

lung be punctured during the procedure this is most unlikely to lead to complications.¹³ Interventional radiologists also have the skills to carry out direct percutaneous puncture of the hepatic veins or inferior vena cava in patients in whom the jugular and subclavian veins cannot be used; they are, therefore, capable of offering a complete venous access service.

Time for re-evaluation

The time has come for all hospitals to re-evaluate the methods they use to insert these catheters. The surgical cutdown should be abandoned; the blind percutaneous method should be considered to be very much a second best. The interventional radiological method is easy to learn; uses equipment that is widely available commercially; and has many advantages, including lower overall costs—a catheter can be inserted on an outpatient basis in about 30 minutes, with the patient being allowed to go home after a short period of observation. Gaining access to angiographic suites is much easier than scheduling catheter insertions in operating theatres, allowing the procedure to be carried out at short notice. Even implantable ports may be inserted by radiologists. Referring clinicians occasionally question the risk of infection if placement of a catheter is done in the angiography

suite instead of the operating theatre; the published evidence shows that the rates are much the same whether the procedure is done in the radiology department or in the operating theatre.¹³⁻²¹

The only real problem with the interventional radiological method of insertion is that there are too few radiologists to cope with the demand for interventional radiological procedures. Many are reluctant to provide a new, high volume service. This problem should be recognised and addressed. The Royal College of Radiologists is currently exploring ways of providing specific training in interventional radiology.

The method of inserting long term central venous catheters should no longer be dictated by tradition and habit. Oncologists and other clinicians whose patients need these catheters should question the practice in their hospitals, and interventional radiologists should learn these techniques. Patients requiring Hickman lines have enough problems to cope with already and should not be subjected to a higher risk or greater inconvenience than is necessary.

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Problem based, small group learning

An idea whose time has come

Problem based learning is an educational method that uses problems as the starting point for student learning.¹ In medical education these problems are usually clinical and integrate basic science with clinical thinking. Such methods have been used since the 1960s, when the medical school at McMaster, Ontario, first introduced an entirely new approach to medical education.²

Identifying material for a course of problem based learning requires teachers to analyse their discipline for the critical elements that are essential to medical practice. Once such core elements have been identified, clinical problems can be composed and supporting learning activities (such as lectures, practicals, workshops, and clinical attachments) arranged. Students learn by seeking solutions to the problems. To do this they work in small groups to break the problem into its constituent parts, identifying relations and connections along

the way. Individual learning and attendance at timetabled activities follow, with students searching for answers to questions they have raised themselves during the analysis. Validation of learning takes place in the small group under the eye of the tutor.

Problem based learning has spread to continental Europe, the Middle and Far East, and Australia³ but has not taken root in the United Kingdom. Newly established medical schools are most likely to use problem based learning, although complete conversion within a traditional curriculum and within existing resources is possible.⁴ A "dual track" approach has been successfully used in several schools (for example, the University of New Mexico).⁵ Evidence of its effectiveness in producing medical graduates comparable to those produced by traditional programmes has been sporadically produced, and concerns have yet to be assuaged that it fails to influence

the development of general problem solving skills. A recurring concern about problem based learning is that it costs more in terms of staff time; however, its effect is not to increase teaching time but rather to change how this time is spent—for example, teachers using problem based learning spend up to 40% more time working with students.⁶ Assessment is another concern. The experience at McMaster, where feedback on progress is prominent, shows that knowledge remains an essential foundation for learning and that it must be tested without styles of student learning being unwittingly distorted.⁷

With publication of the results of Harvard Medical School's evaluation of its new pathway programme⁸ and two recent major review papers, we are still no clearer about the effects of the method on problem solving skills. Harvard used multiple measures, including questionnaires, interviews, and videotapes of consultations, to compare students on the two year preclinical component of the new pathway with their peers randomly allocated to the traditional programme. They found that the students allocated to the new pathway reflected more on their learning, memorised less than their peers, and preferred active learning. Interpersonal skills, psychosocial knowledge, and attitudes towards patients (for example, patient centredness and empathy) were better in the new pathway group, and the students felt more stimulated, challenged, and satisfied. There were no differences, in terms of biomedical knowledge, between the two groups of students in performance in the National Board of Medical Examiners' part I examination. New pathway students reported less cramming of knowledge before exams; better retention in the months afterwards; and, because the result of the exams was a pass or fail rather than a grade, feeling less threatened.^{9,10}

Promoting enjoyable learning

Although the authors recognised that students adapt to the learning environment in which they find themselves, the new pathway students reported significantly greater autonomy, more innovation and involvement, and similar work pressures to those reported by matched controls after two years. The new pathway students were also more sure of themselves in handling uncertainty. Students on the traditional curriculum were more likely to use the key words "non-relevant, passive, and boring" to describe their preclinical experience. New pathway students, however, reported that some interpersonal aspects of tutorial work caused frustration and anxiety, as did concerns over what and how much to study.

Other findings echo these from Harvard. Two recent review papers, one examining over 100 papers about problem based learning and the other reporting on its psychological basis, have offered medical teachers a broad reference base from which to draw conclusions. For Albanese and Mitchell, concerns about the costs of implementation and about the cognitive processes that some students may develop balance evidence of adequate learning of basic science and the development of self learning skills.¹¹ They recommend caution when considering curriculum-wide conversion to problem based learning, suggesting teacher directed learning of basic science alongside the exploration of clinical cases with problem based learning.

Norman and Schmidt, from McMaster (Canada) and Maastricht (Netherlands), report that students using problem based learning have a greater intrinsic interest in learning, their self directed learning skills are enhanced (and are retained), and basic science concepts are better integrated into the solving of clinical problems.^{12,13} They also report that, although the problem based learning format may initially

reduce the amount that students learn, subsequent retention of knowledge is increased. The review emphasises the importance of students puzzling through problems to learn concepts and suggests that individual learning and groups without tutors may both have a role in the future.

Both reviews emphatically support the psychosocial effect that problem based learning has on students and teaching staff. The attitudes of teachers and the atmosphere of cooperation in a problem based learning curriculum mean that graduates report that they find the "learning environment more stimulating and more humane" than do graduates of conventional schools. With undergraduate medical education currently carrying a health warning because of the stress and anxiety exhibited by students and young graduates, any educational process that promotes enjoyment of learning without loss of basic knowledge and skills must be a good thing.¹⁴⁻¹⁶

The General Medical Council has strongly recommended reform of the curriculum in Britain.¹⁷ It wants substantially less teaching of factual information. Instead, it wants an integrated "core" curriculum based on body systems, with active learning driven by curiosity and a greater use of the critical evaluation of evidence. Special study modules will augment core and offer students in depth opportunities to study scientific method and research.

British medical schools are thus under pressure, not only to reform their curriculum but also to change the process of learning. The response so far has been encouraging. Study guides and learning contracts are being introduced in Dundee; clinical skills units are planned or in place at St Bartholomew's Hospital and in Dundee, Leeds, and Liverpool; computer assisted learning is a feature of Aberdeen's plans; and multidisciplinary groups characterise planning for reform of the syllabus in many schools. Sheffield is piloting a structured supervision project, and special study modules have been developed in Birmingham, Edinburgh, Leicester, and Manchester. Manchester has already introduced problem oriented group work into its first year course; Glasgow and Liverpool are committed to problem based learning as a major learning strategy from 1996; and other schools are actively considering its introduction. As far as Britain is concerned, problem based learning seems at last to be coming in from the cold.

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