

The Renal Examination

From Practice to Evidence

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Part 1 — The examination

Setting up. The kidney cannot be examined; what can be examined is the water it regulates, the waste it fails to clear, the pressure it raises, the diseases that damage it and the plumbing that replaces it. The renal examination is therefore five examinations in one — of volume, of uraemia, of the abdomen and pelvis, of the access, and of the eye, heart and nerves — and it begins at the chart rather than the bed: the weight against the last weight and the dry weight, the blood pressure trend, the fluid balance, the urine output, and the creatinine. The patient's own weight, measured on the same scales at the same time of day, is the single most reproducible finding in this chapter and is worth more than everything the hands add to it.

The general survey

- **Colour and skin.** The sallow, yellow-brown complexion of chronic uraemia on a background of pallor; scratch marks from pruritus; bruising; the rare uraemic frost; the half-and-half nails of Lindsay, white proximally and brown distally; Beau's lines from an intercurrent illness; the pigmentation and calcification of the skin in long-standing dialysis; the purpura of vasculitis over the shins and buttocks, the malar rash of lupus, the livedo of cholesterol embolisation, the tophi of gout, the necrotic plaques of calciphylaxis.
- **Breath and breathing.** The ammoniacal feter of uraemia; hiccups; the deep, sighing Kussmaul breathing of metabolic acidosis; the tachypnoea of pulmonary oedema.
- **Hands and arms.** The fistula or graft, examined below; the scars of old lines; the carpal tunnel syndrome and shoulder pain of dialysis amyloid; asterixis with the arms outstretched and the wrists extended, and the multifocal myoclonus of advanced uraemia; the temperature and capillary refill of the peripheries.
- **Mental state.** Attention, orientation and level of consciousness, because uraemic encephalopathy is a drowsiness that is missed when the patient is not spoken to.

Volume status

This is the part of the renal examination on which treatment turns, and the part that the evidence in Part 2 shows to be weakest. It is done as a set of measurements and signs read together, never as a single sign.

- **Weight,** against the recorded dry weight.
- **Blood pressure and pulse lying and standing,** with the postural fall in systolic pressure and the rise in pulse recorded as numbers.

- **The jugular venous pressure and the abdominojugular reflux**, as the cardiovascular chapter set out — the one bedside estimate of filling pressure that has a technique and a reliability.
- **The tissues.** Skin turgor over the sternum or the forearm, the mucous membranes, and the axilla — dry in the hypovolaemic — with the caution that all three are weak signs in adults and turgor is useless in the elderly. Capillary refill, standardised as the previous chapters described.
- **Oedema.** Pitting oedema at the ankles and shins, and over the sacrum in the bedbound, graded by depth and by how far up the leg it extends, and better measured than graded; periorbital oedema on waking, which is the oedema of the nephrotic syndrome; the anasarca of severe nephrosis; and the third spaces — pleural effusions at the bases, ascites, a pericardial effusion.
- **The lungs and heart.** Basal crackles, a pleural effusion, a third heart sound, a raised venous pressure — the set that makes pulmonary oedema; a pericardial rub.

The abdomen and pelvis

- **Inspection.** The loin scar of a nephrectomy; the curved iliac-fossa scar and the swelling beneath it of a transplant; a peritoneal dialysis catheter and its exit site; the distension of ascites or a full bladder; the striae of steroids.
- **The kidneys.** Palpated bimanually, one hand in the loin lifting forward and the other pressing down below the costal margin on inspiration; a normal kidney is not felt except its lower pole in the thin. An enlarged kidney is ballotable, moves down on inspiration, has a rounded lower pole, is resonant anteriorly because of overlying colon, and can be got above — the points that separate it from the spleen on the left and the liver on the right. Bilateral, irregular, enlarged kidneys are polycystic disease, with a polycystic liver beside them; a unilateral mass is a tumour, a hydronephrosis or a compensatory hypertrophy; a smooth bilateral enlargement is amyloid or infiltration. Tenderness is sought at the renal angle, by firm pressure and then by a gentle fist over the examiner's flat hand.
- **The transplant.** In the iliac fossa: its size, consistency and tenderness, and a bruit over it; the swollen, tender graft of rejection, obstruction or pyelonephritis.
- **The bladder.** A full bladder is a smooth, dull, rounded suprapubic mass that rises from the pelvis, cannot be got below, and disappears on catheterisation; percussion from the umbilicus downwards finds the upper border of dullness. The examination is followed by the bladder scan, because the evidence below shows palpation cannot judge volume.
- **Auscultation.** Over the epigastrium and both flanks with the diaphragm and light pressure, for a bruit that extends into diastole; over the femoral arteries; over the transplant.
- **The rectum, prostate and genitalia.** The prostate for size, consistency, nodules and asymmetry; anal tone and perianal sensation when a neurogenic bladder is in question; the scrotum for a varicocele that did not empty on lying down (a left renal vein obstruction), for hydrocele and for the testes; the urethral meatus; and in a woman the pelvic examination that finds the mass obstructing the ureters.

The dialysis access

The arteriovenous fistula is examined in a set sequence at every visit, and it is one of the best-evidenced examinations in this chapter. **Look** for aneurysmal dilatation, thinned or shiny skin, erythema, discharge, and the collateral veins and arm swelling of a central stenosis. **Feel** for a soft, continuous thrill along the whole length; a thrill that is pulsatile rather than continuous, or a fistula that is hard and pulsatile, means outflow stenosis. **Listen** for a low-pitched continuous bruit; a high-pitched, discontinuous bruit marks a stenosis. Then the two manoeuvres: the **arm elevation test** — a normal fistula collapses when the arm is raised above the heart, and one that stays distended has an outflow stenosis; and the **augmentation test** — the outflow vein occluded by the examiner's finger a few centimetres beyond the anastomosis, which in a healthy fistula makes the pulse below it swell, while a pulse that fails to augment means inflow stenosis. A graft is examined the same way, and a central catheter for its exit site, its cuff and the veins of the neck and chest.

The eye, the heart and the nerves

- **Fundi**, dilated, for hypertensive retinopathy — arteriolar narrowing, nipping, haemorrhages and exudates, papilloedema — and for diabetic retinopathy, which travels with diabetic nephropathy so closely that its absence questions the diagnosis; Roth spots in the dialysis patient with fever.
- **Heart and vessels**. Hypertension and its left ventricular heave; the pericardial rub of uraemic pericarditis, which is the finding that brings dialysis forward; the third sound and crackles of fluid; the peripheral pulses, the femoral bruits and the calcified, non-compressible arteries of the dialysis patient; the signs of high-output failure from a large fistula.
- **Nerves**. The glove-and-stocking neuropathy of uraemia, restless legs, the autonomic signs — postural hypotension without a rise in pulse — and the encephalopathy above; the tetany of hypocalcaemia after parathyroidectomy.

Completing the examination

Temperature; the urine looked at — its colour, its foam, which is protein, and the smoky or frank blood of haematuria — and dipsticked; the urine output measured rather than reported; a bladder scan; and the microscopy of the sediment, which is to the renal examination what the blood film is to the haematological one.

Putting the signs together

The renal examination sorts patients into a small number of patterns, and the pattern chooses between fluid and diuretic, catheter and scan, antibiotic and biopsy.

Pattern	The signs that make it
Hypovolaemia	Weight below dry weight; a postural fall in pressure and rise in pulse; a low venous pressure; dry axilla and mucous membranes and sunken eyes in the acutely ill; a low urine output — and none of the tissue signs relied on alone.
Volume overload	Weight above dry weight; raised venous pressure; basal crackles and effusions; pitting oedema and sacral oedema; a third heart sound; hypertension.

Pattern	The signs that make it
Nephrotic syndrome	Periorbital oedema on waking, dependent pitting oedema progressing to anasarca, ascites and effusions; frothy urine; a normal or low blood pressure; the xanthelasma of hyperlipidaemia.
Nephritic syndrome	Hypertension, oedema, oliguria and smoky haematuria together, with the rash, joint signs or pharyngitis of the cause.
Uraemia	Sallow pallor; fetor; scratch marks; asterixis and myoclonus; drowsiness; Kussmaul breathing; a pericardial rub; the half-and-half nails.
Urinary retention and obstruction	A dull suprapubic mass that rises from the pelvis; an enlarged or hard prostate; a palpable kidney; the bladder scan that confirms.
Pyelonephritis	Fever and rigors with renal angle tenderness, in a patient whose history carries the dysuria; a tender transplant in the recipient.
Renovascular hypertension	Severe or resistant hypertension with an epigastric or flank bruit that extends into diastole; asymmetric kidneys; the vascular disease elsewhere.
Polycystic kidney disease	Bilateral, irregular, ballotable kidneys, a polycystic liver, hypertension and the family history; the subarachnoid haemorrhage in the relative.
The failing fistula	A pulsatile rather than continuous thrill, a high-pitched bruit, a fistula that does not collapse on elevation (outflow stenosis) or a pulse that does not augment on occlusion (inflow stenosis); arm swelling and collaterals with a central stenosis.
Renal colic	A patient who cannot lie still, with loin-to-groin pain, renal angle tenderness, and a hydronephrosis on the bedside scan.

Part 2 — What the literature says

How well do examiners agree?

The renal examination's central judgement — is this patient wet or dry — is the one the literature has treated most harshly. When clinicians were asked to predict a patient's haemodynamics from the history and examination alone, they predicted the pulmonary wedge pressure correctly 30 per cent of the time and the cardiac output, vascular resistance and right atrial pressure about half the time [1]. The signs used to make that judgement are no better between examiners than within them: the classic four-point scale for pitting oedema lacks reliability and reproducibility, and a 2024 study that replaced it with a measured ruler reached an inter-observer correlation of 0.985 [2]; the pitting test itself varies in the pressure, the contact area and the duration examiners apply, and a high-frequency ultrasound study showed why the results do not repeat [3]. The systematic review of dehydration in older people found no single symptom, sign or bedside test — dry mouth, thirst, urine colour, heart rate, skin turgor — that could be relied on [4]. Against that, the examinations in this chapter that have a defined manoeuvre and a defined end-point do well: the fistula examination agreed with angiography at kappa 0.78 for outflow stenosis and 0.55 for inflow [5], and the newer ultrasound assessments of venous congestion reproduce between observers at kappa 0.71 and an intraclass correlation of 0.83 [6].

Sign	Agreement	Comment
Clinical estimate of filling pressure	30 per cent correct	Wedge pressure from history and examination; cardiac output and right atrial pressure about 50 per cent [1]
Pitting oedema, 1 – 4 scale	unreliable	Replaced by a measured ruler at ICC 0.985; a modified grade at 0.883 [2]
Skin turgor, mucous membranes, thirst, urine colour	not useful	No stand-alone sign or test identified dehydration in older people [4]
Fistula examination against angiography	κ 0.78 outflow, 0.55 inflow	142 consecutive referrals, examination sealed before the angiogram [5]
Venous excess ultrasound score	κ 0.71, ICC 0.83	Multi-site 2024 reliability study; better with an ECG trace on the images [6]
Inferior vena cava collapse on ultrasound	κ 0.64	Prior studies summarised in a paediatric dehydration cohort [7]
Hypertensive retinopathy by ophthalmoscopy	unreliable in mild disease	The 1989 Lancet study that questioned routine ophthalmoscopy in mild to moderate hypertension [8]

How accurate are the signs? The Rational Clinical Examination series and after

Question	Finding	Likelihood ratio or accuracy	Source
Is this patient hypovolaemic (vomiting, diarrhoea, poor intake)?	Dry axilla · dry mucous membranes · sunken eyes	LR+ 2.8 (LR– 0.6) · LR+ 2.0 (LR– 0.3) · LR+ 3.4 (LR– 0.5); capillary refill and skin turgor of no proven value in adults	McGee 1999 [9]
	Postural pulse rise > 30/min or severe postural dizziness	Sensitivity 97 per cent for a large blood loss, 22 per cent for a moderate one; supine tachycardia sensitivity 12 per cent	
Is this child dehydrated (5 per cent)?	Prolonged capillary refill · abnormal skin turgor · abnormal breathing	LR 4.1 · 2.5 · 2.0	Steiner 2004 [10]
Is this older person dehydrated?	Any single sign or bedside test	None consistently useful	Hooper 2015, Cochrane [4]
Is this hypertension renovascular?	Systolic–diastolic abdominal bruit · any abdominal bruit	LR+ 39 (present in 39 per cent of renovascular and 1 per cent of essential hypertension) · LR+ 5.6; a mid-systolic bruit is heard in 5 – 25 per cent of normal people	Turnbull 1995 [11]
Does this woman have an uncomplicated urinary infection?	Costovertebral angle tenderness	LR+ 1.7; the history (dysuria, frequency, no discharge) carries the diagnosis	Bent 2002 [12]
Is this febrile patient's flank tenderness	Costovertebral angle tenderness	Sensitivity 48 per cent, specificity 90 per cent, LR+	Emergency-department series

Question	Finding	Likelihood ratio or accuracy	Source
pyelonephritis?		4.8	2021 [13]
Is the bladder full?	Palpation with suprapubic percussion, for 400 – 600 mL	Sensitivity 81 per cent, specificity 50 per cent, accuracy 55 per cent; cannot estimate volume	Arch Phys Med Rehabil 2002 [14]
	Bladder ultrasound or scanner	Within about 10 – 15 per cent of the catheterised volume when done correctly	Device validations [15, 16]
Is this a hydronephrosis?	Point-of-care ultrasound by emergency physicians	Pooled sensitivity 70 – 82 per cent, specificity 74 – 75 per cent; specificity 94 per cent for moderate or greater hydronephrosis	Wong 2018 [17]; later series [18]
Is this prostate cancer?	Digital rectal examination in primary care	Sensitivity 51 per cent, specificity 59 per cent; very low-quality evidence; not recommended as a screen	Naji 2018 [19]
Is the prostate enlarged?	Digital rectal examination	Positive predictive value 94 per cent for a gland above 30 mL; under-estimates large glands and over-estimates small	Comparative study 2011 [20]
Is this fistula stenosed?	Physical examination — thrill, bruit, elevation and augmentation	Outflow stenosis: sensitivity 92, specificity 86 per cent; inflow: 85 and 71 per cent	Campos 2008 [21]; Asif 2007 [5]
Does this uraemic patient have pericarditis?	Pericardial friction rub	Present at some point in 35 – 85 per cent; transient	Reviews [22]
Is this uraemia?	Uraemic frost	Prevalence 0.8 – 3 per cent in dialysis populations — a sign of the textbooks	Reviews [23]

Three things stand out. **The examination for hypovolaemia in adults barely works:** the best of the tissue signs has a likelihood ratio of three, the postural signs detect only severe blood loss, and in the elderly nothing at the bedside distinguishes the dry from the wet — which is why the weight and the venous pressure carry the decision. **The bladder and the kidney have been handed to the probe:** palpation finds a full bladder four times in five but cannot say how full, and the scanner can. And **the two examinations in this chapter that were built with a manoeuvre and an end-point — the bruit that extends into diastole and the fistula examination — are among the most accurate in the whole series,** with likelihood ratios in the thirties and sensitivities in the nineties.

The examiner is the limiting reagent

The 30 per cent figure for the wedge pressure has been quoted for forty years because nothing has overturned it [1]; a 2023 blood-volume study in heart failure found clinical assessment inaccurate at detecting both hypervolaemia and anaemia [24], and the reliability of the fistula examination in the

hands of a renal fellow, compared with an experienced interventionalist, is the subject of a paper because it could not be assumed [25]. The dialysis unit is where this matters most, and there the trials have been sobering in the other direction too: when bioimpedance was randomised against careful clinical assessment for setting the dry weight in 132 patients, the device did not improve cardiac outcomes and increased hypovolaemic episodes [26]; when lung ultrasound guided dry-weight reduction in the LUST trial, B-lines fell from 15 to 9 in the intervention arm while rising from 16 to 30 in the controls, and the primary composite outcome did not differ (hazard ratio 0.88), although intradialytic hypotension fell by a third [27]. The examination is unreliable, and the instruments have not yet shown that replacing it changes what happens to the patient.

Technique changes the answer

- **Weigh the patient** on the same scales, and read the volume examination against the weight; it is the one measurement here that reproduces.
- **Measure the postural change** in systolic pressure and pulse rather than asking whether the patient is dizzy; and know that a normal result excludes only large blood loss [9].
- **Use the venous pressure and the reflux**, not turgor, in the adult, and nothing at all from the skin in the elderly [4, 9].
- **Measure oedema** — a ruler at a marked site, the same pressure and duration each day — rather than grading it [2, 3].
- **Scan the bladder** after palpating it; the hand detects, the scanner measures [14, 15].
- **Listen for the bruit with the diaphragm and light pressure, and note whether it continues into diastole**; only the systolic–diastolic bruit is close to diagnostic [11].
- **Examine the fistula in the same order every time** — look, thrill, bruit, elevation, augmentation — and record each; done that way it agrees with the angiogram [5, 21].
- **Elicit renal angle tenderness gently** and interpret it with the fever and the history; alone it is a weak sign for cystitis and a specific one for pyelonephritis [12, 13].

What has changed, 2020 – 2026

The volume examination has been instrumented, and the instruments disagree with each other.

Lung ultrasound counts B-lines that the stethoscope cannot hear; bioimpedance estimates the extracellular water; the inferior vena cava and the internal jugular vein are measured for size and collapse; and since 2020 the venous excess ultrasound score has graded congestion in the hepatic, portal and renal veins. Each has been validated against something — B-lines against weight and outcomes, bioimpedance against isotope dilution, the cava against fluid responsiveness (pooled sensitivity 71 per cent and specificity 81 per cent in spontaneously breathing patients), the venous score against acute kidney injury after cardiac surgery — and a 2023 diagnostic study in hospitalised dialysis patients found that 61 per cent of those judged normally hydrated by bioimpedance had moderate or severe congestion on lung ultrasound, because the two measure different compartments [6, 28, 29, 30, 31]. A 2025 systematic review of lung ultrasound in dialysis and a 2024 review of demystifying volume status both conclude that no single instrument replaces the

integrated assessment, and that the assessment is now built from the weight, the venous pressure, the lungs and the probe together [32, 33].

The outcome trials have not caught up with the measurements. The LUST trial in 2021 and the bioimpedance trials before and after it moved the numbers without moving the primary outcomes, and the 2023 meta-analysis of bioimpedance-guided fluid management found no clear prognostic benefit [26, 27, 34]. The venous excess score's reliability was established in 2024 and its ability to track fluid removal during dialysis shown the same year and again in 2025, but its effect on decisions is still being tested [6, 35, 36].

The bladder and the kidney are scanned at the bedside. Handheld and three-dimensional ultrasound devices measure bladder volume to within a tenth of the catheterised volume, with the three-dimensional device halving the error of two-dimensional estimation in a 2025 comparison [16, 37]; point-of-care ultrasound for hydronephrosis by emergency physicians has settled at a sensitivity around three-quarters and a specificity above 90 per cent for anything more than mild [17, 18]; and a wearable ultrasound bladder monitor has been described [38]. **The prostate examination has been retired as a screen:** the 2018 primary-care meta-analysis found it too insensitive and too non-specific to recommend, and the guidelines that followed agreed [19].

The fistula examination has been kept and taught. A pulse-and-thrill scoring system now quantifies outflow stenosis [39]; Doppler criteria have been standardised against it [40]; and a recording system for the thrill and bruit is being developed to make the finding transferable [41]. It is one of the few examinations in this series that the imaging literature has confirmed rather than replaced.

Part 3 — Practical synthesis for teaching

- Teach the renal examination as five examinations — volume, uraemia, abdomen and pelvis, access, and the organs kidney disease damages — and start it at the weight chart, not the bed.
- Teach that the volume examination is the weakest judgement in medicine and must be built from measurements: the weight, the standing blood pressure, the venous pressure, a measured oedema — and then the probe on the lungs, the cava and the veins, read as a set and not one at a time.
- Retire skin turgor in the adult and every tissue sign in the elderly; keep the dry axilla and the sunken eyes as weak supporting evidence in the acutely ill.
- Teach the bladder as detect-then-scan and the kidney as palpate-then-scan; the hand finds the mass and the probe measures it.
- Teach the two examinations that work — the systolic–diastolic bruit and the fistula sequence — with their numbers, and insist on the sequence.
- Teach the dialysis unit's lesson honestly: the examination is unreliable, the instruments disagree, and the trials that replaced clinical judgement with a device did not make patients better. The remedy is a trained examiner with the instruments, not an instrument without one.

- Put the urine under the microscope. It is the extension of the examination, as the film is in haematology, and the student who looks at the sediment has examined the kidney.

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Caveats

The 30 per cent figure for the wedge pressure is taken from the 2013 Kidney International review, which summarises an older study; the primary paper was not retrieved. The costovertebral-angle figures for pyelonephritis come from a conference abstract. The prevalence of uraemic frost is cited from a secondary source. The bladder-scanner accuracy is a range across device validations rather

than a pooled figure. Where a reference is given by title and address only, the search results did not return an author list; check before distribution.