempted by any one abstractor were re-distributed to abstractors with additional bandwidth in a fashion to maximize the number of paired protocol abstractions (i.e. if a protocol had one abstraction completed, this would be assigned for a second abstraction before a protocol that had zero abstractions). In some cases, new protocols were assigned, and a total number of assigned protocols was 260. Following abstractor attrition, the total number of paired abstractions were 228. As mentioned in the manuscript, discrepancies between paired protocols were adjudicated by two authors not involved in the original abstraction.

Interrater Reliability for Coded Free Text Variables

Free text responses to the TCP Indications and the TCP Failure questions from our abstraction instrument (included as supplementary material) were defined and coded by two authors. Any discrepancies were reviewed by a third author (J.A.K. or J.M.K.) who reviewed the source material to resolve the discrepancy. To assess interrater reliability, Krippendorff's Alpha inter-rater reliability coefficient was calculated using 20 randomly selected protocols for the 40 response codes produced for the two questions above. An α value greater than or equal to 0.80 is considered reliable for drawing conclusions. Krippendorff's Alpha values between 0.69 and 0.79 are considered moderate agreement, <0.67 poor agreement, 0 is no agreement, and <0 systematic disagreement. (Krippendorff, 2018; Marzi et al., 2024). The coded responses are from raw responses and were later rolled up to the themes presented in the tables below.

Coded Response	Krippendorff's Alpha	Subjective Interpretation
As per AHA Guidelines	1	Perfect
Bradycardia, Symptomatic, Rate Unspecified	0.86	Satisfactory
Bradycardia, Symptomatic, Rate Specified	0.889	Satisfactory
Bradycardia, No Mention of Symptomatic or Asymptomatic Presentation	0	None
Inadequate Perfusion	0.768	Tentative
High Degree A/V Block (AVB)	0.9	Satisfactory
Any AVB	0	None
Asystole, Onset Unspecified	1	Perfect
Asystole, Observed or Immediate Onset	1	Perfect
Atropine Refractory	0.889	Satisfactory
Suspected Toxicity	1	Perfect
Bradycardia Unresponsive to Medial Therapy	0.649	Poor
Altered Mental Status Including Lethargy and Somnolence	1	Perfect
Ischemic Chest Pain	1	Perfect
Hypotension	0.86	Satisfactory
Other	1	Perfect
Congestive Heart Failure, Acute Heart Failure, Pulmonary Edema, Shortness of Breath, Dyspnea	0.797	Tentative
Diaphoresis, Pallor, Abnormal Skin Signs	0.86	Satisfactory
Pulseless Electrical Activity	1	Perfect
Overdrive Pacing	1	Perfect
Syncope and Near Syncope	0.458	Poor
STEMI or ECG Evidence of Ischemia or Infarct	1	Perfect
Seizures	0.649	Poor
Sick Sinus Syndrome, Junctional Escape, Ventricular Ectopy, Idioventricular Rhythms	-0.0833	Systematic Disagreement
Premature Ventricular Contractions	-0.0833	Systematic Disagreement
Heart Transplant	0.649	Poor
Internal Pacemaker Failure	1	Perfect
Electrolyte Disturbances	1	Perfect
Absent Radial Pulses	1	Perfect
Pending, Imminent, or Peri-Arrest	0	None

Table 2. Krippendorff's alpha inter-rater reliability coefficient. Indications for adult transcutaneous pacing (n=177).

Coded Response	Krippendorff's Alpha	Subjective Interpretation
None mentioned	1	Perfect
Use Atropine	0.86	Satisfactory
Increase Pacing Energy	1	Perfect
CPR or Resume ACLS	0.79	Tentative
Fluid Challenge	-0.0882	Systematic Disagreement
Medical Intervention Other Than Atropine	1	Perfect
Discontinue Pacing	0.58	Poor
Contact Medical Control	1	Perfect
Other	0.829	Satisfactory
Increase Pacing Rate	1	Perfect

Table 3. Krippendorff's alpha inter-rater reliability coefficient. What to do if pacing fails (n=98).

Subjective Rating	Alpha	Interpretation of Krippendorff's Alpha Values
Perfect	= 1	Indicates perfect agreement among raters. It is the scenario where all raters have provided the exact same ratings for each item evaluated.
Satisfactory	≥ 0.80	This value is generally considered a satisfactory level of agreement, indicating a reliable rating. In many research contexts, a Krippendorff's Alpha equal to or above 0.80 is acceptable for drawing triangulated conclusions based on the rated data.
Tentative	0.67 - 0.79	This range is often considered the lower bound for tentative conclusions. A Krippendorff's Alpha in this range suggests moderate agreement; thus, outcomes should be interpreted with concern, questioning the roots of such diverging ratings.
Poor	< 0.67	This is indicative of poor agreement among raters. Data with a Krippendorff's Alpha below this threshold are often deemed unreliable for drawing triangulated conclusions. It suggests that the raters are not applying the coding scheme consistently or that the scheme itself may be flawed.
None	= 0	Indicates no agreement among raters other than what would be expected by chance. It is similar to a random rating pattern.
Systematic Disagreement	< 0	A negative value of Krippendorff's Alpha indicates Alpha < 0 systematic disagreement among raters. This situation might arise in cases where raters are systematically inclined in opposite rating directions.

Table 4. Definitions of subjective interpretation (Marzi, et al., 2024).

Medical Control Contact Required to Begin Pacing	n	%
No	174	98.3%
Yes	3	1.7%

Table 5. Medical control contact required to begin pacing (n=177).

Mention and Characteristics of Electrical Capture	n	%
Described as having a wide QRS	39	22.0%
Described as having a T-wave	28	15.8%
Other	18	10.2%
Mentioned but not described	68	38.4%
Not mentioned	61	34.5%

Table 6. Mention and characteristics of electrical capture (n=177).

Location of Pulse Palpation for Confirmation of TCP Efficacy	n	%
Femoral	30	24.4%
Radial	17	13.8%
Carotid	7	5.7%
Other	1	0.8%
None mentioned	82	66.7%

Table 7. Location of pulse palpation for confirmation of TCP efficacy (n=123).

Steps to Follow if TCP Fails	n	%
Stop TCP	42	42.9%
Contact medical oversight	20	20.4%
CPR	18	18.4%
Increase TCP current	16	16.3%
Increase TCP rate	7	7.1%
Atropine	6	6.1%
Other medication	6	6.1%

Table 8. Steps to follow if TCP fails (n=98).

Mention and Description of a Procedure for Transfer of Care	n	%
Yes	4	2.3%
Transfer with change in pacer settings	2	1.1%
Transfer without change in pacer settings	1	0.6%
Other transition description	1	0.6%

Table 9. Mention and description of a procedure for transfer of care (n=177).

Prehospital Transcutaneous Pacing Survey Abstraction Form

Abstractor Name *

Please Select

Select a Protocol *

Please Select

Source of protocol *

- ○ https://emsprotocols.org/
- ○ Regular PPP App (no extra download)
- ○ PPP Locality-Specific Separate Download App

Were you able to review this protocol? *

- ☐ Yes
- ☑ No

Please type another option here

Indication(s) for ADULT transcutaneous pacing: *

Paste protocol indications for TCP

Is online medical control contact required to *begin* pacing? *

- ○ Yes
- ○ No

Recommended pad position for transcutaneous pacing: *

- ☐ Antero-Lateral
- ☐ Anterior-Posterior
- ☐ Per manufacturer / AHA instructions
- ☐ Not mentioned

Is sedation or pain management recommended or required specifically for TCP? *

- ○ Recommended (e.g. consider)
- ○ Required (e.g. administer)
- ○ Not mentioned

If medications were mentioned for sedation or pain management specifically for TCP?

- [ ] Benzodiazepines (e.g. diazepam, lorazepam, midazolam, etc.)
- [ ] Opiate/Opioids (e.g. fentanyl, hydromorphone, morphine, etc.)
- [ ] Anesthetic/hypnotic (e.g. etomidate, ketamine)
- [ ] None mentioned specifically for TCP

Is electrical capture (e.g. ECG or visual confirmation of pacing) mentioned? *

- (●) Yes
- ( ) No

In the description of electrical capture, were any of these findings mentioned? *

- [ ] ST-segment
- [ ] Wide QRS
- [ ] T wave
- [ ] None mentioned
- [x] Other

Please type another option here

What methods within the pacing protocol were specifically mentioned for confirming pacing efficacy? *

- [ ] Pulse palpation
- [ ] SpO2
- [ ] End-tidal CO2
- [ ] Blood pressure
- [ ] Mental status
- [ ] Skin color, temperature, or condition
- [ ] Ultrasound
- [ ] None mentioned
- [x] Other not listed

Please type another option here

If confirmation of mechanical capture by pulse palpation is recommended, where should you check?

- [ ] Carotid
- [ ] Femoral
- [ ] Radial
- [ ] Not mentioned

Is false electrical capture mentioned? *

● Yes

○ No

Description of false electrical capture: *

Paste description of false electrical capture

Does the protocol describe what to do if capture cannot be obtained or pacing fails? *

○ Not mentioned

● Yes, click here and paste

Please type another option here

Are there instructions for transitioning a paced patient from EMS to receiving hospital care? *

○ Not mentioned

● Yes, click here and paste

Please type another option here

Upload screenshot of relevant protocol areas (each page you took information from): *

Browse Files

Drag and drop files here

Do you want this entry to be reviewed? *

○ Yes

○ No

Is there anything outstanding or concerning or notable specifically about this protocol that you want to mention: *

Submit

Transcutaneous Pacing Protocol Survey Coding Guide

1. Select your name
2. Select the protocol
   A. Confirm protocol ID and name match
3. Source of protocol
   A. **emsprotocols.net**: you can access this protocol via the web and were sent there from a link on emsprotocols.net
   B. **PPP App**: you did not download an additional application. The protocol was available to load within the original PPP app with just the + button.
   C. **Locality-specific**: A separate app download is required. You were sent to the Google Play or App Store to get a county or agency specific application.
4. Were you able to review this protocol?
   A. **Yes** if it is available for download and you can access the relevant protocols, skills sheets, and data within the group.
   B. **No** - you can download the separate locality-specific app, however a password is required to view the protocols. You can download the protocol but it doesn't have anything more than a facesheet. You can't get it to download, or it downloads empty. Any other reason that you cannot fully read the protocol - please select No. You will be taken to the end of the survey, please make a note describing the inaccessibility.
   C. <u>Please note</u>: if you are prompted for a password, please try this:
   Click cancel, and re-attempt opening the protocol you want again. It is possible the password is for sensitive areas of the protocol and not for protocols related to TCP.
   If you're still unable to open the protocols, mark the protocol as inaccessible due to the password, don't try to guess.
   D. The goal of this project is publicly accessible protocols only. If you know the password, or this is an agency you have data for outside of this process, *please do not use it*. This would not be easily replicated by others.
5. Indications for ADULT transcutaneous pacing.
   A. Please take care not to include pediatric pacing indications.
   B. Search procedure:
      a. Use the search function to search for: **pacing, transcutaneous, TCP**.
      b. Include items found in the skills or procedure sheet or supplement for transcutaneous pacing as well as treatment protocol (e.g. Bradycardia, Heart Problems, Heart Block, etc.).
      c. If there is a conflict between a skills sheet, supplement, or a treatment protocol, write only the indications in the treatment protocol.
6. Is Online Medical Control (OLMC) required to BEGIN transcutaneous pacing?
   A. If OLMC contact is REQUIRED to *initiate* pacing, then **yes**.
   B. If OLMC is an option for additional treatments and not required to initiate pacing, select no.
7. Recommended pad position for transcutaneous pacing:
   A. If the treatment protocol suggests one and then the other if the first fails, **select the first**.
   B. If "you may use either A/L or A/P" is noted, select both.

   C. If the treatment protocol and skills sheet or supplement disagree, you should select all recommended.
8. Is sedation or pain management recommended or required specifically for TCP?
   A. Language for recommended includes: "consider," "if necessary," and "recommend".
   B. Language for required includes: "administer," or other similar directive that makes it clear that pain management and/or sedation is mandatory.
   C. The **goal of this question** is to determine if TCP is **written in the protocol** specifically as an intervention requiring pain management and/or sedation; not clinical judgement.
   D. If the treatment or skills sheet specifically mentions the pain management or sedation, then answer accordingly.
   E. If the treatment or skills sheet states administer pain management or sedation per pain management protocol, then the answer is yes, as this is recommended specifically for TCP.
   F. If during your search for "pacing," or "transcutaneous" you see a pain management protocol that specifically mentions transcutaneous pacing, that counts as yes - and follow above.
   G. If you do not see a pain management or sedation recommendation anywhere, or, there is only a general pain or sedation protocol, do not make this inference yourself, and select none mentioned specifically for TCP.
9. If medications were mentioned for sedation or pain management specifically for TCP?
   A. Following guidelines for question 9 above, complete medication class here. If there is a medication that does not fit, please include it in the box at the end of the protocol.
10. Is electrical capture (e.g. ECG or visual confirmation of pacing) mentioned?
   A. a. Does the entire download, in either the treatment protocol or pacing skill page or supplement mention to look for visual confirmation of pacing, or use the words electronic or capture together? Examples include, "ensure you see a visual change in the QRS," or "ensure pacer spikes and visual deflections are noted".
   B. b. If particular guidance for electrical capture is incorrect, such as "pacing spikes confirm electrical capture," still select yes.
11. In the description of electrical capture, were any of these findings mentioned?
   A. If electrical capture is described using any "**ST-segment**," "**Wide QRS**," or "**T-wave**" please select these.
   B. If electrical capture is described via another method, e.g. look for "paced complex," please select **other** and enter it.
   C. If only "electrical capture" is mentioned without further explanation or description, then select "**not mentioned**".
12. What methods within the pacing protocol were specifically mentioned for confirming pacing efficacy?
   A. If the protocol mentions how to confirm pacing is working, please select all that apply. If there is a conflict between treatment protocol and skill sheet or supplement, select the skill sheet items.

   B. If only "vital signs" are mentioned, select **Other not listed** and type in vital signs.
   C. If none are mentioned, select none, if a method not included is mentioned, select other.
   D. If pulse palpation is mentioned as a confirmation mechanism, this will open a second question to identify if **specific pulse sites** are identified. If none are mentioned, select none mentioned. Sometimes they are hyper-specific (check right carotid). In this case we only have "carotid" so check that.
13. Is false electrical capture mentioned?
   A. If this topic is mentioned anywhere throughout, select yes. This should be **verbatim**.
   B. If another similar discussion is noted within, please copy and paste in the **comment box** at the end of the Jotform and **flag the case for review**. We DO NOT expect you to be 100% sure on this variable as many descriptions sound similar to false capture related.
14. Does the protocol describe what to do if capture cannot be obtained or pacing fails?
   A. If transcutaneous pacing fails, or capture cannot be obtained, is there a suggestion of what to do next?
   B. This may include change pad position (e.g. A/L to A/P), return to medications, immediately disconnect pacer, etc.
   C. If there is something unique, copy and paste in the comment box created by clicking yes and **flag for review**.
15. Are there instructions for transitioning a paced patient from EMS to receiving hospital care?
   A. Is there information anywhere within the protocol noting a process for transitioning care of a paced patient from EMS care to receiving facility. This does not need to be an emergency department only.
   B. This might be found while searching for pacing or TCP and might not be only for TCP.
16. Do you want this entry to be reviewed?
   A. If there are concerns about an inability to abstract or **you are unsure, please select yes**. Use the comment box at the end of the Jotform to include any concerns you may have.
17. Is there anything outstanding or concerning or notable specifically about this protocol that you want to mention:
   A. Use this comment box to include any items that are unusual, impressive, confounding or otherwise notable (can be related to protocol as a whole or questions above).
   B. Use this comment box to include any concerns that you may have.

JOIN
NEMSMA

With nearly 800 members, NEMSMA represents CEOs, chiefs, and managers from every state and type of service, offering voice and vision for professional development and leadership.

NEMSMA is a frequent participant in panels, workgroups, and boards involving EMS in both governmental and non-governmental sectors.

NATIONAL EMS MANAGEMENT ASSOCIATION