

Dialysis Initiation: Timing, Modality Selection & IDEAL Trial

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Definition of ESRD & When RRT is Needed

ESRD = End-Stage Renal Disease: - GFR <15 mL/min/1.73m² (CKD Stage 5) - OR persistent symptoms of uremia despite maximal conservative management - OR acute need for RRT (hyperkalemia, pulmonary edema, severe acidosis, uremia)

[!important] **RRT does NOT have to start immediately at GFR <15.** Conservative management is an option for selected patients. Timing depends on symptoms, residual function, and patient preference.

The IDEAL Trial: Symptom-Driven vs Early Start

IDEAL Trial Design (2010) — UK Study

Question: Does earlier dialysis initiation (eGFR 10–14) improve outcomes vs symptom-driven start (eGFR <7)?

Groups: - **Early-start:** Planned RRT at eGFR 10–14 - **Symptom-driven:** RRT only when uremic symptoms appeared (median eGFR 6–7)

Key Findings

Outcome	Early Start	Symptom-Driven	Result
Mortality	37% at 2 years	37% at 2 years	No difference
Hospitalization	Same	Same	No difference
Quality of life	Same	Same	No difference
Vascular access complications	Higher	Lower	Better with late start
Infection risk	Similar	Similar	Similar

[!tip] **IDEAL Trial conclusion:** Later, symptom-driven initiation is **not inferior** to early start. Avoids unnecessary early dialysis, reduces vascular access complications, preserves residual renal function longer.

Clinical Impact

- Modern practice favors **later, symptom-driven initiation** (eGFR 5–10)
- Emphasis on shared decision-making with patient
- Conservative management an acceptable option for selected patients

Timing of Dialysis Initiation: Clinical Indicators

Absolute Indications (Start RRT Immediately)

Indication	Mechanism	Management
Refractory hyperkalemia (K >6.5 mmol/L despite binders + diuretics)	Life-threatening arrhythmia risk	Acute HD or CRRT
Pulmonary edema (fluid overload unresponsive to diuretics)	Cardiogenic shock risk	Urgent HD (fluid removal)
Severe metabolic acidosis (pH <7.15, refractory)	Impaired cardiac contractility	Emergent CRRT or HD
Uremic pericarditis (chest pain, friction rub, effusion)	Risk of tamponade	Urgent HD; may avoid surgery
Acute poisoning (phenobarbital, isoniazid, lithium, aspirin)	Toxin removal	CRRT or high-flux HD

Elective Indications (Can Defer if Conservative Management Selected)

Uremic symptoms (at eGFR 5–10): - **Anorexia, nausea, vomiting** (reduced appetite; GI irritation from uremia) - **Fatigue, weakness** (anemia, uremia, electrolyte imbalance) - **Cognitive dysfunction** (confusion, memory, concentration decline) - **Pruritus** (itching from uremia; may be severe) - **Hypertension** uncontrolled despite 3+ antihypertensives - **Pericardial friction rub** (asymptomatic pericarditis; risk of progression)

Biochemical parameters (less important than symptoms): - K >6.0 mmol/L (if symptoms or diet very restricted) - PO₄ >8 mg/dL (if refractory despite binders + diet) - PTH >500 pg/mL (secondary HPT; may need RRT for better PTH control) - Urea >150 mg/dL (marker of uremia; not used as sole indicator in IDEAL trial)

[!warning] **Don't start RRT based on lab value alone** — symptoms matter more. Many patients tolerate labs that “should” trigger RRT start.

Pre-Dialysis Planning: Vascular Access Creation

Timing of Access Creation

Fistula maturation time: 8–12 weeks minimum (can take up to 6 months) - **Create fistula when eGFR 15–20** (3–5 years before anticipated RRT) - Start referral to vascular surgery at eGFR 25–30

Graft maturation time: 2–4 weeks

Catheter: Immediately available (tunneled central line), but temporary if possible

[!tip] **Golden rule:** Never delay nephrology referral for fear of “early” access. Fistula failures/maturation delays common — better to create early and have it ready than scramble for emergency access.

Types of Vascular Access

Type	Maturation	Longevity	Infection Risk	Flow
Fistula (AVF)	8–12 weeks	15–20 years	Lowest	Best (300–400 mL/min)
Graft (AVG)	2–4 weeks	3–5 years	Moderate	Good (250–350 mL/min)
Tunneled catheter (CVL)	Immediate	1–2 years	Highest	Fair (200–250 mL/min)

Hierarchy: Fistula > Graft > Catheter (avoid catheters if possible; ↑ infection, ↓ patency)

Modality Choice: HD vs PD vs Conservative

Hemodialysis (HD)

Mechanism: Blood circulates outside body; semipermeable membrane removes uremic wastes + fluid

Schedule: - **In-center HD:** 3×/week, 4–5 hours per session - **Nocturnal HD:** 3–5×/week, 6–8 hours per session (better clearance) - **Home HD:** More flexible scheduling; better outcomes in some studies

Advantages: - Excellent clearance of large molecules - Rapid volume removal (good for hypervolemia, pulmonary edema) - Acute toxin removal (drug overdose, poisoning) - Works at any residual GFR

Disadvantages: - Vascular access complications common (stenosis, thrombosis) - Infection risk (line-related bacteremia, sepsis) - Intradialytic hypotension (especially elderly, diabetics) - Dialysis disequilibrium (rapid electrolyte shifts → cerebral edema; rare now) - Cost ≈ \$50,000/year

Peritoneal Dialysis (PD)

Mechanism: Peritoneal membrane (lining abdominal cavity) serves as dialyzer; dextrose-based solution creates osmotic gradient

Schedule: - **CAPD** (continuous ambulatory): 4–5 exchanges/day, patient-controlled - **APD** (automated peritoneal dialysis): Machine overnight, 8–10 exchanges, 8–10 hours

Advantages: - **Residual renal function preserved longer** (gentler ultrafiltration) - More gradual solute removal → better BP stability - Flexibility (patient-controlled schedule; can travel) - Better quality of life metrics - Home-based (no center dependency) - Lower infection risk than HD (no central line) - Easier initial training; less equipment needed

Disadvantages: - **Peritonitis risk** (bacterial contamination during exchanges; 0.4 episodes/patient-year) - Requires adequate peritoneal surface (obesity, adhesions, hernia contraindications) - Technique failure (peritoneal scarring, low transporter, inadequate clearance) → switch to HD - Protein loss in dialysate (1–2 g/day; malnutrition risk) - Abdominal wall hernias common (40% at 5 years) - Self-care burden higher (patient must perform exchanges)

[!tip] **When to choose PD:** Young, motivated patient; good residual function; wants flexibility; prefers home-based; fistula not feasible or failed.

Conservative (Non-dialytic) Management

Patient selection: - Age >75 with comorbidities (frailty, dementia, cancer) - Declining function expected in <1–2 years regardless - Patient preference (quality of life over quantity) - Adequate social support for symptom management

Strategy: 1. **Optimize medical management:** ACE-I, SGLT2i, diuretics, phosphate binders, BP control 2. **Symptom palliation:** Antiemetics, appetite stimulants, pruritus management, anemia correction 3. **Gradual dietary modification:** Progressive K, PO₄, fluid restriction 4. **Palliative care consultation** when appropriate

Outcomes: - Median survival: 6–24 months (patient-dependent) - Better symptom control may exceed HD quality of life in selected cases - No vascular access complications, fewer hospitalizations - Natural death timeline may be preferred by patient

[!warning] **Conservative management is NOT “doing nothing.”** Requires active medical management, frequent monitoring, and excellent symptom control. Not appropriate if patient wants maximum lifespan.

Shared Decision-Making Framework

Discuss at eGFR 20–25

Elements of informed choice: 1. **Risks & benefits of RRT:** Timing, access complications, infection, lifestyle changes 2. **Modality comparison:** HD vs PD pros/cons tailored to patient 3. **Conservative option:** Realistic expectation of survival, quality of life 4. **Residual function:** Preserved longer with PD/conservative; lost faster with HD 5. **Transplant possibility:** If eligible, can undergo RRT while waiting 6. **Work/lifestyle impact:** HD center schedule vs PD flexibility 7. **Caregiver burden:** Family involvement in choice

Red Flags for Earlier Intervention Consideration

- Diabetes + declining function (→ recommend earlier access; more complications)
 - Congestive heart failure (→ HD better for fluid removal)
 - Obesity (→ HD preferred; PD contraindicated if BMI >40)
 - Poor adherence anticipated (→ HD center-based better supervised)
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Pre-RRT Labs & Optimization

Labs to Order (eGFR 20–25)

- BMP: Cr, K, PO₄, Ca, HCO₃
- CBC: Hgb (start ESA if <10 g/dL)
- PTH, 25-OH vitamin D
- Lipid panel (statin if not already on)
- Hepatitis panel, HIV (dialysis access safety)
- Blood cultures if any fever (exclude infection before vascular access)

Vaccinations Before RRT

- Hepatitis B (if non-immune; response better at higher GFR)
 - Influenza (annual)
 - Pneumococcal (PCV20 × 1, or PCV15 + PPSV23)
 - COVID-19 (additional doses recommended)
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Residual Renal Function (RRF) Preservation

[!important] **Preserving residual function is critical:** Each 1 mL/min RRF adds ~25% to urine output + solute clearance. Can mean difference between 3 × vs 2 ×/week HD, or continued PD adequacy.

Strategies: 1. **Avoid nephrotoxins:** NSAIDs, ACE-I withdrawal (continue even in advanced CKD) 2. **Strict BP control:** Protects remaining nephrons 3. **Avoid contrast, surgery if possible** 4. **Optimize volume status:** Avoid both over- and under-hydration 5. **Consider late start RRT:** Preserves RRF longer than early start (IDEAL trial) 6. **PD better than HD** for RRF preservation (gentler ultrafiltration)

Related Resources

- Comprehensive RRT Initiation Review
 - PD Physiology & Adequacy
 - CRRT for Acute Kidney Injury
 - CKD Staging & Referral Thresholds
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Self-Test Questions

1. **68M, DM, eGFR 16, K 6.1, urine output 800 mL/day, no uremic symptoms yet**
 - IDEAL trial would suggest: Wait for symptoms (symptom-driven initiation)
 - But: Create fistula now (takes 8–12 weeks to mature)
 - Shared decision-making: Discuss HD vs PD vs conservative; continue optimization
 2. **52F, eGFR 6, anorexia, nausea, pruritus, K 5.9**
 - Clear indication for RRT start: Uremic symptoms
 - Access: If fistula mature, start HD; if not ready, tunneled catheter
 - Consider PD if patient prefers flexibility + has good peritoneal function
 3. **82M with dementia, multiple comorbidities, eGFR 12, family wants “quality time”**
 - Conservative management appropriate: Palliation, symptom control
 - NOT candidate for aggressive RRT (poor predicted survival, high morbidity)
 - Palliative care + family meetings
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References: IDEAL trial. N Engl J Med. 2010;363(7). KDIGO 2024 CKD Management Guideline. ISPD PD Practice Guidelines.