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Sociodemographic, clinical, frailty and post-donation complications analysis in kidney donor candidates: a descriptive retrospective cohort study

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ABSTRACT

Introduction: Frailty is a determinant in the health assessment of renal transplant donors and recipients. It is linked to increased surgical risk and poorer postoperative outcomes. However, the impact of frailty in kidney donor candidates (KDC) has yet to be investigated.

Objectives: To describe the socio-demographic and clinical characteristics of a cohort of renal donor candidates in Spain and to analyse the relationship between frailty, suitability for donation, and surgical complications.

Material and Method: A retrospective cohort study that included KDC was evaluated between April 2020 and April 2024 at the Hospital del Mar in Barcelona. Socio-demographic, clinical, and frailty data were collected; statistical analyses included Chi-square and T-Student tests ($p<0.05$).

Results: A total of 231 KDCs completed the first phase of evaluation. The majority were women (61.9%), with a mean age of 56.31±12.95 years and a medium-high or high socioeconomic level (76.62%). According to the Fried scale, 25% (n=27) and 0.93% (n=1) of the KDC had pre-frailty and frailty, respectively, while no frailty was undetected. 30.49% (n=75) of KDC were accepted for donation. Postoperative complications included dehiscence, bleeding, and seroma (n=1; 1.33% each).

Conclusions: This study highlights the low prevalence of frailty among KDC and its limited association with surgical complications. However, cardiovascular risk factors remain key in the evaluation. Further research is needed to improve the safety of the donation process.

Keywords: renal transplantation; kidney donor; frailty.

RESUMEN

Sociodemographic, clinical, frailty and post-donation complications analysis in kidney donor candidates: a descriptive retrospective cohort study

Introducción: La fragilidad es determinante en la evaluación de la salud de donantes y receptores de trasplante renal, vinculada con un mayor riesgo quirúrgico y peores resultados postoperatorios. Sin embargo, el impacto de la fragilidad en candidatos a donantes renales no ha sido investigado.

Objetivos: Describir las características sociodemográficas y clínicas de una cohorte de candidatos a donantes renales en

España, y analizar la relación entre la fragilidad, la idoneidad para la donación y las complicaciones quirúrgicas.

Material y Método: Estudio de cohorte retrospectivo que incluyó a candidatos a donantes renales evaluados entre abril de 2020 y abril de 2024 en el Hospital del Mar de Barcelona. Se recopilaron datos sociodemográficos, clínicos y de fragilidad; los análisis estadísticos incluyeron pruebas Chi-cuadrado y T-Student (p<0,05).

Resultados: 231 candidatos a donantes renales completaron la primera fase de evaluación. La mayoría fueron mujeres (61,9%), con una edad promedio de 56,31±12,95 años y un nivel socioeconómico medio-alto o alto (76,62%). Según la escala Fried, el 25% (n=27) y el 0,93% (n=1) de los cDR presentaron pre-fragilidad y fragilidad, respectivamente; en la escala Frail, no se detectó fragilidad. El 30,49% (n=75) fueron aceptados para la donación. Las complicaciones postoperatorias incluyeron dehiscencia, sangrado y seroma (n=1; 1,33% cada una).

Conclusiones: Este estudio destaca la baja prevalencia de fragilidad entre los candidatos a donantes renales y su limitada relación con complicaciones quirúrgicas. Sin embargo, los factores de riesgo cardiovascular siguen siendo clave en la evaluación. Se requieren investigaciones adicionales para mejorar la seguridad del proceso de donación.

Palabras clave: trasplante renal; donante de riñón; fragilidad.

INTRODUCTION

Frailty has become a key aspect in the assessment of population health, particularly in the field of kidney transplantation (KT), both in donors and recipients[1,2]. It is defined as the presence of certain phenotypic criteria indicating reduced physiological reserve and increased vulnerability to stressors, such as surgical events[2]. The criteria most widely used to identify frailty include: low grip strength; self-perceived fatigue or lack of energy; reduced gait speed; decreased physical activity; and unintentional weight loss[2].

In the context of solid organ transplantation, frailty has gained relevance as a prevalent condition affecting both patient eligibility and post-operative outcomes[3]. Individuals with chronic kidney disease who enter KT programmes and meet frailty criteria are less likely to be placed on the waiting list, less likely to ultimately receive a transplant, and more likely to die while awaiting transplantation[3]. Therefore, frailty assessment has become fundamental to ensuring comprehensive, objective, and thorough evaluation of KT candidates, enabling improved planning of pre-, intra-, and post-operative care[4-7]. The impact of frailty is not limited to KT, as its influence on surgical outcomes across other interventions has been extensively studied. Evidence consistently demonstrates that frailty is associated with increased morbidity and mortality, prolonged hospital stays, and more complex care requirements[8]. Frailty has been shown to be a strong predictor of adverse outcomes across all emergency surgical admissions, irrespective of age[9]. These findings underscore the importance of identifying frailty prior to surgical intervention, allowing for tailored care, prehabilitation strategies, and optimisation of procedural outcomes[10,11]. In particular, identifying frailty before surgery provides the opportunity for informed counselling and shared decision-making, offering relevant information regarding procedural risks and benefits, which is especially important in the context of living donor KT, a planned and low-risk procedure.

In the specific case of potential kidney donors (pKD), candidates must undergo extensive evaluation to determine suitability, given that living donor transplantation is an altruistic, benign, thoroughly studied and closely monitored procedure in which the donor derives no direct benefit[12]. However, one aspect that has not yet been incorporated into this evaluation is frailty assessment. To date, no studies in the literature have explored whether frailty in potential kidney donors increases the risk of postoperative complications.

In response to these gaps, this study aims to: **1)** describe the sociodemographic and clinical characteristics of a cohort of pKD at a tertiary hospital in Spain; **2)** analyse the relationship between frailty and candidate suitability for final acceptance as kidney donors; and **3)** evaluate the association between frailty and intra- and post-operative complications among those ultimately accepted as kidney donors.

MATERIAL AND METHOD

Study Design

We conducted a retrospective descriptive cohort study in accordance with the STROBE reporting guidelines[13]. The study includes data from all individuals evaluated as pKD between April 2020 and April 2024 at Hospital del Mar in Barcelona, an accredited KT centre.

Sample

Universal sampling was employed, including all adults evaluated as pKD during the study period at the study centre who provided consent for data collection. Exclusion criteria included inability to complete the administered assessment questionnaires.

Data Collection

At the centre, the pKD process begins with a telephone call to the nurse responsible for KT access. During this call, the process is explained, donor motivations are explored, and clinical information is reviewed with the candidate's consent. If no absolute medical contraindications exist and the candidate remains interested, a second phase follows, including blood and urine tests, abdominal ultrasound, and in-person consultations with the nurse and nephrologist. On the same day, detailed information regarding donation is provided

and preliminary results are reviewed to determine whether further evaluation is warranted. In the 3rd phase, additional tests, specialist consultations, and a more comprehensive donor assessment are conducted, including frailty evaluation. After completion of this phase, donor suitability is determined, and the process concludes with ethical-legal clearance. This procedure is always individualised, adhering to current regulations and respecting the needs of each candidate and their environment. Variables described below were collected across all phases between April 2020 and April 2024.

Variables

Data were extracted from the institution's electronic medical records:

Sociodemographic variables: sex; age; country of birth; socioeconomic level measured using the Composite Socioeconomic Index (CSI)[14].

Clinical variables: weight, height, body mass index (BMI); diabetes mellitus; hypercholesterolaemia; hypertension; chronic obstructive pulmonary disease or asthma; coronary artery disease; current smoking; sedentary lifestyle (self-reported physical activity <30 minutes/day); donor identity; causes of exclusion from donation; and post-donation complications.

Frailty variables:

a) FRIED scale, an objective assessment based on five criteria: weight loss, muscle weakness, exhaustion, slow walking speed, and low physical activity. Individuals scoring ≥3 points were classified as frail; 1–2 points as pre-frail; and 0 points as non-frail[15].

b) FRAIL scale, a self-reported questionnaire assessing fatigue, resistance, aerobic capacity, comorbidities, and weight loss. Frailty was defined as ≥4 points; pre-frailty as 2–3 points; and non-frailty as 0–1 points[16].

Dependency variables:

a) Barthel Index, assessing ability to perform 10 basic activities of daily living (BADL), classifying individuals as fully independent (100), mildly dependent (91–99), moderately dependent (61–90), severely dependent (21–60), or totally dependent (0–20)[17].

b) Lawton–Brody Scale, evaluating ability to perform 8 instrumental activities of daily living (IADL), classifying individuals as independent (8), partially independent (4–7), or dependent (0–3)[18].

Statistical Analysis

We conducted a descriptive analysis was using Jamovi open-source statistical software. Quantitative variables were summarised using mean, median, standard deviation, and interquartile range. Qualitative variables were expressed as absolute and relative frequencies (%). Comparative analyses used Pearson's chi-square test with Cramer's V as effect size. Student's t-test was applied for quantitative variables. Statistical significance was defined as $p<0.05$. Cramer's V values were interpreted as: <0.1 negligible, 0.1–0.29 small, 0.3–0.49 medium, ≥0.5 large effect.

Ethical Considerations

The study was approved by *Hospital del Mar* Ethics Committee (No. 2020/9418/I), in compliance with current regulations, the nursing code of ethics, and the Declaration of Helsinki.

RESULTS

During the study period (April 2020 to April 2024), 246 individuals expressed interest in being evaluated as potential kidney donors (pKD). After an initial informational telephone consultation, 93.9% (n=231) of pKD agreed to initiate the evaluation process, allowing collection of their sociodemographic and clinical data. These results are presented in **table 1.**

Most of the sample consisted of women (n=143; 61.9%), with a mean age of 56.31±12.95 years, born in Spain (n=184; 79.65%), and with high or upper-middle socioeconomic status (n=177; 76.62%). No statistically significant differences were identified between candidates who ultimately donated and those who did not, except for BMI level (p=0.045), presence of hypercholesterolaemia (p=0.015), and sedentary lifestyle (p=0.021).

After completion of the 1st evaluation phase, FRIED and FRAIL scales were administered to 108 pKD to assess frailty, and Barthel and Lawton–Brody scales were used to assess functional dependence in 40 pKD (dependency data could not be obtained for the entire sample). Results are presented in **table 2**. According to the FRIED scale, 25% (n=27) of candidates were classified as pre-frail and 0.93% (n=1) as frail; no frailty was detected using the FRAIL scale. The cohort was predominantly independent in basic activities of daily living (n=36; 90%) and instrumental activities (n=34; 85%).

At the conclusion of the evaluation process, 75 pKD were considered suitable for donation (30.49% of the 246 individuals who initially expressed interest). Surgical complications included: 1 case (1.33%) of wound dehiscence; 1 case (1.33%) of minor wound bleeding; and 1 case (1.33%) of surgical wound seroma. Causes of exclusion among the 156 non-eligible candidates are summarised in Table 3. The main reasons were withdrawal from the donor evaluation process (n=36; 20.07%), accumulation of cardiovascular risk factors (n=24; 15.38%), surgical contraindication (n=15; 9.62%), and insufficient renal function (n=13; 8.33%).

DISCUSSION

This study provides a detailed overview of the sociodemographic and clinical characteristics of a cohort of potential kidney donors evaluated at a tertiary hospital in Spain, as well as their frailty status and functional dependence.

Table 1. Sociodemographic and Clinical Variables of the Analysed Sample (n=231).

	Total (n=231)	Donors (n=75)	Non-donors (n=156)	p	Cramér's V
Sociodemographic variables					
Age (mean ± SD)	56.31±12.95	57.37±11.45	55.79±13.62	0.387	–
Sex (n; %)					
Women	143 (61.9%)	48 (64%)	95 (60.9%)	0.649	0.0299
Men	88 (38.1%)	27 (36%)	61 (39.1%)		
Country of birth (n; %)					
Spain	184 (79.65%)	62 (82.67%)	122 (78.21%)	0.645	0.195
South America (Ecuador, Peru, Uruguay, Bolivia, Brazil, Colombia, Argentina, Venezuela)	25 (10.82%)	7 (9.33%)	18 (11.51%)		
North Africa (Morocco)	6 (2.60%)	1 (1.33%)	5 (3.21%)		
Western Europe (France, Belgium)	4 (1.73%)	2 (2.66%)	2 (1.28%)		
Southern Europe (Andorra, Italy)	2 (0.87%)	1 (1.33%)	1 (0.64%)		
South-East Asia (Philippines)	2 (0.87%)	0 (0%)	2 (1.28%)		
Central America (Mexico)	2 (0.87%)	0 (0%)	2 (1.28%)		
Caribbean (Cuba)	1 (0.43%)	0 (0%)	1 (0.64%)		
Northern Europe (Estonia)	1 (0.43%)	1 (1.33%)	0 (0%)		
East Asia (South Korea)	1 (0.43%)	1 (1.33%)	0 (0%)		
South Asia (Pakistan)	1 (0.43%)	0 (0%)	0 (0%)		
West Africa (Guinea)	1 (0.43%)	0 (0%)	0 (0%)		
Central Africa (Cameroon)	1 (0.43%)	0 (0%)	0 (0%)		
Socioeconomic level (n; %)					
High (0.00–24.99 points)	29 (12.56%)	10 (13.33%)	18 (11.54%)	0.819	0.0633
Upper-middle (25.00–49.99 points)	149 (64.50%)	50 (66.67%)	99 (63.46%)		
Lower-middle (50.00–74.99 points)	52 (22.51%)	15 (20%)	35 (22.44%)		
Low (75.00–100.00 points)	1 (0.43%)	0 (0%)	4 (2.56%)		
Clinical variables					
BMI (mean ± SD)	**27.94 ± 5.03**	**27.23 ± 4.77**	**28.29 ± 5.13**	**0.161**	–
Underweight (n; %)	3 (1.30%)	0 (0%)	3 (1.92%)	0.045*	0.186
Normal weight (n; %)	64 (27.71%)	29 (38.67%)	35 (22.44%)		
Overweight (n; %)	95 (41.13%)	25 (33.33%)	70 (44.87%)		
Obesity (n; %)	69 (29.87%)	21 (28%)	48 (30.77%)		
Diabetes mellitus (n; %)	14 (6.06%)	0 (0%)	14 (8.97%)	0.134	0.0986
Hypercholesterolaemia (n; %)	91 (39.39%)	38 (50.67%)	53 (33.97%)	0.015*	0.160
Arterial hypertension (n; %)	79 (34.20%)	24 (32%)	55 (35.26%)	0.625	0.0321
COPD or asthma (n; %)	6 (2.60%)	1 (1.33%)	5 (3.21%)	0.059	0.124
Coronary disease (n; %)	**3 (1.30%)**	**0 (0%)**	**3 (1.92%)**	**0.062**	**0.123**
Current smoking (n; %)	**58 (25.11%)**	**13 (17.33%)**	**45 (28.85%)**	**0.064**	**0.123**
Sedentary lifestyle (n; %)	**72 (31.17%)**	**0 (0%)**	**72 (46.15%)**	**0.021***	**0.299**

SD, standard deviation; **BMI,** body mass index; **n,** number.

The findings allow reflection on potential associations between these variables and donor eligibility, in addition to surgical complications.

From a sociodemographic perspective, the sample was predominantly female with a mean age above 56 years. These findings are consistent with previous studies in kidney donation, which report a higher prevalence of female donors[19].

Furthermore, most participants belonged to high or upper-middle socioeconomic strata, consistent with prior literature and potentially influencing healthcare access and capacity for sustained follow-up during the donation process[20]. This socioeconomic profile may ultimately favour recipients from similar backgrounds, particularly men with chronic kidney disease requiring kidney transplantation[21].

Table 2. Frailty (n=108) and Dependency (n=40) Variables.

Frailty variables (n=108)	
FRIED scale results (n; %)	
Non-frail (0 points)	80 (74.07%)
Pre-frail (1–2 points)	27 (25%)
Frail (≥ 3 points)	1 (0.93%)
FRAIL scale results (n; %)	
Non-frail (0 points)	108 (100%)
Pre-frail (1–2 points)	0 (0%)
Frail (≥ 3 points)	0 (0%)
Dependency variables (n=40)	
Barthel scale results (ADL) (n; %)	
Independent (100 points)	36 (90%)
Mild dependency (91–99 points)	2 (5%)
Moderate dependency (61–90 points)	2 (5%)
Severe dependency (21–60 points)	0 (0%)
Total dependency (< 20 points)	0 (0%)
Lawton scale results (IADL) (n; %)	
Independent (8 points)	34 (85%)
Slight dependency (6–7 points)	3 (7.5%)
Moderate dependency (4–5 points)	3 (7.5%)
Severe dependency (2–3 points)	0 (0%)
Total dependency (0–1 points)	0 (0%)

n, number.

Regarding clinical variables, the high proportion of pKD with overweight or obesity was noteworthy. These values exceed those reported in the general Spanish adult population[22] and are striking given that obesity is a recognised cardiovascular risk factor[6] and not a health-promoting attribute for surgical eligibility. Similarly, the prevalence of hypercholesterolaemia, hypertension, and smoking equalled or exceeded that of the general population[23], representing additional cardiovascular risk factors that complicate surgical suitability[24]. These findings highlight the importance of donor motivations, which often prioritise providing well-being and happiness to others over personal risk avoidance[25].

Frailty assessment in this study did not demonstrate a direct association with donor exclusion or peri-operative complications, primarily due to limited sample size and study duration. Although no previous studies have examined frailty specifically in pKD, extensive evidence exists regarding frailty as a predictor of adverse outcomes in transplant recipients and surgical populations[3,26,27]. Differences observed between frailty scales mirror findings in the literature[28,29]. where the Fried scale[15] is considered the gold standard, though combining tools may enhance care planning[30,31].

Table 3. Reasons for exclusion from donation (n=156).

Reasons for Exclusion from Donation	
Reasons for exclusion in the kidney KDC (n; %)	
Lack of desire to continue as a KDC	36 (20.07%)
Cardiovascular risk factors	24 (15.38%)
Surgical contraindication	15 (9.62%)
Insufficient renal function	13 (8.33%)
Assessed as second-choice donor	13 (8.33%)
Positive genetic test	9 (5.77%)
Diabetes mellitus	7 (4.49%)
Cancer	5 (3.21%)
Inability to attend visits due to distance from the centre	5 (3.21%)
Coronary artery disease	3 (1.92%)
Liver disease	1 (0.64%)
Hydrocephalus requiring intracranial shunt	1 (0.64%)
Reasons for exclusion in the kidney transplant candidate (KTC) (n; %)	
Cancer	5 (3.21%)
Deceased donor kidney transplant (DDKT)	3 (1.92%)
Not eligible for KT	3 (1.92%)
Death	2 (1.28%)
Reasons for exclusion in both KDC and KTC (n; %)	
HLA incompatibility without wish for PLDKT	10 (6.41%)
Change of centre	1 (0.64%)

KDC, kidney donor candidate; **HLA,** human leukocyte antigens; **n,** number; **KT,** kidney transplantation; **PLDKT,** paired living donor kidney transplantation.

This study has several limitations that should be considered when interpreting the results. First, the limited follow-up period and small sample size restricted the ability to conclusively evaluate the relationship between frailty and donor suitability, as well as intraoperative and postoperative complications. These limitations preclude generalization of the findings to a broader donor population. In addition, the choice of frailty assessment tools may have influenced the results, as different scales can yield variability in frailty measurement and interpretation. Finally, the prevalence of comorbidities in this cohort may have been influenced by socioeconomic and motivational biases, underscoring the need for future studies that specifically address these variables in larger samples to enhance the understanding and applicability of the findings.

In conclusion, this study provides valuable insight into the sociodemographic and clinical profile of kidney donor candidates, highlighting relevant factors such as the prevalence of comorbidities that may affect donor suitability and surgical safety. The presence of cardiovascular risk

factors in this cohort, together with observed differences in frailty assessment, emphasizes the need for continued investigation into the implications of these variables in donor selection. Furthermore, the study underscores the importance of considering donors' intrinsic motivations, which may outweigh perceived risks, reflecting the complexity of decision-making in organ donation. Future studies focusing on frailty and comorbidities among donors may support more personalized approaches and improve the safety and effectiveness of the donation process.

Conflicts of interest

None declared.

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