- Penicillins and tetracyclines not recommended as first-line agents due to resistance.
- Fluoroquinolones no longer recommended as first-line therapy due to increasing resistance, especially in men who have sex with men.
- For uncomplicated cervicitis/urethritis, ceftriaxone is drug of choice; other third-generation cephalosporins (cefixime, cefpodoxime) are also commonly used. Spectinomycin can be used in penicillin allergic pts.
- Add doxycycline or azithromycin for coexisting chlamydial infections.
- Symptoms may subside without treatment, leaving a chronic asymptomatic carrier state.
- Pharyngeal infection is frequently asymptomatic; it may clear spontaneously over several wk, even without therapy. Ceftriaxone and trimethoprim-sulfamethoxazole can be used for treatment.
- Complicated infections can be treated via penicillin G IV × 5 d or ceftriaxone × 5 d. Oral fluoroquinolones may be used provided susceptibility.
- PID requires second-generation cephalosporin such as cefotetan or cefoxitin or a combination of clindamycin and gentamicin. Treat for chlamydial coinfection.
- Resolution of symptoms after treatment suggests cure; follow-up cultures are recommended.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Conjunctivitis, ophthalmia neonatorum, adult gonococcal conjunctivitis			
	Pharyngeal infection		Exudative tonsillitis	Cultures
GI	Anorectal infectionsProctitis	Pain, pruritus	Purulent discharge, bloody diarrhea	Cultures
GU	*Women*			
	Urogenital tract disease	Abnormal vaginal discharge, dysuria, urinary frequency, lower abdominal pain, labial pain, abnormal menstruation	Mucopurulent cervicitis	Cultures from urethra and vagina
	Men			
	Acute epididymitisProstatitis	Pain		
CV	Gonococcal endocarditis		Possible murmur	ECHO
GI	Perihepatitis (Fitz-Hugh–Curtis syndrome)		RUQ tenderness	Liver enzyme elevation
GU	*Women*			
	PID	Lower abdominal pain, vaginal discharge, fever, palpable adnexal mass	Severe pain to palpation	Endocervix cultures
	Men			
	Urethritis	Dysuria	Purulent urethral discharge	Cultures from urethra
CNS	Gonococcal meningitis		Meningeal signs	
MS	Septic arthritis	Most common cause of septic arthritis in young adults, tends to involve single joints	Warmth, tenderness of affected joint(s)	
DERM	Disseminated lesions			Ranging from maculopapular to pustular or hemorrhagic, usually peripheral

Key References: Tapsall JW: *Neisseria gonorrhoeae* and emerging resistance to extended spectrum cephalosporins, *Curr Opin Infect Dis* 22(1):87–91, 2009; Centers for Disease Control and Prevention: Sexually transmitted disease surveillance, 2014. Atlanta, GA, 2015, US Department of Health and Human Services. <http://www.cdc.gov/std/stats>.

Perioperative Implications

- Universal blood and body fluid precautions and/or barrier precautions

Monitoring

- Awareness of Foley catheter/temp probe placement

Airway

- Awareness if pharyngitis exists

Positioning

- Awareness of joint involvement

Maintenance

- Awareness of extent of disease

Adjuvants

- Vary with hepatic involvement.

Anticipated Problems/Concerns

- No vaccine available
- Follow-up cultures
- Effective antibiotics
- Testing isolates for antibiotic susceptibility
- Routine culturing of high-risk populations
- Diligent contact tracing and prompt referral; treatment of sexual partners
- Education targeted at high-risk groups
- Use of condoms or other barrier methods

Goodpasture Syndrome

Michael A. Hall | Lee A. Fleisher

Risk

- Incidence of 1 case per million people per y.
- Accounts for 20% of cases of RPGN or crescentic glomerulonephritis.
- In terms of bimodal age distribution, more common in males 20–30 y of age and females 60–70 y of age.

Perioperative Risks

- Anemia from recurrent or persistent intrapulmonary hemorrhage
- Hypoxia or hypoxic respiratory failure in cases of massive intrapulmonary hemorrhage
- Rapidly progressive renal failure or uremia
- Significant third-space fluid loss secondary to proteinuria

Worry About

- Pts with active pulmonary hemorrhage may require mechanical ventilation in the postop period for hypoxic respiratory failure.
- Renal failure will alter drug pharmacokinetics and require adjustment of dosing or choice of anesthetic drugs.
- Anemia secondary to iron deficiency from repeated pulmonary hemorrhage, as well as anemia related to chronic kidney disease.
- Opportunistic infections such as pneumocystitis pneumonia in pts receiving immunosuppressive therapy.
- Volume overload in pts with severe renal insufficiency.

Overview

- Rare, autoimmune, renal-pulmonary syndrome caused by autoantibodies directed against the glomerular basement membrane (anti-GBM antibodies).
- Major cause of RPGN, defined as a ≥50% loss of renal function (as quantified by glomerular filtration rate) over a 3-mo period.
- Usually presents with constitutional symptoms (night sweats, malaise), chronic cough progressing

to hemoptysis, and hematuria or foamy urine (from proteinuria).
- Pulmonary symptoms may be episodic in nature, related to discreet episodes of pulmonary hemorrhage. Each episode may be severe and can lead to life-threatening respiratory failure requiring mechanical ventilation.
- Pts may present for elective surgery, such as placement of dialysis access, or require kidney transplantation related to loss of renal function caused by progression of Goodpasture syndrome.

Etiology

- Autoimmune disease caused by anti-GBM antibodies. These antibodies also have affinity for the alveolar basement membrane, causing the renal-pulmonary syndrome.
- In most pts, the anti-GBM antibodies are directed against a specific subunit within the alpha 3 chain of type IV collagen.
- In a classic type II hypersensitivity reaction, anti-GBM antibodies bind to target epitopes and activate the complement system, leading to cellular damage.
- Cellular damage within the glomeruli leads to glomerulonephritis with proteinuria and hematuria. In RPGN, crescentic scarring of the glomeruli can be seen on kidney biopsy.
- Within the alveoli, cellular damage leads to a breakdown in the barrier between airspaces and blood vessels, leading to diffuse alveolar hemorrhage.
- Evidence of a genetic predisposition. A positive association among Goodpasture syndrome, pernicious anemia, systemic lupus erythematosus, and Sjogren syndrome and HLA-DR15 has been demonstrated.
- All other known risk factors are pulmonary insults, such as exposure to hydrocarbon fumes, exposure to metal dusts, inhalation of smoke or cocaine, or viral infections. These insults may lead to damage of the alveolar basement membrane and exposure of type IV collagen to the immune system, leading to the development of autoantibodies.

Usual Treatment

- There are no large trials to guide treatment; however, the basis for treatment of other autoantibody-mediated diseases can be adapted.
- Suppression of antibody production is achieved with immunosuppressant medications such as cyclophosphamide and steroids. Pulse-dose steroids can be used in cases of acute, severe alveolar hemorrhage, followed by a prolonged taper to a low, standing dose.
- Rituximab, which depletes CD20-positive B cells (antibody producing), has also been reported to control anti-GBM antibody levels in pts intolerant of cyclophosphamide.
- Plasmapheresis has been shown to effectively remove anti-GBM antibodies, and can be used in the acute setting or upon initial diagnosis. The pt will undergo plasmapheresis for 2–3 wk, or until clinical status improves, and then be maintained on immunosuppressant medication.
- Treatment for alveolar hemorrhage is usually supportive, and rarely may require mechanical ventilation, while therapy to clear anti-GBM antibodies is instituted.
- Renal dysfunction, especially when present as RPGN, may require renal replacement therapy or kidney transplant, although if anti-GBM antibody levels are not controlled, disease can recur in the allograft.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Volume overloadHypertension	Dyspnea	Vital signs Peripheral edema Rales	Monitor BP and HR
RESP	Alveolar hemorrhage	Cough Hemoptysis Dyspnea	Vital signs (low SpO_2) Tachypnea Rales	Monitor SpO_2 PaO_2 on ABG Increased A-a gradient
RENAL	Acute or chronic renal failure	Oliguria Hematuria Peripheral edema Nondependent edema	Peripheral or nondependent edema	Lytes Serum Cr UA for blood or protein
HEME	Anemia	Dyspnea Recurrent hemoptysis	Conjunctival pallor	CBC Iron studies

Key References: Greco A, Rizzo MI, De Virgilio A, et al.: Goodpasture's syndrome: a clinical update, *Autoimmun Rev* 14(3):246–253, 2015; Copponex K, Kaye AD: Perioperative management of the patient with Goodpasture's syndrome, *Middle East J Anesth* 20(6):779–783, 2010.

Perioperative Implications

Preoperative Preparation

- Elective surgery, such as the placement of permanent dialysis access, should be delayed until the disease is in an inactive state, as evidenced by controlled anti-GBM antibody levels and resolution of any respiratory symptoms.
- Blood count, given risk of significant anemia.
- In pts with renal dysfunction, volume status should be optimized prior to surgery to decrease risk of compounding kidney injury with hypovolemia or hypotension.
- Preop respiratory status and supplemental oxygen requirements should be evaluated, as this may indicate need for postop mechanical ventilation.
- If pt is dialysis-dependent, close attention to electrolyte and volume status should be paid, and consideration given to supplemental preop hemodialysis if significant disturbance is present.
- Pts on immunosuppressant medications should be evaluated for signs of occult infection.

Monitoring

- Standard monitors.
- Urinary cath for UOP monitoring, especially in pts with moderate to severe renal dysfunction.
- Advanced monitors of volume status may be helpful in order to optimize renal perfusion.
- Arterial line, if otherwise indicated by the procedure or the pt's clinical status, would allow for monitoring of stroke volume variation as an indicator of volume status.

Airway

- If a pt has active alveolar hemorrhage, an endotracheal tube of sufficient diameter to allow for pulm suctioning should be used.

Induction

- May need to adjust choice and dosage of anesthetic drugs to account for renal dysfunction.

Maintenance

- Remain cognizant of dosing adjustment for renal and hepatic dysfunction.
- In pts with recent or active alveolar hemorrhage, frequent suctioning and recruitment maneuvers should be performed.
- Close attention to volume status is required in pts with renal failure, as hypovolemia may worsen kidney injury and volume overload may not be correctable until the pt is dialyzed postop.

Extubation

- Requires full reversal of neuromuscular blockade, as duration of action of neuromuscular blockers may be altered by renal dysfunction.
- Ensure that pt will be able to maintain adequate oxygenation after extubation.

Postoperative Period

- Pts require close attention to volume status and electrolytes, with the possibility of supplemental dialysis therapy if necessary in the periop period.
- Choice of analgesic medications must be made with consideration to altered metabolism in renal failure, particularly in avoidance of NSAIDs, morphine, and meperidine.

Anticipated Problems/Concerns

- Hypoxic respiratory failure in the event of massive alveolar hemorrhage.
- Anemia caused by chronic alveolar hemorrhage as well as by renal dysfunction.
- Renal failure can quickly progress to end stage with dialysis dependence.
- Pts susceptible to infection when appropriately treated with immunosuppressant medications.