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How to dissect surgical journals: I – Getting started*

An untrained observer will see only physical labour and often get the idea that physical labour is mainly what the mechanic does. Actually the physical labour is the smallest and easiest part of what the mechanic does. By far the greatest part of his work is careful observation and precise thinking.

Robert M. Persig (Zen and the Art of Motorcycle Maintenance)

This is the first of 16 articles outlining an approach to critical evaluation of the surgical literature. It is not another version of an evidence-based medicine text – there already plenty of those around. Nor is it a re-worded introductory text about statistics – I know how you feel about statistics. Rather, I have tried to write about the things that would have been useful to me as a young surgeon. I have tried to make the text 'surgeon-friendly'.

Although advances are being made for training in technical skills, and greater attention has been paid to the development of 'professional skills', the development of the skills needed for critical evaluation have languished. Why? Some assume that they have been adequately covered before the start of surgical training. Others, who have been given no reason to believe otherwise, regard these skills as synonymous with statistics and epidemiology. Many view such activities as the domain of academics and their fellow travellers; as if somehow there was a divide between the thoughts and actions of surgeons. Regardless of your manual skills, you need to develop the skills to filter, evaluate, and reconcile information.

There is a strong link between manual and cognitive processes. Spencer[1] suggested that 75% of the important events in an operation relate to making decisions, rather than to manual skill. They evolved simultaneously and are functionally inter-dependent. Similar concepts apply to the learning of manual and cognitive skills – task-specificity, learning curves based on experience, the ability to transfer skills between similar tasks, decay of skills that are not reinforced, and the propensity for short-term over practice to result in diminishing returns. Competent cognition is necessary during the acquisition, retention and application of complex motor skills.

Critical evaluation is also a survival skill. The personal toll of building a career can mount up – a lack of free time, family pressures, worry about difficult clinical decisions, criticisms for less than perfect results, and having to work within chaotic health care systems. So, you need to get your priorities right. It is a poor career choice to fall behind the growing edge of surgical knowledge; yet, on the other hand, a haphazard approach to acquiring information can soak up your time and energy. Do not waste time inefficiently seeking information when you could be doing other things, like taking care of yourself.

*The sixteen articles in this series are being made available on ANZJSurg.com as an eBook.

Become an expert

London taxi drivers must have 'the knowledge' – a detailed understanding of the topography of London within a six mile radius of Charing Cross. They cannot get their licence without it. But, as any London taxi driver will tell you, that is just a start: 'The knowledge' does not explain where to wait for the next job, how to pick up tips, or how to get your last job in the direction of home. There are no shortcuts to becoming an expert. And experts, be they surgeons or taxi drivers, share common characteristics (Table 1).[2] You will recognise these characteristics in your role-models and mentors, and perhaps yourself.

Expert surgeons spend time thinking and worrying about problems. Worry, dreams, and imaginary practice are all forms of cognitive processing. They are mechanisms for focusing onto unsolved problems in an attempt to find a solution e.g., 'the 2 am ward round'. Sleep plays a role in the consolidation of an array of learning and memory tasks. It provides an 'off-line memory' that helps to resolve problems through dream enactment. This is a very basic process. Even laboratory rats trained to traverse a maze reactivate memory traces in the cortex and hippocampus during sleep.[3]

What does it take to become an expert? Basically, commitment and time. It takes about 10,000 hours to achieve expertise at performing any complex task.[4] This comment is based on studies of diverse groups including sportspeople, musicians, fiction writers, and chess players. The old adage 'born to be good, train to be great' has a solid basis. Studies in the development of expertise have consistently failed to find 'naturals' who reach the top effortlessly. Mozart was no child genius and his greatest works were produced after he had been composing for more than 20 years; the Beatles had performed live 1,200 times, mostly in Hamburg, before they burst onto the scene in 1964; and, Bill Gates was able to satiate his obsession with computers through a series of lucky breaks whilst in high school. They achieved because they seized the opportunity to immerse themselves in a passionate pursuit. And so can you.

Don't confuse knowledge with expertise

Surgeons, and those who practice other forms of acute medicine, make decisions differently from physicians. We often have to make quick decisions based on incomplete evidence. Safe management, rather than just making a diagnosis, becomes the focus. This 'heuristic' approach relies upon experience and an appreciation of the pay-offs. It often finds expression in the form of adages. Hirshberg & Mattox[5] provide many examples in their sentinel text on trauma surgery e.g., 'An exposed vascular suture line is a ticking time bomb', 'Suture intercostal bleeders parallel to the ribs', and 'Choose

Table 1 The characteristics of experts

Experts:
Are very focused
Automate mechanical tasks
Work fast under pressure
Have an intuitive grasp of situations
Recognise problems early
Think about problems & worry
Acquire a rich professional memory
Develop broad concepts
Monitor their own performance and worry
Are highly motivated and proud

a definitive repair option that fails well'. In contrast, physicians tend to take an 'algorithmic' approach. They draw up a list of differential diagnoses, order tests, and review the situation over time.

The aim is to construct a strong theoretical basis for discretionary judgements. Difficult surgical decisions are rarely aided by a trip to a library – it is more profitable to get advice from an experienced colleague. Surgeons who believe that prime source information is the key face an enormous task. There are about 200 major surgical journals, and each journal publishes about 250 articles per year. So there are 50,000 new surgical articles appearing each year. Although this figure has to be sliced into many speciality interests, trying to cover all of the relevant articles requires more time than any busy surgeon can, or should, spare. You need to know how to dissect the surgical literature.

> *Where is the wisdom we have lost in knowledge?*
> *Where is the knowledge we have lost in information?*
> TS Eliot (1888–1965)

Don't become an information zombie. Information zombies are the people who go to meetings and sit through every session. Just look at their faces towards the end of the day. These are the people who try to remember slabs of text yet have trouble remembering what was on the last page. The great value of going to meetings and reading widely is that it provides a context – it defines the area. Furtive whispers made in the back row of a lecture theatre, inquiring comments made during a break between sessions, and inquisitional demands made of a speaker during question time are all useful parts of the process – although the last is usually the least useful.

What information do you need?

Attempts have been made to define a 'hierarchy of evidence' for written information (Table 2). Note that 'case reports and expert opinion' are listed as the lowest form of evidence. But this is misleading. Just because something is reliable does not mean that it is important. Although everybody is against untested conclusions drawn from inept quasi-analytical studies, there is a valid role for narratives and anecdotes. We do not want to waste too much time navigating the mole hills of personal experience; but, on the other hand, journals full of structured reviews and clinical trials are poor fodder for the 'jobbing' surgeon. Although systematic reviews and clinical trials tend to contain the most reliable information, they only cover a narrow range of topics. By their very nature, such publications usually relate to routine clinical care rather than surgical judgement. The results of quantitative research lack nuance and context. Remember that evidence-based medicine is a classification of knowledge, not a model of learning.

Table 2 A condensed version of the levels of evidence published by Maier[6]

Level 1	Systematic reviews, randomized controlled trials.
Level 2	Cohort studies, outcomes research.
Level 3	Case-control studies.
Level 4	Case series.
Level 5	Expert opinion, untested basic research.

Elitist academics and evidence-based doctors deride the surgical literature because it contains too much anecdotal information. Too many case reports. Too many narratives. They would prefer our journals to be full of high quality analytical studies under the blinkered guidance of statisticians, epidemiologists and public health doctors. But narratives play an important role in surgery. McBurney's point was based on a report of 11 patients.[7] It had great significance because it indicated that surgically curable appendicitis preceded the deadly condition known as perityphlitis (inflammation around the caecum).

Sometimes narratives are expressed as proverbs or epigrams (text that is short on words but long on experience). They promote the informal learning that occurs on ward rounds and during breaks between operations. They are mostly about attitudes and warnings and this helps trainees to become socialised into surgery. They help to define the 'surgical mentality'. They help the uninitiated to become socialised into the practice of surgery. Anecdotes are important – we all remember the patient with epigastric pain who was treated with antacids and died from an aortic dissection. As Maier[6] puts it: 'Evidence informs but does not replace clinical expertise'.

The ultimate aim is to improve patient care. And this requires more than the accumulation of a file full of level 1 evidence and a pocket full of pithy maxims. The surgical literature has lacked information about quality of care and risk management. This is a serious impediment to progress. The SQUIRE (Standards for QUality Improvement Reporting Excellence) statement seeks to redress that imbalance by promoting the better reporting of studies aimed at improving the quality of care. It is available in a digital form (*www.squire-statement.org*) and on paper.[8] Although the current efforts are rudimentary, it is the correct path.

Be aware of the confirmation bias

We are hard-wired to have a low tolerance for ambiguity. We have an impulse to simplify. Decisions are made in accord with our convictions rather than by careful evaluation. Ariely[9] discussed the famous 'Pepsi challenge' In one experiment, a group of neuroscientists

conducted preference experiments whilst the participants were hooked up to a functional magnetic resonance imaging machine. Both drinks stimulated the ventromedial prefrontal cortex (emotion), but only Coke had a major affect on the prefrontal cortex (memory, associations, ideas). Ariely concluded that advertisements, such as 'Things go better with Coke', are as 'much responsible for our love of Coke as the brown bubbly stuff itself'. As Baruch Spinoza (1632–77) commented: 'The mere comprehension of a statement entails the tacit acceptance of its being true, whereas disbelief requires a subsequent process of rejection'.

Sometimes convictions can affect the collection of data. Rosenthal & Fode[10] discussed a study in which psychology students were asked to evaluate the ability of rats to solve a maze. Both groups contained standard laboratory rats assigned at random, but one group of rats were falsely identified as being specially bred for maze brightness and they were incorrectly reported to be the best performers. In a similar vein, Koehler[11] asked 297 senior science students to evaluate the results of two experiments after being provided with false background papers. They gave higher ratings to reports that agreed with the background propaganda. More recently, Resch *et al*.[12] studied the responses of 398 reviewers of manuscripts for a respected journal. They were randomly assigned to assess two fictitious reports about the treatment of obesity. The reports were identical except for the description of the intervention being tested – one was an unproved but credible treatment (hydroxycitrate) whilst the other was implausible ('homoeopathic sculpture'). The assessments of the quality of the articles were appreciably higher for the more plausible intervention.

There was an avalanche of letters in response to the Veterans Administration Cooperative clinical trial examining the efficacy of coronary artery bypass grafting.[13] The trial found no significant difference in mortality between the medical and surgical treatments, but a subgroup of patients with obstruction of the left main coronary artery clearly benefited from surgery. The selective identification of faults in the study was used by both cardiologists and cardiac surgeons to justify their pre-existing positions.

The confirmation bias also relates to authors. Many of the analytical articles in surgical journals lack new information. It is fair enough to validate findings under a range of circumstances, but papers continue to be published well after something has been established with conviction. Fergusson *et al*.[14] evaluated clinical trials about the use of aprontinin to reduce perioperative bleeding in cardiac surgery. Their cumulative meta-analysis achieved stability after the first 20 of the 64 listed trials had been published.

Confirmation bias limits our ability to objectively evaluate new information. As Kaptchuk[15] comments the 'unbiased interpretation of data is as important as performing rigorous experiments'.

Understand innovations

New techniques often enjoy a surge of popularity before they either enter routine clinical practice or drift into obscurity. Concepts about the uptake of innovations, which is referred to in scholarly circles as 'diffusion', are based on a wide range of situations – including Paul Revere's ride across Massachusetts in 1775, cholera deaths around the Broad Street water pumps in London in 1854, the resurgence of

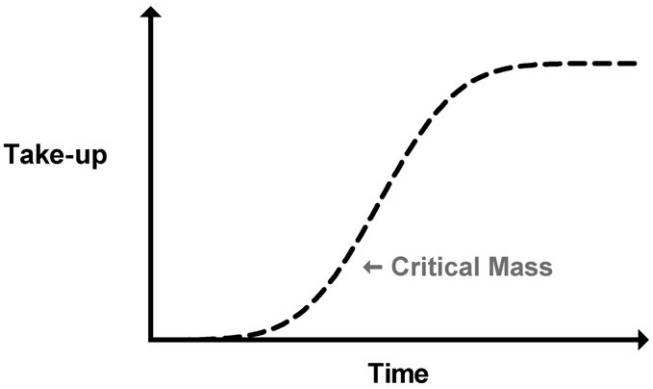

Fig. 1. The diffusion of new information.

Hush Puppies shoes in New York during 1995, and the taking off of the internet.[16,17] The classic diffusion curve is S-shaped. The diffusion becomes self-sustaining once a critical mass is reached, usually at a take-up of about 20% (Figure 1). The shape of the diffusion curve depends on the success of the following stages:

- The process of invention,
- Take-up of the innovation by respected individuals (mavens),
- Spreading of the trend via 'communicators', and
- Judgements by users about its usefulness ('stickiness').

This type of application of social epidemiology has great relevance for the readers of surgical journals, and also for those who wish to sell things to surgeons. Fashions rise and fall. Laparoscopic cholecystectomy has gained universal acceptance; but some other minimally invasive procedures have faltered. Other techniques, such as early total pancreatectomy for severe acute pancreatitis, have sunk without a trace. Surgical dogma has a long half-life – basic surgical truths degrade at an estimated rate of about 1% per year.[18] This means that the amount of surgical literature that you need to be 'up to date' with is quite manageable, as long as you are selective.

It is unusual for old technologies to just fade away. Besides the laggards, there are often 'last gasp' advances in the old technology that hinder a smooth transition. Examples include the move from sailing ships to steam-powered vessels and the replacement of automobile carburettors with fuel-injected systems. Snow[19] has identified two reasons for 'last gasp' technologies. First, the old technology retreats to defensible ground e.g., sailing ships did more work on the open seas rather than around harbours. Second, the old technologies adopt parts of the new technology to improve their performance e.g., automobile carburettors used electronic controls. Snow comments that there is 'a danger in mistaking the last gasp for sustained improvement'.

Key Points

- Surgery involves discretionary judgements and complex motor tasks – both involve higher order cognition.
- Sound discretionary judgements require a strong theoretical base.
- Adopt the characteristics of experts: spend time thinking and worrying about problems.

- Embrace both anecdotal and high level evidence: the main enemy is second rate quasi-analytical studies.
- Experience is crucial, but convictions can lead to bias.
- The fate of innovations follow well-recognized patterns.
- Practice good time-management by staying up to date efficiently.
- Accumulate skills in critical evaluation slowly and steadily – iterate, don't procrastinate.

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