The Information Explosion

Clinical decision making should be based on the best available scientific evidence. However, identification of the most valid scientific data is not an easy task. The number of scientific medical journals and books has become tremendous and the quality of the published data is often doubtful. Thus, the medical literature is suffering from both a quantitative and a qualitative problem. Each year, over one million scientific articles are published in more than 40,000 medical journals [1] and about 17,000 new biomedical books are printed [2]. It has been estimated that only one half of all medical publications are ever cited [3]. Innovative models that are using standardised filtering, critical appraisal, and appropriate qualitative or quantitative synthesis of scientific data are needed.

How to cope with the literature: large randomised trials

Large trials are usually multicentre studies; they are logistically difficult to perform, labour-intensive and expensive. Since large trials are expensive, they often need industrial support. Industrial interests, however, do not always meet the true needs of patients and clinicians. Also, large trials often suffer from a lack of external validity; inclusion and exclusion criteria of study participants are so stringent and explicit that the usual daily patient is not necessarily represented in the study cohort. Obviously, in an ideal world, efficacy and harm of all medical interventions, prevention, therapy or diagnostic, would be tested in large, methodologically sound randomised-controlled trials. In anaesthesiology, large trials are still rare.

How to cope with the literature: narrative reviews

For many years authors have tried to collect data in review articles and to present them in a comprehensible way. These classical or conventional review articles may be useful to give a broad overview on physiopathological issues of a disease, for instance. However, non-systematic, narrative review articles suffer from many serious drawbacks [4,5]. For instance, the reader cannot reproduce the authors’ intellectual process from the original data to the conclusions of the review. Also the method of data identification remains unknown; selection bias cannot be excluded. Finally, there is no critical appraisal and no weighting of the data. Despite many restrictions, conventional reviews remain popular. They are simple to read without needing any basic methodological knowledge. The fact that these articles are often written by opinion leaders may induce a feeling of security and confidence among readers. Editors know that the regular publication of conventional review articles can positively influence the impact factor of their journal, since these articles are often and uncritically cited [6].

How to cope with the literature: systematic reviews and meta-analyses

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 requires the integration of individual clinical expertise with the best available external clinical evidence from systematic research. Valid, relevant evidence should be considered. There should be an active search in the scientific literature for that information. An assessment should be made of the accuracy of the information and the applicability of the evidence to the decision in question, i.e. information should be appraised.

A systematic review is a practical example of systematically finding and appraising contemporaneous research findings that may be used as a basis for clinical decisions. Thus a systematic review, which may regarded as one of the major tools of evidence-based medicine, is fundamentally different from a conventional narrative review. Since systematic reviews gather all relevant and valid data on a particular subject they are often regarded as the highest level of evidence available.
The basic approach to a systematic review can be divided into six steps; the process is reproducible due to a detailed documentation of both method and analysis:

- Framing the question
- Systematic (i.e. unbiased) search for relevant data, published and unpublished, for instance through electronic databases, bibliographies, and contact with authors and manufacturers
- Critical appraisal. The aim is to identify bias, to appraise the quality of data reporting, and to judge the validity (internally and externally) of the original trials
- Extraction of data
- Qualitative or quantitative (meta-) analysis of data. This step may include sensitivity analyses that are addressing issues of applicability (“are these my patients?”), differential effects of interventions in specific patient groups (for instance, children versus adults), or dose-responsiveness
- Dissemination and implementation.

If data can be extracted from the original trials, and the data are clinically homogenous, they can be combined using biostatistical methods. This is then called a “meta-analysis” or a quantitative systematic review. Thus, a valid meta-analysis will always be based on data from a systematic review. Sometimes, data extraction is impossible or data pooling is deemed inadequate (for instance, the trials report on a large variety of endpoints), then a “vote counting” approach may be chosen. Disadvantages of such a qualitative systematic review compared with a quantitative systematic review are obvious. First, weighting of the data is not possible (a large trial may conclude that the intervention is not efficacious, and a small trial may suggest that the intervention is significantly better than control). Second, there is a risk of interpretation bias from the reviewers.

As with randomised controlled trials, systematic reviews should be correctly reported, and there are recommendations on how to do this [7]. The Cochrane Collaboration is an important promoter of systematic reviews.

**Systematic reviews and meta-analyses in anaesthesiology**

In 1995, the majority of the reviews in four major anaesthesia journals did not fulfil the main criteria of a systematic review. This has changed during recent years. The Geneva Evidence-Based Perioperative Medicine Group has been collecting systematic reviews that are relevant to anaesthetists. This list is freely accessible through the web [8]. More than 350 titles have been gathered, and the list is regularly updated. These systematic reviews are about anaesthesia-related complications and risks, postoperative and labour pain, control of nausea and vomiting, regional anaesthesia, perioperative fluid replacement, transfusion medicine, cardiopulmonary resuscitation and many other relevant topics. The majority of these studies are of good quality [9]. In some areas the number of published systematic reviews has become sufficient to enable the establishment of evidence-based strategies for prevention and treatment [10].

**Drawbacks and pitfalls of meta-analyses**

Obviously, a meta-analysis cannot be better than the individual trials it is based on (“you cannot make a good omelette with rotten eggs”). A meta-analysis cannot make bad trials better. However, the systematic review process can unearth biases, methodological drawbacks, and validity problems of the existing literature. As shown by Moore (figure), both original trials and meta-analyses should be of good quality. The amalgamation of data from poor studies in an invalid meta-analysis will almost certainly be misleading [11].
Yet another problem relates to dissemination and implementation. About half of the systematic reviews that are relevant to anaesthetists are not published in anaesthesia journals, they may be found in general medical or specialised non-anaesthesia journals [12]. Thus, dissemination of best evidence data among anaesthetists is likely to be delayed. Finally, there is frequently a lack of implementation of evidence that has been gathered in systematic reviews. Quality programs should ensure that clinical guidelines are based exclusively on best evidence data including knowledge from systematic reviews.

CONCLUSIONS

Systematic reviews and meta-analyses are not an alternative but are complementary to valid randomised controlled trials. The validity of a systematic review depends upon the validity of the included trials. However, a systematic review may be regarded as a powerful tool that tells us what we know, and, as a consequence, what we do not know. Therefore, systematic reviews are the basis of a rational, and thus ethical, research agenda. Systematic reviews have improved our knowledge in many settings in anaesthesiology, and hopefully will continue to do so. Models have been published to facilitate the application of the aggregate results of systematic reviews to the individual patient level [13]. More research is needed to further improve both dissemination of best evidence practices and implementation of evidence-based clinical guidelines.

REFERENCES