Knowledge transfer in surgery: skills, process and evaluation

MARTIN DAWES¹, MARKO LENS²

¹Department of Family Medicine, McGill University, Montreal, Canada

²Genetic Epidemiology Division, King's College, St Thomas's Hospital, London, UK

ABSTRACT

INTRODUCTION Knowledge transfer is an essential element in the management of surgical health care. In a routine clinical practice, surgeons need to make changes to the health care they provide as new clinical evidence emerges.

MATERIALS AND METHODS The information was derived from the authors' experience and research in evidence-based practice, searching of the literature, teaching and organisation of various national and international workshops on evidence-based medicine.

DISCUSSION This manuscript discusses principles of knowledge transfer in surgery including evaluation of recommended changes that can improve quality of health care in routine surgical practice. Skills, process and evaluation are carefully described. Continuous information delivery is required to enable surgeons to improve knowledge transfer and to keep up to date their knowledge.

KEYWORDS

Knowledge transfer – Surgery – Evidence-based medicine

CORRESPONDENCE TO

Marko Lens, Genetic Epidemiology Division, King's College, St Thomas' Hospital, London SE1 7EH, UK
E: markolens@aol.com

Surgical health care is a highly complex process. Due to its complexity, making large changes is more likely to lead to problems.¹ Thus, knowledge transfer is an essential element in the management of surgical health care.

The aim of this paper is to outline the principles of knowledge transfer in relation to surgery, to describe how this can be undertaken in surgical units, and show how small changes are the preferred way to improve surgical health care.

The information in this paper was derived from the authors' experience in evidence-based practice, searching of the literature and reading of the subject, research in the field of evidence-based practice and teaching evidence-based medicine and organisation of various national and international workshops.

Skills

Knowledge is the meaningful link that people make in their minds, between information and its application in a specific setting.²

Information is data that have been sorted, analysed, and displayed and is communicated through spoken language, graphic displays, or numeric tables.

In general, our clinical questioning behaviour is usually for information. Medline and other electronic bibliographic

databases are examples of commonly used information sources. The questions that usually occur in practice can be divided into 'decision making' and 'understanding' questions. As one becomes experienced with the clinical condition, the requirement for background information (understanding questions) such as aetiology, prevalence, and pathology reduces. At the same time, the information about the effectiveness of patient and outcome specific diagnostic and therapeutic strategies (decision-making questions) increases. The result of this change is that the likely source of information changes from textbooks to published journal literature as one's experience with the disease increase. Overall, about one-third of all questions that clinicians ask are related to decision making on therapy.³

Knowledge can also be thought of as explicit or tacit. Explicit knowledge is the knowledge that can be acquired from information sources. For example, it is possible to find out how to perform an appendicectomy by reading a textbook of surgery. The incision, process of removal and closure of the wound may all be well described. However, this does not translate into the ability to perform an appendicectomy in real surgical practice. The tacit knowledge is how to make the incision of the skin, what it feels like, how to open the wound, what it looks like once open, and what it should not look like. This knowledge is difficult to obtain

without observing an appendicectomy. However, the need for this tacit knowledge is extremely high. In routine surgical practice, we need to identify our information requirements, and differentiate these from our knowledge needs when appropriate.

Evidence-based medicine is the conscientious, explicit and judicious use of the current, available best evidence in making decisions about the care of individual patients.⁴ Evidence-based practice, however, is a 5-step process:^{5,6}

1. Question your practice.
2. Find the evidence.
3. Appraise the evidence.
4. Act on the evidence.
5. Check you are acting on the evidence.

How does this happen in practice? Questioning practice can easily be organised in grand rounds, bedside teaching, clinics, or over lunch with colleagues. Finding the evidence may require the involvement of librarians or information specialists. It has been demonstrated that without training, information seeking can not only take a long time but also be relatively ineffective.⁷⁻⁹ This statement itself has some uncertainty, as there are few studies and the methods for assessing search skills are not without some problems in terms of reliability and validity. However, there are short cuts and, clearly, for many questions we should start the searching process ourselves. If we do not find any evidence, it does not mean that it does not exist and at that stage we should involve the information specialists. Also, it is not possible, unfortunately, to take at face value everything that is published. It is necessary to evaluate the quality of the research and the implications of the results.¹⁰⁻¹⁵

In a meta-analysis of four empirical studies, Juni *et al.*^{11,12} demonstrated very clearly the overall effect of the three major methodological aspects on the effect estimates of randomised controlled trials. If there is no randomisation, the results of effectiveness may be overestimated by 20%. If there is no concealment of allocation of randomisation, the results of effectiveness may be overestimated by 30%. If there is no blinding, the results of effectiveness may be overestimated by 15%. This demonstrates clearly that methodological issues have a major impact on effect size. One, therefore, has to check carefully for these (and other) characteristics such as follow-up and intention-to-treat before assuming the validity of the results. This is the reason appraisal is so important.

One way to avoid having to appraise published research is to limit one's search initially to secondary sources of information where the appraisal has already occurred. These are becoming more widely available and include *Evidence-Based Medicine* (<<http://ebm.bmjournals.com>>),

Clinical Evidence (<<http://www.clinicalevidence.com>>), and the ACP journal club (<<http://www.acpjournals.org>>) amongst others. In these journals, the research article has been systematically evaluated for any methodological weakness and a summary produced. The Cochrane database of systematic reviews and randomised trials is not appraised evidence but is a major source of explicitly collected and synthesised information (<<http://www.cochrane.org>>). Although the methodology is explicit they are not always 'perfect'.¹⁵ This means that Cochrane reviews should be submitted to the same critical scrutiny that other systematic reviews should undergo. It is the reason that evidence-based medicine and ACP journal club include appraisals of the more important Cochrane reviews.

The reliability of research, and the likelihood that it does indeed represent the truth, depends largely on the research methodology including the type of study as well as the number and type of patients. There is much evidence for surgery from many types of research. However, the best available evidence is coming from randomised clinical trials which are considered to be the gold standard in clinical practice. A popular belief is that conducting randomised controlled trials is not possible in surgery. However, the following three examples illustrate the possibility of performing randomised trials in the surgical setting:

1. *Surgery is more effective than wrist splinting for the carpal tunnel syndrome (CTS).* A randomised controlled trial enrolled a total of 176 patients with CTS to compare efficacy of surgery with splinting.¹⁴ At the final follow-up assessment, 18 months after randomisation, the therapy success rates were 90% in the surgery group (61/68 patients) versus 75% in the splinting group (59/79 patients). Number needed to treat (NNT) was 7 with 95% CI 4-20. The NNT is the number of patients who need to be treated in order to prevent one additional bad outcome.
2. *A pre-operative smoking intervention decreases postoperative complications in patients undergoing elective knee or hip replacement.* Moller *et al.*¹⁵ conducted a randomised trial to investigate the effect of pre-operative smoking intervention (counselling and nicotine replacement therapy) on the frequency of postoperative complications (cardiopulmonary, renal, neurological, or surgical) in patients undergoing hip and knee replacement. Results from the 120 patients randomly assigned 6-8 weeks before scheduled surgery to either the pre-operative smoking intervention or control group showed that the overall complication rate was 18% in the smoking intervention group and 52% in controls ($P = 0.0005$). NNT was 3 with 95% CI 2-5.
3. *Surgery was more effective than orthosis for hallux valgus.* In a randomised trial, a total of 209 patients

with hallux valgus were randomly assigned to surgery (distal chevron osteotomy), orthosis, or a 1-year waiting list (control group) to compare the effectiveness of surgical and orthotic treatment with no treatment in patients with hallux valgus.¹⁶ After 12 months, 83%, 46%, and 24% of the patients in the surgery, orthosis, and control groups, respectively, had a decrease in the pain. NNT (surgery versus orthosis) was 3 with 95% CI 2–4.

Process

It is not enough to have just found the evidence. In some cases it may confirm that you are doing the right approach, in which case there is no need to change practice. However, there will be times when you need to act on the evidence. This is difficult to do alone and often requires the collaboration of the clinical team.¹⁷ It is useful in practice to have regular clinical meetings to discuss patterns of practice before changes need to be made.¹⁸ However, rather than introducing clinical team meetings and immediately suggesting changes to routine practice, it is recommended to use the initial meetings to highlight their importance in clinical practice and involve the whole team in the process of exploring alternative methods of practice. It is really not effective presenting evidence as a *fait accompli* to a clinical group. Involvement at an early stage is essential. Clinical case presentations at a less stressful setting than grand rounds are often the easiest process. Using students to do the presentation lets the team openly explore alternative approaches without 'loss of face'.

In general terms there are four major elements that produce the variation of effect in surgery:

1. The patients may vary in disease severity.
2. The patients may vary in healing response.
3. The processes of care will vary.
4. The surgeons' or doctors' technical performance may vary.

The natural variation of the first two will be larger in surgery than in drug trials.^{19,20} In drug trials there is certainly an effect from the process of care and style of the physician, but the effect is less than that of the processes of care in surgery. The process of care in surgery is a balance between technical skills and cognitive knowledge.²¹ The process of care in surgery may be pre-operative, intra-operative and postoperative. All these may affect the response to care. That makes standardisation for clinical trials very difficult. What may occur in one unit may not happen in the neighbouring unit. One clinician's process of care may vary from another clinician within the same unit. If a trial is designed to test a new surgical approach, these processes would all have to be the same. This is one major reason that randomised control

trials are so difficult to undertake. We need to investigate all the processes of care that surround surgical procedures as well as the procedures themselves. This could be regarded as a very daunting challenge but it might be actually a major opportunity for surgical research.

While we do not yet have research evidence from randomised trials for all those processes,²⁰ it is possible that surgical units will have major valuable experience that is worth sharing with other units.

These may be in the form of trials but this is unlikely as they are expensive and difficult to perform. In reality, many changes to practice do not occur with a trial. Most of these relate to process and some deal with avoiding potential harm.²² Pointing this out and letting other units change their practice has avoided problems yet there were no trials performed. Many changes in process result in improvement in practice.

Evaluation

There are many ways in which knowledge can be transferred.²³ Serial transfer is occurring when the same team repeats a task. A typical example of a serial transfer in a surgical practice is performing an emergency abdominal aortic aneurysm repair. This is a complex procedure that requires the input from many people working on different teams. In order to assess whether the performed surgical process could be improved, After Action Reviews should be carried out by a standing committee (no chairs) of health professionals involved in a surgical process. The main characteristics of After Action Reviews are shown in Table 1.

In this way, small items come to the surface such as the possible delay in getting the blood from the blood bank to the operating room. The task is to make small changes to operating procedure, which is easy to undertake. To evaluate the whole process from start to finish and address every issue is a huge task and not what this is about. In order to resolve complex problems, it is much better to make little changes rather than a complete overhaul. Making little changes is the answer to complex procedures – not complete overhaul. It is necessary to repeat the After Action Review on an informal basis to keep a check on process.

Near transfer occurs when another team works in a similar context. The process of sharing knowledge is both – electronic plus 'face to face'. The optimal process would be that, following an After Action Review, the unit had made a small change that affected the whole process dramatically and positively. Each unit should have a mechanism of sharing this with other surgical units that worked in the region. Instead of writing an annual report, the following report is generated:

1. Three things (for example, swabs, instruments, nursing staff, bowel prep, charts, timetable, *etc.*) the unit has

Table 1 The main characteristics of After Action Reviews

- The aim of After Action Review is to discover the real truth
- The meeting should be carried out immediately after performed surgery and it should last up to 10 min
- During a meeting and discussion, it is necessary to say what has been seen in the surgical practice
- It is recommended to identify no more than three issues that might need addressing during the discussion
- The concept of sugar coating (commonly applied to bad news which is cast in a positive light or at least, a minimally negative one in order to make it easier to accept) should not be applied
- Open discussion is necessary even with people who might be easily upset by any criticism of their activities or behaviour but this should not be an excuse for rudeness
- During standing committee meetings, someone must be designated to take notes

changed in the surgical practice in the last year that were successful.

2. Three things the unit has changed in the surgical practice in the last year that were not successful.

This would then be shared with the other surgical units in the region both directly and on the web site.

The final element is to make sure that the surgeons are acting upon the evidence. This requires examination of the records of practice and regular audit. There is a need to assess how well the surgeon and a surgical unit are doing. This is not based just on the aspects of care the unit or hospital managers are interested in (such as bed occupancy, *etc.*) but more this evaluation is based on the assessment of the process of surgical and health care. It is necessary to report standardised morbidity and mortality but also to check whether the changes introduced in the surgical practice are still happening. For example, if a new hand-washing protocol between patients has been introduced, then it is necessary to assess if the unit is still implementing this new protocol. Sadly, although there are good intentions, often there are some difficulties in implementing the changes and continuing to respect them. By undertaking routine, simple, small audits, the surgical unit will be able to assess whether the unit is continuing the high standards or maybe identify areas in which there is a requirement for improvement.

Conclusions

Surgeons need to make changes to the health care they provide all the time as new clinical evidence emerges. If the small change results in worse outcomes in the clinical setting, it can be simply reversed; however, this requires the

surgical unit to evaluate outcomes related to that change. Small, frequent changes are more likely to avoid failure of the system than large dramatic changes. Continuous information delivery to surgeons is required to enable them to keep up to date and to improve knowledge transfer.²⁴ There is no progress with no change and no change with those practitioners who can not change.

References

1. Plsek PE, Greenhalgh T. Complexity science: the challenge of complexity in health care. *BMJ* 2001; **323**: 625–8.
2. Wyatt JC. Management of explicit and tacit knowledge. *J R Soc Med* 2001; **94**: 6–9.
3. Jerome RN, Giuse NB, Gish KW, Sathe NA, Dietrich MS. Information needs of clinical teams: analysis of questions received by the Clinical Informatics Consult Service. *Bull Med Libr Assoc* 2001; **89**: 177–84.
4. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ* 1996; **312**: 71–2.
5. Cook DJ, Jaeschke R, Guyatt GH. Critical appraisal of therapeutic interventions in the intensive care unit: human monoclonal antibody treatment in sepsis. *Journal Club of the Hamilton Regional Critical Care Group. J Intensive Care Med* 1992; **7**: 275–82.
6. Dawes M, Summerskill W, Glasziou P, Cartabellotta A, Martin J, Hopayian K *et al.* Sicily statement on evidence-based practice. *BMC Med Educ* 2005; **5**: 1.
7. Rosenberg WM, Deeks J, Lusher A, Snowball R, Dooley G, Sackett D. Improving searching skills and evidence retrieval. *J R Coll Physicians Lond* 1998; **32**: 557–63.
8. Hersh WR, Crabtree MK, Hickam DH, Sacherek L, Rose L, Friedman CP. Factors associated with successful answering of clinical questions using an information retrieval system. *Bull Med Libr Assoc* 2000; **88**: 323–31.
9. Garg A, Turtle KM. Effectiveness of training health professionals in literature search skills using electronic health databases – a critical appraisal. *Health Info Libr J* 2003; **20**: 33–41.

10. Ioannidis JP, Haidich AB, Pappa M, Pantazis N, Kokori SI, Tektonidou MG *et al*. Comparison of evidence of treatment effects in randomized and nonrandomized studies. *JAMA* 2001; **286**: 821–30.
11. Juni P, Altman DG, Egger M. Systematic reviews in health care: assessing the quality of controlled clinical trials. *BMJ* 2001; **323**: 42–6.
12. Juni P, Egger M. Allocation concealment in clinical trials. *JAMA* 2002; **288**: 2407–8.
13. Shea B, Moher D, Graham I, Pham B, Tugwell P. A comparison of the quality of Cochrane reviews and systematic reviews published in paper-based journals. *Eval Health Prof* 2002; **25**: 116–29.
14. Gerritsen AA, de Vet HC, Scholten RJ, Bertelsmann FW, de Krom MC, Bouter LM. Splinting vs surgery in the treatment of carpal tunnel syndrome: a randomized controlled trial. *JAMA* 2002; **288**: 1245–51.
15. Moller AM, Villebro N, Pedersen T, Tonnesen H. Effect of preoperative smoking intervention on postoperative complications: a randomised clinical trial. *Lancet* 2002; **359**: 114–7.
16. Torkki M, Malmivaara A, Seitsalo S, Hoikka V, Laippala P, Paavolainen P. Surgery vs orthosis vs watchful waiting for hallux valgus: a randomized controlled trial. *JAMA* 2001; **285**: 2474–80.
17. Green PL, Plsek PE. Coaching and leadership for the diffusion of innovation in health care: a different type of multi-organization improvement collaborative. *Jt Comm J Qual Improv* 2002; **28**: 55–71.
18. Tobler HG, Sethi GK, Grover FL, Shroyer AL, Moritz TE, Henderson WG. Variations in processes and structures of cardiac surgery practice. *Med Care* 1995; **33** (Suppl): OS43–58.
19. Hannan EL, Popp AJ, Feustel P, Halm E, Bernardini G, Waldman J *et al*. Association of surgical specialty and processes of care with patient outcomes for carotid endarterectomy. *Stroke* 2001; **32**: 2890–7.
20. Kneebone R. Simulation in surgical training: educational issues and practical implications. *Med Educ* 2003; **37**: 267–77.
21. Taxis K, Barber N. Causes of intravenous medication errors: an ethnographic study. *Qual Safety Health Care* 2003; **12**: 343–7.
22. Dixon N. *Common Knowledge: How Companies Thrive by Sharing What They Know*. Cambridge, MA: Harvard Business School Press, 2000.
23. Olsen O, Middleton P, Ezzo J, Gotzsche PC, Hadhazy V, Herxheimer A *et al*. Quality of Cochrane reviews: assessment of sample from 1998. *BMJ* 2001; **323**: 829–32.
24. Dawes M, Sampson U. Knowledge management in clinical practice: a systematic review of information seeking behavior in physicians. *J Med Inform* 2003; **71**: 9–15.