Protocol - Cardiac general

Towards evidence-based medicine in cardiothoracic surgery: best BETS

Joel Dunning*, Brian Prendergast, Kevin Mackway-Jones

Department of Cardiothoracic Surgery, Manchester Royal Infirmary, Oxford Road, Manchester, M13 9WL, UK

Summary

Cardiothoracic surgeons are faced with the dilemma that many clinical questions in their daily practice to do not have universally agreed answers, but patients increasingly demand the 'best practice' from their doctors. In addition time pressures mean that clinicians are unable to keep up with the full spectrum of published research and current resources that collate evidence for clinicians have few if any resources for cardiothoracic surgeons. We have adopted an approach pioneered in emergency medicine, namely the Best Evidence Topic or BestBET. Clinicians select a clinical scenario from their daily practice that highlighted an area of controversy. From this, a three-part question is generated and this is used to search Medline for relevant papers. Once the relevant papers are found, these papers are critically appraised using validated checklists and the results are summarized. A clinical bottom line is reached after this process. To add confidence to the quality of the search a second author and then an Evidence Based Journal Club checks the BET to ensure that no relevant evidence is missed. These BETs will then be posted on the ICVTS website prior to publication for widespread commentary. The resulting BETs, written by practising cardiothoracic surgeons, will then provide robust evidence-based answers to important clinical questions asked during our daily practice.
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1. Introduction

In order to achieve the optimal care for patients undergoing cardiac and thoracic operations it is essential that their management is based upon the best available evidence. However, although coronary bypass grafting is the most studied operation in the world [1], a formalized approach to evidence-based practice in cardiothoracic surgery is lacking. While other hospital and community specialties benefit from many resources that collate and summarize the available evidence [2–5], these resources are notable for the absence of data on surgical research and in particular cardiothoracic surgical research. While some organizations present guidelines on some aspects of our specialty [1], we lack a peer-reviewed resource of topics in cardiothoracic surgery that is created, reviewed and utilized by members of our own specialty, that can lead to best practice in cardiac and thoracic surgery.

The particular problem facing surgical specialties is that the evidence that does exist is frequently not of the highest quality and therefore most formal critical appraisal processes tend to discard the majority of our papers due to methodological flaws or poor design by their standards.

In 1998, emergency medicine faced a very similar problem in that many clinical questions in this specialty could not be answered by high-quality studies, but that answers became apparent when the 'best available' evidence was reviewed. The process was formalized by a process of creating Best Evidence Topics (BestBETs).

BestBETs were first described by the Emergency Department at the Manchester Royal Infirmary [6]. They were developed as an educational tool to focus teaching of competencies in the practice of evidence-based medicine to junior doctors [7], but soon developed into a means of identifying the need for evidence-based changes in practice and of helping to effect these changes. BestBETs have since been published regularly in peer-reviewed journals (currently the *Emergency Medicine Journal* [8] and then the *Archives of Disease in Childhood* [9]), and are now listed and updated on a dedicated website [10]. This website (http://www.bestbets.org) has been enthusiastically reviewed both nationally [11] and internationally [12], and is recognized as a major resource for evidence-based practice [13].

* Corresponding author. Tel.: +44-161-276-6984; fax: +44-161-276-8538.

E-mail address: joeldunning@doctors.org.uk (J. Dunning).

Therefore, realizing that many clinical questions could be answered in this way in cardiothoracic surgery, we set up an Evidence Based Journal Club in Cardiac Surgery. We aimed to answer clinically relevant questions generated during our daily practice, by using the best available evidence to create best-evidence topic reports in cardiothoracic surgery.

2. Design

BETS are constructed in five stages, based on the principles underlying all evidence-based medicine (Table 1).

2.1. Asking the right questions

BETs are generated as a result of clinical questions that face busy cardiac surgeons in their daily practice. Thus as the first step, a clinical scenario is presented that clearly illustrates the topic of interest which is familiar to the person preparing the report. This ensures that each topic is rooted in clinical practice and will be of immediate use to clinicians. In order to ensure that the question is well defined and answerable, this clinical question is then summarized as a three-part question (Table 2).

The three-part question is the cornerstone of all evidence-based search strategies as it both concisely defines the question to be answered, and it leads the search strategy from the available literature databases [14]. An example of these first two steps is given in Table 3.

2.2. Searching for the evidence

A key component of the Best Evidence Topic is that all the 'best available' evidence is reviewed, as only then can strong conclusions be drawn about the particular topic. A major strength of BETs is that they are not exhaustive systematic reviews and thus rather than taking months to perform, they take on average 5 hours to complete [15], meaning that they are easy to perform by practising clinicians.

It must be realized, however, that no attempts are made to search the grey literature, unpublished literature or to statistically aggregate the data, and thus what is offered by BETs are practical answers to clinical questions by clinicians, rather than long reviews and summaries of the full body of research on that topic.

Table 1
The 5 stages of constructing a BET

1.	Asking the right question
2.	Searching for the evidence
3.	Appraising the evidence
4.	Summarizing the evidence
5.	Reviewing the evidence

Table 2
Generation of a three-part question

1.	Patient characteristic or patient group
2.	Intervention(s) or defining question
3.	Relevant outcome(s)

2.3. Medline search

Medline is a register of over 6 million abstracts from 1966 onward, compiled by the National Library of Medicine of the United States. There are several software packages that can be used to search Medline including the free service, PubMed and the subscriber service, Ovid [16,17].

In order to achieve the aims of the BET, which is to find and summarize the best evidence, it is important that the search strategy has a high sensitivity (meaning that it has the highest likelihood of retrieving all relevant papers). In order to achieve this, the search is done in stages. Each section of the three-part question is taken individually, and as many terms as possible are combined using the Boolean operator 'OR' to find all abstracts that contain information on that area. You now have a search for each section of the three-part question. These three sections are then combined using the Boolean operator 'AND' to find papers that contain information on all three areas of your question. This is a well-recognized method for performing sensitive searches and has been described in detail in the *British Medical Journal* [18].

We aim to find around 50–200 abstracts that we can then hand-search for relevance. However, two problems commonly occur during searching: either too many abstracts are found or too few are found. If too few abstracts are found we need to increase the sensitivity of our search. This may be done by using more terms in the search including plural versions and alternative spellings and by using the 'explode' function for Medical Subject Headings (MeSH) to include families of terms that all fall under a single MeSH heading.

If too many abstracts are found, our search is not specific enough (low proportion of abstracts found are relevant). Care must be taken when increasing the specificity not to eliminate abstracts which would be potentially useful.

Table 3
Examples of scenario and question

Clinical scenario
You are about to perform a CABG on a 70-year-old lady who has left main stem disease and an ejection fraction of 30% on echocardiography. She was an urgent referral from the cardiologists after being admitted 3 weeks ago with unstable angina, but has been stable since admission. You wonder whether preoperatively inserting an intra-aortic balloon pump would be of benefit to her?

Three-part question
In [High-risk patients undergoing coronary arterial surgery]
Does [Prophylactic IABP insertion]
Improve [In-patient survival, or time to discharge]

Table 4
Search strategy using Medline 1966 to December 2002 using the OVID interface

[exp Coronary Artery Bypass/ OR CABG.mp OR exp Thoracic surgery/ OR Coronary art$ bypass.mp OR cardiopulmonary bypass.mp OR exp Cardiovascular surgical procedures/ OR exp Thoracic surgical procedures/]
AND
[exp Intra-aortic balloon pumping/ OR intra-aortic balloon pump.mp OR IABP.mp]
AND
[exp preoperative care/ OR pre-operative.mp]

Note that for this search the third section of the three-part question relating to survival or hospital outcome performed very poorly in terms of specificity, giving very large numbers of abstracts and thus it was decided to search for terms relating to preoperative care instead.

/ indicates a MeSH heading, exp indicates explode (applicable only to MeSH headings),.mp is main point search (title, abstract, and MeSH terms).

While search terms can be removed, it is often better to use other techniques such as the LIMIT command, limiting to human studies, or to use a methodological filter to look only for high-quality studies [3,6]. Often the search may need to be done a few times, and the three-part question may need to be changed for the purposes of the search strategy, as often searching for 'survival or outcome' may result in a poor specificity, in comparison to searching for a second key component of the intervention (see Table 4). The abstracts found in our example search are shown in Fig. 1.

2.4. Consider other sources of evidence

The Medline search should form the basis of the BET, but if the results are poor from this search, an author may consider searching other resources. These may include EMBASE, the European equivalent of Medline, with around 4 million abstracts from 1974, including many abstracts not included on Medline, or other databases already mentioned above including the Cochrane Database of systematic reviews [2–5]. These additional resources are usually only necessary if no relevant papers have been found on Medline, as additional searches help to assure

readers that there really were no papers that could answer the clinical question.

2.5. Scanning titles and abstracts

Once a satisfactory number of abstracts have been found, the titles and abstracts now need to be scanned, as the majority of abstracts will not be relevant to the clinical question. From a search that finds 50–200 abstracts it is usual to find only 5–10 papers that require critical appraisal from the full text article. This scanning process is, however, quite quick and therefore we recommend that it is better to scan a larger number of abstracts rather than risk missing relevant papers by over refining the search.

2.6. Appraising the evidence

The papers found by the search strategy are now requested and appraised. The appraisal of each paper is performed in a structured format, using critical appraisal checklists. These are widely available in several formats, and these aid in assessing the paper for methodological and analytical soundness and help uncover any significant methodological flaws [19–21]. In addition, after appraisal, the paper can be categorized in terms of the type of study and the level of evidence presented [3]. Generally, in constructing the BET we are interested in the papers of the highest level only. Thus if some papers are level I evidence then there is no need to consider papers of level II or III evidence in the final BET. In contrast, if there are several level III papers but no papers better than this, then these will all be considered. The levels of evidence are presented in Table 5, and enable readers of the BET to come to a conclusion about the certainty to which evidence exists to answer the question.

2.7. Summarizing the evidence

A search has now been performed, relevant papers identified and reviewed, and we are now in a position to
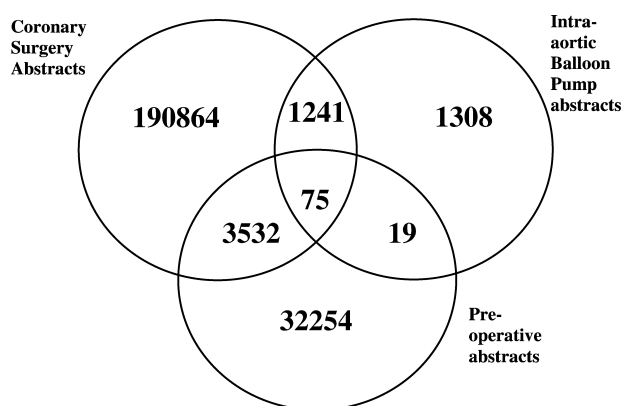

Fig. 1. Number of abstracts found from final search strategy.

Table 5
Levels of evidence

I	Strong evidence from at least one published systematic review of multiple well-designed randomized controlled trials
II	Strong evidence from at least one published properly designed randomized controlled trial of appropriate size and in an appropriate clinical setting
III	Evidence from published well-designed trials without randomization, single group pre-post, cohort, time series, or matched case-control studies
IV	Evidence from well-designed non-experimental studies from more than one centre or research group
V	Opinion of respected authorities, based on clinical evidence, descriptive studies or reports of expert consensus committees

summarize the evidence and answer our original question. The summary follows a structured format in order to ensure transparency in the process for other clinicians reading the BET. The first of our BETs in Cardiac Surgery are published in this Journal. The full process which we have just been through to create the BET is described in full. This includes the title, the clinical scenario, the derived three-part question, the detailed search strategy, and the results of the search. The number of abstracts found is explicitly stated, with the number of papers deemed to be irrelevant or of poor quality. The relevant papers are then summarized in a table, under headings including the author, date and country of research, the patient group, the study type (and level of evidence), the outcomes investigated, the key results and any identified study weaknesses or comments. Below the table a comments section is then used to summarize the findings of the papers and to discuss any issues arising from the critical appraisal of the papers. This section can also be used to highlight the need for further research. Finally, a clinical bottom line is given to answer the original question of the BET.

2.8. Reviewing the evidence

The BET is now complete, and by following a well-structured format it is hoped that the BET is comprehensive and the conclusions are valid. However, there are several further steps that ensure that clinicians worldwide reading BETs in this journal can be convinced that great rigour has been used in its construction (summarized in Table 6).

2.9. Checking author

A second author is asked to fully review the BET. This involves returning to Medline and re-running the search, and adding new terms or changing terms in the search strategy in an effort to find additional papers of relevance. The second author must also look through all the 'hits' from the search to ensure that no relevant papers were missed. Finally, the second author reviews all the critical appraisals of the relevant papers, and checks the reference lists of all papers to ensure that conclusions drawn in the BET are justified and that no relevant papers have been missed.

2.10. Evidence Based Journal Club

An Evidenced Based Journal Club in Cardiothoracic Surgery has been set up in a similar fashion to the well-established Journal Club that reviews BETs in Emergency

Table 6
Further steps

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1. Second author to check the search strategy and output
2. Discussion of search by members of the Evidence Based Journal Club
3. Web-based review on ICVTS website
4. Regular revision of search strategy by web-editors

Medicine [7]. This consists of a weekly meeting of 10–15 consultants and trainees in cardiothoracic surgery who have now been given training and experience with BETs and critical appraisal. Each BET is reviewed at this forum. In particular this expert group is asked whether they know of any additional papers that may have been missed or of any additional search terms that could have been used to improve the sensitivity of the search.

2.11. Web-based review on the ICVTS website

The unique nature of *Interactive Cardiovascular and Thoracic Surgery* means that BETs can be published on the website for widespread review prior to publication. This opportunity allows for widespread appraisal of the content of each Best Evidence Topic. Clinicians entering http://www.ICVTS.org will be able to browse the full BET prior to publication, and in addition will be able to see additional information on the critical appraisal process, the checklists and levels of evidence used in the process and other Best Evidence Topics on http://www.bestbets.org. Only after this process which is unique to ICVTS will the BET be published.

2.12. Regular review of the BETs

Best Evidence topics are a review of the literature at a point in time. However, all Cardiac BETs published in the ICVTS will be given a 'shelf-life', after which the search strategy will be reviewed and re-run. Any additional papers that are relevant can then be reassessed and the BET updated on the website. It is envisaged that this would occur every 3–5 years for each BET.

3. Discussion

BETs are an attempt to promote evidence-based cardiothoracic surgery for busy clinicians by providing clear answers to relevant clinical questions. They are also intended to not only to be read by clinicians but to be performed and reviewed by clinicians that face difficult clinical questions on a daily basis.

Best BETs has transformed emergency medicine into an evidence-based specialty, with over 200 BETs already published in the *Emergency Medical Journal,* and 600 BETS registered on http://www.bestbets.org from authors worldwide. In addition, other specialties are beginning to use this highly successful format, and BETs in Paediatrics have now been published regularly in *Archives of Disease in Childhood* for the last 2 years.

Other bodies exist that do review the evidence behind some aspects of cardiac surgery. The American Heart Association Task Force on Practice Guidelines presents evidence about several areas of Cardiac Surgical Care [1]. However, clinicians worldwide cannot get involved in asking

the questions that they want answered, and then going out and finding that evidence for publication in this document.

The asking of relevant clinical questions to everyday problems is a process that is essential to best practice in cardiothoracic surgery. Using the BestBETs format, busy clinicians will be able to quickly find answers to these questions, and disseminate the answers via peer-reviewed journals and web sites. In addition, BETs clearly demonstrate the strengths and weaknesses of the evidence base on which the practice of cardiac surgery is founded, and thus clinicians will be able to clearly see new directions for future research, based on clinical questions that need answers rather than obscure research questions that may be more convenient to study.

Acknowledgements

References

[1] Eagle KA, Guyton RA. ACC/AHA Guidelines for coronary artery bypass graft surgery. J Am Coll Cardiol 1999;34:1262–347.

[2] The Cochrane Collaboration. Preparing, maintaining and promoting the accessibility of systematic reviews of the effects of health care interventions. http://www.cochrane.org, 2003; accessed May 1, 2003.

[3] CEBM. Oxford Centre for Evidence Based Medicine. http://www.cebm.net, 2003; accessed May 1, 2003.

[4] NHS centre for reviews and dissemination. Database of Abstracts of Reviews of Effects (DARE). http://agatha.york.ac.uk/darehp.htm, 2003; accessed May 1, 2003.

[5] BMJ Publishing Group. Clinical evidence. http://www.clincialevidence.com, 2003; accessed May 1, 2003.

[6] Mackway-Jones K, Carley CD, Morton RJ, Donnan S. The best evidence topic report: a modified CAT for summarizing the available evidence in emergency medicine. J Accid Emerg Med 1998;15:222–6.

[7] Carley CD, Mackway-Jones K, Jones A, Morton RJ, Dollery W, Maurice S, Niklaus L, Donnan S. Moving towards evidence-based emergency medicine: use of a structured critical appraisal journal club. J Accid Emerg Med 1998;15:220–2.

[8] Mackway-Jones K. Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary. Emerg Med J 2002;19:270–5.

[9] Phillips B. Towards evidence-based medicine for paediatricians. Arch Dis Child 2002;87:258–62.

[10] Mackway-Jones K, Carley CD. Bestbets.org: odds on favourite for evidence in emergency medicine reaches the world wide web. J Accid Emerg Med 2000;17:235–6.

[11] Brown H. wwwwatch. http://www.nhs.uk/nhsmagazine/archive/nov/it_webwatch.asp, 2003.

[12] Quin G. ACP J Club 2001;134:A19.

[13] Fatovich DM. Recent developments: emergency medicine. Br Med J 2002;324:958–62.

[14] Richardson WS, Wilson MC, Nishikawa J. The well built clinical question: key to evidence-based decisions [editorial]. ACP J Club 1995;123:A12–A13.

[15] Mylona F, Preece J, Omosigho C, Willey C, Williamson A, Das G, Gardiner S, Khan F, Krishnan V. What's the use of Archimedes? Arch Dis Child 2002;87:168–9.

[16] National Library of Medicine of the United States. Pubmed. http://www.ncbi.nih.gov/entrez/query.fcgi, 2003; accessed May 1, 2003.

[17] Ovid Technologies Inc. Ovid. http://www.ovid.com; 2003; accessed May 1, 2003.

[18] Greenhaligh T. How to read a paper: The Medline database. Br Med J 1997;315:180–3.

[19] Mackway-Jones K, Carley CD, Morton RJ. Best BETs critical appraisal worksheets. http://www.bestbets.org/cgi-bin/public_pdf.pl, 2003; accessed May 1, 2003.

[20] Greenhalgh T. How to read a paper: the basics of evidence based medicine. London: BMJ Publishing Group; 1997.

[21] Crombie IG. The pocket guide to critical appraisal. London: BMJ Publishing Group; 1996.