

## Migraine with aura and increased risk of ischaemic stroke

Patients should be treated aggressively for modifiable cardiovascular risk factors



MIGRAINE SCOTOMA/RICHMOND EYE ASSOCIATES

### RESEARCH, p 1015

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In the linked systematic review, Schürks and colleagues assess the association between migraine and cardiovascular disease, including stroke, myocardial infarction, and death as a result of cardiovascular disease.<sup>1</sup>

Migraine is a highly prevalent chronic condition characterised by a hyper-responsive nervous system that predisposes to recurrent episodes of severe headache and autonomic disturbance.<sup>2</sup> Roughly a quarter of people who have migraine experience temporary neurological symptoms, known as aura, before some or all of their headaches. Aura is distinguished from other causes of brief recurrent neurological disturbance, such as transient ischaemic attacks, by its gradual onset and disappearance, the presence of both positive and negative features, and its duration of an hour or less.

Visual disturbances are the most common sort of aura, although sensory or motor auras can also occur. Patients with aura can be identified using the visual aura rating scale (table), which assigns a point value to common aura features.<sup>3</sup> Its developers make the clinically relevant observation that to identify patients with aura it is necessary only to detect visual aura, because 99% of people with non-visual auras also have visual aura occasionally. Sensitivity to light and visual blurring or fatigue are common accompaniments to migraine but should not be confused with aura.<sup>4</sup>

Doctors have long suspected a connection between migraine and vascular events such as stroke. A previous meta-analysis of the association between migraine and ischaemic stroke provided support for this link, but it could not clearly distinguish risks for migraine subgroups and did not examine the risk of other vascular events.<sup>5</sup> The linked study by Schürks and colleagues incorporates results of several subsequent large, population based studies.<sup>1</sup> Importantly, the results clearly show that the increased risk of ischaemic stroke is

largely confined to migraineurs with aura, who have roughly double the risk of ischaemic stroke compared with people who do not have migraine. Migraine was also associated with an increased risk of transient ischaemic attacks and angina, but not haemorrhagic stroke.

Schürks and colleagues did not find a significant association between migraine and myocardial infarction or death from cardiovascular disease. Their findings should be interpreted cautiously, however, because the number of studies was too small to examine risks in subgroup. It is possible that when additional studies are available they will show that the size of the association between migraine and cardiac outcomes is different in people with and without aura.

The clinical implications of these findings are that patients who have migraine with aura should be followed closely and treated aggressively for modifiable cardiovascular risk factors. Counselling patients about their increased risk of stroke may increase adherence to recommended treatment, but the information should be put in context—the absolute risk of stroke for most patients with migraine is low, so a doubling of risk is not cause for panic. At a population level, however, this risk deserves attention because the prevalence of migraine is so high.

Schürks and colleagues found that the risk of ischaemic stroke in patients with migraine was magnified by the combination of smoking and oral contraceptive use, and that it was most apparent in women under 45. Previous work indicates that the association between migraine and ischaemic stroke in women directly correlates with the frequency but not severity of individual attacks.<sup>6,7</sup>

All of this suggests that clinicians need to identify young women with migraine, particularly those who are seeking oestrogen containing hormonal contraception. Those who have migraine without aura and are otherwise appropriate candidates for hormonal contraception should not be denied its benefits, because we have no convincing evidence of a clinically meaningful increased risk of stroke. For women who have aura, however, decisions about the use of hormonal contraception are more difficult.

Many experts recommend against the use of oestrogen containing contraception in women who have migraine with aura because they judge the risk of stroke to be unacceptably high.<sup>8</sup> Certainly this seems true for women who have aura and additional stroke risk factors, such as smoking and hypertension. Blanket

### Visual aura rating scale (VARS)<sup>3</sup>

| Visual symptom characteristic | Risk score |
|-------------------------------|------------|
| Duration 5-60 min             | 3          |
| Develops gradually over 5 min | 2          |
| Scotoma                       | 2          |
| Zigzag line (fortification)   | 2          |
| Unilateral (homonymous)       | 1          |
| Maximum VARS score            | 10         |
| Migraine with aura diagnosis  | 5*         |

\*A VARS score of 5 or more diagnosed migraine with aura with a sensitivity of 96% (95% confidence interval 92% to 99%) and a specificity of 98% (95% to 100%) in the derivation sample, and a sensitivity of 91% (86% to 95%) and a specificity of 96% (91% to 100%) in the validation sample.

proscription is hard to justify, however, because combination oestrogen-progestin contraceptives are the most effective form of birth control. They have other benefits as well. These must be weighed against other harms, which include the relatively small increased risk of stroke in women with no risk factors beyond aura. Although the risk of stroke is probably modified by the frequency of aura, we do not have good information on how other aspects of aura affect risk. Women who have longer auras, more complex auras, or whose auras appear or worsen in the context of hormone use might be at higher risk for stroke than those with only occasional aura.

In the absence of clear evidence, clinical judgment and tailored decision making are important. In most cases, women with aura should consider their reasons for using oestrogen containing contraception. Persuasive reasons for use despite an increased risk of stroke might include the treatment of conditions such as endometriosis. Another compelling reason for use would be contraception for a woman who is not willing or able to use alternative methods and would not consider termination of pregnancy if contraception failed.

The lowest tolerated oestrogen dose should be used, and treatment should be stopped if auras become more frequent or complex. The risk of venous thromboembolism varies with the type of progesterone. Risk is probably lowest for contraceptives with levonorgestrel and norethisterone.<sup>9</sup>

- 1 Schürks M, Rist PM, Bigal ME, Buring JE, Lipton RB, Kurth T. Migraine and cardiovascular disease: systematic review and meta-analysis. *BMJ* 2009;339:b3914.
- 2 Coppola G, Pierelli F, Schoenen J. Is the cerebral cortex hyperexcitable or hyperresponsive in migraine? *Cephalalgia* 2007;27:1427-39.
- 3 Eriksen MK, Thomsen LL, Olesen J. The visual aura rating scale (VARS) for migraine aura diagnosis. *Cephalalgia* 2005;25:801-10.
- 4 Mattson P, Lundberg PO. Characteristics and prevalence of transient visual disturbances indicative of migraine visual aura. *Cephalalgia* 1999;19:479-84.
- 5 Etmann M, Takkouche B, Isorna F, Samii A. Risk of ischaemic stroke in people with migraine: systematic review and meta-analysis of observational studies. *BMJ* 2004;330:63.
- 6 MacClellan LR, Giles W, Cole J, Wozniak M, Stern B, Mitchell BD, et al. Probable migraine with visual aura and risk of ischemic stroke: the stroke prevention in young women study. *Stroke* 2007;38:2438-45.
- 7 Kurth T, Schuerks M, Logroscino T, Buring JE. Migraine frequency and risk of cardiovascular disease in women. *Neurology* 2009;73:581-8.
- 8 Loder E, Buse D, Golub J. Headache and combination estrogen-progestin oral contraceptives: integrating guidelines, evidence and practice. *Headache* 2005;45:224-31.
- 9 Lidegaard O, Lokkegaard E, Svendsen AL, Agger C. Hormonal contraception and risk of venous thromboembolism: national follow-up study. *BMJ* 2009;339:b2890.

## Rehabilitation in patients admitted to intensive care

Needs to start before discharge and extend beyond physical outcomes



MAURO FERMARELLO/SPL

The number of patients who survive after a stay in the intensive care unit (ICU) is rising.<sup>1</sup> After leaving the ICU they continue to experience the effects of their primary illness and of interventions they received, and they have higher mortality rates and longer physical and psychological recovery times than the general healthy population.<sup>2</sup> Only 49% of patients treated in the ICU for acute respiratory distress syndrome return to work a year after leaving hospital.<sup>2</sup> Family members also experience psychological disturbances.<sup>3</sup> Thus, these patients represent a financial and social burden that extends beyond their initial illness.

Little research has been published about long term management in these patients: one randomised controlled trial,<sup>4</sup> a clinical summary,<sup>5</sup> and a few protocols. The trial's results suggested that rehabilitation started after discharge from the ICU could improve physical state at six months.<sup>4</sup>

In the linked study Cuthbertson and colleagues report a randomised controlled trial and cost effectiveness analysis of a nurse led intensive care follow-up programme aimed at improving physical state and quality of life 12 months after discharge from the ICU.<sup>6</sup> About 80 centres in the UK have already adopted this practice, which has yet to be validated. The authors reported a 33% dropout rate and no improvement in any of the physical and non-physical outcomes. No subgroup, stratified by severity of illness, chronic comorbidity, and length of stay in ICU, benefited from the intervention. Less than half the patients attended follow-up consultations

with family members. Furthermore, the follow-up programme was not cost effective, with average additional costs of £2316 (€2576, \$3803) in the treatment group. The authors suggested that contamination between the intervention and control groups, and the timing of the intervention might explain the findings, but what other reasons could account for the disappointing results? And in the absence of evidence, how can we improve outcomes in patients who have survived the ICU?

Evidence about such patients is difficult to obtain, even after discharge, for several reasons—for example, the challenge of defining syndromes and diseases, heterogeneity of patients, multiplicity of interventions, barely measureable outcomes, and lengthy follow-up, which increases the loss of patients and need for resources.<sup>7,8</sup> Also, patients are recruited solely from ICU irrespective of their clinical state on admission, which underscores the need to look at how we define critical illness and how we manage these patients, inside and outside the ICU.<sup>9</sup>

Accepting that critical illness begins and often ends outside the ICU is a good start.<sup>9</sup> The ICU team should not be restricted to the unit and should, in addition to treating the primary condition, participate in preventing and rehabilitating potential sequelae before, during, and after the ICU admission. Perhaps Cuthbertson and colleagues' study did not find any differences because the intervention was given exclusively to patients who were discharged from the ICU. It appears, in fact, that rehabilitative interventions begun in the ICU yield, in

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the short term, better outcomes. A randomised trial of critically ill patients on mechanical ventilation who were given physical exercises and early mobilisation during interruption in sedation had improved functional capacity, at least until discharge from hospital.<sup>10</sup>

Interventions should aim to not only improve morbidity and mortality in the ICU but also quality of life and future longevity. This optimisation “package” should also consider the future caregivers and families of ICU survivors, who need to participate in decision making and accompany the patient during ICU admission while receiving guidance and instruction about the next steps. Caregivers could also benefit from interventions aimed at preventing future psychological sequelae.<sup>3</sup>

While new evidence is emerging, it is an opportune time to examine current models of care in the ICU. Successful implementation of the “package” will need to take into account factors such as opportunity, intensity, frequency, and length of application. In the absence of randomised evidence we should consider the usefulness of other research designs—for example, observational or even ecological studies.<sup>11 12</sup>

- 1 Bernard GR. Acute respiratory distress syndrome: a historical perspective. *Am J Respir Crit Care Med* 2005;172:798-806.
- 2 Herridge MS, Cheung AM, Tansey CM, Matte-Martyn A, az-Granados N, Al-Saïdi F, et al. One-year outcomes in survivors of the acute respiratory distress syndrome. *N Engl J Med* 2003;348:683-93.
- 3 Anderson WG, Arnold RM, Angus DC, Bryce CL. Posttraumatic stress and complicated grief in family members of patients in the intensive care unit. *J Gen Intern Med* 2008;23:1871-6.
- 4 Jones C, Skirrow P, Griffiths RD, Humphris GH, Ingleby S, Eddleston J et al. Rehabilitation after critical illness: a randomized, controlled trial. *Crit Care Med* 2003;31:2456-61.
- 5 Tan T, Brett SJ, Stokes T. Rehabilitation after critical illness: summary of NICE guidance. *BMJ* 2009;338:b822.
- 6 Cuthbertson BH, Rattray J, Campbell MK, Gager M, Roughton S, Smith A, et al. The PRaCTiCal study of nurse led, intensive care follow-up programmes for improving long term outcomes from critical illness: a pragmatic randomised controlled trial. *BMJ* 2009;339:b3723.
- 7 Hebert PC, Cook DJ, Wells G, Marshall J. The design of randomized clinical trials in critically ill patients. *Chest* 2002;121:1290-300.
- 8 Vincent JL. Evidence-based medicine in the ICU: important advances and limitations. *Chest* 2004;126:592-600.
- 9 Angus DC, Carlet J. Surviving intensive care: a report from the 2002 Brussels Roundtable. *Intensive Care Med* 2003;29:368-77.
- 10 Schweickert WD, Pohlman MC, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. *Lancet* 2009;373:1874-82.
- 11 Dowdy DW, Needham DM, Mendez-Tellez PA, Herridge MS, Pronovost PJ. Studying outcomes of intensive care unit survivors: the role of the cohort study. *Intensive Care Med* 2005;31:914-21.
- 12 Vazquez Mata G, Rivera Fernandez R, Gonzalez Carmona A, Delgado-Rodriguez M, Torres Ruiz JM, et al. Factors related to quality of life 12 months after discharge from an intensive care unit. *Crit Care Med* 1992;20:1257-62.

## Use of erythropoietins in patients with renal transplants

Normalisation of haemoglobin is hazardous, ineffective, and costly



AI PHOTO/SPL

In the United States, patients with renal transplants account for about 16% of all people who have a glomerular filtration rate of less than 30 ml/min (stage 4 chronic kidney disease) or who require renal replacement treatment.<sup>1 2</sup> About 40% of patients with a kidney transplant have anaemia, and half of these are treated with erythropoietins.<sup>3</sup> Management of anaemia in patients with a kidney transplant is complicated by their long history of renal disease, the inflammation associated with infection or rejection, and immunosuppressive medication.<sup>4</sup>

Compared with patients who have chronic kidney disease, kidney transplant recipients tend to be younger, more active, and less likely to have cardiovascular disease, although they may develop anaemia at a relatively higher glomerular filtration rate.<sup>3</sup> Despite these differences, the linked study by Heinze and colleagues indicates that the association between anaemia and mortality previously observed in other patients with low glomerular filtration rate is also present in kidney transplant recipients.<sup>5</sup> Unfortunately, this study raises concerns about the safety of erythropoietins in patients with kidney transplants that are analogous to the issues in other patients with anaemia.

In 1990, a relatively small but convincing placebo controlled, randomised trial showed that recombinant human erythropoietin improved quality of life and decreased transfusion requirements, compared with no treatment, in patients on dialysis.<sup>6</sup> Widespread use of erythropoietins in patients on dialysis and people with chronic kidney disease followed, but questions remained

about the optimal target concentration of haemoglobin. Observational studies showed that low haemoglobin concentrations predicted death in dialysis patients—anaemia was thought to cause left ventricular hypertrophy, dilatation, and heart failure.<sup>7</sup> Anaemia became a therapeutic target for the reduction of cardiovascular mortality in people with end stage renal disease.

This optimism proved unfounded though, as the mortality benefits of erythropoietins have never been proved. In people with kidney disease, raising haemoglobin to normal concentrations, compared with more modest targets, seems harmful. For example, a large randomised trial in patients on dialysis who were treated with erythropoietins was stopped early because of increased mortality in patients treated to a high haemoglobin target.<sup>8</sup> Similarly, the CREATE and CHOIR studies of people with a low glomerular filtration rate showed more cardiovascular events in patients treated to a high haemoglobin target.<sup>9 10</sup> A meta-analysis of randomised studies in anaemic patients with chronic kidney disease found a significantly higher risk of all cause mortality in those treated to higher haemoglobin targets than in those treated to lower targets (risk ratio 1.17, 95% CI 1.01 to 1.35;  $P=0.031$ ).<sup>11</sup> The reasons for the increase in cardiac events remain unclear; direct toxicity of higher erythropoietin doses, the toxicity of iron, alterations in blood viscosity, and increased platelet function have all been postulated.<sup>12</sup>

Data on transplant recipients have also emerged: anaemia in transplant patients, as in patients on dialy-

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sis and patients with low glomerular filtration rate, is associated with increased mortality.<sup>13</sup> Heinze and colleagues' retrospective cohort study is an important extension of previous findings.<sup>5</sup> These authors assessed the associations between erythropoietins, haemoglobin concentration, and mortality by analysing 1794 renal transplant recipients who survived at least three months. They avoided the assumption that the relation between mortality and haemoglobin concentration was linear, and subdivided the data so as to examine the effect of various haemoglobin targets.

The relation between haemoglobin concentration and mortality was essentially linear in patients with renal transplants who did not receive erythropoietins: lower haemoglobin predicted death. A different pattern emerged in patients treated with erythropoietins: haemoglobin values below and above the reference range of 125 g/l were associated with increased mortality, leading to a U-shaped relation.

Should 125 g/l, the nadir in the haemoglobin-mortality curve, be considered a suitable target for transplant patients being treated with erythropoietins or for patients with chronic kidney disease? Perhaps not. A better method of selecting the optimal haemoglobin target is to consider the data in other, randomised studies. In the early placebo controlled randomised trial,<sup>6</sup> quality of life benefits were shown when erythropoietins were used to reach a target haemoglobin range of 95 g/l to 100 g/l. A meta-analysis of quality of life outcomes in patients treated to haemoglobin targets above 120 g/l compared with lower targets found that improvements were not clinically important.<sup>11</sup> The lower targets associated with better outcomes in the three large randomised trials in this area were 100 g/l, 113 g/l, and 105-115 g/l.<sup>8-10</sup> Finally, it is important not to lose sight of the high cost of erythropoietins, and the fact that costs increase non-linearly with higher haemoglobin targets.<sup>8,14</sup>

Normalisation of haemoglobin concentrations is known to be hazardous, ineffective, and costly in patients with chronic kidney disease, and these new

data suggest that the same applies in patients with renal transplants. The important evidence gap concerns lower haemoglobin targets: we lack randomised evidence to help us choose between haemoglobin targets in the range 95 g/l to 120 g/l. Renal transplant recipients with anaemia could be included as an important prespecified subgroup in future randomised trials of erythropoietins in patients with kidney disease.

- 1 Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, et al. Prevalence of chronic kidney disease in the United States. *JAMA* 2007;298:2038-47.
- 2 United States Renal Data System. Annual Report 2008, Section D: treatment modalities. [http://www.usrds.org/2008/ref/D\\_Treatment\\_Modalties\\_08.pdf](http://www.usrds.org/2008/ref/D_Treatment_Modalties_08.pdf).
- 3 Winkelmayer WC, Chandraker A. Posttransplantation anemia: management and rationale. *Clin J Am Soc Nephrol* 2008;3(suppl 2):49-55S.
- 4 Ekberg H, Tedesco-Silva H, Demirbas A, Vitko S, Nashan B, Gurkan A, et al. Reduced exposure to calcineurin inhibitors in renal transplantation. *N Engl J Med* 2007;357:2562-75.
- 5 Heinze G, Kainz A, Hörl WH, Oberbauer R. Mortality in renal transplant recipients given erythropoietins to increase haemoglobin concentration: cohort study. *BMJ* 2009;339:b4018.
- 6 Canadian Erythropoietin Study Group. Association between recombinant human erythropoietin and quality of life and exercise capacity of patients receiving haemodialysis. *BMJ* 1990;300:573-8.
- 7 Foley RN, Parfrey PS, Harnett JD, Kent GM, Murray DC, Barre PE. The impact of anemia on cardiomyopathy, morbidity, and mortality in end-stage renal disease. *Am J Kidney Dis* 1996;28:53-61.
- 8 Besarab A, Bolton WK, Browne JK, Egrie JC, Nissenson AR, Okamoto DM, et al. The effects of normal as compared with low hematocrit values in patients with cardiac disease who are receiving hemodialysis and epoetin. *N Engl J Med* 1998;339:584-90.
- 9 Druke TB, Locatelli F, Clyne N, Eckardt KU, Macdougall IC, Tsakiris D, et al. Normalization of hemoglobin level in patients with chronic kidney disease and anemia. *N Engl J Med* 2006;355:2071-84.
- 10 Singh AK, Szczec L, Tang KL, Barnhart H, Sapp S, Wolfson M, et al. Correction of anemia with epoetin alfa in chronic kidney disease. *N Engl J Med* 2006;355:2085-98.
- 11 Phrommintikul A, Haas SJ, Elsik M, Krum H. Mortality and target haemoglobin concentrations in anaemic patients with chronic kidney disease treated with erythropoietin: a meta-analysis. *Lancet* 2007;369:381-8.
- 12 Fishbane S, Besarab A. Mechanism of increased mortality risk with erythropoietin treatment to higher hemoglobin targets. *Clin J Am Soc Nephrol* 2007;2:1274-82.
- 13 Molnar MZ, Czira M, Ambrus C, Szeifert L, Szentkiralyi A, Beko G, et al. Anemia is associated with mortality in kidney-transplanted patients—a prospective cohort study. *Am J Transplant* 2007;7:818-24.
- 14 Tonelli M, Winkelmayer WC, Jindal KK, Owen WF, Manns BJ. The cost-effectiveness of maintaining higher hemoglobin targets with erythropoietin in hemodialysis patients. *Kidney Int* 2003;64:295-304.

## Ethics in sports medicine

Professional standards need to be clarified and acted on

Doctors and other healthcare professionals have been involved in facilitating both legitimate and illegitimate performance enhancement in sport.<sup>1,2</sup> The recent “blood-gate” affair in Rugby Union shows that healthcare professionals can be involved in producing fake injuries in situations where the apparent “injury” creates an advantage for the team.<sup>3</sup>

The incident happened last April at the semifinals of the European Rugby Cup match between Harlequins and the eventual winners Leinster. Normally in Rugby Union players cannot return to play once they have been substituted except to replace a player who has a “blood injury.” A Harlequins player produced an apparent

blood injury through the use of a fake blood capsule so that a specialist goal kicker could be brought back on to the field to try to secure victory in the last few minutes. At the behest of the head coach, the team physiotherapist had purchased fake blood capsules in advance of the game and had delivered one to the player during the match. At the European Rugby Cup hearing he admitted having done this on four previous occasions.<sup>3</sup> The physiotherapist has received a two year worldwide ban from the sport. It is also alleged by the player that the team doctor reluctantly cut his lip with a scalpel after the incident to produce a real injury, although the European Rugby Cup panel declined to consider the allegation



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on the grounds it had no jurisdiction to do so. The doctor has since been suspended by the General Medical Council, pending investigations.<sup>4</sup>

Further underhand practices have emerged since the Rugby Union incident. Players have told of the deceptive use of blood soaked towels and the opening up of stitches in previous minor wounds to obtain an illicit blood injury substitution.<sup>5</sup> What can we learn about the ethics of sports medicine from the bloodgate case and other instances of cheating facilitated by healthcare professionals?

That healthcare professionals are involved in such activities is no surprise, unless we believe that healthcare professionals involved in sport have ethical standards that diverge radically from the ethical standards of players. Players feign pain and injury in many competitive football matches, for example, only to recover miraculously once a foul has been awarded. Ethical standards may be higher and more deeply entrenched among healthcare professionals than among professional footballers, but healthcare professionals are not all saints.

We should focus attention on the complex environment inhabited by healthcare professionals who work in elite sport. They may overidentify with the goals of the team. They are also working in contexts where health promotion is often a secondary concern, both for their employers and for the clients they treat. Participating in elite sports is not health promoting in general. It very often leads to long term health problems, such as irreparable joint injuries or arthritis,<sup>6,7</sup> and athletes will sometimes trade their immediate ability to perform against increased risks of long term injury and ill health when they can no longer command high salaries.

In exploring the ethical issues raised in elite sports medicine, it is useful to draw on experience from other areas of health care that involve inherent conflicts of interest in complex settings—for example, prison medicine and military medicine. Comparing and contrasting patient power in cosmetic medicine with athletes who seek medical interventions that are deleterious to their present or future welfare might also help to frame the discussion better.

What should be done to ensure that healthcare professionals in elite sports balance possible conflicting interests with the health interests of their clients?

Reformulating professional guidelines or teaching ethics using abstract examples is unlikely to be sufficient. Ethical failings do not typically arise from a lack of knowledge about what is the right action. Instead, reconfiguration of the relationship between elite sports organisations and sports medicine is required so that unprofessional action becomes less acceptable. Complicity with the excesses of elite sports by healthcare professionals—for example, by helping athletes to fake injuries or by encouraging them to “play through” real injuries with deleterious long term effects—must be replaced by norms that reinforce commitment to the long term welfare of the athlete and the defining rules of sports. This process could involve securing the independence of healthcare professionals from the clubs and other sporting organisations that employ them and providing forums where healthcare professionals from different organisations can exchange experiences in a non-judgmental setting that encourages professional and ethical reflection.

Healthcare professionals in younger branches of medicine such as sports medicine might not have had the time to reflect critically on the adequacy of their professional norms. But this can function as a legitimate excuse only for so long. Interestingly, the athletic equivalent of the Hippocratic oath, the Beroia law,<sup>8</sup> has existed since the 3rd century BC. The need for ethical standards in sports medicine has not just recently been sprung on us. The Rugby Union scandal has highlighted the need for greater clarity about the nature and purposes of sports medicine, especially in the pressured arena of elite, commercialised sports.

- 1 Hoberman JM. *Mortal engines: the science of performance and the dehumanization of sport*. Free Press, 1992.
- 2 Waddington I. *Sport, health and drugs: a critical sociological perspective*. Routledge, 2000.
- 3 European Rugby Cup Decision of Appeal Committee in Appeal by Roger O'Connor, ERC Disciplinary Officer. 17 August 2009. [http://www.ercrugby.com/audio/AR-M700U\\_20090902\\_085314.pdf](http://www.ercrugby.com/audio/AR-M700U_20090902_085314.pdf).
- 4 Dyer C. Doctor accused of covering up faked rugby injury is suspended by GMC. *BMJ* 2009;339:b3873.
- 5 Ackford P. Bloodgate: scandal opens the doors to a world of sinister practice in rugby. *Telegraph*. <http://www.telegraph.co.uk/sport/rugbyunion/club/6106177/Bloodgate-scandal-opens-the-doors-to-a-world-of-sinister-practice-in-rugby.html#article>.
- 6 Møller V. *The doping devil*. University of Southern Denmark Press, 2007.
- 7 Howe PD. *Sport, professionalism and pain: ethnographies of injury and risk*. Routledge, 2003.
- 8 Potter D. *The Beroia gymnasiarchy law*. <http://www.umich.edu/~classics/programs/class/cc/372/B015.html>.

## Training in non-technical skills to improve patient safety

As in aviation, education should occur early in the core curriculum

To reduce iatrogenic injury, healthcare organisations have been encouraged to adopt approaches from high risk industries—most notably aviation—that focus on human factors. The best known of these methods is crew resource management (CRM) training, designed to reduce human error by enhancing non-technical skills such as situation awareness, decision making, and teamwork.

Although CRM programmes are widely used in aviation, and mandated in many countries, measurable effects on safety outcomes remain elusive, partly because commercial aircraft accidents are infrequent. Although some studies have reported changes in behaviour, a meta-analysis of the effectiveness of CRM training only found significant improvements in trainees' attitudes to safety.<sup>1</sup>



JAMES KING-HOLMES/SPL

Varieties of CRM training are being adopted for multiprofessional groups of clinical staff who have had no previous education in non-technical skills. Some courses focus on teamwork,<sup>2</sup> others cover a range of topics.<sup>3</sup> Although training in multidisciplinary teams has some benefits, it is not the ideal method for teaching basic CRM concepts.

The timing of such training is important for successful application in health care. Undergraduate and early professional education in non-technical skills would provide course participants with a basic understanding of the psychological and physiological factors influencing human performance. A common vocabulary would facilitate discussion of unsafe behaviours, improve team communication, and help to develop solutions for reducing risks to patients. A study of behaviour observed during surgical procedures before and after team members had attended a CRM training course and received support coaching showed significant improvements in error rates (technical) and non-technical skills.<sup>4</sup> But investigators noted that “considerable cultural resistance to adoption was encountered, particularly among medical staff.”

The introduction of CRM training to health care may ultimately help to improve the safety culture by shifting the norms of acceptable behaviour. But the antipathy encountered in the surgical study<sup>4</sup> and the need for support coaching, suggests that the non-technical skills courses are unlikely to change professional behaviours unless they are properly integrated into educational and safety management systems. Healthcare systems have been advised not to mindlessly import these programmes: “the aviation experience should be used as a template for developing data driven actions.”<sup>5</sup>

Importantly, in aviation, CRM courses are a core component of professional education and they are not the pilot’s first introduction to human factors. A student pilot who wants to gain a licence must pass several theoretical examinations, including one on human performance.<sup>6</sup> The syllabus covers basic physiology (for example, vision, fatigue) and basic psychology (including safety culture, perception, decision making, memory, and stress).<sup>7</sup> For more advanced pilot licences, the syllabuses contain topics on teamwork and leadership. From the very start of a pilot’s professional education, the message is conveyed that technical skills alone are not enough to ensure a safe flight.

Once pilots are employed, their organisation must provide CRM skills training and assessment of the non-technical skills takes place as part of regular competence assurance (licensing) checks. The CRM courses are usually specially designed to cover a syllabus defined by the regulator, which is based on non-technical skills identified from analyses of accidents, flight deck observations, aviation psychology research, and confidential incident reporting.<sup>5,8</sup> Thus a feedback loop transfers safety intelligence into continuing professional development through the CRM training.

Healthcare professionals also need to understand the physiological, psychological, and social factors that may affect their ability to deliver safe clinical treatment. The Parliamentary Inquiry into Patient Safety pointed out that “there are serious deficiencies in the undergraduate medical curriculum which are detrimental to patient safety” and recommended training in non-technical skills.<sup>9</sup> We would agree that it is too late to start delivering this training after undergraduate education has been completed and professional attitudes are almost fully formed. Like the pilots’ training, education in non-technical skills should be delivered early to healthcare students as part of their core curriculum. Failure to include CRM principles and practices in the undergraduate course results in such teaching being undervalued when it is offered after qualification. Similarly, in the postgraduate curriculums, the absence of training in non-technical skills misses the opportunity to provide repeat practice and develop an integrated assessment strategy that includes human factors.<sup>10</sup>

There are indications that this deficit is beginning to be tackled. The WHO curriculum on patient safety for medical students includes a module on human factors, and this training package is now being adapted for other professional groups.<sup>11</sup> At Aberdeen University’s medical school, a new module on non-technical skills has been introduced to the final year course, and during clinical attachments students are asked to identify use of these skills in practice when watching senior doctors. In specialties such as surgery and anaesthesia, scientific studies of behaviours in members of operating theatre teams are now producing suitable data on which to base postgraduate courses in non-technical skills.<sup>12</sup>

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- O’Connor P, Campbell J, Newon J, Melton J, Salas E, Wilson, K. Crew resource management training effectiveness: a meta-analysis and some critical needs. *Int J Aviat Psychol* 2008;18:353-68.
- Morey J, Simon R, Jay G, Wears RL, Salisbury M, Dukes KA, et al. Error reduction and performance improvement in the emergency department through formal teamwork training. *Health Serv Res* 2002;37:1553-81.
- Taylor C, Hepworth J, Buerhaus P, Dittus R, Speroff T. Effect of crew resource management on diabetes care and patient outcomes in an inner city primary care clinic. *Qual Saf Health Care* 2007;16:244-7.
- McCulloch P, Mishra A, Handa A, Dale T, Hirst G, Catchpole K. The effects of aviation-style non-technical skills training on technical performance and outcome in the operating theatre. *Qual Saf Health Care* 2009;18:109-15.
- Helmreich R. On error management: lessons from aviation. *BMJ* 2000;320:781-5.
- Joint Aviation Authorities. JAR-FCL (Joint Aviation Regulations Flight Crew Licensing) 1 and 2. Chapter 19: Detailed theoretical knowledge syllabus and learning objectives. Subject 040. Human performance. Hoofddorp: Joint Aviation Authorities, 2008. [http://www.jaa.nl/licensing/jar-fcl/jar-fcl\\_2009jan\\_frame.html](http://www.jaa.nl/licensing/jar-fcl/jar-fcl_2009jan_frame.html).
- Campbell R, Bagshaw M. *Human performance and limitations in aviation*. 3rd ed. Chichester: Wiley, 2002.
- Flin R, O’Connor P, Crichton M. *Safety at the sharp end. A guide to non-technical skills*. Farnham: Ashgate, 2008.
- House of Commons Health Committee: Patient Safety. 6th Report of session 2008-09. London: Stationery Office, 2009.
- Van der Vleuten C, Schuwirth L. Assessing professional competence: from methods to programmes. *Medical Education* 2005;39:309-17.
- World Alliance for Patient Safety. WHO patient safety curriculum guide for medical schools. 2009. [www.who.int/patientsafety/education/medical\\_curriculum/en/index.html](http://www.who.int/patientsafety/education/medical_curriculum/en/index.html).
- Flin R, Mitchell L, editors. *Safer surgery. Analysing behaviour in the operating theatre*. Farnham: Ashgate, 2009.