Searching for the Evidence Behind EMS

By Bryan E. Bledsoe, DO, FACEP, EMT-P

It has been said that medicine is more of an art than a science. As an experienced emergency physician, I find this both true and false. Certain aspects of medicine, such as physical examination, are truly an art; however, medicine today is much more about science and much less about art. In the overall scheme of things, I am a scientist. I apply the principles of science to the care of emergency patients. EMS personnel do the same thing. EMS has evolved from a primarily anecdotal practice to one that is more science-based. Now, protocol and standing order development are based upon the best scientific evidence available.

What Is Evidence-Based Medicine?

A movement has been building in the house of medicine called evidence-based medicine (EBM), which has been widely embraced by practitioners in emergency medicine. It is only logical that the principles of EBM be applied to EMS, which is an extension of the practice of emergency medicine.

EBM is the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients. It combines clinical expertise with the best available clinical evidence from systematic research. Thus, to practice effective EBM, EMS personnel must first be proficient in prehospital care and exercise sound clinical judgment. These traits can only be developed by following a comprehensive initial education program followed by clinical experience and practice. To move to the next level, prehospital personnel must be familiar with the current and past research pertinent to prehospital care, and be able to integrate that knowledge into the care of individual patients. Furthermore, prehospital personnel must know how to read and interpret scientific literature and determine whether the information is sound. External clinical evidence can invalidate previously accepted treatments and procedures and replace them with new ones that are more powerful, more effective and much safer. Good EMFs and paramedics can become excellent ones by using both their clinical expertise and the best available external evidence. In today’s medical setting, neither alone is enough.

Some critics say that EBM is “cookbook” medicine. This is just not true. EBM requires the EMT or paramedic to be clinically proficient. With cookbook medicine, you can probably safely treat the simple, uncomplicated cases (i.e., those that don’t fit the cookbook’s recipes) require the integration of knowledge and clinical expertise. Anybody can follow simple “cookbook” directions and provide some level of patient care. External evidence can inform, but never replace, individual clinical expertise. It takes individual clinical expertise to best determine what treatment is best for the individual patient.

Implications for Prehospital Care

Over the last decade, there has been a trend in EMS to study the various practices and procedures of prehospital care. When studied, some treatments, such as pneumatic antishock garments (PASG), did not stand up to the test. Likewise, a treatment like early defibrillation was found to have a significant impact on survival following out-of-hospital cardiac arrest. By using the best research data available, we were able to abandon a practice (PASG) that helped few, if any patients. Later, we were able to embrace a practice (early defibrillation) that has saved countless lives through diverse programs like bystander defibrillation.

How Do You Practice Evidence-Based Prehospital Care?

The practice of EBM can be summarized in five simple steps:

Step 1. Convert the need for information, such as prevention, diagnosis or treatment, into an answerable question.

Step 2. Track down the best evidence with which to answer the question.

Step 3. Critically evaluate the evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in our clinical practice).

Step 4. Integrate the critical appraisal with our clinical expertise and with our patient’s unique biology, values and circumstances.

Step 5. Evaluate our effectiveness and efficiency in executing steps 1–4 and seek ways to improve them for the next patient.

By following these simple steps, you can provide your patient with state-of-the-art care that is effective and efficient. These principles can then be applied to all aspects of prehospital care, including management, education, communications and others.

Evidence-based medicine is the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of individual patients.
The Scientific Method

Much of EBM is based upon the scientific method. The scientific method is a system of determining truth from fiction. With the scientific method, some aspect of the universe is observed. In simpler terms, you notice something and wonder why it happens, you see something and wonder what causes it, or you want to know how or why something works. You are asking questions about something that you observe. For example, in prehospital care, you note that you treat more headache patients at the end of the month and wonder why that appears to be so. Thus, the first step in the scientific method is observation.

Next, you develop a tentative statement, called a hypothesis, that is consistent with your observations. Simply, the hypothesis states what you feel you have observed. In the example used above, your hypothesis might be as follows: "The incidence of prehospital patients with headaches is greater at the end of the month." A hypothesis must be stated in a way that can be tested by an experiment. That is, it must ask a question that can be answered by a simple yes or no response. For example: "Are headache patients more common at the end of the month?" In the case of headache patients, it would be fairly simple to gather data related to the number of headache patients you are treating on each day of the month.

Next, you must design an experimental procedure to test your hypothesis. The procedure must change only one thing in each experiment. Things that can be changed are called variables. In our headache example, the variable would be the day of the month.

Next, you must perform the experiment, record the observations and collect the data. Data can be anything from objective measures, such as a pulse rate, to simple observations, such as skin color. Regardless of the data collected, it should be consistently recorded for a previously determined amount of time. Again, in the case of our headache experiment, we would gather data by reviewing all of the run sheets for a given day and recording the number of headache patients encountered.

Next, you must perform any necessary math calculations to turn the raw data into numbers that can be used to make graphs, tables, or to draw conclusions. In our example, you must determine what you consider to be the "end of the month" and define it, such as the last five days of the month. Then, tabulate all of your data by days of the month and compare the incidence of headaches occurring during the end of the month with those that occur during other parts of the month. It may be necessary to use statistical tests to determine whether your observations are statistically relevant.

Next, summarize your results. For example, in the headache study, you did not find any evidence that headache patients are more common at the end of the month compared with other parts of the month; however, you did find that most headache patients were female. This observation could then be tested as well.

Finally, you must use the experimental data and subsequent analysis to answer your original question. In this case, you learned that headache patients are not more frequently encountered at the end of the month. In summary, you disproved your hypothesis and learned that your interpretation of your initial, nonscientific observation was wrong. When adequate high-quality scientific data have been gathered, evaluated and replicated, policy and procedure changes should be implemented that reflect the new knowledge gained by the research.

The Scientific Method and Modern Medical Literature

Although, at its core, modern medical research closely adheres to the scientific method, data reporting from the research has changed.
Table I: Common Format for Medical Research Papers

Abstract: The first part of the paper, after the title page, is the abstract. The abstract is a brief summary of the study's needs, research methods utilized and the results encountered. The abstract is extremely important, as it is what most people read first to determine whether they want to read the entire study. Also, it is the part of the study typically entered into electronic databases, such as PubMed, which are frequently accessed by researchers and practitioners of EBM.

Introduction: The introduction is a brief description of pertinent, previously published papers related to the subject of the investigation. It also describes the author's hypothesis and the reason the study was undertaken.

Methods: The methods section describes, in detail, how the authors conducted the experiment in question. There should be enough information provided so that interested readers could, if they were so inclined, completely reproduce the experimental process. Also, any statistical analysis performed with the data should be described.

Results: The results section describes the data found by the authors. The results section is frequently augmented with charts, tables, graphs and similar visual representations of the data. In the research section, the authors should only present the data, not elaborate or comment on it.

Discussion: The discussion section is where the authors interpret their findings and describe the significance of their findings. Typically, this describes how, in the authors' opinion, the data impact the practice of medicine. In addition, the authors should address what they feel to be the limitations of their study. This is often followed by a call for further research on the subject.

Summary/Conclusions: Finally, the conclusions or summary is a very brief synopsis of the main findings of the study. This section should never be longer than a few sentences.

References: References are one of the most important aspects of a scientific article. Virtually any statement made in the article, including many that might be considered common knowledge, must be referenced. This provides for accuracy in the discussion and allows researchers interested in the study information to go back to the pertinent literature for additional information. The gathering of references was once a time-consuming process. Now, with the advent of the Internet and electronic databases, considerable scientific information is available online.

Table II: Levels of Evidence

1) Positive randomized controlled trials
2) Neutral randomized controlled trials
3) Prospective, nonrandomized controlled trials
4) Retrospective, nonrandomized controlled trials
5) Case series (no control group)
6) Animal studies
7) Extrapolations
8) Rational conjecture (common sense)

Modern scientific research is usually published in peer-reviewed journals, which follow the scientific method. Furthermore, published papers have withstood critical review by experts in the field. Peer-review journals give scientific integrity. They are also the venue by which specialists in a given area follow the pertinent scientific research. Most modern medical research studies are presented in a standardized format (see Table I). This format allows readers to quickly understand what the researchers did and what they found.

All studies are not created equal

In order to practice competent EBM, you must be able to determine which studies are valid and which are not. Often, this is a continuum ranging from totally worthless, leaving considerable room for doubt, to profoundly methodologically sound studies that

leave little room for scientific medical practice opinions, when test results are unacceptable the expert employed.

Several systems to review medical practices American Heart Association methodology. These levels of strength standards study versus a control study that is evidence of a harmless analysis of the recommendation strength. Again, in reviewing studies, stick to the single study. However, in a consensus review, the system must have a good question. It is only the system clinical practice.

Table III: Classifications of Therapeutic Recommendations in CPR and Emergency Cardiac Care*

<table>
<thead>
<tr>
<th>Class</th>
<th>Search for Evidence</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Excellent</td>
<td>Evidence: One or more RCTs</td>
<td>Interventions are always acceptable, proven safe and definitely useful</td>
</tr>
<tr>
<td>IIa: Good to Very Good</td>
<td>Evidence: Higher level Number of Studies: Many Critical Assessment: Good to very good Results: Positive in majority of studies</td>
<td>Interventions are acceptable, safe and useful; considered standard of care; considered intervention of choice by majority of experts</td>
</tr>
<tr>
<td>IIb: Fair to Good</td>
<td>Evidence: Lower to intermediate level Number of Studies: Few Critical Assessment: Fair or poor Results: Generally, not always, positive</td>
<td>Interventions are acceptable, safe and useful; considered within the standard of care; and considered optional or alternative intervention by majority of experts</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>Evidence found, but studies have one or more shortcomings</td>
<td>Interventions can still be used, but reviewers acknowledge that research quality and quantity fall short of establishing a final class decision</td>
</tr>
<tr>
<td>III: Unacceptable</td>
<td>Positive evidence completely absent or evidence strongly suggests or confirms harm</td>
<td>Evidence of benefit is completely lacking and studies suggest or confirm harm</td>
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* Adapted with permission, American Heart Association

Summary

This is an excellent article that offers valuable insights into personal experience. EBM is a sound prehospital practice. However, it is not a panacea.

Bibliography


Bryan Bledsoe and former paramedic Bryan Bledsoe and paramedic Bryan Bledsoe.

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leave little room for doubt. Overall, the closer a study adheres to the scientific method, the stronger the study will be. By definition, the clinical practice of medicine prohibits certain types of studies. For example, when testing a therapy that may be lifesaving, it would be ethically unacceptable to withhold it from a control group simply for the sake of the experiment. Because of this, other methods of study are employed.

Several systems of literature evaluation have been employed in medical practice. One of the more common is that utilized by the American Heart Association in its most recent Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Using this methodology, scientific studies are given a level of evidence (see Table II). These levels of evidence detail, in descending order, the relative strengths of the data derived. For example, prospective randomized controlled studies that show a new treatment is significantly better than a control group represent the highest level of evidence. Likewise, a study that fits with common sense, has face validity and shows no evidence of harm would be among the lowest. Then, following an analysis of the research and a consensus review by experts, the clinical recommendation is assigned an interpretive classification based upon the strength of the studies supporting the treatment (see Table III). Again, in reviewing these, remember that the studies that most closely adhere to the scientific method have the highest validity. A single study will generally point the way for additional research. As a rule, a single study should not prompt a change in medical treatment. However, several studies that have the same or similar results point to a consensus that may lead to a clinical practice change. Following review of the pertinent medical literature, several organizations, such as the American Heart Association, refer the studies to a consensus panel of experts, who then formulate recommendations for clinical policy change. Protocols and standing orders are best developed by the system medical director with the assistance of field personnel who have a good knowledge of the science behind the clinical practice in question. It is essential forprehospital personnel to remember that only the system medical director has the ability to change protocols and clinical procedures.

Summary

This is an exciting time to be involved in EMS. EMTs and paramedics can derive a great deal of satisfaction by assuring that they have offered their patients the best care available, based not only on their personal expertise, but also on ample external scientific evidence. EBM is a sound and fairly simple way to merge the two. Take yourprehospital practice to the next level—give evidence-based medicine a try.

Bibliography


Bryan Blochow, DO, FACEP, EMTP, is an emergency physician, author and former paramedic whose writings include Paramedic Care: Principles and Practice; Paramedic Emergency Care; and Anatomy and Physiology for Emergency Care. He is a frequent speaker at EMS conferences.