Approach to Proteinuria in Children

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1. Definition (2–3 lines)

Proteinuria is the presence of an abnormal amount of protein in urine.

- Normal children excrete **<100 mg/m²/day** (or urine protein/creatinine ratio (UPCR) <0.2 mg/mg in children >2 years).
- Proteinuria may be **transient, orthostatic, or persistent** and can indicate benign conditions or significant kidney disease.

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2. Clinical Presentation

A. Incidental finding (most common)

- Positive urine dipstick during routine examination
- Child appears healthy

B. Symptomatic presentation

History

Ask about:

- Recent fever or vigorous exercise
- Dehydration
- Upper respiratory or skin infection
- Gross hematuria
- Frothy urine
- Facial or leg edema
- Reduced urine output
- Hypertension symptoms (headache, blurred vision)
- Weight gain
- Rash

- Joint pain
- Family history of kidney disease

Physical examination

Assess:

- Blood pressure (**always measure**)
- Weight
- Height/growth
- Periorbital edema
- Peripheral edema
- Ascites
- Skin rash/purpura
- Joint swelling
- Hydration status
- Signs of systemic disease

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3. Diagnostic Approach

Step 1. Confirm proteinuria

Positive dipstick (≥1+)

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Repeat **first-morning urine**

- Negative → transient proteinuria
- Positive → quantify protein

Step 2. Quantify protein

Preferred:

Urine protein/creatinine ratio (UPCR)

Normal:

- <0.2 (>2 years)
- <0.5 (6–24 months)

Nephrotic-range:

UPCR >2 mg/mg

Step 3. Determine the type

Transient proteinuria

Associated with

- Fever
- Exercise
- Stress
- Dehydration
- Seizure

Repeat after recovery.

No further workup if resolved.

Orthostatic proteinuria

Typical:

- Adolescents
- Normal first-morning urine
- Positive daytime urine

Benign.

Persistent proteinuria

Requires evaluation for renal disease.

Step 4. Look for associated abnormalities

Ask:

- Hematuria?
- Hypertension?
- Reduced GFR?
- Edema?
- Low complement?
- Systemic symptoms?

If yes → likely glomerular disease.

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4. Differential Diagnosis

Benign causes

- Transient proteinuria
- Orthostatic proteinuria
- Exercise-induced
- Fever

Glomerular diseases

- Minimal change nephrotic syndrome
- Focal segmental glomerulosclerosis (FSGS)
- Post-streptococcal glomerulonephritis
- IgA nephropathy
- Membranous nephropathy
- Lupus nephritis
- Alport syndrome

Tubular diseases

- Acute interstitial nephritis
- Fanconi syndrome
- Drug-induced tubular injury

Secondary causes

- Diabetes mellitus
- Hypertension
- Vasculitis
- Hemolytic uremic syndrome
- Congenital kidney disease

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5. Investigations

Initial tests

✓ Urinalysis

Look for:

- Hematuria
- Leukocytes
- Casts
- Specific gravity

✓ First-morning UPCR

✓ Serum

- Creatinine
- Urea
- Electrolytes
- Albumin
- Cholesterol (if nephrotic syndrome)

✓ Blood pressure

Additional tests (if persistent)

- CBC
- C3/C4
- ANA
- Anti-dsDNA (if lupus suspected)
- ASO titer
- Anti-DNase B
- Hepatitis B/C (selected cases)
- HIV (selected)
- Renal ultrasound

Kidney biopsy (specialist decision)

Indications include

- Persistent nephrotic syndrome
- Steroid resistance
- Persistent low C3
- Declining renal function
- Significant hematuria
- Suspicion of systemic disease

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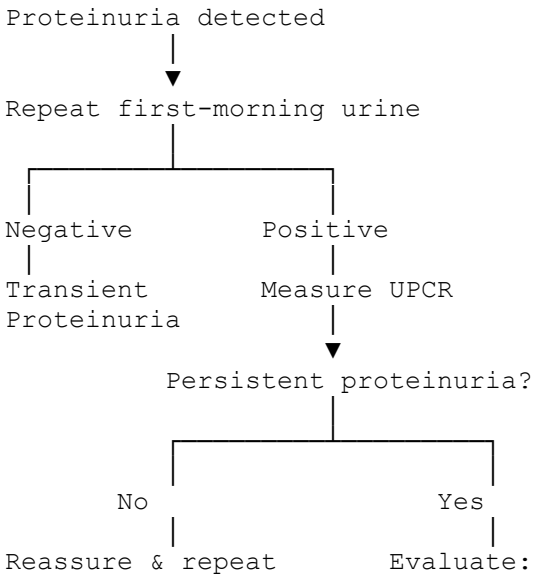
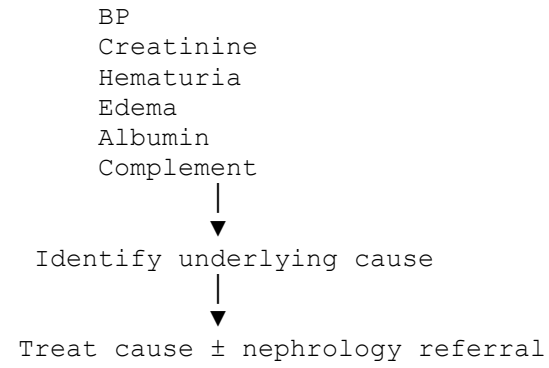
6. Management Algorithm





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7. Drug Summary Table

Medication	Main Indication	Typical Pediatric Dose	Important Notes
Prednisolone	Minimal change nephrotic syndrome	**2 mg/kg/day (maximum 60 mg/day)** for initial therapy (specialist-guided)	Not for isolated proteinuria without diagnosis
Furosemide	Significant edema	**1 mg/kg/dose PO/IV** (usual range 1–2 mg/kg/dose)	Monitor electrolytes
Albumin 20–25% + Furosemide	Severe hypoalbuminemic edema	Specialist use	Hospital only
ACE inhibitor (e.g., Enalapril)	Persistent proteinuria, CKD, hypertension	**0.08 mg/kg/day initially**, titrate as needed	Monitor potassium and creatinine
ARBs	Alternative to ACE inhibitors	Specialist guidance	Avoid combination with ACE inhibitors routinely

Antibiotics are not indicated unless there is a confirmed underlying infection (e.g., post-streptococcal disease).

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8. Admission Criteria

Hospitalize if:

- Generalized edema (anasarca)
- Severe nephrotic syndrome
- Hypertensive emergency
- Acute kidney injury

- Oliguria/anuria
- Gross hematuria with renal impairment
- Electrolyte abnormalities
- Suspected rapidly progressive glomerulonephritis
- Pulmonary edema
- Severe infection
- Thromboembolic complications

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9. Referral Criteria

Refer to **pediatric nephrology** if:

- Persistent proteinuria (>3 months)
- Nephrotic-range proteinuria
- UPCR >0.2 on repeated first-morning samples
- Hematuria with proteinuria
- Hypertension
- Reduced eGFR
- Elevated serum creatinine
- Low complement
- Recurrent edema
- Suspected systemic disease
- Family history of hereditary nephropathy

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10. Follow-up

Transient proteinuria

- Repeat urinalysis after illness resolves
- No long-term follow-up if normal

Orthostatic proteinuria

- Annual urinalysis
- Blood pressure monitoring
- Excellent prognosis

Persistent proteinuria

Monitor:

- Blood pressure
- Growth
- Weight
- Renal function
- UPCR
- Serum albumin
- Response to therapy
- Medication adverse effects

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11. Clinical Pearls

- **Most proteinuria detected on screening is benign.**
- Always repeat a **first-morning urine** before extensive investigations.
- **Orthostatic proteinuria** is common in adolescents and has an excellent prognosis.
- Proteinuria with **hematuria, hypertension, or reduced GFR** strongly suggests significant renal disease.
- A urine dipstick can miss non-albumin proteins; UPCR is preferred for quantification.
- Persistent nephrotic-range proteinuria requires urgent evaluation.
- Blood pressure measurement is mandatory in every child with persistent proteinuria.

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12. Common Mistakes in Exams and Practice

❌ Diagnosing chronic kidney disease after a single positive dipstick

❌ Failing to repeat a first-morning urine sample

❌ Forgetting to measure blood pressure

❌ Ignoring edema or hypoalbuminemia

❌ Assuming all proteinuria is nephrotic syndrome

❌ Starting corticosteroids before establishing the diagnosis (unless following an established nephrotic syndrome protocol under appropriate supervision)

❌ Overlooking associated hematuria

❌ Missing signs of systemic diseases (e.g., lupus, vasculitis)

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13. Key Take-Home Messages

1. Proteinuria is common and often transient or orthostatic.
2. Confirm persistent proteinuria with a **first-morning urine** and **UPCR**.
3. Always evaluate **blood pressure, renal function, edema, and hematuria**.
4. **Transient proteinuria** after fever or exercise usually resolves spontaneously.
5. **Orthostatic proteinuria** is benign and common in adolescents.
6. Persistent proteinuria warrants evaluation for glomerular or tubular kidney disease.
7. **Nephrotic-range proteinuria (UPCR >2 mg/mg)** suggests nephrotic syndrome and requires urgent assessment.
8. ACE inhibitors reduce persistent proteinuria in selected patients but require monitoring of renal function and potassium.
9. Proteinuria associated with hypertension, reduced eGFR, or low complement requires prompt pediatric nephrology referral.
10. Early recognition and appropriate referral help prevent progression of chronic kidney disease.

Rapid Examination Checklist

Step	Key Action
1	Confirm proteinuria with **first-morning urine**
2	Measure **UPCR**
3	Check **blood pressure**
4	Assess for edema and hematuria
5	Measure serum creatinine and albumin
6	Differentiate transient, orthostatic, and persistent proteinuria
7	Refer persistent or nephrotic-range proteinuria to pediatric nephrology