The first RCT on colonoscopy screening

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The per-protocol analysis is more optimistic, but controversial due to the risk of bias: for the 42% of people invited for colonoscopy who actually had one, the risk of colorectal cancer reduced from 1.22% to 0.84% over 10 years (a 31% reduction), and their risk of death from colorectal cancer reduced from 0.3% to 0.15% (a 50% fall).

From the Journals
Edited highlights of weekly research reviews

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The authors conclude that patients “should be advised that they need not change their antihypertensive medication dosing time, but might choose to take their medication at a time that suits them best, because the timing makes no difference to cardiovascular outcomes.”

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Moving on to cardiovascular screening, in Denmark 46 611 men aged 65-74 years were randomised 1:2 to either be invited for cardiovascular screening (including a non-contrast electrocardiography-gated computed tomography to calculate a coronary-artery calcium score, ankle-brachial blood pressure index, and blood tests) or ignored.

After a median follow-up of 5.6 years, a total of 2106 men (12.6%) in the invited group and 3915 men (13.1%) in the control group had died. That gave a hazard ratio of 0.95, with a 95% confidence interval of 0.9 to 1.0 (P=0.06). So, although the participants in the study who were offered screening aren’t seeing a survival benefit yet, the number of positive test results and treatments initiated are quite something: from the 16 738 people invited to screening, 10 471 attended screening, 6381 of whom had a positive test, from which 4105 initiated a preventive treatment.

Education
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Reducing unnecessary preoperative testing

Lesly A Dossett, Anthony L Edelman, Gloria Wilkinson, Shannon M Ruzycki

Preoperative evaluation is a component of risk stratification and mitigation for patients undergoing surgery. These evaluations include comprehensive histories, directed physical exams, and selected preoperative diagnostic testing. However, most people who undergo low risk surgeries do not need any preoperative tests. Routine and unnecessary use of preoperative tests is harmful to patients and can lead to unnecessary specialty consultations, invasive diagnostic and therapeutic interventions, delays in surgery, costs to patients (such as missed days of work, travel burden, out-of-pocket costs), wasted time for clinicians, and environmental harm.1-5

The choice to conduct preoperative testing is guided by characteristics of the patient (which can be classified according to the American Society of Anesthesiologists (ASA)) and the planned procedure (emergent or minor, intermediate, or major elective surgery). While patients with significant systemic disease (ASA 3 or 4) and those undergoing major surgery typically require testing, asymptomatic patients undergoing low risk surgery do not require routine preoperative tests.

The UK National Institute for Health and Care Excellence (NICE) and the International Choosing Wisely campaign recommend against the use of routine laboratory studies, electrocardiograms, echocardiograms, cardiac stress tests, and chest radiographs in most patients undergoing low risk (such as eye and dental surgery, removal of skin lesions) and intermediate risk surgery (such as repair of inguinal hernia, knee arthroscopy). This article summarises the rationale for these recommendations, barriers to change, and strategies for reducing unnecessary preoperative testing.

The evidence for change

How common is unnecessary preoperative testing?
Given the high prevalence of surgical procedures, eliminating unnecessary preoperative testing before low risk surgery represents a key opportunity to improve value in surgery. Despite the recommendations from international campaigns and specialty organisations, unnecessary preoperative testing remains common, with multiple studies demonstrating persistently high rates of testing across several patient populations.

- In a study of patients over the age of 65 years undergoing non-cardiac procedures (such as breast surgery, inguinal hernia repair, laparoscopic cholecystectomy) in the United States, 45% of patients underwent unnecessary preoperative cardiac testing in the form of stress tests, echocardiograms, electrocardiograms and advanced cardiac imaging.6
- Nearly half (47%) of patients undergoing carpal tunnel release in the Veteran’s Health Administration system in the US underwent at least one unnecessary preoperative test.7
- In a study from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP), among healthy women undergoing a hysterectomy (for non-malignant indications), 93% had a preoperative complete blood count and 16% had preoperative coagulation studies.8
- In a Canadian study, over 30% of patients undergoing endoscopy, ophthalmological surgeries, and other low risk procedures underwent electrocardiography.9

Why should we reduce unnecessary preoperative testing?
Multiple systematic reviews demonstrate a lack of clinical benefit to routine testing before minor or intermediate elective surgery.10-15 Routine tests such as full blood counts, renal function tests, coagulation studies, electrocardiograms, and chest radiographs will not usually change management or prevent adverse events.16 For example, routine blood testing, electrocardiography, and chest radiography lead to a change in management in less than 2% of patients, with no evidence that these changes affect clinical outcomes.10

WHAT YOU NEED TO KNOW

- Routine preoperative tests (such as electrocardiograms and blood tests) before low risk surgery do not prevent adverse events during or after surgery
- Unnecessary testing is costly and can lead to other potentially unnecessary specialty consultations and invasive tests
- Choosing Wisely and NICE guidelines provide multi-specialty recommendations to support the avoidance of unnecessary preoperative testing
- Over-testing is rooted in the general misconception that medical screening cannot be harmful
- Interventions shown to reduce unnecessary preoperative testing include local practice guidelines, clinician education, and audit and feedback
In addition, routine preoperative testing is wasteful and potentially harmful. These costs and harms include:

- **Dangerous cascade events**—Unnecessary testing can trigger downstream care cascades after incidental findings. For example, in a US study of patients aged ≥66 years without known heart disease who underwent electrocardiography before cataract surgery, 25% subsequently underwent ≥4 cascade events (such as follow-up tests, treatments, visits, hospitalisations, etc).

- **Surgical delays**—High rates of preoperative testing are associated with greater time to surgery. In the above study of patients undergoing cataract surgery, 35% of patients treated by high-testing physicians waited >30 days, and 8% of patients waited >90 days to proceed with surgery. These delays were associated with a 40% increase in patient falls due to poor vision.

- **Additional healthcare spending**—Unnecessary preoperative tests are estimated to cost $18bn annually in the US, including the cost of the index tests and cascade events. A systematic review published in 2012 estimated unnecessary preoperative testing leads to costs 2.5 times higher compared with no routine testing.

- **Financial toxicity**—Unnecessary testing often requires additional travel, missed days of work, and out-of-pocket expenses. In a study of a clinical process change and educational intervention focused on the appropriate use of preoperative testing, patients saved $50 in out-of-pocket costs primarily from the elimination of unnecessary blood and urine tests and chest radiographs.

**Barriers to change**

Formal, theory-driven study of the barriers to change has found that the complex multi-disciplinary nature of perioperative evaluation, rather than lack of knowledge, is likely the main driver of ongoing low value preoperative testing. The evaluation of the preoperative patient spans multiple clinical disciplines from primary care to surgery and anaesthesia. Furthermore, the preoperative evaluation process varies greatly between centres and health systems, meaning that a single intervention designed to reduce unnecessary testing is unlikely to reduce low value preoperative testing in all settings.

Individual-level drivers of low value testing include lack of role clarity and fear of consequences of not ordering investigations, combined with an attitude of “We’ve always done it this way.” A qualitative study of 16 Canadian surgical teams in 2012 identified that, although surgeons and anaesthesiologists often knew that low value tests were not required, uncertainty about their colleagues’ preferences led them to order these investigations anyway. For example, surgeons often ordered low value preoperative investigations because they anticipated that the anaesthesiologist wanted these results, and anaesthesiologists were reluctant to cancel these tests because they had been ordered by the surgeon. This barrier has been demonstrated in other studies. Further, surgeons and anaesthesiologists felt that the risks of not ordering investigations, even if rare or unlikely (such as patient harm or surgical cancellations), were greater than the consequences of ordering these tests (such as cost or care cascades resulting in additional tests or specialty consultations), suggesting that over-testing is rooted in the general misconception that medical screening cannot be harmful.

Beyond the behaviours of individual clinicians, barriers to change exist at the organisation level. For example, in North America preoperative testing rates vary greatly between institutions, ranging from 3% to over 88% of all patients undergoing low risk surgery. Structural factors that may lead to greater prevalence of low value testing may include perceived institutional requirements for testing, medicolegal concerns, or financial incentives that favour more testing.

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**Unnecessary preoperative tests are estimated to cost $18bn annually in the US**

**PATIENT RISK**

<table>
<thead>
<tr>
<th>PROCEDURAL RISK</th>
<th>Low risk (ASA class 1 or 2)</th>
<th>High risk (ASA class 3 or 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor or intermediate risk elective surgery</td>
<td>Routine testing not recommended</td>
<td>Comorbidity specific testing (such as haemoglobin A1C for diabetes patients)</td>
</tr>
<tr>
<td>Major elective surgery</td>
<td>Procedure specific testing (such as complete blood count if blood loss expected)</td>
<td>Comprehensive evaluation by perioperative medicine or anaesthesia provider</td>
</tr>
</tbody>
</table>

ASA = American Society of Anesthesiologists

**Fig 1** Preoperative evaluation and testing recommendation based on patient and procedural risk

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What other steps are needed to cut unnecessary preoperative testing? Introducing strategies to reduce unnecessary preoperative testing is the responsibility of the multidisciplinary perioperative team leadership. However, individual clinicians can assess their own assumptions and practices against international recommendations to reduce unnecessary preoperative testing in their own units.

Key steps in addressing entrenched practices include engaging key stakeholders, conducting an audit of testing to identify practice gaps, conducting interviews or observations to understand motivations for use of unnecessary tests, and selecting and tailoring baseline interventions to the local setting (fig 2).

How should we change our practice?

What interventions may reduce the overuse of preoperative testing? Several strategies have proved effective in reducing unnecessary preoperative testing in individual institutions. The box lists the major interventions. At the level of the clinician, clinician education and well designed audit and feedback have been shown to reduce unnecessary testing. At the organisational level, development of preoperative clinics specific for low risk surgery, use of procedure-specific guidelines (fig 1), and switching to a default protocol of no evaluation are associated with sustained reductions in testing.

The most successful programmes target multiple drivers of low value testing with a variety of strategy components. For example, a plan-do-study-act quality improvement intervention consisting of audit and feedback with clinician education decreased the use of electrocardiography before cataract surgery from 95% to 29%, and this reduction was sustained over a 12 month follow-up period. Interventions at the level of healthcare system or policy have been used successfully to reduce low value services in other clinical scenarios, and addressing financial incentives that may contribute to testing is a promising system level intervention.

What other steps are needed to cut unnecessary preoperative testing?

Identify key stakeholders (Plan)—Leaders should bring together multidisciplinary representatives of the perioperative team including surgeons, anaesthesiologists, internists, nurses, patient and care giver representatives, and quality and safety experts. Stakeholders should build consensus on how to implement international guidelines in their setting and identify local champions for the improvement efforts.

Audit practice against evidence based standards (Plan)—Identifying gaps between current and evidence based best practices using evaluative and informative feedback can motivate change and direct resources to areas most in need. An audit of baseline preoperative testing rates of a particular test (such as electrocardiography) before a particular low risk surgery can identify clinical areas or clinicians who can be targeted with an intervention. Follow-up, targeted interviews, or surveys can identify motivations or processes that may be contributing to unnecessary testing.

Select and tailor interventions for your setting and context (Do)—Once areas for improvement are identified, interventions can be selected based on the likely determinants of the practice patterns. For example, if testing is routinely ordered because it is part of an outdated order set or protocol, the protocol should be updated to incorporate contemporary data and recommendations.

Intervention evaluation and ongoing monitoring (Study and Act)—When interventions have been implemented, they should be evaluated to ensure they are effective in the local setting. If proved effective, ongoing monitoring and reinforcement can help identify barriers to sustainability and areas for ongoing improvement.

Selected interventions to reduce the overuse of preoperative testing and examples

Individual level intervention
- Clinical education—Patient and provider targeted education campaigns have reduced low value care, including low value preoperative testing, particularly when paired with other categories of intervention.
- Audit and feedback—Social comparison audit and feedback interventions safely reduced low value testing for hospitalised inpatients

Facility level intervention
- Low risk preoperative medicine clinic—Creation of a dedicated, low risk preoperative clinic reduced preoperative investigation costs by between 19% and 38%.
- Local guidelines—Development of clinical knowledge topics and order sets, created by regional experts and adapted for local contexts
- Removal of default order sets—In combination with other interventions, removal of default order sets for preoperative evaluation reduced low value testing

Healthcare system or society level intervention
- Financial disincentives to unnecessary testing
A 39 year old man presents to the emergency department with a seven day history of fever and rigors associated with pain and swelling in the right leg. He had recently injected heroin into the right groin before the onset of pain. On admission he was febrile, tachycardic, and tachypnoeic with audible crackles in both lung fields, and had cellulitis of the right leg.

About 275 million people inject drugs according to the UN 2021 World Drug Report, an increase of 22% from 2010. Acute bacterial infections are common in people who inject drugs. The diagnosis is often delayed as they may hesitate to seek prompt care due to stigma and fear. Mortality can be high due to complications and delayed treatment.

This article aims to highlight key points for the generalist in the initial assessment and management of common infections in people who inject drugs.

Why is it important?

People who inject drugs are less likely to receive primary care than the general population. This may worsen severity of disease. A Canadian retrospective study (663 patients) showed higher rates of emergency department attendance and hospital admission than in the general population.

Estimates from the United States suggest 20,000 hospital admissions for infective endocarditis and 98,000 hospitalisations and emergency department visits for skin and soft-tissue infections related to injecting drug use in 2017. A retrospective cohort study from a teaching hospital in London revealed infections contributed to at least 90% of admissions in people who inject drugs (191 admissions) between 2005 and 2009, with challenges including unplanned discharges and injecting during admission. In a multicentre UK survey (855 patients), 44% of respondents with abscess related to injecting drug use waited at least five days from symptom onset before seeking care. A seven year retrospective review of 558 admissions (330 patients) for limb related complications of drug use in Scotland in 2022 found 15.2% mortality across median follow-up of 38 months, with mean patient age of 37 years.

What are common infections related to injecting drug use?

In addition to common community-acquired infections, people who inject drugs may present with undifferentiated sepsis or with one or more localising features suggesting common infections described below.

Skin and soft tissue infection

Skin and soft tissue infections are the most common infections affecting people who inject drugs. Cellulitis and abscess are most frequently encountered. A systematic review found that abscess formation is more commonly seen in women, and with greater frequency of injecting, and in those who inject in tissues rather than veins (“popping”). Cellulitis is diagnosed clinically with erythema, tenderness, and warmth at injection sites. Abscesses may accompany cellulitis or occur alone. The classic fluctuant mass may not be apparent.

Necrotising soft tissue infection

Necrotising soft tissue infection is a severe form of skin and soft tissue infection, with estimated mortality of 23.1% in a recent systematic review. The initial presentation can be similar to uncomplicated skin and soft tissue infection. In a systematic review of 1463 patients, more than 75% of patients with necrotising soft tissue infection from any cause were initially misdiagnosed. Patients may be admitted to a range of hospital specialties, which can delay recognition and appropriate surgical management.

Pain, erythema, and oedema are the most common symptoms. Pain disproportionate to other features, indistinct margins of infection, rapid progression, and tenderness of seemingly unaffected skin are other key clues. Hypotension, skin necrosis, and bullae occur later in the course of disease.

Infected pseudoaneurysm

Non-sterile arterial injection may result in damage to the vessel wall, leading to the formation of an infected pseudoaneurysm. In a single centre review (72 patients), the femoral artery was most commonly affected, followed by the brachial, radial, and axillary arteries. Little high quality data exist on presenting features of infected pseudoaneurysms. Pain and swelling at the site are common features, followed by a pulsatile mass. In late presentations, bleeding or limb ischaemia can occur.

WHAT YOU NEED TO KNOW

- Have a low threshold for imaging with computed tomography (CT) angiography, thoracic CT, and echocardiography in people who inject drugs presenting with acute infections
- Arrange urgent surgical referral for patients with pseudoaneurysm, abscess, necrotising soft tissue infection, or septic arthritis
- Early switch to oral antimicrobial therapy, once clinically stable, may improve compliance and can be as effective as intravenous therapy
An international cohort study of 7616 patients in 2021
Infective endocarditis
formation, occasionally complicated by empyema. 18
pulmonary vessels, leading to infarction and abscess
containing microorganisms embolise into the
Septic pulmonary embolism occurs when thrombi
Septic thrombophlebitis
A retrospective observational study (70 patients) in
Septic pulmonary embolism
Septic pulmonary embolism occurs when thrombi

<table>
<thead>
<tr>
<th>Empirical antimicrobial regimens for treating infections in people who inject drugs, amalgamated from guidelines23 29-31 34 35</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Options for therapy</strong></td>
</tr>
<tr>
<td><strong>Source</strong></td>
</tr>
<tr>
<td>Uncomplicated skin and soft tissue infection (cellulitis or abscess), septic arthritis, or osteomyelitis19</td>
</tr>
<tr>
<td>MRSA unlikely</td>
</tr>
<tr>
<td>• Flucloxacillin/nafcillin 1 g 6 hourly IV or</td>
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<tr>
<td>• Cefazolin 1-2 g 8 hourly IV or</td>
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<tr>
<td>• Ceftiraxone 2 g daily IV</td>
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<tr>
<td>• Severe penicillin allergy:</td>
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<tr>
<td>• Clindamycin 600 mg 8 hourly IV</td>
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<tr>
<td>When oral appropriate:</td>
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<tr>
<td>• Flucloxacillin 1 g 6 hourly PO or</td>
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<tr>
<td>• Trimethoprim-sulfamethoxazole 960-1920 mg 12 hourly PO or</td>
</tr>
<tr>
<td>• Doxycycline 100 mg 12 hourly PO or</td>
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<tr>
<td>• Clindamycin 450mg 8 hourly PO</td>
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<tr>
<td>MRSA suspected</td>
</tr>
<tr>
<td>• Vancomycin 15-20 mg/kg 12 hourly IV (adjust based on therapeutic monitoring) or</td>
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<tr>
<td>• Daptomycin 6 mg/kg daily IV or</td>
</tr>
<tr>
<td>• Linezolid 600 mg 12 hourly IV</td>
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<td>When oral appropriate:</td>
</tr>
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<td>• Trimethoprim-sulfamethoxazole 960-1920 mg 12 hourly PO or</td>
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<td>• Linezolid 600 mg 12 hourly PO</td>
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<tr>
<td>Endovascular infection (endocarditis, septic thrombophlebitis or infected pseudoaneurysm)1</td>
</tr>
<tr>
<td>• Flucloxacillin/nafcillin 2 g 4-6 hourly IV</td>
</tr>
<tr>
<td>• Severe penicillin allergy:</td>
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<tr>
<td>• As per MRSA suspected</td>
</tr>
<tr>
<td>MRSA unlikely</td>
</tr>
<tr>
<td>• Piperacillin-tazobactam 4.5 g 6 hourly IV or</td>
</tr>
<tr>
<td>• Meropenem 1-2 g 8 hourly IV or</td>
</tr>
<tr>
<td>• Flucloxacillin/nafcillin 2 g 4-6 hourly IV, gentamicin 5-7 mg/kg IV (dosing based on therapeutic monitoring), and metronidazole 500 mg 8 hourly IV</td>
</tr>
<tr>
<td>• If NSTI add clindamycin 900 mg 8 hourly IV to above</td>
</tr>
<tr>
<td>• Severe penicillin allergy:</td>
</tr>
<tr>
<td>• Clindamycin 900 mg 8 hourly IV and either:</td>
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<tr>
<td>• Gentamicin 5-7 mg/kg IV (dosing based on therapeutic monitoring) or</td>
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<tr>
<td>• Ceftriaxone 400mg 8-12 hourly IV</td>
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<tr>
<td>• Vancomycin 15-20 mg/kg 12 hourly IV (adjust based on therapeutic monitoring) and gentamicin 3 mg/kg daily IV or</td>
</tr>
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<td>• Daptomycin 6-10 mg/kg daily IV</td>
</tr>
<tr>
<td>Severely ill patient without obvious source or necrotising soft tissue infection (NSTI)</td>
</tr>
<tr>
<td>• Piperacillin-tazobactam 4.5 g 6 hourly IV or</td>
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</tr>
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<td>• Linezolid 600 mg 12 hourly IV</td>
</tr>
</tbody>
</table>

— | **Empirical regimens should be based on local resistance patterns.** |
— | **Consider adding metronidazole if risk factors for anaerobic infection.** |
— | **If severely ill or deterioration despite initial empirical therapy, consider broadening therapy to ensure cover for MRSA, Gram negatives and anaerobes (such as addition of vancomycin and either aminoglycoside, quinolone, or third/fourth generation cephalosporin with metronidazole).** |
— | **Oral penicillins are not preferred for bone and joint infection as bone penetration is poor.** |

### Septic thrombophlebitis
A retrospective observational study (70 patients) in Scotland suggested leg pain and fever are the most common features, with or without swelling. Some patients present with predominantly respiratory symptoms, suggesting concurrent septic pulmonary embolism.18 Injecting drug use was noted in up to 48% of patients with deep vein thrombosis (DVT) aged less than 40 years in a retrospective study (232 episodes of lower limb DVT).17 Suspect septic thrombophlebitis if there are features of DVT such as limb pain or swelling combined with evidence of local or systemic infection.

### Septic pulmonary embolism
Septic pulmonary embolism occurs when thrombi containing microorganisms embolise into the pulmonary vessels, leading to infarction and abscess formation, occasionally complicated by empyema.18 A systematic review (168 patients) found that fever, chest pain, and dyspnoea were common symptoms, and in most cases a primary infective focus was identifiable, often septic thrombophlebitis or right sided infective endocarditis.19

### Infective endocarditis
An international cohort study of 7616 patients in 2021 reported that about 8.4% of people who inject drugs contracted infective endocarditis.20 People who inject drugs accounted for 29% of the 123 776 patients with infective endocarditis in the United States in 2015.21 Compared with the general population, people who inject drugs tend to be younger and infection is more commonly right sided. Presentation is often non-specific, involving fever, weight loss, and malaise.22

### Avoid the use of stigmatising terms such as “addiction” or “substance abuse”

Staphylococcus aureus is the leading cause and usually presents acutely. Typical pathogens such as viridans group streptococci and enterococci are also well recognised. Other pathogens such as Pseudomonas aeruginosa and fungi, while rare, are also more common in this group.22

### Bone and joint infection
Septic arthritis and osteomyelitis generally occur by haematogenous spread in people who inject drugs, with the axial skeleton commonly affected.20 Patients with septic arthritis are usually unwell with acute joint pain and swelling. Localised bone pain may be the only feature of osteomyelitis. Back pain with or without fever or acute neurological symptoms (especially bilateral limb weakness) suggests the possibility of vertebral osteomyelitis or epidural abscess.21

### What to cover on initial evaluation?
Ask for a history of drug use in patients with unexplained sepsis or signs of one of the infections above. Avoid the use of stigmatising terms such as “addiction” or “substance abuse.”24

On examination, look for physical signs of drug use such as injection sites or bruising. A small survey of people who inject drugs suggested large groin veins may lead to stigma.25 A history of injecting followed by localised pain and swelling raises suspicion of abscess, pseudoaneurysm, or septic thrombophlebitis. Injecting into tissues rather than veins (“popping”), particularly with contaminated heroin, increases risk of severe clostridial infections, including botulism and tetanus.26
What investigations to consider?

**Laboratory investigations**
Request a full blood count, renal function and liver function tests, C reactive protein, and coagulation profile in patients with signs suggestive of an infection. In addition, we recommend discussing and offering opportunistic screening for HIV infection, hepatitis B, and hepatitis C. In a retrospective US study, 90% of people who were seeking health care for reasons related to injected drug use were not tested for bloodborne viruses.

Microbiological sampling is critical to guide ongoing management. Obtain at least two sets of blood cultures before starting antimicrobial therapy if there is suspicion of sepsis. Bacteraemia may be present in 90% or more of patients with septic thrombophlebitis, infective endocarditis, or septic pulmonary embolism. In patients with suspected necrotising soft tissue infection, abscess, or pseudoaneurysm, obtain samples of pus or tissue at time of surgical debridement for microscopy and culture. In suspected bone and joint infection, blood culture is advised even if fever is absent. Joint aspiration can be performed for Gram stain and culture in patients with possible septic arthritis. In patients with osteomyelitis, multiple bone biopsy samples are sent for culture and histopathology. Superficial samples correlate poorly with bone and are discouraged.

**Imaging**
Early imaging can minimise delay in appropriate treatment. Chest x-ray may show pulmonary airspace opacification, rounded lesions (with or without cavitation), and/or pleural effusions (fig 1a). Thoracic computed tomography (CT) is the optimal method for distinguishing septic pulmonary embolism from primary pulmonary infection (fig 1b). CT angiography identifies pseudoaneurysms (fig 2) in addition to deeper extension of soft tissue infection. It can also suggest septic thrombophlebitis with features such as gas within thrombus or venous wall enhancement.

Echocardiography is undertaken if there is an audible murmur, stigmata of infective endocarditis, evidence of septic pulmonary emboli, or bacteraemia. Transoesophageal echocardiography is recommended if transthoracic echocardiography is not diagnostic but suspicion remains high.

Consider imaging for osteoarticular infection only if localising symptoms suggest osteomyelitis. Plain radiography may show signs of osteomyelitis after 7-10 days, but non-contrast magnetic resonance imaging (MRI) is often needed, especially in more acute presentations. MRI is recommended if vertebral osteomyelitis is suspected.

In the absence of clear guidelines, our practice is to undertake CT angiography in people who inject drugs presenting with sepsis with a history of groin injecting or when there is suspicion of deep infection or vessel injury such as localised pain or swelling. This can allow prompt diagnosis or exclusion of common potentially life-threatening infections such as necrotising soft tissue infection, pseudoaneurysm, septic thrombophlebitis and deep abscesses. Thoracic CT can be undertaken simultaneously if there is suspicion of septic pulmonary embolism.

**When to refer?**
Urgently refer patients with necrotising soft tissue infection, deep abscess, or pseudoaneurysm detected on imaging to the appropriate surgical subspecialty (plastic/general surgery, vascular surgery) for emergent operative management. Any untoward feature on imaging, such as the presence of gas or oedema below the fascial layer must be promptly surgically explored. Orthopaedic surgery referral is needed for washout of septic arthritis. In cases of vertebral osteomyelitis, surgery is reserved for those with associated epidural abscess or neurological compression.

**EDUCATION INTO PRACTICE**
- How often do you see people who inject drugs presenting with acute infections? How many of them required investigation and inpatient management?
- How would you develop a local policy for management of people who inject drugs presenting with sepsis?
How are infections managed in people who inject drugs?

Initial treatment includes providing pain relief and antimicrobial treatment. Systemically well patients with uncomplicated soft tissue infection may be managed with oral antibiotics. Superficial abscesses may only require incision and drainage.

Initial antimicrobial therapy should include an agent active against Staphylococcus aureus and streptococci, the most common pathogens for all infections in people who inject drugs. Local prevalence of methicillin-resistant S aureus (MRSA) will influence choice of therapy. Anaerobic cover may be added if there are risk factors such as licking needles. In cases of severely ill patients or suspected necrotising soft tissue infection, therapy should be broadened to cover anaerobes and Gram negative bacilli. The table lists suggested empirical antimicrobial regimens, amalgamated from guidelines.

Central venous access may be required in patients with sepsis. Prolonged parenteral antimicrobial therapy was previously routine for more complex infections. Pragmatic use of oral therapy could improve treatment compliance. Recent randomised controlled trials suggest that, in patients who are stable, early switch after 7-10 days to oral therapy (usually to complete up to 4-6 weeks therapy in total) is equivalent to intravenous therapy for endocarditis, septic arthritis, and osteomyelitis.

Anticoagulation with subcutaneous low molecular weight heparin or direct oral anticoagulants (such as rivaroxaban) for septic thrombophlebitis is contentious but is unlikely to cause harm with short term therapy.

What are preventive measures?

Harm reduction strategies are vital. A cross-sectional survey of 1876 people who inject drugs suggests that opiate substitution therapy and use of safe injecting equipment reduce the risk of developing skin and soft tissue infections. A systematic review including 138716 people who inject drugs suggested that opiate substitution therapy reduced all-cause mortality. Reduction in infectious complications of injecting drug use has been observed with implementation of several harm reduction policies in Canada, including supervised injection facilities, needle exchange programmes, and opiate substitution therapy, although marginalised groups of people who inject drugs may require more targeted services to improve access.

Discuss treatment of substance use, for example with titrated doses of methadone or buprenorphine for opiate withdrawal initially. A retrospective cohort study of 220 people who inject drugs admitted with invasive infections described increased completion of parenteral antimicrobial therapy and reduced readmission rates with provision of opiate replacement.

Competing interests: None declared.

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HOW PATIENTS WERE INVOLVED IN THE CREATION OF THIS ARTICLE

We sought to involve patients by using clinical images from consenting patients who were also able to read the full manuscript. One patient provided a written account of his experience. We are grateful to these patients for their contribution.
An adolescent girl with acute abdominal pain and an abdominal mass

A girl in her early teens presented to the general paediatric department with 24 hours of acute, continuous, lower abdominal pain. She had not experienced menarche, but for the past year she had experienced monthly lower abdominal pain that lasted 1-2 days. This pain had not concerned her.

She was under paediatric care for an eating disorder. Knowing that some eating disorders cause delayed menarche, the patient, her mother, and the paediatrician were not concerned that the girl had yet to show menarche. She reported no dysuria, no urinary retention, no previous urinary tract infection, and no experiences of sexual intercourse.

According to Japanese standard criteria for body mass index (BMI), the girl was underweight (height 156 cm, weight 36 kg, BMI 14.8). Her body temperature was 37°C, blood pressure 90/60 mm Hg, and pulse 72 beats/min. On examination, slight tenderness was observed in her lower abdomen and an abdominal mass was palpable. She was referred to gynaecology, where inspection of the external genitalia revealed a bulging hymenal membrane and closed vaginal opening. Breast and pubic hair development corresponded to Tanner III stage, being appropriate for her age.

Abdominal ultrasound examination was requested to investigate the palpable abdominal mass (figure). Relevant laboratory data are shown in the table.

1. What are the main differential diagnoses of acute pain in an adolescent girl?
2. What are the main differentials of a cystic mass with a soft tissue component in the abdominal/pelvic cavity of an adolescent girl?
3. What is the most likely diagnosis?

Submitted by Shigeki Matsubara and Takashi Watanabe

Parental consent obtained

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Relevant laboratory data at presentation

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Reference range</th>
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</thead>
<tbody>
<tr>
<td>C reactive protein (mg/dL)</td>
<td>4.6</td>
<td>0–1.4</td>
</tr>
<tr>
<td>Leucocyte count (10⁹/L)</td>
<td>9.2</td>
<td>3.3–8.6</td>
</tr>
<tr>
<td>Haemoglobin (g/dL)</td>
<td>99</td>
<td>116–148</td>
</tr>
</tbody>
</table>

Transabdominal ultrasound image showing a cystic mass with a soft tissue component of approximately 130 × 76 mm (white arrow). Yellow dotted lines are the measurement marks.
A winter wave of covid-19

Waning immunity and the many factors that help respiratory viruses thrive in cooler months are likely to drive covid-19 infections higher in the northern hemisphere this winter. It’s also clear that omicron and other variants of SARS-CoV-2 are continuing to evolve and we may soon see a new generation of immunity dodging viruses. The good news is that, so far at least, both old and new covid-19 vaccines remain effective in preventing severe disease (www.nature.com/articles/d41586-022-03157-x).

Activity after retirement

Participants in the Finnish Retirement and Aging study wore accelerometers to measure their physical activity before and after they retired. Not surprisingly, time spent in active behaviours tended to decrease after retirement, especially among manual workers. Moderate and vigorous physical activity decreased more than light activity (Int J Behav Nutr Physical Act doi:10.1186/s12966-022-01364-3).

Treatment of asymptomatic carotid stenosis

What’s the best treatment for asymptomatic people with severe stenosis of common or internal carotid arteries? Unfortunately, a multi-centre randomised trial in Austria, Germany, and Switzerland designed to answer this question had to be stopped after failing to meet its recruitment target. The available data suggested that surgical intervention was no better than best medical treatment in preventing stroke, but the small numbers mean that this isn't a reliable conclusion (Lancet Neurol doi:10.1016/S1474-4422(22)00290-3).

Treatment of asymptomatic aortic stenosis

Another unresolved question about optimum treatment in asymptomatic patients concerns the timing of valve replacement in people with severe aortic stenosis. Is it better to intervene early or pursue a policy of watchful waiting? A systematic review comes down firmly on the side of early intervention, which was associated with lower all-cause mortality and lower risk of hospital admission for heart failure (Heart doi:10.1136/heartjnl-2022-321411).

Antecedent infections in Guillain-Barré syndrome

A serological investigation of the first 1000 patients enrolled in an international study of Guillain-Barré syndrome reports that laboratory evidence of recent infection is present in around 40% of cases. Among these, Campylobacter jejuni was the commonest culprit. Mycoplasma pneumoniae, cytomegalovirus, hepatitis E virus, and Epstein-Barr virus each accounted for a small proportion of cases. A few patients showed evidence of more than one recent infection (Neurology doi:10.1212/WNL.000000000000200885).

Neanderthals and Denisovans

This year’s Nobel Prize in Physiology or Medicine was awarded to the Swedish geneticist Svante Pääbo for his work sequencing the genomes of Neanderthals and Denisovans using DNA recovered from fossil bones. Both these species interbred with Homo sapiens. One consequence is that a small percentage of the genomes of modern humans of European or Asian descent is derived from Neanderthals (www.scientificamerican.com/article/discoveries-about-ancient-human-evolution-win-2022-nobel-prize-in-physiology-or-medicine).

Neurodegenerative disease among former international rugby players

The electronic records of 600 former Scottish international rugby union players were compared with those of community controls matched for age, sex, and socioeconomic status of residential area. Mortality from all causes was lower in former rugby players than controls until 70 years of age, after which there was no difference. During a median of 32 years of observation, 47 former rugby players were diagnosed with neurodegenerative diseases—a rate roughly 3 times higher than the control group. Players who had played as forwards had a similar risk to those who had played as backs (J Neurol Neurosurg Psych doi:10.1136/jnnp-2022-329675).

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An eruption of dome-shaped, red papules

These are reactive capillary haemangiomas (RCHs) on the trunk of a man in his 40s who had been taking camrelizumab to treat stage IV lung adenocarcinoma. He reported developing the papules two weeks after his first injection of camrelizumab. On examination, numerous, dome-shaped, bright red papules were seen on the trunk. RCH is typically a rapid capillary proliferation associated with trauma, infection, and medications such as VEGF (vascular endothelial growth factor) inhibitors, ciclosporin, and camrelizumab. Camrelizumab is an anti-PD-1 (programmed cell death protein 1) inhibitor used to treat patients with solid tumours to improve survival. For most patients who develop RCH secondary to camrelizumab injection, it will occur six weeks after the first dose. Common differentials are senile angiomas and pyogenic granuloma. Although some patients might be concerned about the lesions, most cases of RCH secondary to camrelizumab do not require treatment being withdrawn immediately. Termination of treatment is only considered in cases with high risk of rupture and bleeding that might cause life threatening complications, but most patients can be reassured of the benign nature of this condition and of the spontaneous resolution after drug withdrawal.

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MINERVA

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Patient consent obtained.

If you would like to write a Minerva picture case, please see our author guidelines at http://bit.ly/29HCBAL and submit online at http://bit.ly/29yyGSx

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