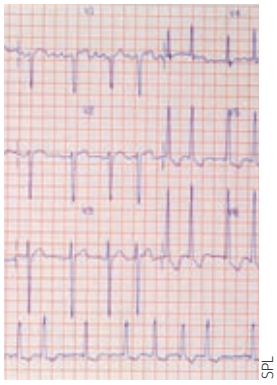
Diagnosing atrial fibrillation in general practice

The combination of a clinical history, clinical signs, and an ECG will pick up most cases



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RESEARCH, pp 380, 383

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In this week's *BMJ*, Mant and colleagues and Fitzmaurice and colleagues present the results of the SAFE (screening for atrial fibrillation in the elderly) study. They assess how accurately general practitioners, practice nurses, and an interpretive computer program can diagnose atrial fibrillation on an electrocardiogram (ECG), and they report on the effectiveness of screening patients aged 65 and over for atrial fibrillation in British general practice.[1 2] The prevalence of atrial fibrillation rises with age from 1.5% in people in their 60s to more than 10% in those over 90. People with atrial fibrillation have double the mortality and a four to fivefold higher risk of stroke than those without fibrillation. About a quarter of all strokes in elderly people are caused by atrial fibrillation. Strokes caused by atrial fibrillation are often severe and lead to high mortality and a low quality of life.[3]

Even if normal rhythm cannot be restored, antiplatelet agents reduce the risk of stroke by around 22% and vitamin K antagonists, such as warfarin, reduce the risk by 64% (number needed to treat for one year 37, for patients who have already had a transient ischaemic attack or stroke 12).[4] Thus, diagnosing atrial fibrillation is worthwhile, because effective interventions are available. However, intervention is not without risk and often requires lifelong drug treatment. Therefore, a diagnosis must be made on objective criteria. The 12 lead ECG is the reference standard, but interpretation can be difficult and misinterpretations often occur. [5]

The study by Mant and colleagues assesses the accuracy of 49 general practitioners, 49 practice nurses, and interpretative software in diagnosing atrial fibrillation on ECG, without any clinical information.[1] Sensitivity was around 80% in all three groups, but specificity was lower in nurses (85%) and general practitioners (92%) than with the software (99%). Because all three methods failed to diagnose about 20% of patients, none seems appropriate for screening purposes. A further disappointment was that training had little effect on the ability to interpret the ECGs correctly. Fortunately, one lead ECGs were as sensitive as 12 lead ECGs, and agreement between the two cardiologists who were the reference standard was very high. The logical conclusion is that a one lead ECG (which saves time and permits the use of loop recorders in daily practice) is sufficient for diagnosis, and that an experienced cardiologist should interpret the ECG.

Another small study in general practice has shown that an experienced nurse and general practitioner could diagnose atrial fibrillation on ECGs with a sensitivity of 96% and 100% and a specificity of 93% and 98%, respectively. [6] However, only one experienced nurse and one specially trained general practitioner interpreted the ECGs. The results of both of these studies are interesting, but the implications for general practice are limited. In daily practice general practitioners do not use ECGs to screen for atrial fibrillation. They use an ECG when disease is suspected, so probability of disease is higher than in the study by Mant and colleagues. Skills in interpreting ECGs improve when useful clinical information is available, especially when interpreters are less experienced. [7] When clinical information points to a rhythm disorder, a general practitioner will scrutinise the ECG for indicative signs, which probably increases sensitivity.

What diagnostic instruments does the general practitioner have to hand? The first is medical history and presenting symptoms. Symptoms of atrial fibrillation are palpitations, breathlessness, dizziness, chest discomfort, and stroke. About 10% of patients presenting with palpitations might have (paroxysmal) atrial fibrillation, but history and symptoms do not discriminate sufficiently between those with and without a serious rhythm disorder. [8]

The first diagnostic test a general practitioner would use is to palpate the pulse for any irregularity, which has a sensitivity of 94% for detecting atrial fibrillation (determined in cohorts of elderly patients). However, because of the low specificity (72%) further diagnostic tests are needed. [9] In patients with an irregular pulse or high clinical suspicion the next test would be an ECG. If this shows atrial fibrillation, the diagnosis is clear. However, around a third of patients with atrial fibrillation will have paroxysmal atrial fibrillation. In these cases, a diagnosis is unlikely to be picked up on an ECG measured in the practice, and a patient activated loop recorder may be needed. [8 10]

Many patients with atrial fibrillation do not have symptoms, so screening has been advocated because it is such a life threatening condition. [11] The SAFE study found that in general practice, screening leads to an increase of newly detected atrial fibrillation of 6/1000 patients aged 65 and over and provides evidence that simple opportunistic screening of elderly people is just as effective as a much more labour intensive systematic strategy and seems quite acceptable to the patients. Opportunistic screening involves feeling the pulse of elderly patients who visit their general practitioner for any reason, and carrying out electrocardiography if the pulse is irregular. [2] As most patients with atrial fibrillation have serious comorbidity they will visit a doctor regularly. When the ECG does not provide a diagnosis and doubt

remains, an automatically triggered loop recorder could be used.[12] This strategy will identify about one new case of atrial fibrillation for each 70 pulses taken. Five ECGs will have to be measured to find this one such patient. A general practitioner who is experienced in interpreting ECGs could do this, but general practitioners vary greatly in this respect. A sensible strategy would be for an experienced second reader, such as a cardiologist, to interpret the ECGs. Modern technology should make this feasible and not too expensive.

Management of urinary tract infection in children

New NICE guidelines emphasise prompt diagnosis and treatment but more restrained imaging

RESEARCH, p 386
see also p 395

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This week's *BMJ* contains two articles about the diagnosis and management of urinary tract infections in children.[1 2] The first is a summary of the recently published guidelines from the National Institute for Health and Clinical Excellence (NICE) on the diagnosis and management of such infections.[1] The second is a multicentre randomised controlled trial comparing exclusive oral antibiotic treatment with antibiotic treatment started parentally and completed orally in children with a first episode of acute pyelonephritis.[3] What do these articles add to current knowledge about how best to diagnose and treat urinary tract infections in children?

The 1991, UK guidelines on acute urinary tract infections in childhood were prompted by the great variation in management of this condition.[4] They emphasised that urinary tract infections and vesicoureteric reflux can cause scarred kidneys (reflux nephropathy), leading to hypertension and chronic renal failure. US guidelines also emphasised the need to diagnose, treat promptly, and investigate children with a confirmed urinary tract infection, especially those under 2 years of age who are at greatest risk of renal damage.[5]

Enthusiasm for extensively investigating children with urinary tract infections for vesicoureteric reflux has lessened with the finding of globally "scarred" kidneys due to dysplasia in infants born with antenatally detected urinary tract abnormalities, gross vesicoureteric reflux, and no urinary tract infection. In addition, the widespread use of dimercaptosuccinic acid renal scintigraphy has revealed parenchymal defects in many kidneys after infection that do not develop into renal scarring. Indeed, many scars are present in the absence of demonstrable reflux.[6] As most children with urinary tract infection will only ever have one infection and have a normal urinary tract, enthusiasm for investigations beyond an initial ultrasound has waned. Also, micturating cystourethrography and radionuclide scans can be traumatic for children and families.[7]

The NICE guidelines summarised in this issue have been eagerly awaited.[1] They deal with some of the problems in diagnosing urinary tract infections in young infants—the diagnosis is not even thought of and urine cultures are not taken appropriately. The younger the child the more non-specific the symptoms are—for example, lethargy, irritability, malaise, failure to thrive, poor feeding, vomiting, jaundice.

A key feature is that urinary tract infection should be considered in any child with unexplained fever of 38° or higher, and the guidelines cross refer to a recent NICE clinical guideline on feverish illness in children.[8] History taking and clinical examination are paramount, including whether any abnormalities were noted on antenatal ultrasound and whether the family has a history of urinary tract problems. Vesicoureteric reflux can have a 30% familial incidence.

Urinary tract infection is defined as symptoms and a pure growth of 10^5 organisms/ml on a clean voided specimen. General practitioners predominantly deal with women with lower urinary tract symptoms who can produce a midstream specimen of urine. Obtaining urine samples from incontinent children is extremely difficult and needs to be performed with diligence.

The NICE guidelines state that parents and carers should be helped to make decisions about their child's care in partnership with healthcare professionals. Because proving that a urine infection exists affects treatment and investigations, parents should be involved in the decision about whether to obtain urine by clean catch or using a urine collection pad or bag.[9] If urine cannot be sampled in primary care then the child should be referred to hospital, where a catheter sample or suprapubic aspirate can be attempted (preferably under ultrasound guidance), especially in the sick febrile younger child.[1]

Dipstick testing for leucocytes and nitrite is increasingly used, but positive results still require careful interpretation.[10] The urine needs to be cultured unless both leucocytes and nitrite are negative and there are no symptoms. Microscopy of fresh urine for white cells and bacteria can give a strong indication of urinary tract infections, but general expertise in this area has greatly diminished. Microbiology laboratories are often overwhelmed with urine specimens from adult patients and are developing flow cytometer methods for handling urine specimens.[11] As a consequence, laboratory technicians may have reduced expertise when asked to perform microscopy out of hours, and this requires research in the paediatric setting.

Ten days of antibiotic treatment are recommended if the child is febrile and has a suspected upper urinary tract infection. Oral antibiotics are advocated unless oral intake is not possible, when treatment should be intravenous.[3] This approach is supported by the study in this issue by Montini and colleagues.[2] The multicentre randomised non-inferiority trial of 502 children with a first attack of pyelonephritis randomised chil-

dren to receive either amoxicillin plus clavulinic acid for 10 days or parenteral ceftriaxone for three days followed by oral amoxicillin plus clavulinic acid for a further seven days.[2] No significant differences were seen between orally or parenterally treated children on the primary outcome of scarring on dimercaptosuccinic acid scans at 12 months, or on the secondary outcomes such as reduction of fever, blood counts, or urine sterilisation rates. As a cannula is often in place for initial sampling of blood cultures and electrolytes, most sick children will probably receive initial parenteral treatment. Of note, 10% of the children in Montini's study who started oral treatment were switched to intravenous treatment due to diarrhoea or vomiting caused by antibiotics or intercurrent rotavirus gastroenteritis.

Most children with urinary tract infections will have lower tract symptoms and will be systemically well. The NICE guidelines follow a recent systematic review in stating that such children can be treated with three days of oral antibiotics according to local guidance and sensitivities.[12]

The statement that the routine prescription of prophylactic antibiotics is no longer supported will surprise many, but evidence is accumulating that prophylactic antibiotics do not significantly decrease the risk of recurrent urinary tract infections and may increase the risk of resistant organisms.[13]

The imaging strategies will provoke even more debate. Much relies on using non-invasive ultrasound to determine the status of the urinary tract. In children who are systemically well, only those under 6 months or with recurrent infections need an ultrasound scan. Routine imaging to identify vesicoureteric reflux is not recommended, and only in children under 6 months should a micturating cystourethrogram be requested when there is severe or atypical illness, or recurrent urinary tract infections.[1]

Many specialists may think the guidelines downplay the importance of urinary tract infections in childhood, but the opposite may be the case. Linking the guidelines to the management of febrile illness emphasises the importance of such infections as a cause of unexplained fever, and this may improve the detection rate in vulnerable infants in both primary and secondary care.

Children with atypical features and recurrent urinary tract infections also need appropriate referral and investigation, but watchful waiting can be used in those over 6 months who remain well or have a negative history and only lower tract symptoms. The parent or carer should be informed about the importance of a diagnosis of urinary tract infection and be involved in obtaining urine samples, especially during febrile episodes if prophylaxis is not used.[1]

Human papillomavirus vaccination programmes

Need to have a broader perspective than simply increasing uptake of the vaccine

ANALYSIS, p 375

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Human papillomavirus (HPV) vaccine is a scientific and public health breakthrough in the prevention of cervical cancer. In an analysis article in this week's *BMJ*, Raffle argues that HPV vaccination must be part of a comprehensive, integrated system of cervical cancer prevention.[1] She emphasises that public health policy should be data driven, and several outcomes of an HPV vaccination programme must be assessed, including uptake, follow-up screening, cancer incidence, and cost effectiveness.

Therefore, a successful HPV vaccination programme requires more than just a series of injections. A still broader perspective would also tackle the controversial matters of adolescent sexuality, parental control, and protection of children. HPV vaccine should be given before exposure to the virus. Ethical and political dilemmas arise because some parents may not want to consider the possibility that their daughters might initiate sexual intercourse at an early age.

Responding to individuals who decide against participation in such vaccination programmes presents a classic public health dilemma. Voluntary measures to encourage the uptake of HPV vaccine—which include government coverage of costs, practice guidelines that make it standard care, public health campaigns, and peer counselling programmes, pose no insurmountable ethical problems. However, some parents or adolescents will still decline HPV vaccination.

In the United States, calls for mandatory HPV vaccination, driven by a vaccine manufacturer and by advocacy groups funded by it,[2 3] have drowned out the kind of careful public health planning that Raffle exemplifies. Mandatory public health policies can be ethically justified if voluntary measures have failed, no less coercive alternatives exist, the scientific rationale is compelling, and members of the general public are unknowingly at risk.[4] HPV vaccine does not meet these strict standards. Furthermore, mandatory public health measures are impractical to enforce except during infectious disease outbreaks.

In the US, most states allow exceptions to mandatory childhood vaccinations, for religious reasons or for parental objections. Pro-family and anti-vaccination groups strongly oppose mandatory HPV vaccination, drawing on widespread mistrust of government and drug manufacturers.[3] One legal scholar has suggested that a policy of mandatory HPV vaccination, coupled with a broad parental "opt-out" clause would strike an appropriate balance between preventing harm and respecting parental authority.[5]

Persuasion is an alternative to mandatory vaccination. How can doctors and public health nurses develop

strategies to change the minds of adolescents and parents who at first refuse HPV vaccination?[6] When disagreements arise in other clinical situations, physicians are encouraged to understand the patient's (or parent's) perspective and to respond to their concerns and needs.[7] Such a patient centred approach might also be useful with individuals who decline HPV vaccination.

Some parents question the need for vaccination because their daughters are not sexually active. Physicians should acknowledge that HPV vaccine is unnecessary until just before sexual activity starts. It is also not unreasonable for parents to delay vaccination for other reasons, including uncertainty about long term effectiveness and concerns that rare adverse effects may not yet have been identified.[8] The challenge is for doctors to help parents consider a different perspective: their child's sexual activities may differ from what they would approve.

In other clinical settings, physicians have used "I wish" or "I hope" statements to respond to unrealistic expectations[9]: "I only wish that a parent could be sure in this day and age that their child won't be sexually active . . . " It is possible that parents who feel that the doctor or nurse has listened to them might then be willing to consider the evidence that girls who pledge premarital abstinence start having sex at about the same age as other girls.[10 11]

Other parents may fear that the HPV vaccine will encourage or condone adolescent promiscuity. Their concerns are understandable given parental fears that children grow up too quickly in the 21st century. Indeed, public health officials should monitor trends in the incidence of sexually transmitted infections. Once parents have their underlying concerns acknowledged, it is possible that they might be more willing to accept that the weight of the evidence indicates that the vaccine is unlikely to increase sexual activity.[12] Furthermore, HPV vaccine may indeed offer parents an opening to talk with their children about sexuality, including the possibility of sexual disinhibition after HPV vaccination. Focus groups of parents and adolescents and community advisory boards can suggest how healthcare workers can respond to concerns about HPV vaccine.

Despite their parents' objections, some girls will want to receive the vaccine. Adolescents who know they are likely to become sexually active should have the opportunity to benefit from HPV vaccine. In the US, most states allow adolescents to obtain care for sexually transmitted infections, contraception, and pregnancy care without parental consent. The rationale is that reducing serious harms to adolescents and respecting their emerging independence outweigh parental interests in control over their children. It would be wise to enact laws that explicitly allow them to receive HPV vaccine as well.[13]

As Raffle's article illustrates, public health is an inherently utilitarian enterprise, guided by outcomes and cost effectiveness. The distribution of risk and resources also needs to be taken into account. Uptake of HPV vaccine might be lower in certain socioeconomic and ethnic groups,[14] where the likelihood of earlier sexual activity or risk of cervical cancer may also be greater. Targeting vaccination campaigns at these groups may be more cost effective than a broader based campaign but may be opposed on the grounds of being stigmatising and discriminatory. Suggestions from adolescents who are at risk and their parents can help to design effective targeted campaigns and build community support.

In summary, making HPV vaccine mandatory might advance the immediate goal of increasing uptake. However, public policies also need to consider a broader perspective. Such vaccination is not a goal in itself, but a means to achieve the goal of cancer prevention. Furthermore, physicians need to persuade people who have concerns about the HPV vaccine to trust in and cooperate with other measures to promote adolescent health.

NICE's cost effectiveness threshold

How high should it be?

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The recent judicial review instigated by the drug companies Pfizer and Eisai concerning National Institute for Health and Clinical Excellence (NICE) guidance,[1] which would deny access to three drugs for patients with mild Alzheimer's disease, and a second ongoing inquiry into NICE by the House of Commons Health Select Committee,[2] are the latest examples highlighting the importance of NICE and the challenges it faces. The judicial review, which ruled predominantly in favour of NICE, concerned the procedures NICE used to arrive at their judgment, not the outcome specifically. However, NICE has to make a judgment that is more fundamental than the matters at stake in the judicial review—at what point should an intervention be deemed cost effective enough to warrant public subsidy via the National Health Service (NHS)?

An advantage of the way in which the United Kingdom funds the NHS is that its patients do not have to judge whether or not the health benefits of their treatment are worth its costs. But someone, somehow, still has to grapple with the decision over the value that is placed on health.

This valuation lies at the heart of the work performed by NICE—which, since its inception in 1999, has adopted a cost effectiveness threshold range of £20 000 (€29 500; $40 000) to £30 000 per quality adjusted life year (QALY) gained. NICE does not accept or reject healthcare technologies on cost effectiveness grounds alone,[3-5] although it is undoubtedly a major deciding factor. But the uncomfortable truth is that NICE's threshold has no basis in either theory or evidence.

This is not a technical problem confined to the decisions made by NICE. That is just the tip of an iceberg of clinical, managerial, and policy decisions made daily

in health care—decisions that, unlike those derived from NICE's transparent procedures, may not be based on an explicit threshold, or even consider cost effectiveness at all. Nevertheless, these decisions all imply that the value of the health benefits justify the costs—of the operation, the prescription, the new hospital, a reduction in waiting times, and so on.

The cost effectiveness threshold is emerging as a key factor in the House of Commons Health Select Committee inquiry into NICE, which has received evidence that the threshold may be too generous.[2 6] If this suggestion is correct, the implications are profound. It means that NICE has recommended too many new technologies. It also means that when primary care trusts implement NICE's guidance, resources may be diverted from other healthcare services that are better value for money. By setting the hurdle too low (the cost per QALY threshold too high), NICE might be reducing the efficiency of the NHS. So, what should the threshold be?

Two approaches to setting a cost effectiveness threshold have been proposed.[7] The first is to decide the worth or value of a QALY and set the NHS budget so that all health care is provided at a cost at or below that value. The second is to decide how much we wish to spend on the NHS, and let the value of a QALY emerge from the decisions made by NHS purchasers. If purchasers aim to maximise QALYs, and their budgets are set so that they can do so, these approaches converge. In practice these conditions are not met and there is currently no political or other mechanism to facilitate them. The danger is that purchasers are likely to make inconsistent decisions based on their variable, and often implicit, valuations of health gain.

Evidence suggests a mismatch between NICE's threshold range and that apparent elsewhere in the NHS. The average primary care trust spends £12 000 to gain an extra QALY in circulatory disease and £19 000 in cancer.[8] In contrast, an analysis of NICE's decisions suggests that its threshold is in practice even more generous than NICE admits, being closer to £45 000.[4]

Why should NICE be required to set and defend what is an NHS wide cost effectiveness threshold? The factors that should determine this threshold—such as society's willingness to pay for health improvements, the size of the NHS budget, the level of health sector inflation, and the discount rate used for future costs and benefits—are beyond NICE's control. Moreover, as these factors are not constant the problem of thresholds can never be resolved. This means NICE has to keep the threshold constantly under review, although its main business and expertise is in appraising health technologies and producing guidelines.

In 1997, Gordon Brown (then chancellor) gave the Bank of England operational independence from the treasury so that it could set UK interest rates to contain inflation. It does this via its Monetary Policy Committee, which consists of bank officials and independent members. The NHS could be given similar independence from the Department of Health on the specific matter of setting a cost effectiveness threshold. The NHS should have a threshold committee with a similar structure to the Monetary Policy Committee; and NICE, primary care trusts, and other NHS purchasers should be required to adopt the common NHS threshold. NICE conjuring up a threshold and others not using one at all creates neither efficiency nor fairness in the NHS.

Improving the outcome of stroke

UK needs to reorganise services to follow the example of other countries

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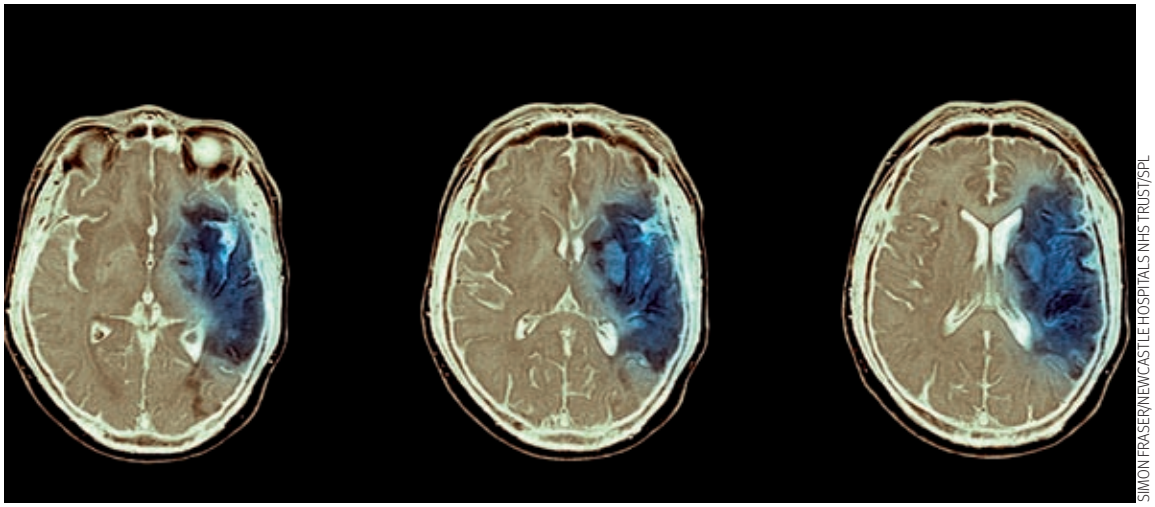
The outcome of stroke varies markedly between countries. A study of 12 centres in seven European countries found that mortality varied twofold even when adjusted for case mix and use of healthcare resources.[1] Similar variation was also found in two large international multicentre trials of acute stroke.[2 3] All three studies found the outcome was worst in the United Kingdom; in one study the differences in the proportion of patients dead or dependent between the UK and the other eight countries were between 150 and 300 events per 1000 patients.[2]

What underlies this variation and why is outcome so poor in the UK compared with countries with similar economies in western Europe? Residual confounding by case mix is difficult to exclude completely, but differences in the process of care are likely to be important.[3] In many European countries stroke care is an integral part of neurology. In contrast, in the UK it has, until recently, been a "Cinderella" subject, often falling between neurology and general and geriatric medicine. It is tempting to conclude that this lack of interest has led to underinvestment and a resulting poor outcome. However, the cost of care of stroke patients seems to be as high, if not higher, in the UK than in European countries with better outcomes.[1 4] This suggests that organisational and structural problems in delivery of resources are important.

Limited data show that European countries with better outcomes focus resources more heavily on the acute aspects of care.[1] The vast majority of the cost of in-hospital stroke care in the UK is for nursing and hospital overheads, with the cost of investigations and medical care being very low. The higher length of stay in England found in comparative studies suggests that improvements in acute care could not only improve outcome but also lower costs by reducing length of stay.

Organisation of acute stroke care has become even more important now that there are specific treatments for acute stroke. Thrombolysis with alteplase (tPA) improves outcome if given within three hours of ischaemic stroke onset.[5] Providing thrombolysis is challenging even in countries with well developed services.



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Essential components include patient education and awareness of stroke symptoms, rapid ambulance assessment and transfer to specialised stroke centres, and rapid brain imaging to exclude haemorrhage before administration of alteplase. Despite these challenges, effective thrombolysis services exist in many countries in Europe, North America, and Australia, in both urban and rural settings, with as many as 20-30% of eligible patients receiving thrombolytic therapy.[4] Currently less than 1% receive such therapy in the UK.[4]

These deficiencies in stroke care have already been recognised in England in a 2005 National Audit Office report.[4] The report concluded that if care was better organised, annually £20m (€29m; $41m) could be saved and 550 deaths avoided and 1700 patients would recover fully who would not otherwise do so. In response, England's Department of Health National Stroke Strategy is due to publish its recommendations in autumn 2007.

A major challenge is to change the perception of stroke, among both health professionals and the public, so that stroke is viewed as a condition that requires emergency action. This will require major structural changes at several levels. Despite robust evidence of the efficacy of organised stroke unit care, the 2006 Royal College of Physicians Stroke Sentinel Audit found that only 62% of people admitted for stroke in England, Wales, and Northern Ireland were treated in a stroke unit at any time during their stay, while only 54% spent more than half of their stay in a specialised unit.[6] The UK has a severe shortage of specialists trained in acute stroke care. This is being remedied by the recently developed stroke subspecialty training programme but will need many years to be fully corrected. Developing acute stroke services and implementing thrombolysis requires not only specialised acute medical teams but also access to computed tomography, and when required magnetic resonance imaging, and brain imaging. Brain computed tomography is the "electrocardiography" of stroke. In many European countries it is performed on admission in the accident and emergency department, while in the UK many units struggle to provide it within 24 hours.[4] The response that "it will make no difference to management" must be overcome now that we have effective treatments for acute stroke and research has shown that scanning patients immediately is the most cost effective strategy.[7] Implementing thrombolysis will need 24 hour availability of specialised expertise, including stroke specialists and imaging support. It is unlikely that every acute hospital will be able to provide such a service, and alternative strategies are needed. These include forming larger regional centres or telemedicine approaches, as successfully implemented in the United States and Germany.[8]

Increasing the proportion of patients receiving thrombolysis will undoubtedly improve outcome, but even in the best units only a minority of patients will be eligible. The benefit of thrombolysis beyond three hours is being examined in international trials, although we know that its efficacy falls dramatically with time from stroke, even within the first three hours.[8] Furthermore, the risk of intracerebral haemorrhage secondary to alteplase increases with time from onset of stroke. It is hoped that even at later time points newer magnetic resonance imaging and computed tomography techniques will be able to distinguish between patients with potentially reversible damage, who may benefit from thrombolysis, and those with no salvageable tissue in whom alteplase can only cause harm.

In addition, the early risk of recurrent stroke is much higher than previously thought—as high as 10-15% in the first week.[9] Much of this increased risk is within the first 48 hours. More aggressive antiplatelet regimens in the first days after stroke may prove effective but can only be administered after acute imaging to exclude haemorrhage. The risk of recurrent stroke is particularly high in people with carotid artery stenosis,[9] who require rapid identification and consideration for carotid endarterectomy.

Probably the most important outcome of reorganisation of services will be a general improvement in acute care of stroke. Improved early diagnosis with imaging, together with improved monitoring and treatment of physiological parameters, will improve outcome independent of administration of thrombolysis. If we can set such acute systems in place they will also facilitate implementation of other new treatments.