Cool runnings

The pages of medical journals aren’t the typical place for a Hollywood feel-good film storyline, but I reckon the tale of how a group of people with diabetes collaborated to create the world’s first open-source artificial pancreas and beat the medical device industry at its own game could have the makings of a blockbuster hit. It starts in 2013 when Dana Lewis, founder of the Do-It-Yourself Pancreas System, hacked her continuous glucose monitoring device so that it would wake her at night if her glucose levels became too low or too high. She discovered she wasn’t alone and found hundreds of other people with diabetes and their loved ones who were sharing their DIY solutions and computer code.

Nine years later, results from a randomised controlled trial of the open-source closed-loop automated insulin delivery system (which combines continuous glucose monitoring, calculating insulin requirements, and delivering insulin all in one—the “artificial pancreas”) find that it was safe and well tolerated, and those using the device had over three hours longer per day in their target glucose range than controls, who used a sensor-augmented insulin pump. The study recruited 97 adults and children with type 1 diabetes and followed them over a six month period.

Monoclonal antibodies for SLE

Systemic lupus erythematosus (SLE) would be near the top of any list of serious diseases for which more effective treatments would surely make a massive difference to a lot of people. In the US it’s the fifth highest cause of death among Black or Hispanic women aged 15-24 years. Might monoclonal antibody treatment provide a breakthrough? A phase 2 study of the humanised monoclonal antibody litifilimab, where at baseline the 132 participants with SLE had an average of 19 swollen and tender joints, found a greater reduction in number of active joints at 24 weeks in those given litifilimab than in controls at 24 weeks (−15 versus −11.6, P=0.04). Longer, larger studies are needed to explore this treatment further, particularly since secondary outcomes did not support the primary outcome.

Search for a long term partner for aspirin goes on

Poor old aspirin is still struggling to find a long term antithrombotic partner for secondary prevention of ischaemic stroke. We all thought clopidogrel might be the one—but they could only stay together for a few weeks (before bleeding risk started to outweigh the benefits of dual antiplatelet therapy). The same happened with ticagrelor. Maybe aspirin could do better alongside a drug with more of an X factor? The factor Xa inhibitor asundexian, to be more specific. Unfortunately, in a phase 2, dose finding study of aspirin plus asundexian in patients with non-cardioembolic ischaemic stroke, the sparks weren’t flying: it failed to show any dose dependant reduction in symptomatic recurrent ischaemic stroke and incident covert brain infarcts on MRI. While they may give it another go—perhaps the trial population wasn’t right, wonders an editorial—asperin’s search for a lifelong partner goes on.

Websites in need of cookie cutters

In the US, where abortion is now criminalised, there are concerns that browsing history could be used against those seeking information about abortion services online, according to the authors of a research letter in *JAMA Internal Medicine*. They checked 223 web pages of National Abortion Member facilities and found that 221 of them included a third-party data transfer and 154 included a third-party cookie. They call on abortion clinics to remove these third-party trackers, which collect data that could be shared or sold to law enforcement agencies, from their websites.

Changing your image isn’t easy

Knowing that x-rays are of limited (and often negative) value for most musculoskeletal conditions is one thing, but changing practice can still be a challenge—as we discuss in our latest episode of the Deep Breath In podcast (www.bmj.com/podcasts/deepbreathin).

A randomised controlled trial set in Australia recruited GPs in the top 20% of radiology requesters from over 2000 practices. They sent some of them individualised written audits and feedback on their imaging request rates in a letter from the chief medical officer of Australia. Despite a covid-induced sharp decline in requests across the board, those in the audit and feedback arms of the trial reduced their imaging request more than the control group, but only about 2% more. The median overall rate of musculoskeletal imaging at baseline was 32.3 per 1000 patient consultations—which is anything from one a day to every half an hour, depending on how busy things are.

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Pelvic floor disorders affect women of all ages, with one in 10 over the age of 20 being affected, increasing to one in two over the age of 80.1 2 One in 10 women with pelvic floor dysfunction require surgical management in their lifetime, with more requiring re-operation.3 Management of pelvic floor dysfunction has substantial healthcare costs. For example, managing urinary incontinence costs the NHS £818m annually, with surgery incurring higher costs than conservative management.4

Moreover, surgical management of pelvic floor dysfunction can be invasive, with potential complications, particularly with pelvic and vaginal mesh.5 Therefore, the recommended first line intervention for pelvic floor dysfunction is conservative, using pelvic floor muscle training (PFMT).6 This article offers a practical guide to help non-specialist clinicians working in primary care and the community, particularly when advising women how to do their own PFMT. This article refers to women but is relevant to anyone with internal female pelvic organs.

WHAT YOU NEED TO KNOW

- A basic unsupervised pelvic floor exercise programme is 8–12 maximal voluntary contractions, three times a day, with adequate rest in between each contraction
- The pelvic floor can also be contracted in preparation for a leakage-provoking event (an approach sometimes referred to as the “knack”)
- Adherence to pelvic floor muscle training often decreases over time. However, long term adherence is key and can enhance the effect of pelvic floor muscle training

What is the pelvic floor?

The pelvic floor is a supportive structure that spans the bottom of the pelvis, attaching to the pubic bone and sacrum. It is composed of nerves, muscle, and associated connective tissue, which support the pelvic organs and maintain bowel, bladder, and sexual function.7 Normally, the pelvic floor musculature has a constant tone at rest. The pelvic floor also voluntarily and involuntarily contracts and relaxes to allow for reflex muscle contraction to sudden increases in intra-abdominal pressure, for example, with coughing or sneezing.8

Dysfunction of the pelvic floor can cause symptoms such as urinary incontinence, voiding difficulty, pelvic organ prolapse, anal incontinence, evacuation difficulty, sexual dysfunction, and chronic pelvic pain.9 Fig 1 shows a diagram of the female pelvic cavity, including the pelvic organs and pelvic floor, with a schematic diagram which can be shared with patients.
Consider an unsupervised, self-administered PFMT programme for patients in whom referral to specialist services is not indicated and to avoid delaying management when waiting for specialist service review. A home programme should include basic voluntary contractions, which aim to improve pelvic floor muscle reaction to activities such as coughing, sneezing, exercise, and lifting, and sustained voluntary contractions which improve endurance.

Women can be instructed to sit comfortably with their knees slightly apart and contract the pelvic floor by lifting and tightening the muscles around the anus and vagina—as if they were to prevent the passage of gas and stop the flow of urine. Once women can achieve PFMT seated, they can perform the exercises in a standing position and during activity. Women who experience stress urinary incontinence can contract the pelvic floor in preparation for a leakage-provoking event (the “knack”).15 A basic voluntary contraction involves a hold of one to two seconds with the same rest time, while a sustained voluntary contraction should last between six and 10 seconds, again with the same rest time.16 17 Once a baseline sustained contraction is determined, the length of the sustained contraction should be increased gradually (to a maximum of 10 seconds) (fig 2).

Ability, needs, and goals differ between patients. If progress is minimal, ensure that pelvic floor contractions and relaxations are being performed correctly. Approximately a quarter of women are

### What is pelvic floor muscle training?

PFMT is defined by the International Urogynaecology Association and the International Continence Society as exercise which improves pelvic floor muscle strength, endurance, power, relaxation, or a combination of these.8 PFMT can be unsupervised and self-administered by patients, or supervised by a suitable healthcare professional with the appropriate expertise in PFMT, for example, a physiotherapist or a specialist continence nurse.8 However, substantially greater evidence supports supervised PFMT in the management of pelvic floor dysfunction in comparison with the evidence supporting unsupervised pelvic floor muscle training.5

### Who is pelvic floor muscle training for?

NICE recommends PFMT to manage symptoms of pelvic floor dysfunction in women, and that all women aged 12 and over should be encouraged to perform preventive exercises.6 PFMT is indicated particularly for urinary incontinence, pelvic organ prolapse, and faecal incontinence.6

Pelvic floor dysfunction can also occur in men and PFMT is a recommended first line conservative treatment measure.2 11 The Pelvic, Obstetric, and Gynaecology Physiotherapy (POGP) network has useful resources containing information surrounding PFMT for men.12

### How to examine the pelvic floor

Clinicians can use the acronym PERFECT to assess the condition of the pelvic floor when performing a digital vaginal examination (box). Power can be graded using the modified Oxford score (MOS): 0=absence; 1=flicker; 2=weak (increase in tension, with no lift or squeeze); 3=moderate (some degree of lift and squeeze); 4=good (pelvic floor elevation and some resistance); 5=strong.13 14 Typically, healthcare professionals with an expertise in pelvic floor function perform this assessment to develop individual treatment objectives. Healthcare professionals who feel confident doing a digital vaginal examination of the pelvic floor in primary care or the community can use the PERFECT scheme; alternatively, asking the woman to bear down allows assessment of any visible pelvic organ prolapse.6 Power may also be assessed visually, as a pelvic floor muscle contraction with an MOS ≥3 is usually visible on external examination of the perineum.14

### How to do PFMT

Consider an unsupervised, self-administered PFMT programme for patients in whom referral to specialist services is not indicated and to avoid delaying management when waiting for specialist service review. A home programme should include basic voluntary contractions, which aim to improve pelvic floor muscle reaction to activities such as coughing, sneezing, exercise, and lifting, and sustained voluntary contractions which improve endurance.

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Ability, needs, and goals differ between patients. If progress is minimal, ensure that pelvic floor contractions and relaxations are being performed correctly. Approximately a quarter of women are
How to do PFMT

Vaginal cones. Training with biofeedback, electrical stimulation, or may consider supplementing pelvic floor muscle assessment and a personalised, supervised PFMT programme. In this setting, in those unable to perform an effective pelvic floor muscle contraction, clinicians may consider supplementing pelvic floor muscle training with biofeedback, electrical stimulation, or vaginal cones. A barrier to engaging with and maintaining a PFMT regimen is often inadequate information provision, with women feeling uncertain of how to perform a pelvic floor contraction correctly. A variety of resources providing useful instructions are available (also in translation), for example, a patient education leaflet from IUGA (www.yourpelvicfloor.org/media/Pelvic_Floor_Exercises_RV2-1.pdf) and mobile applications such as the Squeezy NHS pelvic floor app.

The supplementary table lists the PFMT protocols described in the literature, including those in supervised and unsupervised settings. Although no evidence suggests an optimal PFMT protocol, of the 51 randomised controlled trials (RCTs) identified, 13 described a protocol which involved performing 8-12 maximal voluntary contractions, three times a day. In an unsupervised setting, this protocol has been shown to improve pelvic floor muscle strength, symptoms of urinary incontinence, pelvic organ prolapse, and quality of life. Ensure an adequate relaxation time between each voluntary contraction to avoid increased pelvic floor muscle tone.

Adherence to PFMT is key and can enhance its effect. However, long term adherence to PFMT has been shown to decrease over time. For example, a randomised controlled trial showed that in a cohort of 164 women who were post menopause, although they were advised to perform pelvic floor muscle exercises every day, the participants’ adherence reduced over time, with 82% reporting practice of PFMT two to three times per week at three months to 68% at 12 months.

Similarly, a RCT which evaluated the effectiveness of antenatal PFMT showed that only 38% of women continued to perform PFMT twice or more every week at eight year follow-up. Although antenatal PFMT was shown to reduce the incidence of urinary incontinence at three months, this benefit was no longer evident at eight years. This is likely secondary to a reduction in adherence over time. Further research is required to understand how to improve long term benefit from, and adherence to, PFMT.

How to check patient progress

In women with symptoms of pelvic floor dysfunction, no consensus exists on the expected time for a clinical benefit to be seen with PFMT. It may take weeks to months. Progress can be gauged by the patient’s perception of improvement. Depending on the predominant symptom, validated questionnaires can be used to allow quantitative assessment. For example, the International Consultation on Incontinence Questionnaire series can be used to gauge progress in women with urinary incontinence.

When to refer

NICE recommends offering supervised PFMT to women with stress urinary incontinence or mixed urinary incontinence. In addition, consider a supervised PFMT programme for symptomatic pelvic organ prolapse which does not extend beyond the hymen (POP-Q Stage 1 and 2). Refer women with more severe pelvic organ prolapse to secondary care for assessment. In asymptomatic women, a supervised PFMT programme can also be considered to prevent development of symptoms during pregnancy and the postpartum period, and in women with significant risk factors for pelvic floor dysfunction, such as family history, instrumental birth (forceps or ventouse), occipito-posterior birth, and obstetric anal sphincter injury.

How to become competent in pelvic floor muscle assessment

Improving women’s access to healthcare professionals with relevant competencies in pelvic floor health is a public health priority in the UK, recommended by the NHS Long Term Plan and the Independent Medicines and Medical Devices Safety Review. Clinicians undertaking pelvic floor muscle assessment need to be appropriately skilled to practise safely and effectively, with particular consideration to informed consent and ethical and legal concerns surrounding intimate examinations. Professional networks such as the POGP and the Pelvic Floor Society provide relevant courses for clinicians to achieve competence in pelvic floor muscle assessment.

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SEARCH STRATEGY

We conducted a literature search of protocols for pelvic floor muscle training. We included systematic reviews and RCTs, and searched the Medline, Embase, Cochrane, and Emscare databases from database inception to December 2021, using terms including “Pelvic floor muscle” AND “education” OR “training” OR “education” [MeSH terms], “Pelvic floor muscle exercise” AND “physical therapy” OR “physiotherapy” OR “protocol” OR “program” OR “rehabilitation”. A hand search of references from identified systematic reviews was also conducted to identify other relevant studies.
A patient reports feeling unsteady while walking. This has come up suddenly. He had a renal stent inserted for calculi removal two days previously, for which he received intravenous gentamicin as prophylaxis. He also reports wobbly vision on head movement, which resolves with his head held still. Neurological examination reveals severe gait imbalance, with the patient requiring support for walking even short distances. He is diagnosed with gentamicin related vestibulotoxicity and started on vestibular rehabilitation.

Aminoglycoside antibiotics are implicated in functional impairment and/or cellular damage to the vestibular system as an adverse reaction (box). Gentamicin is the most frequently used aminoglycoside antibiotic in adults. As with other aminoglycosides such as streptomycin and tobramycin, gentamicin related vestibulotoxicity is typically bilateral due to systemic administration. The damage can be permanent. Early diagnosis can help initiate measures to improve balance.

This article focuses on gentamicin related vestibulotoxicity in adults. Symptoms and the indications for gentamicin use, dosing, and monitoring can differ in children.

### What you need to know

- Ask for a history of gentamicin administration in patients who experience vestibular symptoms such as imbalance while walking or wobbly vision
- Gentamicin related vestibulotoxicity is often permanent, but prompt diagnosis and early physical rehabilitation can improve gait and balance
- Avoid gentamicin, if possible, for surgical prophylaxis and in patients with risk factors such as pre-existing kidney disease, overweight, or using other drugs that can potentiate its effects (such as vancomycin)

### What is gentamicin?

Gentamicin is used to treat several local and systemic infections and for surgical prophylaxis. It is active against Gram negative aerobic bacteria (such as *Pseudomonas*, *Acinetobacter*, *Klebsiella*, and *Enterobacter* species) and certain Gram positive bacteria (including mycobacteria). NICE guidelines recommend gentamicin as treatment for bacterial septicemia, meningitis, urinary tract infections, some gastrointestinal tract infections (such as biliary sepsis), and soft tissue infection (such as necrotising fasciitis). It has minimal gastrointestinal absorption and is usually administered by parenteral routes, with systemic, topical, intraperitoneal, and ophthalmic formulations.

It is used for the treatment of discharging ears by ear, nose, and throat specialists, even in the presence of tympanic perforation, but evidence that this can lead to vestibulotoxicity is lacking.
How do patients with this adverse reaction present?

In our clinical experience, most patients present with gait disturbance and imbalance. This is possibly because systemic administration of gentamicin tends to affect bilateral vestibular function. Patients with acute bilateral vestibular loss will be unable to stand unaided. In more chronic states, inability to stand unaided may only be present if asked to stand on a foam surface. Other symptoms can include dizziness, vertigo, and oscillopsia, which arise from asymmetrical vestibular nerve firing.

Initial signs can go unnoticed. Gentamicin is primarily toxic to the vestibular rather than auditory system. The majority (90%) of patients will not have accompanying hearing loss or tinnitus. Many patients will have been inpatients and bedbound when the drug was administered. They may only notice a balance problem when they become ambulant, at which point it is typically (incorrectly) attributed to critical illness and deconditioning.

There are no robust data on time of onset of vestibulotoxicity symptoms relative to administration of gentamicin. In a retrospective case series (103 patients) time to diagnosis ranged from four days to 15 years. Gentamicin is renally excreted within hours but accumulates over months in the inner ear, accounting for the drug’s toxic effects much later.

How common are these reactions?

Clinically evident ototoxicity (hearing and/or vestibular loss) is estimated to affect 11% of people taking daily treatment with gentamicin, and between 0.2% and 6.2% of patients who have received a single dose. The prevalence of vestibulotoxicity specifically is less well documented, and may be higher in at risk groups (for example, people with pre-existing kidney failure or obesity).

Prevalence of vestibulotoxicity is usually estimated from clinical data in patients experiencing imbalance that is not attributable to another disorder (such as stroke, meningitis, head trauma) and who have been treated with gentamicin (hours or sometimes weeks earlier). In a retrospective case series of 53 patients with bilateral vestibular failure, 17% (n=9) were attributed to gentamicin toxicity. At a specialist centre in the US, gentamicin toxicity was noted as the cause in 28% of 213 patients with bilateral weakness, the second commonest after “idiopathic.”

Safety warnings for gentamicin and aminoglycosides

- The British National Formulary (BNF) advises caution regarding “vestibular disorder” and avoidance of “prolonged” use.
- The Electronic Medicines Compendium summary of product characteristics lists a special warning on ototoxicity (loss of balance and hearing loss) with use of aminoglycosides, including gentamicin.
- The US Food and Drug Administration advises that ototoxicity, both vestibular and auditory, can occur in patients treated with gentamicin, primarily those with pre-existing renal damage and in patients with normal renal function treated with higher doses and/or for longer periods than recommended.

What is the evidence?

Vestibulotoxicity is considered to be dose dependent and commonly occurs when levels are high or renal clearance is poor. There is a lack of high quality data correlating symptoms with gentamicin levels in blood.

The mechanism by which gentamicin affects the vestibular (and cochlear) structures is not completely understood. Studies implicate gentamicin in interference with mitochondrial ribosomes, inhibiting protein synthesis and impairing cell respiration. This may lead to destruction of vestibular (and cochlear) hair cells through superoxide overproduction and cell apoptosis.

Vestibular and cochlear hair cells are particularly prone to damage given their high density of mitochondria. Gentamicin generates free radicals within the inner ear, causing damage to sensory cells and neurons. Mutations in the mitochondrial 12S ribosomal RNA gene reportedly predispose carriers to cochlear (and presumably also vestibular) toxicity.

What factors increase the risk?

Vestibulotoxic effects are more common with multiple daily regimens versus single daily dosing. Concomitant use of other vestibulotoxic drugs can increase the risk. For example, vancomycin, commonly used in conjunction in sepsis, potentiates the toxic effects of gentamicin. Renal disease leads to reduced gentamicin excretion and hence raised drug levels, increasing the risk of toxicity.

People who are overweight or obese can be more susceptible since dosing by weight can lead to higher doses and overestimate the volume of distribution. Genetic factors can increase risk of vestibulotoxicity in some people, but this is not proven.

TIPS FOR PATIENTS

- When gentamicin is prescribed, ensure that possible risks to inner ear function have been discussed with you.
- Report any new issues with your balance or vision, particularly those that occur when you are moving (such as when walking rather than when you are sitting still) if you have recently received gentamicin.
- Ask your doctor whether antibiotics other than gentamicin may be given, particularly if you are >65 years old or have other medical problems that might increase the risk of damage to vestibular function.
How can the risk of harm be minimised?

Use gentamicin sparingly, particularly in surgical prophylaxis, and for the shortest duration possible. Inform patients of vestibular dysfunction as a possible adverse event before administration. Ask them to promptly report if they experience related symptoms. We recommend baseline screening with dynamic visual acuity (fig 1) or head impulse test (fig 2) before gentamicin administration and 24 hours after each dose in all patients. Closer monitoring may be needed in patients at increased risk.

For adults, the BNF recommends measuring serum gentamicin concentrations after three or four doses of a multiple daily dose regimen and after a dose change. Blood samples are taken at 1 hour after intramuscular or intravenous administration (peak concentration) and just before the next dose (trough concentration). If the pre-dose (trough) concentration is high, the interval between doses is increased. If the post-dose (peak) concentration is high, the dose must be decreased. Loading and maintenance doses of gentamicin are usually calculated based on the patient’s weight and renal function using a nomogram. These are available as online applications (for example, Aminoglycoside Calculator - ClinCalc.com). In people who are overweight or obese, serum concentrations of gentamicin are closely monitored, and dose is reduced if required. Local guidelines typically exist for once daily dose regimens.

How is it managed?

Consider vestibulotoxicity in patients prescribed gentamicin who present with gait imbalance or wobbly vision on head movement. Certain clinical tests can help confirm bilateral vestibular dysfunction (figs 1 and 2). Performing and interpreting these requires training, and misinterpretation is common. Discontinue gentamicin if you suspect vestibulotoxicity and the patient is still taking it. We recommend referral within two weeks to a vestibular, balance, ENT, or neurology specialist for confirmatory vestibular testing (such as caloric, video head impulse test, or rotary chair test).

Gentamicin related vestibular loss is permanent in most patients. Vestibular hair cells cannot regenerate in humans once damaged, but early intervention with vestibular rehabilitation can improve long term functional outcomes. Treatment aims to enhance central nervous system compensatory mechanisms rather than reverse the damage. Patients can be taught compensatory strategies using vision and proprioception to improve motion and reduce postural anxiety.

More recently, a vestibular implant prototype—like cochlear implants for hearing loss—has shown promise in restoring a degree of vestibular function (the dynamic visual acuity) illustrating potential for clinical use.
More than 700 people who had shoulder pain related to the rotator cuff were randomly assigned to receive either:

• Up to six sessions of an exercise programme (that builds up over 16 weeks), tailored to them and supervised by a physiotherapist, plus exercises at home
• One-off advice from a physiotherapist with a home exercise programme supported by a booklet and videos
• A corticosteroid injection into the shoulder joint followed by the six sessions of physiotherapy
• A corticosteroid injection into the shoulder joint followed by the one-off advice and home exercise programme.

Exercises at home were a core part of treatment, regardless of which group they were in. People were asked to do their exercises five days a week.

What did this study do?

Shoulder pain is common, especially among people over 45; it accounts for two in every 100 GP appointments. Most (70%) shoulder pain is caused by disorder of the rotator cuff muscles.

Previous reviews of research have found uncertainty about how best to treat rotator cuff disorders. Treatments have included rest, exercise, physiotherapy, corticosteroid injection, massage, and pain relief drugs. Some evidence suggests that exercise, physiotherapy advice, and corticosteroid injections work better than no treatment.

This trial looked at improvements in pain and function with different treatment approaches.

Why was this study needed?

The study

Why is this important?

A one-off session with a physiotherapist, followed by a home exercise programme supported by a booklet and videos, is an effective treatment. People with shoulder pain relating to a rotator cuff disorder benefited as much from this self-management approach as from a comprehensive programme of supervised exercise sessions with a physiotherapist (plus home exercises). The one-off session would free up time for both patients and physiotherapists; it could save NHS trusts money.

Corticosteroid injections improved shoulder pain and function at eight weeks. The trial suggested that people in most pain may see the greatest benefit, but the researchers say this was not certain from their results.

By 12 months, the injection made no difference to pain or function. NHS Trusts and commissioning groups could incorporate the findings of this study into their routine treatment pathways for shoulder pain.

What's next?

The researchers are working on a training package for physiotherapists which will allow them to deliver the one-off advice session, which delivers strategies to help people stick to the exercise plan, and progress through it without further supervision.

The training package also gives physiotherapists access to the self-management exercise programmes used in the study. The researchers say that physiotherapists will be familiar with the exercises; implementing this programme would be straightforward.

Many physiotherapy services that took part in the trial are now using the one-off best practice advice system. However, the researchers warn that self-management is not suitable for everyone. Some people, such as those with low literacy, or those in intense pain, may still need more than one session with a physiotherapist.

Not everyone in the trial had recovered after 12 months. Future research should look at rotator cuff disorders which do not improve and explore what can be done for people who continue to have pain and disability.
You can record CPD points for reading any article. We suggest half an hour to read and reflect on each.

CASE REVIEW
Dyspnoea with diffuse T wave inversion
A woman in her 50s presented with sudden onset severe chest tightness, shortness of breath, and surgical incision pain on the third day after thoracoscopic left upper lung lobectomy for lung cancer. She had not received chemotherapy or radiotherapy, and she had no family history of coronary artery disease or sudden death.

Her pre-operative ECG was normal (fig 1). Her vital signs were as follows: temperature 36.0°C, heart rate 100 beats/min, respiration 18 breaths/min, blood pressure 112/74 mm Hg, and oxygen saturation 95% (when inhaling oxygen 3 L/min).

Physical examination found normal heart sounds and no pericardial friction rub. Breath sounds from the left lung were coarse and diminished, and no significant wet rales were heard. The patient underwent a second ECG (fig 2), coagulation tests, and tests for markers of myocardial injury.

1 What does the ECG show?
A partial right bundle branch block (RBBB), S waves deepened in lead 1 (compared with the earlier ECG, fig 1), and T wave inversion (TWI) with Q waves in lead 3, which is also known as the S1 Q3 T3 sign. The stuttering/fragmented QRS waves and deep TWI were also observed in leads V1 to V5. The ECG showed left axis deviation.

2 What is the most likely diagnosis?
Pulmonary embolism. This places an increased load on the right ventricle, resulting in increased pressure in the pulmonary artery, right atrium, and right ventricle. This can cause anatomical dilatation of the right atrium and right ventricle, which manifests as a right ventricular strain pattern, such as the S1 Q3 T3 sign, TWI in V1 to V4, and new RBBB.

The diagnosis is confirmed by computed tomography pulmonary angiography (CTPA).

3 What are the differential diagnoses?
Wellens syndrome is a clinical syndrome with characteristic ECG abnormalities which suggest critical stenosis in the left anterior descending artery. Wellens is characterised by biphasic or deeply inverted T waves in V2 to V3, which may extend to V1 to V6.

Pneumonia (or other lower respiratory tract infection) can have similar clinical presentation but usually without atrial fibrillation.

Myopericarditis usually presents with pleuritic pain, but pericardial friction rub may be heard.

LEARNING POINTS
• Consider acute pulmonary embolism after high risk events, such as surgery and cancer.
• Suspect pulmonary embolism when the ECG shows an RV strain pattern, such as the S1 Q3 T3 sign, new RBBB, and biphasic or deeply inverted T waves in V1 to V4, especially if the patient has syncope, chest pain, chest tightness, and manifestations of hypoxaemia.
• Myopericarditis usually presents with pleuritic pain, but pericardial friction rub may be heard.

PATIENT OUTCOME
The patient was discharged home 7 days after hospital admission.
**Cutaneous fungal infection masquerading as a gyrate erythema**

This is tinea corporis on the upper chest of a man in his 50s. The patient presented to Partners in Hope, a healthcare organisation in Lilongwe, Malawi, with a three month history of a pruritic rash on his arms and chest. Polycyclic annular eruptions with erythematous, raised scaly borders were seen on examination. No peripheral neuropathy or loss of sensation was evident.

The patient had advanced HIV disease (CD4 cell count: 370×10^6/L). He was receiving antiretroviral therapy and prophylactic cotrimoxazole, which had not changed. The rash failed to improve on initial treatment with hydrocortisone 1% cream.

Differential diagnoses include tinea corporis, cutaneous larva migrans, erythema multiforme, syphilis, tuberculous leprosy, and granuloma annulare.

As tinea corporis was suspected because of the time course and appearance of the lesions—superficial, gyrate (ring-shaped)—oral fluconazole was started. Noticeable improvement in the lesions and the pruritus confirmed the diagnosis of tinea corporis. When further testing is unavailable, such as in low resource settings, empirical treatment with a well tolerated drug might be reasonable.

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Patient consent obtained

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**Nuclear war modelling**

Except for a few deranged dictators, everybody knows that a nuclear war would have devastating consequences. Just how devastating is emphasised by recent modelling which shows that even a limited conflict involving a brief nuclear exchange between two nations would probably lead to worldwide famine. Soot from burning cities would encircle the planet, leading to global crop failures and deaths of billions (www.nature.com/articles/d41586-022-02219-4).

**Adding a balloon to intercostal chest drains**

A new type of chest drain with an integrated intrapleural balloon is less likely to become displaced than a conventional drain, according to a randomised trial. Unfortunately, adverse events were commoner in people treated with the balloon drain. Most of these were associated with drain removal, which was often painful (Eur Respir J doi:10.1183/13993003.01753-2021).

**Steroid knee injections**

Intra-articular glucocorticoid injections reduce pain in people with knee osteoarthritis. However, there’s concern that this short term benefit comes at the price of long term damage to cartilage. Findings from a longitudinal study from France provide some reassurance. During five years’ follow-up, those treated with glucocorticoid injections were no more likely to need total knee replacement or to show radiographic deterioration than those not given steroids (Arthritis Rheumatol doi:10.1002/art.42118).

**Progression of multiple sclerosis**

A longitudinal study challenges the idea that older age at onset of multiple sclerosis carries a poorer prognosis. Among 661 patients with a median age at disease onset of 31 years, outcomes at age 50 were worse in those who were younger when they first developed symptoms. This was true both for measures of disability and for indicators of disease activity (Neurol Neurosurg Psych doi:10.1136/jnnp-2022-329353).

**Study noted a small rise in IHD rates in people exposed to noise and in those working night shifts**

**Occupational exposures and risk of ischaemic heart disease**

A large study among New Zealanders linked data on job descriptions (at the time of the 2013 census) with subsequent hospitalisations, prescriptions, and deaths. It reports a small increase in rate of incident ischaemic heart disease in people with occupational exposure to noise and in those working night shifts. By contrast, ischaemic heart disease wasn’t associated with working long hours or spending long periods sitting (Heart doi:10.1136/heartjnl-2022-320999).

**Face masks in schools**

In primary schools in Catalonia, Spain, wearing face masks became obligatory during the first term of the 2021-22 academic year, although masks weren’t required for children attending preschool. A comparison between children in the last grade of preschool and those in the first year of primary education finds no evidence that this influenced transmission of SARS-CoV-2. The primary school children (aged 6) who had to wear masks had a higher incidence of infection than the preschool children (aged 5) who didn’t (Arch Dis Child doi:10.1136/archdischild-2022-324172).