From protocol to pantogen and pantino: customizable surgical scripts with all the expert information

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Operative surgical training is handicapped by the lack of space and time of traditional training methods. This article reveals the extent and dangers of such constraints, and the benefits of surgical scripts with unlimited information, stored on a computer.

The surgical protocol is a popular way of expressing the principles of a surgical procedure. It is concise, memorable (particularly if associated with an acronym) and fits within the constraints of traditional publishing.

However, one should recall the original protocol. This was a sheet, glued to the front of a manuscript, summarizing its detailed contents. Surgery depends as much on the detail as on the principle. Surgical experts as well as trainees may not recognize the large number of steps they perform in an operation, and the mass of information required to support each step.

The trainee must learn these expert steps and information, ideally before he/she performs an operation. The cost of a poorly prepared trainee (or consultant) at the operating table is enormous in terms of time, manpower, hazards, and use of scarce facilities. Yet this operative detail from traditional training sources such as books, courses and workshops is disappointingly incomplete, mainly because of lack of space and time. Trainees may not be aware that their training programmes have defects. They may not believe this, until they are wrestling with an operation themselves.

Trainers themselves may deny the poor provision of detailed information. For instance, it is common to hear the following: 'You can only learn surgery by doing it', 'All patients are different, so you cannot cover all possibilities' and 'Get the principle and the details will follow'.

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Trainers may fear the enormity of filling such an information gap, but the prospect of adapting an existing fully detailed text, requiring minimal effort to align with their own preferences, could be most attractive.

Pilots have detailed flying manuals, concert soloists have scores, and actors have scripts. Why not have operative surgical scripts?

CONSTRAINTS OF TRADITIONAL TEXTS

The lack of operative scripts is linked to the constraints of traditional texts. The constraints are hard to recognize and to reject, despite the complete freedom offered by the computer. A compressed text may give appear clear and useful, when really it is misleading or only half true. For instance, consider the sentence:

'Identify and preserve the right ureter, gonadal vessels, and the duodenum.'

This is derived from an operative textbook describing a right hemicolectomy for a carcinoma. It would appear to be a single step, but is, in fact, a whole section of the operation covering six steps. These are:

1. Identify the ureter
2. Preserve the ureter
3. Identify the gonadal vessels
4. Preserve the gonadal vessels
5. Identify the duodenum
6. Preserve the duodenum.

It should be possible to expand the text, but this cannot happen because the text is in a book.

When the text is expanded on a word processor, it becomes clear that the order of the steps is not ideal. The trainee may try to identify the ureter before identifying the gonadal vessels, which are more superficial. This would probably lead to troublesome bleeding from the vessels. It should be possible to change the order of the steps, but not in a book.

The surgical expert would have to disagree about preserving the above structures. The gonadal vessels are often divided without mishap. The ureter may need to be divided if invaded. The duodenum may need to be resected with en bloc removal of the tumour. It should be possible to change this text to clarify these points.

Finally, the reader is given no information about how to perform any of the six steps. This is where it should be possible to add all an expert's operative experience, plus have space to add notes, comments and updates to this information at any time. With a computer-based text, a pantogen, all these requirements are easily met.

WHAT IS A PANTOGEN?

A basic pantogen consists of an unlimited amount of text stored on a word processor. There is often 20 times more text than is common in operative textbooks. *Figure 1* is page 41 of a right hemicolectomy pantogen, which is 78 pages long.

The layout is clear and uncompressed on the right hand page. The opposite page is left blank for the user to write in any alterations or additions.

The text is divided into sections, which are similar to the familiar divisions seen in traditional text. *Figure 1* shows section 7 out of a total of 14 sections. Section 7 describes the mobilization of the right colon and ileum.

Each section is divided into an unlimited number of steps. These steps

are very small, many more than are seen in textbooks. Each step is often just a simple command. For instance, section 7 contains 31 steps, the fifteenth of which is: 'Identify the right ureter'.

Each step is supported by an unlimited number of items of information. Such pieces of information are usually very simple, obvious when pointed out, and easy to remember, but might take years to acquire by trial and error. They have not been comprehensively documented previously. Some steps, such as: 'Check you have the correct patient', do not need any information support. Other steps will need a great deal of information support, of several different types. In *Figure 1*, the step: 'Identify the right ureter' has 23 items of information.

WHAT IS A PANTINO?

The item of information is so fundamental to pantogens that it has been given a new name — a pantino. A medium-sized operation may contain 1000 pantinos, and a major operation more than 2000.

Pantinos come in 24 or more useful surgical categories, which break down into three main groups — basic pantinos, problem-avoiding pantinos and problem-solving pantinos (*Figure 2*). Any step may be supported by pantinos from any category.

Primary pantinos in the text lead to layers of secondary and tertiary information. The expert usually performs operations using the primary pantinos. If things go wrong, he/she uses deeper layers of information to retrieve the situation. The novice, lacking these secondary and tertiary pantinos, is likely to get into more and more serious trouble.

Right hemicolectomy pantogen Page 41

Section 7.00 Mobilising the right colon and ileum

Step 7.15 Identify the right ureter

Write here any additions, updates, changes, diagrams, etc

Identify the ureter as it runs down the right paracolic gutter

I prefer to use dissecting scissors
Professor Smith

Use a pledget on a stick

It is deeper than the testicular/ovarian vessels. In the upper half of the dissection it is lateral to these vessels. In the lower half, it runs medially

It is thicker, being over 5 mm diameter

It is whiter than the testicular artery and has very fine blood vessels running along it

It may be adherent to the medial leaf of the paracolic peritoneum as you pull that tissue medially

11 01 01
we found a double ureter today

Prod it to show its characteristic downward peristaltic contractions

Trace it from the kidney to lower end of the peritoneal incision as it runs over the right common iliac artery at the pelvic brim and into the pelvis

Make sure it is out of danger, but do not deliberately free it from its bed

If you cannot find the ureter:

Ask for help from a more experienced surgeon

If the ureter is compressed by the tumour:

Dissect the ureter free

If the ureter is definitely invaded by tumour:

Remove the invaded ureter in continuity with the tumour

Tie off the proximal ureter

check there is a left kidney before doing this
MHE

Consider a right nephrectomy

Figure 1. An illustration of one step in a right hemicolectomy pantogen.

APPLICATIONS OF PANTOGENS

So far, pantogens cover 80 general surgical operations, ranging from a three-stage oesophagectomy to a haemorrhoidectomy. There are pantogens for fine needle aspiration and sigmoidoscopy, since traditional texts lack essential detail for these very minor procedures just as much as for larger operations.

The most direct use is in everyday surgery where all the pantogens are printed out and displayed in loose-leaf folders for all operating staff. The senior staff use them as a check before starting complex operations, for clarifying a point with a trainee and for recording new information or a solution to a new problem. The trainees read the texts before and after assisting at and performing operations. The nurses use them for training, particularly equipment assembly, checking, testing and troubleshooting.

Colleagues modify the texts to suit their preferences (*Figure 1*) and then have their own personal versions printed out from computer disk. They change about 10% of the text, usually different equipment and materials. Specialist registrars can build up their own library of pantogens, modified with information as they move from one firm to another.

House surgeons, medical students and surgeon's assistants use the interactive multimedia CD-ROM version of pantogens on basic surgical skills (Edwards and Trigwell, 1999). These are permanently available with surgical equipment and materials in the operating department. Two CD-ROMs on a basic open surgical training operation and a basic laparoscopic training operation (Edwards, 1995, 1997) are available for junior surgical staff.

Text versions of pantogens are easy to transmit on the Internet for distance learning and distance expertise. They are being prepared for the website of the Royal College of Surgeons of Edinburgh.

WRITING PERSONAL PANTOGENS

The easiest way to write a pantogen is to customize an existing pantogen and edit the text by hand to suit your preferences. The alterations are made on floppy disk and customized print outs will be made.

Starting from scratch is harder work. However, most experienced surgeons can visualize the steps of their operations. It is relatively easy to dictate the first draft of the text into a hand-held Dictaphone: put everything down that comes to mind. There are no limitations to the size of the pantogen. A secretary can type out the first draft, but the editing takes longer. Follow the advice of Hartley (1994) for the ideal layout. Check the steps and the pantinos against what you actually do during your next case. Check them again when you are assisting your registrar. You will become aware how much information you use subconsciously as an expert when you see a trainee operating. Add all this to the text, and do not leave anything to doubt. Put in the numbering last. Expect to make three or four editions before the text is robust enough. It will be revised indefinitely.

THE FUTURE OF PANTOGENS AND PANTINOS

Pantogens and pantinos are in their infancy. They could easily become standard for best practice operations. Research into surgical technique is possible by correlating the pantogens of several experts with the outcomes of surgery. They are an easy move towards quality assurance in the operating theatre. They are suitable for any procedure. They could become required backup information for any paper or presentation where there are constraints on space or time. They should become effective adjuncts to traditional training methods in operative surgery. It would be satisfying if they made the trainee indistinguishable from an expert. HM

Conflict of interest: Mr M Edwards is director of Scalpel Information Systems.

Edwards MH (1995) *CurrentTechniques in Surgery. Open Repair of Inguinal Hernia on CD-ROM.* Advanced Surgical Education Systems, Warrington

Edwards MH (1997) *CurrentTechniques in Surgery. Laparoscopic Cholecystectomy on CD-ROM.* Advanced Surgical Education Systems, Warrington

Edwards MH, Trigwell PJ (1999) *PrimeSkills in Surgery on CD-ROM.* Advanced Surgical Education Systems, Warrington

Hartley J (1994) *Designing Instructional Text.* Kogan Page, London

Basic pantinos	**Problem-avoiding pantinos**	**Problem-solving pantinos**
Where is the anatomy?	**D**angers	**S**urprises
Instruments	**If** If a happens, then do b	i.e. The opposite to common sense
Materials	Or If you can't do c, then do d	**U**npredictable
Beginning	If you still can't do c, then do e etc.	i.e. No way of working this out from basic principles
Landmarks	Or If f and g and h, then probably do i	**P**roblems
End point	**T**ips	**E**rrors
Do it this way	**C**hecks	**R**ectifying errors
Other ways	**H**ints	**M**ayday
No-nos	**E**vidence	i.e. When to call the boss
	Suggestions	**A**nything else
		Next step
WIMBLEDON	**DITCHES**	**SUPERMAN**

Figure 2. Twenty-four categories of pantinos (items of surgical information) divided into three groups with an acronym as a memory aid.

KEY POINTS

- Constraints on operative surgical information should no longer be tolerated.
- Computer-based texts (pantogens) provide unlimited information (pantinos).
- Pantogens are suitable for any operation and any operative regimen.
- Pantogens should accelerate operative surgical training.
- Pantogens should assist in quality assurance.

Forthcoming articles in the Education and Training Update

Medical Masterclass	John Firth gives an outline of the Medical Masterclass, which comprises twelve paper-based modules, two CD-ROMs and a companion website. Its main aim is to help doctors in their first few years of training to improve their medical skills and knowledge, and in particular in their preparation for the MRCP examination. It will also be a valuable tool for continuing professional development
Career success after flexible training in psychiatry: a survey of former flexible trainees	Alicia Etchegoyen, Fiona Stormont and Ilfra Goldberg discuss the results of a retrospective survey of the progress of flexible trainees in psychiatry into the Consultant grade in the two Thames Regions