

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

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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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graphy in patients with oliguric renal failure is inadvisable⁵; a positive diagnosis of deep vein thrombosis with this approach would be difficult given the pre-existing compression (hence inability to fill with contrast media) of the deep veins due to muscle oedema. The patient was treated with heparin, which has been linked in a recent report to the development of the compartment syndrome.⁶

In our case the leg swelling was bilateral, though not symmetrical. Unilateral calf swelling is much more likely to be the result of deep vein thrombosis than rhabdomyolysis. Even if only one calf is swollen, however, rhabdomyolysis should be excluded (by measuring the creatine kinase activity, especially when there are suggestive features in the history—for example, alcohol misuse, drug overdose, damaged muscle, and prolonged immobility or unconsciousness.

TREATMENT

Specific treatment for rhabdomyolysis should be started promptly to decrease the nephrotoxic potential of the released pigments. Appropriate treatment includes the administration of mannitol and normal saline, usually while monitoring central venous pressure; the correction of systemic acidosis; and after establishing good urinary flow, the maintenance of urinary pH at 7.0 or higher by infusion of bicarbonate and mannitol. Such treatment may prevent the dissociation of myoglobin with the release of the toxic moiety ferrihaemate. Acetazolamide can also be used to achieve urinary alkalisation. Alkaline urine will also reduce the crystallisation of uric acid, further reducing the potential for tubular damage.⁷ Early diagnosis and intervention can prevent renal failure and the need for dialysis. As with any forced alkaline

diuresis, careful monitoring of potassium and calcium is mandatory.

CONCLUSIONS

We recommend that anybody presenting with a history of prolonged immobility associated with muscle swelling should be considered to be at risk of rhabdomyolysis. These patients should have their urine tested for myoglobin, or for blood and red cells, and serum creatine kinase activity should be measured at an early stage. Prompt treatment as described should result in a better long term prognosis. Recovery from acute renal failure may be delayed if rhabdomyolysis persists in patients who develop compartment syndromes; these syndromes therefore need to be promptly recognised and dealt with. In addition to the beneficial systemic effects, a judicious fasciotomy can sometimes rescue limbs that would be otherwise lost; monitoring of intracompartmental pressure is a valuable and practical aid to management.⁸

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A FAMILY THAT CHANGED MY CAREER

Two preventable deaths

On my first day as a medical student in paediatrics in the 1970s I was assigned a 5 year old who had been admitted the previous night with what was thought to be a peritonillar abscess. On the clinical round the consultant paediatrician examined the child. She turned to us and said "You cannot rule out diphtheria in this case. Has anyone sent off the appropriate studies?" The child looked ill with a fairly swollen neck, a greyish exudate covering the back of her throat. Her sister was admitted later that day with similar symptoms. We called in the senior member of the infectious disease department, who had been involved in the last outbreak of diphtheria in the United States in the 1940s. She agreed that we needed to rule out diphtheria. A further opinion was sought from the best infectious disease expert in the city, who agreed that clinically it looked like diphtheria. Culture reports came back that night confirming the diagnosis. The children became more and more ill, soon requiring intensive care including ventilation. As the diphtheria toxin took hold heart failure ensued. Surgeons and anaesthetists finally used an aortic balloon pump to assist the function of their failing hearts. Both died in the next few days.

Reviewing their medical records, I found that the older child had been admitted to our hospital as a toddler with an iron overdose. The only comment in the record covering immunisations was "Mother poor historian." Although the mother came from a Latin American background, she spoke English and communicated well. She also recalled distinctly that every time the child had been taken to medical clinics she had not been vaccinated because of cold symptoms or some other reason. The child had not been vaccinated on leaving the hospital

after her initial overdose admission. Neither sister had been immunised against diphtheria, pertussis, and tetanus in spite of repeated contacts with medical services.

Their younger brother had had one immunisation. On testing he proved to have diphtheria infection but without clinical illness. The youngest child in the family had had a full immunisation and tested negative. The mother, pregnant at the time of the deaths of her two oldest children, suffered a miscarriage in the subsequent months. From this failure to immunise came the deaths of two children and possibly the miscarriage of a third. Had the girls been given even one injection against diphtheria, pertussis, and tetanus it could have saved their lives. All the technological advances available within a tertiary care specialist teaching hospital for children in one of the largest cities of the world were useless in the face of diphtheria infection that could so easily have been prevented.

My first two paediatric patients left an indelible impression that contributed substantially to turning me towards a combination of paediatrics and public health. I have not seen another case in the subsequent years but the outbreak in the Russian Federation shows that a failure or weakening of public health systems can lead to a recrudescence of the diseases that we faced in the past. The epidemic of tuberculosis in New York City and the recent increases of tuberculosis in London are ample evidence that public health and preventive medicine remain central to the maintenance of a healthy population.—LESLIE DAVIDSON is regional paediatric epidemiologist in South Thames Regional Health Authority