www.nefrologialatinoamericana.com
ISSN: 2444-9032
Indexed in: DOAJ, Latindex (Directorio), MIAR, BIBLAT, SciELO México

Nefrología Latinoamericana

Volume 23 • Number 2 • May-August 2026

PERMANYER
www.permanyer.com

SLANH
SOCIEDAD LATINOAMERICANA DE NEFROLOGÍA E HIPERTENSIÓN
SOCIEDADE LATINOAMERICANA DE NEFROLOGIA E HIPERTENSÃO

11913BLAT262

PERMANYER

EDITORIAL

The WHO Kidney health resolution and the First Officially Recognized World Kidney Day: an equity agenda with Latin American roots

La Resolución de Salud Renal de la OMS y el primer Día Mundial del Riñón oficialmente reconocido: una agenda de equidad con raíces latinoamericanas

Randall Lou-Meda[1,2] *and Vicente Sánchez-Polo*[3,4]*

[1]*Programa de Salud Renal, Ministerio de Salud Pública y Asistencia Social, Guatemala, Guatemala;* [2]*Guatemalan Foundation for Children with Kidney Diseases, FUNDANIER, Guatemala, Guatemala;* [3]*Nephrology Program, San Carlos University Medical School, Guatemala, Guatemala;* [4]*Latin-American Society of Nephrology (SLANH), Panamá, Panamá*

A resolution of the World Health Organization (WHO) is an agreement adopted by the World Health Assembly (WHA), composed of the ministers of health of Member States. These resolutions are not merely symbolic statements: they establish political mandates at the highest level, set technical priorities, mobilize resources, and generate accountability commitments. Throughout history, some resolutions have represented true turning points. The resolution that led to the eradication of smallpox[1] transformed global public health, demonstrating that collective action can overcome seemingly insurmountable challenges. Similarly, resolutions on universal immunization[2] laid the foundation for expanded vaccination programs that now save millions of children's lives each year.

In 2025, the adoption of the Resolution on Kidney Health by the WHO marks a comparable milestone for the nephrology community. For the first time, Kidney Health occupies an explicit place on the global agenda of noncommunicable diseases (NCDs), with a clear mandate to strengthen prevention, early identification, comprehensive treatment, and equitable access to kidney replacement therapies (KRT), including transplantation.[3] This global achievement has deep Latin American roots. The Resolution on Kidney Health is the result of a deliberative, technical, and political process in which Latin America has demonstrated voice, leadership, and vision. For decades, the region has witnessed the growing burden of chronic kidney disease (CKD), but it has also been a source of innovative responses through clinical practice, research, public policy development, and multilateral cooperation[4].

CKD is one of the fastest-growing NCDs worldwide and represents a disproportionate burden for developing countries. Gaps in access to early diagnosis, nephroprotective drugs, dialysis, and transplantation remain profound in Latin America[5]. The WHO Resolution provides a strategic framework to address these inequities. By explicitly recognizing the need to integrate Kidney Health into national NCD plans, strengthen primary care, improve health information systems, and promote equitable access to cost-effective therapies such as kidney transplantation, it establishes concrete tools to transform health systems[3].

Our *Sociedad Latinoamericana de Nefrología e Hipertensión* (SLANH) has played a key coordinating role in advancing the principles of the Resolution, fostering technical and political dialogue around Kidney Health as a

***Correspondence:**
Vicente Sánchez-Polo
E-mail: visanpolo@gmail.com

Date of reception: 17-02-2026
Date of acceptance: 19-02-2026
DOI: 10.24875/NEFRO.M26000076
Available online: 09-03-2026
Nefro Latinoam. 2026;23(2):47-48
www.nefrologialatinoamericana.com

How to cite: Lou-Meda R, Sánchez-Polo V. The WHO Kidney health resolution and the First Officially Recognized World Kidney Day: an equity agenda with Latin American roots. Nefro Latinoam. 2026;23(2):47-48. doi: 10.24875/NEFRO.M26000076

regional priority. The SLANH Congress Guayaquil 2025 consolidated this effort by promoting the development of a Kidney Health Strategy-Action Plan, designed to engage with *Organización Panamericana de la Salud* (OPS) and align the regional agenda with the global process. This commitment was also reflected in active participation at the High-Level Meeting of Ministers of Health of the *Sistema de Integración Centroamericana* (SICA/COMISCA), held in November 2025 in Antigua Guatemala, where the integration of kidney transplantation into the comprehensive management of CKD was promoted and the need to strengthen registries, regulatory frameworks, and regional cooperation was reaffirmed. Likewise, Member States of the Ibero-American Network/Council on Donation and Transplantation proposed expanding and aligning the 2019-2030 regional strategy with the new WHO Resolution, incorporating Kidney Health as an integrated and sustainable axis.

In this historic context, the recent Resolution adopted by the OMS on Kidney Health not only positions kidney disease as a priority on the global public health agenda, but also officially recognizes World Kidney Day, granting it political and institutional endorsement that amplifies its scope and impact. Official recognition of World Kidney Day by the OMS transforms an awareness campaign into an institutional platform supported by the multilateral system, enabling dialogue with ministries of health, parliaments, and funding agencies. In Latin America, where social and health inequities continue to shape access to treatment, this new legitimacy must be leveraged by the nephrology community to increase public awareness, strengthen political commitment, and promote global solidarity around Kidney Health.

The adoption of the Resolution on Kidney Health is not the endpoint, but the beginning of a new phase. It is now incumbent upon the kidney care community to use the officially recognized World Kidney Day as a catalyst for public policy, intersectoral dialogue, and social mobilization in favor of Kidney Health. We call upon the SLANH community to deepen its commitment to ongoing multilateral efforts, including kidney health promotion, joint procurement mechanisms, strengthening of registries, and regional technical cooperation, and to translate the principles of the Resolution into concrete actions that reduce inequities and expand access to quality services.

SLANH's vision of providing optimal care to all people in Latin America requires that this historic moment translate into tangible outcomes: effective prevention, early identification, timely treatment, and equitable access to kidney transplantation. Today more than ever, Kidney Health is a global priority with Latin American roots. History offers us a unique opportunity. It is up to us to transform it into lasting change – because we are all SLANH!

References

1. World Health Organization. The global eradication of smallpox: final report of the Global Commission for the Certification of Smallpox Eradication, Geneva, December 1979. Geneva: World Health Organization; 1980. Available at: https://iris.who.int/handle/10665/39253
2. World Health Organization. Expanded Programme on Immunization. Weekly Epidemiol Rec. 1984;59(14):101-104. Available at: https://iris.who.int/handle/10665/224900
3. World Health Organization. Reducing the burden of noncommunicable diseases through promotion of kidney health and strengthening prevention and control of kidney disease. Geneva: World Health Organization; 2025 May 27. Available at: https://apps.who.int/gb/ebwha/pdf_files/WHA78/A78_R6-en.pdf
4. Lou-Meda R, Depine SA, Burgos-Calderón R, Luyckx VA. From the field to the assembly hall: the history of the kidney health resolution. Kidney Int. 2025;108(6):962-968. doi: 10.1016/j.kint.2025.08.023
5. GBD 2023 Chronic Kidney Disease Collaborators. Global, regional, and national burden of chronic kidney disease in adults, 1990-2023, and its attributable risk factors: a systematic analysis for the Global Burden of Disease Study 2023. Lancet. 2025;406(10518):2461-2482. doi: 10.1016/S0140-6736(25)01853-7

PERMANYER

ORIGINAL ARTICLE

Use of rituximab and mycophenolate in cortic-dependent nephrotic syndrome in pediatrics

Uso de rituximab y micofenolato en el sindrome nefrotico cortico dependiente en pediatría

Miguel Liern, Ana Caturia, and Maia Loretti*

Servicio de Nefrología, Hospital General de Niños Ricardo Gutierrez, Buenos Aires, Argentina

Abstract

Introduction: *Idiopathic nephrotic syndrome (INS) in children may present frequent relapses or steroid dependence, with a risk of corticosteroid toxicity. In this context, rituximab (RTX) and mycophenolate mofetil (MMF) were used as alternative therapeutic options.* **Materials and methods:** *A prospective observational cohort study was conducted in a pediatric nephrology unit in the Autonomous City of Buenos Aires, including 12 patients with steroid-dependent nephrotic syndrome (SDNS) who received sequential treatment with RTX and MMF.* **Results:** *Of the 12 patients treated with RTX, 4 achieved sustained remission. The remaining 8 had fewer than 2 relapses per year but required potentially toxic steroid doses; therefore, after a mean period of 13 months post-RTX, MMF was added. All patients remained in remission until the end of the study. The cumulative steroid dose (CSD) pre-RTX was 5335 mg/m^2 and post-RTX was 2024 mg/m^2 (p = 0.001). Finally, the mean CSD with MMF was 1378 mg/m^2 (Wilcoxon test: T = 3.5, p = 0.005). In the 10 patients who experienced at least one relapse, the mean CD20 lymphocyte count one month after RTX was 3.7 cells/mm^3, and at relapse it was 26 cells/mm^3 (CD20–proteinuria correlation coefficient: 0.54). Observed adverse effects were minimal and reversible.* **Conclusion:** *Sequential therapy with RTX and MMF may be an option for patients with primary steroid-dependent nephrotic syndrome.*

Keywords: *Mycophenolate mofetil. Steroid dependent nephrotic síndrome. Rituximab.*

Resumen

Introducción: *El síndrome nefrótico idiopático (SNI) en niños puede presentar recaídas frecuentes o dependencia a esteroides, con riesgo de toxicidad por corticosteroides. En este contexto, se utilizó rituximab (RTX) y micofenolato mofetil (MMF) como alternativas terapéuticas.* **Material y métodos:** *Se realizó un estudio observacional de cohortes prospectivo en una unidad de nefrología pediátrica de la ciudad Autónoma de Buenos aires, sobre 12 pacientes con síndrome nefrótico cortico dependiente (SNCD), quienes recibieron tratamiento secuencial con RTX y MMF.* **Resultados:** *De los 12 pacientes tratados con RTX, 4 remitieron permanentemente, los 8 restantes mantuvieron menos de 2 recaídas anuales, pero con dosis esteroides potencialmente toxicas, por lo cual, luego de un tiempo medio de 13 meses post-RTX, agregamos el MMF, permaneciendo todos en remisión hasta finalizar el estudio. La dosis acumulativa corticoide (DAC) pre-RTX fue de 5335 mg/m2 y post RTX de 2024 mg/m2 (p 0,001). Finalmente, la DAC media con MMF fue de 1378 mg/m2 (test de Wilcoxon: T: 3,5, p 0,005). En los 10 pacientes que presentaron por lo menos 1 recaída el recuento promedio de linfocitos CD 20 post RTX al mes fue de 3.7*

***Correspondence:**
Miguel Liern
E-mail: jliern@yahoo.com

Date of reception: 06-11-2024
Date of acceptance: 19-01-2026
DOI: 10.24875/NEFRO.24000043
Available online: 06-07-2026
Nefro Latinoam. 2026;23(2):49-56
www.nefrologialatinoamericana.com
How to cite: Liern M, et al. Use of rituximab and mycophenolate in cortic-dependent nephrotic syndrome in pediatrics. Nefro Latinoam. 2026;23(2):49-56. doi: 10.24875/NEFRO.24000043

células/mm³ y con la recaida fue de 26 células/mm³. (Coef. Corr. CD20-proteinuria 0.54). Los efectos adversos observados mínimos y reversibles. **Conclusión:** *La terapia secuencial con RTX y MMF puede ser una opción en los pacientes con síndrome nefrótico cortico dependiente primario.*

Palabras clave: *Rituximab. Micofenolato mofetil. Síndrome nefrótico corticodependiente.*

Introduction

Idiopathic nephrotic syndrome is the most common chronic glomerular disease in childhood and occurs in 2 per 100,000 children per year.[1] Overall, between 80% and 90% of patients present with steroid-sensitive nephrotic syndrome (SSNS); however, 50% to 60% of these patients may become frequent relapsers (FRNS) or develop steroid-dependent nephrotic syndrome (SDNS),[2] with potential corticosteroid (CS)-related toxic effects.[3] To reduce the occurrence and severity of these adverse events, several clinical practice guidelines recommend the use of non-steroidal immunosuppressive agents such as cyclophosphamide (CP), levamisole, cyclosporine (CsA), tacrolimus, or mycophenolate mofetil (MMF).[4-6] Nevertheless, approximately 10%-20% of children, despite receiving these therapies, continue to experience frequent relapses or steroid dependence. For these patients with SDNS, rituximab (RTX) has been increasingly used.[7] However, many children treated with this monoclonal antibody also relapse, particularly when CD20 lymphocyte populations recover. In such cases, MMF may be added. This immunosuppressant selectively inhibits de novo purine synthesis, suppresses T- and B-cell proliferation, and reduces antibody production, significantly decreasing steroid dependence.[8] Therefore, sequential RTX-MMF therapy could be considered for pediatric SDNS.

Endpoints

Primary endpoints

To evaluate:

- Cumulative steroid dose (CSD) before RTX administration
- Mean number of relapses after RTX treatment
- Mean number of relapses after MMF treatment
- CSD prior to RTX use
- CSD prior to MMF use
- CSD after MMF use
- Duration of CD20 cell depletion below physiological levels
- Correlation between CD20 cell recovery and proteinuria

Secondary endpoints

To evaluate:

Adverse events associated with RTX:

Infusion-related hypersensitivity:

- Mild: flushing, palpitations, tremors, headache, nausea
- Moderate: hypotension or hypertension (< 20 mm Hg change from baseline), chest pain, fever, urticaria
- Severe: hypo- or hypertension, chest pain, dyspnea, bronchospasm

Delayed hypersensitivity:

- Fever, urticarial rash, arthralgia, myalgia, bacterial infections, viral infections, progressive multifocal leukoencephalopathy, severe thrombocytopenia and neutropenia, severe arrhythmias

Adverse events associated with MMF:

- Oral ulcers, recurrent abdominal pain, constipation, polyarthralgia, sleep disturbances, drug-induced rash, leukopenia, headache.

Materials and methods

We conducted a prospective observational cohort study in a pediatric nephrology unit in the Autonomous City of Buenos Aires. Patients aged 5 to 11 years with primary SDNS were included. Prior to study entry, all patients had received one of the following treatments: MMF (12 months), CP (3 months), levamisole (12 months), or CsA (12 months).

The indication for RTX treatment was clinical SDNS with increasing corticosteroid requirements to maintain remission.

Inclusion criteria

Glomerular filtration rate > 90 mL/min/1.73 m^2; blood pressure < 95th percentile for age and height; complete vaccination schedule (according to the national immunization program), including 13-valent pneumococcal and meningococcal B vaccines; and pproved informed consent.

Exclusion criteria

Active infections and/or malignancy; primary immunodeficiency; leukopenia (WBC < 3000/mm^3); neutropenia

(< 1500/mm^3); thrombocytopenia (< 50,000/mm^3); refractory anemia; persistent gastrointestinal intolerance; and pregnancy.

Discontinuation criteria

Reduction in glomerular filtration rate > 30% from baseline for more than 3 months; active infections and/or malignancy; drug hypersensitivity; pregnancy; and non-compliance with ≥ 2 consecutive follow-up visits.

Study design

Prospective observational cohort study in patients with primary SDNS treated sequentially with RTX + MMF.

Definitions

- Initial nephrotic syndrome: first episode with proteinuria > 40 mg/m^2/h, serum albumin < 3 g/dL, often accompanied by edema and hypercholesterolemia above the 95th percentile.[4]
- Complete remission: absence of edema and proteinuria < 1+ on dipstick, proteinuria/creatinine ratio < 0.2, or proteinuria < 4 mg/m^2/h for at least 3 consecutive days.[4]
- Partial remission: proteinuria < 2+, proteinuria/creatinine ratio > 0.2 and < 3.5 g/mg, or proteinuria between 4 and 40 mg/m^2/h with serum albumin > 3 g/dL.[4]
- Frequent relapses: ≥ 2 relapses in 6 months or ≥ 4 in 12 months.[4]
- Steroid-dependent nephrotic syndrome: recurrence of proteinuria > 40 mg/m^2/h during steroid tapering or within < 20 days after discontinuation.[4]
- Steroid toxicity: diabetes, GI bleeding, cerebral edema, glaucoma, hypertension, fluid retention, obesity, insulin resistance, growth retardation, increased intraocular pressure, cataracts, psychological and behavioral changes, Cushingoid features.[5,9]
- CD20 depletion: CD20 lymphocytes < 1% of total B cells or < 5 cells/mm^3. Recovery: CD20 lymphocytes > 1% in peripheral blood.[10]

Drug administration

Patients in remission receiving corticosteroids (30 mg/m^2 on alternate days) were treated with RTX 375 mg/m^2 weekly for 4 consecutive weeks (4 doses). Corticosteroids were maintained at 30 mg/m^2 on alternate days until week 4[4]. MMF was initiated at 250 mg/m^2/day and titrated up to 1200 mg/m^2/day.

Clinical and laboratory monitoring

Each patient was evaluated.

- At baseline:
  Blood tests: lymphocyte subsets, CD20 lymphocytes, immunoglobulins (IgG, IgA, IgM), serum creatinine (Schwartz formula), urea, complete blood count, cholesterol, triglycerides, LDL, HDL, protein electrophoresis, amylase, uric acid, lipase, liver function tests, electrolytes, calcium, phosphate, magnesium
  24-hour urine: proteinuria/day, urinary electrolytes (17 mEq sodium ≈ 1 g salt)
- Monthly:
  Blood tests: serum creatinine, urea, complete blood count, cholesterol, serum protein electrophoresis, electrolytes.
  24-hour urine collection: urinary electrolytes to indirectly estimate salt intake (17 mEq sodium corresponds to 1 g of salt), proteinuria/day, and urinary urea.
- Every 6 months:
  Blood tests: lymphocyte subsets, CD20 lymphocyte count, immunoglobulins (IgG, IgA, IgM), calcium, phosphate, magnesium, serum amylase, and lipase.
  24-hour urine collection: proteinuria/day and urinary electrolytes.

Study variables

Independent variables evaluated:

- Time from diagnosis to initiation of non-steroidal immunosuppression.
- Time to initiation of RTX.
- Time to initiation of MMF.
- Number of relapses prior to RTX use.
- Number of relapses after RTX and before MMF.
- Number of relapses after MMF.
- Cumulative steroid dose (CSD) prior to RTX.
- CSD after RTX.
- CSD after MMF.

Dependent variables evaluated

- CD20 lymphocyte counts.
- Proteinuria before RTX, after RTX, and after MMF.
  Study duration: 57.6 months.

Statistical analysis

One-way ANOVA with multiple comparisons was used to compare 3 groups defined by proteinuria levels under different treatments.

Table 1. Description of the 12 patients included in the study

Patient	Sex	Age (years)	BMI (kg/m^2) Initial–Final	Prior immunosuppression	Time to non-steroidal immunosuppression (months)
1	F	10.1	22.5-23.5	Levamisole (LV)	11.5
2	M	8.3	23.2-25.5	MMF	9.4
3	M	5.4	19.8-18.9	MMF	10.2
4	M	9.1	21.5-22.4	MMF	8.5
5	F	7.5	23.1-23.6	MMF	9.4
6	M	6.6	18.7-19.9	Levamisole (LV)	12.2
7	F	7.3	27.9-28.1	Cyclosporine (CsA)	8.6
8	F	8.2	19.5-20.5	MMF	6.8
9	F	5.8	24.1-25.0	MMF	7.1
10	F	9.5	25.6-25.7	Cyclophosphamide (CF)	6.4
11	M	9.8	26.2-26.4	Cyclophosphamide (CF)	7.9
12	F	6.3	18.9-20.2	MMF	11.3

MMF: mycophenolate mofetil; RTX: rituximab; CF: cyclophosphamide; LV: levamisole; CsA: cyclosporine.

The Wilcoxon test was used to compare the median rank of 2 related samples (proteinuria in patients receiving corticosteroids vs proteinuria in patients receiving RTX + MMF).

Spearman correlation coefficient was used to assess the relationship between CD20 lymphocyte counts and proteinuria/day. A positive value indicates that as one variable increases, the other tends to increase.

The study, approved by the hospital ethics committee, adhered to the Declaration of Helsinki and the principles outlined in the "Good Clinical Practice Guidelines" of the International Conference on Harmonisation.

Results

Twelve patients with SDNS were included, 7 females, aged between 5 and 11 years (mean age, 7.8 years). All had previously received non-steroidal immunosuppression: MMF (7 patients), levamisole (2 patients), cyclophosphamide (2 patients), and CsA (1 patient) (Table 1).

The mean time from completion of non-steroidal immunosuppressive therapy to initiation of RTX was 17.9 months. Two patients remained in remission until the end of the study, and another two had one relapse each. The remaining 8 patients, who had a mean of 1.75 relapses/year, required increasing doses of corticosteroids (mean 14 mg/m^2/day) to maintain remission. Therefore, after a mean of 13.4 months following RTX infusion, MMF was reintroduced at a dose of 1220 mg/m^2/day for 12 months. Subsequently, the relapse rate decreased to 0.6 relapses/year. After completing 1 year of MMF treatment, these 8 patients remained without immunosuppression and in remission for 15 months until the end of the study (Fig. 1).

The mean levels of proteinuria before RTX was 15.5 mg/m^2/day, 2 months after RTX was 2.4 mg/m^2/day, and at MMF initiation after RTX was 41.66 mg/m^2/day. After completing corticosteroid + MMF treatment, mean proteinuria was 4.9 mg/m^2/day (one-way ANOVA, $F = 19.5$, $p = 0.0001$) (Fig. 2).

The CSD before RTX was 5335 mg/m^2 and after RTX was 2024 mg/m^2 ($p = 0.001$). Finally, mean CSD with MMF was 1378 mg/m^2 (Wilcoxon test: $T = 3.5$, $p = 0.005$) (Table 2).

In 10 of the 12 patients who experienced at least 1 relapse, the mean CD20 lymphocyte count before RTX was 55 cells/mm^3, 60 days after RTX was 3.7 cells/mm^3, and during relapse was 26 cells/mm^3 (Spearman correlation coefficient CD20–proteinuria = 0.54).

Two patients who remained in remission after RTX maintained CD20 counts of 6 and 8 cells/mm^3, respectively.

During the last 15 months of the study, without any immunosuppressive therapy, 7 of 8 patients remained in remission, while the remaining patient had one relapse associated with a mild viral infection, which resolved spontaneously after infection control.

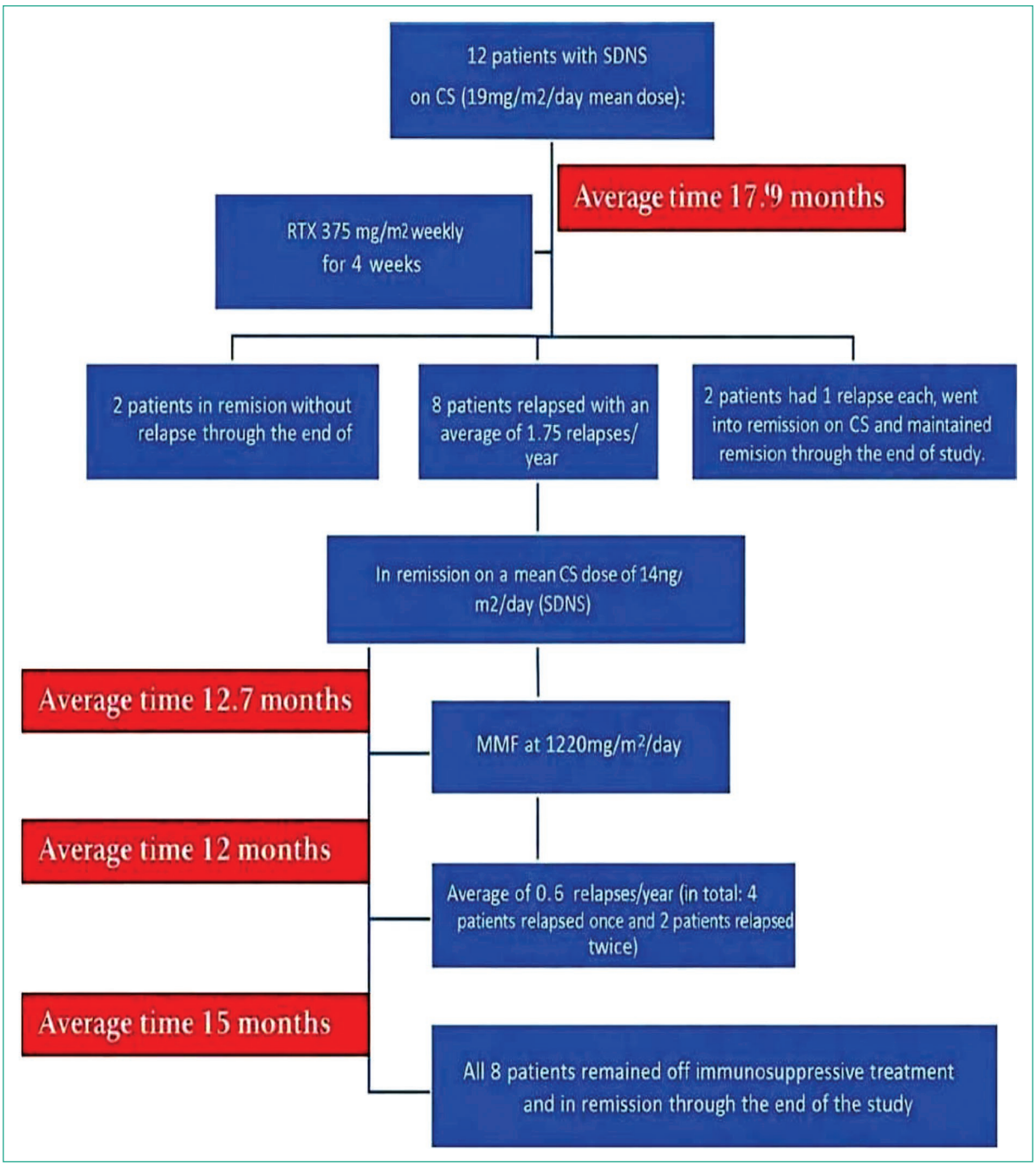

Figure 1. Treatment sequencing in patients with SDNS, illustrating responses defined by remission following rituximab and mycophenolate mofetil. SDNS: steroid-dependent nephrotic syndrome; CS: corticosteroids; RTX: rituximab; MMF: mycophenolate mofetil.

Three patients experienced adverse effects related to RTX: one developed urticarial rash during infusion, and two reported arthralgia and myalgia 24 hours after RTX, which improved with standard analgesics.

Regarding MMF, moderate abdominal pain was observed, treated with analgesics and resolving spontaneously after a mean of 5 days.

In terms of corticosteroid toxicity, 9 patients presented clinical signs; 7 resolved by the end of the protocol (5 with increased intraocular pressure and 2 with pathological bone mineral density, Z-score < –2).

One patient with posterior cataract required surgical correction, and another patient with cutaneous lesions (striae) remained under dermatological treatment until the end of the study.

Table 2. Cumulative corticosteroid dose during the study period

Patient	Time to initiation of non-steroidal immunosuppressive therapy (months)	Cumulative corticosteroid dose before initiation of non-steroidal immunosuppressive therapy (mg/m²)	Time to rituximab initiation (months))	Post-rituximab cumulative corticosteroid dose (mg/m²)	Time to mycophenolate mofetil initiation (months)	Cumulative corticosteroid dose during MMF therapy (mg/m²)
1	11.5	6160	18.3	2250	11.2	2200
2	9.4	5540	17.4	1850	11.9	1150
3	10.2	4980	16,8	1740	12.3	1100
4	8.5	4900	19.5	1800	14.5	1280
5	9.4	5800	15.9	2100	13.8	1160
6	12.2	6100	17.8	1980	13.5	1180
7	8.6	5760	18.2	1900	13.3	1250
8	6.8	4400	17.9	2200	12.2	1450
9	7.1	4200	19.5	1740	-	-
10	8.4	5100	16.8	2350	-	-
11	7.9	6200	19.9	2220	-	-
12	11.3	4880	17.7	2100	-	-

The cumulative corticosteroid dose (CCD) and the time elapsed until the initiation of each therapeutic intervention are shown for the entire patient cohort. The last four patients did not receive mycophenolate mofetil (MMF) because remission was maintained with corticosteroid therapy alone.
RTX: rituximab; MMF: mycophenolate mofetil; CCD: cumulative corticosteroid dose.

Renal biopsy was not performed in any patient because, in our setting, this diagnostic procedure is reserved for patients with steroid-resistant nephrotic syndrome or children older than 11 years.

The total duration of the study was 57.6 months.

Discussion

Our study evaluated, in a pediatric cohort with primary SDNS, the response to sequential RTX + MMF therapy over a period of nearly 58 months. At the end of follow-up, we observed that MMF administered after RTX significantly prolonged relapse-free survival and reduced CSD. It is well established that most children with idiopathic nephrotic syndrome (80-90%) are steroid-sensitive, with normalization of proteinuria typically occurring within 4 to 6 weeks after initiation of daily oral corticosteroids.[4] However, a subgroup may experience frequent relapses or become steroid-dependent.[11] To minimize the potential toxicity of corticosteroids, non-steroidal immunosuppressive agents are commonly used in the management of SDNS.

KDIGO guidelines[4,12] propose a sequence of steroid-sparing agents, including MMF, RTX, cyclophosphamide, levamisole, and calcineurin inhibitors. However, these therapeutic strategies may be limited by systemic toxicity (cyclophosphamide),[13] direct nephrotoxicity (cyclosporine, tacrolimus),[14,15] or dependency (levamisole).[16] More recent reviews consider RTX an effective therapeutic option.[6,17] In our cohort, we avoided high cumulative steroid doses required to control progressive proteinuria by using RTX, a chimeric anti-CD20 monoclonal antibody that depletes B lymphocytes (potential immunoglobulin-producing cells). RTX has emerged as an effective and safe option for children with SDNS.[18,19]

MMF, on the other hand, is an immunosuppressive agent that inhibits de novo purine synthesis, and its efficacy appears to be enhanced when used in combination with monoclonal antibody therapy.[20] In the RITURNS I trial,[21] B-cell counts recovered to 12%, 39%, and 93% at 6, 9, and 12 months, respectively, after a single RTX cycle, and relapses occurred predominantly in patients with B-cell reconstitution, generally beyond 8 months post-treatment. In our study, the 1-year interval before MMF reintroduction was based on clinical observation: although patients were not in overt relapse, they required progressively higher corticosteroid doses to control proteinuria. At the time of MMF initiation, the 8 patients were receiving a mean steroid dose of 14 mg/m²/day, associated with potential toxicity. MMF was selected based on findings from the RITURNS II trial,[22] a controlled study demonstrating that combined RTX + MMF therapy resulted in longer remission periods, significantly reduced relapse rates over 24 months, and predominantly mild adverse effects.

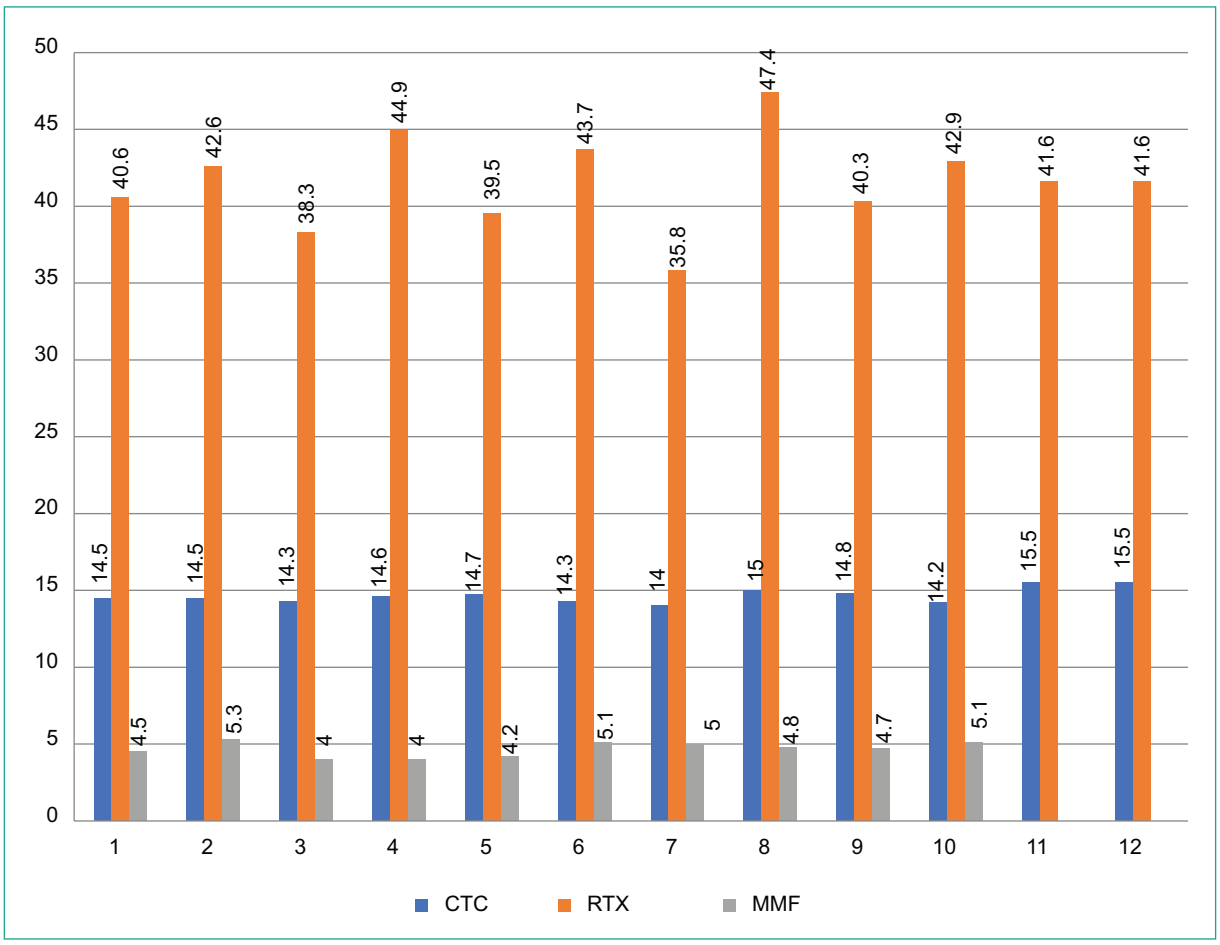

Figure 2. Changes in proteinuria values (mg/m^2/day) in all patients after each treatment cycle. CS: corticosteroids; RTX: rituximab; MMF: mycophenolate mofetil.

Similarly, Chan et al.,[23] in a large multicenter international retrospective study, identified RTX followed by maintenance immunosuppressive therapy as the optimal regimen.

Additional studies by Zhun[24] and Colucci[25] further supported these findings, confirming the efficacy of RTX and identifying relapse-free survival patterns. Notably, recovery of memory B cells has been proposed as a strong predictor of relapse after RTX therapy, suggesting a key role for these cells in disease pathogenesis. Recently, Bashford-Rogers et al.[26] demonstrated that although RTX reduces circulating B-cell populations, these cells may undergo isotype switching and clonal expansion. MMF may act on these residual CD20-positive cells by reducing both their number and clonal expansion, while relatively preserving IgM clones that have undergone somatic hypermutation.[27] These pathophysiological mechanisms may justify the sequential use of RTX and MMF.[28] Importantly, relapse may occur even in the absence of detectable circulating B cells, possibly due to persistence of B cells in specific tissue compartments. Although repeated preventive RTX infusions have been proposed, their use must be weighed against cost and potential immunological consequences.[29] Therefore, maintenance therapy with MMF following RTX appears justified in this patient population.[30,31] In our study, comparison of relapse-free survival between RTX monotherapy and sequential RTX + MMF clearly demonstrated an additional benefit of MMF in maintaining long-term remission. These findings, together with the favorable safety profile of MMF and its steroid-sparing effect, support its use as maintenance therapy after RTX in primary SDNS. Notably, MMF appears suitable for prolonging relapse-free remission for a mean 2 years.[32,33]

Our study has several limitations. First, the small sample size (12 patients) limits generalizability and statistical power. Second, the absence of a control group precludes randomized comparisons. Finally, due to logistical constraints, MMF area under the curve (AUC) measurements were not performed.[34]

On the other hand, a strength of our study is the originality of implementing a sequential therapeutic strategy aimed at improving quality of life, reducing steroid toxicity, and optimizing healthcare resource utilization and associated costs.

Conclusions

Maintenance therapy with MMF after RTX may be an effective strategy to sustain remission in patients with primary SDNS. However, randomized clinical trials with larger pediatric populations are needed to further evaluate the long-term safety and efficacy profile of this sequential combination therapy.

Funding

The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely collected and anonymized clinical data; therefore, individual informed consent was not required. Relevant ethical recommendations have been followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. McEnery PT, Strife CF. Nephrotic syndrome in childhood: management and treatment in patients with minimal change disease, mesangial proliferation, or focal glomerulosclerosis. Pediatr Clin North Am. 1982;29:875–94.
2. Hahn D, Hodson EM, Willis NS, Craig JC. Corticosteroid therapy for nephrotic syndrome in children. Cochrane Database Syst Rev. 2015.
3. Moghadam-Kia S, Werth VP. Prevention and treatment of systemic glucocorticoid side effects. Int J Dermatol. 2010;49:239–48.
4. KDIGO. KDIGO 2025 clinical practice guideline for the management of nephrotic syndrome in children. Kidney Int Suppl. 2025;107(Suppl 5S):S241–S289.
5. Boyer O, Hodson E, Bagga A, Gipson DS, Vivarelli M, Haffner D. IPNA clinical practice recommendations for the diagnosis and management of children with steroid-sensitive nephrotic syndrome.
6. Rovin BH, Caster DJ, Cattran DC, Gibson KL, Hogan JJ, Moeller MJ, et al. Management and treatment of glomerular diseases (part 2): conclusions from a KDIGO Controversies Conference. Kidney Int. 2019;95(2):281–95.
7. Kamei K, Ishikura K, Sako M, Ito S, Nozu K, Iijima K. Rituximab therapy for refractory steroid-resistant nephrotic syndrome in children. Pediatr Nephrol. 2020;35(1):17–24.
8. Allison AC, Eugui EM. Mycophenolate mofetil and its mechanisms of action. Immunopharmacology. 2000;47(2–3):85–118.
9. Kneteman NM. Steroid-free immunosuppression: balancing efficacy and toxicity. Liver Transpl. 2001;7(8):698–700.
10. Basu B, Angeletti A, Islam B, Ghiggeri GM. New and old anti-CD20 monoclonal antibodies for nephrotic syndrome: where are we? Front Immunol. 2022;13:805697.
11. Trautmann A, Boyer O, Hodson E, Bagga A, Gipson DS, Vivarelli M, et al. IPNA clinical practice recommendations for the diagnosis and management of children with steroid-sensitive nephrotic syndrome. Pediatr Nephrol. 2023;38(3):877–919.
12. Kidney Disease: Improving Global Outcomes (KDIGO) Glomerulonephritis Work Group. Chapter 3: steroid-sensitive nephrotic syndrome in children. Kidney Int Suppl. 2012;2(2):163–71.
13. Kyrieleis HA, Levtchenko EN, Wetzels JF. Long-term outcome after cyclophosphamide treatment in children with steroid-dependent and frequently relapsing minimal change nephrotic syndrome. Am J Kidney Dis. 2007;49:592–7.
14. Sümegi V, Haszon I, Bereczki C, Papp F, Túri S. Long-term follow-up after cyclophosphamide and cyclosporine A therapy in steroid-dependent and -resistant nephrotic syndrome. Pediatr Nephrol. 2008;23(7):1085–92.
15. Delbet JD, Aoun B, Buob D, Degheili J, Brocheriou I, Ulinski T. Infrequent tacrolimus-induced nephrotoxicity in French patients with steroid-dependent nephrotic syndrome. Pediatr Nephrol. 2019;34(12):2605–8.
16. Mühlig AK, Lee JY, Kemper MJ, Kronbichler A, Yang JW, Lee JM, et al. Levamisole in children with idiopathic nephrotic syndrome: clinical efficacy and pathophysiological aspects. J Clin Med. 2019;8(6):860.
17. Ruggenenti P, Ruggiero B, Cravedi P, Vivarelli M, Remuzzi G. Rituximab in steroid-dependent or frequently relapsing idiopathic nephrotic syndrome. J Am Soc Nephrol. 2014;25(4):850–63.
18. Iijima K, Sako M, et al. Rituximab for childhood-onset complicated frequently relapsing nephrotic syndrome or steroid-dependent nephrotic syndrome: a multicentre, double-blind, randomised, placebo-controlled trial. Lancet. 2014.
19. Ramos-Casals M, Díaz-Lagares C, Brito-Zerón P. Recomendaciones sobre el uso off-label de rituximab en enfermedades autoinmunes sistémicas. Sociedad Española de Medicina Interna; 2009.
20. Filler G, Huang SH, Sharma AP. Should we consider MMF therapy after rituximab for nephrotic syndrome? Pediatr Nephrol. 2011;26(10):1759–62.
21. Basu B, Sander A, Roy B, Preussler S, Barua S, Mahapatra TKS, et al. Efficacy of rituximab vs tacrolimus in pediatric corticosteroid-dependent nephrotic syndrome: a randomized clinical trial. JAMA Pediatr. 2018; 172(8):757–64.
22. Basu B, Preussler S, Sander A, Mahapatra TKS, Schaefer F. Randomized clinical trial comparing repeated rituximab vs single-course rituximab followed by mycophenolate mofetil. BMC Nephrol. 2020;21:520.
23. Chan EY, Webb H, Yu E, Ghiggeri GM, Kemper MJ, Ma AL, et al. Both rituximab dose and maintenance immunosuppression affect outcomes. Kidney Int. 2020;97:393–401.
24. Zhu Y, Chen J, Zhang Y, Wang X, Wang J. Immunosuppressive agents for frequently relapsing/steroid-dependent nephrotic syndrome in children: a systematic review and network meta-analysis. Front Immunol. 2024;15:1310032.
25. Colucci M, Carsetti R, Cascioli S, Casiraghi F, Perna A, Ravà L, et al. B cell reconstitution after rituximab treatment in idiopathic nephrotic syndrome. J Am Soc Nephrol. 2016;27:1811–22.
26. Bashford-Rogers RJM, Bergamaschi L, McKinney EF, Pombal DC, Mescia F, Lee JC, et al. Analysis of the B cell receptor repertoire in immune-mediated diseases. Nature. 2019;574:122–6.
27. Ito S, Kamei K, Ogura M, Sato M, Fujimaru T, Ishikawa T, et al. Maintenance therapy with mycophenolate mofetil after rituximab. Pediatr Nephrol. 2011;26(10):1823–8.
28. Lugani F, Angeletti A, Ravani P, Vivarelli M, Colucci M, Ghiggeri GM. Rituximab vs mycophenolate mofetil in steroid-dependent nephrotic syndrome: study protocol. BMJ Open. 2021;11:e052450.
29. Chan EY, Yu E, Angeletti A. Long-term efficacy and safety of repeated rituximab. J Am Soc Nephrol. 2022;33:1193–1207.
30. Iijima K, Sako M, Oba M. Mycophenolate mofetil after rituximab. J Am Soc Nephrol. 2022;33:401–19.
31. Kamei K, Ogura M, Iijima K, Ito S. Maintenance therapy with mycophenolate mofetil after rituximab. Pediatr Nephrol. 2011;26:1823–8.
32. Ishikura K, Sharma P, Tullus K. Effects of rituximab dose and maintenance immunosuppression. Kidney Int. 2019.
33. Okutsu M, Kamei K, Ishikura K. Prophylactic rituximab in children with complicated nephrotic syndrome. Pediatr Nephrol. 2020.
34. Sharma AP, et al. Clinical applicability of IPNA therapeutic drug monitoring formulae. Pediatr Nephrol. 2025;40:1965–73.

Nefrología Latinoamericana

PERMANYER

Check for updates

ORIGINAL ARTICLE

First regional consensus on renal nutrition: recommendations for the management of patients with chronic kidney disease

Primer consenso regional de nutrición renal: recomendaciones para manejo de pacientes con enfermedad renal crónica

Karen Courville[1,2], Guillermo Rodríguez-Méndez[3], Blandina Solís-Morales[4], Cristina Brolo-España[5], Mabel Sandoval-Díaz[6], Paola Sánchez-Corrales[7], Mario Espinach-Roel[8], Laura Maroto-Meneses[9], Katya Velasco-Escobar[10], Jessenia Nóchez[10], Jimmy Morán-Alvarado[10], Melissa Arias-Tróchez[11], Carolina Rodríguez-Canaca[12], Ángeles de Gracia-Domínguez[13], Rosa Larreategui-Arosemena[14], Ricardo Marte-Álvarez[15], Norda Figueroa-Toribio[16], Wanda Rodríguez-Díaz[17], Guillermo Álvarez-Estévez[18] and Vicente Sánchez-Polo[19]*

[1]Unidad de Hemodiálisis, Departamento de Nefrología, Hospital Dr. Gustavo N. Collado, Herrera, Panamá; [2]Sistema Nacional de Investigación, SNI, SENACYT, Ciudad de Panamá, Panamá; [3]Servicio de Nefrología, Hospital Calderón Guardia, San José, Costa Rica; [4]Hospital General de Enfermedades Instituto Guatemalteco de Seguridad Social, Guatemala, Guatemala; [5]Clínica Privada Clinuré, Ciudad de Guatemala, Guatemala; [6]Hospital Infantil y Hospital Vivian Pellas, Managua, Nicaragua; [7]Unidad de Soporte Nutricional, Hospital Calderón Guardia, San José, Costa Rica; [8]Servicio de Nefrología, Hospital Calderón Guardia San José, Costa Rica; [9]Servicio de Nutrición, Hospital Calderón Guardia, San José, Costa Rica; [10]Servicio de Nutrición Clínica, Hospital Médico Quirúrgico, Instituto Salvadoreño del Seguro Social, San Salvador, El Salvador; [11]Departamento de Nutrición, Universidad Autónoma de Honduras, Tegucigalpa, Honduras; [12]Servicio de Nefrología Pediátrica, Hospital María Especialidades Pediátricas, Tegucigalpa, Honduras; [13]Departamento de Nutrición, Hospital Dr. Gustavo N. Collado, Herrera, Panamá; [14]Unidad de Soporte Nutricional, Hospital Ciudad de La Salud, Caja de Seguro Social, Panamá, Panamá; [15]Hospital General Fuerzas Armadas, Santo Domingo, República Dominicana; [16]Unidad de Nutrición, Hospital Padre Billini, Santo Domingo, República Dominicana; [17]Hospital Padre Billini y Centro de Ginecología y Obstetricia, Santo Domingo, República Dominicana; [18]Departamento de Nefrología, Coordinación de Residencia de Nefrología CEDIMAT, Santo Domingo, República Dominicana; [19]Posgrado en Nefrología, Facultad de Medicina, Universidad de San Carlos, Sociedad Latinoamericana de Nefrología e Hipertensión (SLANH) Guatemala, Guatemala

Abstract

Introduction: Chronic kidney disease (CKD) in the nutritional context is a challenge in Central America and the Caribbean. This work aims to assess its current status and provide recommendations for its medical and nutritional management in the region. **Material and methods:** *Expert meetings (nephrologists, nutritionists, internists, and nutritionists) were held virtually and in person during 2022 and 2024. International guidelines on nutrition in CKD were reviewed, considering the country-specific situational assessment, nutritional diagnosis and intervention, and management recommendations.* **Results:** *A lack of data on the prevalence and incidence of CKD and its nutritional complications in the region was identified. Recommendations were developed for nutritional screening, evaluation, diagnosis, and intervention at different stages of CKD and renal replacement therapy, including guidelines on dietary prescription, meal plans, nutritional education, and follow-up.* **Conclusion:** *This document provides a regional expert consensus to standardize nutritional management of CKD patients in Central America and the Caribbean, highlighting the importance of individualized treatment and the need for a multidisciplinary approach. Its unique feature lies in the adaptation of international guidelines to the specific characteristics of the region.*

Keywords: *Chronic kidney disease. Nutrition. Protein-energy wasting. Diet. Albumin. Dialysis.*

***Correspondence:**
Karen Courville
E-mail: kavac7@gmail.com

Date of reception: 12-04-2025
Date of acceptance: 28-05-2025
DOI: 10.24875/NEFRO.25000014

Available online: 07-10-2025
Nefro Latinoam. 2026;23(2):57-68
www.nefrologialatinoamericana.com

How to cite: Courville K, et al. First regional consensus on renal nutrition: recommendations for the management of patients with chronic kidney disease. Nefro Latinoam. 2026;23(2):57-68. doi: 10.24875/NEFRO.25000014

Resumen

Introducción: *La enfermedad renal crónica (ERC) en el contexto nutricional representa un reto en América Central y el Caribe. Este trabajo busca evaluar su situación actual y generar recomendaciones para su manejo médico y nutricional en la región.* **Material y métodos:** *Se realizaron reuniones de expertos (nefrólogos, nutriólogos, internistas y nutricionistas) de forma virtual y presencial durante 2022 y 2024. Se revisaron guías internacionales sobre nutrición en ERC, considerando el diagnóstico situacional por país, el diagnóstico e intervención nutricional y las recomendaciones de manejo.* **Resultados:** *Se identificó la insuficiencia de datos sobre la prevalencia e incidencia de la ERC y sus complicaciones nutricionales en la región. Se elaboraron recomendaciones para el tamizaje, evaluación, diagnóstico e intervención nutricional en las diferentes etapas de la ERC y terapias de reemplazo renal, incluyendo pautas sobre prescripción dietética, plan de alimentación, educación nutricional y seguimiento.* **Conclusión:** *El documento proporciona un consenso regional de expertos para homogeneizar el manejo nutricional del paciente con ERC en Centroamérica y el Caribe, destacando la importancia de la individualización del tratamiento y la necesidad de un abordaje multidisciplinario. La originalidad radica en la adaptación de guías internacionales a las particularidades de la región.*

Palabras clave: *Enfermedad renal crónica. Nutrición. Desgaste proteico energético. Dieta. Albúmina. Diálisis.*

Introduction

Chronic kidney disease (CKD) is a major global health problem, ranking as the 12th cause of mortality among non-communicable diseases, with an estimated prevalence of 9%.[1] It is a slow, progressive, degenerative, irreversible disease with a poor prognosis, particularly in men. Poverty, malnutrition, and low birth weight are risk factors. In 2017, 1,200,000 deaths worldwide were attributed to CKD, representing a 41% increase in the annual mortality rate since 1990.[2] It is estimated that CKD will be the fifth leading cause of all-cause mortality by 2040.

Latin America has a population of 652,000,000 inhabitants, distributed across 20 countries, and about 60,000,000 suffer from CKD. The 2019 report from the Latin American Dialysis and Renal Transplant Registry[3] indicates that 432,610 people were on renal replacement therapy, most of them (66.7%) on hemodialysis (HD), 9.3% on peritoneal dialysis (PD), and 24% were kidney transplant recipients. Each country in the region presents a different reality in terms of incidence and prevalence, as well as access to therapy and types of coverage for renal health services (Fig. 1 of the supplementary data).

The main causes of CKD are diabetic kidney disease (40%) and high blood pressure (39%). In Central America and the Caribbean, Mesoamerican nephropathy accounts for 10-15% of CKD causes, making the CKD problem more complex than in the rest of the world, as it etiologically combines traditional and non-traditional causes.[4,5] Life expectancy is reduced by one-third in dialysis patients compared to transplant patients, who have a 5-year survival rate of 85-93%.[6]

Very little information is available about patients in CKD stages 3-5. Nine out of ten people with CKD do not know they have it, and up to 2% may end up requiring renal replacement therapy.

Similarly, there is little information about the nutritional status of CKD patients in pre-dialysis stages. Therefore, the objective of this document is to evaluate the current state of CKD in the nutritional context to generate recommendations through a regional expert consensus that will facilitate the medical nutritional management of CKD patients in the countries of the region.

Protein-energy wasting syndrome

Protein-energy wasting (PEW) syndrome is a state of malnutrition in renal patients, characterized by the depletion of body proteins and energy reserves, with a decrease in fat mass, muscle mass, and the visceral protein pool. It is associated with adverse clinical outcomes such as an increased risk of infections, anemia, higher hospitalization rates, reduced quality of life, and increased mortality.

The reported prevalence of PEW syndrome ranges from 11-54% in patients with CKD stages 3-5 not on dialysis, and between 28-54% in subjects on dialysis.[7] The factors involved include both a decrease in intake (anorexia or dietary restrictions) and aspects related to the retention of uremic substances and inflammation (metabolic acidosis, insulin resistance, alterations in counter-regulatory hormones), inherent to underlying pathologies (diabetes, essential hypertension, obesity), and those related to protein losses during dialysis and the effect of medications (Fig. 1).[8,9] For diagnosis, criteria based on laboratory tests, body mass, muscle mass, and over-ingestion are used (Table 1).

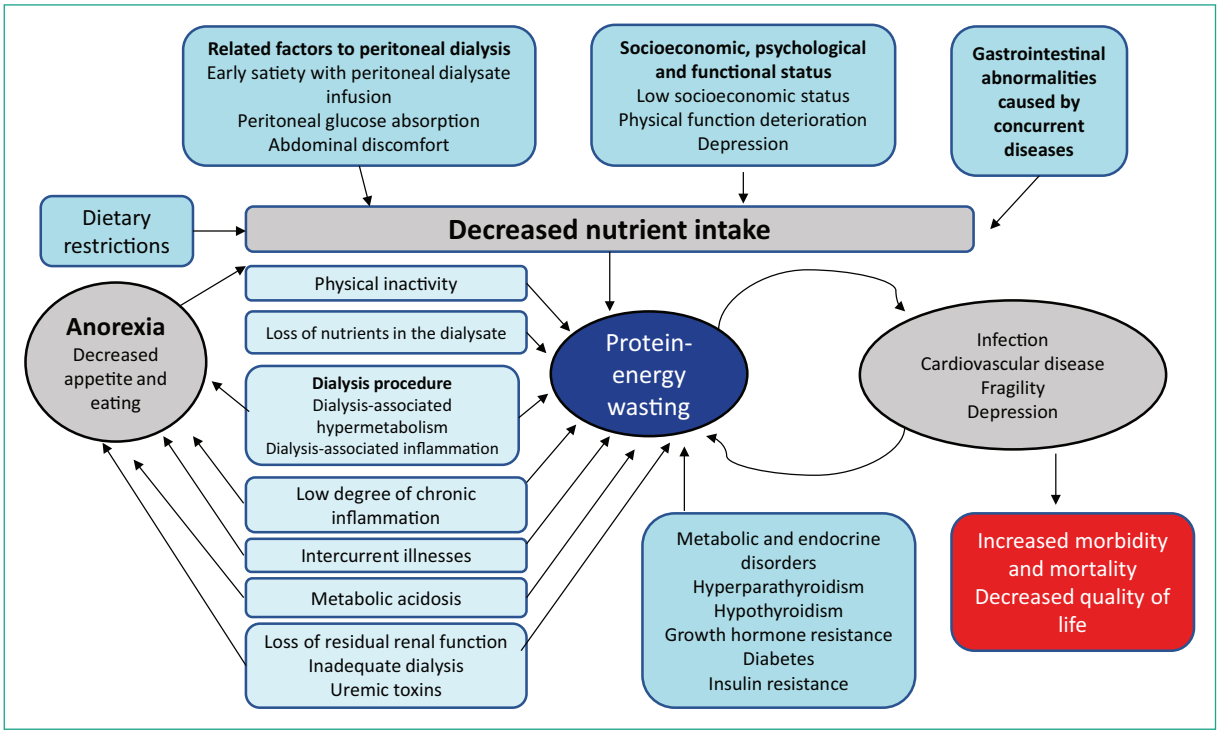

Figure 1. Etiology and clinical implications of protein-energy wasting in chronic kidney disease *(adapted from Chan et al.[10]).*

Nutritional support for the renal patient is a fundamental part of the treatment, on the same level as other components such as lifestyle changes, drugs, or replacement therapy, as it improves clinical outcomes and the quality of life for both patients and their families. Furthermore, it allows for significant savings for the health system (costs of medications, hospitalizations, procedures, dialysis, etc.), for the patient and their family, and for the state.[10-17]

According to the Kidney Disease Improving Global Outcomes (KDIGO) organization, CKD is defined as the presence of abnormalities in kidney structure or function for more than 3 months with health implications and requires one of two documented criteria: altered renal function or structure (Fig. 2 of the supplementary data).[18] Although the glomerular filtration rate (GFR) is usually estimated from creatinine, it can be complemented with other indicators, such as cystatin C, if measurement is possible.[18]

In teams for managing and evaluating CKD patients, a multidisciplinary approach is recommended, including various professionals who will collaborate in interventions, such as a nephrologist, nutriologist, nutritionist, dietitian, psychologist, social worker, nurse, pharmacist, surgeon, dentist, and exercise prescriber (Fig. 2).

Method

In virtual and in-person expert meetings held during June, July, and August 2022, and in October and December 2024, nephrologists, nutriologists, internists, and nutritionists from Central America and the Caribbean reviewed international guidelines on renal disease nutrition, considering 3 aspects: situational diagnosis by country, nutritional diagnosis and intervention, and management recommendations.

In general, data for a situational diagnosis on the prevalence and incidence of renal disease and its nutritional complications in the region are insufficient.[20] Regulations for the care of renal patients and the use of nutritional foods/supplements vary depending on the country and are available in the annexes (Figs. 3 and 4 of the supplementary data).

Nutritional approach recommendations

For nutritional diagnosis and intervention, it is important to perform a nutritional screening with a complete nutritional assessment to make a nutritional diagnosis, which will define the nutritional management, the diet plan, education, and follow-up.

Table 1. Diagnostic criteria for protein-energy wasting PEW in chronic kidney disease

Laboratory*	Serum albumin < 3.8 g/100 dL Pre albumin < 30 mg/100 dL (Only for patients on maintenance dialysis. Values may vary depending on the GFR level in patients with CKD 2-5) Serum cholesterol < 100 mg/100 dL
Body mass	BMI < 23 kg/m2 Unintentional weight loss: 5% in 3 months or 10% in 6 months Total body fat percentage < 10% (post dialysis)
Muscle mass	Reduction in muscle mass: 5% in 3 months or 10% in 6 months Reduction in muscle area of the mid-upper arm circumference (> 10% with relation to the p50 of the reference population) measured by a trained anthropometrist Creatinine level lower than expected (value influenced by muscle mass and meat intake)
Deficient intake	Protein intake < 0.8 g/kg/d for at least 2 months for dialysis patients or < 0.6 g/kg/d for patients with CKD 2-5 Calorie intake < 25 kcal/kg/d for at least 2 months

*Not valid if low concentrations are due to high urinary or intestinal protein losses, liver disease, or lipid-lowering medication.
PEW: protein-energy wasting; BMI: body mass index; GFR: glomerular filtration rate.

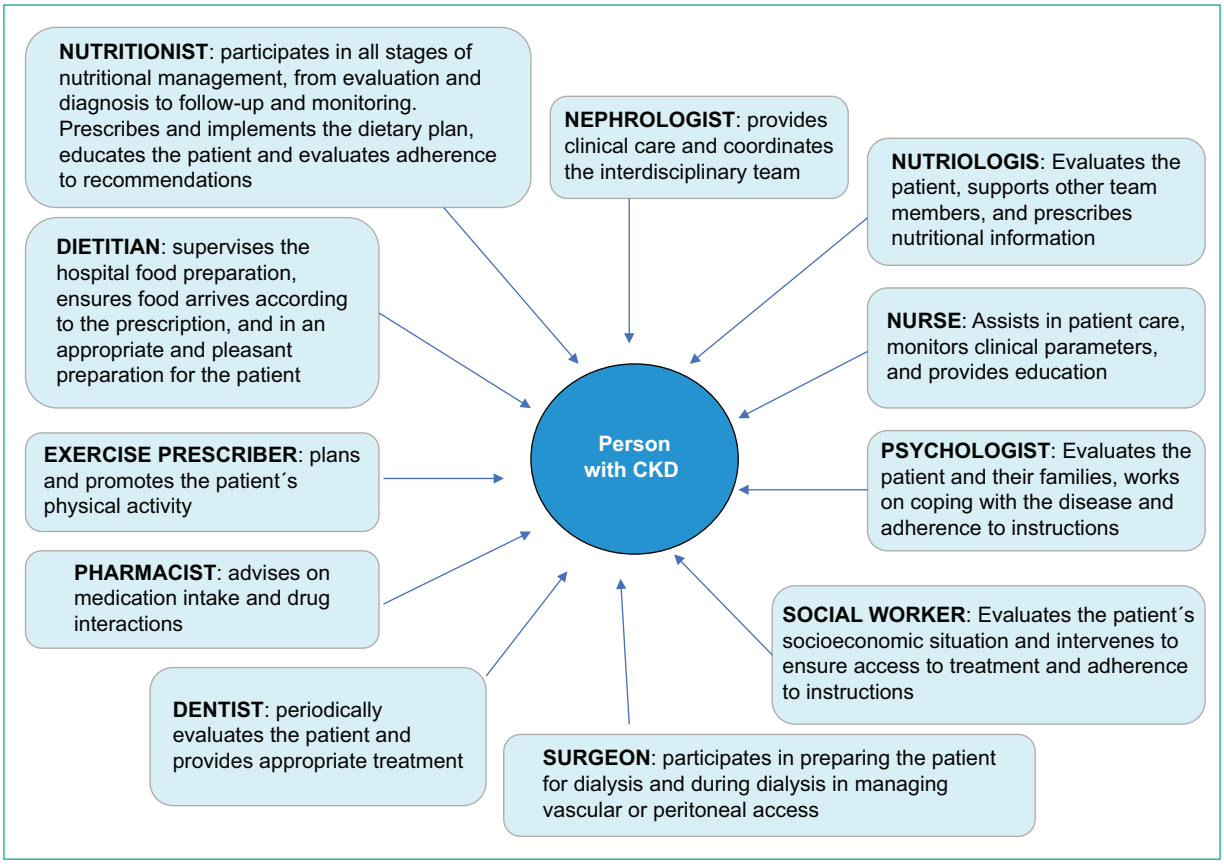

Figure 2. Composition of the team for the care of people with CKD.

Nutritional screening

At the first patient visit, it is recommended to use the 7-point subjective global assessment (SGA) as a screening tool, which includes data from the anamnesis (weight loss in the last 6 months, change in food intake, gastrointestinal symptoms, functional capacity, and metabolic demand according to the underlying disease state) and the physical examination (loss of subcutaneous fat, loss of muscle mass, edema, ascites) (Fig. 5 of the supplementary data).[20] If possible, it is recommended to supplement with the Malnutrition Inflammation Score (MIS), proposed for HD patients, which adds laboratory parameters (serum albumin and total iron-binding capacity) and body mass index (BMI) to the SGA (Fig. 6 of the supplementary data).[21]

Screening allows for the rapid detection of patients at nutritional risk for subsequent evaluation and should be performed by any member of the healthcare team in contact with the patient. Each center can opt for other available screening tools with which its staff is familiar (e.g., Malnutrition Screening Tool [MST], Malnutrition Universal Screening Tool[MUST]).[17]

It is recommended to perform the SGA at least every 6 months, adding the MIS in CKD5, and to use simpler tools in the intermediate period.

Nutritional status evaluation

The nutritional status assessment should include a food anamnesis, anthropometric measurements (weight, height, skin folds); a physical examination, with blood pressure measurement, evaluation of the presence of edema, and measurement of urinary volume. Muscle strength should be evaluated with a dynamometer and/or body composition analysis by multifrequency bioimpedance in situations where the equipment is available. The nutritional status should be complemented with some biochemical indicators, such as albumin, prealbumin, hemoglobin, lipids, glucose, uric acid, electrolytes, parathormone (PTH), and if available, the value of urinary sodium. The utility of these markers is determined according to the stage of CKD.

Serial evaluations are recommended depending on the renal stage for an early diagnosis. In patients in stages 1-3, consultations every 2-4 months after the initial evaluation are recommended, depending on the case. In patients in stages 4-5, the second visit should occur after one month and then be determined individually, subject to factors such as nutritional status, educational level, and adherence to instructions. Ideally, it should coincide with the nephrologist's visit every 1-2 months. In pre-dialysis or dialysis patients, visits are recommended every 1-2 months, but in some cases, they may need to be more frequent (e.g., at the start of dialysis), as the diet is modified. In pediatrics, monthly evaluations are recommended for dialysis patients and a maximum of every 3 months for pre-dialysis patients, along with the nephrologist's visit. In the patient's context, it is important to consider family support and access to food.

Nutritional diagnosis

The diagnostic criteria for PEW proposed by the International Society of Renal Nutrition and Metabolism (ISRNM) in 2008 are listed in figure 2. For a nutritional diagnosis, at least three of the four categories and at least one criterion from each selected category are needed. Each criterion should be documented on at least three occasions, 2-4 weeks apart.[22]

Nutritional intervention by stage or therapy type

After performing the screening and nutritional evaluation, it will be important to carry out a targeted intervention according to the stage of kidney disease or the type of renal replacement therapy the patient has, as there are differences in requirements and goals to achieve.

Nutritional intervention in pre-dialysis

Dietary prescription

For dietary prescription, there is agreement on the importance of individualizing each case according to the results obtained in the nutritional assessment and depending on whether hospitalized or outpatient management is required.[23]

– With respect to macronutrient intake, the following is agreed upon:
  - Energy requirement of 25 to 35 kcal/kg/d as established by the KDOQI guidelines,[24] 2020 for metabolically stable patients. Regarding protein intake, it is agreed to prescribe 0.8 g/kg/d as recommended by KDIGO,[25] 2024; this intake could be modified according to the patient's proteinuria. With respect to the prescription of carbohydrates and fats, they should be distributed to meet the total energy value, promoting the intake of complex carbohydrates

and an adequate distribution of polyunsaturated and monounsaturated fatty acids. An adequate intake of at least 22 g/d of fiber should be provided.

– With respect to micronutrient intake, the following is agreed upon:
  - Potassium intake will depend on the patient's serum values, but usually, in these stages, it should not be restricted; on the contrary, the intake of this nutrient has a cardioprotective effect and will help control blood pressure. In case of restriction, it is of utmost importance to consider the bioavailability of potassium in foods.
  - Phosphorus intake at this stage of kidney disease should be focused on the patient's serum values. It is also important to consider the bioavailability of this nutrient in foods, so only foods containing inorganic phosphorus should be eliminated from the diet.
  - A sodium prescription of less than 2,000 mg of sodium per day is agreed upon, as established in the KDIGO guidelines.[25]
– With respect to fluid intake, it should be adjusted according to diuresis, hydration status, and depending on the region, an adjustment for insensible losses of 500 to 750 cc can be made, especially in regions with high temperatures.

Diet plan

The diet plan could be based on eating patterns such as the Mediterranean diet or plant-based diets. The distribution of portions should be adjusted as much as possible to the patient's tastes and preferences, as well as their socioeconomic situation, to try to improve adherence to the prescribed diet. It is agreed that if the patient cannot meet the proposed requirements with the diet, supplementation can be initiated with a specialized formula, with high caloric density, low in protein, and with electrolyte control. If a specialized formula is not available, the standard formula can be used.

Nutritional education

Nutritional education in the early stages of the disease should be focused on slowing down the progression of the disease without compromising the nutritional status. Therefore, it should focus on the following aspects:

– Protein control: promote the use of plant-based proteins. This protein control should be accompanied by an adequate energy intake to promote the plastic function of proteins.
– Sodium control: emphasize sodium sources, especially hidden ones, and avoid the use of salt substitutes.
– Fluid quantity: promote adequate and abundant fluid intake if the patient does not have overhydration and still has preserved diuresis to avoid the risk of dehydration. These fluids should be mostly water, and all processed juices and sodas should be eliminated.
– Fiber quantity: the increase in the consumption of fruits and vegetables should be promoted to improve fiber intake. Control of fruits and vegetables with high potassium content should only be done in case of hyperkalemia.

Follow-up

With respect to follow-up, the ideal would be monthly, but if there is no installed capacity for it, quarterly follow-up is recommended. During follow-up, a complete nutritional status assessment should be performed again to determine the effectiveness of the proposed nutritional approach.

Nutritional intervention in hemodialysis

Dietary prescription

For dietary prescription, there is agreement on the importance of individualizing each case according to the results obtained in the nutritional assessment.

– With respect to macronutrient intake, the following is agreed upon:
  - Energy requirement of 25 to 35 kcal/kg/d in metabolically stable patients and a protein intake of 1 to 1.2 g/kg/d; this could be increased according to the goals for the patient and their clinical and metabolic condition. With respect to the prescription of carbohydrates and fats, they should be distributed to meet the total energy value, promoting the intake of complex carbohydrates, polyunsaturated, and monounsaturated fatty acids. An adequate intake of at least 22 g/d of fiber should be provided.
– With respect to micronutrient intake, the following is agreed upon:
  - Potassium intake will depend on the patient's serum values, but typically, high-potassium foods are controlled to avoid hyperkalemia. However, individualization and consideration of the bioavailability of this nutrient in foods are important.

- Phosphorus intake should be managed according to serum values, but again, the bioavailability of this nutrient in foods should be emphasized. Therefore, it is recommended to eliminate sources of inorganic phosphorus and, if necessary, control sources with a higher intake of organic phosphorus of animal origin. Sources of organic phosphorus of plant origin have very low absorption, so it is not necessary to eliminate them from the diet.
- A sodium prescription of less than 2,000 mg of sodium per day is agreed upon, as established in KDIGO.[25]

– With respect to fluid intake, it should be adjusted according to diuresis, hydration status, and depending on the region, an adjustment for insensible losses of 500 to 750 cc can be made, especially in very hot regions.

Diet plan

The distribution of portions in the diet plan should be adjusted as much as possible to the patient's tastes and preferences and their socioeconomic situation to try to improve adherence to the prescribed diet.

It is agreed that if the patient cannot meet the proposed requirements with the diet, supplementation can be initiated with a specialized formula, with high caloric density, high protein intake, and electrolyte control. If a specialized formula is not available, the standard formula can be used. The formulas can be provided to the patient intradialysis or post-dialysis, according to the regulations of each center.

In subjects who do not manage to cover 70% of the macronutrient recommendation with oral nutrition (foods and oral nutritional supplementation [ONS]), nutritional support via the enteral route is recommended.

In subjects with PEW, the use of total parenteral nutrition is suggested for patients with CKD 1-5 and the use of intradialytic parenteral nutrition (IDPN) for those on HD when the intake achieved through the oral and enteral routes is insufficient, and as a short-term strategy.

Nutritional education

Nutritional education in HD should be focused on maintaining an optimal nutritional and metabolic state and should therefore focus on the following aspects:[26]

– Adequate protein intake: strive to provide the optimal amount of protein, teaching the patient which proteins are high in phosphorus to avoid their consumption, especially in cases of hyperphosphatemia.
– Phosphorus control: eliminate the consumption of foods containing inorganic phosphorus and control sources of organic phosphorus of animal origin in case of hyperphosphatemia.
– Sodium control: emphasize sodium sources, especially hidden ones, and avoid the use of salt substitutes. It is important to educate on the relationship between excessive sodium intake and overhydration.
– Fluid quantity: promote fluid restriction according to the patient's condition, teach the patient to quantify the fluids they ingest, and the sources of fluids in the diet to avoid excessive intradialytic weight gain. These fluids should be mostly water, and all processed juices and sodas should be eliminated.
– Potassium quantity: control food sources of potassium, especially eliminating inorganic ones. If the patient has a tendency to hyperkalemia and has limited access to food, the use of cooking methods that promote potassium loss, such as soaking, is suggested.
– Fiber quantity: the increase in the consumption of fruits and vegetables should be promoted to improve fiber intake, while controlling foods rich in potassium.

Follow-up

With respect to follow-up, the ideal would be monthly. During these follow-ups, a complete nutritional status assessment should be performed again to determine the effectiveness of the proposed nutritional approach.

Nutritional intervention in peritoneal dialysis

Dietary prescription

For dietary prescription, there is agreement on the importance of individualizing each case according to the results obtained in the nutritional assessment.

– With respect to macronutrient intake, the following is agreed upon:
  - Energy requirement of 25 to 35 kcal/kg/d in metabolically stable patients and a protein intake of 1 to 1.2 g/kg/d; this could be increased according to the goals for the patient and their clinical and metabolic condition.
  - With respect to the prescription of carbohydrates and fats, they should be distributed to meet the

total energy value, promoting the intake of complex carbohydrates and eliminating simple carbohydrates, as glucose intake through the peritoneum is important. This intake can be counted within the total energy value. With respect to fats, an adequate distribution of polyunsaturated and monounsaturated fatty acids should be promoted. In addition, an adequate intake of at least 22 g/d of fiber should be provided.

– With respect to micronutrient intake, the following is agreed upon:
  • Potassium intake will depend on the patient's serum values; of note, there is a risk of hypokalemia, so in some patients, this nutrient is not restricted.
  • Phosphorus intake in PD should be managed according to serum values, but again, the bioavailability of this nutrient in foods should be emphasized. Therefore, it is recommended to eliminate sources of inorganic phosphorus and, if necessary, control sources with a higher intake of organic phosphorus of animal origin.
  • A sodium prescription of < 2,000 mg of sodium per day is agreed upon, as established in KDIGO.[25]
  • With respect to fluid intake, it should be adjusted according to diuresis, hydration status, and ultrafiltration, and depending on the region, an adjustment for insensible losses of 500 to 750 cc can be made, especially in regions with high temperatures.

Diet plan

The distribution of portions in the diet plan should be adjusted as much as possible to the patient's tastes and preferences and their socioeconomic situation to try to improve adherence to the prescribed diet.

It is agreed that if the patient cannot meet the proposed requirements with the diet, supplementation can be initiated with a specialized formula, with high caloric density, high protein intake, and electrolyte control. If a specialized formula is not available, the standard formula can be used.

Nutritional education

Nutritional education in PD should be focused on maintaining an optimal nutritional and metabolic state and should therefore focus on the following aspects:

– Adequate protein intake: strive to provide the optimal amount of protein, controlling those high in phosphorus, especially if the patient has hyperphosphatemia.
– Phosphorus control: eliminate the consumption of foods containing inorganic phosphorus and control sources of organic phosphorus of animal origin in case of hyperphosphatemia.
– Sodium control: emphasize sodium sources, especially hidden ones, and avoid the use of salt substitutes. It is important to educate on the relationship between excessive sodium intake and overhydration.
– Fluid quantity: promote fluid restriction according to the patient's condition, teach the patient to quantify the fluids they ingest, and the sources of fluids in the diet to avoid overhydration. These fluids should be mostly water, and all processed juices and sodas should be eliminated.
– Potassium quantity: control food sources of potassium only if the patient has hyperkalemia. Otherwise, the consumption of high-potassium foods should be promoted.
– Fiber quantity: the increase in the consumption of fruits and vegetables should be promoted to improve fiber intake, in order to avoid constipation that could decrease ultrafiltration.

Follow-up

An ideal individual follow-up would be monthly. During these follow-ups, a complete nutritional status assessment should be performed again to determine the effectiveness of the proposed nutritional approach.

Intervention in renal transplantation

Although renal transplantation is the preferred treatment for end-stage CKD, the procedure may have greater risks with critical nutritional challenges related to recovery from major surgery, immunosuppressive pharmacotherapy, or preexisting comorbidities.[27]

Nutrition in renal transplantation is an aspect of nutritional therapy that has been little studied in Latin America. The treatment of the transplant patient has two important considerations: the lack of total recovery of function due to the placement of a single kidney and the side effects of the immunosuppressive drugs that the transplant patient must necessarily use.

Each stage of transplantation has both clinical and nutritional differences. The pre-transplant stages have already been explained in the nutritional management of CKD and dialysis. In the immediate post-transplant

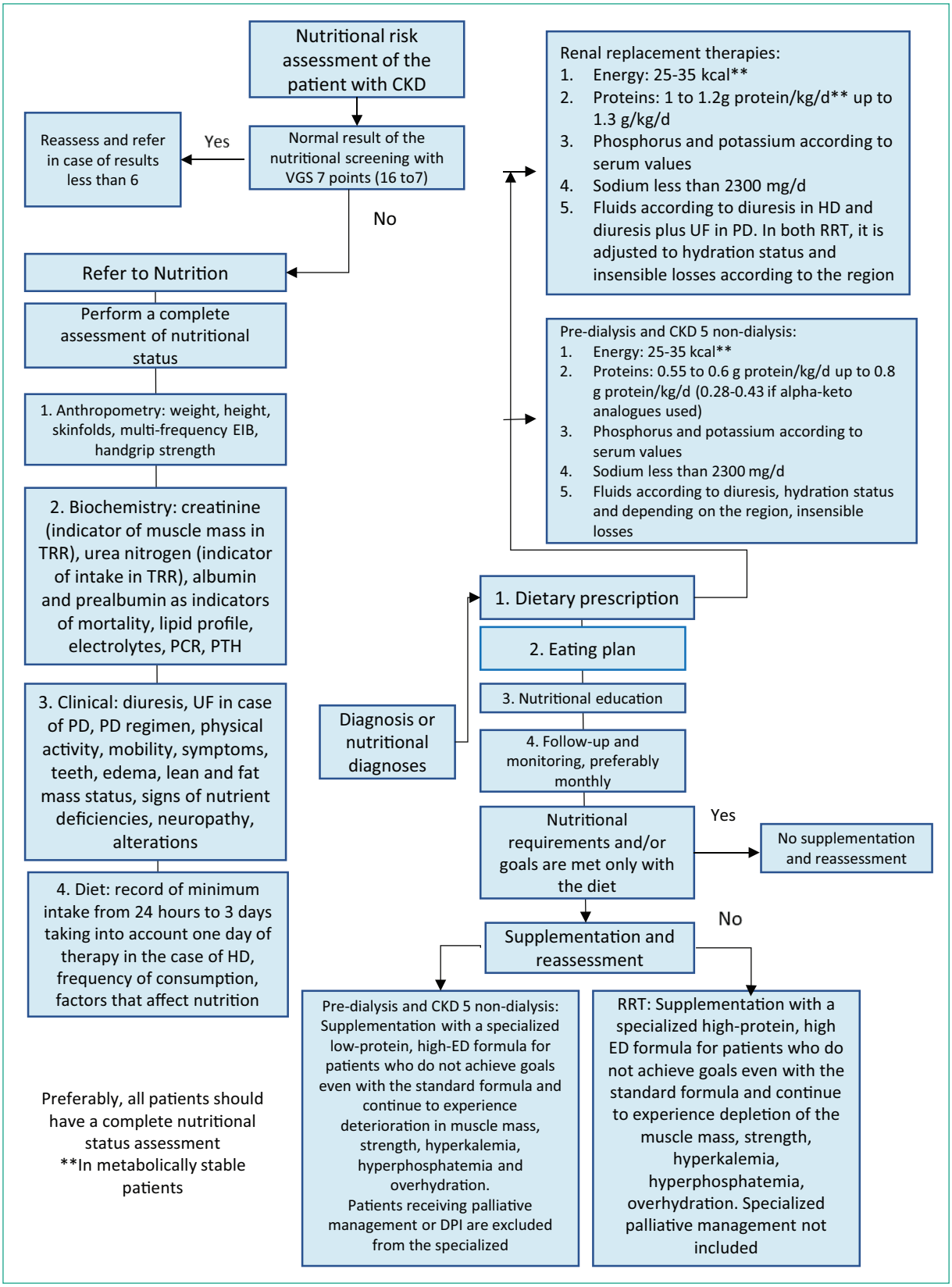

Figure 3. Nutritional management algorithm for patients with CKD. PD: peritoneal dialysis; HD: hemodialysis; CRP: C-reactive protein; PTH: parathyroid hormone; RRT: renal replacement therapy.

stage (4-6 weeks), it is recommended to focus on improving the nutritional status of the patient who is discharged after a transplant surgical procedure in a probable state of malnutrition. The nutritional goal is 30-35 kcal/kg/day of energy and a protein intake of 1.2-2.0 g of protein per kg of weight. All this is to combat postoperative catabolism and improve the state of malnutrition after dialysis or prolonged uremic states.

The goal for these individuals is to achieve adequate nutrition with a functional organ and successfully recover lost muscle mass and fat[27]. For the maintenance stage or late stage (> 3 months), the dietary recommendation is directed towards a healthy diet, with a broad view of foods, that promotes general well-being. Therefore, the energy recommendation is 25-35 kcal/kg/day and as for protein consumption, the recommendation for the post-transplant population is 0.8 g/kg/d.[28]

The risk factors and cause of mortality in this population are dyslipidemia, hypertension, and carbohydrate intolerance, so the knowledge of the transplant patient towards a healthy diet must be strengthened. This should provide no more than 30% of calories from lipids. Emphasize the consumption of mono- and polyunsaturated fats, a low intake of saturated fats and trans fats. A reduced sodium intake of 2,300 mg/day is recommended, along with a high consumption of foods rich in fiber and complex carbohydrates.[29]

Nutritional support recommendations

Dialysis therapies cause the loss of nutrients, such as proteins, vitamins, and trace elements. The chronic low-grade inflammatory state, metabolic acidosis, and the presence of acute and chronic comorbidities contribute to an increase in protein catabolism. It is very frequent that nutritional supplementation is required to meet the recommendations. One strategy is the intake of meals or ONS during dialysis.[24-26]

Oral nutritional supplementation

Its use is considered when nutritional requirements cannot be met with the usual food intake, with the aim of preventing or recovering protein depletion.[29,30] It is necessary to evaluate the level of intake, the patient's appetite, whether there has been weight loss > 5% within the past 3 months, and an alteration of indicators, such as albumin < 3.8 g/dL or prealbumin < 28 g/mL.

It is possible to use standard supplements regularly. Specific supplements for kidney disease will be indicated in selected patients, for example, in those with electrolyte imbalances.

Specific ONS should be controlled for critical nutrients (phosphorus, sodium, and potassium) and in high caloric density volume (1.3-1.8 kcal/mL), with high biological value proteins, slow-absorption carbohydrates, and fats to complete the caloric value (mono- and polyunsaturated omega-3 fatty acids, low in saturated fats, and 0% trans fats), and fiber (at least 3 g per serving).

The administration and duration of supplementation should be indicated individually and re-evaluated every 1-2 months. In dialysis patients, ONS with higher protein content will be used, while in pre-dialysis, those with lower protein content will be used. In some cases, it is preferable to use protein modules or polymeric formulas.

Ready-to-drink or easy-to-reconstitute and good-tasting formulations are preferred and can be administered fractionally at the beginning to facilitate tolerance.

It is recommended to work hard on food education so that the use of the formula is a complement to the diet and not a meal replacement. There are different behaviors among centers regarding intradialytic feeding. In stable patients without complications and with adequate monitoring, it is recommended to administer an ONS during or after dialysis.

Enteral nutritional supplementation

In subjects who do not manage to cover 70% of the macronutrient recommendation with oral nutrition (food and ONS), nutritional support via the enteral route is recommended.[24,25]

Parenteral nutrition and intradialytic parenteral nutrition

In subjects with PEW, the use of total parenteral nutrition is suggested for patients with CKD 1-5 and the use of IDPN for those on HD when the intake achieved through the oral and enteral routes is insufficient, and as a short-term strategy, between 3 to 6 months.[31]

Nutritional approach algorithm for the CKD patient

To summarize, we have developed a nutritional algorithm (Fig. 3) that details all the steps to systematically perform the screening, evaluation, and management of patients who need nutritional supplementation.[32]

Conclusions

- CKD is a major public health problem in Latin America. The main causes are diabetes, high blood pressure, and Mesoamerican nephropathy, which is very important in our region.
- The representatives of the countries of Central America and the Dominican Republic in this consensus are clear that the participation and contribution of nutriologists and nutritionists are fundamental in the care of renal patients.
- In most countries in the region, there is no national renal health program, but each institution makes efforts for pre-dialysis care that includes the nutritional approach for patients.
- Nutritional care is very uncommon in pre-dialysis care and is more frequent in renal replacement therapy programs on dialysis.
- The number of specialists in nutrition for renal patients in the region is low, and although they are fully trained to perform their function, they are not sufficient due to the high demand that exists in all nephrology programs.
- Access to nutritional supplements is scarce in the different public programs that care for renal patients, both in pre-dialysis and in patients on renal replacement therapy.
- Despite the lack of resources and access to nutritional care programs, nephrology services and various specialists carry out honorable, scientific, and up-to-date work to improve the nutritional care of renal patients in their different stages. After sharing the reality of the different countries, the consensus participants developed a nutritional approach algorithm as a useful and practical tool to improve patient focus, diagnosis, and treatment.
- The members of this consensus developed recommendations for the nutritional management of patients with CKD stages 3-5, considering the different realities and contexts in which they work.

Recommendations

The consensus for the nutritional management of renal patients recommends implementing the developed algorithm as a practical proposal for the nutritional management of patients in a clinical setting.

- The training of nutrition professionals specialized in CKD is of paramount importance. It is suggested to start this training at the undergraduate level and deepen it in postgraduate studies, through intensive programs taught by universities and scientific societies. This will ensure a greater number of specialists in each country.
- It is fundamental to raise awareness throughout the health team about the relevance of nutritional status in the evolution and well-being of patients with CKD.
- It is recommended to conduct epidemiological studies to determine the prevalence of malnutrition in CKD patients. This data will be crucial to justify the need for specialized care, multidisciplinary human resources, and adequate materials.
- Every institution that cares for renal patients must implement a nutritional care protocol that includes evaluation, intervention, and short-, medium-, and long-term follow-up.
- It is essential to record data at a national level and present it to health authorities to make the problem visible and promote the implementation of cost-effective strategies to improve the nutritional status of these patients. Scientific societies should provide their support in this task.

Acknowledgments

To our patients for being our continuous source of need for the search for improvements in the care they receive.

Funding

Abbott Central America Laboratories provided sponsorship for the in-person and virtual meetings. However, they did not participate in the review of the content, selection of the material, drafting of the report, or in the submission of the manuscript for publication.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

Supplementary data

Supplementary data are available at DOI: 10.24875/NEFRO.25000014. These data are provided by the corresponding author and published online for the benefit of the reader. The contents of supplementary data are the sole responsibility of the authors.

References

1. GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2020;395(10225): 709-33.
2. Burgos-Calderon R, Depine SÁ, Aroca-Martínez G. Population kidney health. A new paradigm for chronic kidney disease management. Int J Environ Res Public Health. 2021;18(13):6786.
3. Luxardo R, Ceretta L, González-Bedat M, Ferreiro A, Rosa-Diez G. The Latin American Dialysis and Renal Transplantation Registry: report 2019. Clin Kidney J. 2022;15(3):425-31.
4. Vaidya SR, Aeddula NR. Chronic kidney disease [Internet]. Treasure Island (FL): StatPearls Publishing; 31 jul 2024. Available at: https://pubmed.ncbi.nlm.nih.gov/?term=4.%09Vaidya+SR%2C+Aeddula+NR.+-Chronic+Kidney+Disease+
5. Sanchez Polo V, Garcia Trabanino R, Rodriguez G, Madero M. Mesoamerican nephropathy (MeN): what we know so far. Int J Nephrol Renovasc Dis. 2020;13:261-72.
6. Laux TS, Barnoya J, Cipriano E, Herrera E, Lopez N, Polo VS, et al. Prevalence of chronic kidney disease of non-traditional causes in patients on hemodialysis in southwest Guatemala. Rev Panam Salud Publica. 2016;39(4):186-93.
7. Romagnani P, Remuzzi G, Glassock R, Levin A, Jager KJ, Tonelli M, et al. Chronic kidney disease. Nat Rev Dis Primers. 2017;3: 17088.
8. Carrero JJ, Thomas F, Nagy K, Arogundade F, Avesani CM, Chan M, et al. Global prevalence of protein-energy wasting in kidney disease: a meta-analysis of contemporary observational studies from the International Society of Renal Nutrition and Metabolism. J Ren Nutr. 2018;28(6): 380-92.
9. Carrero JJ, Stenvinkel P, Cuppari L, Ikizler TA, Kalantar-Zadeh K, Kaysen G, et al. Etiology of the protein-energy wasting syndrome in chronic kidney disease: a consensus statement from the International Society of Renal Nutrition and Metabolism (ISRNM). J Ren Nutr. 2013;23(2):77-90.
10. Chan W. Chronic kidney disease and nutrition support. Nutr Clin Pract. 2021;36:312-30.
11. Chao CT, Tang CH, Cheng RW, Wang MY, Hung KY. Protein-energy wasting significantly increases healthcare utilization and costs among patients with chronic kidney disease: a propensity-score matched cohort study. Curr Med Res Opin. 2017;33(9):1705–13.
12. Tyler R, Barrocas A, Guenter P, Araujo-Torres K, Bechtold ML, Chan LN, et al. Value of nutrition support therapy: impact on clinical and economic outcomes in the United States. JPEN J Parenter Enteral Nutr. 2020;44(3):395–406.
13. Philipson TJ, Snider JT, Lakdawalla DN, Stryckman B, Goldman DP. Impact of oral nutritional supplementation on hospital outcomes. Am J Manag Care. 2013;19(2):121–8.
14. Ruiz AJ, Buitrago G, Rodríguez N, Gómez G, Sulo S, Gómez C, et al. Clinical and economic outcomes associated with malnutrition in hospitalized patients. Clin Nutr. 2019;38(3):1310–6.
15. Sriram K, Sulo S, van der Bosch G, Partridge J, Feldstein J, Hegazi RA, et al. A comprehensive nutrition-focused quality improvement program reduces 30-day readmissions and length of stay in hospitalized patients. JPEN J Parenter Enteral Nutr. 2017;41(3):384–91.
16. Buitrago G, Vargas J, Sulo S, Partridge JS, Guevara-Nieto M, Gomez G, et al. Targeting malnutrition: nutrition programs yield cost savings for hospitalized patients. Clin Nutr. 2020;39(9):2896–901.
17. Pérez-Torres A, González E, Bajo MA, Palma Milla S, Sánchez-Villanueva R, Bermejo LM, et al. Evaluación de un programa de intervención nutricional en pacientes con enfermedad renal crónica avanzada (ERCA). Nutr Hosp. 2013;28(6):2252–60.
18. Songer T, Caggiula A, Ettaro L, Olson M, Larsen D; American Dietetic Association. Cost-effectiveness of nutrition therapy in the MDRD study [Internet]. Available from: http://www.pitt.edu/~tjs/mdrd/mdrd.pdf
19. Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO 2020 Clinical Practice Guideline for management in chronic kidney disease. Kidney Int. 2020;98(4 Suppl 1):S1–337.
20. Rodríguez-Chávez LA, Ramírez-Pachamango S, Rodríguez-Mendoza CRE. Frecuencia de desnutrición en pacientes adultos con enfermedad renal crónica grado V en hemodiálisis. Rev Peru Med Exp Salud Publica. 2024;41(4):399–404.
21. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN J Parenter Enteral Nutr. 1987;11:8–13.
22. Kalantar-Zadeh K, Kopple JD, Block G, Humphreys MH. A malnutrition-inflammation score is correlated with morbidity and mortality in maintenance hemodialysis patients. Am J Kidney Dis. 2001;38(6):1251–63.
23. Fouque D, Kalantar-Zadeh K, Kopple J, Cano N, Chauveau P, Cuppari L, et al. A proposed nomenclature and diagnostic criteria for protein-energy wasting in acute and chronic kidney disease. Kidney Int. 2008;73(4): 391–8.
24. Ikizler TA, Burrowes JD, Byham-Gray LD, Campbell KL, Carrero JJ, et al. KDOQI Clinical practice guideline for nutrition in CKD: 2020 update. Am J Kidney Dis. 2020;76(3 Suppl 1):S1-S107.
25. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Int. 2024;105(4S):S117-S314.
26. Fiaccadori E, Sabatino A, Barazzoni R, Carrero JJ, Cupisti A, De Waele E, et al. ESPEN guideline on clinical nutrition in hospitalized patients with acute or chronic kidney disease. Clin Nutr. 2021;40(3):1644-68.
27. Chan M, Patwardhan A, Ryan C, Trevillian P, Chadban S, Westgarth F, et al. Evidence-based guidelines for the nutritional management of adult kidney transplant recipients. J Ren Nutr. 2011;21(1):47-51.
28. Anderson C, Nguyen H, Rifkin D. Intervención nutricional en enfermedad renal crónica. Clin Med North Am. 2016;100(6):1265-83.
29. Ikizler TA, Cano NJ, Franch H, Fouque D, Himmelfarb J, Kalantar-Zadeh K, et al. Prevention and treatment of protein energy wasting in chronic kidney disease patients: a consensus statement by the International Society of Renal Nutrition and Metabolism. Kidney Int. 2013;84(6):1096-107.
30. Losappio V, Infante B, Leo S, Troise D, Calvaruso M, Vitale P, et al. Nutrition-based management of inflammaging in CKD and renal replacement therapies. Nutrients. 2021;13(1):267.
31. Jadeja YP, Kher V. Protein energy wasting in chronic kidney disease: An update with focus on nutritional interventions to improve outcomes. Indian J Endocrinol Metab. 2012;16(2):246-51.
32. Kistler BM, Benner D, Burrowes JD, Campbell K, Fouques D, Garibotto G, et al. Eating during hemodialysis treatment: a consensus statement from the International Society of Renal Nutrition and Metabolism. J Ren Nutr. 2018;28(1):4-12.

ORIGINAL ARTICLE

Results of a survey on accessibility to renal care in Latin America

Resultados de una encuesta sobre accesibilidad a los cuidados nefrológicos en Latinoamérica

Santiago Torales[1], Leticia Botta[2], Florencia Rossi[2], María Oliver[2], and Lucía Perdomo[2]*

[1]Comité de Economía, Sociedad Latinoamericana de Nefrología e Hipertensión, Ciudad de Panamá, Panamá; [2]Departamento de Investigación, Agencia de Evaluación de Tecnologías Sanitarias de Uruguay, Montevideo, Uruguay

Abstract

Introduction: *Access to renal care in Latin America shows significant disparities. To better understand these barriers, a tool was developed and implemented to collect nephrologists' perspectives on access to renal care in the region.* **Material and methods:** *A survey comprising 52 questions/4 dimensions (health coverage; care setting; access to diagnostic/therapeutic technology; renal replacement characteristics) was distributed online (to selected nephrologists/18 countries); certainty per dimension was assessed and correlated with socioeconomic variables using Microsoft Excel® (descriptive) and JASP® (probabilistic).* **Results:** *Over 94 responses (mean = 5.2/country) the mean certainty was 3.93/5 points (lower for human resources, higher for regulations and access to technologies in private subsector). Public healthcare funding predominates (65%), coexisting with cross-coverage; availability of professionals were divergent between countries (lower in the public subsector); 70% reported integrated nephrology guidelines (many under development), the registries show asymmetric evolution (37% consolidated, 19% unregistered), 50% cited renal care programs, and 53% reported current transplant laws; diagnostic/therapeutic technology (even basic) was less available in the public sector, correlating with lower economic development and healthcare spending; the private sector does not adequately meet the remaining demand.* **Conclusion:** *Obtaining validated information from nephrologists is crucial, to provide decision-makers with concrete elements to develop public policies on kidney health. The developed tool is replicable and scalable for new, more representative and specific studies in different subregions or countries.*

Keywords: *Accessibility. Renal care. Health policies. Socioeconomic determinants.*

Resumen

Introducción: *El acceso a la atención renal en América Latina presenta importantes desigualdades. Para comprender mejor estas barreras, se desarrolló e implementó una herramienta para recopilar las opiniones de nefrólogos sobre la accesibilidad a la atención renal en la región.* **Material y métodos:** *Encuesta con 52 preguntas en 4 dimensiones (cobertura; marco de atención; acceso a tecnología diagnóstica/terapéutica; características de reemplazo renal) distribuida online a nefrólogos seleccionados (18 países); se evaluó certeza de respuestas por dimensión correlacionando con variables socioeconómicas mediante Microsoft Excel® (descriptivo) y JASP® (probabilístico).* **Resultados:** *Hubo 94 respuestas (media = 5,2/país), certeza media = 3,93/5 puntos (menor en recursos humanos, mayor para normativas y acceso a tecnologías en el subsector privado).*

***Correspondence:**
Santiago Torales
E-mail: santiago.torales@gmail.com

Date of reception: 25-02-2025
Date of acceptance: 07-05-2025
DOI: 10.24875/NEFRO.25000003

Available online: 06-07-2026
Nefro Latinoam. 2026;23(2):69-80
www.nefrologialatinoamericana.com

How to cite: Torales S, et al. Results of a survey on accessibility to renal care in Latin America. Nefro Latinoam. 2026;23(2):69-80. doi: 10.24875/NEFRO.25000003

Predomina la salud pública (65%) coexistiendo coberturas cruzadas; las tasas de profesionales resultaron divergentes entre países (menor disponibilidad en el subsector público); 70% refirió guías nefrológicas integradas (muchas en desarrollo), los registros presentan evolución asimétrica (37% consolidados, 19% sin registro), 50% citó programas renales y 53% refieren leyes de trasplante vigentes; la tecnología diagnóstica/terapéutica (incluso básica) tuvo menor disponibilidad en el subsector público, correlacionando con menor desarrollo económico y gasto sanitario; el subsector privado no cubre la demanda remanente. **Conclusión:** *consideramos importante obtener información experta generada por los nefrólogos, para aportar herramientas concretas a decisores para construir políticas públicas en salud renal. La herramienta es replicable y escalable para nuevos estudios más representativos y específicos en diferentes subregiones o países.*

Palabras clave: *Accesibilidad. Atención nefrológica. Políticas sanitarias. Determinantes socioeconómicos.*

Introduction

A growing body of evidence demonstrates the progressive evolution in the incidence and prevalence of chronic kidney disease (CKD) and its end-stage phases requiring renal replacement therapies (RRT) such as dialysis or transplantation. This implies high rates of morbidity and mortality in populations, posing significant economic challenges for families and countries.[1-3] Almost a billion people live with CKD worldwide: data from systematic reviews[4] estimate a global prevalence of CKD at 13.4% (95%CI, 11.7-15.1), and the magnitude of its impacts, not only clinical or organizational but also social and economic, increases in low and middle-income countries,[5-7] leading to inequitable access to renal care. While Latin America is characterized by countries sharing common historical and cultural traits, they exhibit asymmetries in geographical features, socioeconomic development, and equity in their health systems to confront CKD.[8-10] Potential differences in access between urban and rural areas within countries[11] are not always adequately explored in global renal service reports.[8]

Different studies on these topics have been developed in recent decades globally and regionally, driven by projects emerging from scientific and civil society along with international organizations.[12-14] This work was promoted by the Presidency of the Latin American Society of Nephrology and Hypertension (SLANH), convening two of its Scientific Committees for the 2024 International Society of Nephrology Congress: the aim was to update available information on this topic from the perspective of nephrologists in the region, inquiring about relevant topics concerning the organization and accessibility of renal care in their respective countries; furthermore, it aimed to establish the level of certainty perceived by the respondents themselves regarding the information they provided, and complementarily determine the correlation of the responses with particular socioeconomic characteristics of their countries.

Materials and methods

A 52-question multiple-choice survey was developed, adapting the World Health Organization (WHO) Survey Assessment model on the National Capacity Profile in Noncommunicable Diseases (NCDs); this is used to estimate the availability of goods and services in NCD care and has produced 8 consecutive reports with 160 participating countries from 2001 to the present.[15] The survey contents were agreed upon and validated with the participation of 7 members of SLANH Committees (Economy and Renal Health), and sent to be completed by Latin American nephrologists, selected and contacted through direct intervention of the SLANH Presidency with scientific societies from 18 countries in the region.

The instructions were thematically grouped to gather information about 4 dimensions of renal care: estimation of population health coverage (1); context for CKD care covering human resources (2A) and regulatory framework (2B); access to diagnostic and therapeutic technology in the public (3A) or private (3B) subsectors; and characteristics of RRT services (4), with a final section for comments and specific contributions (see ANNEX).

To enhance access to the survey within the short timeframe available for analysis and presentation (from early March through mid-April 2024), it administered online via a Google Forms® survey, initially distributed by email to the selected recipients, and complementarily expanded to public health decision-makers in each country until a population of final responses was obtained by a “snowball” method.

To estimate the consistency of provided responses a general question was added for each dimension concerning to the perceived level of certainty the respondent had, valued on a 5-point Likert scale. Each country was considered to have high consistency in responses when it was ranked among the top 5 with the highest perceived certainty in the opinions of their participants (> 70%).

Table 1. Estimated country prevalence of patients and treatment units per million people by renal replacement therapy modality

Country	Population (PMP)	HD Patients (PMP)	PD Patients (PMP)	TX Patients (PMP)	HD Units (PMP)	PD Units (PMP)	TX Units (PMP)	Certainty level
Argentina	45.8	638	73	199	10.6	2.4	1.1	4.2
Bolivia	12.4	365	5	24	3.9	0.8	0.7	3.4
Brazil	216.4	693	37	231	4.6	1.2	0.7	3
Chile	19.6	1224	77	230	13.3	1.5	1.0	4.6
Colombia	52.7	512	184	65	2.9	1.0	0.3	3.8
Costa Rica	5.2	58	231	288	1.5	2.3	1.0	4
Ecuador	18.2	1044	33	22	4.4	0.8	1.1	4
El Salvador	6.3	476	635	159	4.0	1.6	0.3	3.2
Guatemala	18.9	423	185	42	1.6	0.5	0.2	4
Honduras	10.6	377	24	8	1.9	0.3	0.2	4.3
Mexico	128.4	312	327	210	2.7	2.8	0.8	3.5
Nicaragua	7.1	563	42	21	2.8	0.9	0.4	3.5
Panama	4.5	667	167	111	4.9	2.2	0.7	3.6
Paraguay	6.1	410	21	46	3.6	1.2	0.5	3.6
Peru	34.3	496	52	44	7.3	0.9	0.4	3.3
Dominican Republic	11.3	336	111	35	9.7	1.3	0.4	4.4
Uruguay	3.4	882	82	426	11.8	2.1	1.2	4

PMP: per million people; HD: hemodialysis; PD: peritoneal dialysis; TX: kidney transplant.

Complementarily, 3 specific socioeconomic variables explored in previous publications on RRT[16] were selected: gross domestic product adjusted per purchasing power parity (GDP PPP), percentage of population in extreme poverty, and percentage of health expenditure per country. These were correlated with the most frequently obtained responses in each country regarding key questions for each dimension, using Pearson's coefficients (r) for continuous variables and Spearman's (ρ) for categorical variables (statistical significance = $p < 0.05$). The data obtained were consolidated for a general analysis limited to descriptive statistics using Microsoft Excel®, while the JASP® tool was used for correlation analyses with socioeconomic variables.

Results

A total of 94 responses were obtained from the 18 participating countries (Table 1) with an average of 5.2 responses per country (range: 2 to 11); 74.3% representing the country's Nephrology Society and 25.7% corresponds to other organizations.

Estimation of response certainty

The perceived overall certainty level for the responses was medium-to-high, with an average of 3.93 (out of 5) points. In the evaluation by dimension, a lower level of certainty was observed for data related to human resources, whereas the higher certainty was found about knowledge of regulations (Fig. 1). Bolivia, Panama, Paraguay, and Peru were the countries with the greatest uncertainty in their opinions, while Honduras, Nicaragua, Dominican Republic, and Uruguay had a higher perception of certainty in the provided responses.

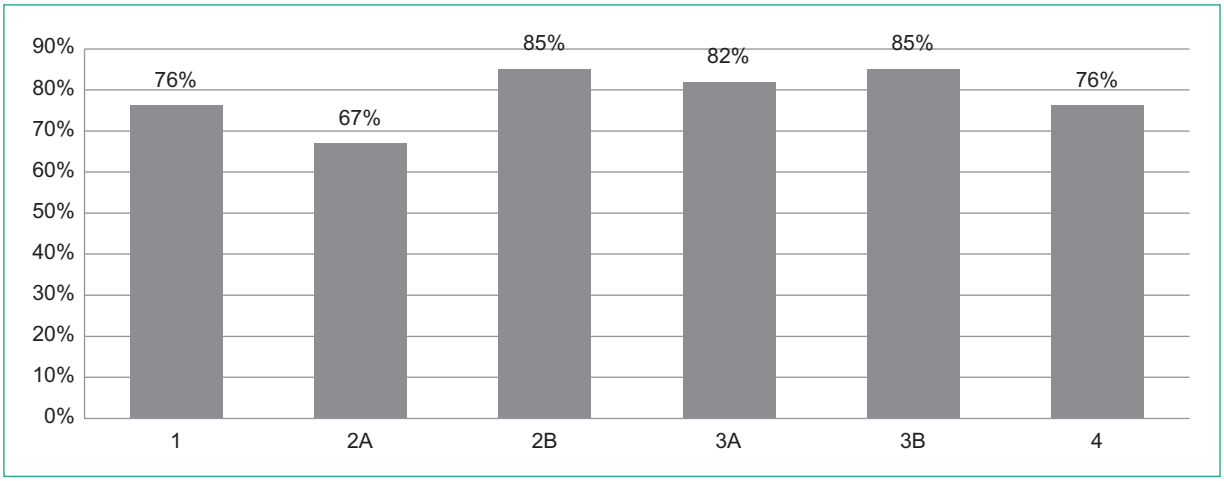

Figure 1. General certainty level of responses (%) based on each surveyed dimension and sub-dimension: **1:** estimation of health coverage in the population. **2A**: framework for chronic kidney disease care, divided into human resources. **2B**: regulatory framework. **3A**: access to diagnostic and therapeutic technology, (public subsector). **3B**: access to diagnostic and therapeutic technology, (private subsector). **4**: characteristics of renal replacement treatment services.

Analysis by evaluated dimensions

Dimension 1: Estimated healthcare coverage

a predominance of public subsector coverage (65%) was evident, surpassing social security (42%) and the private subsector (23%) according to the averaged opinions reflected in the responses. The final proportional values exceed unity due to the phenomenon of overlapping coverage among the subsectors, which was observed in all countries.

Dimension 2: Framework for CKD care

A) Human resources

Based on the responses, the rate of nephrologists per million people (pmp) per country was estimated. Regarding the availability of professionals needed for renal care (Fig. 2), the values were generally similar for the three selected professions (nephrologist, nutritionist, and vascular surgeon, with a greater shortage of the latter). In the case of nephrologists, supply is greater in the private subsector than in the public (although the private sector also has a deficit, as only 63% believed that nephrologists are available in more than half of the subsector's facilities). Continuing the comparison by health system subsectors, the global supply of professionals (evaluated as "personnel available in more than half of the services") was higher in the private vs. public subsector (61% vs. 21%). Finally, the need for additional out-of-pocket payments was greater in the private subsector, although the requirement for payments (full or partial) for vascular surgery procedures was also observed in the public subsector (27% of opinions).

B) Regulatory framework

Although most countries have integrated nephrology guidelines at the initial levels of medical care, most of them (71%) are still in the development or initial implementation stage. Regarding the existence of patients registries for RRT, 37% of responses indicated the existence of information from these in an advanced information systems, while 19% indicated that no registry exists. Concerning the existence of a renal health program prior to RRT, in 50% of responses indicated that, they do not exist or are in an initial implementation stage. Half of the responses confirmed the existence of specific current laws or a coordinating body and renal transplant regulations at the country level (Fig. 3).

Dimension 3: Access to diagnostic and therapeutic technology

A) Public sector

Regarding diagnostic methods, a clear difference was observed between the subsectors, with availability being markedly lower in the public subsector generally, but particularly for basic methods such as estimated

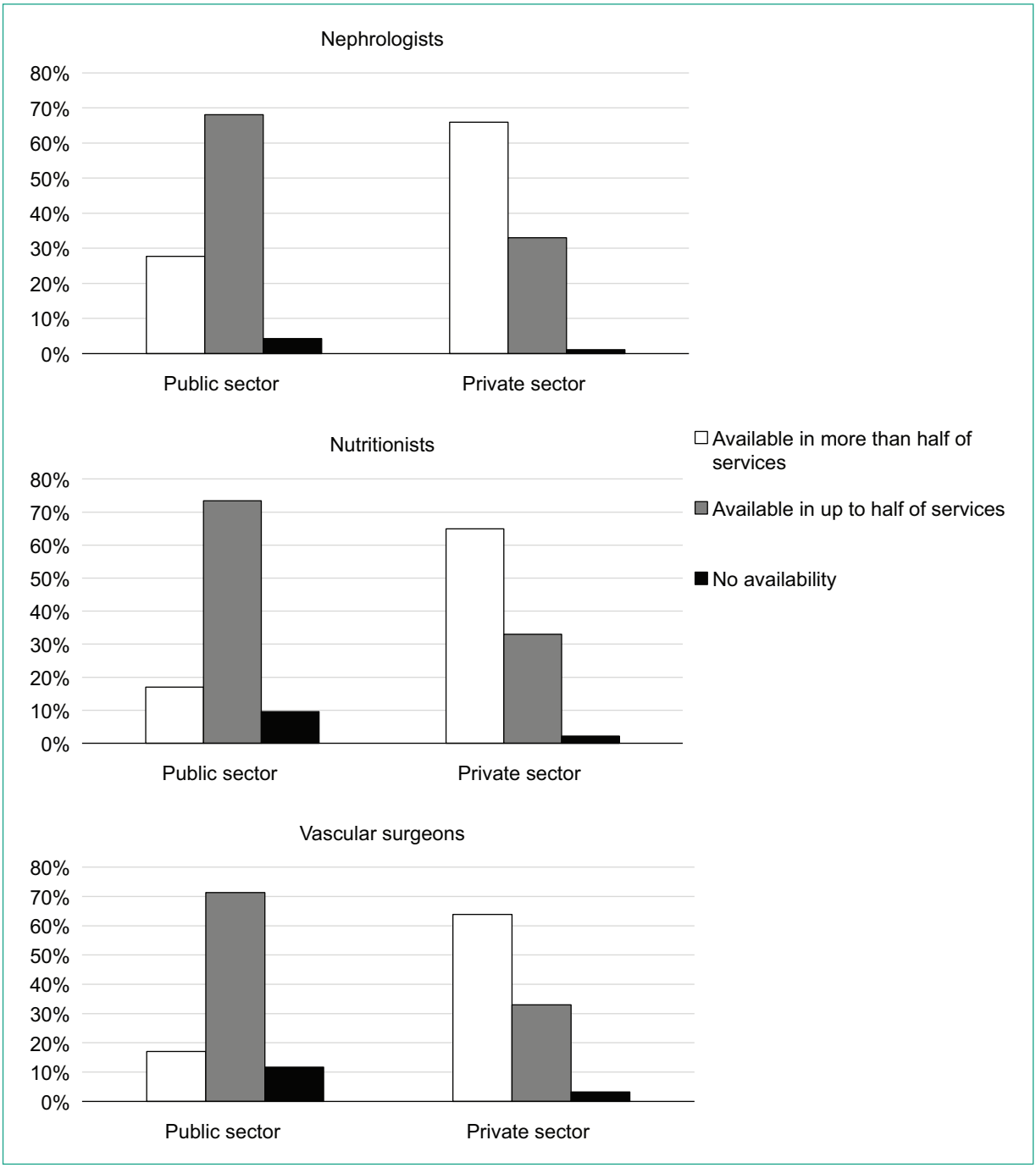

Figure 2. Estimated availability of nephrologists, nutritionists, and vascular surgeons for the public and private sectors of the healthcare system: White: available in more than half of services. Gray: available in less than half of services. Black: no availability.

glomerular filtration rate (eGFR) reports, quantitative proteinuria, albuminuria, renal and urinary tract ultrasound, and renal citopathology (Fig. 4).

Regarding pharmacological therapeutic alternatives, public health presents specific shortages of basic renal medications such as those related to bone metabolism, anemia treatment, or immunosuppressants; the gap is greater for advanced options such as calcitriol, sevelamer, cinacalcet, or sodium-glucose cotransporter type 2 (SGLT2) inhibitors (Fig. 5). Even within public coverage, it is estimated that 23% make full or partial payments to access drugs.

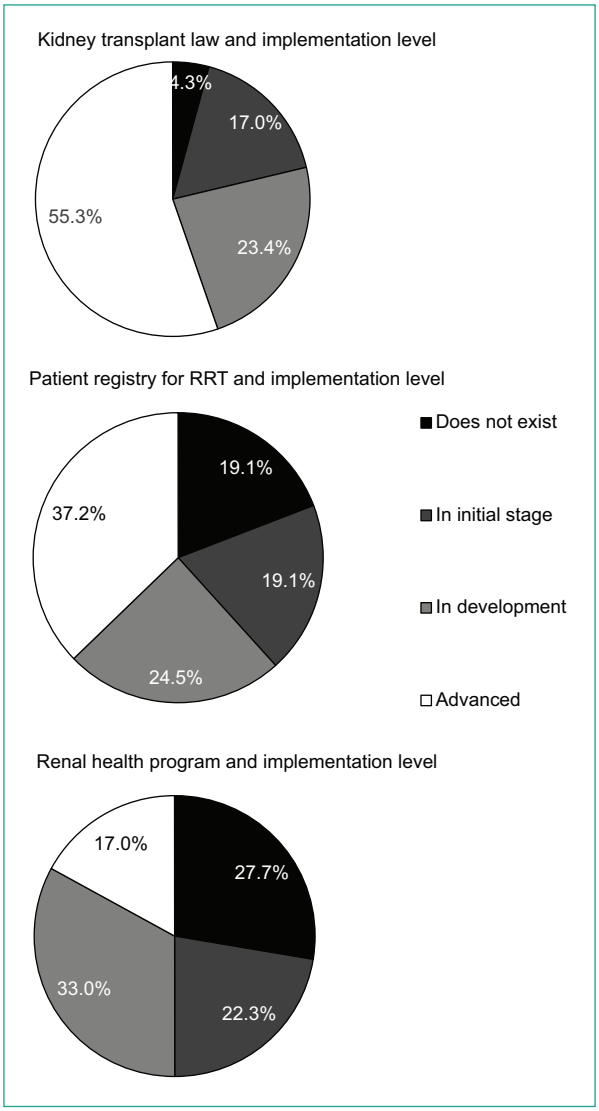

Figure 3. Regulatory framework and its implementation levels: White: advanced. Light gray: in development. Dark gray: in initial stage. Black: does not exist.

B) Private sector

Although diagnostic methodologies were more present in this subsector, their availability is not absolute, and high out-of-pocket payments are required for access. Access to drug alternatives was markedly superior to public health, although some groups still had lack of access (calcitriol, sevelamer, cinacalcet, SGLT2 inhibitors), with higher additional out-of-pocket payments reported (86.2% of opinions). Asymmetry between subsectors was also evidenced on the availability of advanced therapeutic devices (double high-flux hemodialysis, automated peritoneal dialysis (APD), and continuous renal replacement therapies (CRRT)), with supply predominantly in the private subsector (Fig. 6).

Regarding immunosuppression, complete coverage appears to be lacking in initial and late stages of transplant (45%, similar between subsectors), while vaccine access is satisfactory (85% for HBV vaccine and 90% for COVID-19, pneumococcal, and flu vaccines) in both the public and private subsectors.

Dimension 4: Characteristics of RRT services

The received information was consolidated and expressed per million people per country (Table 1) and contrasted with data from registries as of 2019 by country, revealing some differences. Regarding particular access characteristics, it is noteworthy that peritoneal dialysis bags are sent to the patient's home in only 58% of cases (similar in public and private subsectors), while transportation for treatments and/or follow-up controls is mostly at the patient's expense (70% of cases). Moreover, both recipient studies for transplant and living donor studies are mostly covered by out-of-pocket expenses in the private subsector, although in the public sector this also occurs in up to 28% of cases (Fig. 7).

Correlation with socioeconomic variables

Correlations were found for specific dimensions and topics with different levels of relevance (Table 2): the preponderance of public health coverage in the region showed no correlation with the wealth level or health expenditure of the countries. However, within this subsector, both diagnostic methods (eGFR, proteinuria, and disease) and pharmacological treatments (ARA2 and statins, calcitriol, cinacalcet and sevelamer, IV Fe2+, and erythropoietin in RRT, and immunosuppressants such as mycophenolate mofetil and cyclosporine-tacrolimus) and high-complexity procedures (APD and CRRT) is greater in countries with higher wealth and healthcare expenditure. A correlation was observed between greater wealth (and less poverty) and the development of renal TX laws, and fewer out-of-pocket payments were registered for pre-TX studies (recipient and donor) in countries with higher health expenditure. Finally, accessibility in the private sector would have a similar distribution of access among countries, with no significant differences for these socioeconomic variables.

Discussion

Since the beginning of the current millennium, increasing attention from the nephrological scientific community

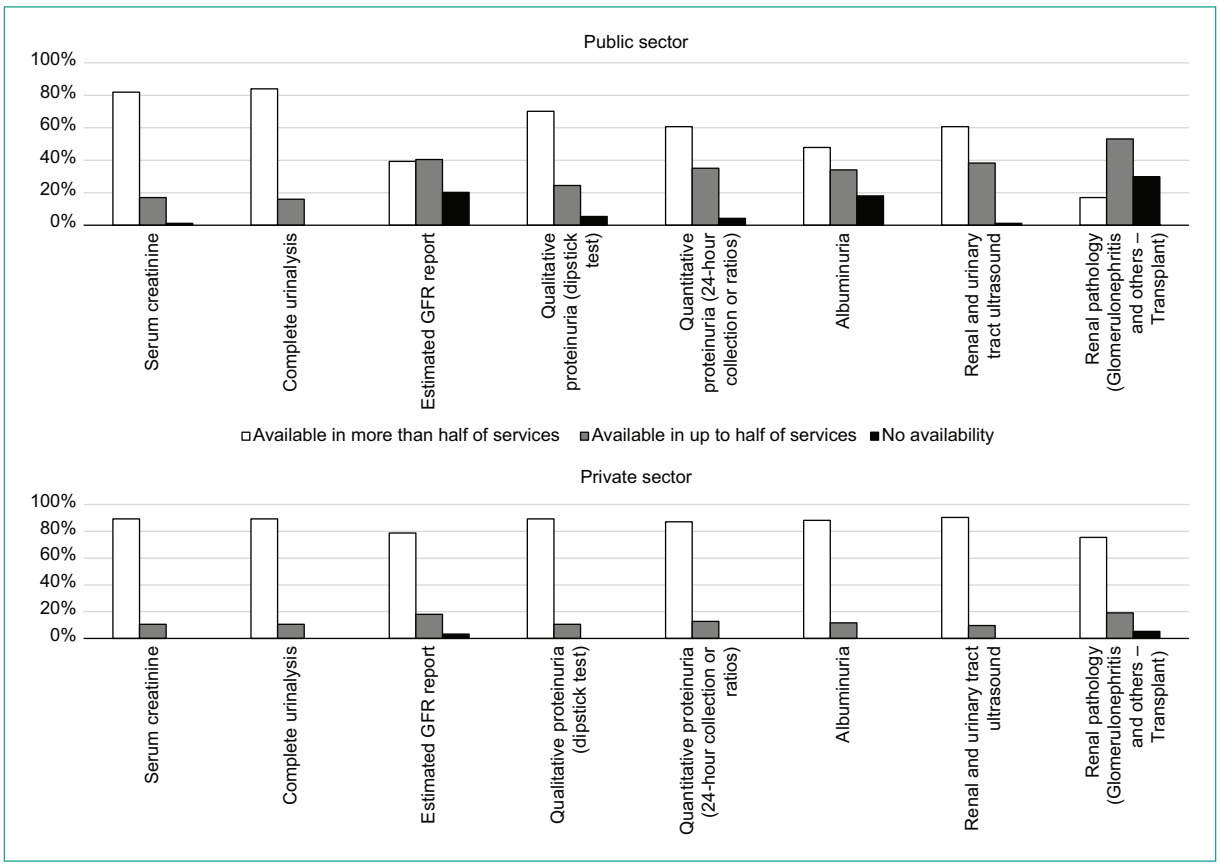

Figure 4. Diagnostic methods available in public and private institutions: White: available in more than half of services. Gray: available in less than half of services. Black: no availability. GFR: glomerular filtration rate.

has been oriented towards addressing issues related to access to care and equity in resource use through forums and publications.[1-3,5-7,10,13] This conceptual shift alters the path followed over the last 50 years by Nephrology, focused on promoting and disseminating innovative therapeutic alternatives (from RRT to pharmacological interventions such as ACE inhibitors or immunosuppressants) for patient care, affected by a clearly visible and debilitating disease in social and health terms. Much of this development was sustained by a conglomerate of global technological production and marketing,[17] which began to encounter limitations due to budgetary restrictions of health systems facing different health priorities. At the same time, new evidence emerged regarding interventions in prevention and adequate management of CKD as the most efficient alternatives,[4,18,19] although these have taken a backseat likely due to the limited interaction of nephrologists with primary care levels, the inherent complexity of patients population, and a therapeutic focus oriented towards incentivizing the supply and care of patients through RRT in the end stages of the disease.[20]

Through a joint effort of SLANH scientific committees, a consensus was reached on the construction and internal validation of a survey aimed at capturing characteristics regarding the accessibility of nephrological care in the region. Distributed online, it achieved significant participation with 94 responses from 18 countries, with 74.3% representing nephrology societies, surpassing some recent works on this topic in terms of representativeness by volume.[8] The tool also aimed to generate a self-assessment by respondents on the level of certainty they felt when answering it.[21] Despite a high overall average reliability (79%), a wide asymmetry of knowledge on relevant topics or between countries was evidenced, and even more so in divergent opinions within each country: in this sense, data related to human resource endowment presented the greatest inaccuracies, while the highest level of certainty was concentrated in the regulatory framework and the supply of access to diagnostic and therapeutic technology in the private subsector. This is relevant, as proposals for improvement from the nephrological community to decision-makers would require homogeneous data to guide

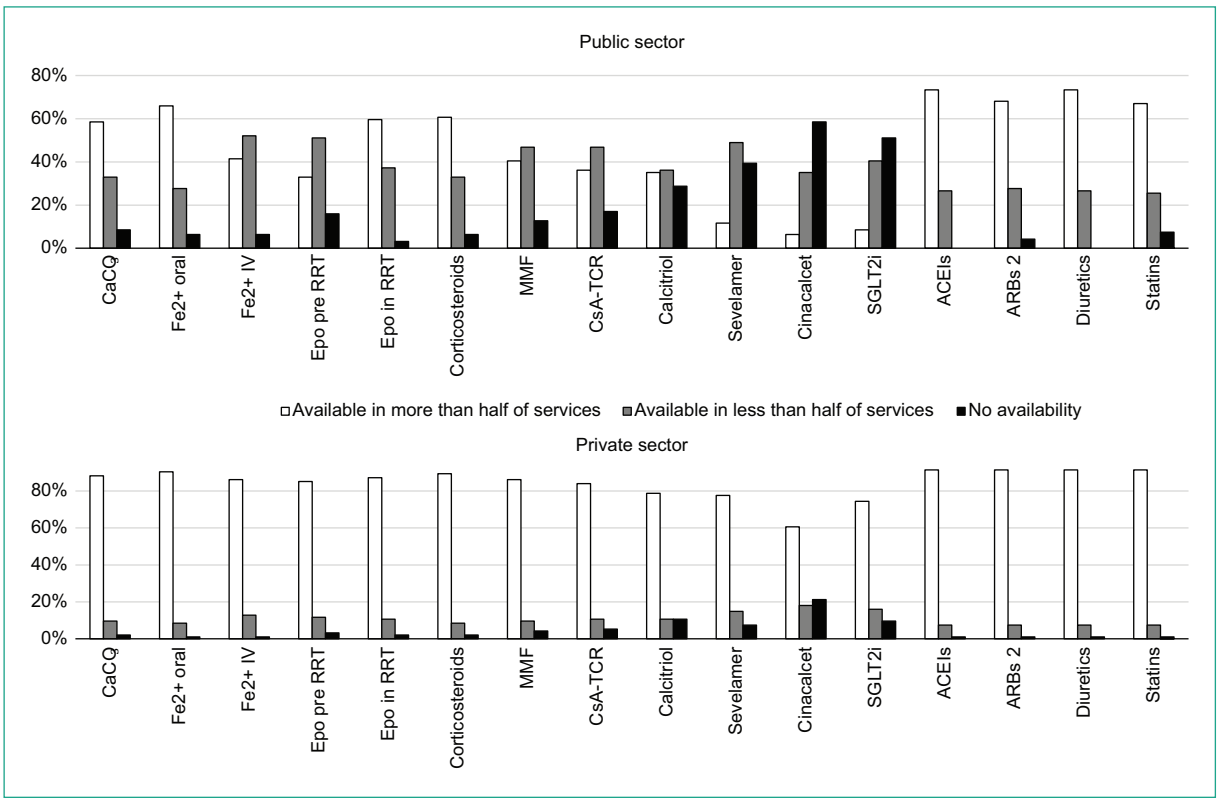

Figure 5. Access to medications in the public and private sectors. White: available in more than half of services; Gray: available in less than half of services; Black: no availability; $CaCO_3$: calcium carbonate; Fe2+: iron; Epo: erythropoietin; RRT: renal replacement therapies; MMF: mycophenolate mofetil; CsA-TCR: cyclosporine-tacrolimus; SGLT2i: sodium-glucose cotransporter type 2 inhibitors; ACEIs: angiotensin-converting enzyme inhibitors; ARBs 2: angiotensin II AT1 receptor blockers.

discussions based on accurate data. It could be argued that the inconsistency in the data of nephrological discourse could be an unexplored barrier that limits the implementation of effective public policies, a factor that is modifiable through adequate analysis by scientific societies. In this sense, the development and dissemination of adequate registries[22] and reliable information are the core of effective healthcare management.

Regarding the particular analysis by the considered dimensions, the average of responses showed the preponderance of exclusive public subsector coverage (65%, that supported by full public funding), above social security (42%) and the private subsector (23%) which would act as the counterpart of funding and service provision, consistent with preliminary publications.[8,10] This phenomenon of cross-coverage is a hallmark of segmented and fragmented health systems in the region, being a potential source of loss of efficacy and efficiency in the health policies required for the care of chronic diseases.[18]

The estimation of nephrologists (per million people) showed high heterogeneity: this point is crucial given regional and global evidence on the current and future shortage of specialists;[22] the results obtained also differ from those available in the Latin American Dialysis and Transplant Registry 2019,[23] and other recent published studies,[7,15] underscoring the need for updated and adequately disseminated information on this problem. As a relevant topic, the supply of nephrologists appears to be greater in the private subsector (albeit with shortages of up to 37%) than in the public. Deficits and asymmetries also extend to the analysis of the other surveyed professions, with particular emphasis on the lack of sufficient surgeons for the vascular access procedures. The public sector is again the most neglected with a global presence of professionals (evaluated as "personnel available in more than half of the services") 50% lower than that the private subsector: Evidently, through market mechanisms, supply seems to position itself where economic access is concentrated, but with

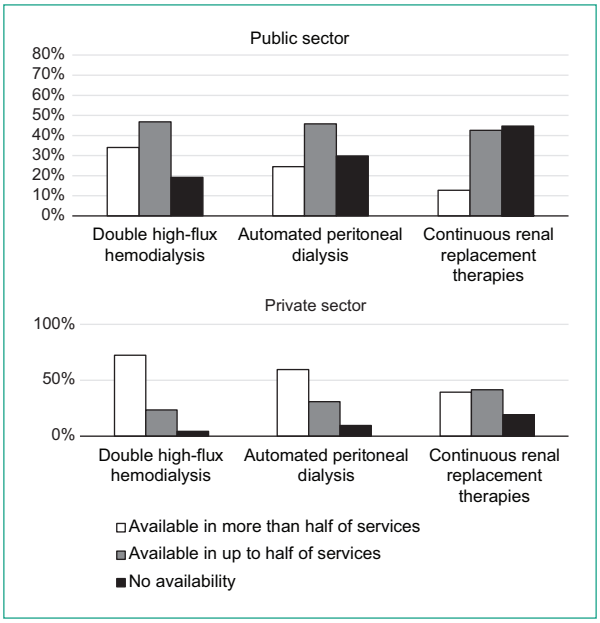

Figure 6. Availability of advanced therapeutic devices in the public and private sectors. White: available in more than half of services; Gray: available in up to half of services; Black: no availability.

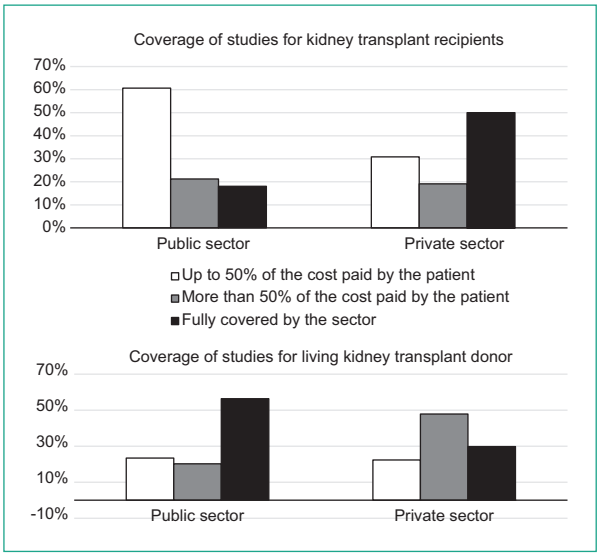

Figure 7. Coverage of recipient studies and living donor studies for renal transplant, for the public and private sectors. White: patient-covered in > 50% of cases; Gray: patient-covered in up to 50% of cases; Black: fully covered by the sector.

an increase in the prices of services. Even healthcare practices within the public system additional out-of-pocket expenses for patients were evidenced (e.g., vascular access surgeries). It is imperative to divise management and financing mechanisms based on efficient incentives to modify this paradigm of inequity in access, in a region clearly marked by public health coverage, that fails to maintain the basic balances in effective human resources, needed to integrate interdisciplinary teams to supply nephrological care with other specialties and professions.[18]

Regarding the regulatory framework, general advances were evidenced in nephrological guidelines integrated with initial healthcare levels, patient registries for RRT, and an incipient development of renal health programs, although with marked differences in terms of development and evolution between countries: disseminating effective strategies from scientific and academic communities, based on institutional agreements, sharing results and advances from those with greater experience towards more needy regions would be a necessary step,[24] particularly concerning the legal aspects of renal transplantation.

The chapter on access to diagnostic and treatment technology is perhaps the most relevant of this study, given that it had a high level of certainty in opinions, showing the existing asymmetries between the opportunities of the subsectors. In relation to diagnostic methods, public health suffers from an evident lack of supply in those methods for developing preventive programs[4] (e.g., automated eGFR reporting and quantitative proteinuria, albuminuria, and renal ultrasound), or specific alternatives such as renal pathology service (also widely lacking even in the private subsector in some countries).

In relation to treatments, usual nephrological drugs (e.g., antihypertensives, bone metabolism management, or anemia) would be available in more than half of public health centers for only 32% according to respondents, as would basic immunosuppressants related to kidney transplant: in this context, it seems utopian to consider access to more advanced therapeutics (e.g., cinacalcet, sevelamer, SGLT2 inhibitors) when basic drug shortages cannot be resolved, or else it would occur by increasing the already pronounced lack of equity. While the private subsector would generally offer more access to these alternatives, availability is also incomplete, even with high out-of-pocket co-payments. A similarly concerning reality is the continued and effective access to transplant immunosuppressive treatment: the survey evidenced situations of incomplete coverage (even in early stages), when it should be primarily guaranteed to maintain the efficacy of this therapy, whose best cost-effectiveness profile is achieved with adequate graft survival rates.[25]

Table 2. Correlations with selected socioeconomic variables, by dimension and topic

Dimension	Theme	GDP adjusted PPP ρ (p-value)	Total health expenditure (% GDP)	% Extreme poverty ρ (p-value)
Healthcare coverage	% Public subsector	NS	NS	NS
Care framework	Available professionals	NS	NS	NS
Regulations	Renal TX Law	0.880 (< 0.001)	NS	–0.494 (0.037)
Access to diagnostic methods (Public sector)	Estimated GFR	0.490 (0.039)	0.495 (0.044)	–0.562 (0.015)
	24-hour proteinuria	NS	0.525 (0.025)	NS
	Albuminuria	0.594 (0.012)	NS	NS
	Citopathology	0.546 (0.023)	0.476 (0.046)	NS
	ARB2 blockers	0.580 (0.015)	NS	–0.477 (0.045)
	Statins	0.505 (0.039)	NS	–0.515 (0.029)
	Calcitriol	0.573 (0.016)	NS	NS
Access to drugs (Public sector)	Sevelamer	0.598 (0.011)	NS	NS
	Cinacalcet	0.560 (0.019)	NS	NS
	IV Fe2+	0.631 (0.007)	NS	–0.530 (0.024)
	Epo in RRT	NS	0.496 (0.036)	NS
	MMF	0.808 (0.001)	0.608 (0.007)	–0.728 (0.001)
	CsA- TCR	0.667 (0.003)	NS	–0.481 (0.044)
Access to complex procedures (Public sector)	APD	NS	0.471 (0.049)	NS
	CRRT	0.650 (0.005)	NS	NS
Access to RRT (Public sector)	Payment for recipient TX tests	NS	–0.659 (0.003)	0.461 (0.050)
	Payment for donor TX tests	NS	–0.636 (0.005)	0.419 (0.083)
Access to RRT (Private sector)	Payment for donor TX tests	NS	–0.610 (0.007)	NS

GDP: gross domestic product; PPP: purchasing power parity; NS: Not significant; TX: transplant; GFR: glomerular filtration rate; ARB2: angiotensin II AT1 receptor blockers; Fe2+: Iron; Epo: erythropoietin; RRT: renal replacement therapy; MMF: mycophenolate mofetil; CsA- TCR: cyclosporine tacrolimus; APD: automated peritoneal dialysis; CRRT: continuous renal replacement therapies.

According to opinions gathered in the survey comments, in some countries, coverage extends only up to the first year post-transplant, after which drug purchase is largely at the patient's expense. Only the item of vaccine access escapes these asymmetries, with high availability and no differences between subsectors throughout the region. Finally, differences between countries and subsectors continued to be evidenced regarding access to advanced therapeutic options such as double/high-flux hemodialysis, APD, and CRRT, which (even with incomplete availability) were again more covered by the private subsector.

The last dimension evaluated corresponded to the availability of chronic RRT. The information compared regarding patients and units pmp showed some significant differences with reference reports,[8,16] probably explained by the higher mortality recorded during the COVID-19 pandemic[26] in renal patients, the progressive activation of new services, or the potential lack of certainty in the survey responses. Delving into specific service details, in most cases peritoneal dialysis supplies are delivered to the patient's home, although a significant fraction must arrange their own collection from centralized hospital pharmacies, potentially leading to a lack of continuity and efficacy in treatments. Regarding mechanisms to guarantee patient transportation for frequent treatments such as hemodialysis or necessary follow-up controls in clinical consultation (CKD, PD, or TX), these mostly fall under out-of-pocket expenses, which can also lead to significant losses of therapeutic

efficacy due to missed sessions or consultations. Finally, access to evaluation studies to determine the suitability of individuals for a transplant (both recipient and potential living donors) would largely depend on families' out-of-pocket expenses, without being able to guarantee opportunities for the population of both subsectors in the basic steps of access to this benefits.

Although the tool was not specifically oriented towards finding a relationship between participants' responses and socioeconomic determinants, this additional analysis showed interesting insights for each dimension. No correlation was observed between greater wealth or health expenditure and the observed preponderance of public health coverage in the region: probably this variable may be conditioned by other factors, such as the political, cultural, or social context of each country. The high uncertainty about the opinions gathered regarding human resources did not allow discerning a differential relationship between countries with socioeconomic variables, with the inadequate supply of professionals being a relevant global and regional problem that affects both coverage subsectors.[2] Regarding the regulatory framework, countries with greater wealth (and less poverty) are those with more developed renal TX laws. As for access to diagnostic or therapeutic technology in the private subsector, it would be independent of these factors, with all countries showing a similar distribution. However, the analysis of public health presented highly relevant data: diagnostic methods such as eGFR, albuminuria, proteinuria, and pathology studies are more available in this subsector for countries with greater wealth and health expenditure. This would imply a clear need to consolidate these tools (particularly eGFR) in lower-resource countries to improve early detection and address the problem of CKD. With respect to pharmacological treatments, their public coverage was again associated with greater wealth and health expenditure in the analyzed countries, as was access to complex procedures (greater availability in countries with higher GDP or health expenditure). Finally, fewer out-of-pocket payments were reported for evaluation studies for renal TX recipients and donors in countries with higher health expenditure, which corroborates the need for specific investment to increase access to this treatment in low-resource countries, where patient costs lead to loss of opportunities and inequity in access. While these results are more exploratory than categorical (due to the uncertainty or heterogeneity of the opinions refered and the indirect mechanism of data collection by the tool), they open perspectives for future research on these topics that are complementary to recent reports.[16]

Conclusions

Although the data collected showed high overall reliability (79%), wide variability of opinions on particular topics was registered. Coverage by the public subsector is predominant in the region, coexisting with cross-financing. The human resources endowment was the most variable dimension, with lower supply for the different professions in the public subsector. Normatively, progress has been made in the region, although further development is still required at the level of registries and transplant legislation. Access to diagnostic and therapeutic technology again evidences the deficiencies of public health, while for socioeconomic variables, the level of wealth correlated with greater social security coverage, a more advanced regulatory framework, and more technological access in the public sector.

Latin America faces current and future challenges to ensure adequate access to quality and equitable nephrological care. The data obtained in this study reveal already known situations[7], and new critical points to raise informed discussions about priorities in renal health. We hope to open a proposal for reflection on the importance of having accurate and consolidated information from members of the nephrological community genuinely interested in these topics, coming from selected opinions in each country, attempting to reflect the context with the greatest possible certainty; this could provide elements of dissemination that facilitate a change of perspective in decision-makers when discussing public policies in renal health, which face a real environment of competition with different health priorities. Similarly, we believe that this adapted tool can be replicated and used in more advanced studies, with greater participation of opinions and subdividing its results by different subregions of Latin America or even within each country, situations that could reveal new challenges and particular priorities in each analyzed context.

Acknowledgements

The authors thank the colleagues from the SLANH Scientific Committees who contributed to the drafting and dissemination of the material: G. Álvarez-Estévez, A. Robayo, C. Carlino, L. Cortés-Sanabria, A. Ferrari, A. Cueto-Manzano, and C. Bonanno; and especially the 94 nephrologists and decision-makers convened who responded to the survey for providing us with the invaluable data that made this work possible.

Funding

The authors declare that this work was conducted with the authors' own resources.

Conflicts of interest

The authors declared no conflicts of interest whatsoever.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2020 Feb 29;395(10225):709-733. doi: 10.1016/S0140-6736(20)30045-3. Epub 2020 Feb 13. PMID: 32061315; PMCID: PMC7049905.
2. Levin A. Building blocks toward sustainable kidney care around the world: results from a multinational survey by the International Society of Nephrology. Kidney Int Suppl (2011). 2018 Feb;8(2):27-29. doi: 10.1016/j.kisu.2017.10.006. Epub 2018 Jan 19. PMID: 30675436; PMCID: PMC6336221.
3. Teerawattananon Y, Luz A, Pilasant S, Tangsathitkulchai S, Chootipongchaivat S, Tritasavit N, et al. How to meet the demand for good quality renal dialysis as part of universal health coverage in resource-limited settings? Health Res Policy Syst. 2016 Mar 18;14:21. doi: 10.1186/s12961-016-0090-7. PMID: 26988562; PMCID: PMC4797124.
4. Hill NR, Fatoba ST, Oke JL, Hirst JA, O'Callaghan CA, Lasserson DS, et al. Global Prevalence of Chronic Kidney Disease - A Systematic Review and Meta-Analysis. PLoS One. 2016 Jul 6;11(7):e0158765. doi: 10.1371/journal.pone.0158765. PMID: 27383068; PMCID: PMC4934905.
5. Crews DC, Bello AK, Saadi G. World Kidney Day Steering Committee. Burden, access, and disparities in kidney disease. Braz J Med Biol Res. 2019 Mar 25;52(3):e8338. doi: 10.1590/1414-431X20198338. PMID: 30916222; PMCID: PMC6437937.
6. Bello AK, Okpechi IG, Levin A, Ye F, Damster S, Arruebo S, et al. ISN-GKHA Group. An update on the global disparities in kidney disease burden and care across world countries and regions. Lancet Glob Health. 2024 Mar;12(3):e382-e395. doi: 10.1016/S2214-109X(23)00570-3. PMID: 38365413.
7. Li PK, Garcia-Garcia G, Lui SF, Andreoli S, Fung WW, Hradsky A, et al. Kidney health for everyone everywhere - from prevention to detection and equitable access to care. Clin Nephrol. 2020 Mar;93(3):111-122. doi: 10.5414/CNWKDEditorial. PMID: 32017699.
8. Wainstein M, Bello AK, Jha V, Harris DCH, Levin A, Gonzalez-Bedat MC et al. ISN Latin America Regional Board. International Society of Nephrology Global Kidney Health Atlas: structures, organization, and services for the management of kidney failure in Latin America. Kidney Int Suppl (2011). 2021 May;11(2):e35-e46. doi: 10.1016/j.kisu.2021.01.005. Epub 2021 Apr 12. PMID: 33981469; PMCID: PMC8084731.
9. Rosas-Valdez FU, Aguirre-Vázquez AF, Agudelo-Botero M. Cuantificación de la carga de la enfermedad renal crónica en América Latina: una epidemia invisibilizada. Rev Panam Salud Publica. 2024 Apr 15;48:e41. Spanish. doi: 10.26633/RPSP.2024.41. PMID: 38623527; PMCID: PMC11018258.
10. Pecoits-Filho R, Sola L, Correa-Rotter R, Claure-Del Granado R, Douthat WG, Bellorin-Font E; International Society of Nephrology Regional Board. Kidney disease in Latin America: current status, challenges, and the role of the ISN in the development of nephrology in the region. Kidney Int. 2018 Dec;94(6):1069-1072. doi: 10.1016/j.kint.2018.07.026. Erratum in: Kidney Int. 2019 Oct;96(4):1040. doi: 10.1016/j.kint.2019.08.002. PMID: 30466564.
11. Marinho ML, Dahuabe A, Arenas de Mesa A. Salud y desigualdad en América Latina y el Caribe: la centralidad de la salud para el desarrollo social inclusivo y sostenible. CEPAL: Serie Políticas Sociales N° 244. ISSN: 1680-8983 (versión electrónica LC/TS.2023/115)
12. Bello AK, Okpechi IG, Levin A, Johnson DW. Variations in kidney care management and access: regional assessments of the 2023 International Society of Nephrology Global Kidney Health Atlas (ISN-GKHA). Kidney Int Suppl (2011). 2024 Apr;13(1):1-5. doi: 10.1016/j.kisu.2023.12.001. Epub 2024 Apr 8. PMID: 38619132; PMCID: PMC11010599.
13. Htay H, Alrukhaimi M, Ashuntantang GE, Bello AK, Bellorin-Font E, Benghanem Gharbi M, et al. Global access of patients with kidney disease to health technologies and medications: findings from the Global Kidney Health Atlas project. Kidney Int Suppl (2011). 2018 Feb;8(2):64-73. doi: 10.1016/j.kisu.2017.10.010. Epub 2018 Jan 19. PMID: 30675440; PMCID: PMC6336224.
14. Harris DCH, Davies SJ, Finkelstein FO, Jha V, Donner JA, Abraham G, et al. Working Groups of the International Society of Nephrology's 2nd Global Kidney Health Summit. Increasing access to integrated ESKD care as part of universal health coverage. Kidney Int. 2019 Apr;95(4S):S1-S33. doi: 10.1016/j.kint.2018.12.005. PMID: 30904051.
15. Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2021 global survey. ISBN 978-92-4-007169-8 (electronic version) © World Health Organization 2023
16. Torales S, Cortés-Sanabria L, Ferrari A, Rossi F, Oliver M. (2025). Determinantes socioeconómicos sobre la oferta y el acceso a terapias de reemplazo renal en Latinoamérica. Nefrología Latinoamericana. 10.24875/NEFRO.24000020.
17. Wilson NE. For-profit status and industry evolution in health care markets: evidence from the dialysis industry. Int J Health Econ Manag. 2016 Dec;16(4):297-319. doi: 10.1007/s10754-016-9192-6. Epub 2016 Jul 14. PMID: 27878689.
18. Tonelli M, Nkunu V, Varghese C, Abu-Alfa AK, Alrukhaimi MN, Fox L, et al. Framework for establishing integrated kidney care programs in low- and middle-income countries. Kidney Int Suppl (2011). 2020 Mar;10(1):e19-e23. doi: 10.1016/j.kisu.2019.11.002. Epub 2020 Feb 19. Erratum in: Kidney Int Suppl (2011). 2020 Dec;10(2):e186. doi: 10.1016/j.kisu.2020.11.001. PMID: 32149006; PMCID: PMC7031683.
19. Luyckx VA, Tuttle KR, Abdellatif D, Correa-Rotter R, Fung WWS, Haris A, et al. World Kidney Day Joint Steering Committee. Mind the gap in kidney care: translating what we know into what we do. Kidney Int. 2024 Mar;105(3):406-417. doi: 10.1016/j.kint.2023.12.003. PMID: 38375622.
20. Regier D, Sicsic J, Watson V. Choice certainty and deliberative thinking in discrete choice experiments. A theoretical and empirical investigation. Journal of Economic Behavior & Organization. Volume 164 (2019) Pages 235-255, ISSN 0167-2681
21. Couchoud C, Gharbi MB. Advocacy for renal replacement therapy: the role of renal registries. Clin Kidney J. 2020 Jul 29;13(5):742-744. doi: 10.1093/ckj/sfaa067. PMID: 33125002; PMCID: PMC7577751.
22. Osman MA, Alrukhaimi M, Ashuntantang GE, Bellorin-Font E, Benghanem Gharbi M, Braam B, et al. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. Kidney Int Suppl (2011). 2018 Feb;8(2):52-63. doi: 10.1016/j.kisu.2017.10.009. Epub 2018 Jan 19. PMID: 30675439; PMCID: PMC6336213.
23. Luxardo R, Ceretta L, González-Bedat M, Ferreiro A, Rosa-Diez G. The Latin American Dialysis and Renal Transplantation Registry: report 2019. Clin Kidney J. 2021 Oct 12;15(3):425-431. doi: 10.1093/ckj/sfab188. PMID: 35211302; PMCID: PMC8862045.
24. Sola L, Plata-Cornejo R, Fernández-Cean J. Latin American special project: kidney health cooperation project between Uruguay and Bolivia. Clin Nephrol. 2015;83(7 Suppl 1):21-3. doi: 10.5414/cnp83s021. PMID: 25725237.
25. Torales S, Berardo J, Hasdeu S, Esquivel MP, Rosales A, Azofeifa C, et al. Evaluación económica comparativa sobre terapias de reemplazo renal en Argentina, Costa Rica y Uruguay. Rev Panam Salud Publica. 2021 Oct 18;45:e119. Spanish. doi: 10.26633/RPSP.2021.119. PMID: 34703459; PMCID: PMC8529996.
26. Chang AY, Cullen MR, Harrington RA, Barry M. The impact of novel coronavirus COVID-19 on noncommunicable disease patients and health systems: a review. J Intern Med. 2021 Apr;289(4):450-462. doi: 10.1111/joim.13184. Epub 2020 Oct 27. PMID: 33020988; PMCID: PMC7675448.

Nefrología Latinoamericana

PERMANYER

Check for updates

ORIGINAL ARTICLE

Chronic kidney disease from non-traditional causes: report from the Fourth International Workshop

Enfermedad renal crónica de causa no tradicional: reporte del Cuarto Taller Internacional

Marvin González-Quiroz[1,2], Anna Strasma[3], Gerardo Arroyo[4], Daniel Brooks[5], Ben Caplin[2], Karen Courville[6], Jennifer Crowe[7], Carl-Gustaf Elinder[8], Nathan Raines[9], Vidhya Venugopal[10], and Vicente Sánchez-Polo[11]*

[1]Department of Environmental and Occupational Health, UT School of Public Health San Antonio, The University of Texas Health Science Center at San Antonio, San Antonio, Texas, USA; [2]Centre for Kidney and Bladder Health, University College London, London, UK; [3]Duke University School of Medicine, Durham, NC, USA; [4]Departamento de Citohistología, Universidad de San Carlos de Guatemala, Guatemala, Guatemala; [5]Boston University School of Public Health, Boston, MA, USA; [6]Instituto de Ciencias Médicas, Las Tablas, Panamá; [7]Instituto Regional de Estudios en Sustancias Toxicas, Universidad Nacional de Costa Rica, Heredia, Costa Rica; [8]Department of Renal Medicine, Karolinska Institutet, Stockholm, Sweden; [9]Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA, USA; [10]Department of Environmental Health Engineering, Sri Ramachandra Institute of Higher Education and Research, Porur, Chennai, India; [11]Instituto Guatemalteco de Seguridad Social (IGSS), Guatemala, Guatemala

Abstract

Introduction: *Chronic kidney disease of nontraditional cause (CKDnt) is a major concern in Mesoamerica and South Asia. Given its high burden and unclear etiology, an international workshop was held to review current evidence and guide public health strategies.* **Materials and methods:** *The Fourth International Workshop on CKDnt was held in 2024 and organized by the Consortium for the Epidemic of Nephropathy in Central America and Mexico (CENCAM), in collaboration with the Executive Secretariat of the Council of Ministers of Health of Central America and the Dominican Republic (SE-COMISCA), the Latin American Society of Nephrology and Hypertension (SLANH), the Central American Program for Health, Work and Environment (SALTRA), and the Spanish Agency for International Development Cooperation (AECID). The objective was to provide evidence-based support for the program "Strategy for the Prevention, Mitigation, and Control of CKDnt in Central America and the Dominican Republic".* **Results:** *Participants numbered 165, most from Mesoamerica. Workshop discussions were centered around: (1) the causes of CKDnt, (2) methodological research approaches, and (3) strategies for application of findings.* **Conclusion:** *Addressing CKDnt requires coordinated, evidence-based actions at both regional and international levels.*

Keywords: *CKD. CKDnt. CKDu. Mesoamerican Nephropathy.*

Resumen

Introducción: *La enfermedad renal crónica de causa no tradicional (ERCnt) representa un importante problema en Mesoamérica y el sur de Asia. Ante su elevada carga y etiología aún incierta, se realizó un taller internacional para analizar la evidencia actual y orientar estrategias de salud pública.* **Materiales y métodos:** *El Cuarto Taller Internacional sobre ERCnt se celebró en 2024, organizado por el Consorcio para la Epidemia de Nefropatía en Centroamérica y México (CENCAM), en*

***Correspondence:**
Anna Strasma
E-mail: annastrasma@gmail.com

Date of reception: 19-05-2025
Date of acceptance: 09-07-2025
DOI: 10.24875/NEFRO.25000015

Available online: 26-08-2025
Nefro Latinoam. 2026;23(2):81-90
www.nefrologialatinoamericana.com

How to cite: González-Quiroz M, et al. Chronic kidney disease from non-traditional causes: report from the fourth international workshop. Nefro Latinoam. 2026;23(2):81-90. doi: 10.24875/NEFRO.25000015

colaboración con la Secretaría Ejecutiva del Consejo de Ministros de Salud de Centroamérica y República Dominicana (SE-COMISCA), la Sociedad Latinoamericana de Nefrología e Hipertensión (SLANH), el Programa Centroamericano de Salud, Trabajo y Medio Ambiente (SALTRA) y la Agencia Española de Cooperación Internacional para el Desarrollo (AECID). El objetivo fue respaldar con base científica la implementación del programa "Estrategia para la prevención, mitigación y control de la ERCnt en Centroamérica y República Dominicana". **Resultados:** *Participaron 165 personas, principalmente de Mesoamérica. Las discusiones se centraron en: (1) las causas de la ERCnt, (2) enfoques metodológicos de investigación y (3) estrategias para la implementación.* **Conclusión:** *Abordar la ERCnt requiere acciones coordinadas, tanto regionales como internacionales, basadas en evidencia científica.*

Palabras claves: *ERC. ERC no tradicional. ERC de causa desconocida. Nefropatía Mesoamericana.*

Introduction

Chronic kidney disease of non-traditional causes (CKDnt) is an emerging form of chronic kidney disease (CKD) primarily affecting young individuals engaged in strenuous labor under hot climatic conditions, particularly those from low socioeconomic backgrounds.[1,2] It is termed "non-traditional" because it occurs independently of traditional CKD risk factors, such as hypertension or diabetes.[1,2] CKDnt is characterized by high morbidity and mortality in Central America and South Asia, though cases have also been reported elsewhere.[3-6] Patients often present without hematuria or significant proteinuria, and kidney biopsies typically show predominant chronic tubulointerstitial nephritis.[7,8] Despite advances in research, the underlying causes of CKDnt remain incompletely understood.[1,4,5] While heat stress has been implicated in certain populations, other potential alternative or interacting contributors to disease include environmental exposures, nephrotoxic medications, and genetic predisposition.[1,4,5] In addition, social determinants of health –such as poverty, limited access to healthcare, inadequate occupational protections, and poor living conditions– are thought to significantly predispose affected populations to the development and progression of this disease.[9,10]

Methods

The Consortium for the Epidemic of Nephropathy in Central America and Mexico (CENCAM) organized the fourth workshop in collaboration with the Executive Secretariat of the Council of Ministers of Health of Central America and the Dominican Republic (SE-COMISCA), the Latin American Society of Nephrology and Hypertension (SLANH), The Central American Program for Health, Work and Environment (SALTRA), and the Spanish Agency for International Development Cooperation (AECID). These entities organized the Fourth International Workshop on Chronic Kidney Disease of Unknown Etiology (CKDnt) in Antigua Guatemala, Guatemala, from February 14 to 16 in 2024, with the main objective to review the existing scientific evidence on the epidemic of CKDnt in Mesoamerica and South Asia. This workshop was also designed to inaugurate and establish the scientific framework for the "Implementation of the Strategy for the Prevention, Mitigation, and Control of CKDnt in Central America and the Dominican Republic" (In Spanish, *Implementación de la Estrategia para la Prevención, Mitigación y Control de la Enfermedad Renal Crónica de Origen no Tradicional (ERCnT) en Centroamérica y República Dominicana*), a regional program overseen by SE-COMISCA designed to improve CKDnt management. This program consists of educational and capacity-building efforts to enhance CKDnt identification, prevention, and patient care led by the Ministries of Health of SE-COMISCA member countries.

The organizing committee promoted an interdisciplinary approach, facilitating an exchange of evidence-based thoughts and collaborative scientific dialogue. The objective was to bring together experts, both international and from CKDnt-affected regions, with a wide range of skills, interests, and approaches, covering disciplines, such as epidemiology, occupational health, toxicology, nephrology, policy, and others. Table 1 demonstrates areas of participant expertise by country. This diversity made it possible to approach the problem of the disease from multiple perspectives, promoting collaborative work between researchers, industry, and government.

Before the workshop, the organizing committee identified eleven working group topics, and invited CKDnt experts to serve as working group leaders. Workshop participants were assigned to groups according to their expressed interest and area of specialization. They had

Table 1. Description of participants by country and area of expertise (n = 165)

Variable	n (n = 165)	%
Gender		
Female	90	54.5
Male	75	45.5
Country		
United States	45	27.3
Guatemala	33	20.0
Costa Rica	17	10.3
Nicaragua	12	7.3
El Salvador	12	7.3
Sweden	8	4.8
Panama	6	3.6
United Kingdom	6	3.6
Honduras	5	3.0
Mexico	5	3.0
Dominican Republic	3	1.8
Belize	2	1.2
Canada	2	1.2
Spain	2	1.2
Sri Lanka	2	1.2
India	2	1.2
Chile	1	0.6
Colombia	1	0.6
Paraguay	1	0.6
Main area of expertise (self-reported)		
Environmental and occupational health	36	21.8
Internal medicine/Nephrology	35	21.2
Epidemiology	32	19.4
Public Health	28	17
Pharmacology/Toxicology	9	5.5
Renal Pathology	4	2.4
Analytical chemistry	4	2.4
Genetic/biomarkers	4	2.4
Other	13	7.9

pre-workshop discussions with the organizing committee members and working group leaders to establish the group's agenda for the workshop.

The working groups were as follows: Analytical Epidemiology; Clinical Diagnosis and Management; Surveillance and Screening; Overall discussion of CKDnt causality; Heat Exposure as a cause of CKDnt; Environmental Exposures (heavy metals, pesticides, pathogens, silica, etc) as a cause of CKDnt; Histopathology; Basic Science and "Omics" Approaches; Qualitative Methods and Patient/Community Voices; Work involving both government/public health systems and researchers; and Work involving both industry and researchers. Members of each working group were given a list of scientific literature to review, although conclusions were based off of additional readings and personal experience.

Each working group met for approximately 10 hours of discussion sessions over the course of 2 days. At the end of these discussions, each group presented a summary of their findings to all workshop attendees as well as the Ministry of Health delegates representing SE-COMISCA member countries. These presentations included areas of consensus, but also areas in which controversy and disagreement remain. Workshop organizing committee members, in conjunction with working group leaders, then compiled the information presented in these summaries for use as the scientific basis for designing elements of the "Implementation of the Strategy for the Prevention, Mitigation, and Control of CKDnt in Central America and the Dominican Republic" program. A summary of the discussion (including areas of disagreement) produced by the working groups at the Fourth International Workshop on CKDnt is presented here.

Results

There were 165 participants in the workshop, with both members and non-members of CENCAM. Participants came from 19 countries, including the United States (27%), Guatemala (20%), and Costa Rica (10%) (Table 1). The participants' most common areas of expertise were environmental and occupational health (22%), nephrology (21%), epidemiology (19%), and public health (17%).

Causal evidence

There is no simple answer to what causes CKDnt. Present evidence suggests that there are multiple risk factors for CKDnt and that different factors may be important in disease onset and progression. The exposures and injury mechanisms driving CKDnt may differ across individuals and/or populations. There remains a range of opinions among experts about the relative importance of each identified risk factor and the potential to identify new significant risk factors for disease. Rigorous and generalizable research studies aimed at exploring potential causal factors continue to be important, ideally with methodologies that allow for comparisons across CKDnt-affected regions. There was, nevertheless, a general consensus that there is consistent evidence supporting the role of two factors in the development of CKDnt – social determinants of health and heat stress.

Social determinants of health

Socioeconomic determinants play a crucial role in creating conditions of vulnerability that predispose affected populations to disease. These include poverty, limited access to health care, low education, pre-maturity,

and low birth weight. In this setting, other directly injurious factors may trigger or aggravate the disease. Examples include exposure to thermal stress, recurrent dehydration, contact with environmental toxins, and frequent use of nephrotoxic drugs, such as non-steroidal anti-inflammatory drugs (NSAIDs), among others. Understanding the interrelationship between these elements not only allows a better characterization of CKDnt but also offers strategic opportunities to intervene and mitigate its impact on affected communities.

Heat and thermal stress

Evidence suggests that exposure to heat stress worsens renal function in populations at risk of CKDnt. Observational studies also demonstrate that workers who perform heavy work (such as digging, lifting, or cutting) in hot conditions are at high risk for CKDnt. It has been proposed that this group sustains a higher incidence of kidney injury, which if recurrent or unresolved, may lead to the development of CKDnt. The risk of kidney injury may be higher in those working in conditions that incentivize productivity, which may discourage workers from adequate rest and hydration. Controlled human and pre-clinical studies provide additional support for the link between heat exposure and kidney injury. Given these findings, implementing targeted interventions is likely to be an important tool to mitigate long-term health consequences in vulnerable workers.

Existing evidence from intervention studies suggests that incorporating mandatory rest periods, ensuring access to shade, and providing clean drinking water with electrolyte solutions can significantly decrease the physiological burden associated with heat stress and reduce the risk of kidney injury. However, further studies replicating such interventions are needed in similar populations in other countries, as well as in different occupations, but with similar exposure to heat stress.

Environmental exposures

While existing evidence suggests that heat stress plays an important role in this disease, the contribution of many other environmental exposures, such as agrochemicals, heavy metals, and vector-borne or environmentally transmitted infections to CKDnt in Central America remains a topic of discussion and disagreement among researchers in this field. Individual toxicants from each of the broad categories listed have been proposed to either initiate or exacerbate CKDnt, potentially by interacting with other risk factors. Although there are individual reports suggesting a number of these exposures are important in CKDnt, evidence supporting a role for any one of these factors, replicated across independent studies, is not currently available. Evidence around these environmental exposures is challenging to capture, as agricultural workers in particular often experience multiple different environmental exposures, making it difficult to assess the contribution of each environmental component to kidney disease.

Environmental exposure assessment is complicated by the latency period between the exposure and onset of symptoms, as well as the lack of standardized exposure analyses. The use of standardized surveys in assessing region-specific occupational and residential environmental exposures can improve exposure analysis efforts.

Interventions in the context of uncertain causality

Importantly, although the causality of CKDnt is unknown, immediate interventions can be implemented to reduce its impact. Many of these interventions are likely to be beneficial for overall health, even if their efficacy in CKDnt specifically has not yet been established. Employers should implement preventive measures and ensure that workers receive adequate education on heat-related illness, the importance of hydration, and the benefits of acclimatization. Studies show that these interventions can help to preserve renal function in high-risk populations. Reducing exposure to nephrotoxic medications, especially NSAIDs and aminoglycoside antibiotics, may be a cost-effective and feasible strategy to prevent further kidney damage. Ensuring access to safe drinking water, minimizing the use of unnecessary chemicals at work and at home, using personal protective equipment, proper handling and use of chemicals and metals, and limiting the introduction of environmental toxins into the home should all be considered good practice, even if evidence supporting their efficacy in CKDnt is currently lacking. Addressing social determinants of health requires a broader, systemic intervention, but has an even greater potential to improve not only CKDnt outcomes, but also overall population health.

Learning more about CKDnt: causes, prevention, and treatment

Effectively addressing CKDnt requires collaboration among public health professionals, government

agencies, industry, and academia. These stakeholders should engage with multidisciplinary research teams and leverage existing networks, such as CENCAM and SALTRA to build research strategies grounded in existing knowledge. Incorporating community-based participatory research and qualitative methods can improve health care and promote workplace health. Priority should be given to implementation research to evaluate the real-world effectiveness of interventions and understand why outcomes may vary across settings. Interventions should target key risk factors, including reducing the use of nephrotoxic medications, which may help lessen the burden of CKDnt.

Analytical epidemiology

Analytic epidemiology plays a key role in identifying the causes of CKDnt and guiding prevention. Studies of the etiology of CKDnt are extremely challenging due to difficulties in observing surrogates of early disease and robustly measuring exposure. A broad variety of research methodologies may be appropriate.

The working group reached consensus that decreased estimated glomerular filtration rate (eGFR) is currently the most accessible and informative outcome measure for analytical epidemiology studies. Within-individual change in eGFR, even if it falls within the normal or near-normal range, may provide additional insight. In this context, they proposed the concept of "incident kidney injury (IKI)," as an epidemiological tool for monitoring kidney function in longitudinal studies. IKI can be defined as an increase in serum creatinine of 0.3 mg/dL or 1.5 times baseline during a study period.

Further research is needed to identify early, affordable, non-invasive markers for disease onset and progression. Because AKI often precedes CKD, tracking AKI cases through clinical registries and periodic creatinine testing in high-risk populations may also yield valuable insights.

Characterizing the burden of disease

Many countries lack CKDnt-specific surveillance programs, underscoring the need for research to better quantify disease burden. Useful data can be derived from national mortality statistics, specialized monitoring systems, and periodic population-based surveys using standardized protocols.

Routine CKD screening in high-risk groups is crucial for early detection and intervention. Standardizing reporting practices, creating a uniform registry, and including CKDnt in mandatory disease reporting systems are critical next steps. Finally, the present Pan American Health Organization (PAHO) definition of CKDnt – which requires a patient to be an agricultural worker – should be reevaluated, as the disease also affects workers in other occupational sectors.

Histopathology

Histopathological research is fundamental to advance the understanding of CKDnt as it provides key information on diagnosis, prognosis, and possible etiological factors. Analysis of biopsy-derived kidney tissue may allow assessment of the contribution of various risk factors and the efficacy of preventative interventions. To effectively address CKDnt, it is crucial to strengthen infrastructure and develop human resources, particularly in training renal pathologists and improving laboratory capacity in affected regions. Collaborative initiatives with international organizations, such as SLANH, the International Society of Nephrology with programs, such as the ISN Sister Renal Centers, and GlomCon can facilitate training and build capacity.

In addition, implementing standardized biopsy templates would ensure consistency in data collection, improve interdisciplinary communication, and allow for more accurate analyses of trends and outcomes. Establishing renal tissue biobanks and a registry storing histopathological results would allow for large studies on CKDnt pathogenesis. Finally, the development of an educational histopathology atlas of CKDnt would serve as a valuable reference tool for training pathologists and improve diagnostic accuracy. These collective histopathologic efforts are essential to deepen the understanding of CKDnt.

Omics and biomarkers

The application of omics technologies and basic science techniques has great potential to advance the understanding of CKDnt. Omics approaches, such as genomics, epigenetics, transcriptomics, proteomics, and metabolomics have already demonstrated genetic predispositions, metabolic pathways, and potential biomarkers important to CKDnt. These tools may be useful for identifying environmental exposures, genetics, and mechanisms driving CKDnt progression. Even though resource limitations will likely prevent the widespread clinical adoption of such technologies, omics still show promise for use in case identification, risk prediction, and the discovery of potential therapeutic targets.

Complementing these tools, animal and cellular models are useful to explore the roles of various factors implicated in CKDnt. Advances in technology and bioinformatics continue to improve the accuracy and applicability of these methods, especially as publicly available datasets offer valuable opportunities to expand CKDnt research.

Patient and community perspectives

Incorporating the voices of patients and communities in CKDnt research is fundamental to advance the identification of the underlying cause(s) and to strengthen education and prevention strategies in affected regions. Tools, such as focus group discussions and body mapping can provide key information about the subjective experience of patients and the barriers they face in accessing care. In addition, during the past decade, qualitative methods, such as semi-structured interviews, photovoice, and photonovela have been used to address multiple aspects of medical problems, including ethical concerns, quality of life, perceptions of health professionals, and community empowerment. These approaches also have the potential to better demonstrate social determinants of health and diverse factors that influence access and quality of health care. Moreover, the inclusion of patient and community perspectives can enhance the promotion of occupational health, prevention of occupational hazards, and the implementation of social support strategies that benefit the most vulnerable families and communities.

To improve the effectiveness of research and disease treatment, it is crucial to actively involve diverse social actors. Integrating community leaders into research projects fosters equitable collaborations and reinforces the ethical and scientific relevance of studies.

Identifying and addressing CKDnt

To best address CKDnt, it is absolutely essential to collaborate with patients and affected communities. This includes community councils, community leaders, patient associations, labor unions, worker associations, community health workers, health councils, education professionals, and family associations. In general, provision of basic public health needs –such as access to clean water and sanitation, occupational health, maternal health, and healthy food– will likely reduce susceptibility to CKDnt at the population level.

The dissemination of information should be adapted to each context through social media, traditional media, and community campaigns. There should be better communication among researchers, patients, community members, healthcare providers, public health professionals, industry, and government agencies to support evidence-based decisions and implementation of interventions to reduce the burden of CKDnt. Formation of public policies should include participatory mechanisms that prioritize the needs and ideas of the community, ensuring a comprehensive and equitable approach against CKDnt.

Surveillance systems and screening strategies

CKDnt represents a major challenge within the broader landscape of non-communicable diseases. However, many affected countries lack comprehensive surveillance systems to monitor its prevalence and progression, which is important both for research purposes and to address the disease. Existing efforts often focus on areas already recognized as high-risk, which can exclude other affected populations. The actions to address this gap include broadening the PAHO definition of CKDnt as discussed above, integrating CKDnt monitoring into existing health surveillance systems, and standardizing diagnostic protocols to ensure consistency across regions. The analysis of national mortality statistics and the implementation of periodic population-based surveys can provide key information on disease trends. Together, effective surveillance and screening strategies can guide policymakers and health professions in the identification of at-risk populations, implementation of early detection strategies, and development of targeted interventions.

Early detection and timely intervention are essential to reduce the burden of CKDnt (Fig. 1). Clinicians, including primary care physicians, should be able to recognize the symptoms of CKDnt. They should also incorporate screening for CKD into routine health examinations, especially in high-risk populations, such as agricultural and construction workers, regardless if they live in CKDnt-endemic regions or not. Screening should include blood pressure assessment, urinalysis, and serum creatinine assessment. Nephrologists play a key role in confirming the diagnosis and collaborating with primary care providers to ensure a coordinated approach to disease management. Public health workers should prioritize training programs to improve CKDnt surveillance, data collection, and trend analysis.

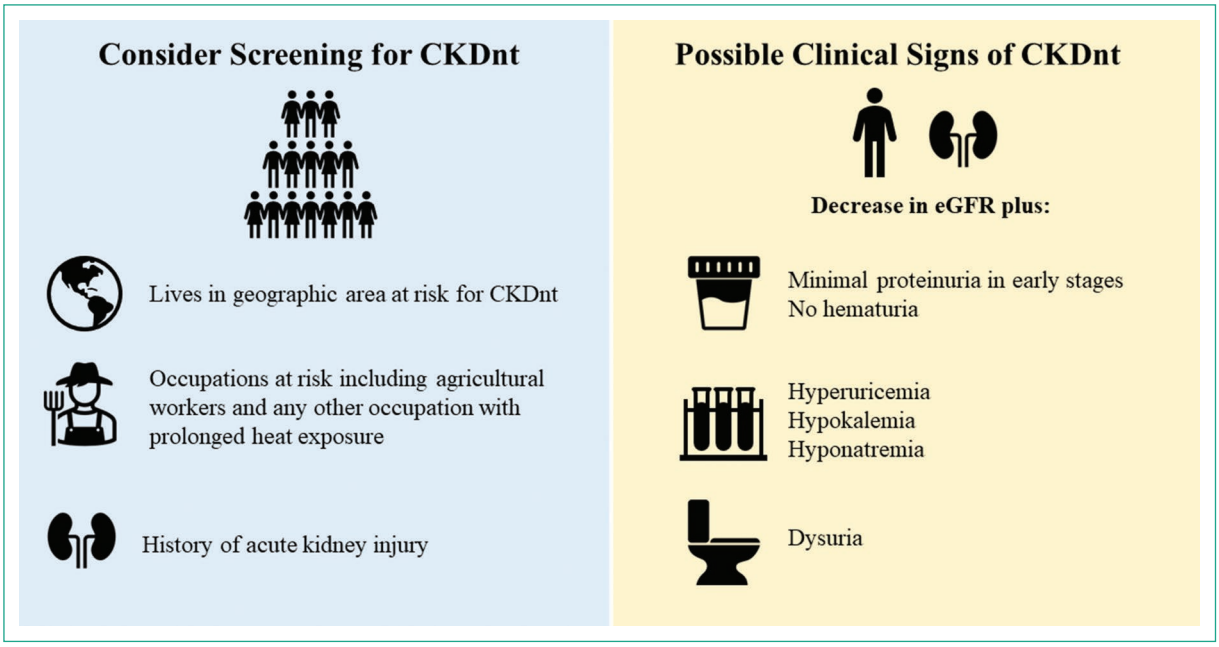

Figure 1. Screening and clinical signs of CKDnt.

Collaboration between researchers, governments, and industries

Effective communication between researchers and decision-makers in industry and government health ministries is essential for developing and implementing evidence-based strategies to address CKDnt. However, this interaction is currently limited, representing a key opportunity for improvement by strengthening inter-institutional collaboration mechanisms. Entities, such as CENCAM, SALTRA, and SLANH can be consultants – providing support to government ministries interested in applying scientific findings into public policy. To improve coordination, we propose that inter-institutional collaborations be formalized to ensure initiatives continue among key actors even beyond political cycles and changes in administration.

Expanding these opportunities for collaboration and offering short-term training on CKDnt to a variety of stakeholders is crucial. To this end, different government sectors should be integrated into these efforts – including health, agriculture, economy, environment, labor, and water– to ensure a comprehensive approach to tackling CKDnt.

Through the Executive Secretary of the Council of Ministers of Health of Central America and the Dominican Republic (SE-COMISCA) and other entities, it is possible to coordinate and implement strategic actions at the local, national, and regional levels. A fundamental step in preventing and mitigating CKDnt would be the development of a surveillance algorithm that incorporates screening in high-risk populations. This would inform decision-making and promote sustainable public policies based on the best, most present evidence.

In addition to government entities, a collaborative approach between industry and the scientific community is useful to address CKDnt's complex etiology. Industry involvement can bring access to large databases, advanced analytical tools, and technical expertise, significantly improving the quality and scope of research. These partnerships not only accelerate the development of preventative strategies, but also promote an interdisciplinary approach that integrates nephrology, environmental epidemiology, and implementation science to understand the multiple factors involved in CKDnt. In addition, collaboration with industry can strengthen occupational safety and health, which can support long-term sustainability of preventative interventions beyond the research phase. These industry-led interventions are especially important for informal and migrant workers in micro, small, and medium-sized businesses. They tend to face greater occupational risks because they often lack awareness on occupational health policies and how to enforce regulations, in addition to being more economically vulnerable. Clinicians, policymakers, and community leaders should value these collaborations with industry to design

1. **Causal Evidence**
- There is **no simple answer to what "causes" CKDnt**
- **Multiple factors** are likely to contribute to CKDnt either independently or in combination. Consistently identified risk factors include: **social determinants of health and occupational heat stress.**
- CKDnt may be caused by different disease mechanisms in different individuals and/or populations. There remains a **range of opinions amongst experts as to the relative importance of different causal factors.**
- Despite the incomplete understanding CKDnt's causality, it is possible to implement interventions to protect people against the disease.

2. **Learning More about CKDnt: Causes, Prevention and Treatment**
- Individuals and organizations from public health, government, industry, and academia interested in addressing or understanding CKDnT should engage with multidisciplinary research teams to **ensure a scientifically sound research strategy that builds on existing knowledge about the disease.**
- We recommend the use of **community participatory research and qualitative methods.**
- We need to **better understand the burden of CKDnt** and **reexamine the current definitions of CKDnt** proposed by the Pan American Health Organization.
- **Evaluation of interventions** to reduce disease burden is critical. We recommend that these evaluations use serum **Creatinine.**
- Developing **histopathologic investigation, better early clinical biomarkers, and studies based on omics** are key components to improve our understanding of disease.
- Studies of the **etiology of CKDnt** are extremely challenging due to problems observing surrogates of early disease and robustly measuring exposures. **A broad variety of research methodologies may be appropriate.**

3. **Identifying and Addressing CKDnt**
- **Diagnosis of CKDnt is challenging** and relies on a high level of clinical suspicion as there are no specific tests for this disease.
- **Early detection and diagnosis** allows for possible effective management promoting healthy behaviors such as maintaining optimal weight, avoiding heat exposure, staying hydrated, and refraining from smoking.
- Offering adequate supportive care to **manage the advances stages of disease** should be prioritized in CKDnt endemic regions.
- The **proactive involvement of patients and affected communities** is essential.
- We advocate improving communication between researchers, patients and community members, medical and public health professionals, industry, and government agencies to support **evidence-based decision making and implementation** of interventions aimed at reducing the burden of CKDnt.
- Overall, provision of **basic public health needs** will likely reduce population-level susceptibility to CKDnt.
- Interdisciplinary and multiprofessional **education in CKDnt** should be prioritized for healthcare professionals, community members, and employers of workers exposed to heat stress.

Figure 2. Summary of key points from workshop.

targeted, evidence-based solutions that may reduce harm, increase productivity, and promote ethical responsibility by protecting vulnerable populations.

CKDnt diagnosis and clinical management

CKDnt is a growing concern for public and private health systems due to the number of patients affected and its rapid progression to advanced stages of CKD. Most cases are not detected early, resulting in severe clinical presentations related to uremia or cardiovascular disease. Those diagnosed in advanced stages often already require renal replacement therapies, which are expensive and not widely available in many countries due to limited infrastructure and technology.

Diagnosing CKDnt remains challenging due to its uncertain etiology and requires a comprehensive clinical approach (Fig. 1). Healthcare professionals should

maintain a high index of suspicion in individuals with occupational risk factors and abnormal laboratory results, even in the absence of symptoms. A thorough clinical evaluation, including evaluation of proteinuria, hematuria, and kidney function, is critical for early identification of the disease.

In addition, the working group of clinicians emphasized the importance of community awareness of CKDnt, as many affected patients do not recognize early symptoms. Individuals should seek medical attention for symptoms, such as fatigue, hematuria, or unexplained weakness. Public health initiatives should focus on educating high-risk populations, addressing the disease and its risk factors (such as heat stress, dehydration, and environmental toxin exposures). Promoting regular medical visits is also crucial, especially in patients who suffer from CKD, cardiovascular disease, or diabetes. Managing these comorbidities is important to promote overall health and limit CKD progression.

While there is no specific medical treatment of CKDnt preventative measures, such as maintaining adequate hydration, reducing prolonged heat exposure, maintaining a healthy weight, and avoiding harmful medications, such as NSAIDs, can help mitigate CKDnt risk in those with abnormal kidney function. Patients diagnosed with CKDnt should have regular visits with healthcare professionals to provide supportive care to manage the complications of the disease. For example, sodium bicarbonate should be used for acidosis, iron and erythropoietin for anemia, and allopurinol for gout. In more advanced stages, a discussion on dialysis and/or transplantation is critical.

Workshop findings in action

On the third day of the workshop, the working groups collaborated with the country-specific representatives to create a regional agenda on continuing education plans designed to strengthen diagnostic capacity in primary care. Each initiative sought to address the urgent need to improve the recognition, early diagnosis, and management of CKDnt in the region. The discussions were structured around a series of key questions: What are the general priorities we should address? What specific aspects require strengthening in each country? What content should we include in an educational program targeted to physicians and healthcare workers? What strategies are viable to implement these programs in each country? How should we execute an educational program focused on the affected communities? What key players should participate? What is the role that regional organizations, such as CENCAM, SLANH, SALTRA, and SE-COMISCA, should play to achieve these objectives?

Based on the suggestions from these discussions, we created the Regional Plan of Continuing Education in CKDnt to strengthen capacities in healthcare workers and community leaders in the member countries. The education strategy includes a communication program developed by communication specialists from SE-COMISA. SE-COMISCA is in charge of steering the plan, while its implementation is led by the ministries of health of each country, in coordination with the national representatives of CENCAM, SLANH, and SALTRA.

The strategy's central objective is to standardize the educative content about CKDnt for three principal audiences: Community members and patients, primary care healthcare workers, and secondary and tertiary physicians and nurses. Each component was designed with a focus to define the minimum knowledge each group needs to effectively contribute to the prevention, detection, and management of the disease. This integrated focus promotes: (1) Community empowerment to recognize early signs and symptoms and seek medical attention, (2) teach health professionals how to diagnose the disease early and refer patients effectively, and (3) improve timely treatment to reduce the progression of the disease to advanced stages.

Conclusion

The Fourth International Workshop on CKDnt Causes (Fig. 2) assembled key stakeholders to evaluate recent scientific advances and explore how academics, researchers, and policymakers can shape public policies and support the implementation of COMISCA's proposed strategy. This report synthesizes the core discussions – highlighting both areas of consensus and unresolved controversies. The central ideas addressed during the workshop included how to research the etiology, prevention, and treatment of CKDnt and how the interested parties can collaborate more effectively to combat the disease. The authors urge the global scientific and medical communities to rise to the challenge of CKDnt by fostering a collaborative, interdisciplinary approach that bridges research, clinical insight, affected community voices, and political action.

Acknowledgments

The authors would like to thank J. Molina, Ma. de los Angeles Campos, Dr. R. Santos, Lic. R. Fernández, Lic.

Y. Estrada, M. Zúñiga, G. Reyes, and all the workshop participants who generously dedicated their time and shared their knowledge during the workshop.

Funding

The authors declare that the workshop was funded by the Spanish Agency for International Development Cooperation through the Executive Secretariat of the Council of Ministers of Central America and the Dominican Republic, and the Central American Integration System.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely collected and anonymized clinical data; therefore, individual informed consent was not required. Relevant ethical recommendations have been followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. Correa-Rotter R, Wesseling C, Johnson RJ. CKD of unknown origin in Central America: the case for a Mesoamerican nephropathy. Am J Kidney Dis. 2014;63:506-20.
2. Trabanino RG, Aguilar R, Silva CR, Mercado MO, Merino RL. End-stage renal disease among patients in a referral hospital in El Salvador. Rev Panam Salud Publica. 2002;12:202-6.
3. Gonzalez-Bedat M, Rosa-Diez G, Pecoits-Filho R, Ferreiro A, García-García G, Cusumano A, et al. Burden of disease: prevalence and incidence of ESRD in Latin America. Clin Nephrol. 2015;83 7 Suppl 1:3-6.
4. Johnson RJ, Wesseling C, Newman LS. Chronic kidney disease of unknown cause in agricultural communities. New Engl J Med. 2019;380: 1843-52.
5. Jayasumana C, Orantes C, Herrera R, Almaguer M, Lopez L, Silva LC, et al. Chronic interstitial nephritis in agricultural communities: a worldwide epidemic with social, occupational and environmental determinants. Nephrol Dial Transplant. 2017;32:234-41.
6. Rutter CE, Njoroge M, Cooper PJ, Prabhakaran D, Jha V, Kaur P, et al. International prevalence patterns of low eGFR in adults aged 18-60 without traditional risk factors from a population-based cross-sectional disadvantaged populations eGFR epidemiology (DEGREE) study. Kidney Int. 2025;107:541-57.
7. Wijkström J, Leiva R, Elinder CG, Leiva S, Trujillo Z, Trujillo L, et al. Clinical and pathological characterization of Mesoamerican nephropathy: a new kidney disease in Central America. Am J Kidney Dis. 2013;62: 908-18.
8. López-Marín L, Chávez Y, García XA, Flores WM, Garcia YM, Herrera R, et al. Histopathology of chronic kidney disease of unknown etiology in Salvadoran agricultural communities. MEDICC Rev. 2014;16:49-54.
9. Gonzalez-Quiroz M, Smpokou ET, Silverwood RJ, Camacho A, Faber D, Garcia BR, et al. Decline in kidney function among apparently healthy young adults at risk of mesoamerican nephropathy. J Am Soc Nephrol. 2018;29:2200-12.
10. Sanchez Polo V, Garcia-Trabanino R, Rodriguez G, Madero M. Mesoamerican nephropathy (MeN): what we know so far. Int J Nephrol Renovasc Dis. 2020;13:261-72.

CLINICAL CASE

A hidden case of tuberculosis: a rare kidney abscess

Cuando la tuberculosis se esconde: un caso infrecuente de absceso renal

Roberto R. Gutiérrez-Gómez[1], Kelly V. Andrade-Mejía[2], and Samuel M. Rovira-Bayas[2]*

[1]Servicio de Nefrología, Hospital Guayaquil Dr. Abel Gilbert Pontón; [2]Universidad Católica de Santiago de Guayaquil. Guayaquil, Ecuador

Abstract

Urogenital tuberculosis is the most common extrapulmonary form. Although considered rare, it accounts for up to 30% of cases. It predominates in males and is associated with immunosuppressive conditions. Its clinical presentation is usually insidious and nonspecific, which often delays diagnosis. However, in advanced stages, it can cause serious complications, affecting the prognosis. **Objective:** *To describe one of the clinical presentations of renal tuberculosis.* **Materials and Methods:** *We present a case of renal tuberculosis in an immunocompetent patient, which manifested as a renal abscess.* **Results:** *The patient required drainage of the renal abscess and antituberculosis antibiotic treatment.* **Conclusion:** *This case highlights the importance of considering renal tuberculosis as a differential diagnosis, even in immunocompetent patients with renal abscesses of unclear etiology.*

Keywords: *Urogenital tuberculosis. Renal abscess. Renal tuberculosis.*

Resumen

La tuberculosis urogenital es la forma extrapulmonar más común. Aunque se considera rara, representa hasta el 30% de los casos. Predomina en hombres y se asocia con condiciones de inmunosupresión. Su presentación clínica suele ser insidiosa y poco específica, lo que a menudo retrasa el diagnóstico. Sin embargo, en etapas avanzadas, puede provocar complicaciones graves, repercutiendo en el pronóstico. **Objetivo:** *Describir una de las formas de presentación clínica de la tuberculosis renal.* **Materiales y Métodos:** *Se presenta el caso de tuberculosis renal en un paciente inmunocompetente, que se manifestó como un absceso renal.* **Resultados:** *Requirió drenaje del absceso renal y tratamiento antibiótico antituberculoso.* **Conclusión:** *Este caso resalta la importancia de considerar la tuberculosis renal como un diagnóstico diferencial, incluso en pacientes inmunocompetentes con abscesos renales de etiología no clara.*

Palabras clave: *Tuberculosis urogenital. Absceso renal. Tuberculosis renal.*

***Correspondence:**
Roberto R. Gutiérrez-Gómez
E-mail: mdrobertoguti@gmail.com

Date of reception: 07-04-2025
Date of acceptance: 28-06-2025
DOI: 10.24875/NEFRO.25000013

Available online: 26-08-2025
Nefro Latinoam. 2026;23(2):91-94
www.nefrologialatinoamericana.com

How to cite: Gutiérrez-Gómez RR, et al. A hidden case of tuberculosis: a rare kidney abscess. Nefro Latinoam. 2026;23(2):91-94. doi: 10.24875/NEFRO.25000013

Introduction

Tuberculosis (TB) continues to pose a significant epidemiological challenge, particularly in developing countries, due to its high prevalence and socioeconomic burden. In 2023, approximately 7.5 million new cases were reported worldwide, solidifying its position as the second leading cause of global mortality.[1]

TB can manifest in both pulmonary and extrapulmonary forms. While the pulmonary form is the most frequent, the incidence of extrapulmonary TB has shown an increase due to its association with the human immunodeficiency virus (HIV) or immunocompromised states.[2] In particular, genitourinary tuberculosis (GUTB) is the 2nd most common extrapulmonary form.[3]

Renal TB can result from hematogenous dissemination or present as a localized disease of the genitourinary tract, where it induces the formation of granulomas with caseous necrosis and subsequent parenchymal destruction. The progression of the infection to the urinary tract can lead to tuberculous pyelonephritis, strictures, and fibrosis of the urinary tract[4]. The initial clinical presentation is often nonspecific, ranging from predominant constitutional or urinary symptoms to symptoms related to complications such as sepsis, renal abscesses, urinary tract strictures, chronic kidney disease, among others. The diagnosis of GUTB includes urinalysis for the detection of *Mycobacterium tuberculosis*, as well as imaging techniques such as ultrasound and computed tomography.[3]

Currently, Ecuador does not have specific official data on cases of renal TB. The available information focuses on tuberculosis in general, without detailing the extrapulmonary forms. For example, although in 2024, a total of 6,872 cases of sensitive tuberculosis were reported in the country, these data do not specify the locations of the disease.[5] Therefore, we consider it important to report this clinical case.

Materials and methods

we describe the case of an immunocompetent patient diagnosed with renal tuberculosis, who was treated at *Hospital Guayaquil Dr. Abel Gilbert Pontón* in Guayaquil, Ecuador. Demographic and laboratory data were collected from the computerized health record.

Results

This is the case of a 40-year-old man with no personal pathological history, habits, or allergies. He sought care for a clinical picture of one-week evolution characterized by fever and chills, associated with low back pain and dysuria. Physical examination revealed a febrile patient with generalized pallor, alert and oriented in time and space, normotensive, and breathing ambient air. The abdomen was soft and painful on palpation, with a positive punch percussion on the right side. Laboratory tests, images, and peripheral cultures were requested (Table 1). Lab test results highlighted leukocytosis with a left shift, an impaired renal function, and a urine test showing leukocyturia. An abdominal ultrasound showed an 8 cm heterogeneous collection adjacent to the kidney with a volume of 250 mL and mild right hydronephrosis. Since he was an immunocompetent patient, the initial picture was interpreted as sepsis of urinary focus due to a right renal abscess and acute kidney injury. Therefore, parenteral hydration, peripheral cultures, and empirical IV antibiotic therapy were initiated. Based on the

Table 1. Lab test results

Laboratory test	At admission	At 72 hours
Hematocrit	0.245	0.304
Hemoglobin	7.8 g/dL	9.5 g/dL
Platelets	319,000/mm	435,000/mm
Leukocytes	28.31/mm	20.25/mm
Neutrophils (%)	0.857	0.857
Lymphocytes	2.07/mm	1.28/mm
AST (TGO)	52 U/L	39 U/L
ALT (TGP)	65 U/L	41 U/L
Creatinine	7.12 mg/dL	2.89 mg/dL
Total bilirubin	0.63 mg/dL	1.91 mg/dL
Direct bilirubin	0.49 mg/dL	1.26 mg/dL
Indirect bilirubin	0.14 mg/dL	0.65 mg/dL
Sodium	136 mEq/L	134 mEq/L
Potassium	5.40 mEq/L	5.40 mEq/L
Chloride	98 mEq/L	105 mEq/L
Urine: Color	Brown	-
Urine: Appearance	Turbid	-
Urine: Specific Gravity/pH	1.027–5	-
Urine: Leukocytes	+++	-
Urine: Bacteria	Negative	-
Urine: Proteins	+	-

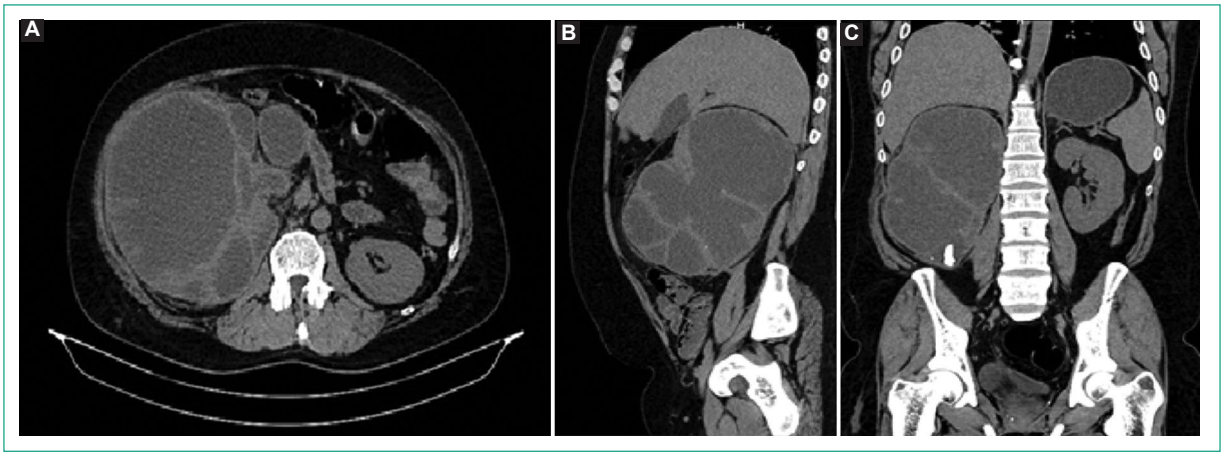

Figure 1. Non-contrast urotomography. **A** and **B:** axial and sagittal views show a hypodenseimage compromising the entire structure of the right kidney with thick-walled septa inside. **C:** coronal view shows the same hypodense image plus a hyperdense image compatible with a renal calculus. **D:** purulent fluid obtained from the right nephrostomy is shown.

ultrasound findings, a non-contrast urotomography was performed given the renal injury, which revealed a hypodense image compromising the entire structure of the right kidney and the presence of a calculusinside consistent with a renal abscess and right renal lithiasis. We decided to perform a renal abscess drainage via nephrostomy, obtaining abundant purulent fluid, which was sent for culture (Fig. 1).

Despite the implemented strategies, the clinical picture persisted for > 3 days, so a new tomographic image was proposed in case of a probable undrained focus or the presence of resistant germs. However, within the next few days, the results of the uroculture and the purulent fluid were received, reporting: *Mycobacterium* detected with no rifampicin-resistance by GeneXpert assay. Therefore, the patient was treated as an abscessed pyelonephritis caused by *Mycobacterium tuberculosis*, and first-line anti-tuberculosis therapy with isoniazid, pyrazinamide, and ethambutol, adjusted for renal function, was initiated.

Once the targeted therapy was started, we observed that the patient's overall clinical condition improved, leading to a medical discharge and follow-up with internal medicine and infectology.

Discussion

Genitourinary tuberculosis (GUTB), a poorly recognized extrapulmonary form, represents a silent challenge for public health, especially in developing countries, where its prevalence ranges from 1% to 30% of extrapulmonary cases.[6,7] In Ecuador, with 34 cases of tuberculosis per 100,000 inhabitants, the lack of effective epidemiological follow-up worsens the situation.[7]

The kidney is the most vulnerable organ, as the bacterium can remain latent until its reactivation, disseminating via hematogenous or lymphatic routes and causing complications such as tuberculous pyelonephritis or chronic kidney disease.[8,9] Its diagnosis is complex and by exclusion, as it combines clinical evaluation, laboratory analysis, and imaging studies to detect renal alterations.[10] Although risk factors such as HIV and diabetes increase susceptibility, the disease can also manifest in individuals without pathological history, making its early identification difficult.[11-13]

The described case is noteworthy for: firstly, the presentation of a renal abscess in an immunocompetent patient, suggesting that probable local and/or systemic dissemination mechanisms may exist that initiate the infectious process. Secondly, it is described that renal TB is characterized by a febrile condition with sterile pyuria, which is similar to the presentation of the case. Therefore, renal TB should be suspected as a differential diagnosis for urinary infectious processes without germ isolation. Finally, the great utility of the GeneXpert molecular techniques for the detection of *M. tuberculosis* and its resistance to rifampicin, which allowed for targeted treatment and subsequent clinical improvement.

The implementation of standardized protocols, access to advanced microbiological tests, and research in vulnerable populations to improve the early

recognition of GUTB should be priority objectives when establishing public health policies.

Conclusions

The collection of more information about GUTB, its epidemiology, pathogenic mechanisms, diagnosis, and treatment is essential to address its impact on morbidity and mortality.

Funding

The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declared no conflicts of interest whatsoever.

Ethical considerations

Protection of people and animals. The authors declare that no experiments on human beings or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve personal patient data and does not require ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that they did not use any type of generative artificial intelligence for the writing of this manuscript.

References

1. Global tuberculosis report 2023 [Internet]. Who.int. World Health Organization; 2023 [citado el 25 de mayo de 2025]. Disponible en: https://www.who.int/publications/i/item/9789240083851
2. Daher Ede F, Silva GB, Barros EJ. Renal tuberculosis in the modern era. Am J Trop Med Hyg. 2013;88(1):54–64. doi: 10.4269/ajtmh.2013.12-0413.
3. Figueiredo AA, Lucon AM, Srougi M. Tuberculosis urogenital. Microbiol Spectr. Enero de 2017; 5 (1). doi: 10.1128/microbiolspec.TNMI7-0015-2016.
4. Altez-Fernandez C, Ortiz V, Mirzazadeh M, Zegarra L, Seas C, Ugarte-Gil C. Diagnostic accuracy of nucleic acid amplification tests (NAATs) in urine for genitourinary tuberculosis: a systematic review and meta-analysis. BMC Infect Dis. 2017;17(1):390. doi: 10.1186/s12879-017-2476-8.
5. Rodriguez-Takeuchi SY, Renjifo ME, Medina FJ. Extrapulmonary tuberculosis: Pathophysiology and imaging findings. Radiographics [Internet]. 2019;39(7):2023–37. doi: 10.1148/rg.2019190109.
6. Mantica G, Ambrosini F, Riccardi N, Vecchio E, Rigatti L, De Rose AF, et al. Genitourinary tuberculosis: A comprehensive review of a neglected manifestation in low-endemic countries. Antibiotics. 2021;10(11). doi: 10.3390/antibiotics10111399.
7. Gob.ec. [citado el 9 de abril de 2025]. Disponible en: https://www.salud.gob.ec/wp-content/uploads/2023/10/Reporte-de-TB-2019-2022-vd-signed-signed-signed-signed-signed.pdf
8. Nieto-Ríos J, Zea-Lopera J, Sánchez-López S, Barrientos-Henao S, Bello Márquez D, Velez Hoyos A, et al. Tuberculosis urogenital en un paciente con falla renal, estado del arte. Iatreia. 2020;33(4):360-9. Doi:10.17533/udea.iatreia.67.
9. Rodríguez Sánchez, Martha Patricia; Ríos Valbuena, Juan José; Nieto González, Manuel Alejandro & Guarín Navas, Érika Geraldine. Tuberculosis genitourinaria, una causa poco frecuente y olvidada. Universitas Médica. (2023). 64(3). doi.org/10.11144/Javeriana.umed64-3.tgpf
10. Mhmedical.com. [citado el 25 de mayo de 2025]. Disponible en: https://accessmedicina.mhmedical.com/content.aspx?bookid=3463&sectionid=288836406
11. Roddy K, Tobin EH, Leslie SW, Rathish B. Genitourinary tuberculosis. En: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557558
12. Bausch, K., Mantica, G., Smith, E. J., Bartoletti, R., Bruyère, F., Cai, T., et al. Genitourinary tuberculosis: a brief manual for urologists on diagnosis and treatment from the European Association of Urology Urological Infections Panel. European urology focus. 2024. 10(1), 77-79. doi: 10.1016/j.euf.2023.07.006.
13. Castro-Duarte JC, López-Alarcón A, Villegas-Capiz J. Tuberculosis genitourinaria. Rev Mex Urol [internet]. 2011;71(81):18-21. Disponible en: https://www.elsevier.es/es-revista-revista-mexicana-urologia-302-articulo-tuberculosis-genitourinaria-X2007408511009602

Nefrología Latinoamericana

PERMANYER

Check for updates

CLINICAL CASE

High-flow arteriovenous fistula and pseudoaneurysm in a native kidney after percutaneous biopsy

Fístula arteriovenosa de alto flujo y pseudoaneurisma en riñón nativo posterior a biopsia percutánea

Julian C. Ramirez-Acosta[1], Griselda I. Bratti[1], Oscar Peralta[2], and Cora Giordani[1]*

[1]Servicio de Nefrología Adultos; [2]Servicio de Radiología Intervencionista y Terapia Endovascular. Hospital Italiano de Buenos Aires, Buenos Aires, Argentina

Abstract

Arteriovenous fistulas (AVFs) with hemodynamic compromise represent an uncommon complication of percutaneous renal biopsy in native kidneys. In most cases, these fistulas are asymptomatic and self-limiting. However, on certain occasions, depending on their size, they may impair renal perfusion and lead to hemodynamic alterations. We report the case of a 61-year-old female patient who required embolization of the right renal artery due to a high-flow arteriovenous fistula (AVF-HF) associated with a pseudoaneurysm, presenting with gross hematuria and hemodynamic decompensation following a percutaneous renal biopsy.

Keywords: *Arteriovenous fistula. Pseudoaneurysm. Renal biopsy. Embolization therapeutic.*

Resumen

Las fístulas arteriovenosas (FAV) con compromiso hemodinámico representan una complicación poco frecuente de la biopsia renal percutánea en riñones nativos. En la mayoría de los casos, las fístulas son asintomáticas y autolimitadas. Sin embargo, en algunas ocasiones, dependiendo de su tamaño, pueden comprometer la perfusión renal y provocar alteraciones hemodinámicas. Presentamos el caso de una paciente de 61 años que requirió embolización de la arteria renal derecha debido a una fístula arteriovenosa de alto flujo (FAV-AF) asociado a pseudoaneurisma, con hematuria macroscópica y descompensación hemodinámica tras una biopsia renal percutánea.

Palabras clave: *Fístula Arteriovenosa. Pseudoaneurisma. Biopsia renal. Embolización terapéutica.*

***Correspondence:**
Julian C. Ramirez-Acosta
E-mail: jcra01@hotmail.com

Date of reception: 23-08-2025
Date of acceptance: 28-09-2025
DOI: 10.24875/NEFRO.25000032

Available online: 06-07-2026
Nefro Latinoam. 2026;23(2):95-98
www.nefrologialatinoamericana.com

How to cite: Ramirez-Acosta JC, et al. High-flow arteriovenous fistula and pseudoaneurysm in a native kidney after percutaneous biopsy. Nefro Latinoam. 2026;23(2):95-98. doi: 10.24875/NEFRO.25000032

Introduction

Percutaneous renal biopsy (PRB) is a widely performed diagnostic procedure in nephrology, with a low rate of major complications, such as bleeding with hemodynamic compromise, high-flow arteriovenous fistulas (HF-AVF), pseudoaneurysm, and, in rare cases, nephrectomy or death.

AVFs are abnormal connections between the arterial and venous systems without an intervening capillary network. According to flow characteristics, they can be classified as low- or high-resistance depending on the artery involved. On Doppler ultrasound, they are identified by a high-velocity arterialized waveform in the draining vein and turbulent flow at the arteriovenous junction.[1]

The incidence rate of AVFs following PRB in native kidneys varies considerably among centers. In a multicenter study by Andrulli et al., which included 5,304 patients, an incidence of 0.7% was reported.[2] In contrast, Sosa-Barrios et al. reported an incidence of 9%.[3] In our center, the observed rate in this population was 0.02%. Initial diagnosis of AVF is performed using color Doppler ultrasound, a modality whose accuracy depends on equipment resolution and operator experience.

We present a case of HF-AVF associated with a pseudoaneurysm, vascular steal phenomenon, and increased right venous return, diagnosed 7 days after PRB.

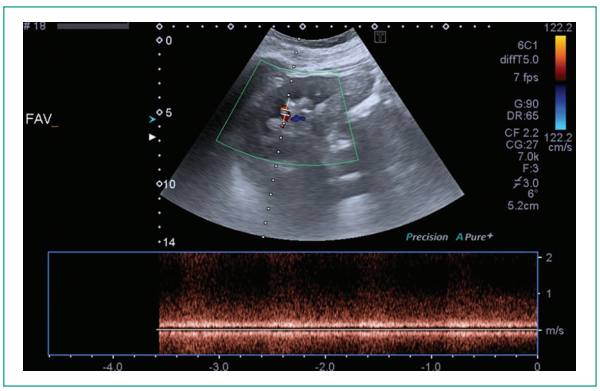

Figure 1. High-flow AVF in the middle third of the kidney.

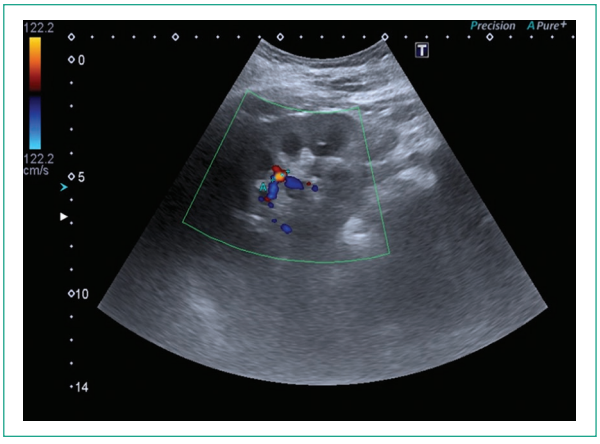

Figure 2. AVF size: 8.1 mm.

Case presentation

A 61-year-old woman with a past medical history of hypertension underwent PRB of the right native kidney at another center due to acute kidney disease with dysmorphic hematuria and nephrotic-range proteinuria requiring hemodialysis from admission. At the time of PRB, she had risk factors for complications, including hemoglobin 5.8 g/dL, hypertension, and reduced glomerular filtration rate requiring acute dialysis (Table 1). No immediate complications were reported after the procedure; however, 7 days later, the patient developed gross hematuria and hypotension at home, leading to transfer to the emergency department, where she required transfusion of 2 units of red blood cells with subsequent hemodynamic stabilization.

Due to persistent hematuria, she was referred to our center, where color Doppler ultrasound demonstrated a high-flow AVF in the middle third of the right kidney (Fig. 1) and an 8 mm pseudoaneurysm (Fig. 2). Angiography revealed hypoperfusion of the upper two-thirds of the renal parenchyma due to diversion of blood flow to the inferior vena cava through the AVF and pseudoaneurysm at the hilum (Fig. 3). The inferior polar artery was preserved, maintaining perfusion of the lower pole (Fig. 4).

Superselective embolization was performed, achieving partial closure of the pseudoaneurysm and AVF. However, persistent flow toward the renal vein remained, posing a risk of right-sided cardiac overload and heart failure (Fig. 4). Therefore, embolization of the main renal artery was performed using a 7 mm Vascular Plug® with adjunctive use of histoacryl®, preserving the inferior polar artery. The patient subsequently remained on chronic hemodialysis.

Discussion

PRB, although considered a safe procedure, is not without complications. These include perirenal hematoma,

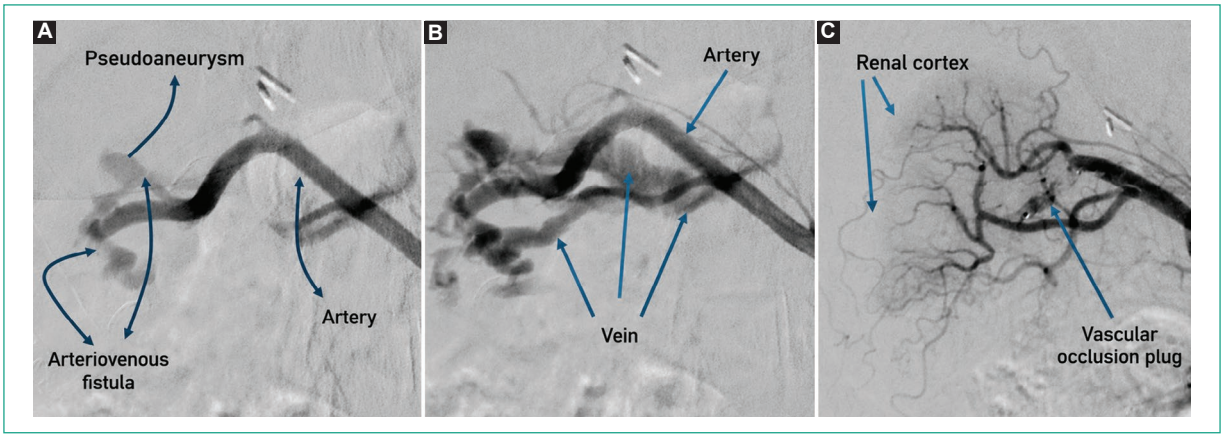

Figure 3. Renal angiographic images showing the high-flow arteriovenous fistula before and after embolization. **A** and **B:** pre-embolization angiography showing HF-AVF. **A:** the very early arterial phase demonstrates the arteriovenous communication and the pseudoaneurysm. **B:** the early venous phase of the AVF clearly shows venous filling and significant vascular steal, preventing visualization of the renal parenchyma. **C:** (post-embolization) shows closure of the HF-AVF and reappearance of the renal parenchymal vasculature.

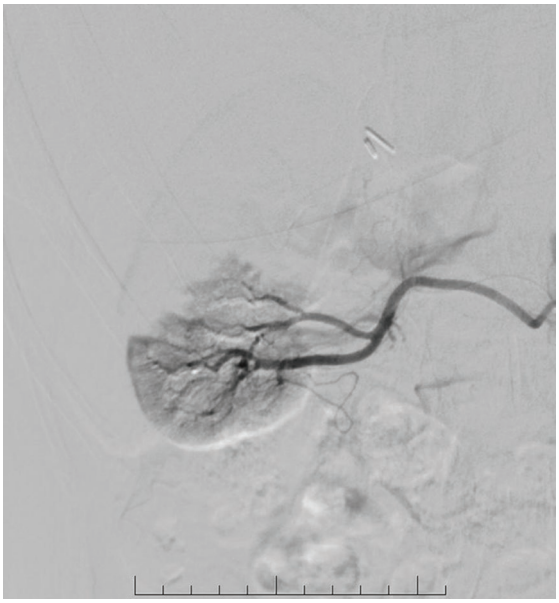

Figure 4. Inferior polar branch.

Table 1. Complementary studies at the time of biopsy

Study	Value	Reference values
Hemoglobin	5.8 g/dL	11.6-15.2
Hematocrit	17%	35.5-47.0
Urea	186 mg/dL	20-50
Creatinine	11.2 mg/dL	0.50-1.20
Prothrombin time	90%	70-120
Activated partial thromboplastin time	37 s	24-37
Albumin	4 g/dL	3.20-5.00
Urinary red blood cells	2-3 per field	0-4
Proteinuria/creatininuria ratio	9074 mg/dL	0-150

Renal ultrasound: both kidneys orthotopic with preserved morphology and increased bilateral echogenicity.

micro- and macrohematuria, AVF, pseudoaneurysm, and arteriocaliceal fistula. AVF results from simultaneous injury to adjacent arteries and veins, leading to communication between both vessels.[4]

Symptomatic large AVFs are considered a rare complication of PRB. Clinical signs depend on size and location. They are generally asymptomatic and tend to close spontaneously in 70-95% of cases when small or peripherally located.[5] In contrast, those near the hilum have a higher risk of persistence and hemodynamic complications.

Hypertension is an associated manifestation of AVF in 40-50% of cases, presumably secondary to renal ischemia and activation of the renin–angiotensin system.[6]

The coexistence of AVF and pseudoaneurysm is uncommon but clinically significant. Both may arise simultaneously from a single puncture, especially in complex vascular regions such as the hilum. Their association increases the risk of bleeding, persistent hematuria, and vascular steal phenomena.[7]

Diagnosis of post-biopsy AVF in native kidneys is performed using Doppler ultrasound, with an incidence of up to 0.7% as part of routine evaluation.[2,8]

Surgical or endovascular treatment is reserved for cases with hemodynamic instability, persistent gross hematuria for more than 72 hours, hypertension, high-flow communications with risk of heart failure, or deterioration of renal function. In symptomatic AVFs, treatment options include percutaneous selective embolization or, in some cases, partial or total nephrectomy. Endovascular embolization is considered the first-line treatment due to its effectiveness and lower invasiveness.[9-11]

Conclusions

High-flow AVF and pseudoaneurysm following percutaneous renal biopsy are rare but potentially serious complications. Early diagnosis using Doppler ultrasound and selective endovascular intervention are essential for management.

This case highlights the importance of identifying risk factors such as severe hypertension, anemia, and advanced kidney disease at the time of the procedure. The presence of persistent hematuria and signs of decompensation should raise suspicion for vascular complications. Angiographic evaluation revealed renal venous arterialization, a finding associated with a high risk of heart failure, which prompted embolization of the renal artery.

Funding

The authors declare that this work was carried out with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. González SB, Busquets JCV, Figueiras RG, Martín CV, Pose CS, de Alegría AM, et al. Imaging arteriovenous fistulas. AJR Am J Roentgenol. 2009;193(5):1425-33.
2. Andrulli S, Rossini M, Gigliotti G, Manna L, Feriozzi S, Aucella F, et al. The risks associated with percutaneous native kidney biopsies: a prospective study. Nephrol Dial Transplant. 2022;38(3):655-63.
3. Sosa-Barrios RH, Burguera V, Rodríguez-Mendiola N, Galeano C, Elías S, Ruiz-Roso G, et al. Arteriovenous fistula after renal biopsy: diagnosis and outcomes using Doppler ultrasound assessment. BMC Nephrol. 2017;18(1):365.
4. Barkhausen J, Verhagen R, Müller RD. Successful interventional treatment of renal insufficiency caused by renal artery pseudoaneurysm with concomitant arteriovenous fistula. Nephron. 2000;85(4):351-3.
5. Paredes-Mariñas E, Llort-Pont C, Mateos-Torres E, Crespo-Barrio M, Barrios-Barrera C, Clará-Velasco A. Percutaneous treatment of an arteriovenous fistula and a pseudoaneurysm after transplanted kidney biopsy. Nefrologia. 2013;33(5):744-5.
6. Guevara GO, García L, López AL, Lorios U. Embolización de fístula arteriovenosa pospunción de injerto renal [Internet]. Rev Intervencionismo. 2018 [citado 2025 Sep 2]. Disponible en: http://revistaintervencionismo.com/wp-content/uploads/2018_01_intervencionismo_casoclinico1.pdf
7. Ullian ME, Molitoris BA. Bilateral congenital renal arteriovenous fistulas. Clin Nephrol. 1987;27(6):293-7.
8. Murakami T, Takeda S, Kanazawa H, Ugajin A, Kijima S, Nakamura H, et al. Subclinical growth of an arteriovenous fistula associated with renal biopsy: a case report. BMC Nephrol. 2016;17:106.
9. Martinez T, Palomares M, Bravo JA, Alvarez G, Galindo P, Entrena AG, et al. Biopsy-induced arteriovenous fistula and venous aneurysm in a renal transplant. Nephrol Dial Transplant. 1998;13(11):2937-9.
10. Ribera L, Rodríguez Jornet A, Falcó J, Perendreu J. Arteriovenous fistula: complication of renal biopsy. Superselective embolization. Nefrologia. 2004;24(4):372-5.
11. Lorenzen J, Schneider A, Körner K, Regier M, Adam G, Nolte-Ernsting C. Post-biopsy arteriovenous fistula in transplant kidney: treatment with superselective transcatheter embolization. Eur J Radiol. 2012; 81(5):e721-6.

PERMANYER

CLINICAL CASE

IgA nephropathy associated with superimposed acute kidney injury. A report of an unusual case

Nefropatía por IgA asociada a Lesión renal aguda por sobreposición. A propósito de un caso inusual

Carlos M. Restrepo[1], Vanessa Villavicencio-Cerón[2], Rodrigo Daza-Arnedo[3], Jorge Rico-Fontalvo[3,4], Marcelo De Rosa[5], and Verónica P. Remache-Otanez[6]*

[1]Facultad de Medicina, Universidad del Norte, Barranquilla, Colombia; [2]Departamento de Nefrología, Hospital IEES Portoviejo, Portoviejo, Ecuador; [3]Comité de Riñón, Diabetes y Metabolismo, Asociación Colombiana de Nefrología e HTA, Bogotá, Colombia; [4]Departamento de Nefrología, Universidad Simón Bolívar de Barranquilla, Barranquilla, Colombia; [5]Hospital de Clínicas, Universidad de Buenos Aires, Buenos Aires, Argentina; [6]Servicio de Anatomía Patológica, Hospital de Especialidades Eugenio Espejo, Quito, Ecuador

Abstract

IgA nephropathy is the most common glomerulopathy, characterized by immune complex deposits in the glomeruli causing renal damage. It is associated with genetic predisposition and abnormal immune responses. We present the case of a 15-year-old adolescent with glomerular hematuria and acute renal deterioration following a viral illness and exposure to NSAIDs and iodinated contrast. Renal biopsy revealed IgA nephropathy and acute tubulointerstitial nephritis (ATIN) with eosinophilia. She received methylprednisolone pulses, achieving renal recovery. This case highlights the importance of distinguishing acute complications in patients with IgA nephropathy to ensure timely and appropriate management. IgA nephropathy and interstitial nephritis are connected through inflammatory mechanisms in the kidney. Although IgA nephropathy primarily affects the glomeruli with different histologic patterns, in this case we found interstitial inflammation exacerbating damage and accelerating the deterioration of renal function. This highlights the importance of addressing all the mechanism of acute kidney injury to prevent progression to end-stage renal disease.

Keywords: *IgA nephropathy. Tubulointerstitial nephritis. Renal biopsy. Hematuria.*

Resumen

La nefropatía por IgA es la glomerulopatía más común, caracterizada por depósitos de complejos inmunes en los glomérulos que causan daño renal. Se asocia con predisposición genética y respuestas inmunológicas anormales. Se presenta el caso de una adolescente de 15 años con hematuria glomerular y deterioro renal agudo tras un cuadro viral y exposición a AINEs y contraste iodado. La biopsia reveló nefropatía por IgA y nefritis túbulo-intersticial aguda (NTIA) con eosinofilia. Recibió pulsos de metilprednisolona, logrando recuperación renal. Este caso subraya la importancia de diferenciar complicaciones agudas en pacientes con nefropatía por IgA para un manejo oportuno. La nefropatía por IgA y la NTIA están interconectadas a través de mecanismos inflamatorios a nivel renal. Aunque la nefropatía por IgA afecta principalmente a

***Correspondence:**
Carlos M. Restrepo
E-mail: Drcarlosrestrepo@gmail.com

Date of reception: 29-09-2024
Date of acceptance: 17-12-2025
DOI: 10.24875/NEFRO.24000032
Available online: 06-07-2026
Nefro Latinoam. 2026;23(2):99-104
www.nefrologialatinoamericana.com
How to cite: Restrepo CM, et al. IgA nephropathy associated with superimposed acute kidney injury. A report of an unusual case. Nefro Latinoam. 2026;23(2): 99-104. doi: 10.24875/NEFRO.24000032.

los glomérulos con diferentes patrones histológicos, en este caso encontramos una inflamación intersticial aguda y severa que exacerba el daño y acelera el deterioro de la función renal. Esto pone de manifiesto la importancia de abordar todos los mecanismos de la lesión renal aguda para prevenir la progresión a la enfermedad renal crónica avanzada.

Palabras claves: *Nefropatía por IgA. Nefritis túbulo intersticial. Biopsia renal. Hematuria.*

Introduction

As the most common glomerular disease, immunoglobulin A nephropathy (IgA) has become better understood over the years. This condition is characterized by the accumulation of immune complexes in the mesangium, which leads to inflammation and progressive renal damage. The pathophysiology of this disease is related to a combination of genetic predisposition and abnormal immune responses.

In genetically predisposed individuals, exposure to specific stimuli, such as bacterial infections, may trigger an exaggerated immune response in the mucosa. This hyperreactivity results in the production of an abnormal form of IgA known as galactose-deficient IgA (GD-IgA). This abnormality in the O-galactosylation of IgA causes these molecules to be less readily recognized and therefore less efficiently cleared by the immune system.[1]

The defect in O-galactosylation alters the structure of O-glycans in the hinge region of IgA, creating a form that is recognized as foreign by the immune system. In response, the body produces autoantibodies, predominantly of the IgG or IgA type, directed against these GD-IgA molecules.[1,2]

Autoantibodies bind to GD-IgA to form circulating immune complexes. These complexes may deposit in the mesangial areas of the glomeruli, which are the filtering structures of the kidney. The deposition of these immune complexes in the mesangium triggers a series of inflammatory responses that include mesangial cell proliferation and excessive production of extracellular matrix, as well as the release of cytokines and chemokines.

These processes ultimately result in glomerular damage characterized by impaired renal function and progressive loss of the kidney's filtration capacity. Thus, the interaction between autoantibodies and GD-IgA, together with immune complex deposition, plays a central role in the pathogenesis of IgA nephropathy (IgAN).[1-3]

Worldwide prevalence remains uncertain due to the large number of asymptomatic cases that do not undergo renal biopsy for definitive diagnosis, as many patients opt for a more conservative management approach.[4]

Of note, acute deterioration of renal function in patients with IgA nephropathy is not always exclusively due to the activity of the underlying disease. In some situations, acute kidney injury (AKI) may be related to other etiologies. In this context, a detailed clinical history, appropriate complementary studies, and, when necessary, renal biopsy are essential.

We present a case in which acute tubulointerstitial nephritis (ATIN) was identified as the underlying cause of the associated AKI, highlighting the importance of comprehensive evaluation for accurate diagnosis and appropriate treatment.

Case summary

This is a 15-year-old female patient, born and residing in Ecuador, with a medical history of asthma diagnosed at the age of 6 years and atopic dermatitis. The patient sought medical attention due to macroscopic hematuria.

One month prior to admission, she presented an episode of hematuria associated with an upper respiratory viral infection, which was managed on an outpatient basis with second-generation antihistamines. Due to the persistence of hematuria, she was evaluated by urology, where cystoscopy revealed bleeding originating from the left ureter. Management with nonsteroidal anti-inflammatory drugs (NSAIDs) was indicated, and a contrast-enhanced computed tomography (CT) scan of the abdomen and pelvis was requested.

Following administration of iodinated contrast and the use of NSAIDs, an increase in nitrogenous waste markers and the development of oliguria (200 mL/day) were observed. Nephrology consultation was therefore requested due to the rapid deterioration of renal function.

During the nephrology evaluation, the first urinary sediment report showed isomorphic erythrocytes; however, in a repeat sediment reviewed directly by the nephrology team, dysmorphic erythrocytes and hematic casts were identified, consistent with glomerular hematuria. In light of these findings and the progressive renal deterioration, it was decided to administer pulses of methylprednisolone at a dose of 250 mg intravenously

every 24 hours for 3 days, with the aim of controlling the underlying inflammatory process contributing to renal injury.

Complementary examinations: Laboratory tests (Table 1) and imaging modalities (Table 2) were performed to evaluate renal status and rule out other possible causes of hematuria and renal deterioration. The patient remains under close monitoring by a multidisciplinary team, including nephrology, urology, and pediatrics.

A percutaneous ultrasound-guided renal biopsy was performed, with the following results:

In hematoxylin-eosin (HE), PAS, Masson trichrome, and Jones silver methenamine stains, 12 glomeruli were identified, without global or segmental sclerosis. All glomeruli showed mesangial matrix expansion with preserved cellularity, without endocapillary or extracapillary hypercellularity. The tubules showed focal tubulitis without atrophy. The interstitium showed no fibrosis but demonstrated a focus of lymphocytic inflammatory infiltrate with some eosinophils. The vessels showed normal histology (Fig. 1).

Direct immunofluorescence showed: IgG negative, IgA positive ++/+++ with fine granular diffuse mesangial deposition, IgM traces, C3 negative, and C1q negative, establishing a diagnosis of IgA nephropathy with an Oxford MEST-C score of M0, E0, S0, T0, C0, associated with tubulointerstitial nephritis with eosinophils (Fig. 2).

After initiation of treatment with intravenous corticosteroid pulses (methylprednisolone) at a dose of 250 mg every 24 hours for 3 days, the patient – who presented with overt hematuria and progressive deterioration of renal function – showed significant improvement in renal parameters (Table 3). Renal biopsy revealed acute tubulointerstitial nephritis (ATIN) associated with IgA nephropathy. This finding highlights the effectiveness of corticosteroid therapy in reducing the inflammatory process and promoting recovery of impaired renal function.

Table 1. Patient paraclinical profile at admission

Paraclinical test	p
Blood analysis	
Hemoglobin	13.1 g/dL
MCV	83 fL
MCH	29 pg
RDW	9 fL
Platelets	343000 mm^3
Leukocytes	5270 mm^3
Eosinophils	321.47 mm^3
Basophils	21.08 mm^3
Monocytes	368.90 mm^3
Lymphocytes	1707.48 mm^3
Neutrophils	2851.07 mm^3
Serum urea	21 mg/dL
GOT	15 IU/L
GPT	6 IU/L
Serum creatinine	4.85 mg/dL
Serum glucose	83 mg/dL
ANCA	Negative
AntiDNA	Negative
Lupus anticoagulant	Negative
ANA	Negative
Urinalysis	
Appearance	Slightly turbid
Color	Dark yellow
Density	1.009
pH	6.0
Leukocyte esterase	Negative
Nitrites	Negative
Urine proteins	25 mg/dL
Glucose	Negative
Ketone bodies	Negative
Bilirubin	Negative
Blood	150/µL
Red blood cells	224/HPF
Leukocytes	5/HPF
Dysmorphic erythrocytes	4.00%
Isomorphic erythrocytes	96.00%

MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; RDW: red cell distribution width; GOT: aspartate aminotransferase; GPT: alanine aminotransferase; ANCA: antineutrophil cytoplasmic antibodies; AntiDNA: anti-DNA antibodies; ANA: antinuclear antibodies.

Discussion

The present case showed a combination of IgA nephropathy with ATIN following exposure to NSAIDs and contrast material. ATIN is an inflammation of the renal interstitium, which corresponds to the region surrounding the tubules. It is often caused by allergic reactions to medications, infections, or autoimmune diseases. This inflammation can lead to tubular dysfunction, reduced urine-concentrating capacity, and, in severe cases, acute or chronic kidney failure.

IgA nephropathy is a renal disease with a variable clinical course characterized by IgA deposition in the mesangium, which triggers several pathogenic processes. This cascade is divided into three main phases: (1) the synthesis of pathogenic IgA; (2) its mesangial deposition and the resulting inflammatory injury; and (3) the development of tubulointerstitial damage.[5]

Although abnormal IgA glycosylation and its interaction with mesangial receptors are recognized as playing an important role, the exact mechanisms remain incompletely understood. What has been established is that deposited IgA induces the release of inflammatory mediators that damage renal tissue. A less explored aspect is how this mesangial deposition can lead to tubulointerstitial injury.[6]

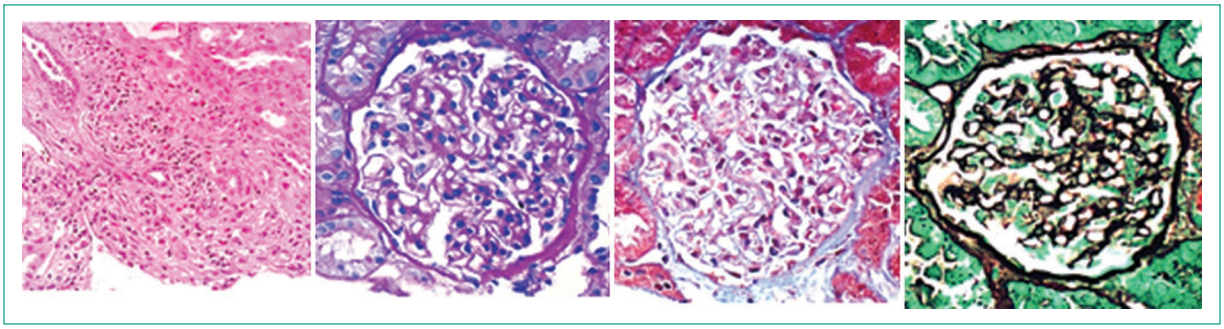

Figure 1. HE, PAS, trichrome, and methenamine silver stains. A total of 12 glomeruli were present. There was no global sclerosis or segmental sclerosis; all glomeruli showed expansion of the mesangial matrix (preserved cellularity), with no endo- or extracapillary hypercellularity. The tubules showed focal tubulitis, but no atrophy. The interstitium, without fibrosis, showed a focus of lymphocytic inflammatory infiltrate with some eosinophils. The vessels were of normal histology.

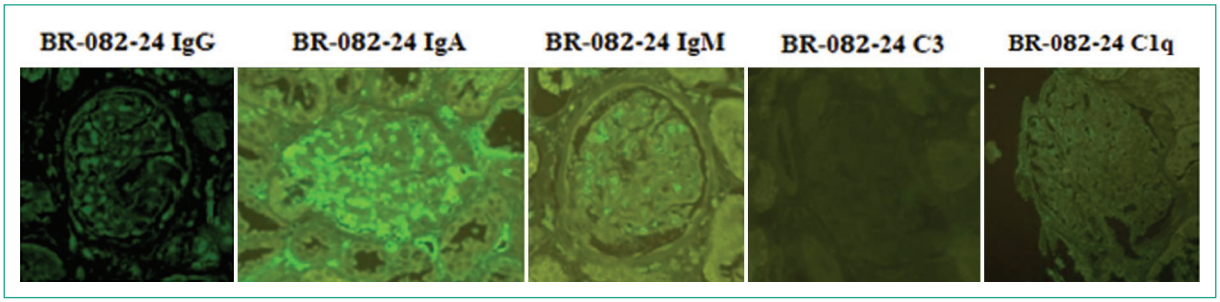

Figure 2. Direct immunofluorescence results: IgG: negative, IgA: positive ++/+++ fine granular diffuse mesangial, IgM: traces, C3: negative, C1q: negative, with a diagnosis of IgA nephropathy. Oxford MEST-C scale: M0, E0, S0, T0, C0, and associated with tubulointerstitial nephritis with eosinophils.

There are four main pathogenic mechanisms that may contribute to tubulointerstitial injury in IgAN, acting independently or jointly: infiltration of monocytes and macrophages, proteinuria, direct inflammatory effects of IgA, and glomerulotubular communication. The infiltration of inflammatory cells is a key mechanism mediating tubular injury and renal fibrosis. This process may activate resident cells, particularly proximal tubular epithelial cells (PTEC), which amplify the inflammatory response by producing chemotactic mediators that attract additional inflammatory cells, generating a feedback cycle that over time may lead to fibrosis and loss of renal function.[7,8]

Proteinuria is an important stimulus for PTEC activation and immune cell chemotaxis in multiple nephropathies; however, in IgAN – where massive proteinuria is uncommon – other factors, such as the direct toxic effect of IgA on the tubules, may be relevant.[8]

In the management of patients with IgA nephropathy, it is essential to recognize that although tubulointerstitial involvement may be secondary to the primary disease, atypical presentations exist in which other etiologies must be considered. One such example is ATIN, an entity that may be associated with the use of certain drugs, such as NSAIDs, which are widely recognized for their nephrotoxic potential.[9]

In the present case, the patient with IgA nephropathy developed acute kidney injury whose clinical course and histological findings did not fully align with tubulointerstitial involvement attributable solely to IgAN. Although electron microscopy was not performed, in this context such analysis would only have confirmed the presence of electron-dense deposits in the mesangium and paramesangium.

The renal biopsy findings were more consistent with ATIN, which led to the consideration of recent NSAID use as a key factor in the acute renal injury. This

Table 2. Patient imaging modalities

Imaging study	Patient result
Renal ultrasound	The right kidney measures 85 × 37 × 41 mm and the left kidney 88 × 38 × 41 mm. Both show normal morphology, preserved cortex, and adequate corticomedullary relationship without cysts, lithiasis, or tumors. Mild bilateral pyelocaliceal ectasia is observed with no identifiable cause and persists after voiding. The bladder is normal with a thin wall, a pre-void volume of 319 cc, and a post-void residual of 53 cc.
Renal doppler	Native kidneys with preserved parenchymal-cortical relationship. No significant vascular or hemodynamic alterations are observed bilaterally at the intrarenal level. The left renal vein shows increased diameter with an SMA axis angle of 18° and PSV of 8 cm/s.

Table 3. Patient paraclinical profile after corticosteroid use

Paraclinical test	Patient value	Paraclinical test	Patient value
Blood analysis			
Hemoglobin	9.10 g/dL	Serum urea	31 mg/dL
MCV	74 fL	Serum creatinine	0.74 mg/dL
MCH	24 pg		
RDW	16 fL		
Platelets	434000 mm^3		
Leukocytes	14280 mm^3		
Eosinophils	185.68 mm^3		
Basophils	14.28 mm^3		
Monocytes	828.24 mm^3		
Lymphocytes	4184.04 mm^3		
Neutrophils	9067.80 mm^3		

reasoning is supported by the atypical clinical course, the relevant medical history, and the fact that the entire clinical picture could not be explained by a single entity. Although IgA nephropathy and ATIN are usually considered separate diseases, in this case their coexistence suggests a multifactorial phenomenon requiring consideration of multiple hypotheses.

One such hypothesis is tubular obstruction by red blood cells, particularly in the context of macroscopic hematuria. This obstruction may occur when erythrocytes present in the urine accumulate within the tubules, reducing urinary flow, increasing intratubular pressure, and causing tubular damage. This form of tubulitis may contribute to renal dysfunction and mimic the findings of ATIN.[10]

In such scenarios, precise identification of the etiology allows discontinuation of the causative agent and facilitates renal recovery, especially when intervention occurs early. Therefore, differentiating between tubulointerstitial involvement secondary to IgA nephropathy and drug-induced ATIN, such as that associated with NSAIDs, is essential to guide treatment and improve prognosis. Likewise, this highlights the importance of a detailed clinical history and careful review of medications recently used by the patient.

Conclusions

Our clinical case involves a patient with IgA nephropathy associated with acute kidney injury due to overlap with ATIN. It is important to keep in mind that acute kidney injury in patients with IgA nephropathy is not always explained solely by decompensation of the underlying disease. When atypical clinical features are present, the possibility of overlapping renal diseases should be considered. Renal biopsy is an important diagnostic tool that can be highly useful in establishing an accurate diagnosis and guiding appropriate management.

Funding

The authors declare that this work was conducted with the authors' own resources.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of human subjects and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. This study does not involve personal patient data, medical records, or biological samples, and does not require ethical approval. SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

References

1. Chen A, Fang SY, Nikolic-Paterson DJ, Kitching AR, Holdsworth SR. IgA nephropathy: advances in diagnosis and management. Am J Kidney Dis. 2023;83(2):229-240. doi:10.1016/j.ajkd.2023.09.019

2. Wyatt RJ, Julian BA. IgA nephropathy. N Engl J Med. 2013;368(25):2402-2414. doi:10.1056/NEJMra1206793
3. Yeo SC, Cheung CK, Barratt J. New insights into the pathogenesis of IgA nephropathy. Pediatr Nephrol. 2018;33(5):763-777. doi:10.1007/s00467-018-3940-3
4. Rodrigues JC, Haas M, Reich HN. IgA nephropathy. Clin J Am Soc Nephrol. 2017;12(4):677-686. doi:10.2215/CJN.09490916
5. Valdenebro M, Marques M, Rubio P. Nefropatía IgA asociada a nefritis intersticial aguda tras administración de contraste yodado. Nefrologia. 2015;35(6):651-653. doi:10.1016/j.nefro.2015.09.006
6. Zhang L, Li J, Yang S, Huang N, Zhou Q, Yang Q, et al. Clinicopathological features and risk factor analysis of IgA nephropathy associated with acute kidney injury. Ren Fail. 2016;38(5):799-805. doi:10.1080/0886022X.2016.1141572
7. Tomino Y, Sakai H. Clinical guidelines for immunoglobulin A nephropathy in Japan, second edition. Clin Exp Nephrol. 2003;7(2):93-97. doi:10.1007/s10157-003-0278-9
8. Lai KN, Tang SC, Guh JY, Chan TM, Lam MF, Leung JC, et al. Polymeric IgA1 from IgA nephropathy upregulates synthesis and signal transduction of transforming growth factor-β in human mesangial cells via the renin-angiotensin system. J Am Soc Nephrol. 2003;14(11):3127-3137. doi:10.1097/01.ASN.0000097053.60176.3A
9. Kidney Disease: Improving Global Outcomes (KDIGO) Glomerular Diseases Work Group. KDIGO 2021 Clinical Practice Guideline for the Management of Glomerular Diseases. Kidney Int. 2021;100(S1):S1-S276. doi:10.1016/j.kint.2021.05.001
10. Rivera F, López-Gómez JM, Pérez-García R. Nefropatía IgA y hematuria glomerular. Nefrologia. 2011;31(3):247-250. doi:10.3265/Nefrologia.pre2011.Apr.10940