Commentary: both hospital and community services are needed

Although stroke is common few properly designed studies have tested the value of different approaches to management. But acute stroke units have been shown to confer benefit, and the argument in favour of having an acute stroke unit in every hospital seems to me to be compelling. This is not to say that there should not be equally well organised stroke services in the community. We do not yet have data to indicate that a community based stroke rehabilitation service would be effective. But given the huge cost of stroke patients in both financial and social terms such a study seems long overdue. The likely outcome is that there should be a continuum beginning in hospital and then following through when the patient goes home. In the meantime it is important to recognise that some patients are more likely to benefit from rehabilitation than others and resources should be directed at those with the best prognosis.—PETER C RUBIN, *professor of therapeutics, University of Nottingham*

focus for the training of medical and non-medical staff and for the development and evaluation of new techniques. Unless stroke care is coordinated from a single centre we will not be able to evaluate new

treatments when they become available. Only by concentrating clinical skills in one area can stroke care be effectively coordinated, and only by concentrating stroke patients in one area will appreciable advances be made in knowledge and clinical practice.

Stroke units have been shown to provide the most effective service. They should coordinate stroke management until we have a better and cheaper alternative. Without a considerable investment of time and effort, community services are incapable of mounting any form of comprehensive coordinated programme. If it does not become routine policy for stroke patients to be managed in specialist units the quality of stroke management will inevitably decline.

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Medicine in Europe

Electronic health records: the European scene

Dipak Kalra

This is the 11th in an intermittent series of articles looking at medical issues in Europe

Caring for patients' health problems relies increasingly on sharing information between clinical departments and disciplines and with managers. The medical record of the future will need to provide a flexible and shareable framework for recording and analysing the consultation process. The advanced informatics in medicine (AIM) programme seeks to encourage research and development in telemedicine in areas that are beyond the scope of any one country. It includes many European projects attempting to define the best storage and transmission formats for such diverse data types as laboratory results, bio-signals, x ray images, and photographs, and in clinical specialties varying from intensive care to medicine for elderly people. One example, the good European health record project, is developing a model architecture for computerised health records across Europe that is capable of operating on a wide variety of computer hardwares and will also be able to communicate with many different information systems. The ultimate European health record will be comprehensive and medicolegally acceptable across clinical domains, hold all data types, and be automatically translated between languages.

In the future, a French patient on holiday could walk into your consulting room and present you with an optically printed card containing his entire medical file, which is written in French and uses ICD-10 classification terms. Sitting at your consulting room desk, using an updated version of your current com-

puter system, you place his card into your card reader. Your system presents to you (with familiar screens) the file in English and with matched Read terms. You will be able to see the medical summary created by your French counterpart, but your system will also have scanned the record and created its own summary in your favourite predetermined way. If you need to see a recent radiograph on the patient, your system can dial up his district hospital in France, and the radiograph can be shown on screen. You make a record of the consultation in English, confident that his own doctor can later read it in French (and that an appropriate bill will be sent directly to the insurer). You will copy your consultation onto his optical card and retain a copy of it or even his entire medical file in your system's hard disk for medicolegal eventualities.

This vision is not farfetched. Its components are being developed in Britain and the rest of Europe. There are many initiatives in the world of medical informatics within the United Kingdom and across Europe which will help to unlock the true potential of the computer in the clinical domain.

Britain, 1994

Successful and creative information management is rapidly becoming essential to developments within the NHS. As hospitals and general practice become more complex, the computerisation of many administrative processes is vital for strategic planning and resource management. The devolution of local budgetary

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MARGOT and ISAAC—part of the AIM programme

THE MANSSELL COLLECTION

control and the collaboration of patient care across many clinical disciplines rely heavily on shared, computer based information.

Clinicians are increasingly becoming aware of how computers can support their clinical practice: in managing chronic and complex diseases, medical audit, and automatic generation of summary reports, for example. Unfortunately, the computer technology currently installed in most hospitals and general practices, and more importantly the data modelling concepts which underlie these systems, are ill equipped to cope with the exciting opportunities which lie ahead. The medical record of the future will need to provide clinical practice with a flexible and shareable framework for recording and analysing the consultation process. General practitioners' various computer systems and local hospitals need to be able to access these records.

The NHS Executive's key objectives in its information management and technology strategy include an approach to patient care plans based on patients' electronic health records rather than on conventional institutional records. This recognises the growing importance of shared care, and the parallel requirement to share relevant health information.

The AIM programme

The advanced informatics in medicine (AIM) programme, funded through the European Community,

seeks to encourage research and development in areas of telemedicine beyond the scope of any one country, or where the expertise of several countries could usefully come together to enrich the work. Its projects (box) involve the collaboration of many different institutions and commercial organisations, each spread over several European countries.

AIM forms part of a telematics framework (RACE II), which is in turn a component of the 1990-4 research and technological development programme in the European Union. This vast programme, at a cost of 57m ecu, was launched in June 1991. It contains five specific research and development programmes: ENS (administration), DRIVE (transport services), AIM (health care), DELTA (flexible and distance learning), and ORA (rural areas). The European Commission will fund up to half of the costs incurred by commercial organisations (or the full costs of an academic body) and expects the commercialisation of any benefits of the projects to generate the rest of the costs.

AIM's approved projects include the evolution of optimal processes and standards which could help harmonise important facets of the handling of medical information. The first prototypes and draft proposals for standards are now being produced. These standards will be made freely available, and the new hardware and software that result will have commercial possibilities for their development.

The Good European Health Record project is one example of such a collaboration. An academic body (the Medical College of St Bartholomew's Hospital) is coordinating a 5m ecu project which includes industrial partners such as SmithKline Beecham and France Telecom; hospitals in England, France, and Portugal; and several computer developers throughout Europe. The project brings together expertise from clinical and academic practice as well as industry. Starting from an existing prototype, the project aims to develop and propagate a common architecture for computerised health records across Europe, making health records compatible across clinical domains, countries, and computer systems.

Developments in computer technology

Newspaper advertisements show that personal computers are tumbling in price and yet advancing in speed and storage capacity in leaps and bounds. Unfortunately, many of the early systems used in general practice and hospitals are based on a large, intelligent central computer and simple terminals at the user end. Modern systems have networks with a central information store and intelligent personal computers

Projects in the AIM programme

BEAM—Biomedical equipment assessment and analysis
CAMARC II—Computer aided movement analysis
COVIRA—Image analysis in oncology and neuroscience
DIABCARD—Communication in diabetes using chip cards
DILEMMA—Logic entering in GP, oncology and shared care
EMDIS—Marrow donor information system
EPIC—European prototype for integrated care
ESPIS—EEG signal processing and interpretation in sleep
ESTEEM—EMG platform
EURIPACS—European integrated picture archiving system
FEST—Framework for telemedicine services
GALEN—Generalised architecture for language handling
GEHR—Good European health record
HELIOS—Hospital object software tools
IDMR—Intelligent decision-mapping record
IMPACT—Integrated microscopy for pathology
IREP—Integrated rehabilitation programme
ISAAC—Integrated rehabilitation support programme
KAVAS—Knowledge acquisition tools

MagnoBrain—Biomagnetic method for brain investigation
MARGOT—Medical record software
MEMPHIS—Measurement and modelling of health care systems
MENELAS—Medical records access system
MILORD—Multimedia interaction with radiology databases
MIMOSA—Medical image management
NUCLEUS—Integrated dossier for Hospital Information Systems
OEDIPE—Open data interchange system for ECG
OPADE—Drug prescription system
OPENLABS—Telematics for clinical laboratory services
ORATEL—Oral health telematic system
PROCAS—Care profiles system
QUICHE—Quality assurance for child health care
SAMMIE—Software for multimodal images and education
SEISMED—Security and protection in health systems
SEMAG—General architecture for knowledge-based systems
SHINE—Shared health information network
TANIT—Telematics for anaesthesia and intensive care
TeleGastro—Telematics for gastroenterology

(PCs) on the users' desks. Individual PCs can be upgraded according to the user's requirements, and users can access conventional software as well as their dedicated medical systems.

Faster and more responsive machines and customisation may be accompanied by easier methods of data entry. Software developers and computing departments have finally recognised that even the most brilliantly designed systems will fail if the user is presented with an unintelligible screen, or has to negotiate complex key strokes in order to enter data. Some AIM projects are working within window interfaces to devise strategies for clinical data entry, using a keyboard, mouse, touch screen with pen, or—further into the future—voice input. Those who need to compute on the move such as with home visits, will soon be able to use radio modems to keep in touch with their central computer base.

Communications links for sharing information

Caring for patients' health problems is increasingly about sharing information between clinical departments, and also with managerial and financial departments. For this, an appropriate telecommunications link has to be in place, a common language has to be used, and an exact structure for the data to be shared must have been agreed.

In the United Kingdom, links between general practice and family health services authorities have recently completed the pilot phase of testing. A national electronic mailbox system allows messages to be exchanged overnight. It uses EDIPACT, an international protocol for message exchange with formal rules concerning identification of the sender and recipient, the structure of the message, and the data elements which it contains. This protocol has been used already in several pilot projects within the United Kingdom, including the exchange of registration details between general practitioners and the family health services authority, and another in South West region enabling general practitioners to get laboratory data electronically into their surgeries. EDIFACT will soon be used in primary care to communicate fee claims and the clinical information necessary for cytology and mammography recall systems. Hospitals will be using it to communicate test results with general practitioners and for referral messages and discharge communications. The links between purchaser and provider units will become increasingly sophisticated.

In the next few years patients, clinicians, and information technology will be shared increasingly across Europe. Clinicians in general practice, as well as in hospitals, will need to directly access specialised types of data held on their patients. The most obvious is *x* ray data, and it should be possible for the electronic "address" of a chest radiograph taken at the local hospital to be held within the computerised health record and the computer to dial the hospital automatically and after an exchange of security codes to present the radiograph on screen. The same principle can be applied to electrocardiograms, laboratory results, microscopic slides, photographs, videos, and many of the other newer images that technology is generating.

For communications to take advantage of these opportunities, European standard messages are urgently needed. Research bodies themselves are not able to create "standards." The Comité Européen de Normalisation (CEN) has many working groups that review proposals for standards emerging from research and development projects. In consultation with relevant member states, the committee defines formal standards which then become applicable across that field within the European Union.

The European Commission currently funds many

research projects that are attempting to draft "pre-standards" for such diverse data types as laboratory results, biosignals, and *x* ray images. The commercial partners within each project consortium will develop software products to facilitate the storage, display, manipulation, and communication of such data. These will allow clinicians to access a wide variety of data types directly on their individual PCs within an institution and to pass such information effortlessly across Europe.

The future electronic health record

As well as projects concentrating on specific data types and the ways these may be handled, other projects are concerned with the integration of all of this information into a unified electronic health record. If patients are to benefit fully from the electronic age, the current paper medical records folder must be tackled. As well as test results, this record mainly consists of the narrative account of individual consultations as an inpatient, outpatient, or in general practice.

The clinician's thoughts in a individual consultation are given some structure by coding and classification systems. The clinical terms project, a three year British scheme, is attempting to compile a compendium of all useful terms across the clinical specialties; it is based on the Read classification. This might one day provide the rudimentary vocabulary of the NHS—but this concept still has much ground to make across the rest of Europe.

A comprehensive Read code set could greatly enhance the flexibility of data entry. A wide range of clinical terms available within a computer dictionary would certainly facilitate some freedom of expression, but searching through tens of thousands of terms for a phrase might itself prove an obstacle to that freedom, and a vocabulary alone does not solve the problem of the underlying record structure into which those words will be placed.

If a comprehensive electronic record is to become widely acceptable it must be truly portable. Even though each country may use a different classification system, the medical record must be able to accept data from any of these classifications. It must also accept input in any of the common European languages and be able to translate that record as accurately as possible into the other languages. To cope with the diversity of computer systems used in primary and secondary care throughout Europe, the ultimate European health record will be capable of operating on a wide variety of computer hardware and software systems.

Decision support and medical education

Once a framework for the storage of medical terms has been agreed, standard mechanisms can be devised to link the medical record computer to external databases and the newer decision support systems. Some projects are working specifically in this domain. It will soon be possible for a practitioner to highlight a clinical term or group of terms, press a help key—which will dial up a computer diagnostic support system—and receive on screen within a matter of moments a specific display showing a list of differential diagnoses, a page from a medical textbook, or the outline of an agreed care plan protocol. Many computer systems currently offer a limited version of this internally, giving drug interactions for repeat prescriptions. Linked to nationally updated systems, such support systems would be enormously powerful.

Such an interface also has a great role in medical education. Students could keep copies of all of their own clinical notes as they journey through their undergraduate training, and they could carry out

analyses of the work they are doing. Clinicians could review their own clinical work for medical audit or research.

Security and legality

Institutions now hold data mainly on their dealings with patients, but if health information from several sources is amalgamated a vast file could cover patients' whole medical life. Many professionals may see this as an exciting prospect, but there are many fears, particularly from patients, about such a "Big Brother" approach to their private health information.

A computerised record admissible in court must have a watertight method to identify the author (an electronic signature). It must be possible to update the record but impossible to alter or erase previous entries completely. Electronic record systems must be secured against illegitimate use and messages must be cleverly encrypted.

An agreed set of information may be recorded every time new data are entered in the electronic record. Such information could include the time and date, a definition of the time zone, the provider (identification number, name, position, level of competence, physical location, telematic address), identification of coding system used, definition of ownership of the information, and who is permitted to view it.

Whether such a unified record comes to exist or not, the electronic traffic of health information will grow. Information systems will be used by more people from non-clinical fields who need to access health related information. The legal and ethical issues are complex, and these are being considered within AIM. The legal status of paper and electronic medical records throughout the European Union is under review, and those projects will be drafting a series of official and legal issues which will need to be addressed before the record is capable of being used in a widely acceptable way.

Lesson of the Week

Acute swollen legs due to rhabdomyolysis: initial management as deep vein thrombosis may lead to acute renal failure

R H Mallinson, D J A Goldsmith, R M Higgins, M C Venning, P Ackrill

Rhabdomyolysis should be considered in the differential diagnosis of swollen legs. Mismanagement as deep vein thrombosis may lead to acute renal failure

Deep vein thrombosis is often diagnosed in patients who present with acutely swollen and painful calves. By contrast, rhabdomyolysis is a fairly rare condition that can easily be missed. It may be discovered only when the patient has established renal failure and the opportunity for preventive treatment has passed. We present the case history of a patient with bilateral calf swelling that was initially managed as deep vein thrombosis but was later found to be due to rhabdomyolysis. The initial management may have contributed to the development of acute renal failure and the need for dialysis.

Case report

A 44 year old man who had previously been well, apart from frequently misusing alcohol, was admitted to a neighbouring hospital's accident and emergency department after a particularly heavy bout of drinking, which had left him in a stuporous state. When he eventually woke up he could not walk; he had "pins and needles" in his legs, and his calves were swollen. Bilateral deep vein thrombosis was diagnosed and apparently confirmed by non-filling of deep veins on venography. The patient was therefore treated with intravenous heparin. At this stage his haemoglobin and blood urea concentrations and chest radiograph were normal, but the white cell count was raised at 12.2×10^9 cells/l.

Two days later he was oliguric with rapidly declining renal function, and he was therefore transferred to this regional renal unit. On arrival he had swollen, tense, tender calves; his foot pulses were absent, his urine was dark brown, and his serum creatine kinase activity was 30 000 IU/l. Acute renal failure secondary to rhabdomyolysis (possibly due to a combination of acute alcoholic myopathy and some muscle compression) was diagnosed, together with a compartment syndrome affecting both calves. He underwent immediate fasciotomies of his calves. Intermittent

haemodialysis was needed for two weeks while the kidneys recovered, and his renal function returned to normal within three weeks of discharge. The fasciotomies were repaired by plastic surgery, and his legs were functionally normal within six weeks of discharge.

Discussion

Myoglobinuria resulting from rhabdomyolysis is a more common cause of acute renal failure than is perhaps appreciated. The mechanism of renal damage, though first described by Bywaters and Beall in acute muscle trauma as long ago as 1941,¹ is still unclear. Non-traumatic rhabdomyolysis as described by Grossman *et al*² can easily be missed unless considered in a differential diagnosis. A retrospective study by Ward³ showed an incidence of acute renal failure of 16.5% in 157 patients with rhabdomyolysis. Subclinical rhabdomyolysis is probably quite common, but the full blown syndrome leading to renal failure is not, though it is responsible for 5-10% of the cases of acute renal failure referred to by renal units.⁴

DIAGNOSIS

The diagnosis of rhabdomyolysis rests on clinical suspicion, urine stick reagents testing positive for blood in the absence of urinary erythrocytes, myoglobinuria, and a raised serum creatinine phosphokinase activity. Other markers include lactate dehydrogenase, aspartate and alanine aminotransferases, phosphate and potassium (all released from dead and injured myocytes), and initially a low serum calcium concentration. Not all features may be present simultaneously, but patients with a high creatinine phosphokinase activity and myoglobinuria must be considered to be at risk of acute renal failure.

This case history shows how rhabdomyolysis may be mistakenly diagnosed as deep vein thrombosis, resulting in an important delay in treatment. The use of potentially nephrotoxic contrast media for phlebo-

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