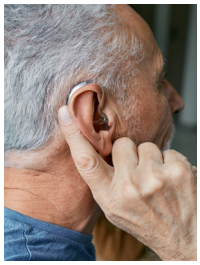
education

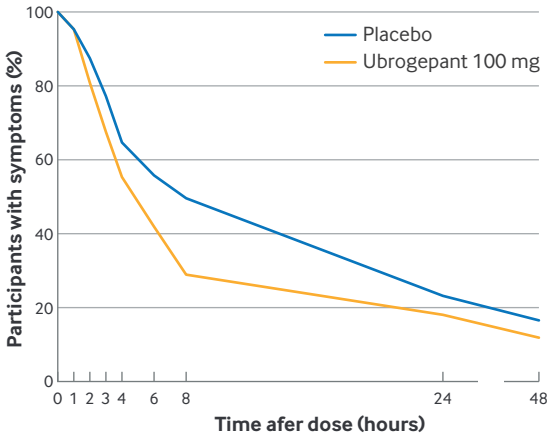
RESEARCH REVIEWS Fortnightly round up from the leading medical journals

Hearing aids to reduce loneliness



Giving a hearing aid to people with untreated hearing loss helps them retain one additional person in their social network over a three year period. This catchy finding from a secondary analysis of the ACHIEVE study seems ripe for being widely cited as evidence that we can make a big difference to patients' lives by getting the basics right. Unfortunately, it's unclear how much of a difference to loneliness and social isolation it actually makes: after three years, people in the hearing aid arm of the study still had a social network size of 21.3 people (over a two week period), down from 22.6. The control group's social network dropped from 22.3 to 19.8 people.

JAMA Intern Med doi:10.1001/jamainternmed.2025.1140



Percentage of participants continuing to have sensitivity to light prodromal symptoms at timepoints post-dose

PRODROME trial on the treatment of migraine prodromal symptoms

Rimegepant is recommended by the National Institute for Health and Care Excellence for acute treatment of migraine where at least two tripans haven't worked well enough. In 2023 the PRODROME study found that taking ubrogepant, another calcitonin gene-related peptide receptor antagonist, at the onset of migraine prodromal symptoms led to lower rates of moderate to severe headache after 24 hours compared with placebo. Now the study has reported on prodromal symptoms, finding modest improvements in symptoms of photophobia, fatigue, and difficulty concentrating within a few hours of treatment compared with placebo (see figure).

Nat Med doi:10.1038/s41591-025-03679-7

Head-to-head for weight loss drugs

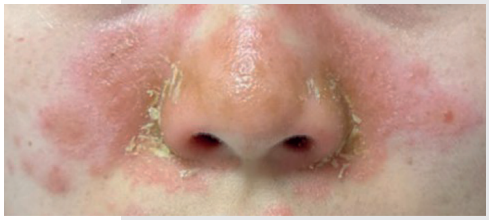
More evidence has been published that weight loss with tirzepatide is typically greater than that from semaglutide. In a head-to-head randomised trial of people with obesity and without diabetes average weight loss with tirzepatide was 20.2% after 72 weeks, compared with 13.7% with semaglutide. The open label study—funded by tirzepatide patent holders Eli Lilly—randomised 751 participants to receive the maximum tolerated dose of tirzepatide or semaglutide.

N Engl J Med doi:10.1056/NEJMoa2416394

GOADSBY PJ, AILANI J, DODICK DW, ET AL. UBROGEPANT FOR THE TREATMENT OF MIGRAINE PRODROMAL SYMPTOMS: AN EXPLORATORY ANALYSIS FROM THE RANDOMIZED PHASE 3 PRODROME TRIAL. *NAT MED* 2025

CLINICAL PICTURE

Atypical facial rash in systemic lupus erythematosus



This woman in her early 30s with an 11 year history of systemic lupus erythematosus (SLE) experienced a sudden disease flare-up with symptoms of SLE encephalopathy. She was treated with methylprednisolone (500 mg daily for three days, then reduced to 40 mg daily), hydroxychloroquine (200 mg orally twice daily), and a single intravenous infusion of cyclophosphamide (400 mg). Two weeks after starting treatment, she developed a pustular erythematous facial rash, involving the nasolabial folds (figure). This differs from the typical SLE malar rash, which generally spares the nasolabial folds and presents as erythema with desquamation or oedema, or both. Pustular manifestations of SLE are rare.

The rash gradually spread to the chest and abdomen, accompanied by fever and skin pain. Laboratory tests showed raised inflammatory markers. She was diagnosed with generalised pustular psoriasis (GPP) on a background of SLE. Hydroxychloroquine was discontinued,

Clinicians get a D for vitamin blood requests

How did we get into the position where vitamin D is a routine blood test that gets tagged on to the end of almost any set of first line investigations, costing millions in laboratory costs and treatment and wasting countless appointments? A cohort study set in Ontario, Canada, cites evidence that 75% of vitamin D tests are ordered inappropriately. It found that in 2011, when testing was restricted to specific clinical criteria, requests went down by 82.6%. Since then they have gradually crept back up again to over a million tests in 2023. The authors suggest that media campaigns about vitamin D and a lack of oversight and efforts to enforce the policy may be behind the increase.

JAMA Intern Med doi:10.1001/jamainternmed.2025.1000

A brief history of discharge summaries

Nobody has yet written a book on the history of discharge summaries, so here's my pitch. "Write as little as possible as quickly as possible," was the mantra less than 20 years ago when I was scrawling "CP, trop neg, d/c" on pieces of carbon paper that rarely made it into an envelope, never mind a GP's desk. Nowadays discharge summaries seem to go on forever, challenging NHS111 letters for the crown of highest ratio of irrelevant to relevant information in a clinical letter. Will large language models (LLMs) finally get it right? A cross sectional study of 100 physician—and LLM—generated discharge summaries suggests they might: the LLM summaries were more concise and coherent, they were less comprehensive and more likely to contain minor errors. Only time will tell.

JAMA Intern Med doi:10.1001/jamainternmed.2025.0821

Cite this as: *BMJ* 2025;389:r1027

and she was treated with intravenous spesolimab (900 mg), leading to rapid resolution of the rash with no recurrence. GPP can be triggered by various drugs including hydroxychloroquine, and by the abrupt discontinuation or reduction of steroids. GPP should be considered in patients who have SLE with pustular rashes to avoid unnecessary escalation of glucocorticoids.

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Patient consent obtained.

Cite this as: *BMJ* 2025;389:e082188

MINERVA From the wider world of research

Sigmoid resection after diverticulitis

In a trial in hospitals in Finland, 90 patients with recurring or complicated diverticulitis were randomised either to elective sigmoid resection or to conservative treatment (*JAMA Surg* doi:10.1001/jamasurg.2025.0572). During four years of follow-up, a third of patients allocated to conservative treatment needed surgery because of persistently poor quality of life. By contrast, early surgery prevented recurrence of diverticulitis without increasing complications.

Golf courses and Parkinson's disease

Living close to a golf course increases the likelihood of developing Parkinson's disease, according to a case-control study from the United States (*JAMA Netw Open* doi:10.1001/jamanetworkopen.2025.9198). People living within a mile of a golf course had double the risk of Parkinson's disease compared with those living more than six miles away. One possible explanation is that pesticides applied to golf courses either leach into the ground and contaminate drinking water supplies or increase levels of airborne exposure.

Air pollutants and Parkinson's disease

Nationwide data from Taiwan also implicate airborne exposures in the causation of Parkinson's disease (*J Neurol Neurosurg Psychiatry* doi.org/10.1136/jnnp-2024-334825). In a cohort of five million people followed for 11 years, more than 20 000 new cases of Parkinson's disease were diagnosed. Based on a measure of exposure to pollutants derived from air quality monitoring stations, risk rose threefold for each interquartile range increment for exposure to particulate matter (PM2.5 and PM10), with smaller increases linked to exposure to nitrogen and sulphur dioxides.

Prenatal exposure to cannabis

Cannabis is the most commonly used illegal substance in pregnancy. An update of a systematic review of its effect on neonatal outcomes incorporates eight new studies and concludes that smoking cannabis during pregnancy roughly doubles the risk of the fetus being born with low birthweight (*JAMA Pediatr* doi:10.1001/jamapediatrics.2025.0689). The risk of preterm birth and being small for gestational age is also raised.

Cannabis and cardiovascular events

Using cannabis also leads to a substantial increase in the risk of myocardial infarction and stroke. Analysis of nearly 5 million de-identified electronic medical records of adults aged 50 or younger from US healthcare organisations found that myocardial infarction was six times more frequent in cannabis users than non-users (*JACC: Advances* doi:10.1016/j.jacadv.2025.101698). Ischaemic stroke was four times more frequent.

Cite this as: *BMJ* 2025;389:r1021

PRACTICE POINTER

Diagnosis and management of gonorrhoea

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CPD READING
0.5 HOURS

LEARNING MODULE
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Gonorrhoea is of increasing concern for global sexual health. Continued stigmatisation of sexual health, particularly for those in marginalised communities, contributes to increasing incidence, greater complexity of cases, and the rise of multidrug resistant strains.[1] Antimicrobial resistance (AMR) limits treatment options. Condoms are highly effective at preventing transmission, but their use has been declining across several groups, even prior to the arrival of HIV pre-exposure prevention.[2 3] Here, we consider the challenges of diagnosis and holistic management of gonorrhoea in a global context as well as current and future treatment strategies.

What is the scale of the problem?

An estimated 82.4 million new gonorrhoea infections occurred globally in 2020, making gonorrhoea the second most commonly diagnosed bacterial sexually transmitted infection (STI) after chlamydia.[4] Incidence of reported cases is highest in the World Health Organization (WHO) African region (adult incidence 36 per 1000 person-years) and the Western Pacific region (adult incidence 24 per 1000 person-years).[4] Most countries in the regions that bear the highest burden of infection also lack adequate laboratory facilities and other infrastructure needed for effective diagnosis and management.[4] International targets for reduction of gonorrhoea incidence as part of an elimination strategy have not been met[1] and data from most high income settings, where the capacity to track incidence is greatest, show rising case numbers.[5 6]

WHAT YOU NEED TO KNOW

- Increasing incidence of gonorrhoea is likely to lead to more complicated and systemic presentations such as pelvic inflammatory disease, septic arthritis, and neonatal infection
- Increasing antimicrobial resistance is limiting treatment options for gonorrhoea, and management of suspected and confirmed cases must seek to minimise the development of further resistance. Gaining specimens for culture and sensitivity to guide treatment and monitor resistance patterns prior to treatment is crucial
- Gonorrhoea disproportionately affects marginalised groups, such as men who have sex with men and some ethnic minorities, and control will not be achieved without dismantling systemic barriers to good sexual health

Globally, people in marginalised groups experience higher rates of gonorrhoea, with higher prevalence in gender and sexual minorities, Indigenous peoples, and ethnic minority communities worldwide.[7]

If untreated, gonorrhoeal infections may spread to the epididymis and/or testes causing epididymo-orchitis, or to the endometrium, fallopian tubes and/or ovaries, causing pelvic inflammatory disease (PID). PID occurs in up to 14% of women with untreated gonorrhoea[8] and may result in subfertility, ectopic pregnancy, and chronic pelvic pain, with risk increasing with each recurrent infection.[9] Current infection with gonorrhoea increases the risk of HIV acquisition by 2.81 times in women[10] and 2.38 times in men who have sex with men.[11]

Gonococcal infection during pregnancy is associated with preterm birth and low birth weight.[12] Intrapartum infection of the infant occurs in 30-42% of vaginal deliveries in women with gonorrhoea, most commonly resulting in purulent conjunctivitis (ophthalmia neonatorum), which may progress to blindness, and occasionally disseminated infection which can be fatal.[13] Globally, the prevalence of gonorrhoea in pregnancy is estimated to be 1.85%, with higher rates among women in low-income countries, women living with HIV, and in young people.[14] In many settings, including the UK, screening is not routinely offered during pregnancy. As global gonorrhoea cases rise, undetected infections during pregnancy as well as neonatal gonococcal disease will also likely rise.

How does gonorrhoea present?

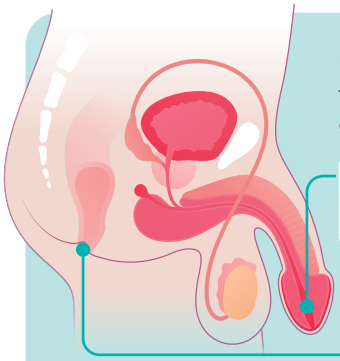
Gonorrhoea is caused by the Gram negative bacterium *Neisseria gonorrhoeae*, which can be transmitted through condomless vaginal, oral, or anal sex. A significant proportion of cases (40-47.9%[15 16]) are asymptomatic or involve infection occurring at sites other than the penile urethra (table 1). The symptoms that someone might have depends on the site of infection.

People with gonorrhoea may also present with symptoms of complicated infection, in particular epididymo-orchitis, characterised by testicular or scrotal pain and/or swelling, with or without urethral symptoms; or PID, presenting with pelvic pain or dyspareunia, altered vaginal bleeding, and/or fever. Haematogenous dissemination occurs in up to 3% of people with genital gonorrhoea,[18] leading to skin and joint manifestations. Gonorrhoeal septic arthritis is typically a monoarthritis or asymmetrical oligoarthritis with knees, ankles, wrists, and elbows most commonly affected.[18] A gonococcal arthritis-dermatitis syndrome usually includes a triad of tenosynovitis, pustular or vesicular skin lesions, and polyarthralgia (fig 1). Many patients (60%) report constitutional symptoms such as fever, chills, and

thebmj Visual summary

Gonorrhoea: Identification and management

Gonorrhoea is an increasing global sexual health concern. Patients without genital symptoms are likely to present outside of dedicated sexual health services, requiring a high index of suspicion among primary care providers to diagnose gonorrhoea correctly. This graphic summarises common symptoms, testing protocols, and initial treatment

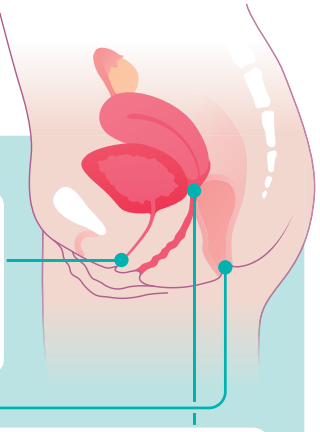


Common symptoms

The specific constellation of symptoms depends on the site of infection

Longer penile urethra — 90% symptomatic
- Mucopurulent discharge
- Dysuria

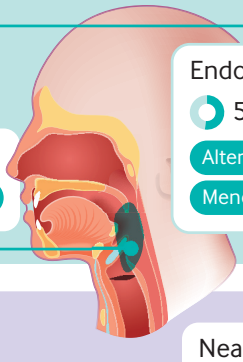
Shorter female urethra
- ? % symptomatic unknown
- Dysuria



Rectum — 20% symptomatic
- Anal pain
- Rectal discharge

Endocervix — 52% symptomatic
- Altered vaginal discharge
- Pelvic pain
- Menorrhagia
- Intermenstrual bleeding

Pharynx — 4% symptomatic
- Majority asymptomatic
- Rarely, sore throat



Individuals may not have exclusively male or female anatomy. Base clinical decision making on an individual's current anatomy

Diagnosis and initial treatment

Test individuals with suggestive symptoms - and those seeking asymptomatic sexual health screening - for gonorrhoea

Asymptomatic individuals

Symptomatic individuals

Nucleic Acid Amplification Test (NAAT)

Site of testing determined by symptom and/or sexual history

Type of sex reported	Sample type
Insertive anal, oral, or vaginal intercourse	First void urine
Receptive anal intercourse	Anal swab
Receptive oral intercourse	Pharyngeal swab
Receptive vaginal intercourse	Vulvovaginal swab

Higher rate of false positive tests. Only test those groups at high risk of gonorrhoea

+ Simultaneous testing for chlamydia is also recommended

Near-patient microscopy

Sensitivity is dependent on quality of the specimen and experience of the microscopist. Can allow for presumptive diagnosis while the patient is still in clinic

⚠ Generally only available in specialist sexual health settings

Sensitivity variation across sites

90-95%	37-50%
Penile urethra	Endocervix

Gonorrhoea culture

Required for antimicrobial susceptibility testing.

Where available, all major guidelines advise samples be collected for culture prior to initiating treatment in people with suspected or confirmed gonorrhoea

Empirical treatment

If high clinical suspicion of gonorrhoea treat to:

- Alleviate symptoms
- Reduce risk of complications
- Prevent onwards transmission

Collection of specimens for culture and follow up are essential

Extended spectrum cephalosporins such as ceftriaxone are the mainstay of treatment (with or without co-administered azithromycin)

Antimicrobial resistance: Penicillins, tetracyclines, ciprofloxacin, and azithromycin are now unsuitable for empirical treatment

+ Positive test

Targeted treatment

Where antibiotic sensitivity results are available prior to treatment, these should be used to guide antibiotic therapy

Table 1 | Likelihood and type of symptoms at site of infection with *Neisseria gonorrhoeae* (from studies in the UK and Australia)

Site of infection	Proportion symptomatic	Common symptoms[15-17]	Mean time to symptom onset (days)
Penile urethra	90%[17]	Mucopurulent discharge Dysuria	8.3[17]
Shorter urethra (typical of women and some trans men and non-binary people)	Unknown	Dysuria	Unknown
Endocervix	52%[15]	Altered vaginal discharge Pelvic pain Intermenstrual bleeding Menorrhagia	7.3[15]
Rectum	20%[15]	Anal pain Rectal discharge	Unknown
Pharynx	4%[17]	Majority asymptomatic Rarely, sore throat	Unknown

malaise.[18] As overall global incidence of gonorrhoea increases, it is likely these presentations will become more common. Patients without genital symptoms are likely to present in settings away from dedicated sexual health services, requiring a high index of suspicion among primary care providers to diagnose correctly.

How is gonorrhoea diagnosed?

Gonorrhoea testing should be performed in anyone with suggestive symptoms, those seeking asymptomatic sexual health screening or otherwise as per local guidelines. Many people feel uncomfortable talking about sex with healthcare professionals (and indeed partners), and may not volunteer information about sexual partners or known risk factors for gonorrhoea, such as commercial sex work, same sex partners, or non-use of condoms. Maintain a low threshold for offering testing where patients are symptomatic, even if they do not report new sexual partners.

Choice of diagnostic test depends on local testing and/or screening guidelines, available testing modalities, and presence or absence of specific symptoms.

Symptomatic individuals

Nucleic acid amplification tests (NAATs) are highly sensitive and are used globally for the diagnosis of gonorrhoea in both symptomatic and asymptomatic individuals. NAATs can be performed on swabs from genital or extragenital sites, or first void urine, with site of testing determined by symptom and/or sexual history. Gonorrhoea NAAT testing is often combined with chlamydia NAAT testing. Given that the two infections have considerable overlap in terms of risk factors and clinical presentation, simultaneous testing for chlamydia is recommended in all patients testing for gonorrhoea.[19]

Gonorrhoea culture is required for antimicrobial susceptibility testing, with guidelines from WHO, International Union against Sexually Transmitted Infections (IUSTI Europe), British Association for Sexual Health and HIV (BASHH), and Centers for Disease Control and Prevention (CDC) advising that samples be collected for culture prior to initiating treatment in people with suspected or confirmed gonorrhoea. Specific requirements for collection, storage, and transport of specimens mean culture is usually not available outside of specialist sexual health settings.

In most settings, NAAT results are not available the same day, however near-patient microscopy of Gram stained genital specimens (while the patient is still in clinic) can, in some settings, facilitate presumptive diagnosis, rapid treatment, and prevention of onward transmission. That said, sensitivity of microscopy, even in symptomatic patients, varies considerably across anatomical sites (90-95% penile urethra,[17] 37-50% endocervix[16]) and depends on the quality of the specimen obtained and the experience of the microscopist (fig 2). Again, these requirements mean this is generally only available in specialist sexual health settings.

Asymptomatic individuals

For asymptomatic individuals undergoing STI screening, NAATs remain highly sensitive and are the preferred method of testing for gonorrhoea. Site of testing is determined by sexual history (table 2). Self-taken samples for NAAT are as accurate as clinician-taken samples.[20] Self-sampling removes the need for examination, or even visiting a clinic for STI screening, which may help to widen access to testing by reducing or removing concerns about privacy, convenience, and autonomy, as well as reducing the burden on service providers.[21] Self-sampling has been found to

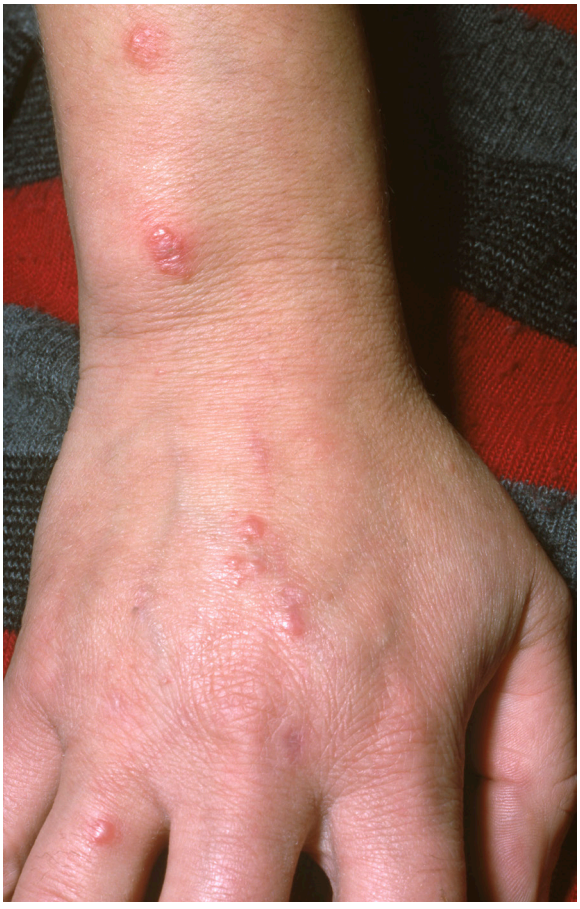


Fig 1 | Pustular rash secondary to disseminated gonorrhoea. Lesions are typically tender and occur as part of a triad with tenosynovitis and polyarthritis (arthritis-dermatitis syndrome)

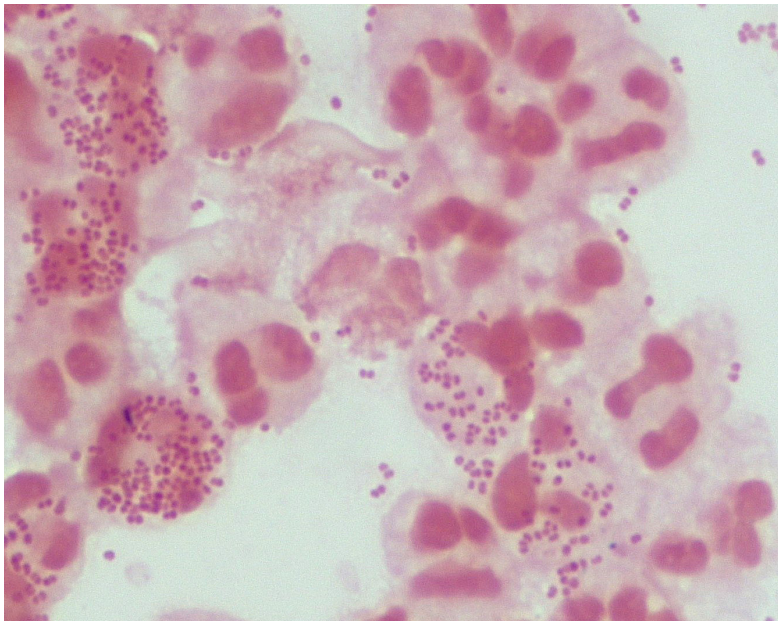


Fig 2 | Light microscopy of Gram stained urethral specimen showing *N gonorrhoeae*. Near patient microscopy allows rapid diagnosis and treatment, and breaks the cycle of transmission

be feasible and acceptable across a range of patient groups and settings and is recommended by WHO as an additional method of STI testing.[21] Self-sampling alone may not be appropriate for symptomatic patients, in whom examination is key for collecting samples for microscopy and culture, excluding differential diagnoses (for example, in people presenting with intermenstrual bleeding, examination and additional sample collection are likely warranted to address other differential diagnoses, including PID, cervical ectropion, and cervical or endometrial malignancy), and identifying complications of infection.

Where possible, refer asymptomatic patients testing positive for gonorrhoea to specialist services where samples can be taken for culture to guide antibiotic treatment (including parenteral treatment).

How is gonorrhoea managed?

N gonorrhoeae has developed resistance to all active classes of antibiotics, and measures to avoid the development of further resistance must be central in treatment decisions.

Antimicrobial resistance

Misuse and overuse of antimicrobials have been major drivers of AMR, leading to multidrug resistant strains of gonorrhoea, since *N gonorrhoeae* can develop resistance through several mechanisms. Poorer antibiotic penetration to the oropharynx results in a lower rate of cure at this site and may drive onwards transmission.[22 23] The pharynx commonly contains commensal *Neisseria* species, from which *N gonorrhoeae* may acquire AMR mutations through horizontal gene transfer.[24]

Prevalence of AMR among gonorrhoea isolates is increasing globally.[23] Recent UK data show a high level of resistance to antibiotics that have previously been used for treatment: penicillins (13.6%), tetracyclines (84.1%), ciprofloxacin (58.6%), and azithromycin (20.4%),[25]

Table 2 | Recommended sites of gonorrhoea NAAT testing[19]

Type of sex reported	Sample to be performed
Insertive anal, oral, or vaginal intercourse	First void urine
Receptive anal intercourse	Anal swab
Receptive oral intercourse	Pharyngeal swab*
Receptive vaginal intercourse	Vulvovaginal swab

*Tests at the pharynx have a higher rate of false positive results, therefore they should be performed only in patients at high risk of gonorrhoea, for example men who have sex with men, commercial sex workers and their clients, or patients who report receptive oral intercourse with a person known to have gonorrhoea

rendering these classes of drugs unsuitable as empirical treatment. Resistance to azithromycin, which has been widely used as first line treatment for gonorrhoea, is increasing globally, and sustained transmission of resistant strains has been observed.[24 25]

Extended spectrum cephalosporins such as ceftriaxone are now the mainstay of treatment and are considered the last available option for empiric monotherapy. Ceftriaxone resistance and associated treatment failures have been well documented, mainly from high income settings including the UK.[24-27] However, cases are often associated with travel to the global south (especially the Asia-Pacific region), and some direct reports of cephalosporin resistance come from lower income settings.[24 26] A paucity of susceptibility and treatment outcome data from these regions, which are known to bear a disproportionate burden of gonorrhoea, raises the concern that there may be further AMR that is as yet undetected.[24 26]

There is also concern about the potential for syndromic management and empirical treatment of gonorrhoea to drive broader AMR, including in other STIs such as *Mycoplasma genitalium*, for which antibiotic treatment options are already limited due to widespread resistance. Data from the UK in 2023 found 62.2% of *M genitalium* specimens displayed genes associated with macrolide resistance,[28] contributing to the withdrawal of azithromycin as first line treatment for gonorrhoea, although many international guidelines continue to recommend its use in combination with ceftriaxone.

Syndromic management

Syndromic management is the instigation of multiple antimicrobial treatments at first presentation of a patient with possible STI in order to alleviate symptoms, prevent complications, and prevent onward transmission. Multiple antibiotics are usually given to cover several potential pathogens. This approach is recommended by WHO only when laboratory diagnosis is likely to be delayed or unfeasible because of limited or no access to rapid, affordable, and accurate testing.[29] Testing should always be performed when laboratory diagnosis is available.[27] Exposure to multiple antibiotics may promote AMR, therefore consistent surveillance is needed in areas that use syndromic management for gonorrhoea to monitor any effects on resistance and inform treatment guidelines in these settings.

Empirical treatment

Even in settings where there is easy access to diagnostics, empirical treatment (ie, provision of

Table 3 | Recommended antibiotic treatment for uncomplicated anogenital and pharyngeal gonorrhoea infection in adults, based on international guidelines

Organisation	British Association for Sexual Health and HIV (BASHH)[19]	International Union Against Sexually Transmitted Infections (IUSTI) Europe[30]	Centers for Disease Control and Prevention (CDC)[31]	World Health Organization[29]
Recommended empirical treatment for uncomplicated gonorrhoea	Ceftriaxone 1 g IM stat	Ceftriaxone 1 g IM stat and azithromycin 2 g PO stat or Ceftriaxone 1 g IM stat*	Ceftriaxone 500 mg IM stat	Ceftriaxone 250 mg IM stat and azithromycin 1 g PO stat
Alternative regimens	Cefixime 400 mg PO stat and azithromycin 2 g PO stat or Gentamicin 240 mg IM stat and azithromycin 2 g PO stat or Spectinomycin 2 g IM stat and azithromycin 2 g PO stat† or azithromycin 2 g PO stat or ciprofloxacin 500 mg PO stat‡	Cefixime 400 mg PO stat and azithromycin 2 g PO stat or Gentamicin 240 mg IM stat and azithromycin 2 g PO stat or Spectinomycin 2 g IM stat and azithromycin 2 g PO stat or Ciprofloxacin 500 mg PO stat‡	Gentamicin 240 mg IM stat and azithromycin 2 g PO stat or Cefixime 800 mg PO stat	Cefixime 400 mg PO stat and azithromycin 1 g PO stat

*Only recommended in settings where:
(1) Comprehensive, recent, and quality assured local in vitro ceftriaxone susceptibility testing has shown lack of ceftriaxone resistance
(2) Test of cure (TOC) is mandatory
(3) The patient is considered very likely to return for test of cure
(4) Doxycycline 100 mg oral dose twice daily for 7 days is administered at the same time to cover any concomitant *Chlamydia trachomatis* infection, if *C trachomatis* infection has not been excluded by NAAT.
†Not recommended for pharyngeal infection
‡Only if isolate known to be sensitive
IM=intramuscular; PO=by mouth; stat=immediately

antibiotics targeted to treat gonorrhoea where there is a very high clinical suspicion) is often used with the aim of alleviating symptoms, reducing risk of complications, and preventing onward transmission. This is usually based on near patient microscopy results, and or sexual contact with a person with confirmed gonorrhoea. Empirical treatment differs from syndromic management in that confirmatory testing is initiated and follow-up is arranged, which allows antibiotics to be more closely targeted. As AMR surveillance data are usually available in such settings, antibiotics can be tailored to known gonorrhoeal resistance patterns. However, provision of antibiotics before sensitivities are available still has the potential to drive resistance. Therefore, collection of specimens for culture with consideration of delaying treatment until these are available (for example, for asymptomatic patients who are able to abstain from sex until after treatment) is best practice where feasible.

Recommended empirical treatment options for uncomplicated gonorrhoea are summarised in table 3.

Antimicrobial treatment

Intramuscular administration of ceftriaxone is considered first line treatment in all settings; refer patients to a service where this can be given rather than offering oral alternatives. UK guidelines have recommended the dose of ceftriaxone be increased, as while resistance remains rare in the UK, an increasing proportion of isolates show higher minimum inhibitory concentrations for ceftriaxone (and therefore reduced susceptibility) which may be overcome by increasing the dose.[19] This may also slow the development of overt resistance. Dual therapy with ceftriaxone and azithromycin, recommended in some guidelines, aims to ensure successful treatment even when ceftriaxone sensitivity is reduced and aims to delay the development of ceftriaxone resistance. Azithromycin has also been included to treat concomitant chlamydia, but concerns about efficacy of this regimen for rectal chlamydia[32] and the potential of co-treatment to drive resistance in other bacteria have led to its removal from UK and USA guidelines.

When antibiotic sensitivity results are available prior to treatment, these should be used to guide antibiotic therapy. Follow-up to ensure resolution of symptoms and/or test of cure are also best practices where feasible. Patients with complicated gonorrhoea—infections involving the upper genital tract or with evidence of dissemination or systemic illness—may require a prolonged course of treatment and warrant referral to specialist services.

Sexual contacts of people with gonorrhoea should be actively traced and offered testing and/or treatment to prevent further spread of infection.[19]

HOW PATIENTS WERE INVOLVED IN THE CREATION OF THIS ARTICLE

Two patients were involved in the creation of this article. Patient A gave permission for clinical photographs to be used in support of the article, and gave suggestions as to the content of the article. Patient B reviewed and commented on the draft article. In particular, the section of the article "How does gonorrhoea present" was rewritten according to the patients' comments, including specific mention of the stigmatisation of the condition. Both patients have chosen to remain anonymous.

EDUCATION INTO PRACTICE

- How confident do you feel in recognising gonorrhoea, including non-genital presentations?
- When might you refer patients with suspected or confirmed gonorrhoea to genitourinary medicine?
- Why is gonorrhoea incidence higher in marginalised groups? What could be done to overcome this?

Competing interests: None declared.

Cite this as: *BMJ* 2025;389:e084789

Find the full version with references at doi: 10.1136/bmj-2025-084789

EDITORIAL

Rising cases of gonorrhoea

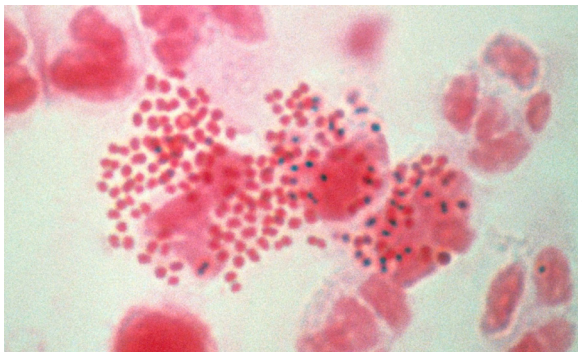
Novel interventions are needed to tackle a public health crisis

Annually, there are more than 82 million cases of gonorrhoea worldwide.[1] In 2023, England recorded more than 85 000 gonorrhoea diagnoses—the highest annual incidence since records began in 1918 and a threefold increase since 2012.[2] This dramatic rise in case numbers is not limited to the UK: in Europe notification rates increased by more than 300% between 2014 and 2023,[3] and cases reported in Australia have doubled in the past decade.[4]

Men who have sex with men are at high risk for gonorrhoea infection, but cases are also rising in heterosexual individuals, with some European countries reporting >70% increases in cases in young heterosexual women aged 20-24 years.[3 5] While increased testing may contribute to higher case numbers, the rising incidence indicates a public health crisis confirmed in high income countries and likely also present in low- and middle income countries, where gaps in surveillance data may mask the true scale of the problem.[6]

Antimicrobial resistance (AMR) in gonorrhoea poses a significant global threat,[7] with resistance shown to all antimicrobial classes recommended for treatment. Extensively drug resistant (XDR) strains are increasingly reported internationally, heightening the risk of untreatable infection.[8] As a result of AMR, *Neisseria gonorrhoeae* is designated a global "priority pathogen" by the World Health Organization and an urgent threat to public health by the US Centers for Disease Control[11] and the UK Health Security Agency,[12] emphasising the need for urgent research and interventions.

Amid these challenges are promising developments in the diagnosis, treatment, and prevention of gonorrhoea. Advances in point-of-care testing (POCT) for sexually transmitted infections (STIs) are



BIOPHOTO ASSOCIATES/SPL

While there is a high risk of infection in men who have sex with men, cases are rising in heterosexual individuals globally

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progressing rapidly.[13] However, implementation of POCT for gonorrhoea remains more than five years away even in well resourced settings, and modelling studies suggest it must include *N gonorrhoeae* resistance testing to prevent the propagation of antimicrobial resistant strains.[15]

Developments in treatment

After decades without new antibiotics for gonorrhoea, encouraging results have been reported for two topoisomerase inhibitors in phase 3 trials: zoliflodacin and gepotidacin. These oral antibiotics utilise a novel inhibition mechanism and have shown non-inferiority to ceftriaxone plus azithromycin in treating uncomplicated gonorrhoea.[16 17] However, there are concerns regarding their ability to treat extragenital infections and the potential to promote tetracycline resistance.[18 19] Therefore, continued investment in the development of novel treatments remains urgent.

Increased service provision for HIV pre-exposure prophylaxis (PrEP) has not only reduced HIV transmission and engaged high-risk communities but also created infrastructure that could support broader STI screening and preventive measures in some settings.[20] A meta-analysis conducted in 2024 suggests doxycycline post-exposure prophylaxis (Doxy-PEP) may reduce bacterial STIs, including gonorrhoea, in certain populations.[21] However, unlike the use of antivirals for PrEP and HIV post-exposure prophylaxis, the effectiveness of Doxy-PEP against gonorrhoea infection is unclear and may be associated with an increased rate of tetracycline resistant *N gonorrhoeae* infections.[19] Unanswered questions remain regarding the long term effects of Doxy-PEP, including a potentially adverse impact on the human microbiome and AMR among bacterial STIs that warrant surveillance.[22]

Perhaps most exciting is the serendipitous finding that vaccines targeting *Neisseria meningitidis* serogroup B have shown modest effectiveness in preventing *N gonorrhoeae* infection. Modelling which suggested that targeted implementation of even a modestly efficacious vaccine could have a significant public health impact.[25] This proposal was recently implemented in England, making it the world's first vaccination programme against the infection. Although the effectiveness of 4CMenB has reinvigorated gonorrhoea vaccine development, with numerous candidates close to assessment in humans,[27] roll-out of an efficacious gonorrhoea specific vaccine remains, unfortunately, some years away.

In the meantime, healthcare workers must be mindful of the soaring incidence of gonorrhoea and reinforce the importance of behavioural interventions including condom use, comprehensive contact tracing, and test of cure in high risk cases to minimise onward transmission. We must remember the societal context within which gonorrhoea infection occurs; as a highly stigmatised disease, disproportionately affecting vulnerable populations, it can be challenging for individuals to seek diagnosis and treatment or even participate in gonorrhoea research.[28]

Cite this as: *BMJ* 2025;389:r1001

Find the full version with references at http://dx.doi.org/10.1136/bmj.r1001

STATE OF THE ART REVIEW

Advances in treatments for acute ischaemic stroke

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This is a summary of Clinical Review *Advances in treatments for acute ischemic stroke*. The full version can be read here: https://www.bmj.com/content/389/bmj-2023-076161

CPD READING
0.5 HOURS

Acute ischaemic stroke is defined as an interruption of blood supply to a region of the brain, and its cause varies. Regardless of its mechanism, an ischaemic stroke often results in significant neurological deficits, and, if enough regions are deprived of perfusion, in death. The global disease burden and mortality and morbidity associated with stroke have decreased slowly since the early 20th century.[1] Confirmed treatments include intravenous thrombolysis (IVT) and endovascular thrombectomy (EVT), and the indications for both are increasingly expanding.

Epidemiology

In 2021, 69.93 million people worldwide had an ischaemic stroke, representing a 1.33% decrease since 2010.[1] Compared with men, women have a higher lifetime risk of and increased mortality from stroke, regardless of age. Large vessel and small vessel atherosclerosis were more frequently associated causes of stroke in high income countries, whereas other or undetermined causes of stroke were seen more frequently in middle and low income countries.[1] Risk factors for stroke are also disproportionate. For example, diabetes and hypertension are more commonly found in black and Asian people, and weight gain is associated with higher risk of stroke in women than in men.[1]

WHAT YOU NEED TO KNOW

- Intravenous thrombolysis was the first acute treatment developed for ischaemic strokes. First with alteplase and now with tenecteplase, intravenous thrombolysis remains a cornerstone of acute ischaemic stroke treatment
- In large vessel occlusions, endovascular thrombectomy is an effective treatment in acute stroke management for anterior and posterior circulation strokes
- The boundaries for both intravenous thrombolysis and endovascular thrombectomy have expanded, improving outcomes in patients who were previously unable to access these treatments. Efforts continue to expand the time windows for acute stroke interventions

Intravenous thrombolysis

IVT has become the guideline based treatment for acute stroke within 4.5 hours of onset.[3-6] Tenecteplase, with its higher specificity for fibrin, longer half life, and lower risk of systemic haemorrhage, has replaced tPA in many stroke centres.[7-9] However, the boundaries for IVT administration continue to expand.

Unknown time of onset

A 2018 randomised controlled trial (WAKE-UP, n=503) showed an improvement in functional outcome at 90 days in patients with unknown last known well (LKW).[10] This finding was contested by a 2020 multicentre, randomised controlled trial in Japan (THAWS, n=131), which showed that while it was safe, administering tPA versus placebo in patients with stroke with diffusion weighted imaging–fluid attenuated inversion recovery mismatch had no effect on functional outcome at 90 days.[11] A multicentre, randomised controlled trial (TWIST, n=578) in 2023 attempted to identify patients eligible to receive tenecteplase among those who were within 4.5 hours of waking up with stroke; although tenecteplase administration versus placebo was safe, there was no difference between the two when measuring functional outcome at 90 days.[12]

Extended window

The first evidence of the potential benefit of IVT outside the 4.5 hour window was shown in 2012 (IST-3).[13] A 2019 meta-analysis (total n=414), examining pooled data from EPITHET, EXTEND, and ECASS 4-EXTEND, further provided support for administering IVT versus placebo for carefully selected patients in the 4.5-9 hour window for improved functional outcome at 90 days.[15]

Alternative thrombolysis agents

Besides tPA and tenecteplase, alternative thrombolytic agents continue to be studied (see table 1 online).[18]

Recombinant human prourokinase was compared with alteplase in a randomised controlled non-inferiority trial (PROST) in 2023 in 663 patients with stroke within 4.5 hours of symptom onset. At 90 days, 65.2% in the recombinant human prourokinase group and 64.3% in the alteplase group achieved good functional outcome (risk difference 0.89, 95% confidence interval −6.52 to 8.29), which was within the non-inferiority margin. The rates of symptomatic intracerebral haemorrhage were similar in both groups, but the recombinant human prourokinase group had less systemic bleeding.[19] A 2024 randomised controlled non-inferiority trial (RAISE) compared reteplase, a recombinant plasminogen activator administered in two boluses of standardised dosing, and alteplase in 1412 patients with stroke within 4.5 hours of symptom onset. Good functional outcome at 90 days was seen in 79.5% *v* 70.4% (95% confidence interval 1.05 to 1.21), exceeding the non-inferiority criterion and showing potential superiority of reteplase, although any intracranial haemorrhage (7.7% *v* 4.9%, risk ratio 1.59, 95% confidence interval 1.00 to 2.51) and

Existing absolute contraindications for intravenous thrombolysis according to American Heart Association/American Stroke Association

- Unknown time of onset or unwitnessed symptom onset with last known well >4.5 hours*
- Awoke with symptoms with last known well >4.5 hours*
- Extensive hypoattenuation on computed tomography scan
- History of intracerebral haemorrhage
- History of ischaemic stroke within three months*
- Severe head trauma within three months
- Intracranial or intraspinal surgery within three months
- Subarachnoid haemorrhage
- Gastrointestinal malignancy
- Gastrointestinal bleed within 21 days
- Coagulopathy (international normalised ratio >1.7, activated partial thromboplastin time <40 seconds, prothrombin time >15 seconds)
- Therapeutic low molecular weight heparin within 24 hours
- Thrombocytopenia (platelet count <100 000/mm^3)
- Concurrent use of glycoprotein IIb/IIIa receptor inhibitors
- Direct thrombin inhibitors or factor Xa inhibitors within 48 hours*
- Infective endocarditis
- Aortic arch dissection
- Intra-axial intracranial neoplasm*

*Contraindications for which evidence supports use of intravenous thrombolysis despite their presence[3 28]

JAVIER LARREA/SPL

adverse events (91.6% *v* 82.4%, 1.11, 1.03 to 1.20) were higher with reteplase.

Adjunctive agents

Some studies have explored IVT in combination with other agents to enhance thrombolysis. To date, no beneficial adjunctive treatment to IVT has been identified.

IVT in patients with traditional contraindications

IVT guidelines today have exclusion criteria that mainly centre around reducing the risk of haemorrhagic complications (box).[3 4] However, growing evidence shows that these criteria might be too restrictive. For example, a 2020 meta-analysis of six clinical trials (total n=52 823 across six studies) showed no increased risk of haemorrhagic transformation, symptomatic haemorrhagic transformation, or early mortality with IVT in patients who had taken a direct oral anticoagulant within 48 hours.[24] Similarly, a 2023 retrospective cohort study (n=33 207) showed that among patients with stroke who received IVT and had taken a direct oral anticoagulant within 48 hours, the risk of symptomatic intracerebral haemorrhage was lower compared with no anticoagulation.[25]

A 2020 retrospective observational study of 293 patients showed that while those with previous ischaemic stroke within three months were less likely to be discharged home or have good functional outcome at discharge, the increased risk of symptomatic intracerebral haemorrhage after tPA was only seen in those with a history of ischaemic stroke within the last 14 days.[26] A 2022 systematic review of 23 studies (n=495) suggested that the presence of benign, as opposed to malignant or metastatic, intracranial tumors was not associated with increased risk of intracerebral haemorrhage after tPA.[27] Although additional studies are required, the current literature seems to point to a reduction of the exclusion criteria for IVT.

Systems of care designed to expand access to thrombolysis

Although the maximal benefit of thrombolysis was seen within the first 90 minutes of stroke onset in the initial NINDS trial, a 2016 review of the Get With The Guidelines-Stroke data showed that IVT started within 60 minutes of stroke onset was associated with increased odds of being able to be discharged home, ambulating independently at discharge, and freedom from disability compared with administration at later time points.[5 29] Telestroke has the potential to hasten IVT administration. Telestroke has been in existence since 1999 and has been shown to be superior to telephone consults with neurologists in making accurate decisions about administering IVT.[30 31] More recently, a 2020 retrospective cohort study (n=12 803) showed that with every 10 telestroke consults done at a community hospital, there was a 1.8 minute decrease in the door-to-needle time (P=0.02).[32]

Mobile stroke units (MSUs) have also been used to optimise access to intravenous thrombolytics in stroke care (fig 1). MSUs are specialised ambulances with a CT scanner, emergency medical services personnel, a nurse, a radiology technician, and a neurologist—available in person or through telestroke, with capabilities to administer intravenous thrombolytics.[33 34] Despite potential benefits of MSUs, barriers for widespread adoption still exist, including high cost of purchase and maintenance, availability of specialised personnel, limited funding sources, and lack of recognition by governmental agencies.[34]

Mechanical thrombectomy

In 2015, through careful selection of patients with proximal anterior circulation large vessel occlusions—mostly targeting intracranial internal carotid artery and M1—several randomised clinical trials individually showed the benefit of EVT plus tPA versus tPA alone

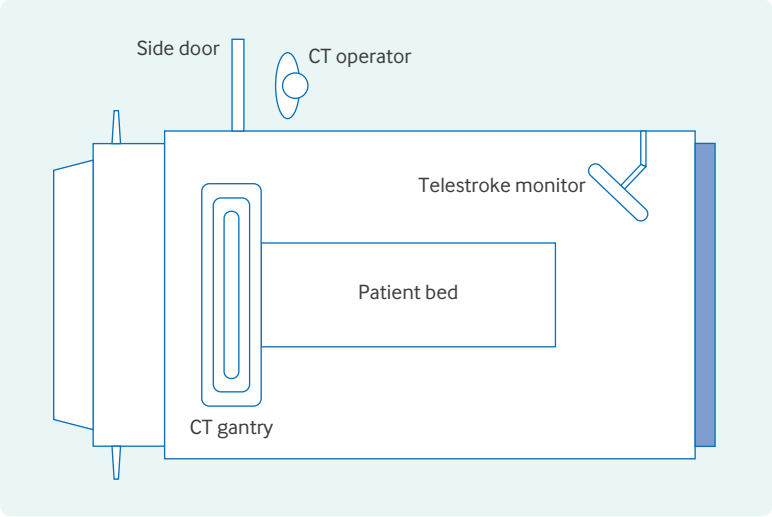

Fig 1 | Layout of a typical mobile stroke unit. CT=computed tomography

in the early window of less than six hours from stroke onset.[40-44] A 2016 meta-analysis came to a similar conclusion—compared with controls, EVT was more likely to lead to good clinical outcome at 90 days.[45] The window for EVT was extended up to 24 hours from stroke onset in 2018 when two randomised controlled trials showed the benefit of EVT in patients with clinical deficit-ischaemic core mismatch between 6 and 24 hours after LKW using perfusion imaging.[46 47] Selecting patients based on collateral flow on CT angiography was also shown to be effective in the 6-24 hour window.[48]

Posterior circulation

It is important to note that while the early successful EVT trials focused on the anterior circulation, infarcts in the posterior circulation still represent about 20% of all ischaemic strokes and are associated with significant morbidity and mortality.[49-51] In 2020, a randomised open label trial in China found no difference in modified Rankin scale (mRS) score at 90 days in patients with vertebrobasilar occlusions who underwent EVT plus medical treatment versus medical treatment alone within eight hours of symptom onset.[52] In 2021, another randomised controlled trial only included patients for whom EVT could be performed within six hours of stroke onset but did not show any significant difference in the 90 day functional outcome between the EVT group and the medical management group (44.2% *v* 37.7%, risk ratio 1.18, 95% confidence interval 0.92 to 1.50).[53] Although these were negative trials, owing to poor recruitment, both studies had large numbers of patients treated outside of trial protocols.

In 2022, two randomised controlled trials showed that EVT for basilar occlusions performed within 12 and 24 hours of stroke onset, increased the chance of good clinical outcome at three months.[55 56] Meta-analysis of the four posterior circulation EVT trials confirmed the benefit of EVT in posterior circulation large vessel occlusions, despite a higher chance of symptomatic intracerebral haemorrhage.[57]

Blood pressure management

In patients receiving IVT, the blood pressure goal is <185/110 mm Hg before administration and <180/105 mm Hg after treatment based on the initial NINDS study.[3 91] In 2019, a partial factorial, open label, blinded endpoint trial investigated whether intensive blood pressure control after intravenous thrombolysis was beneficial. The trial showed that lowering the systolic blood pressure to 130-140 mm Hg within one hour of IVT did not result in any improvement in 90 day functional outcome compared with those with systolic blood pressure <180 mm Hg . However, there were significantly fewer occurrences of any intracerebral haemorrhage or haemorrhagic transformation associated with the lower blood pressure target.[92]

Similar to after IVT, the blood pressure target is set at <180/105 mm Hg after EVT according to the existing guidelines, although the level of evidence for this recommendation is weak.[3 91] A prospective observational study in 2017 showed that those who were functionally independent at three months had lower systolic blood pressure in the first 24 hours after EVT (160±19 *v* 179±23 mm Hg, P=0.001).[93 94] By contrast, a 2021 randomised controlled trial showed that intensive blood pressure control (100-129 mm Hg) within one hour and maintained for 24 hours after EVT did not reduce the rate of radiographic intracerebral haemorrhage on follow-up imaging in 24-36 hours compared with standard care (130-185 mm Hg; odds ratio 0.96, 95% confidence interval 0.60 to 1.51), with similar rates of hypotensive events for both.[95]

A 2022 randomised controlled trial investigated functional outcomes at 90 days for intensive blood pressure management (<120 mm Hg, achieved within one hour of EVT, and sustained for 72 hours) and less intensive management (140-180 mm Hg), and showed that the intensive management was associated with greater poor functional outcome with no significant differences in symptomatic intracerebral haemorrhage.[96] Similarly, a 2023 randomised controlled trial from South Korea showed that systolic blood pressure <140 mm Hg for 24 hours after EVT was associated with lower likelihood of functional independence at three months compared with standard care (140-180 mm Hg; 39.4% *v* 54.4%, odds ratio 0.56, 95% confidence interval 0.33 to 0.96).[97] Also in 2023, another randomised controlled trial showed no difference in stroke burden at 36 hours or degree of disability at 90 days in patients in whom systolic blood pressure was lowered to various targets <180 mm Hg.[98] Although not a new method, blood pressure management continues to be a critical part of acute ischaemic stroke treatment.

MRI in acute stroke management

Magnetic resonance imaging (MRI) was used to identify eligible patients for earlier EVT trials and has been studied in identifying patients eligible for IVT in the setting of unknown time of onset. However, the use of MRI in acute clinical settings has been limited because

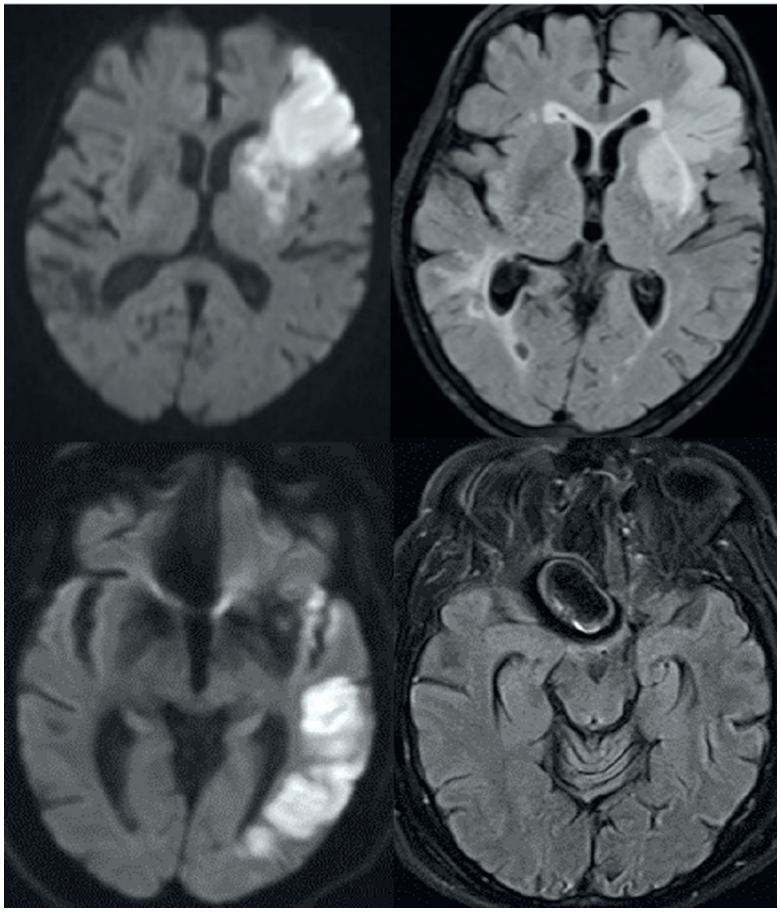

Fig 2 | Comparisons of DWI and T2 FLAIR images in acute and hyperacute ischaemic strokes without large vessel occlusion. Top: DWI hyperintensity in left frontal region (left), with corresponding T2 FLAIR hyperintensity (right), showing acute ischaemic stroke. Bottom: DWI hyperintensity in left temporal region (left) without corresponding T2 FLAIR hyperintensity (right) from hyperacute MRI protocol. The patient with the bottom images would be considered a potential candidate for intravenous thrombolysis based on the MRI. DWI=diffusion weighted imaging; FLAIR=fluid attenuated inversion recovery; MRI=magnetic resonance imaging

of its sparse availability, greater resource utilization, and prolonged preparation for each scan. With the advent of hyperacute protocols, which can be completed within 15 minutes, MRI's role in acute stroke management is being investigated.[99] A small prospective cohort study in 2016 showed that the use of hyperacute MRIs to identify patients with acute ischaemic stroke among those thought to have stroke mimics did not affect the door-to-needle time (39 minutes (before hyperacute MRI) *v* 37 minutes (after hyperacute MRI), P=0.63) and symptomatic haemorrhage rates (4.5% *v* 1.9%, P=0.32).[100] A 2018 retrospective cohort study showed that it was feasible to use diffusion weighted and perfusion weighted MRIs alone to identify patients with large vessel occlusions who were eligible for EVT and even correctly localise the segment of occlusion.[101] Hyperacute MRIs could also potentially have cost advantages. A 2017 retrospective cohort study showed that the average daily direct cost of caring for patients with stroke was reduced by 24.5% when comparing cost of care before and after the implementation of hyperacute MRI, without affecting the length of stay.[102] Although more studies are needed, these findings underscore the growing potential of hyperacute MRIs to enhance acute stroke care (fig 2).

Emerging treatments

Efforts continue to expand the time windows for acute stroke interventions. A 2023 retrospective cohort study showed that, compared with those who underwent EVT within the 6-24 hour window, patients who underwent EVT beyond 24 hours tolerated the procedure with similar rates of symptomatic intracerebral haemorrhage; yet, these patients were less likely to be functionally independent and had higher odds of mortality at 90 days.[103] With careful selection of patients, another retrospective cohort study showed similar rates of functional outcome and symptomatic intracerebral haemorrhage between EVT beyond 24 hours and EVT within the standard window.[104] Artificial intelligence is also being deployed in acute stroke care. A 2024 cluster randomised trial showed that patients with acute stroke who were treated by physicians using an artificial intelligence clinical decision support system had fewer vascular events than controls.[106] Neuroprotective agents are also being studied as an adjunctive therapy to EVT. A 2023 phase 1, randomised controlled trial showed that administering ApTOLL, a DNA aptamer with potential anti-inflammatory effects through its antagonistic action on toll like receptor 4, was associated with a higher chance of good functional outcome at 90 days in patients who underwent EVT.[107]

Guidelines

Several guidelines about the management of acute stroke have been published, including the American Heart Association/American Stroke Association (AHA/ASA) and the European Stroke Organisation (ESO) guidelines.[3 4 112-116] Although the AHA/ASA have not updated their guidelines since 2019, the ESO has maintained its guidelines up to date to incorporate newer evidence. The ESO makes recommendations for IVT between 4.5 and 9 hours from LKW based on MRI or CT perfusion, tenecteplase as an alternative to alteplase, the use of MSUs, and EVT for basilar artery occlusions, while the AHA/ASA guidelines do not provide specific recommendations for these treatments.[4 114-116] Neither the AHA/ASA nor ESO makes specific recommendations about adjunctive agents to IVT and EVT, EVTs in medium vessel occlusions and large core infarcts, acute stenting, and rescue stenting for failed EVT.

HOW PATIENTS WERE INVOLVED IN THE CREATION OF THIS ARTICLE

This manuscript was reviewed by Mr Joseph Engel, an ischaemic stroke survivor who was treated at Yale-New Haven Hospital. He has experienced first hand the long term symptoms associated with ischaemic stroke. He encourages the use of evidence based therapies to abort an acute ischaemic stroke in eligible patients to prevent post-stroke sequelae. He has provided feedback to strengthen this manuscript.

Competing interests: None declared.

Cite this as: *BMJ* 2025;389:r991

Find the full version with references at http://dx.doi.org/10.1136/bmj.r991

Please explain the seriousness of the situation

CPD READING
0.5 HOURS

Freddie Stening shares the challenges he faced while coming to terms with his wife's unexpected death

Georgina, my wife of 57 years, passed away in January 2024. Her death came as a big shock to the family as until two days prior we were told she should recover from what we believed was infection related delirium. Only a few months before, my wife had been very active, playing badminton, doing pilates, walking, swimming, and was cognitively very alert.

First, she had symptoms of a urinary tract infection, then later infections of the chest and bowel. Several rounds of antibiotics didn't help, and everyone kept telling us that she would get better. Doctors seemed optimistic. We never imagined the progressive physical and mental decline she would experience over the coming weeks. Our family was devastated and shocked when she passed away so quickly. We were left with so many questions.

Georgina's condition, paraneoplastic syndrome, was rapidly progressive and very debilitating. It was mentioned for the first time as a potential cause of her symptoms only the day before she passed. Since losing her, we have struggled to find information or support for families of people with the condition.

PRIYA SUNDRAM

We had little time or information to understand what to expect

Importance of a conversation

When Georgina was in hospital she was well cared for. As a family we felt informed of the care and tests she was having. The hospital team was very supportive, giving us time every day to speak with them. However, only the day before Georgina passed, we found ourselves meeting with the palliative care team and learning for the first time the seriousness of her condition.

It would have been helpful also to meet with the healthcare team after Georgina passed, to discuss what happened and to address our unanswered questions.

Being unable to piece together what led to Georgina's death has made our journey in processing our loss much more challenging. We had very little time or information to understand what to expect, which meant we were unable to prepare. I wish the health professionals we saw had been able to explain what they thought was happening at the time. Knowing that her condition was potentially irreversible and even terminal may have helped us prepare for her passing.

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Cite this as: *BMJ* 2025;389:r880

WHAT YOU NEED TO KNOW

- Losing a loved one suddenly and unexpectedly may leave family and friends with questions
- Having so many unanswered questions can make grief harder to process
- Families benefit from knowing how serious a condition could become, even when diagnosis and treatment are uncertain

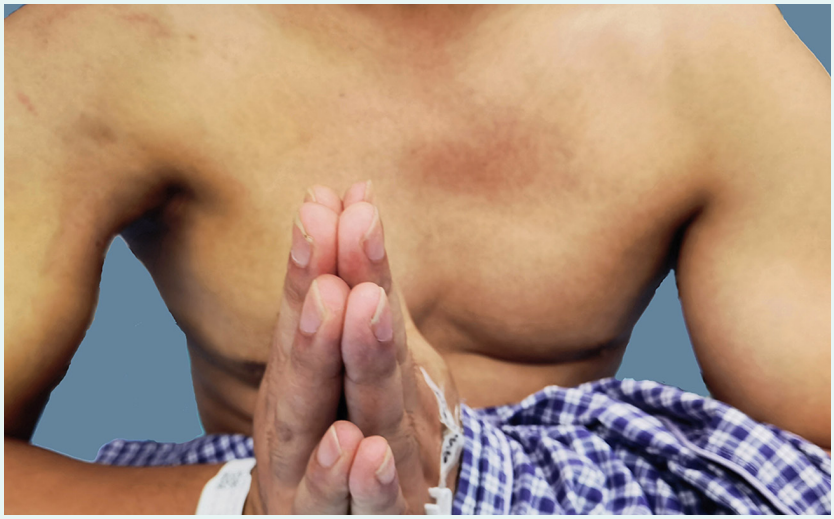
EDUCATION IN PRACTICE

- How could you help ensure that families of a patient are informed about the seriousness of their symptoms or condition?
- How could you helpfully share information about the condition a patient has died from with family or loved ones?

CASE REVIEW

Right anterior axillary dimpling

A man in his 30s, who had been training at a gym for the past six years, presented to the emergency department three days after experiencing a sudden "pop" sound during bench press training, followed by weakness and pain in his right arm. He reported that he had used heavy weights (100 kg). His medical history was unremarkable, with no history of taking steroid drugs. On examination, the patient's vital signs were stable. Physical findings revealed slight bruising on the right upper arm, mild swelling and tenderness across the right chest, and dimpling on the right chest wall near the anterior axilla (figure). Notably, the right nipple was positioned lower than the left. The right shoulder had normal range of motion, but weakened adduction and internal rotation. Strength and sensation in the patient's forearm and hand were intact.



General appearance of patient's chest, with hands in a prayer position

1 What are the differential diagnoses?
2 What is the most likely diagnosis?
3 What is the management?

Submitted by Jiahao Meng, Xiong Li, and Shuguang Gao
Patient consent obtained.
Cite this as: *BMJ* 2025;389:e083924

answers

CASE REVIEW **Right anterior axillary dimpling**

1. What are the differential diagnoses?

Based on the patient's experience of a sudden "pop" during a bench press with heavy weights, followed by bruising, swelling, chest wall dimpling, and weakness in adduction or internal rotation—but without loss of range of motion or signs of dislocation—the most likely differential diagnoses include pectoralis major tendon rupture, biceps tendon rupture, and rotator cuff injury.

2. What is the most likely diagnosis?

The most likely diagnosis is a rupture of the right pectoralis major tendon. An estimated incidence rate of 60 per 100 000 person years has been reported for pectoralis major muscle tears in military personnel. A high level of clinical suspicion is required to avoid missing the diagnosis. This injury predominantly affects men aged 20-40 engaged in weightlifting, wrestling, or contact sports.

Acute symptoms include sudden pain, weakness, and ecchymosis in the affected region. The range of motion of the affected area might be normal, but patients will have weakness on adduction and internal rotation. Key signs include anterior axillary dimpling and the dropped nipple sign (ipsilateral nipple displacement owing to muscle retraction), which is best observed by asking the patient to put the hands in a prayer position. A complete tear could even result in characteristic gaps in the muscle. X ray imaging can help identify bone abnormalities, such as fractures. However, ultrasound or MRI (magnetic resonance imaging) can confirm the diagnosis. Ultrasound or MRI findings in cases of pectoralis major tendon rupture typically include loss of normal muscle fibre structure, fibre discontinuity, and displacement of remaining fibres.

3. What is the management?

Conservative treatment might be sufficient for those with low activity levels. Conservative management includes resting, immobilisation with a sling, pain relief, and physical therapy.

For active patients or athletes, surgical intervention may be the preferred choice, aiming to restore strength and function. The prognosis is not influenced by the patient's age or the location of the tendon rupture. Surgical intervention within eight weeks of the injury yields noticeably better outcomes compared with conservative management or delayed repair.

LEARNING POINTS

- Pectoralis major tendon rupture predominantly affects male athletes participating in high impact activities.
- Key signs to suggest a pectoralis major tendon rupture include anterior axillary dimpling and the dropped nipple sign.
- Consider conservative management for patients who are less active; surgical management might be appropriate for patients who are more active or younger.

PATIENT OUTCOME

See bmj.com.

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