

ANDREW SMITH

Anaesthesia/Health Services Research Unit
Royal Lancaster Infirmary
Lancaster, United Kingdom

Saturday May 28, 2005

16:00-16:45

Room Q

EVIDENCE-BASED MEDICINE

The thinking behind evidence-based medicine is simple. If we can base our practice on the highest-quality, most up-to-date research evidence then we will be more effective clinicians and our patients will benefit. There are five steps to the process of evidence-based practice [1,2]:

1. *Ask a clinical question you can answer.* A good question specifies the intervention used, the subjects studied and outcomes sought.
2. *Search for evidence.* Usually on computerised databases such as Medline
3. *Critically appraise the evidence.* Is the research of good quality? Are the results important and useful for me as a clinician?
4. *Integrate the evidence into practice.* Decide how (or if) it applies to the patient.
5. *Evaluate the process.* Did it work? Could we have done it better?

In reality, of course, this can be a challenge. For a start, our reading tends to be directed by whatever happens to be in the journals the postman brings to our door each month, rather than being directed by problems from real patients. Searching well is also time-consuming.

This review will concentrate on step 3 above, namely how to make sense of published papers. It will be a practical guide to critical appraisal from the author's experience and will focus on how to promote an understanding of published evidence using the journal club format. Some suggestions for improving the integration of evidence into practice (step 4) will also be made.

CRITICAL APPRAISAL

Many anaesthetists read journals. Typically, though, they focus on certain parts – editorial comment, review articles and correspondence. Reports of original research may not be read at all or, if they are, more attention is often given to the abstract, results and possibly the discussion than to the methods section. This is unfortunate as the methods section is probably the most important in determining the quality of the work.

There are three guiding principles of critical appraisal, which are applied here to a randomised controlled trial (RCT) format:

The first is **logic**. Is the paper constructed along sound lines of thought? It is probably written in the standard IMRAD format (Introduction, Methods, Results and Discussion) but this in itself is no guarantee of intellectual probity. Is there a clear research question? Is the hypothesis plausible? Is the method described the right way of answering that question? Does the conclusion follow from the results?

Next is **method**. This is important to ensure the validity of the trial. If the method is questionable, how can we rely on the results? How far have the investigators gone to avoid bias? Allocation concealment (whether the investigators were unaware of how patients were allocated into study groups), method of randomisation (was it truly random?), extent of blinding (single, double, treble or even quadruple) and completeness of follow-up are the most important determinants of this. You should also check that any ethical issues have been dealt with appropriately.

Third is **applicability**. We need to be able to justify applying the results to our patients. Is the subject under study of clinical relevance? Are the study patients described closely enough so that I can tell if they're like mine? Were useful, meaningful outcomes chosen? How do the findings enhance what we already know about this subject? Will the findings help my patients? Will it make life easier for me? If not useful in practice, is the study useful to generate hypotheses for future research work?

Finally, we need to mention **statistics**. In my experience, one of the things that discourages people from trying to read published research is a belief that it is impossible to understand articles if you do not understand statistics. This is not true. Far more important are the methods used, the samples chosen, the way clinical measurements were made and how patients were followed up in the analysis. If a study is good, the statistical analysis will help point the way. If a study is bad it is usually obvious and no amount of statistical manipulation of the data will rescue it! Of course, it is useful to bring in some statistical concepts [3,4] later in the critical appraisal course. Perhaps the most helpful practical distinction to make early on is between *statistical* significance and *clinical* significance.

I have used two main approaches to critical appraisal. The first relies on a checklist of questions and can be very useful for beginners as it enables them to read the paper in a more directed manner, searching out the material for each checklist item. Such lists are widely available [5,6]. Questions typical of this approach are shown in Box 1.

**BOX 1. - ILLUSTRATIVE 'CHECKLIST' QUESTIONS FOR APPRAISING
A RANDOMISED CONTROLLED TRIAL**

Three screening questions

Did the trial address a clearly focused question?

Was the assignment of patients to treatments randomised?

Were all of the patients who entered the trial properly accounted for at its conclusion?

Detailed questions

Were patients, health workers and study personnel 'blind' to treatment?

Were the groups similar at the start of the trial?

Aside from the experimental intervention, were the groups treated equally?

How large was the treatment effect?

How precise was the estimate of the treatment effect?

Can the results be applied to the local population?

Were all important outcomes considered?

Are the benefits worth the harms and costs?

Source: Critical Appraisal Skills Programme [5]

More experienced appraisers can be introduced to a more *intuitive* approach. I cannot say that all experts read this way, but this is how I do it. Rather than start with the abstract, I leave it until last, as this allows me to check that it accurately represents what is written in the body of the paper. Running through the article should be a logical 'thread' linking the background, the idea, the research question, the method, the results and the conclusion. As I read through, inconsistencies and ambiguities raise questions in my mind and I look for clarification later in the paper. The references should support the statements they are cited for – sometimes it is clear even from the title that the reference has been wrongly cited. Sometimes one's own personal knowledge, or actually checking the references oneself, reveals discrepancies. Whilst this does not invalidate the research, it does make me suspicious that there may be errors elsewhere. An important area for scrutiny is how authors deal with their own work in the discussion. Most researchers only discuss the issues they have solved, not those they have failed to solve or have overlooked. This section was traditionally used to 'sell' the paper to reviewers and readers. While rhetoric does have a function in science, it has been suggested that a more contemporary approach might be to structure discussions in the way that many abstracts already are [7]. Further examination of a paper that doesn't 'feel' quite right can be prompted by such open-ended questions as:

- What assumptions have been made but not articulated?
- What question should have been asked that was not?
- What has not been said that should have been?

Often, it is then possible to locate in the text the sentences which address these questions. Tables and figures are worth particular attention as they often contain errors.

STRUCTURING THE JOURNAL CLUB

Many doctors (myself included!) have had bad experiences of journal clubs as trainees. Typically, a trainee is assigned an individual issue of a journal and instructed to present one or more articles to the group.

Often there is no further supervision of the trainee until the presentation takes place.

Typically basic science reports are chosen because they appear more prestigious than clinical material. It is no surprise, then, that listeners' eyes glaze over as they try to follow a PowerPoint presentation summarising a paper on the effect of spinal neostigmine in rats and struggle to search for relevance to their clinical practice. We do not expect our trainees to give anaesthetics without training and supervision and we should expect to provide similar instruction and support as they learn the new skills of appraisal.

Here I describe a series of four modules in appraisal. I have presented them separately but they are inter-linked. How far through them you can progress will depend on how much time you have available and on the interest and abilities of your students – and indeed your faculty, as teaching critical appraisal well needs people who are confident in their clinical area, familiar with epidemiology and biostatistics and have good facilitating skills – an unusual combination! It would be ideal to spend about 3 hours a week over 3 months on this topic but we have so far never managed to achieve this in practice! Practical suggestions for running the sessions themselves, some adapted from [8], are given in Box 2.

BOX 2. - PRACTICAL ASPECTS OF RUNNING A JOURNAL CLUB

- Running an evidence-based appraisal journal club is labour-intensive if it is done well. Whoever runs the sessions needs to be familiar with critical appraisal as well as the clinical topic under consideration.
- Organisation is important. It is best if a timetable is prepared for a few months in advance and the topics to be addressed are publicised beforehand.
- Journal clubs are social occasions as well as educational ones and drinks and possibly also food should be provided. This will encourage attendance, especially if you are planning to hold the session early in the morning or at lunchtime.
- A supportive senior clinician should lead the session. Setting the right tone is important – participants should not be afraid to contribute, even if this means showing their lack of knowledge. Enthusiastic trainees may lead the session but this should be in the presence of, and under the supervision of, their senior.
- Clinically relevant papers should be chosen wherever possible. The choice of topics will depend on the interests and needs of those present, but less specialised clinical material allows very junior anaesthetists to contribute and may therefore influence clinical practice more widely in the department of anaesthesia.
- I think that each person should have his or her own copy of the paper. These should be made available at least a few days before the meeting so that everyone can read the article through carefully before the meeting starts. Whilst some journal clubs encourage presenters to summarise articles, this can introduce a bias and I think it is better to read the authors' original words. In addition, each participant then has a reminder of what has been discussed to take away and keep.
- Sometimes, games may be used to enliven the session. For instance, splitting the participants into two teams, who takes turns to debate the pros and cons of the article, referring to the text as they do so, can be fun, especially if a 'referee' is appointed, complete with football shirt, whistle and stopwatch!

LEVEL 1: BASIC PRINCIPLES OF CRITICAL APPRAISAL

The aim of this introductory module is to give trainees (and many experienced clinicians too) an understanding of the three guiding principles above. A good place to start is with randomised controlled trials as these are familiar to most anaesthetists and it is possible to compare them against well-known standards for trial reporting [10]. It does no harm to encourage the belief that research findings are unambiguous and evidence for clinical problems is straightforward. This is in fact frequently true, and picking papers containing solid evidence supporting current practice is useful in this respect [for instance,11]. This can be extended to include 'pairs' of papers on the same subject, one good and one flawed.

LEVEL 2: INCREASING RELEVANCE TO PRACTICE

Once readers understand how to deal with published evidence, it is rewarding to put it to use in answering clinical questions. This involves framing the questions in the first place – the first of the five steps of evidence-based medicine above- and the most worthwhile ones come directly from problems in practice. It is possible to compile a ‘bank’ of such questions and participants can be detailed to choose one, search for the evidence, present the results of their search and then appraise one or more key papers to address the issue. Another possibility is to run each session in three parts. In the first, participants decide which question will be addressed in the next meeting. In the second, they review material retrieved during searching to answer the previous week’s question and choose which paper(s) to read in detail the following week, and in the third part they read the articles selected to address the question posed two weeks previously. Thus the meetings run on three-week cycles.

LEVEL 3: ANATOMY OF THE ANAESTHESIA JOURNAL

Whilst the randomised controlled trial tends to predominate in clinical anaesthetic research, and this is a good starting-point, journals contain other types of writing too. The focus of this module, then, is to understand the functions and structures of these different pieces. Review articles are useful as a time-saving summary of previously published material but the traditional, so-called ‘narrative’ review article has been accused of being open to bias [12]. Systematic reviews, on the other hand, as promoted by the Cochrane Anaesthesia Review Group [13,14], work to a predetermined protocol, just like a primary research study. This enables systematic reviews to address a clearly defined question, use explicit and systematic methods to identify, select and critically appraise all relevant research, to collect and analyse data from the primary studies included in the review, and to present results and draw conclusions [15]. If statistical techniques are used to pool the results of the studies, this is termed meta-analysis. Guidance on appraising reviews is widely available [16]. I have also found useful work on the role of editorials [17] case reports [18,19] and correspondence [20] whilst Chapter 3 in Trish Greenhalgh’s book [2, 21] summarises the features of case-control and cohort studies. Other publication types are dealt with in the Users’ Guides to the Medical Literature referenced above [6]. Recently there has been more interest in qualitative research in anaesthesia and this needs a different approach too [22].

LEVEL 4: THE NATURE AND LIMITS OF EVIDENCE

This advanced level module can also be tied in to clinically relevant material. A useful starting-point is a sharing of ideas on the clinical topic of the paper, which introduces the notion that the same anaesthetic problem can be successfully managed in a number of ways, and there is often no single ‘textbook’ technique. This leads on to a discussion of the evidence base and theoretical justification for each option, which in turn paves the way for exploring the relationship between knowledge and practice more generally. It is often instructive to choose an older, ‘classic’ paper as it can be surprising how poorly conducted such studies can be by modern standards. It is also possible to find systematic reviews on the same subject which come to different conclusions (though this is rare!).

The discussion in such sessions can lead in many directions and has to be carefully led by the session facilitator, but can help participants understand the evidence base for anaesthesia, where it may be lacking and how we deal with that in practice.

Recurring themes are:

- how we handle uncertainty in practice
- how clinical predictions based on pharmacological or physiological theory do not always hold
- how, despite the supposed objectivity of science, papers can be written with a particular ‘spin’
- how patients in research studies may differ from those in practice and how this affects the applicability of results
- how references can be used and misused
- limitations of the randomized controlled trial

I believe that this approach is useful because, in the move towards syllabus-driven training and competence-based assessment in anaesthesiology, there is a danger that fundamental epistemological issues – how we know what we know - are neglected. Further, some recent work [23,24] has highlighted the need for anaesthetists to be able to deal with uncertainty in their practice and the journal club may provide one option for promoting this ‘tolerance of ambiguity’.

DOES CRITICAL APPRAISAL WORK?

Our evaluation of our own journal club in Lancaster (conducted at levels 1-3) suggested that there was no improvement of participants' understanding of the language of evidence-based medicine [25], though it later became clear that they had overestimated their initial knowledge! A well-conducted meta-analysis of postgraduate journal clubs established that journal clubs broaden students' sense of clinical epidemiology and biostatistics, reading habits and use of medical literature in clinical situations [26]. A more recent review [27] suggested that clinical integration of teaching in evidence-based medicine – either by incorporating it into clinical activities or by using patient problems as in Level 2 above- is more likely to change clinicians' attitudes and behaviour. There is as yet no evidence that the care of patients is improved.

THE NEXT STEP: INTEGRATING EVIDENCE INTO PRACTICE

Even the best evidence can only benefit patients if it is incorporated into practice and the variety of approaches have been reviewed by Grol [28] and others [29,30]. Here it is worth making the distinction between *dissemination* – which refers to the communication to raise awareness of research and make people readier for change – and *implementation*, the activities to facilitate, reinforce and support changes in practice. Clearly, the journal club is part of dissemination but, by fostering an understanding of evidence as well as simply transmitting information, it may help implementation too. The commonest method of implementation is to incorporate the evidence into *practice guidelines* but other strategies include *audit and feedback*, *educational outreach* (visits to clinicians by 'experts') and *reminder systems* (for instance, a checklist in the anaesthetic chart) [31].

All this depends on changing the clinical behaviour of anaesthetists and that can of course be difficult. Experienced clinicians have learned, correctly, to trust their experience and judgement and may not see the need for change. They can be reassured, however, that clinical expertise (and, for that matter, patients' preferences) still plays a vital role in determining how and where research evidence is used as part of successful professional practice in anaesthesia [24].

REFERENCES

1. Møller AM, Smith AF, Pedersen T. Evidence-based medicine and the Cochrane Collaboration in anaesthesia. *Br J Anaesth* 2000; 84: 615-8.
2. Greenhalgh T. *How to read a paper: the basics of evidence-based medicine*. London: BMJ Books, 2nd edn, 2001. Collection of articles from the *British Medical Journal* – some cited here as references 3,4 and 21.
3. Greenhalgh T. How to read a paper: statistics for the non-statistician I: Different types of data need different statistical tests. *Br Med J* 1997; 351: 364-6
4. Greenhalgh T. How to read a paper: statistics for the non-statistician II: 'Significant' relations and their pitfalls. *Br Med J* 1997; 351: 422-5
5. Critical Appraisal Skills Programme. Available at www.phru.nhs.uk/casp/casp (accessed 26 November 2004)
6. Users' Guides to the Medical Literature. Available at www.cche.net/usersguides/main.asp (accessed 26 November 2004)
7. Docherty M, Smith R. The case for structuring the discussion of scientific papers. *Br Med* 1999; 318: 1224-5
8. Gibbons A. Organising a successful journal club. *Br Med J* 2002; 325: s137-8 (2 November)
9. Goodman N. How to write a critical letter and respond to one. *Hosp Med* 2000; 62:426-7
10. Moher M, Shultz KF, Altman DG, for the CONSORT Group. The CONSORT statement: revised recommendations for improving the quality of parallel-group randomised trials. *Lancet* 2001; 357: 1191-4
11. Møller AM, Villebro N, Pedersen T, Tonnensen H. Effect of preoperative smoking intervention on postoperative complications: a randomised controlled trial. *Lancet* 2002; 359: 114-7
12. Smith AF. An analysis of review articles in four anaesthesia journals. *Canadian J Anaesth* 1997; 44: 405-9
13. Pedersen T, Møller AM, Cracknell J. The mission of the Cochrane Anaesthesia Review Group: preparing and disseminating systematic reviews of the effect of health care in anesthesiology. *Anesth Analg* 2002; 95: 1012-8
14. Cochrane Anaesthesia and Critical Care Group. See www.cochrane-anaesthesia.suite.dk/ (accessed 26 November 2004)
15. Handoll HHG, Smith AF. How to perform a systematic review. *Curr Anaesth Crit Care* 2004; 15: 227-34
16. Moher D, Cook D, Eastwood S, Olkin I, Rennie D, Stroup et al. Improving the quality of reports of meta-analyses of randomised controlled trials: the QUOROM statement. *Lancet* 1999;354:1896-1900
17. Goodman N. Why do anaesthesia journals publish editorials? *Eur J Anaesthesiol* 2001;18:703-5
18. Vandembroucke JP. Case reports in an evidence-based world. *J Roy Soc Med* 1999;92:159-163
19. Mason RA. The case report – an endangered species? *Anaesthesia* 2001;56:99-102.
20. Bhopal RS, Tonks A. The role of letters in reviewing research. *Br Med J* 1994;308:1582-83.
21. Greenhalgh T. How to read a paper: getting your bearings (deciding what the paper is about). *Br Med J* 1997; 315: 243-6
22. Merry AF, Davies JM, Maltby JR. Qualitative research in health care. *Br J Anaesth* 2000; 84: 552-5
23. Klemola U-M, Norros L. Analysis of the clinical behaviour of anaesthetists: recognition of uncertainty as the basis for practice. *Med Educ* 1997; 31: 449-56
24. Smith AF, Goodwin D, Mort M, Pope C. Expertise in practice: an ethnographic study exploring acquisition and use of knowledge in anaesthesia. *Br J Anaesth* 2003;91: 319-28
25. Knight S, Smith AF. Using the journal club format to foster critical appraisal skills in anaesthetic trainees. *Eur J Anaesthesiol* 2003; 20(Suppl 30): 7
26. Ebbert JO, Montori VM, Schultz J. The journal club in postgraduate medical education: a systematic review. *Medical Teacher* 2001; 23: 455-61
27. Coomarasamy A, Khan KS. What is the evidence that postgraduate teaching in evidence based medicine changes anything? *Br Med J* 2004; 329: 1017-9
28. Grol R. Beliefs and evidence in changing clinical practice. *Br Med J* 1997;315:418-21.
29. Donald A, Haines A. *Getting research findings into practice*. London: BMJ Books, 2nd edn, 2001
30. Haynes B, Haines A. Barriers and bridges to evidence-based clinical practice. *Br Med J* 1998; 317: 273-6
31. Hutchinson A, Baker R (eds). *Making Use of Guidelines in Clinical Practice*. Abingdon: Radcliffe Medical Press, 1999.