Evidence-based Medicine Meets Radiology

a report by

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Although an apparently recent idea, evidence-based medicine (EBM) has quite a long history. EBM's quite recent philosophical origins go back to the 17th century.[1] Hippocrates must be considered the first physician who perceived the importance of evidence in everyday clinical practice.[2] In 1996, Sackett et al. formally introduced the term 'evidence-based medicine' to the medical community. Today, EBM integrates clinical experience and patient values with the best available research information in order to expand research evidence and to provide sensible answers to medical questions in clinical decision-making.[1] In addition, EBM can help all imaging professionals to rigorously evaluate all perceived information in order to construct a more definitive knowledge basis concerning everyday best medical imaging choices for patient care. Last but not least, EBM has the potential to reduce healthcare costs significantly. The link between EBM and radiology is the integration of evaluative sciences and technology assessment into clinical practice. In this report the five tools of EBM will be analysed. Evidence-based radiology (EBR), as a relatively new approach to the practice of radiology based on the principles of EBM, will also be discussed.

Evidence-based Medicine

"Evidence-based medicine 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." That was the very first definition of EBM, given by Sackett et al.[3] According to them, "Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannised by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients."[3] Over the past decade, EBM has gained wide acceptance. As the context of both care and science has changed, the ways in which physicians judge the effectiveness of an intervention during everyday clinical practice have also changed.[4] Today, EBM advocates the use of up-to-date 'best' scientific evidence from healthcare research as the basis for making medical decisions. EBM includes five basic steps that can be applied to any clinical discipline, as well as to radiology.[1,5,6,7,8]

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> Evidence-based medicine integrates clinical experience and patient values with the best available research information in order to expand research evidence and to provide sensible answers to medical questions in clinical decision-making.

First 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 fist step is the single most important one and requires careful thought.[6] The more detail incorporated into a clinical question, the more relevant the specific literature review becomes.[9] Once the clinical question has been identified, it then needs to be put into a searchable and answerable four-part form covering:[1]

- the population with the clinical problem;
- an intervention or an exposure;
- the comparator intervention or exposure; and
- the outcomes.

In radiological practice, resident radiologists will need 'background' knowledge about anatomy, imaging techniques, pathology and radiological signs. On the other hand, staff radiologists will know enough to interpret the case but may have other 'foreground' knowledge needs. In addition, 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.

Second Step – Access (Find the Best Available and Current Information, or Evidence)

Conventionally, radiologists may search for useful evidence concerning clinical practice without applying appropriate or scientific methods.

Unfortunately, today more sophisticated and robust methods are needed for systematically combining evidence.[6] The ideal information source must be:[10]

- valid (contains high-quality data);
- relevant (clinically applicable);
- comprehensive (has data on all benefits and harms of all possible interventions); and
- 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 sift through the literature that is identified and to select that which is appropriate.[8]

Third Step – Appraise Critically the Information for Validity and Relevance

Having found the research information, the user then needs to appraise the study (or studies) critically. 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.[6] This notion has given rise to the concept of a 'hierarchy of evidence',[11] which provides a framework for ranking evidence. Thus, the evidence level can be categorised as follows.[1,12]

- 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.
- 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.

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- 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 be included only 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.

Fourth 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 for radiologists is to combine the information gathered from literature reviews with their clinical expertise and experience, as well as 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.[6] In order to apply findings to clinical practice, any radiologist must following certain steps.[13]

> Radiology is a rapidly evolving field, with new diagnostic methods and interventional techniques continuously replacing the previously accepted ones.

1. 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.
2. 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.
3. From research data, quantify the likelihood of benefits and harms in relative terms. To estimate this you 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 those factors. The benefits and harms of interventions are generally best expressed in relative terms (such as relative risks).
4. Convert the relative benefits and harms into absolute terms for your patient using his or her 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.
5. Decide whether the benefits outweigh the harms. Having listed all benefits and harms of an intervention and assigned a 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.

Fifth Step – Evaluate Performance

Radiologists who incorporate EBM into their routine clinical practice must evaluate the approach at frequent intervals and decide whether any improvement is needed in any of the five steps discussed above.[11] The formal auditing of performance will show whether the EBM approach is improving patient care.[7]

Evidence-based Radiology

Radiology is a rapidly evolving field, with new diagnostic methods and interventional techniques continuously replacing the previously accepted ones. Traditionally, medical doctors were taught how to

practise their speciality through textbook memorisation and from copying the behaviour of acknowledged experts. The remodelling of today's radiological practice requires skills that are not usually part of medical training. These skills include defining each patient's problem and determining how to search for the information required to solve the problem, how to access the best information, how to appraise the information for validity and relevance, and how to apply this information to patient care.[14]

> The link between evidence-based medicine and radiology is the integration of evaluative sciences and technology assessment into clinical practice.

The link between EBM and radiology is the integration of evaluative sciences and technology assessment into clinical practice.[5] Practising radiologists feel that finding reliable, up-to-date evidence on current problems in radiology may be complex and daunting. When radiologists try to decide between imaging pathways or try to select the best option between many available interventional options, they usually find that current available textbooks are out of date, guidelines are not specific enough and there are conflicting or apparently unreliable reports in the literature. Expert opinions and policies vary between experienced authors, and even the definition of what 'evidence' means varies between experts. Some use the 'consensus of experts' approach, but the reliability and reproducibility of this type of evidence is questionable; others use guidelines that are based on expert appraisal of the literature. These are roughly equivalent to a consultation with experts but may not answer the specific question well. Another issue is that these must be based on strong evidence or take into account new developments and local circumstances.[14] Besides the five standard approaches (ask, access, appraise, apply and evaluate) to assess validity in EBM, radiologists must also ask the following specific questions.[15]

- Has the imaging method been described in sufficient detail to be reproduced in each respective department?
- Have the imaging tests been evaluated and the gold standard test performed to the same degree of excellence?
- Have 'generations' of technology development within the same modality been considered adequately in the study design?

Each time the answer to a question is no, a potential source of methodological bias has been introduced. In the case of a diagnostic test evaluation, a bias-free study is an independent, blinded comparison of an appropriate spectrum of consecutive patients, all of whom have undergone both the diagnostic test and the reference standard.[16]

Even though money is considered to potentially influence everything, quality has nothing to do with money in the healthcare business field. Before making decisions, radiology or hospital managers could gain insights by studying the outcomes of evidence-based research efforts. It is true that these managers are searching ways to decrease the current levels of costs without reducing access to needed healthcare services. EBM can potentially provide bridges between medical research and clinical practice, ensuring that healthcare funding is well spent by cutting down unnecessary diagnostic tests or investigations. Cost-benefit analysis strategies are generally in favour of EBM. For instance, evidence shows that only a small percentage of patients requires a 64-slice computed tomography scan On the other hand, the value of clinical guidelines can be served as a benchmark tool. EBM should be made relevant to the resources available, the patient population and the pattern of diseases, in order to offer the surest and most objective way of consistently determining and maintaining quality and safety standards in medical practice.

> Evidence-based medicine can potentially provide bridges between medical research and clinical practice, ensuring that healthcare funding is well spent by cutting down unnecessary diagnostic tests or investigations.

Conclusion

EBM can change the way in which radiologists look after their patients by accessing and applying valid and relevant summaries of guidelines and systematic reviews. There is a powerful demand for new evidence and ways of introducing evidence into clinical practice in the most efficient manner. Ongoing medical costs and improving quality of medical care are also issues strongly related to EBM. In the near future, we can expect EBM to grow and evolve into many different forms. ■

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