

Inflammation and Infections

Testis and Epididymis

Pathologic patterns, mechanisms, and clinicopathologic consequences

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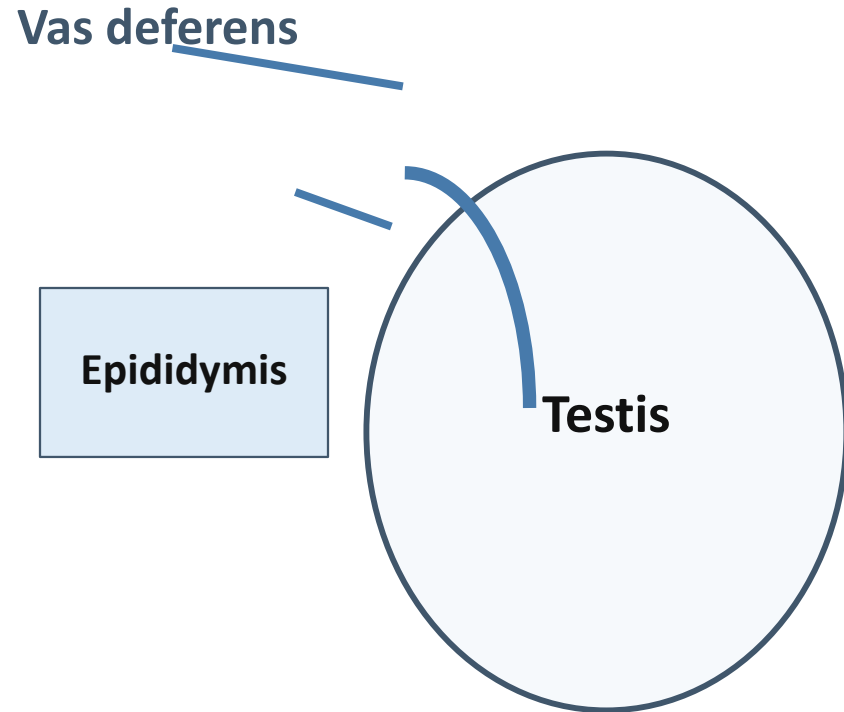
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Learning outcomes

- Localize the initial site of epididymal and testicular inflammation.
- Relate age and route of infection to likely causes.
- Recognize acute, granulomatous, lymphoplasmacytic, and vascular inflammatory patterns.
- Explain suppuration, fibrous scarring, and fertility-related consequences.

The two organs form a connected inflammatory field



- The epididymis connects anatomically with the testis and duct system.
- Pathogens may ascend from other genitourinary sites.
- Site of earliest involvement helps organize the differential diagnosis.

Inflammatory disease is more frequent in the epididymis

Epididymis

- Inflammatory disorders occur here more often.
- May be the primary site before secondary testicular involvement.

Testis

- May be involved through contiguous spread.
- Certain infections preferentially begin in the testis.

Initial site varies with the etiology

Epididymis first

- Gonorrhea and tuberculosis commonly begin in the epididymis.
- Subsequent testicular involvement may occur.

Testis first

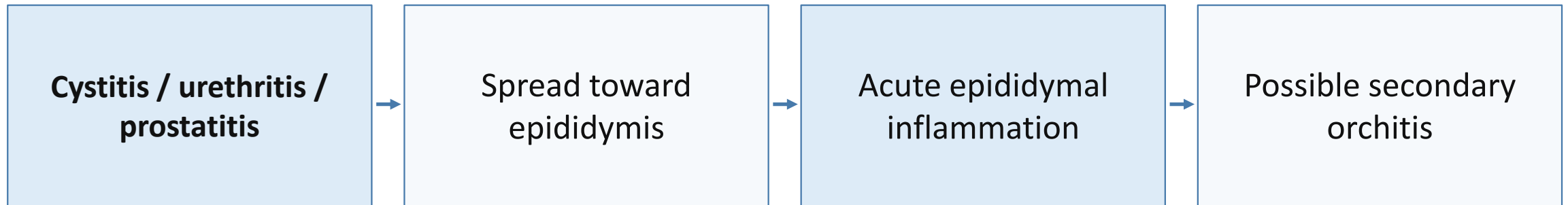
- Syphilis and mumps characteristically involve the testis first.
- These do not follow the same typical anatomic sequence.

Site of onset is an organizing clue, not a substitute for etiologic confirmation.

The inflammatory reaction provides a second diagnostic axis

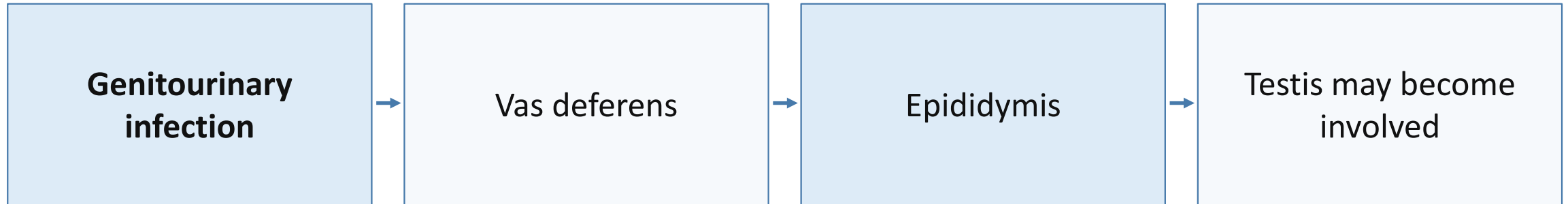
Pattern	Source-linked examples	Characteristic finding
Acute suppurative	Bacterial epididymitis; Gonorrhea	Neutrophils, edema ± abscess
Granulomatous	Idiopathic orchitis; Tuberculosis	Tubule-limited vs caseating granulomas
Interstitial mononuclear	Mumps orchitis	Lymphocytes and plasma cells
Vascular / granulomatous	Syphilis	Endarteritis or gumma

Epididymitis often follows an infection elsewhere in the GU tract



Vas deferens and spermatic-cord lymphatics as routes of spread.

The vas deferens is a pathway of extension



Conceptual pathway; Not a claim about the route in every patient.

Spermatic-cord lymphatics offer another route



Robbins explicitly identifies this as an alternative to spread through the vas deferens.

Associated urinary tract sites matter

Cystitis

- Bladder involvement precedes or accompanies some cases.

Urethritis

- Urethral infection can extend to proximal genital tract.

Prostatitis

- Prostatic infection is a documented antecedent site.

Likely bacterial causes vary with age

Clinical group	Associations	Teaching emphasis
Childhood (uncommon)	Congenital GU abnormality; Gram-negative rods	Consider accompanying anatomic abnormality
Sexually active males <35 years	C. Trachomatis; N. Gonorrhoeae	Sexually transmitted pathogens predominate
Males >35 years	E. Coli; Pseudomonas	Common urinary tract organisms predominate

Childhood epididymitis has a distinctive association

- Epididymitis is uncommon in children.
- When it occurs, it commonly to congenital genitourinary abnormalities.
- Gram-negative rods are the typical associated pathogens.
- The age association is a clue, not organism identification.

In sexually active younger males, STI pathogens predominate

Chlamydia trachomatis

- One of the most frequent pathogens named in this age group.
- Located within the sexually transmitted etiologic category.

Neisseria gonorrhoeae

- Another major sexually transmitted cause.
- Severe disease may become destructive and suppurative.

After 35 years, common urinary pathogens predominate

Escherichia coli

- Named as a common urinary tract cause.
- Fits the association with infections at other GU sites.

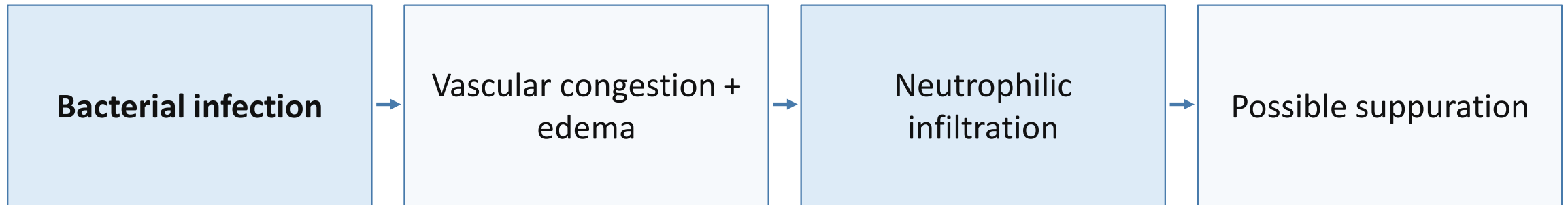
Pseudomonas

- Also named among common causative urinary organisms.
- The textbook does not provide a patient-level diagnostic rule.

Age-based associations are not definitive diagnoses

- Age organizes likely etiologies at the population level.
- The disease mechanism also depends on the involved genitourinary sites and spread route.
- A named pathogen cannot be proven by age or morphology alone.
- Use the age framework as teaching context, not a stand-alone diagnostic algorithm.

Bacterial inflammation produces a stereotyped acute reaction

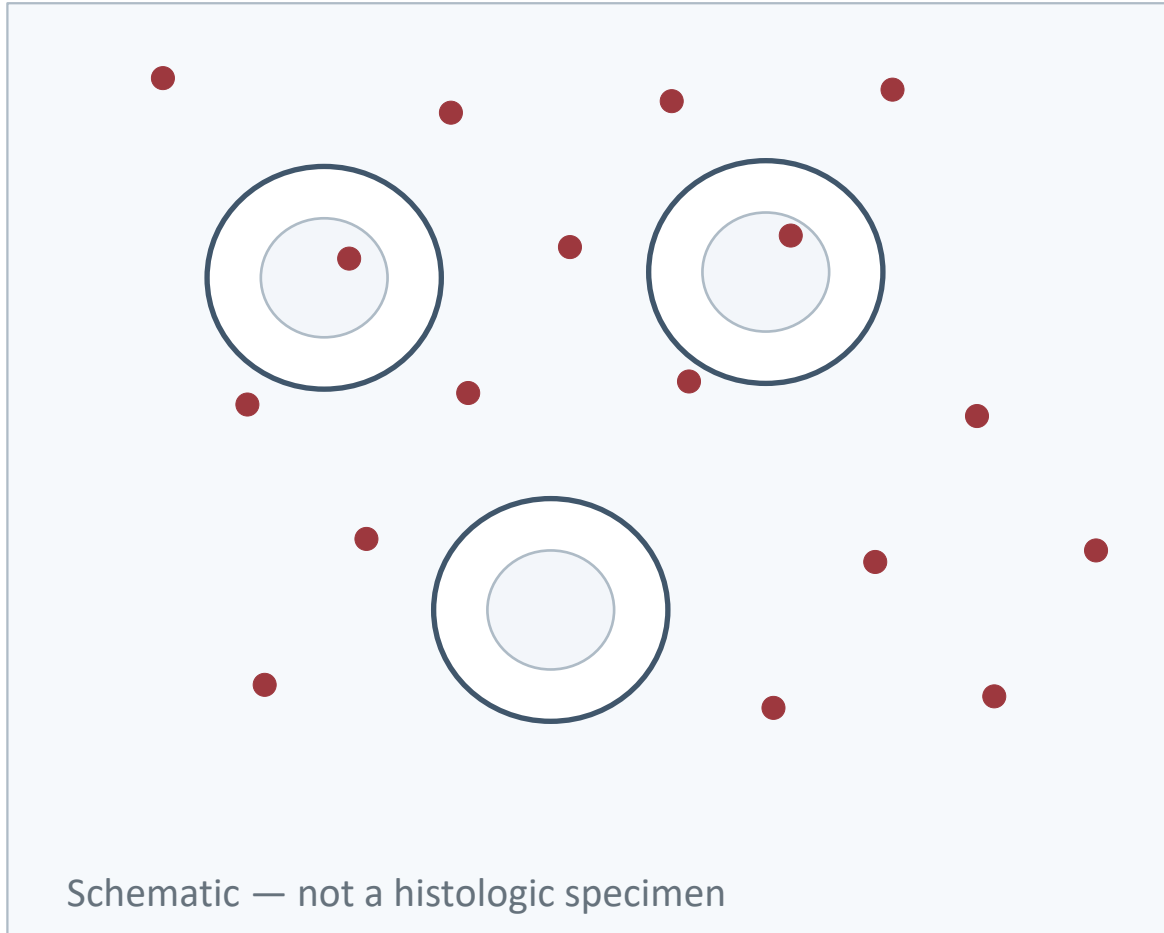


These morphology stages are connected conceptually; Their prominence varies with disease severity.

Congestion represents the vascular component of acute inflammation

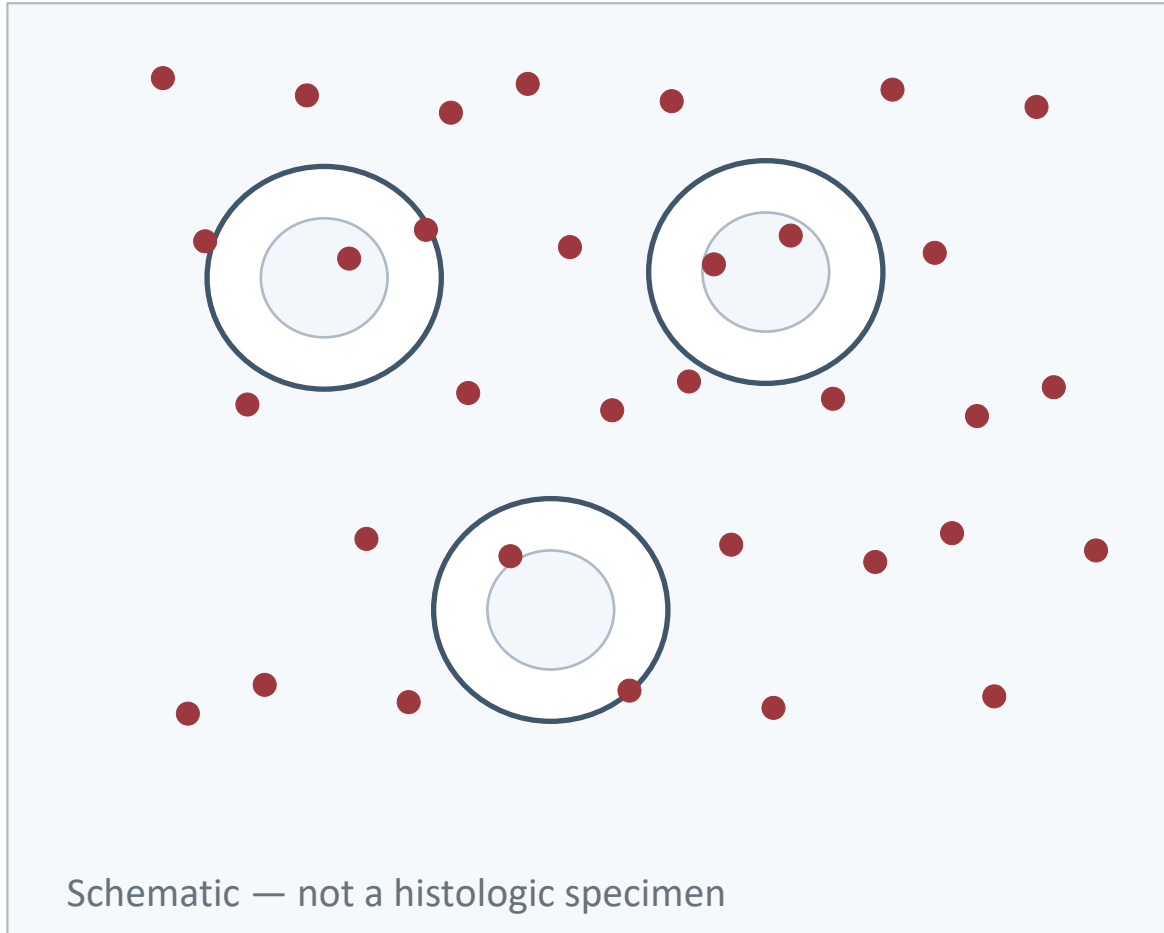
- Bacterial epididymitis is associated with vascular congestion.
- Congestion accompanies the early inflammatory response.
- It occurs together with tissue edema and neutrophil entry.
- The combination is characteristic of acute bacterial inflammation.

Edema expands inflamed interstitial tissue



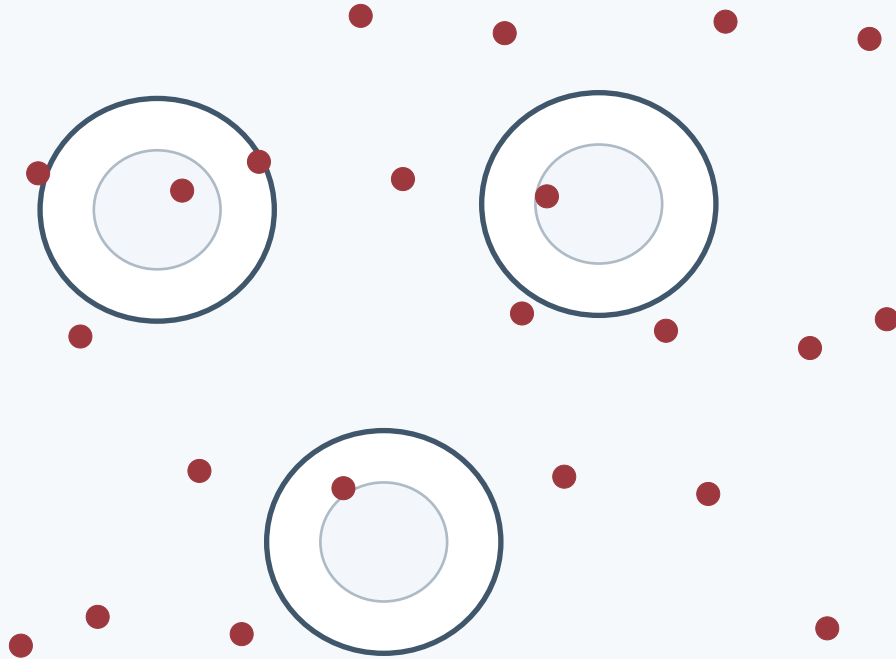
- Edema is explicitly described in the acute bacterial lesion.
- The inflammatory process commonly starts in interstitial connective tissue.
- Tubules may be secondarily affected as inflammation extends.

Neutrophils are the defining acute inflammatory cells



- Acute bacterial infection produces infiltration by neutrophils.
- Neutrophil-rich inflammation may accompany tissue destruction.
- A severe lesion can progress to abscess formation.

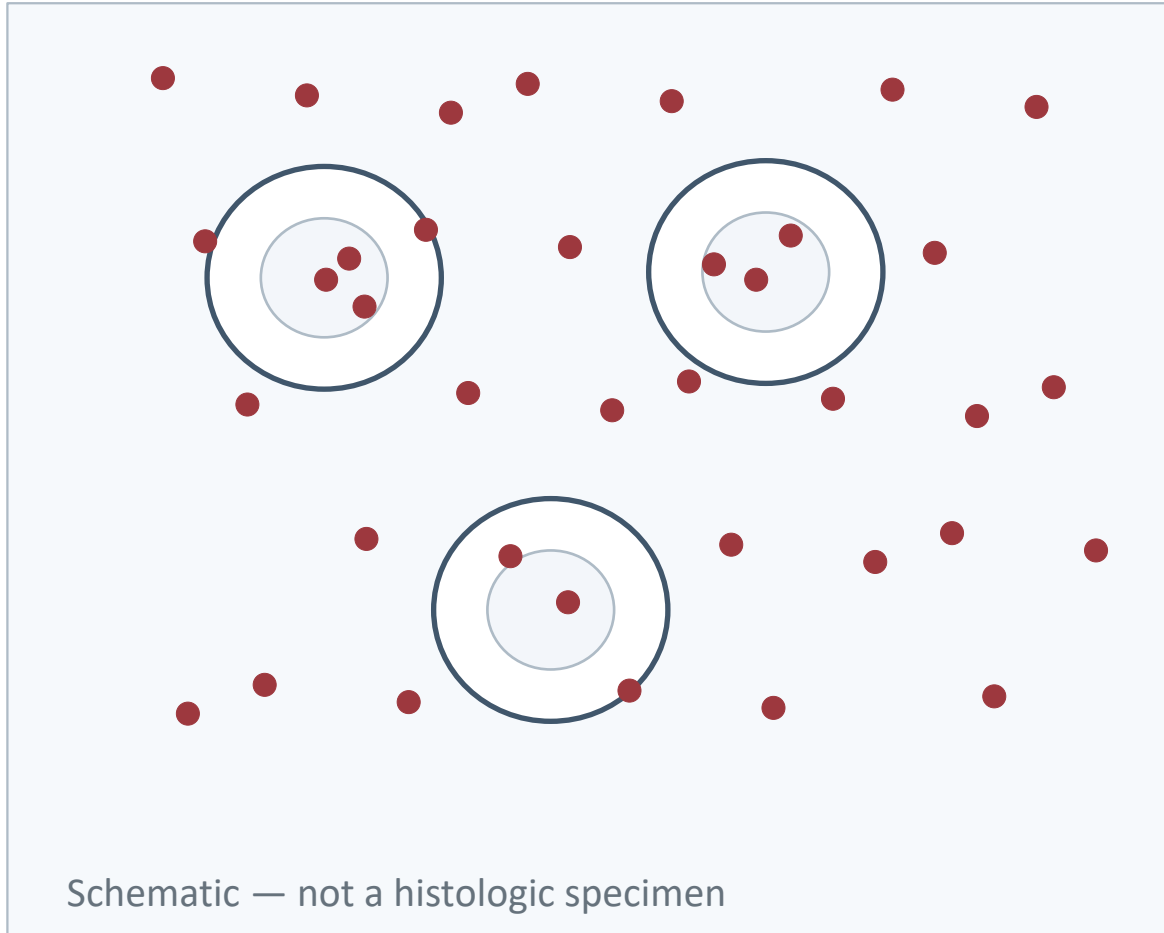
The initial bacterial lesion is usually interstitial



Schematic — not a histologic specimen

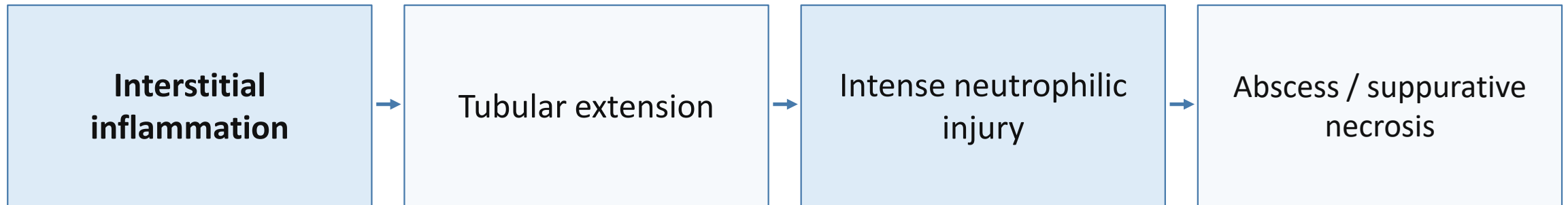
- The process generally begins in connective tissue between tubules.
- It is not initially confined to the tubular lumen.
- Progression can rapidly involve the tubules themselves.

Inflammation can extend into epididymal tubules



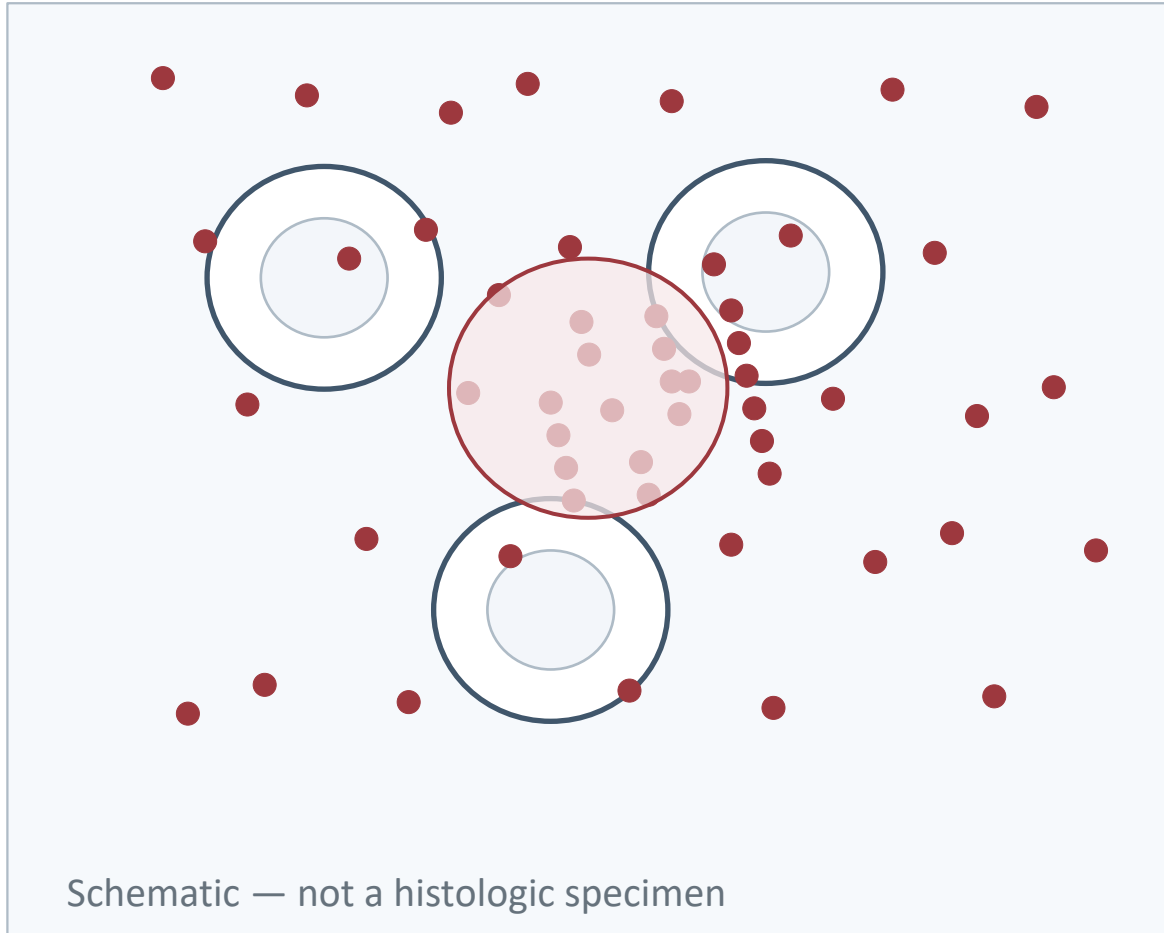
- The expanding acute infiltrate may reach the tubular compartment.
- Tubular involvement indicates progression beyond the initial interstitial focus.
- Destructive disease can culminate in abscess or necrosis.

Suppuration is a potential endpoint of severe bacterial disease



The source describes possible—not inevitable—progression to destructive infection.

An epididymal abscess is a destructive lesion

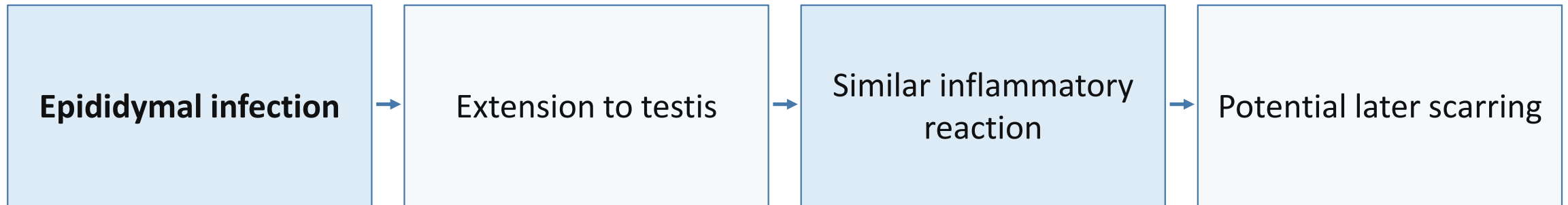


- Abscess formation is a recognized consequence of severe epididymitis.
- The normal epididymal tissue can be substantially replaced.
- Localized suppuration may replace much of the affected epididymal tissue.

Extensive necrosis can destroy the epididymis

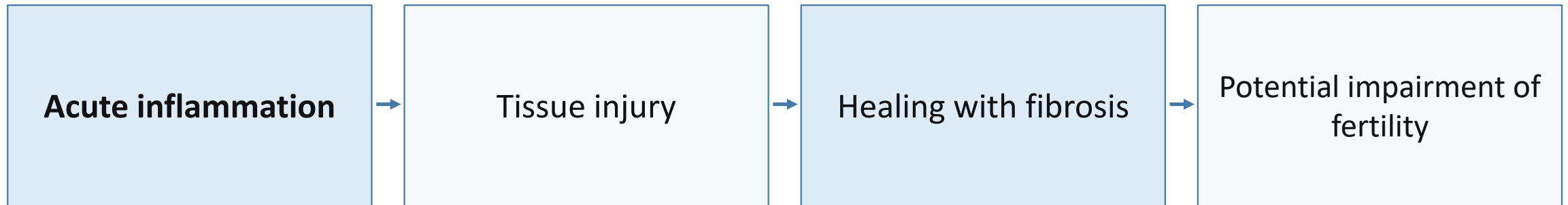
- Suppurative necrosis of the entire epididymis in severe cases.
- This is the extreme end of neutrophil-dominated tissue injury.
- It represents a qualitatively different consequence from edema alone.
- Subsequent healing may involve fibrous replacement.

Secondary orchitis can follow epididymal inflammation



The sequence is an important pattern for several infections, but not all etiologies begin in the epididymis.

Healing may leave fibrous scarring



Fibrous scarring following epididymitis/orchitis is explicitly linked to sterility in the source.

Fertility can be impaired after epididymo-orchitis

- Fibrous scarring can follow inflammation of the epididymis and testis.
- Robbins explicitly identifies sterility as a possible consequence.
- The reproductive outcome reflects injury to the genital tract and its tissue architecture.
- A reversible acute episode does not guarantee reversal of established scarring.

Leydig cells are usually relatively spared

Inflamed tissue

- Epididymal and testicular compartments may show neutrophils and scarring.
- The seminiferous / ductal apparatus may be compromised.

Leydig cells

- Usually not destroyed by the inflammatory process.
- Androgen production is therefore relatively unaffected.

Fertility and androgen production may diverge

Outcome	Source-supported interpretation
Fertility	May be reduced or lost after postinflammatory scarring
Androgen output	Relatively preserved because Leydig cells are usually spared
Key distinction	Preserved androgen output does not exclude reproductive sequelae

Bacterial epididymo-orchitis: Integrated tissue course

Antecedent infection

Cystitis, urethritis, or prostatitis



Early lesion

Congestion, edema, neutrophils



Progression

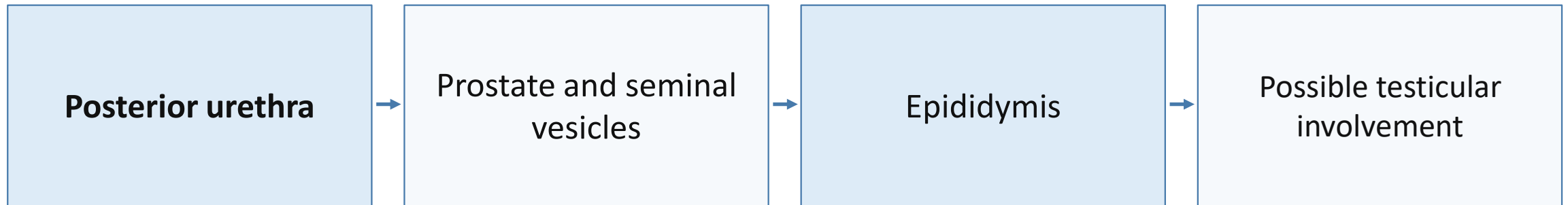
Tubular spread, abscess or necrosis



Sequelae

Fibrous scarring; Possible sterility

Gonorrhea can ascend from the posterior urethra



This extension with neglected gonococcal infection.

Severe gonococcal epididymitis may form abscesses

- Untreated / neglected gonococcal infection can extend to the epididymis.
- Severe epididymal infection may cause abscesses.
- Abscesses may lead to extensive destruction and scarring.
- Gonorrhea is therefore an example of potentially destructive suppuration.

Gonococcal infection may also produce suppurative orchitis

Epididymal component

- Ascending genital tract infection.
- Abscess formation and tissue destruction may occur.

Testicular component

- Can follow spread from the epididymis.
- Suppurative orchitis is a reported manifestation.

Granulomatous orchitis may be idiopathic

- Idiopathic granulomatous orchitis is described as rare.
- It is predominantly a testicular inflammatory disorder.
- The defining histologic feature is granulomas restricted to spermatic tubules.
- Its cause remains uncertain description.

Idiopathic granulomatous orchitis often presents in middle age

- The usual patient is middle-aged.
- Presentation may be a moderately tender testicular mass of sudden onset.
- Fever may accompany the abrupt presentation.
- A more indolent, painless presentation is also described.

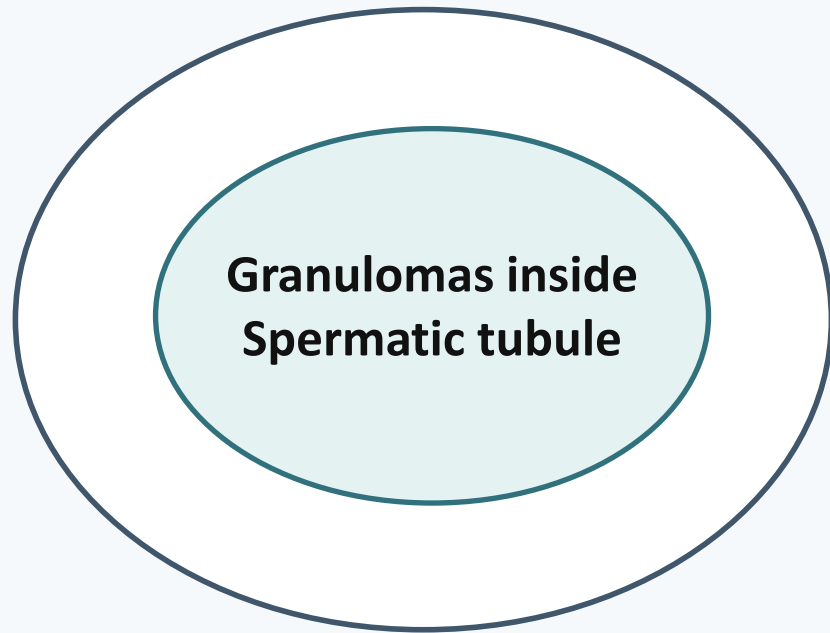
Granulomatous orchitis may clinically mimic a tumor

A middle-aged patient has an insidiously developing, painless testicular mass. The pathologic process ultimately proves inflammatory.

Which Robbins-listed inflammatory disorder is a key tumor mimic?

Idiopathic granulomatous orchitis; A painless testicular mass is a described presentation.

Tubule-restricted granulomas are a defining microscopic clue

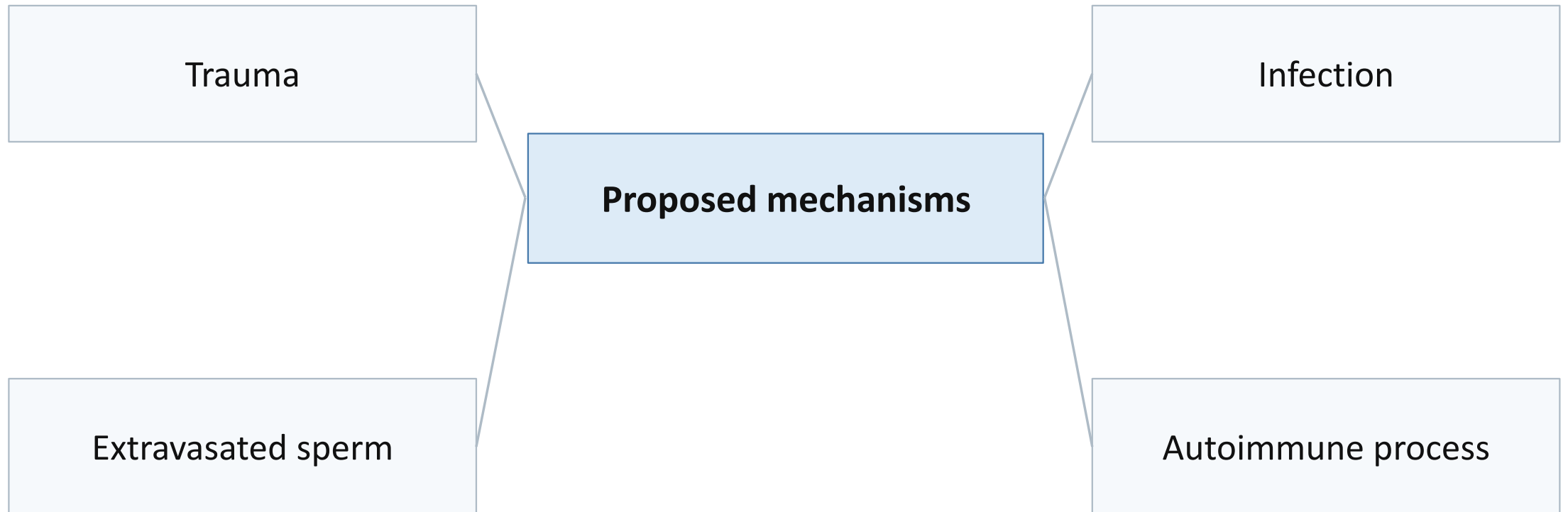


Tubule boundary

Conceptual pattern — not a photomicrograph

- Idiopathic granulomatous orchitis is characterized by granulomas within spermatic tubules.
- This localization is highlighted as distinctive.
- Interpret morphology alongside clinical and infectious context.

Several causes of idiopathic granulomatous orchitis are postulated

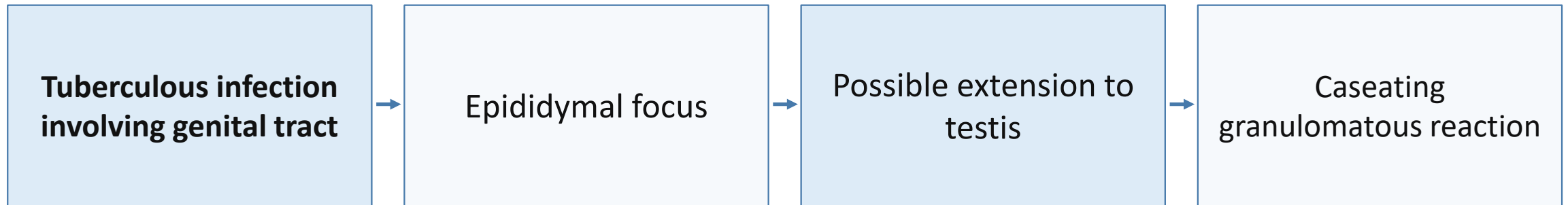


These are hypotheses identified—not established causes for every case.

Distinguish idiopathic granulomatous orchitis from tuberculosis

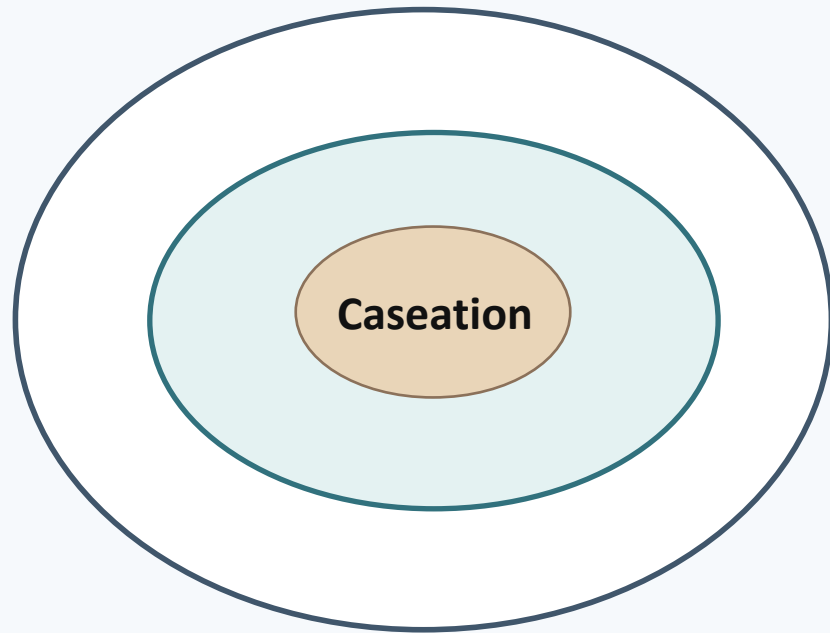
Feature	Idiopathic granulomatous orchitis	Tuberculous involvement
Primary clue	Granulomas confined to spermatic tubules	Often begins in epididymis
Necrosis	No defining caseation described	Caseating granulomatous inflammation
Diagnostic caution	Can mimic a neoplasm	Can resemble another granulomatous process

Genital tuberculosis usually begins in the epididymis



“Almost invariably begins in the epididymis” is the textbook formulation.

Caseating granulomas are the characteristic TB reaction



Conceptual pattern — not a photomicrograph

- Male genital tuberculosis evokes caseating granulomatous inflammation.
- The reaction is analogous to tuberculosis elsewhere in the body.
- This pattern differs from tubule-limited idiopathic granulomatous orchitis.

Epididymal location and caseation help distinguish TB

Anatomic distribution

- Tuberculosis almost invariably begins in the epididymis.
- The testis can become involved secondarily.

Histopathologic pattern

- Caseating granulomatous inflammation is characteristic.
- Location and necrosis should be interpreted together.

Mumps orchitis is strongly influenced by pubertal status

School-aged children

- Mumps commonly affects this age group.
- Testicular involvement is extremely uncommon.

Postpubertal males

- Orchitis is substantially more frequent.
- Orchitis in 20%–30% of cases.

Orchitis in 20%–30% of postpubertal mumps cases

- This range pertains to postpubertal males with mumps.
- It does not refer to school-aged children, in whom orchitis is very uncommon.
- The figure is reproduced as textbook information, not a current population estimate.
- Age context is essential when interpreting the percentage.

Mumps orchitis typically follows parotid swelling

Systemic mumps

Parotid gland swelling

Approximately 1 week later

Orchitis may develop

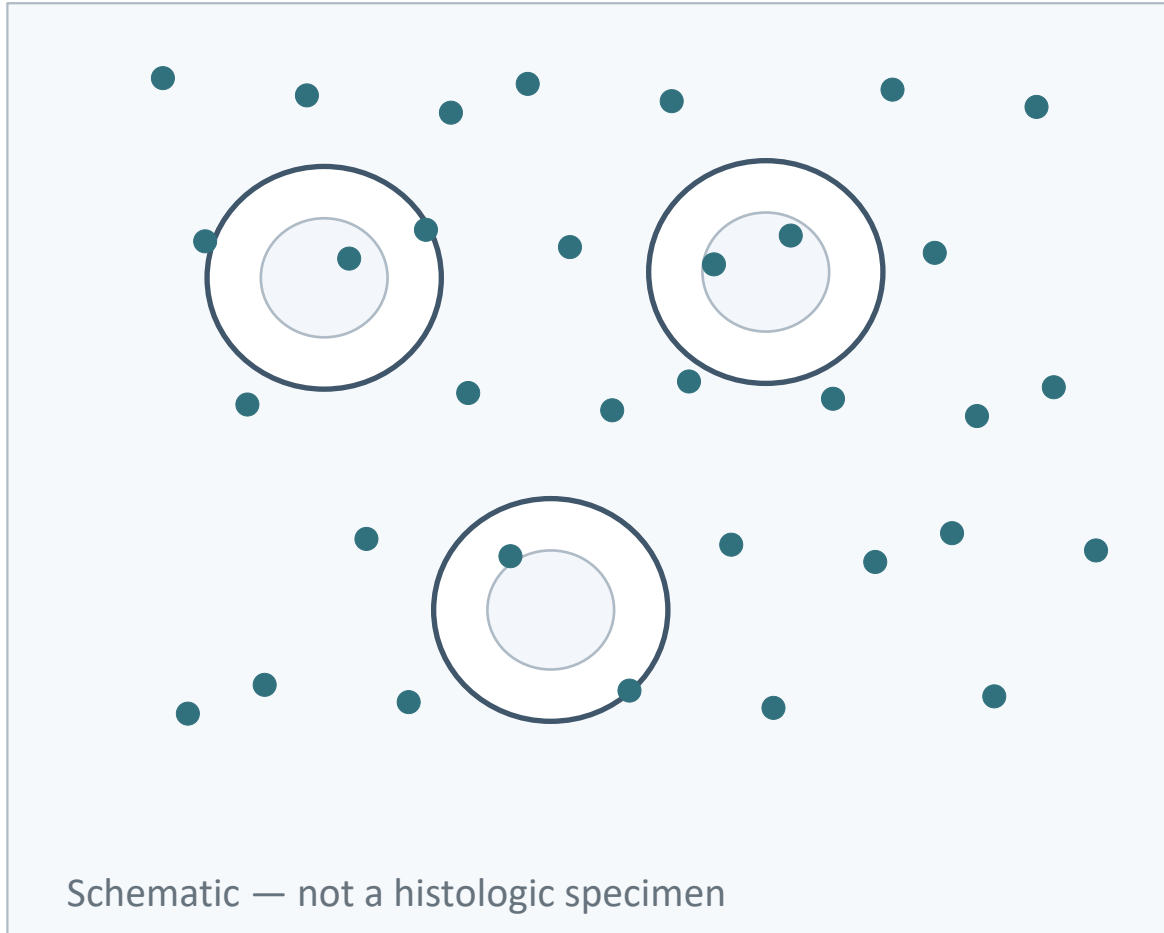
Inflammatory lesion

Acute interstitial orchitis

Possible consequence

Reduced fertility if bilateral

Mumps orchitis has an interstitial mononuclear infiltrate



- The characteristic reaction is acute interstitial orchitis.
- Infiltrating lymphocytes and plasma cells are emphasized.
- This differs in dominant cell type from acute bacterial neutrophilic inflammation.

Bilateral mumps orchitis can reduce fertility

- Mumps may involve the testis in postpubertal males.
- Bilateral testicular involvement is the context in which reduced fertility is emphasized.
- Testicular-first involvement contrasts with many ascending infections.
- The source does not establish inevitable infertility in every affected patient.

Bacterial and mumps orchitis differ in dominant morphology

Aspect	Typical bacterial process	Mumps orchitis
Usual initial site	Epididymis often first	Testis first
Inflammatory cells	Neutrophils	Lymphocytes, plasma cells
Tissue pattern	Congestion; Edema; Suppuration possible	Acute interstitial orchitis
Fertility concern	Fibrous scarring	Bilateral involvement

Syphilis commonly involves the testis first

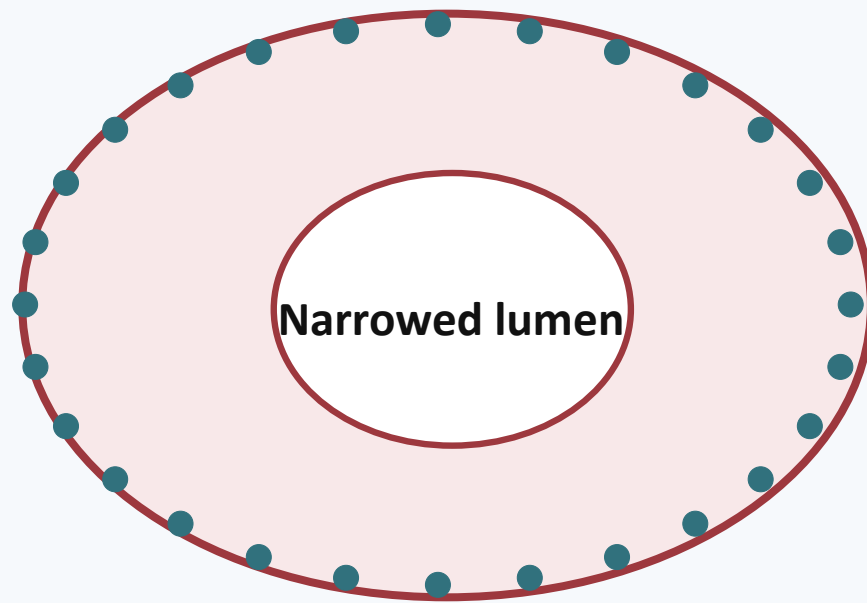
Site and setting

- Acquired and congenital syphilis may involve male genital organs.
- The testis is almost invariably the first involved site.

Major tissue reactions

- Obliterative endarteritis with perivascular inflammatory cuffs.
- Granulomatous inflammation forming a gumma.

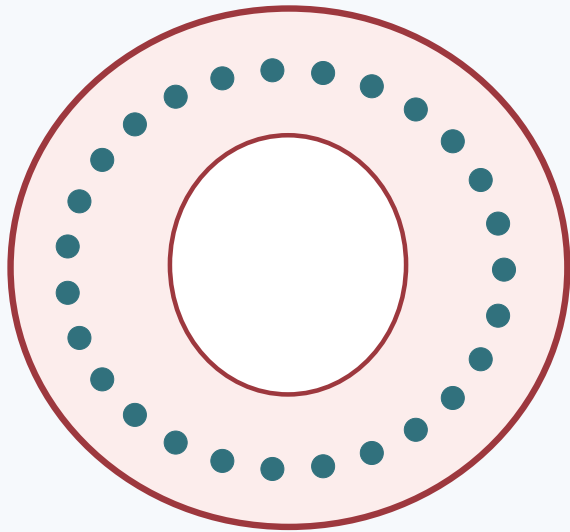
Obliterative endarteritis is a syphilitic pattern



Schematic vessel cross-section

- Obliterative endarteritis as a characteristic reaction.
- The vessel-centered lesion is associated with inflammatory cuffs.
- This vascular pattern contrasts with typical neutrophilic epididymitis.

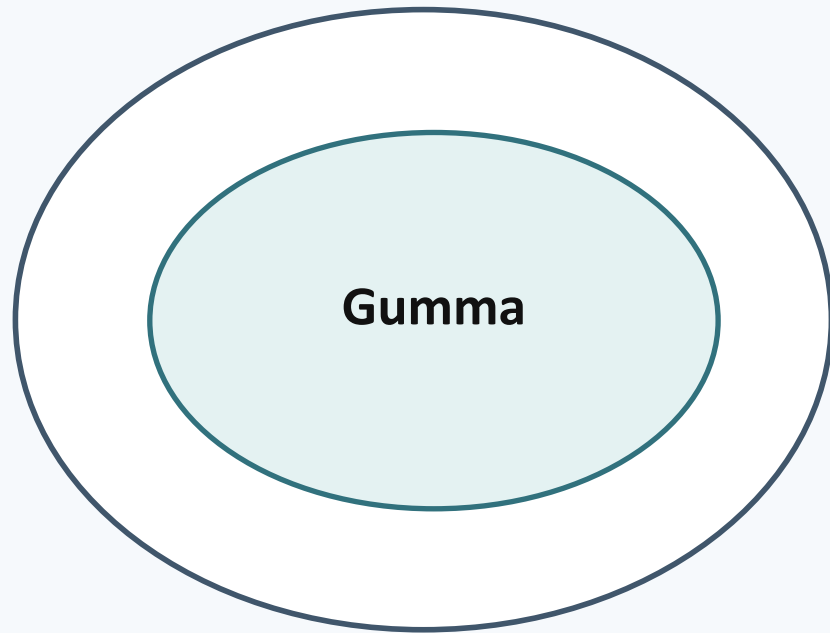
Perivascular cuffs contain lymphocytes and plasma cells



Schematic — not a histologic specimen

- The perivascular inflammatory infiltrate is lymphoplasmacytic.
- It accompanies the obliterative vascular lesion in syphilis.
- The cell population should be interpreted with its vascular distribution.

A gumma is the granulomatous syphilitic pattern



Conceptual pattern — not a photomicrograph

- Syphilis can also produce granulomatous inflammation.
- This form is named a gumma.
- It is an alternative to obliterative endarteritis.

Syphilis has two described morphologic expressions

Vascular pattern

- Obliterative endarteritis.
- Perivascular lymphocytes and plasma cells.

Granulomatous pattern

- Gummatous inflammation.
- A distinct alternative reaction described in the source.

Not all rare orchitis causes are infections

Additional infectious causes

- Leprosy; Toxoplasmosis; Fungi.
- Other viruses; Parasites; Brucellosis.

Other inflammatory associations

- Sarcoidosis and Crohn disease are noninfectious conditions.
- Malakoplakia is also listed among rare causes.

Less common infectious etiologies are heterogeneous

Bacterial / related

- Leprosy and brucellosis are listed.

Parasites

- Toxoplasmosis and other parasitic causes are listed.

Fungal / viral

- Fungi and other viruses are listed.

Systemic inflammatory disease may be associated with orchitis

- Sarcoidosis and Crohn disease appear list of rare causes.
- These diagnoses should not be mislabeled as microbial infections.
- The supplied source gives no specific testicular histologic signature for either condition.
- They belong in the broader differential for inflammatory testicular pathology.

The initial organ often predicts the relevant differential

First site	Examples emphasized	Interpretive caution
Epididymis	Gonorrhea; Tuberculosis; Bacterial epididymitis	Secondary orchitis may follow
Testis	Mumps; Syphilis	Do not presume ascending epididymal infection
Primarily intratubular	Idiopathic granulomatous orchitis	Morphologic localization is a clue, not complete proof

Inflammatory cell type and necrosis refine interpretation

Finding	Most directly associated process
Neutrophils, abscess, suppurative necrosis	Bacterial epididymitis / gonorrhea
Granulomas restricted to spermatic tubules	Idiopathic granulomatous orchitis
Caseating granulomas with epididymal focus	Tuberculosis
Interstitial lymphocytes and plasma cells	Mumps
Vessel-centered lymphoplasmacytic cuffs ± gumma	Syphilis

Application: An acute suppurative epididymal lesion

A sexually active younger adult has evidence of acute epididymal inflammation. Histology demonstrates neutrophils and an abscess.

Which organisms and complication fit the source-based pattern?

C. Trachomatis or N. Gonorrhoeae are frequent in this age group; Severe gonorrheal epididymitis can form destructive abscesses.

Application: Orchitis after parotid swelling

A postpubertal patient develops testicular inflammation approximately one week after parotid swelling. The infiltrate is interstitial and lymphoplasmacytic.

Which etiology and potential reproductive concern are most directly supported?

Mumps orchitis; Bilateral disease may reduce fertility.

Application: A granulomatous testicular mass

A middle-aged patient has a testicular mass. Granulomas are restricted to spermatid tubules, and caseating necrosis is not described.

Which diagnosis is favored, and which important mimic remains?

Idiopathic granulomatous orchitis is favored by intratubular distribution; Tuberculosis remains a key granulomatous differential.

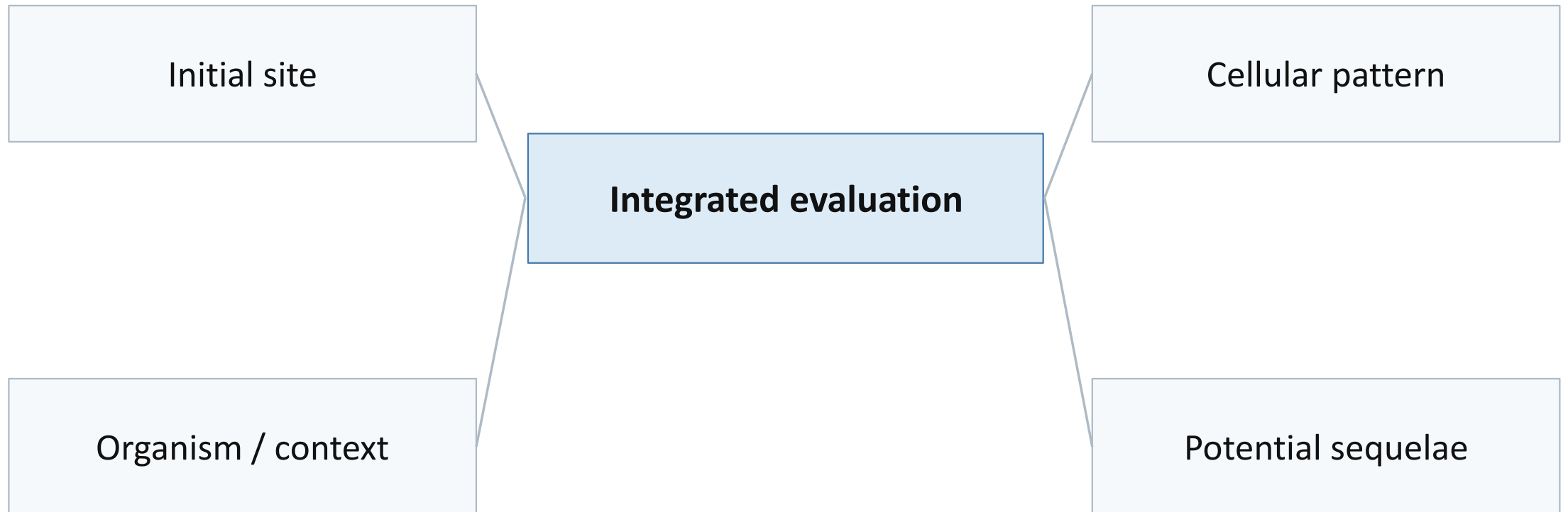
Application: Testis-first vessel-centered inflammation

Testicular pathology shows obliterative endarteritis and perivascular lymphocytes with plasma cells.

Which infection produces this characteristic morphologic reaction?

Syphilis; A gumma is the other principal histopathologic pattern described.

Read a testicular inflammatory lesion along four axes



A structured synthesis of observations in the supplied chapter; Not a clinical testing guideline.

Core synthesis: Distribution, morphology, and function

Recognize

- Epididymis-first: Common bacterial infections, gonorrhea, tuberculosis.
- Testis-first: Mumps and syphilis.
- Intratubular granulomas: Idiopathic granulomatous orchitis.

Explain

- Neutrophilic injury may cause abscess and necrosis.
- Fibrosis may impair fertility.
- Leydig sparing may preserve androgen output.

Source reference

Robbins, Cotran & Kumar: Pathologic Basis of Disease. 11th edition (2026).

Section: Inflammation and Infections of the Testis and Epididymis, including the immediately adjacent subsections.

All diagrams in this lecture are original editable schematics, not reproduced histopathology images or diagnostic evidence.