

A 48 year old lady is admitted with crampy abdominal pain and diarrhoea. She has been unwell for the past 12 hours. In the history she complains that her milk bottles have been pecked repeatedly by birds, she otherwise has had no dietary changes. Which of the following is the most likely causative organism?

- A. *Staphylococcus aureus*
- B. *Campylobacter jejuni*
- C. *Clostridium difficile*
- D. Norovirus
- E. *Clostridium botulinum*

Birds are a recognised reservoir of campylobacter.

Bacterial Gastroenteritis

Causative organisms

Campylobacter jejuni

- Most common cause of acute infective diarrhoea
- Spiral, gram negative rods
- Usually infects terminal ileum but spreads to involve colon and rectum. Local lymphadenopathy is common
- May mimic appendicitis as it has marked right iliac fossa pain
- Reactive arthritis is seen in 1-2% of cases

Shigella spp.

- Members of the enterobacteriaceae
- Gram negative bacilli
- Clinically causes dysentery
- *Shigella sonnei* is the commonest infective organism (mild illness)
- Usually self limiting, ciprofloxacin may be required if individual is in a high risk group

Salmonella spp

- Facultatively anaerobic, gram negative, enterobacteriaceae
- Infective dose varies according to subtype
- Salmonellosis: usually transmitted by infected meat (especially poultry) and eggs

E. coli

- Enteropathogenic
- Enteroinvasive: dysentery, large bowel necrosis/ulcers
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- Enterohaemorrhagic: O157, cause a haemorrhagic colitis, haemolytic uraemic syndrome and thrombotic

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Yersinia enterocolitica

- Gram negative, coccobacilli
- Enterocolitis, acute mesenteric lymphadenitis or terminal ileitis
- Differential diagnosis acute appendicitis
- May progress to septicemia in susceptible individuals
- Usually sensitive to quinolone or tetracyclines

Vibrio cholera

- Short, gram negative rods
- Transmitted by contaminated water, seafood
- Symptoms include sudden onset of effortless vomiting and profuse watery diarrhoea
- Correction of fluid and electrolyte losses are the mainstay of treatment
- Most cases will resolve, antibiotics are not generally indicated

A 50-year-old female with a history of rheumatoid presents with a suspected septic knee joint. A diagnostic aspiration is performed and sent to microbiology. Which of the organisms below is most likely to be responsible?



A. *Staphylococcus aureus*



B. *Staphylococcus epidermidis*



C. *Escherichia coli*



D. *Neisseria gonorrhoeae*



E. *Streptococcus pneumoniae*

Septic arthritis - most common organism: *Staphylococcus aureus*

Septic arthritis

Overview

- Most common organism overall is *Staphylococcus aureus*
- In young adults who are sexually active *Neisseria gonorrhoeae* should also be considered

Management

- Synovial fluid should be obtained before starting treatment
- Intravenous antibiotics which cover Gram-positive cocci are indicated. The BNF currently recommends flucloxacillin or clindamycin if penicillin allergic
- Antibiotic treatment is normally be given for several weeks (BNF states 6-12 weeks)
- Needle aspiration should be used to decompress the joint
- Arthroscopic lavage may be required

A 22 year old man presents with crampy abdominal pain diarrhoea and bloating. He has just returned from a holiday in Egypt. He had been swimming in the local pool a few days ago. He reports that he is opening his bowels 5 times a day. The stool floats in the toilet water, but there is no blood. What is the most likely cause?

- A. Cryptosporidium
- B. *Salmonella* sp
- C. *E.coli* sp
- D. Chronic pancreatitis
- E. *Giardia lamblia*

Giardia causes fat malabsorption, therefore greasy stool can occur. It is resistant to chlorination, hence risk of transfer in swimming pools.

Diarrhoea

World Health Organisation definitions

Diarrhoea: > 3 loose or watery stool per day

Acute diarrhoea < 14 days

Chronic diarrhoea > 14 days

Acute Diarrhoea

Gastroenteritis

May be accompanied by abdominal pain or nausea/vomiting

Diverticulitis

Classically causes left lower quadrant pain, diarrhoea and fever

Antibiotic therapy

More common with broad spectrum antibiotics
Clostridium difficile is also seen with antibiotic use

Constipation causing overflow

A history of alternating diarrhoea and constipation may be given
May lead to faecal incontinence in the elderly

Chronic Diarrhoea

Irritable bowel

Extremely common. The most consistent features are abdominal pain, bloating and change in bowel habit. Patients may be divided into

syndrome	those with diarrhoea predominant IBS and those with constipation predominant IBS. Features such as lethargy, nausea, backache and bladder symptoms may also be present
Ulcerative colitis	Bloody diarrhoea may be seen. Crampy abdominal pain and weight loss are also common. Faecal urgency and tenesmus may occur
Crohn's disease	Crampy abdominal pains and diarrhoea. Bloody diarrhoea less common than in ulcerative colitis. Other features include malabsorption, mouth ulcers perianal disease and intestinal obstruction
Colorectal cancer	Symptoms depend on the site of the lesion but include diarrhoea, rectal bleeding, anaemia and constitutional symptoms e.g. Weight loss and anorexia
Coeliac disease	<ul style="list-style-type: none"> • In children may present with failure to thrive, diarrhoea and abdominal distension • In adults lethargy, anaemia, diarrhoea and weight loss are seen. Other autoimmune conditions may coexist

Other conditions associated with diarrhoea include:

- Thyrotoxicosis
- Laxative abuse
- Appendicitis with pelvic abscess or pelvic appendix
- Radiation enteritis

Diagnosis

Stool culture

Abdominal and digital rectal examination

Consider colonoscopy (radiological studies unhelpful)

Thyroid function tests, serum calcium, anti endomysial antibodies, glucose

A 54-year-old female is admitted one week following a cholecystectomy with profuse diarrhoea. Apart from a minor intra-operative bile spillage incurred during removal of the gallbladder, the procedure was uncomplicated. What is the most likely diagnosis?

- A. Campylobacter infection
- B. E. coli infection
- C. Clostridium difficile infection
- D. Salmonella infection
- E. Pelvic abscess

Antibiotics are not routinely administered during an uncomplicated cholecystectomy.

Indications for administration of broad spectrum antibiotics include intraoperative bile spillage. Delayed pelvic abscesses following bile spills are extremely rare since most surgeons will manage these intra-operatively.

Clostridium difficile

Clostridium difficile is a Gram positive rod often encountered in hospital practice. It produces an exotoxin which causes intestinal damage leading to a syndrome called pseudomembranous colitis. *Clostridium difficile* develops when the normal gut flora are suppressed by broad-spectrum antibiotics. Clindamycin is historically associated with causing *Clostridium difficile* but the aetiology has evolved significantly over the past 10 years. Second and third generation cephalosporins are now the leading cause of *Clostridium difficile*.

Features

- Diarrhoea
- Abdominal pain
- A raised white blood cell count is characteristic
- If severe, toxic megacolon may develop

Diagnosis is made by detecting *Clostridium difficile* toxin (CDT) in the stool

Management

- First-line therapy is oral metronidazole for 10-14 days
- If severe, or not responding to metronidazole, then oral vancomycin may be used
- For life-threatening infections a combination of oral vancomycin and intravenous metronidazole should be used

Which of the following is not a feature of *Campylobacter jejuni* infection?

- A. Infection may present in a similar manner to acute appendicitis
- B. Pyrexia is unusual
- C. They are gram negative organisms
- D. Infection accounts for 26% case of Guillain-Barre syndrome
- E. It is the commonest cause of infective diarrhoea

A prodromal period of fever and generalised malaise precedes abdominal pain (which may mimic appendicitis) and diarrhoea.

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A 53-year-old woman is diagnosed with cellulitis surrounding her stoma site. A swab is taken and oral flucloxacillin is started. The following result is obtained:

Skin swab: Group A streptococcus

How should the antibiotic therapy be changed?

- A. No change
- B. Add topical fusidic acid
- C. Add clindamycin
- D. Add penicillin
- E. Add erythromycin

Penicillin is the antibiotic of choice for group A streptococcal infections. The BNF suggests stopping flucloxacillin if streptococcal infection is confirmed in patients with cellulitis, due to the high sensitivity. This should be balanced however with the variable absorption of phenoxymethylpenicillin.

Streptococci

Streptococci may be divided into alpha and beta haemolytic types

{Alpha haemolytic streptococci}

The most important alpha haemolytic streptococcus is *Streptococcus pneumoniae* (pneumococcus). Pneumococcus is a common cause of pneumonia, meningitis and otitis media. Another clinical example is *Streptococcus viridans*

{Beta haemolytic streptococci}

These can be subdivided into group A and B

Group A

- most important organism is *Streptococcus pyogenes*
- responsible for erysipelas, impetigo, cellulitis, type 2 necrotizing fasciitis and pharyngitis/tonsillitis
- immunological reactions can cause rheumatic fever or post-streptococcal glomerulonephritis
- erythrogenic toxins cause scarlet fever

Group B

- Streptococcus agalactiae may lead to neonatal meningitis and septicaemia

Theme: Infectious disease

- A. Clostridium difficile
- B. Clostridium perfringens
- C. Clostridium tetani
- D. Streptococcus pyogenes
- E. Streptococcus Bovis
- F. Staphylococcus aureus
- G. Staphylococcus epidermidis
- H. Bacteroides fragilis
- I. None of the above

Please select the most likely infective organism for the scenario given. Each option may be used once, more than once or not at all.

10. A 23 year old man is readmitted following a difficult appendicectomy. His wound is erythematous and on incision foul smelling pus is drained.

 You answered Streptococcus pyogenes

The correct answer is Bacteroides fragilis

Bacteroides is commonly present in severe peritoneal infections and as it is facultatively anaerobic may be present in pus. It smells foul!

11. A 62 year old lady is unwell following a difficult acute cholecystectomy for acute cholecystitis. Her gallbladder spilled stones intraoperatively and she has been on ciprofloxacin intravenously for this for the past 4 days. She now has colicky abdominal pain and profuse, foul smelling diarrhoea.

 Clostridium difficile

C. difficile may complicate administration of broad spectrum antibiotics.

12. A 21 year old man is admitted with crampy abdominal pain and diarrhoea. He attended a large wedding earlier in the day. Several other guests are also affected with the same illness.

 You answered Staphylococcus aureus

The correct answer is *Clostridium perfringens*

C. Perfringens is a common cause of food borne illness and its ability to form spores may make it relatively resistant to cooking. The timing of onset would favor *C. Perfringens* which typically evolves over several hours, rather than *staphylococcus aureus* poisoning which may occur sooner.

Surgical Microbiology

An extensive topic so an overview is given here. Organisms causing common surgical infections are reasonable topics in the examination. However, microbiology is less rigorously tested than anatomy, for example.

Common organisms

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- Facultative anaerobe
- Gram positive coccus
- Haemolysis on blood agar plates
- Catalase positive
- 20% population are long term carriers
- Exo and entero toxin may result in toxic shock syndrome and gastroenteritis respectively
- Ideally treated with penicillin although many strains now resistant through beta Lactamase production. In the UK less than 5% of isolates are sensitive to penicillin.
- Resistance to methicillin (and other antibiotics) is mediated by the *mec* operon , essentially penicillin binding protein is altered and resistance to this class of antibiotics ensues
- Common cause of cutaneous infections and abscesses

Streptococcus pyogenes

- Gram positive, forms chain like colonies, Lancefield Group A *Streptococcus*
- Produces beta haemolysis on blood agar plates
- Rarely part of normal skin microflora
- Catalase negative
- Releases a number of proteins/ virulence factors into host including hyaluronidase, streptokinase which allow rapid tissue destruction
- Releases superantigens such as pyogenic exotoxin A which results in scarlet fever
- Remains sensitive to penicillin, macrolides may be used as an alternative.

Escherichia coli

- Gram negative rod
- Facultative anaerobe, non sporing
- Wide range of subtypes and some are normal gut commensals
- Some subtypes such as O157 may produce lethal toxins resulting in haemolytic-uraemic syndrome
- **Enterotoxigenic E-Coli** produces an enterotoxin (ST enterotoxin) that results in large volume fluid secretion into the gut lumen (Via cAMP activation)
- **Enteropathogenic E-Coli** binds to intestinal cells and cause structural damage, this coupled with a moderate (or in case of enteroinvasive E-Coli significant) invasive component produces enteritis and large volume diarrhoea together with fever.
- They are resistant to many antibiotics used to treat gram positive infections and acquire resistance rapidly and are recognised as producing beta lactamases

Campylobacter jejuni

- Curved, gram negative, non sporulating bacteria
- One of the commonest causes of diarrhoea worldwide
- Produces enteritis which is often diffuse and blood may be passed
- Remains a differential for right iliac fossa pain with diarrhoea
- Self limiting infection so antibiotics are not usually advised. However, the quinolones are often rapidly effective.

Helicobacter pylori

- Gram negative, helix shaped rod, microaerophilic
- Produces hydrogenase that can derive energy from hydrogen released by intestinal bacteria
- Flagellated and mobile
- Those carrying the cag A gene may cause ulcers
- It secretes urease that breaks down gastric urea > Carbon dioxide and ammonia > ammonium > bicarbonate (simplified!) The bicarbonate can neutralise the gastric acid.
- Usually colonises the gastric antrum and irritates resulting in increased gastrin release and higher levels of gastric acid. These patients will develop duodenal ulcers. In those with more diffuse H-Pylori infection gastric acid levels are lower and ulcers develop by local tissue damage from H-Pylori- these patients get gastric ulcers.
- Diagnosis may be made by serology (approx. 75% sensitive). Biopsy urease test during endoscopy probably the most sensitive.
- In patients who are colonised 10-20% risk of peptic ulcer, 1-2% risk gastric cancer, <1% risk MALT lymphoma.

Which of the following statements related to necrotising fasciitis is false?

- A. Mainly polymicrobial

- B. A feature may include 'dirty dishwater fluid' in the wound
- ✓ C. The presence of crepitus is needed to make the diagnosis
- D. Further surgery is mandatory 24-48h after initial surgery to review extension of infection
- E. The muscles are relatively spared

Never attempt primary closure after the initial debridement of necrotising fasciitis.

Crepitus may be present in only 35% of cases, therefore its absence should not exclude a diagnosis of necrotising fasciitis.

Meleney's Gangrene and Necrotising Fasciitis

Necrotising fasciitis

- Advancing soft tissue infection associated with fascial necrosis
- Uncommon, but can be fatal
- In many cases there is underlying background immunosuppression e.g. Diabetes
- Caused by polymicrobial flora (aerobic and anaerobic) and MRSA is seen increasingly in cases of necrotising fasciitis
- *Streptococcus* is the commonest organism in isolated pathogen infection (15%)

Meleney's gangrene

- Meleney's is a similar principle but the infection is more superficially sited than necrotising fasciitis and often confined to the trunk

Fournier gangrene

- Necrotising fasciitis affecting the perineum
- Polymicrobial with E.coli and Bacteroides acting in synergy

Clinical features

Fever

Pain

Cellulitis

Oedema

Induration

Numbness

Late findings

Purple/black skin discolouration
Blistering
Haemorrhagic bullae
Crepitus
Dirty Dishwater fluid discharge
Septic shock

A typical case of gas gangrene presenting late demonstrating some of the features described above



Image sourced from [gangrene" target=" blank" style = "font-size:11px; color:#777;" >Wikipedia](#)

Diagnosis is mainly clinical

Management

- Radical surgical debridement forms the cornerstone of management
- Sterile dressing is used to dress the wound
- Reconstructive surgery is considered once the infection is completely treated

Reference

Necrotising fasciitis

Saiidy Hasham, Paolo Matteucci, Paul R W Stanley, Nick B Hart
BMJ 2005;330:830-833

A surgical trainee is incising a groin "abscess" in an intravenous drug abuser. Unfortunately the "abscess" is a false aneurysm and torrential bleeding ensues. In the panic of the situation the doctor then stabs himself in the finger. It transpires that the patient is a Hepatitis B carrier and the doctor is not immunised! What type of virus is Hepatitis B?

- ✓ A. Double stranded DNA virus
- ✗ B. Single stranded DNA virus
- C. Double stranded RNA virus
- D. Single stranded RNA virus
- E. Retrovirus

Hepatitis B

Hepatitis B is a double-stranded DNA virus and is spread through exposure to infected blood or body fluids, including vertical transmission from mother to child. The incubation period is 6-20 weeks.

Immunisation against hepatitis B

- Contains HBsAg absorbed onto aluminium hydroxide adjuvant and is prepared from yeast cells using recombinant DNA technology
- Most schedules give 3 doses of the vaccine with a recommendation for a one-off booster 5 years following the initial primary vaccination
- At risk groups who should be vaccinated include: healthcare workers, intravenous drug users, sex workers, close family contacts of an individual with hepatitis B, individuals receiving blood transfusions regularly, chronic kidney disease patients who may soon require renal replacement therapy, prisoners, chronic liver disease patients
- Around 10-15% of adults fail to respond or respond poorly to 3 doses of the vaccine. Risk factors include age over 40 years, obesity, smoking, alcohol excess and immunosuppression
- Testing for anti-HBs is only recommended for those at risk of occupational exposure (i.e. Healthcare workers) and patients with chronic kidney disease. In these patients anti-HBs levels should be checked 1-4 months after primary immunisation
- The table below shows how to interpret anti-HBs levels:

Anti-HBs level (mIU/ml)	Response
> 100	Indicates adequate response, no further testing required. Should still receive booster at 5 years
10 - 100	Suboptimal response - one additional vaccine dose should be given. If immunocompetent no further testing is required
< 10	Non-responder. Test for current or past infection. Give further vaccine

course (i.e. 3 doses again) with testing following. If still fails to respond then HBIG would be required for protection if exposed to the virus

Complications of hepatitis B infection

- Chronic hepatitis (5-10%)
- Fulminant liver failure (1%)
- Hepatocellular carcinoma
- Glomerulonephritis
- Polyarteritis nodosa
- Cryoglobulinaemia

Management of hepatitis B

- Pegylated interferon-alpha used to be the only treatment available. It reduces viral replication in up to 30% of chronic carriers. A better response is predicted by being female, < 50 years old, low HBV DNA levels, non-Asian, HIV negative, high degree of inflammation on liver biopsy
- However, due to the side-effects of pegylated interferon it is now used less commonly in clinical practice. Oral antiviral medication is increasingly used with an aim to suppress viral replication (not in dissimilar way to treating HIV patients)
- Examples include lamivudine, tenofovir and entecavir

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Which virus is implicated in cervical carcinoma?

- A. Human papilloma virus 16
- B. Human papilloma virus 2
- C. Human herpes virus 8
- D. Human herpes virus 2
- E. Epstein-Barr virus

Oncoviruses

- Viruses which cause cancer
- These may be detected on blood test and prevented by vaccine

These are the main types of oncoviruses and their diseases:

Oncovirus	Cancer
Epstein-Barr virus	Burkitt's lymphoma Hodgkin's lymphoma Post transfusion lymphoma Nasopharyngeal carcinoma
Human papillomavirus 16/18	Cervical cancer Anal cancer Penile cancer Vulval cancer Oropharyngeal cancer
Human herpes virus 8	Kaposi's sarcoma
Hepatitis B virus	Hepatocellular carcinoma
Hepatitis C virus	Hepatocellular carcinoma
Human T-lymphotropic virus 1	Tropical spastic paraparesis Adult T cell leukaemia

A young woman is admitted to hospital with E-coli 0157 after visiting Germany during an outbreak. Which of the following is not true of the condition?

- A. It may be complicated by micro-angiopathic haemolytic anaemia.
- B. Adults typically develop haemolytic uraemic syndrome.
- C. It is most commonly transmitted by consumption of contaminated food.
- D. Plasmids typically confer antibiotic resistance.
- E. E-Coli is a gram negative organism.

Children typically develop this complication.

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heme: Infections

- A. Staphylococcus aureus
- B. Streptococcus bovis
- C. Clostridium perfringens
- D. Clostridium difficile
- E. Clostridium tetani
- F. Klebsiella
- G. Streptococcus pyogenes
- H. Yersinia enterocolitica
- I. None of the above

Please select the most likely pathogen to account for the scenario given. Each option may be used once, more than once or not at all.

17. A 72 year old man with peripheral vascular disease develops a gangrenous toe. This becomes infected and there is evidence of infection in the surrounding tissues.

✓ Clostridium perfringens

Clostridium perfringens is the most likely pathogen to be associated with gangrene.

18. A 22 year old lady is breastfeeding her first child. One week post partum she presents with a tender indurated mass in the right breast.

 You answered None of the above

The correct answer is *Staphylococcus aureus*

Staphylococcus aureus is the commonest cause of lactational mastitis.

19. A 45 year old man is recovering in hospital following a total hip replacement. He develops a profuse and watery diarrhoea. Several other patients have been suffering from similar symptoms.

 *Clostridium difficile*

Clostridium difficile can spread rapidly on surgical wards. The use of broad spectrum prophylactic antibiotics during arthroplasty surgery can increase the risk.

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lower and ulcers develop by local tissue damage from H-Pylori- these patients get gastric ulcers.

- Diagnosis may be made by serology (approx. 75% sensitive). Biopsy urease test during endoscopy probably the most sensitive.
- In patients who are colonised 10-20% risk of peptic ulcer, 1-2% risk gastric cancer, <1% risk MALT lymphoma.

A 27-year-old male presents to urology for investigation of pyelonephritis. He reports malaise, pyrexia, lymphadenopathy and a maculopapular rash. The Monospot test is negative. Given a history of high-risk sexual behaviour you are asked to exclude a HIV seroconversion illness. What is the most appropriate investigation?

- A. Antibodies to HIV-2
- B. gp120 polymerase chain reaction
- C. p24 antigen test
- D. CCR5 polymerase chain reaction
- E. Antibodies to HIV-1

HIV testing

HIV seroconversion is symptomatic in 60-80% of patients and typically presents as a glandular fever type illness. Increased symptomatic severity is associated with poorer long term prognosis. It typically occurs 3-12 weeks after infection

Features

- sore throat
- lymphadenopathy
- malaise, myalgia, arthralgia
- diarrhoea
- maculopapular rash
- mouth ulcers
- rarely meningoencephalitis

Diagnosis

- antibodies to HIV may not be present
- HIV PCR and p24 antigen tests can confirm diagnosis

HIV antibody test

- most common and accurate test
- usually consists of both a screening ELISA (Enzyme Linked Immuno-Sorbent Assay) test and a confirmatory Western Blot Assay
- most people develop antibodies to HIV at 4-6 weeks but 99% do by 3 months

p24 antigen test

- usually positive from about 1 week to 3 - 4 weeks after infection with HIV
- sometimes used as an additional screening test in blood banks

Which statement relating to actinomycosis is false?

- A. They are gram positive bacilli
- B. They are strict aerobes
- C. It may be a cause of chronic multiple abscesses
- D. Abdominal cases may develop in the appendix
- E. Open biopsy of the lesions is the best diagnostic test

They are facultative anaerobes and may be difficult to culture. Direct visualisation of organisms and sulphur granules from lesions themselves is the easiest way to make a diagnosis. It remains a differential of conditions such as hydradenitis suppurativa, particularly if it is occurring in odd locations and with deeper abscesses than usual.

Surgical Microbiology

An extensive topic so an overview is given here. Organisms causing common surgical infections are reasonable topics in the examination. However, microbiology is less rigorously tested than anatomy, for example.

Common organisms

Staphylococcus aureus

- Facultative anaerobe
- Gram positive coccus
- Haemolysis on blood agar plates
- Catalase positive
- 20% population are long term carriers
- Exo and entero toxin may result in toxic shock syndrome and gastroenteritis respectively
- Ideally treated with penicillin although many strains now resistant through beta Lactamase production. In the UK less than 5% of isolates are sensitive to penicillin.

- Resistance to methicillin (and other antibiotics) is mediated by the mec operon , essentially penicillin binding protein is altered and resistance to this class of antibiotics ensues
- Common cause of cutaneous infections and abscesses

Streptococcus pyogenes

- Gram positive, forms chain like colonies, Lancefield Group A *Streptococcus*
- Produces beta haemolysis on blood agar plates
- Rarely part of normal skin microflora
- Catalase negative
- Releases a number of proteins/ virulence factors into host including hyaluronidase, streptokinase which allow rapid tissue destruction
- Releases superantigens such as pyogenic exotoxin A which results in scarlet fever
- Remains sensitive to penicillin, macrolides may be used as an alternative.

Escherichia coli

- Gram negative rod
- Facultative anaerobe, non sporing
- Wide range of subtypes and some are normal gut commensals
- Some subtypes such as O157 may produce lethal toxins resulting in haemolytic-uraemic syndrome
- **Enterotoxigenic E-Coli** produces an enterotoxin (ST enterotoxin) that results in large volume fluid secretion into the gut lumen (Via cAMP activation)
- **Enteropathogenic E-Coli** binds to intestinal cells and cause structural damage, this coupled with a moderate (or in case of enteroinvasive E-Coli significant) invasive component produces enteritis and large volume diarrhoea together with fever.
- They are resistant to many antibiotics used to treat gram positive infections and acquire resistance rapidly and are recognised as producing beta lactamases

Campylobacter jejuni

- Curved, gram negative, non sporulating bacteria
- One of the commonest causes of diarrhoea worldwide
- Produces enteritis which is often diffuse and blood may be passed
- Remains a differential for right iliac fossa pain with diarrhoea
- Self limiting infection so antibiotics are not usually advised. However, the quinolones are often rapidly effective.

Helicobacter pylori

- Gram negative, helix shaped rod, microaerophilic

- Produces hydrogenase that can derive energy from hydrogen released by intestinal bacteria
- Flagellated and mobile
- Those carrying the cag A gene may cause ulcers
- It secretes urease that breaks down gastric urea > Carbon dioxide and ammonia > ammonium > bicarbonate (simplified!) The bicarbonate can neutralise the gastric acid.
- Usually colonises the gastric antrum and irritates resulting in increased gastrin release and higher levels of gastric acid. These patients will develop duodenal ulcers. In those with more diffuse H-Pylori infection gastric acid levels are lower and ulcers develop by local tissue damage from H-Pylori- these patients get gastric ulcers.
- Diagnosis may be made by serology (approx. 75% sensitive). Biopsy urease test during endoscopy probably the most sensitive.
- In patients who are colonised 10-20% risk of peptic ulcer, 1-2% risk gastric cancer, <1% risk MALT lymphoma.