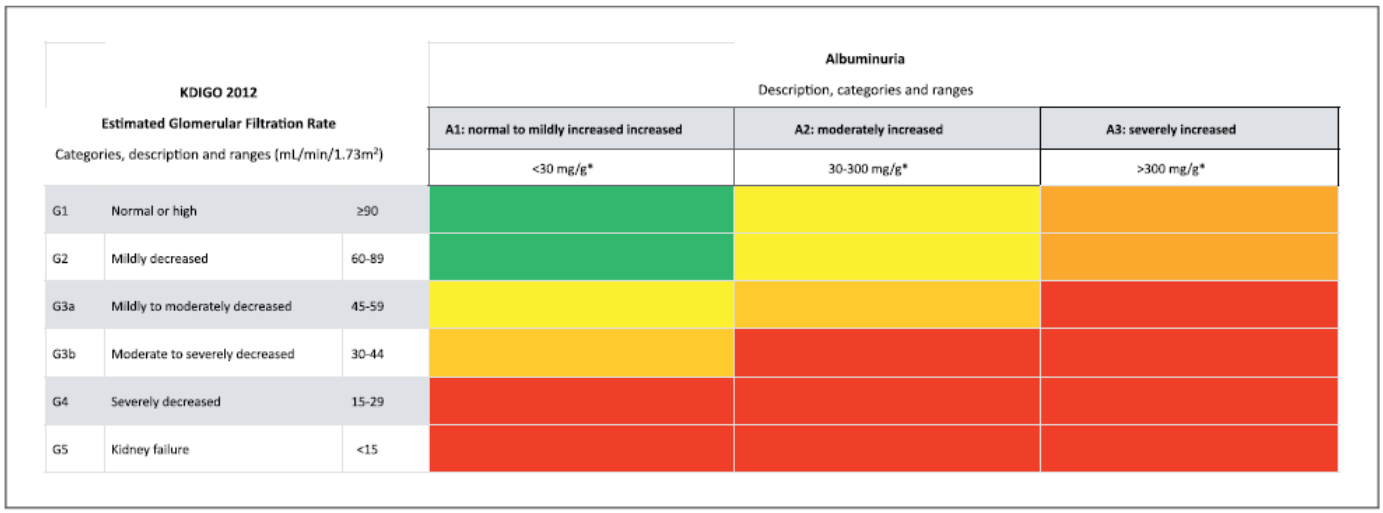
Enfoques prácticos para el manejo de la enfermedad cardiorrenal

Contenido



KDIGO 2012 Estimated Glomerular Filtration Rate Categories, description and ranges (mL/min/1.73m²)			Albuminuria Description, categories and ranges		
			A1: normal to mildly increased increased	A2: moderately increased	A3: severely increased
			<30 mg/g*	30-300 mg/g*	>300 mg/g*
G1	Normal or high	≥90			
G2	Mildly decreased	60-89			
G3a	Mildly to moderately decreased	45-59			
G3b	Moderate to severely decreased	30-44			
G4	Severely decreased	15-29			
G5	Kidney failure	<15			

Fig. 1. Prognosis of CKD according to the categories of glomerular filtration and albuminuria. Risk categories of CKD according to 2012 KDIGO classification. Patients are categorized into each risk category based on eGFR value and severity of albuminuria. Green: low risk; yellow: moderately increased risk; orange: high risk; red, very high risk. KDIGO, Kidney Disease: Outcomes Quality Initiative; eGFR, estimated glomerular filtration rate. *Albuminuria is expressed as albumin/creatinine ratio mg/g in urine.

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Tratamiento IC-FEr ajustado a FG.

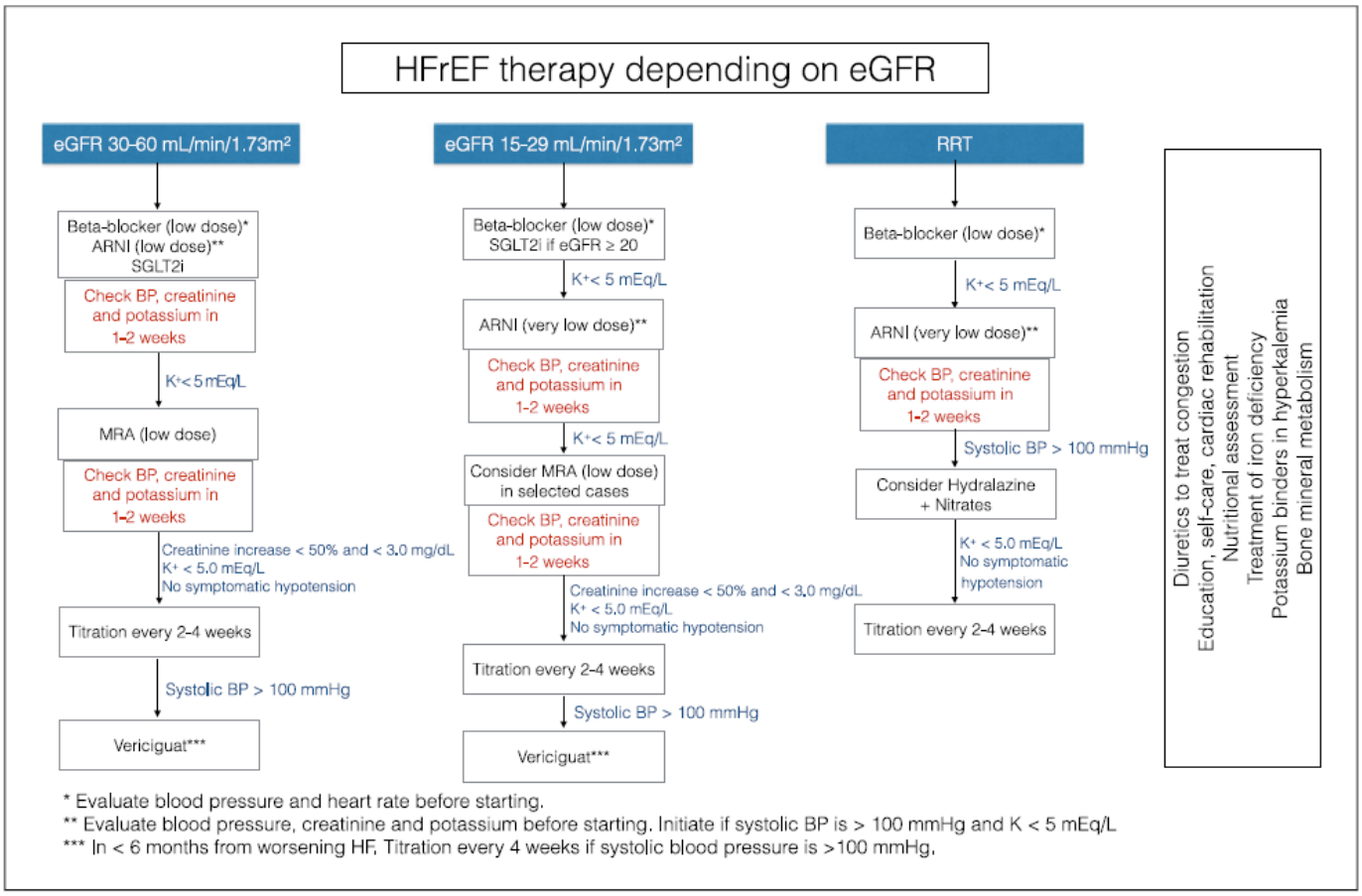

Fig. 2. HFrEF therapy proposed approach, depending on glomerular filtration rate. ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; ARNi, angiotensin receptor-neprilysin inhibitor; BP, blood pressure; eGFR, estimated glomerular filtration rate; HFrEF, heart failure with reduced ejection fraction; K^+, serum potassium; MRA, mineralocorticoid-receptor antagonist; RRT, renal replacement therapy; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

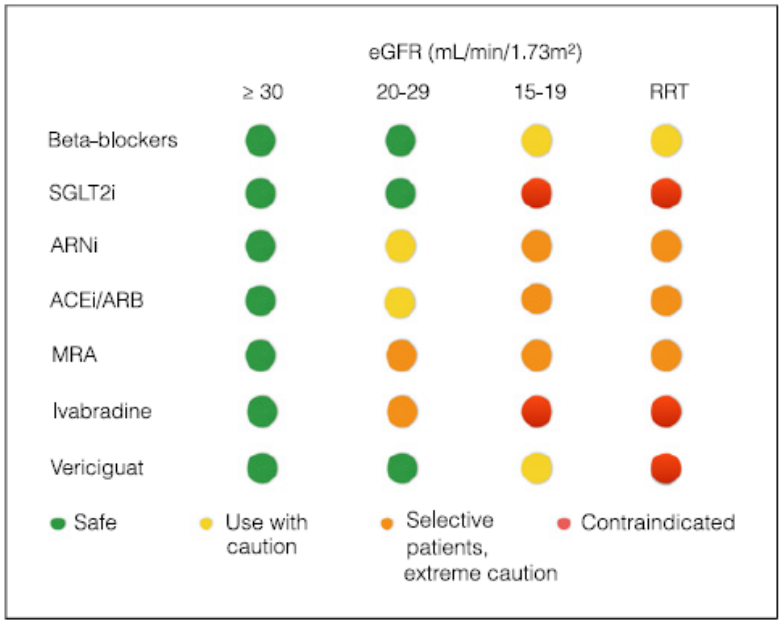

Fig. 3. Pharmacological treatment of heart failure in CKD. ACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin II receptor blocker; ARNi, angiotensin receptor-neprilysin inhibitor; eGFR, estimated glomerular filtration rate; MRA, mineralocorticoid-receptor antagonist; RRT, renal replacement therapy; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

Abordaje de la anemia en enfermedad cardiorrenal.

Table 1. Evaluation of anemia in patients with cardiorenal disease

Initial tests for diagnosis
- Complete blood count (including red cell indices, reticulocyte count, and evaluation of the peripheral blood smear)
- Iron studies: transferrin saturation and serum ferritin (testing soluble transferrin receptor may be appropriate when there is a strong suspicion of iron deficiency because it is not affected by inflammation)
- Kidney function: creatinine and glomerular filtration rate
- Assess for inflammation: C-reactive protein and erythrocyte sedimentation rate
- Serum levels of vitamin B12 and folate
- When hemolysis is suspected: unconjugated bilirubin and LDH (both increased) and haptoglobin (decreased)

Additional evaluations
Patients with iron deficiency should be evaluated for the source of the deficiency
- Dietary history
- Menstrual history in females
- History of gastrointestinal symptoms and gastrointestinal blood loss
- Use of NSAIDs or anticoagulants
- Testing the stool for occult blood in adults 50 years of age or older
- Endoscopies for possible occult gastrointestinal blood loss are indicated for adults of all ages for whom a source of bleeding would be treated

In case of vitamin B12 deficiency, testing for autoantibodies to intrinsic factor is used to identify pernicious anemia

Bone marrow examination for possible myelodysplastic syndrome

Iron deficiency treatment with ferric carboxymaltose

Weight <70 kg		Weight ≥70 kg	
Day 1	Week 6	Day 1	Week 6
Hb < 10 g/dL: 1g	500 mg	Hb < 10 g/dL: 1g	1 g
Hb 10–14 g/dL: 1g	No dose	Hb 10–14 g/dL: 1g	500 mg
Hb 14–15 g/dL: 500 mg	No dose	Hb 14–15 g/dL: 500 mg	No dose

Iron deficiency treatment with iron sucrose
200 mg/per week
Based on Ganzoni formula: total iron dose (mg iron) = body weight (kg) × (target actual Hb) (g/dL) × 2.4 + iron for iron stores (mg iron)

Folate deficiency
Oral folic acid (1–5 mg daily) for one to 4 months or until there is laboratory evidence of hematologic recovery. For those with a chronic cause of folate deficiency, such as chronic hemolytic anemia, therapy may be given indefinitely

Vitamin B12 deficiency
The recommended dose is 1,000 µg intramuscular weekly until the deficiency is corrected and then monthly (cyanocobalamin) or once every other month (hydroxocobalamin). In patients with normal absorption, oral dosing is equally effective as IM dosing when given at 1000 µg orally once daily. Some medications can interfere with vitamin B12 absorption (e.g., metformin and proton pump inhibitors), and its withdrawal must be considered

Erythropoiesis-stimulating agents
ESA (epoetin or darbepoetin, administered subcutaneously) are indicated in patients with CKD with Hb < 10 g/dL and transferrin saturation >20% and ferritin >200 ng/mL. If there is iron deficiency, iron must be administered before giving an ESA, and if the response to iron supplementation is adequate, ESA are not indicated
Doses
The lowest and most effective ESA doses are recommended: the initial dose for epoetin is approximately 50–100 units/kg/week. Darbepoetin is initiated with doses of 40-100 µg every two to 4 weeks. Higher doses have been associated with increased mortality and cardiovascular events independent of Hb level
Target Hb level
The optimal target Hb level is not well-defined
Hb levels between 10 and 11.5 g/dL are usually recommended
Hb levels ≥13 g/dL are associated with adverse outcomes

Quelantes del potasio

	Calcium polystyrene sulfonate	Sodium zirconium cyclosilicate	Patiromer
Mechanism of action	Nonselective calcium-based ion exchange resins	Non-absorbed, non-polymer inorganic powder that captures K^+ in exchange for H^+ and Na^+ in the GI tract	Non-absorbed, cation exchange polymer that binds K^+ in the lumen of the GI tract
Posology	15 g/3–4 per day	Starting: 10 g/day Maintaining: 5–10 g/day	Starting: 8.4 g/day Maintaining: 8.4–16.8 g/day
Place of action	Colon	Intestine	Colon distal
Start of drug action	1–2 h	1 h	4–7 h
4-week effectivity	–	−0.8 a −1.2 mEq/L	−1.01 mEq/L
Drug interactions	Antacids, laxatives, digitalis, sorbitol, lithium, thyroxine	Separate 2-h medication with gastric pH-dependent bioavailability	Separate 3 h from other medication
Adverse effects	GI disorders Hypokalemia Hypercalcemia Intestinal necrosis	Hypokalaemia Edema GI disorders	GI disorders Hypomagnesemia

Tratamientos antidiabéticos en ECR

Table 4. Dose adjustment of antidiabetic treatments according to estimated glomerular filtration rate

Drug	Comments
Biguanides	
Metformin	Dose adjustment is required when eGFR is between 30 and 60 mL/min/1.73 m^2 Not indicated when eGFR <30 mL/min/1.73 m^2
SGLT2i	
Dapagliflozin	Lose antidiabetic effectivity when eGFR is <45 mL/min/1.73 m^2 Not indicated when eGFR <25 mL/min/1.73 m^2
Empagliflozin	25 mg presentation is not recommended when eGFR is 30–60 mL/min/1.73 m^2 10 mg presentation can be used safely in patients with eGFR ≥20 mL/min/1.73 m^2 Not indicated when eGFR <20 mL/min/1.73 m^2
Canagliflozin	300 mg presentation is not recommended when eGFR is 30–60 mL/min/1.73 m^2 100 mg presentation can be used safely with eGFR >15 mL/min/1.73 m^2 Not indicated with renal replacement therapy
DPP4i	
Linagliptin	No dosage adjustment is required
Sitagliptin	Dose adjustment required with eGFR <45 mL/min/1.73 m^2 eGFR 30–45 mL/min/1.73 m^2: 50 mg per day eGFR <30 mL/min/1.73 m^2: 25 mg per day
Vildagliptin	Dose adjustment required with eGFR <50 mL/min/1.73 m^2 (50 mg per day)
Alogliptin	Dose adjustment required with eGFR <50 mL/min/1.73 m^2 eGFR 30–50 mL/min/1.73 m^2: 12.5 mg per day eGFR <30 mL/min/1.73 m^2: 6.25 mg per day
Saxagliptin	Dose adjustment required with eGFR <45 mL/min/1.73 m^2 (2.5 mg per day) Not indicated with renal replacement therapy
GLP1-RA	
Liraglutide (subcutaneous)	No dosage adjustment Limited data for severe CKD
Semaglutide (subcutaneous and oral)	No dosage adjustment Limited data for severe CKD
Dulaglutide (subcutaneous)	No dosage adjustment Use with eGFR >15 mL/min/1.73 m^2
Exenatide (subcutaneous)	Use with eGFR >30 mL/min/1.73 m^2
Lixisenatide (subcutaneous)	No dosage adjustment, Limited data for severe CKD, Not recommended with eGFR <15 mL/min/1.73 m^2
Tirzepatide* (subcutaneous)	No dosage adjustment Limited data for severe CKD
Insulin	No dosage adjustment is required

Tratamiento hipolipemiante en ECR

Table 5. Dose adjustment of lipid-lowering pharmacologic agents according to estimated glomerular filtration rate

Drug	Dose	Comments
Statins		
Fluvastatin	80 mg once daily	For patients with eGFR between G3a and G5, those on dialysis, or individuals who have undergone a kidney transplant, recommended doses are based on regimens that have demonstrated benefits in clinical trials conducted specifically within this patient population
Atorvastatin	20 mg once daily	
Rosuvastatin	10 mg once daily	
Simvastatin/Ezetimibe	20/10 mg once daily	
Pravastatin	40 mg once daily	
Simvastatin	40 mg once daily	
Pitavastatin	2 mg once daily	
Alirocumab (subcutaneous)	75/150 mg every 2 weeks or 300 mg SC monthly	No dose adjustment is required Limited data in patients with eGFR <30 mL/min/1.73 m^2. No indication on RRT or kidney-transplant recipients
Evolocumab (subcutaneous)	140 mg every 2 weeks or 420 mg SC monthly	No dose adjustment required in patients with advanced CKD or RRT.
Bempedoic acid	180 mg once daily PO	No dose adjustment required Limited data in patients with eGFR <30 mL/min/1.73 m^2 or RRT
Inclisiran (subcutaneous)	284 mg basal and at 3 months. Every 6 months afterward	No dose adjustment required Limited data in patients with eGFR <15 mL/min/1.73 m^2 or RRT.

Tratamiento NACO según FG

eGFR ml/min/1.73m^2	Dabigatran	Apixaban	Rivaroxaban	Edoxaban
>50	150 mg twice daily	5 mg twice daily	20 mg once daily	60 mg once daily
30-49	110 mg twice daily	5 mg twice daily	15 mg once daily	30 mg once daily
15-29	Not recommended	2.5 mg twice daily Or if ≥2 of the following: -Cr ≥1.5 mg/dL -Age ≥80 years - Body weight ≤60 kg	15 mg once daily	30 mg once daily Or if ≥1 of the following: - Body weight ≤60 kg - Verapamil/Dronedarone or Quinidine
<15	Not recommended	Not recommended	Not recommended	Not recommended

Fig. 4. Dose adjustment of direct oral anticoagulants according to estimated glomerular filtration rate in atrial fibrillation. eGFR, estimated glomerular filtration rate; Cr, creatinine.

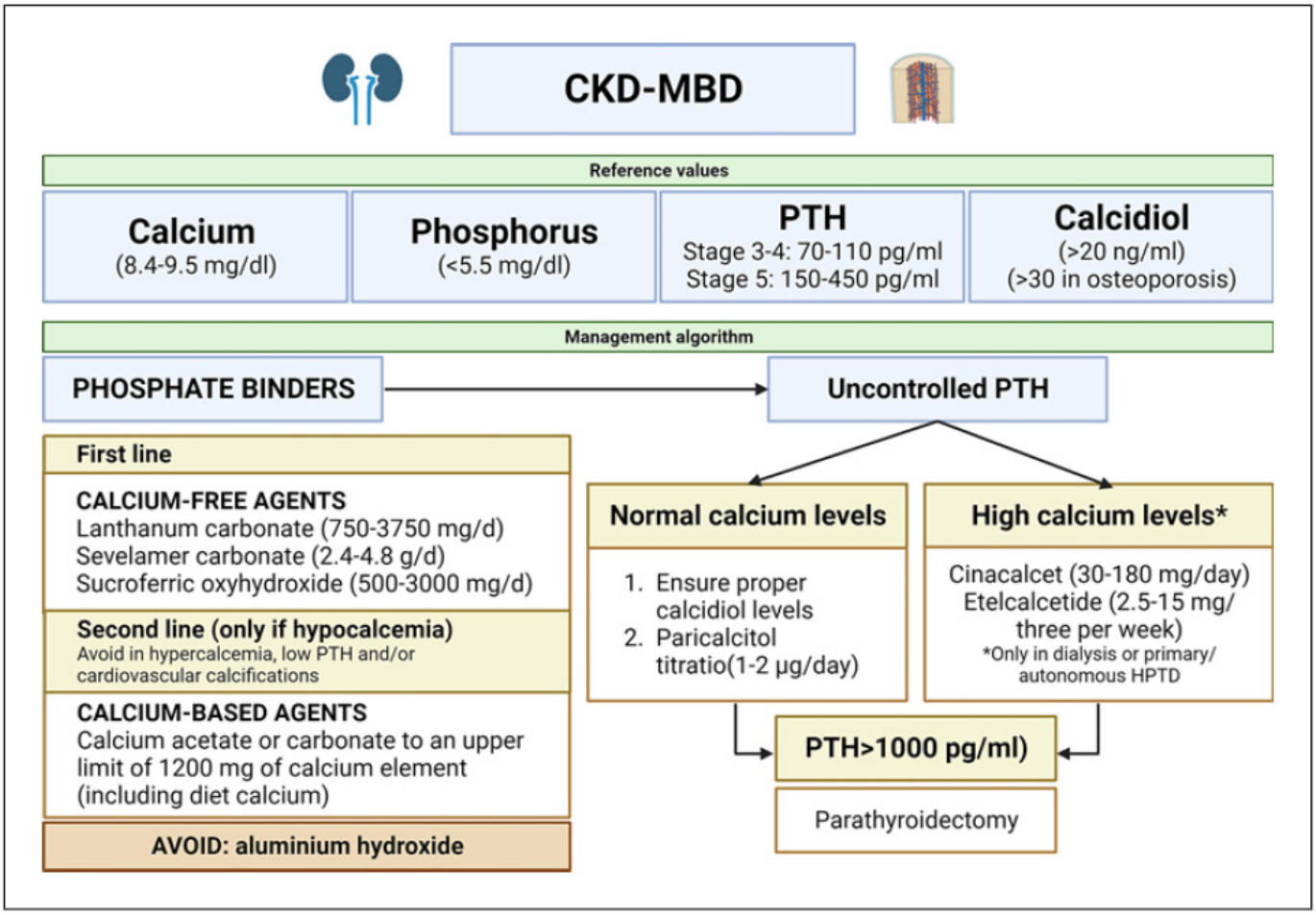

Fig. 5. Proposed algorithm for the management of chronic kidney disease-mineral and bone disorder (CKD-MBD). Created by "BioRender." All these considerations are opinion-based by several clinical guidelines. No level 1 grade evidence (suggestions). CKD-MBD, chronic kidney disease-mineral and bone disorder; PTH, parathormone; HPTD, hyperparathyroidism.