OBSTETRICS & GYNAECOLOGY · UNDERGRADUATE LECTURE

WOMEN'S HEALTH · GENITAL TRACT INFECTION

# Pelvic Inflammatory Disease

Diagnosis, management and prevention in reproductive-age women
— an evidence-based update

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BEFORE WE BEGIN

# Learning Objectives

01 Define PID and identify the anatomical structures and organs it affects

02 Describe the causative organisms and how infection ascends the genital tract

03 Recognise risk factors and the broad clinical spectrum of disease

04 Apply the CDC clinical criteria to reach a timely presumptive diagnosis

05 Select appropriate empiric antibiotic regimens per current CDC guidance

06 Counsel patients on complications, prevention and partner management

ROADMAP

# What We Will Cover

**01** **Introduction & Epidemiology**

Definition, burden of disease, microbiology & pathophysiology

**02** **Risk Factors & Clinical Spectrum**

From subclinical infection to tubo-ovarian abscess

**03** **Diagnosis & Evaluation**

CDC clinical criteria, labs, imaging & differential diagnosis

**04** **Management**

Hospitalisation criteria and CDC 2021 antibiotic regimens

**05** **Complications & Prevention**

Long-term sequelae, screening and partner management

01

# Introduction & Epidemiology

Definition, disease burden, microbiology and pathophysiology

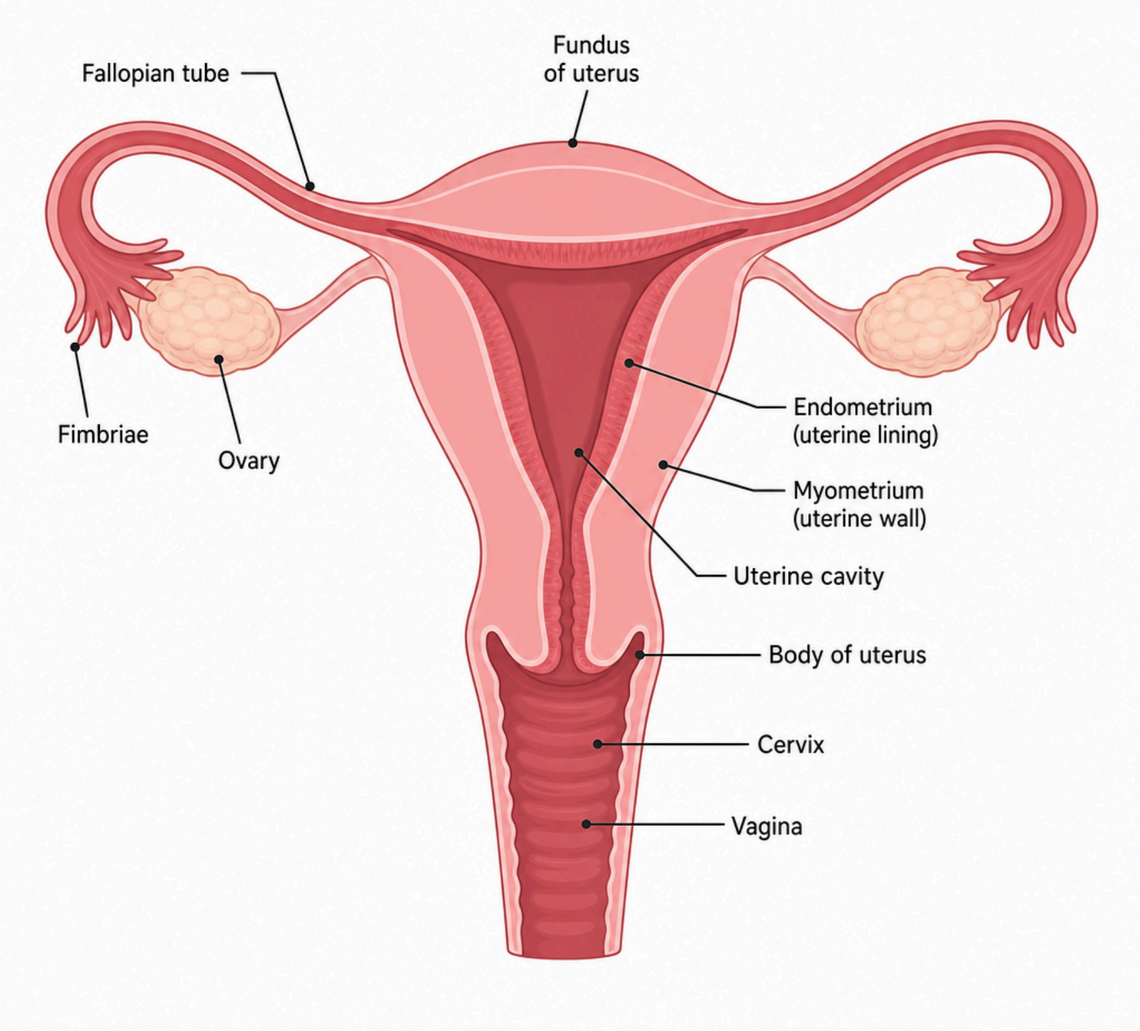
INTRODUCTION

# Definition & Anatomical Extent

PID refers to acute and subclinical infection/inflammation of the upper female genital tract — the uterus, fallopian tubes and ovaries — often with involvement of neighbouring pelvic structures.

**PID ENCOMPASSES:**

- **Endometritis**
- **Salpingitis**
- **Oophoritis**
- **Pelvic peritonitis**
- **Perihepatitis (Fitz-Hugh-Curtis)**
- **Tubo-ovarian abscess**



INTRODUCTION

# Epidemiology & Burden of Disease

**2.1–2.5M**

US reproductive-age women (18–44) with a lifetime history of PID

**4.4%**

Self-reported lifetime prevalence among sexually experienced women 18–44 (NHANES)

**15–25**

Peak age range (years) — highest incidence in adolescents & young adults

**~129,000**

Average annual physician-office visits for PID in the United States

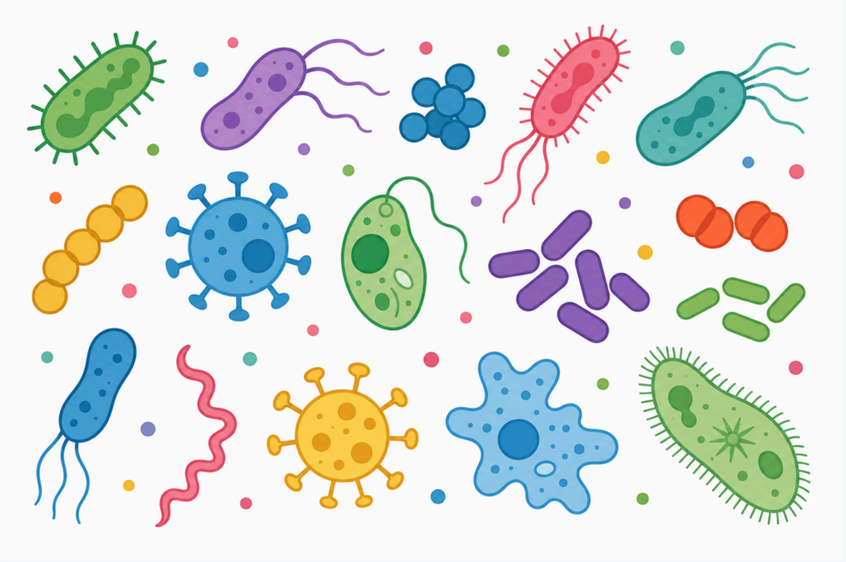
## TRENDS & DISPARITIES

- Overall PID burden declined 2006–2016 across most US data sources, with small upticks noted after 2015
- Disproportionately higher burden among non-Hispanic Black women and women in the southern United States
- Comparable ascending-infection epidemiology is seen worldwide, closely tracking local rates of gonorrhoea and chlamydia

# Etiology & Microbiology

## CAUSATIVE ORGANISMS

- **N. gonorrhoeae & C. trachomatis**
  Classic sexually-transmitted pathogens; most extensively studied
- **Mycoplasma genitalium**
  Causes 9–13% of PID; often milder symptoms; not covered by standard regimens
- **BV-associated & vaginal anaerobes**
  Peptostreptococcus, Bacteroides, G. vaginalis — frequently co-isolated
- **Enteric / respiratory organisms**
  E. coli, Bacteroides fragilis, H. influenzae, S. pneumoniae, S. aureus (≈15%)
- **Rare: M. tuberculosis, Actinomyces**
  Indolent, chronic presentations — consider with IUD or atypical course



Only ≈50% of clinically-diagnosed PID has a positive NAAT for GC/CT — PID is a polymicrobial syndrome, not a single-organism disease.

# Pathophysiology: An Ascending Infection

STEP 1

### Disruption of vaginal/cervical flora

BV-associated organisms and STIs impair the cervical mucus barrier and innate immune defences

STEP 2

### Breach of the cervical barrier

Pathogens degrade antimicrobial peptides in cervical mucus, permitting ascent

STEP 3

### Ascent to the endometrium

Endometritis develops — may be the only histologic sign of PID in some women

STEP 4

### Spread to tubes / peritoneum

Salpingitis, oophoritis, pelvic peritonitis and perihepatitis may follow

STEP 5

### Tissue injury & scarring

Loss of ciliated tubal epithelium → adhesions → infertility, ectopic pregnancy, chronic pain

02

# Risk Factors & Clinical Spectrum

From subclinical infection to tubo-ovarian abscess and perihepatitis

# Who Is at Risk?

- Age younger than 25 years
- Multiple sexual partners
- New or symptomatic sex partner / partner with an STI
- History of prior PID or another STI
- First 3 weeks after IUD insertion
- Cervical instrumentation (e.g. D&C, HSG)
- Early pregnancy (before the mucus plug seals the cervix)
- Inconsistent barrier contraception use

Protective: consistent barrier contraception. PID is rare in pregnancy after the first 12 weeks, once the decidua and mucus plug seal the uterus.

# The Spectrum of Disease

PID ranges from silent, subclinical infection to fulminant sepsis — presentation may be acute (days) or indolent (weeks to months).

### Subclinical PID

No care-seeking symptoms; later found via infertility work-up

### Acute mild–moderate

Bilateral pelvic pain, cervical/adnexal tenderness — majority of cases

### Severe / complicated

Peritonitis, tubo-ovarian abscess, systemic sepsis (minority)

### Perihepatitis

Fitz-Hugh-Curtis syndrome — RUQ extension of inflammation

### Chronic sequelae

Recurrent PID, chronic pelvic pain, tubal infertility, ectopic risk

# Acute Symptomatic PID — Symptoms

**Cardinal symptom: bilateral lower abdominal / pelvic pain, usually of less than two weeks' duration**

- Pain that worsens with coitus or jarring movement may be the only symptom
- Onset during or shortly after menses is particularly suggestive
- Character is variable — can be quite subtle and easily overlooked
- Abnormal uterine bleeding (post-coital, intermenstrual, menorrhagia) in ≥⅓ of patients

**OTHER NON-SPECIFIC COMPLAINTS**

- Abnormal / purulent vaginal discharge
- Urinary frequency
- Dyspareunia
- Low-grade fever

Most women have mild-to-moderate disease; only a minority develop peritonitis or pelvic abscess.

# Examination Findings

## ABDOMINAL EXAMINATION

- Abdominal tenderness on palpation — the commonest finding
- Greatest in the lower quadrants; may or may not be symmetrical
- In severe PID: rebound tenderness, fever, decreased bowel sounds

## PELVIC EXAMINATION — KEY FINDING

Cervical motion, uterine and adnexal tenderness on bimanual exam is the defining characteristic of acute symptomatic PID.

- Purulent endocervical and/or vaginal discharge is common
- Cervical friability may be seen on speculum exam
- A palpable adnexal mass suggests possible tubo-ovarian abscess

# Laboratory Findings

Routine laboratory tests are largely non-specific in PID — they support severity assessment rather than confirm the diagnosis.

### Peripheral blood leukocytosis

Present in a minority of cases — a normal WBC count does not exclude PID

### Elevated ESR

Non-specific marker of inflammation; used to gauge severity

### Elevated CRP

Correlates better with severity than with diagnostic certainty

**Bottom line: normal inflammatory markers should not be used to rule out PID in a patient with a compatible clinical picture.**

# Perihepatitis — Fitz-Hugh-Curtis Syndrome

**~10% OF WOMEN WITH ACUTE PID**

- Inflammation of the liver capsule and peritoneal surfaces of the anterior right upper quadrant, with minimal hepatic parenchymal involvement
- Presents with right upper quadrant pain, sometimes pleuritic and referred to the right shoulder
- Marked RUQ tenderness — severity of pain may mask the PID diagnosis and raise concern for cholecystitis
- Aminotransferases usually normal or only slightly elevated
- Classically associated with gonococcal salpingitis and C. trachomatis

**LAPAROSCOPIC SIGN**

“Violin-string” adhesions: a patchy, purulent and fibrinous exudate over the anterior liver surface — the parenchyma itself is spared.

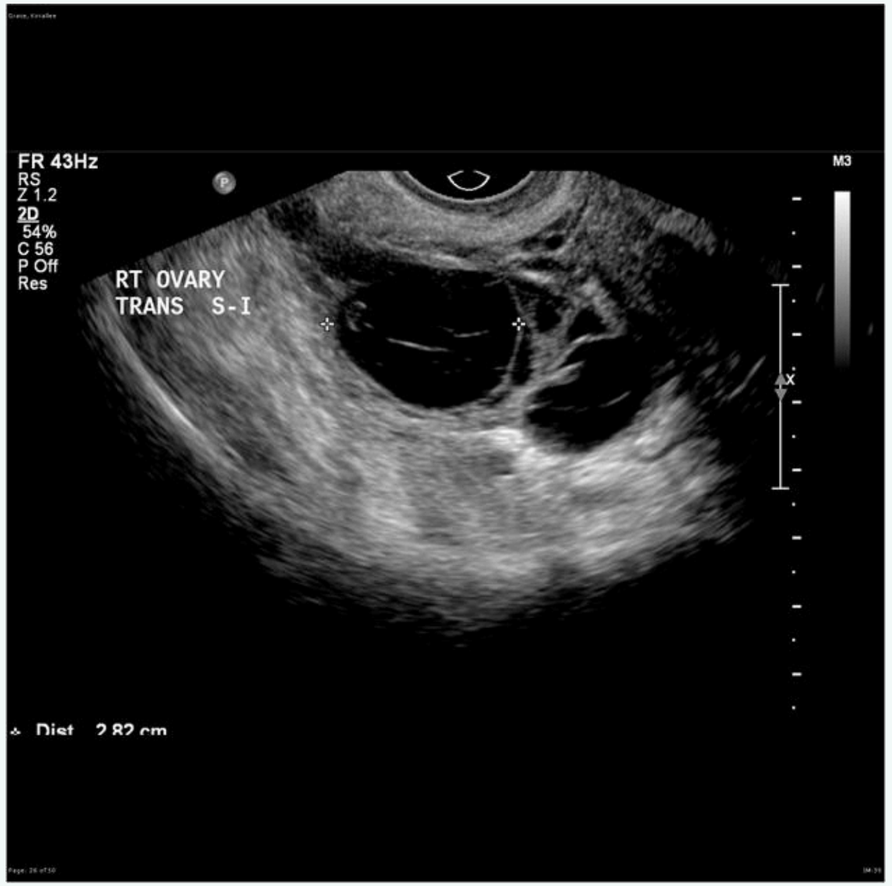
Consider Fitz-Hugh-Curtis in any young woman with RUQ pain and a normal or near-normal liver panel, especially with pelvic tenderness.

# Tubo-Ovarian Abscess (TOA)

An inflammatory mass involving the fallopian tube, ovary and, occasionally, other adjacent pelvic organs.

**DEVELOPS IN 15–35% OF PID CASES**

- Palpable, tender adnexal mass may be found on bimanual examination
- Transvaginal ultrasound is first-line: complex, thick-walled, multilocular cystic collection with internal echoes
- Surgical drainage indicated if the abscess is ≥8 cm, ruptures, or the patient becomes septic




Transvaginal ultrasound: right ovary / adnexal complex

# Subclinical & Chronic PID

## Subclinical PID

- Upper-tract infection severe enough to cause sequelae, yet not severe enough to prompt care
- Common in women later found to have tubal-factor infertility, with no recalled history of PID
- In an at-risk cohort of 562 women without clinical PID, 13% had endometritis on biopsy
- May occur more frequently among oral contraceptive users

## Chronic PID

- Indolent course: low-grade fever, weight loss and abdominal pain over weeks to months
- Reported with pelvic actinomycosis and tuberculosis
- An association between indwelling IUDs and actinomycosis has been suggested, though it remains unclear

# 03

# Diagnosis & Evaluation

CDC clinical criteria, laboratory tests, imaging and differential diagnosis

# The Diagnostic Approach: Goals

PID is a clinical diagnosis. Maintain a low threshold for presumptive diagnosis and treatment — the consequences of a missed diagnosis outweigh those of empiric, unnecessary treatment.

Establish a presumptive clinical diagnosis of PID

Assess for findings that increase diagnostic likelihood

Evaluate for other potential causes of pelvic pain

Delaying treatment by ≥3 days from symptom onset is associated with a ~3-fold increase in infertility or ectopic pregnancy — do not wait for NAAT results to begin therapy.

# CDC Clinical Diagnostic Criteria

## MINIMUM CRITERIA

Treat empirically if ≥1 is present on bimanual exam, with pelvic/lower abdominal pain and no other identified cause:

- ✓ **Cervical motion tenderness**
- ✓ **Uterine tenderness**
- ✓ **Adnexal tenderness**

## ADDITIONAL CRITERIA (↑ SPECIFICITY)

- Oral temperature >38.3°C
- Abnormal cervical/vaginal mucopurulent discharge or cervical friability
- Abundant WBCs on saline microscopy of vaginal fluid
- Elevated ESR or CRP
- Laboratory-confirmed N. gonorrhoeae or C. trachomatis

## MOST SPECIFIC (SELECTED CASES)

- Endometrial biopsy with histopathologic endometritis
- TVS/MRI: thickened, fluid-filled tubes ± free fluid or TOA; laparoscopic findings of PID

# History & Physical Examination

## FOCUSED HISTORY

- Sexual history: new partners, consistent condom use
- Onset (usually recent) and character of pelvic pain — typically constant and aching
- Subtle and mild symptoms can still be consistent with PID
- Screen for features of the differential diagnosis (see later)

## PHYSICAL & PELVIC EXAM

- Bimanual exam for cervical motion, uterine or adnexal tenderness — the defining feature of acute PID
- Speculum exam to assess for cervical mucopurulent discharge or friability
- Consider alternative diagnoses if uterine/adnexal tenderness is not prominent
- A palpable adnexal mass may suggest TOA, but consider the broader differential

# Point-of-Care & Laboratory Tests

Recommended for all women with suspected PID:

| | |
|---|---|
| **Pregnancy test** | Excludes ectopic pregnancy and complications of intrauterine pregnancy |
| **Saline microscopy** | Assesses vaginal WBCs (sensitive for PID); detects BV / trichomoniasis |
| **NAAT: GC / CT (± M. genitalium)** | Positive result supports diagnosis; a negative result does NOT exclude PID |
| **HIV & syphilis serology** | Shared risk factors with PID — test all women with suspected disease |
| **CBC, ESR, CRP** | Obtained in more severe presentations to gauge severity, guide admission |

# Imaging Techniques

Pelvic imaging helps evaluate alternative causes of pain or complications (e.g. TOA) — but normal imaging does NOT exclude PID and should never delay empiric therapy.

### TRANSVAGINAL ULTRASOUND — FIRST LINE

- Dilated, fluid-filled fallopian tubes
- “Cogwheel” sign on cross-section of the tube
- Gas or fluid within the endometrial canal
- Complex, multiloculated adnexal mass → tubo-ovarian abscess

### CT / MRI

- Limited direct evidence for routine use in suspected PID
- Useful to exclude alternative diagnoses in atypical or severe presentations
- MRI can further characterise a complex adnexal / tubo-ovarian mass

# Laparoscopy & Endometrial Biopsy

## LAPAROSCOPY

**HIGH SPECIFICITY · ~50% SENSITIVITY**

- Not sensitive enough to serve as a true diagnostic gold standard
- Invasive, for a condition that rarely needs surgical intervention
- Reserve for: failed outpatient therapy, no improvement after ~72h of inpatient treatment, or high suspicion of a competing surgical diagnosis (e.g. appendicitis)
- Obtain consent for laparotomy in advance when appropriate

## ENDOMETRIAL BIOPSY

Detects endometritis, which correlates with salpingitis — but is not used routinely because:

- Correlation with salpingitis is not 100%
- Processing the biopsy introduces a diagnostic delay
- Patchy inflammation causes inter-observer variation in histologic interpretation

# Differential Diagnosis

### Ectopic pregnancy

History of missed menses; positive pregnancy test

### Ovarian cyst rupture / torsion

Sudden onset of severe, often unilateral pain

### Endometriosis

Cyclical or chronic pelvic pain

### Cystitis

Urinary frequency and/or dysuria

### Appendicitis

Pain localised to the right iliac fossa; vomiting

### Diverticulitis

Bowel symptoms, typically in older women

### Irritable bowel syndrome

Generalised abdominal pain; constipation or diarrhoea

### Functional pain

Diagnosis of exclusion once other causes are ruled out

# 04
# Management

Hospitalisation criteria and CDC 2021 antibiotic regimens

MANAGEMENT

# Hospitalisation Criteria & Treatment Principles

## CONSIDER HOSPITALISATION IF:

- Surgical emergency (e.g. appendicitis) cannot be excluded
- Tubo-ovarian abscess
- Pregnancy
- Severe illness, nausea/vomiting, or T >38.5°C
- Unable to tolerate an outpatient oral regimen
- No clinical response to oral antimicrobial therapy

### GUIDING PRINCIPLE

Treat empirically as soon as a presumptive diagnosis is made. Regimens must provide broad-spectrum coverage of N. gonorrhoeae, C. trachomatis, and anaerobic/vaginal flora — outcomes are similar with parenteral vs. oral therapy for mild-to-moderate disease.

# Inpatient (Parenteral) Regimens — CDC 2021

**PREFERRED REGIMEN**

**Ceftriaxone 1 g IV q24h + Doxycycline 100 mg PO/IV q12h + Metronidazole 500 mg PO/IV q12h**

## ALTERNATIVE PARENTERAL REGIMENS

- Cefotetan 2 g IV q12h + Doxycycline 100 mg PO/IV q12h
- Cefoxitin 2 g IV q6h + Doxycycline 100 mg PO/IV q12h
- Ampicillin-sulbactam 3 g IV q6h + Doxycycline 100 mg PO/IV q12h
- Clindamycin 900 mg IV q8h + Gentamicin (2 mg/kg load, then 1.5 mg/kg q8h, or 3–5 mg/kg once daily)

Transition to oral doxycycline + metronidazole after 24–48h of clinical improvement, to complete 14 days total.

MANAGEMENT

# Outpatient (IM/Oral) Regimens — CDC 2021

**PREFERRED REGIMEN · 14 DAYS TOTAL**

**Ceftriaxone 500 mg IM ×1 + Doxycycline 100 mg PO BID ×14d + Metronidazole 500 mg PO BID ×14d**

## ALTERNATIVE OUTPATIENT OPTIONS

- Cefoxitin 2 g IM + Probenecid 1 g PO (concurrent) + Doxycycline + Metronidazole ×14d
- Cephalosporin allergy, low local GC risk: Levofloxacin/Moxifloxacin ± Metronidazole (quinolone-resistant GC is a concern)

Reassess within 72 hours. No improvement on oral/IM therapy → hospitalise, reassess the regimen and diagnosis. Metronidazole is now a routine part of outpatient regimens for reliable anaerobic coverage.

# Special Considerations

## Pregnancy

High risk of maternal morbidity and preterm delivery — hospitalise and treat with IV antimicrobials; involve infectious disease.

## HIV infection

Similar symptoms and treatment response to HIV-negative women, but higher rates of tubo-ovarian abscess.

## IUD in place

No need for routine removal. Continue treatment with close follow-up; consider removal if no improvement by 48–72h.

## Mycoplasma genitalium

Not reliably covered by standard regimens. If detected/suspected with persistent symptoms, add moxifloxacin 400 mg daily ×14 days.

# Partner Management & Follow-Up

## Partner Management

- Evaluate, test and presumptively treat for chlamydia and gonorrhoea any partner from the preceding 60 days — regardless of the PID etiology
- If last intercourse was >60 days before symptom onset, treat the most recent partner
- Abstain from intercourse until therapy is complete, symptoms resolve, and partners are treated

## Follow-Up

- Expect clinical improvement (defervescence, less tenderness) within 3 days of starting therapy
- No improvement by 72h → hospitalise, reassess the antimicrobial regimen and diagnosis (consider laparoscopy)
- Retest all women treated for chlamydial/gonococcal PID at 3 months, regardless of partner treatment

# 05

# Complications & Prevention

Long-term sequelae, screening strategy and partner management

# Complications & Long-Term Sequelae

**15–35%**

Develop a tubo-ovarian abscess

**≤⅓**

Develop chronic pelvic pain after PID

**Up to 16.8%**

Develop infertility (20–24y cohort)

**~9% vs 1.4%**

Ectopic pregnancy rate after PID vs. controls

## KEY DRIVERS OF LONG-TERM SEQUELAE

- Recurrent PID is the strongest predictor of chronic pelvic pain
- Infertility risk rises with delayed treatment, disease severity, recurrent episodes, and C. trachomatis infection
- Tubal damage — loss of ciliated epithelium and luminal scarring — underlies both infertility and ectopic pregnancy risk

# Prevention Strategies

- Annual chlamydia & gonorrhoea screening for all sexually active women <25y, and ≥25y with risk factors (USPSTF)
- Consistent and correct use of barrier contraception
- Prompt evaluation and presumptive treatment of partners to prevent reinfection
- Patient education on safe sex practices and limiting number of partners
- Encourage prompt care-seeking for pelvic symptoms — early treatment prevents long-term sequelae
- Timely, guideline-based antibiotic therapy started without waiting for confirmatory testing

# Key Takeaways

PID is a clinical diagnosis — treat empirically with just one minimum criterion present

Do not delay treatment awaiting NAAT results; delay materially worsens fertility outcomes

PID is polymicrobial: cover N. gonorrhoeae, C. trachomatis AND anaerobes (metronidazole)

CDC 2021: metronidazole is now a routine component of all standard regimens

Always evaluate and treat partners from the preceding 60 days

STI screening and barrier contraception remain the cornerstones of prevention

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# Thank You

Questions & Discussion

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