Changing radiological behaviour through the evidence-based medicine approach

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Purpose

The purpose of this paper is to present the definitions of Evidence Based Medicine (EBM), to describe how EBM can change the current and the future imaging practice and to help radiologists who have no postgraduate specialist training in research to become familiar with EBM and to find solutions that are based on best current evidence for problems arising in their practice.

Study/Project design

Although an apparently recent idea, Evidence-Based Medicine (EBM) has a long history in North America for almost 3 decades now. In the early 1990’s, a group of physician-epidemiologists in McMaster University in Canada developed a system, become known as the "Evidence-Based Medicine (EBM)" paradigm. These doctors developed ways of efficiently tracking down and appraising literature and "wrote them up" in order to help other doctors, with no or with minimal formal epidemiological training (1). The complexity of radiology today is the result of the introduction of many revolutionary technologic developments in imaging during the past 3 decades (2).

Today’s challenge for radiologists is to keep up to date with the rapidly expanding volume of medical knowledge and to learn how to acquire, interpret, and apply this knowledge appropriately (3). Not only for radiologists but also for clinicians, limited skills in appraising the scientific literature can be a substantial problem, as can limited expertise in integrating research evidence with medical practice (4, 5).

Results

Today EBM integrates clinical experience and patient values with the best available research information in order to expand research evidence and to provide sensible
Discussion

What is evidence-based medicine? According to the literature several definitions for EBM exist. EBM is an approach to health care that promotes the collection, interpretation, and integration of valid, important and applicable patient-reported, clinician-observed, and research-derived evidence. The best available evidence, moderated by patient circumstances and preferences, is applied to improve the quality of clinical judgments (9). EBM is the process of systematically finding, appraising, and using contemporaneous research findings as the basis for clinical decisions. It is also a habit that is recommended to all practicing radiologists so that they use the best logical thinking techniques to derive treatment plans (1, 10, 11). EBM is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research (7).

EBM and radiology. The link between EBM and radiology is the integration of evaluative sciences and technology assessment into clinical practice (2). Application of EBM principles to diagnostic imaging can facilitate the interpretation of imaging studies and create a well-conducted and effective radiologic evaluation. Evidence-based radiology (EBR) is a relatively new approach to the practice of radiology based on the principle of EBM (12). Evidence-based imaging is defined as medical decision making based on clinical integration of the best medical imaging research evidence with the physician’s expertise and with patient’s expectations (2, 8, 13). Evidence-based Radiology focuses mainly on the accuracy of diagnostic tests, the screening and proper use of interventional techniques, and their outcomes. EBR also focuses on the critical appraisal of literature about reviews, screening and prognosis (2). Which are the five steps in incorporating the best available research evidence in patient decision making? EBM includes 5 basic steps that can be applied to any clinical discipline as well as to radiological imaging: (1, 2, 12, 14, 15):

1st Step. Ask - Formulate a practical answerable and focused clinical question.

The inability to ask a focused and precise clinical question can be a major impediment to Evidence-based practice. This first step is the single more important one and requires
careful thought (15). The more detail incorporated into a clinical question, the more relevant the specific literature review becomes (11).

Once the clinical question has been identified, it then needs to be put into a searchable and answerable four part form concerning (1):

- The **population** with the clinical problem.
- An **intervention** or an exposure.
- The **comparator** intervention or exposure.
- The **outcomes**.

In the radiological practise the radiographer will need "background" knowledge about anatomy, imaging techniques, pathology and radiological signs. The staff radiologist will know enough to *interpret* the case, but may have other "foreground" knowledge needs.

In diagnostic radiology the main "foreground" questions EBM can address are related to the superiority of one imaging method over another in resolving clinical dilemmas and the power of imaging signs to reliably confirm or exclude suspected disease processes.

In interventional radiology, the main "foreground" questions are related to the short, medium and long-term benefit/harm of new interventional techniques compared with older interventional methods or more invasive surgical procedures. (14, 15)

**2nd Step. Access - Find the best available and current information (evidence).**

Conventionally, radiographers may search for useful evidence for clinical practice without applying appropriate or scientific methods. Unfortunately today more sophisticated and robust methods are needed for systematically combining evidence (15).

- The ideal information source must be (16):
  - Valid (*contains high quality data*).
  - Relevant (*clinically applicable*).
  - Comprehensive (*has data on all benefits and harms of all possible interventions*).
  - User-friendly (*quick and easy to access and use*).

Currently there are more than 50 radiological journals, and imaging research is also frequently published in journals from other medical specialities. Radiologists are often confronted with more literature and information than they can process. The great challenge is to shift through the literature that is identified and to select that which is appropriate (14).

**3rd Step. Appraise critically the information for validity and relevance.**
Having found the research information, the user then needs to critically appraise the study (or the studies).

Always have in mind that: Publication does not always guarantee "quality". Therefore medical literature may be classified according to its quality level ranging from type 1, the highest quality, to type 5 the lowest (15). This motion has given rise to the concept of a "hierarchy of evidence" (17), which provides a framework for ranking evidence. Thus the evidence level can be categorized as follows (2,18):

**Type 1:** *(Ideal evidence)*. Controlled case series with an appropriate spectrum of consecutive patients, all of whom have undergone both diagnostic and reference standard tests. The systematic review must include at least one randomized controlled trial and a summary of all included studies. The evidence from such a review requires careful appraisal; if well done, such evidence is powerful.

**Type 2:** *(Strong evidence)*. Controlled case series either with non-consecutive patients or confined to a narrow spectrum of study individuals, all of whom have undergone both diagnostic and reference standard tests.

**Type 3:** *(Moderate evidence)*. Uncontrolled case series in an appropriate spectrum of consecutive patients but without a reference standard test used for comparison. Evidence in this category will only be included if no type 1 or 2 evidence is available.

**Type 4:** *(Weak evidence)*. Uncontrolled case series in which a reference standard was used; study of diagnostic accuracy efficacy; expert opinion without explicit critical appraisal. Economic analyses (cost-effectiveness studies) are also classified as type 4 evidence. Studies in this category will only be included if no type 1, 2, or 3 evidence is available.

**Type 5:** *(Very weak evidence)*. Case report; study of technical efficacy of a new technology.

**4th Step. Apply the information to patient care.**

Once the best available evidence has been found and appraised, the final step is to apply the research to decision making. The right approach is for radiologists to combine the information gathered from literature reviews with their clinical expertise and experience and with available external evidence such as a patient's history or laboratory test results. Only then can the best diagnostic options available be matched to a specific patient's condition (14).

In order to apply findings into clinical practice any radiologist must (19):

**Compare the patient's characteristics with the trial's inclusion or blockade criteria** to determine whether the results of a trial of a treatment are applicable to any individual
patient. This approach may lead to treating some patients who may experience more harm than benefit.

**Think of an alternative approach.**

1. **Make a balance sheet of the benefits and harms of the intervention.**

All outcomes (both beneficial and harmful) that are important to the patient and influenced by the intervention need to be considered.

2. **From research data, quantify the likelihood of benefits and harms in relative terms.**

To estimate this we need to know the average effect of the treatment from systematic reviews (or trials, if systematic reviews are not available) and whether the effect varies according to patient and disease factors or whether it is relatively constant and independent of these factors. The benefits and harms of interventions are generally best expressed in relative terms (such as relative risks).

3. **Convert the relative benefits and harms into absolute terms for your patient using the patient's specific characteristics.**

If the relative beneficial effect of treatment is stable across patients at different levels of risk from their disease, then those at greatest risk will have the most to gain from treatment, and those at least risk from their disease will have the least to gain.

4. **Decide whether the benefits outweigh the harms.**

Having listed all benefits and harms of an intervention and assigned some likelihood for each outcome based on research and individual patient data, the next step is to determine whether, on balance, the treatment is likely to do more good than harm.

5**th Step. Evaluate performance.**

Radiographers who incorporate EBR into their routine clinical practice must evaluate the approach at frequent intervals and decide whether any improvement is needed in any of the 4 steps discussed above (17). The formal auditing of performance will show whether the EBR approach is improving patient care (12).

**Limitations of EBM and EBR** There are several limitations to the evidence based clinical or radiological every day practice. The key to integrating EBM into clinical practice is having it easily available and understanding its limitations. EBM helps in shaping, rather than making, clinical questions (20). EBR is relatively new to radiologists and is not part of the radiology curriculum. Until recently radiologists did not focus on developing their appraisal skills and on hypothesis-driven research as sufficiently as their colleagues from other fields of medicine (21). EBR is not easily
accessible. Searching can be difficult and the best evidence may not be readily available despite internet-based search tools. Furthermore, the current usage of electronic databases is suboptimal, with patient data being scattered across multiple data sources such as hospital information systems, radiology information systems, and picture archiving and communication systems, making it difficult to provide comprehensive results (13). Papers may be inadequately or inappropriately indexed. Many abstracts are never published as papers and there is a tendency for authors and editors not to submit or publish "negative studies". It can be difficult to find good data on diagnostic questions. The reference text books available in many radiology reading rooms and libraries are often out of date (21). EBM favours interventions that attract commercial sponsorship. EBM is good for common disorders and for those that require a treatment or intervention that has a commercial application. EBM misses important patient experiences. The classic large treatment trials miss out on all sorts of experiences which patients have as a result of their treatment. EBM is biased. There is no question that EBM is biased. The art of critical appraisal is to detect bias, determine whether it is influencing the results and, if so, in what direction (20). The future of EBM Despite its limitations there is little doubt that EBM has an exciting future. Today there is a powerful demand for new evidence and for ways of getting evidence into clinical practice in the most efficient way. We can expect EBM to grow and evolve into many different forms. In the near future technology will drive this change at a phenomenal pace and transform the things we are taught and the way we practice (22). EBM deals directly with the uncertainties of clinical medicine and has the potential for transforming the education and practice of the next generation of physicians. These physicians will continue to face an exploding volume of literature, rapid introduction of new technologies, deepening concern about burgeoning medical costs, and increasing attention to the quality and outcomes of medical care. The likelihood that evidence-based medicine can help ameliorate these problems should encourage its dissemination. EBM will require new skills for the physician, skills that residency programs should be equipped to teach. Finally EBM will become part of the curriculum for health professionals and the general public (13).

Conclusions

Conclusion

In conclusion EBM is the key that improves the quality of both patient management and research in radiology. It requires the acquisition and development of new skills in literature searching and critical appraisal (38). Understanding the principles of EBM, and keeping abreast of the way it develops, is a challenge for all of us (6).
References


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