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Maternal and Fetal Outcomes in Pregnant Women with Chronic Kidney Disease Based on Glomerular Filtration Rate

Juan Carlos H Hernández Rivera[1]*, María Juana Pérez López[2], Luis García Covarrubias[3], EEAEC Mariana Salazar Mendoza[4], Elvia Mera Jiménez[5], Rosa Amalia Bobadilla Lugo[5], Cruz Vargas De León[5], José Cruz Santiago[6] and Ramón Paniagua Sierra[1]

[1]Unidad de Investigación Médica en Enfermedades Nefrológicas, HE CMN Siglo XXI IMSS, CdMx
[2]Servicio de Nefrología HE CMN La Raza
[3]Servicio de Trasplante Renal, Hospital General de México, CdMx
[4]Servicio de Urgencias, Hospital Regional "Lic. Adolfo López Mateos", ISSSTE CdMx
[5]Sección de Estudios de Posgrados e Investigación, Escuela Superior de Medicina, Instituto Politécnico Nacional
[6]Unidad de Trasplante Renal, HE CMN La Raza

Abstract

Introduction: Pregnancy causes adaptations in the kidney, both in anatomy and function, to maintain the extracellular, hemodynamic and hormonal environment. However, these may not be carried out completely optimally in the presence of kidney disease. The objective was to study the relation between kidney disease and maternal-fetal outcomes during pregnancy, associated with a rejection by patient and/or relative to specialized treatment.

Material and Methods: Observational, retrospective study in a series of cases, reviewing 134 files of pregnant patients with some degree of kidney disease prior to pregnancy. Maternal outcomes recorded were: hypertensive disease during pregnancy, acute renal deterioration, need for renal substitution therapy, and in products: prematurity, restriction of intrauterine growth, fetal death. and miscarriage.

Results: Maternal outcomes: mean glomerular filtration rate (GFR) of 58.23 ml/min, weight gain of 7 kg; preeclampsia was diagnosed in 92 women (55 severe). 46 patients showed acute renal lesion, 40 were conservatively resolved; 1 required peritoneal dialysis and 15 hemodialysis (with decision delayed an average of one month by rejection by patient and/or relative). Resolution of pregnancy was by cesarean in 111 patients; 116 products were born before 37 weeks of gestation, with average weight of 1910 g, 94 showed restriction of intrauterine growth.

Conclusion: Kidney disease directly influenced the greater number of adverse maternal and fetal outcomes when specialized medical care was rejected. There is a correlation between slight Davison state with states I, II and IIIa of KDIGO in correspondence analysis.

Keywords: Kidney disease; Pregnancy; Preeclampsia; Glomerular filtration rate

Correspondence to: Juan Carlos H Hernández Rivera, Unidad de Investigación Médica en Enfermedades Nefrológicas, UMAE Hospital de Especialidades Bernardo Sepúlveda Gutiérrez, Centro Médico Nacional Siglo XXI. IMSS, Av. Cuauhtémoc 330, Col. Doctores, México, E-mail: juancarloshhernandezrivera@hotmail.com

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Introduction

The incidence and prevalence of chronic kidney disease (CKD) is growing worldwide as a consequence of elevated rates of diabetes mellitus and hypertension, which mainly affect the adult and elderly population. In young populations, some systemic diseases, like systemic lupus erythematosus, Sjögren syndrome, rheumatoid arthritis and vasculitis, among others. The onset and evolution of CKD can be monitored and renal care planned[1]. However, in young adults, an important number of primary kidney diseases pass unperceived and patients are not detected until in advanced stages of CKD, which is evident from the high percentage of patients that come to dialysis without diagnosis of the primary disease [1,2]. This condition is particularly important in women of reproductive age, in whom CKD is frequently detected when menstrual disorders appear of when they become pregnant [3-5]. In developing countries such as Mexico, and important part of the population does not regularly visit health services as a preventative measure and for early detection of diseases.

CKD has important effects of female gonad physiology, such as hyperprolactinemia, hippothalamus-hypophisary dysfunction and loss of libido, which reduce fertility [4,5]. When pregnancy appears, the comorbidity can affect up to 40% of cases [3-5]. Comorbidity includes hypertensive diseases (preeclampsia and eclampsia), persistence of post-partum hypertension, spontaneous abortion in ranges from 12 to 46%, according to state, polyhydramnios between 42 and 79% [6-8], pre-

term birth (birth before 37th week of gestation), cesarean, deterioration of renal function or requirement for substitutive therapy. Among the fetal morbidities reduction in intrauterine growth (below 3 percentile), low birth weight (less than 2,500 g), fetal death and more entry into neonatal intensive care units (NICU) stand out [3,9,10]. Although the adverse effects that pregnancy can cause on the progression of kidney disease has been clarified, few articles have classified CKD during pregnancy with KDIGO (Kidney Disease: Improving Global Outcomes) classification, which is based on GFR in the collection of 24-hour urine and proteinuria [3,4,11-19].

It is suggested to carry out pregnancy to term and to resolve it by vaginal delivery. However, if this is not possible, at least pulmonary maturity should be reached by passing week 34 - 36 of gestation; the best option would be to approach week 38 [5,20,21].

In 86% of pre-term births take place in women with CKD, 81% occur in moderate stage, compared with 97% in severe state. The need for substitution therapy for renal function, be it hemodialysis or dialysis, is found in 23% in severe state once the pregnancy is concluded [3,22,23].

Mexico does not have a CKD registry, which is why the cause of disease by age and gender is unknown. In patients that enter peritoneal dialysis, 40% of the non-diabetics lack a diagnosis of CKD, and the expected frequency of the disease is 10% in general population [24]. Prior distribution implies an important number of women have CKD and do not know it, which can complicate medical care in pregnant women. The object of the present work was to analyze the kind, frequency of complications and clinical outcomes in regards to pregnancy, products and renal function, in a cohort of women with CKD and pregnancy; in addition to the conditions of an important part of the population who do not regularly visit health services for prevention, associated with fear of beginning invasive treatments, such as initiating dialysis or hemodialysis, delaying the start and increasing adverse results for both mother and products.

Material and Methods

Design

SA retrospective cohort was analyzed from single center in the period from January 1, 2007 to December 31, 2013.

Patients

134 clinical files of pregnant patients were analyzed, all with some degree of kidney disease, stratified according to KDIGO classification, based on glomerular filtration measured by creatinine clearance and proteinuria in 24-hour urine.

Data collection

Demographic and clinical data were obtained from clinical files. Special care was taken in recording weight at the start of pregnancy and gain during evolution. Laboratory data were also recorded by trimester, including: glucose, urea, creatinine, uric acid, creatinine clearance and proteins in 24-hour urine, and serum albumin.

The following outcomes were recorded for each patient: development of some hypertensive disease during pregnancy and its severity (diastolic blood pressure equal or greater than 90 mmHg; 110 mmHg in case of severe preeclampsia, and systolic pressure equal or greater than 140 mmHg; 160 mmHg in case of severe preeclampsia), miscarriage (interruption of fetal development before week 20 of gestation), pre-term birth (birth before the 37th week of gestation), resolution of pregnancy via cesarean. From the products, the following were recorded: reduced intrauterine growth (under 3 percentile, based solely on birth weight; there were no ecographic results), low birth weight (less than 2,500 g), fetal death and greater entry into NICU. For renal function, deterioration of same was recorded, as well as the need for substitution renal therapy, kind of substitutive therapy, week of gestation that such therapy was required.

Statistics

Data are expressed as frequencies, means and interquartile ranges or averages and standard deviation, according to the characteristics of the variables. Differences between groups were analyzed with chi square or Student "t", according to the case. All analyses were performed with SPSS version 21 statistical program. $p < 0.05$ was considered statistically significant.

Results

Table 1 and table 2 shows the most important characteristics at the start of the observation period, where the outstanding features are the young population, half of whom have at least overweight before pregnancy; all the women had at least one previous pregnancy and all products were born with birth weight under 2,500 g.

Table 3 shows the causes of CKD and the number of patients by stage of renal function, while table 4 shows the characteristics by stage. Distribution was not uniform; KDIGO stage I was the most frequent, with 47 patients, and 19, 22, 18, 18, and 10, respectively, for stages II, IIIa, IIIb, IV, and V. Here attention is drawn to the fact that patients "migrated" to another stage close to the conclusion of pregnancy, according to GFR measured by collection of 24-hour urine. In the case of stage I, of 47 patients in 1st trimester, only 42 continued in this same

Table 1: Baseline characteristics of pregnant participants with CKD (n = 134).

Age (years)	26	(22 - 29)
Pregnancies (number)	2	(1 - 2)
Weight prior to pregnancy (kilograms)	58	(51.75 - 67.50)
Final weight in pregnancy (kilograms)	67	(59.75 - 76.00)
Body mass index prior to pregnancy	23.8	(21.65 - 27.15)
Final body mass index in pregnancy	27.51	(24.57 - 30.12)
Weight gain (kilograms)	7	(5 - 9)
Height (centimeters)	157	(153 - 160)
Weeks of gestation at diagnosis	9	(8 - 11)
Weeks of gestation at resolution	34	(29.75 - 36)
Product weight (grams)	1910	(1465 - 2402)
Weight twin, 3 cases (grams)	2200	(2200 - 2250)
Creatinine 1st trimester (mg/dl)	1.2	(0.7 - 1.98)
Creatinine 2nd trimester (mg/dl)	1.17	(0.65 - 2.1)
Creatinine 3rd trimester (mg/dl)	1.01	(0.5 - 2.1)
Glomerular filtration rate 1st trimester (ml/min)	58.23	(38.75 - 104.77)
Glomerular filtration rate 2nd trimester (ml/min)	51.58	(27.78 - 106.25)
Glomerular filtration rate 3rd trimester (ml/min)	36.49	(10 - 86.82)
Proteinuria in 24 hours 1st trimester (grams)	0.8	(0.21 - 1.9)
Proteinuria in 24 hours 2nd trimester (grams)	1.0	(0.17 - 2.54)
Proteinuria in 24 hours 3rd trimester (grams)	0.88	(0.06 - 2.32)
Uric acid 1st trimester (mg/dl)	6.35	(4.67 - 7.9)
Uric acid 2nd trimester (mg/dl)	6.8	(4.8 - 8.72)
Uric acid 3rd trimester (mg/dl)	6.4	(3.67 - 9.22)
Albumin 1st trimester (mg/dl)	3.55	(3 - 3.9)
Albumin 2nd trimester (mg/dl)	3.3	(2.8 - 3.8)
Albumin 3rd trimester (mg/dl)	3.0	(2.1 - 3.6)

Note: *described as mean and interquartile range.

Table 2: Baseline characteristics of 134 pregnant women with CKD.

Characteristics		Number/Percentage
Comorbidities	Diabetes mellitus 2	15 (11.19)
	Chronic hypertension	15 (11.19)
	Primary glomerulonephritis	20 (14.92)
	Secondary glomerulonephritis	27 (20.14)
	Renal transplant	2 (1.49)
	Others (Monorrenas, poststreptococcica, etc.)	36 (26.86)
Initial division	Slight	85 (63.43)
	Moderate	24 (17.91)
	Severe	25 (18.65)
Final division	Slight	72 (53.73)
	Moderate	28 (20.89)
	Severe	34 (25.37)
Initial KDIGO	I	47 (35.07)
	II	19 (14.17)
	III a	22 (16.41)
	III b	18 (13.43)
	IV	18 (13.43)
	V	10 (7.46)
Final KDIGO	I	42 (31.34)
	II	18 (13.43)
	III a	14 (10.44)
	III b	20 (14.92)
	IV	22 (16.41)
	V	18 (13.43)

Table 3: Number of women by stage that required SRFT*, kind and number of weeks.

	I	II	IIIA	IIIB	IV	V
Substitution therapy*	2	1	1	0	6	6
Peritoneal dialysis	0	0	0	0	1	0
Hemodialysis	2	1	1	0	5	6
Weeks at onset of SRFT+	33	18	33	0	19.66 (15 - 25)	17.83 (16 - 22)

Note: *substitution renal function; (*) frequencies; and (+) mean and interquartile range.

stage; for stage II with 19 patients, 18 maintained; in stage IIIa, 22 initial to 14 by 3rd trimester, and from there a greater number of patients by stage at the end of pregnancy in comparison with at onset; stage IIIb began with 18 patients and ended with 20; stage IV had 18 patients in 1st trimester and 22 by 3rd trimester; and finally, in stage V, the 10 patients ended up 18 at the end of gestation. The rest of the baseline characteristics are as described in table 1; 91 patients had preeclampsia, of whom 55 were severe preeclampsia. Mean GFR during the first trimester was 58.23 ml/min (IQR (interquartile range) 38.75 to 104.77 ml/min) and in the third trimester it was 36.49 ml/min (IQR 10 to 86.82 ml/min).

Regarding outcomes, fetal ones were: restriction of intrauterine growth presented in 94. Births after week 37 or more were 18 term newborns, from week 36 to 28 89, and less than 28 weeks (the most at risk of neurological sequelae) were 7, the rest were week 23 or miscarriages. There were 10 miscarriages; fetal death occurred in 28 products (extreme prematurity (before week 28), one limitation of the study is not knowing pulmonary maturity, which might explain the adverse outcomes). Maternal outcomes included: acute renal lesion in 46 patients, 40 of which were resolved with conservative measures during hospitalization, 6 required initiation of substitution renal therapy with hemodialysis. Pregnancy was resolved by cesarean in 111 women (Table 2).

Pregnant patients that required substitution renal function therapy (SRFT) during gestation, either by peritoneal dialysis or hemodialysis, were 16 (including 6 with acute chronic kidney disease), of whom 15 were treated with hemodialysis and only one with peritoneal dialysis, although there was a delay in onset of therapy due to rejection by the patient and/or relative. It is worth mentioning that the patient who required peritoneal dialysis was classified as stage IV by KDIGO, in week 14 of pregnancy, and had no complications in the installation of the Tenckhoff catheter; in the case of patients on hemodialysis, a Mahurkar catheter was installed (when the women decided to belatedly accept substitution renal therapy), all in the right jugular, with sessions required to maintain urea lower than 100 mg/dl or uric nitrogen lower than 50 mg/dl (in the case of the patient on continuous ambulatory peritoneal dialysis, there were 4 exchanges with bags alternating 1.5 and 2.5%; the women in hemodialysis had an average 5 sessions per week at 3 hours/day). It should be mentioned that none of these patients were in substitution before pregnancy and that SRFT was initiated during gestation (Table 3).

Finally, we analyzed data regarding outcomes using glomerular filtration, based on KDIGO classification, which established the number of women who presented outcomes by stage and percentage in regards to the total, performed using chi square. Statistically significant differences were found in: pre-term birth (being greater in more advanced stages, or mean GFR in 24-hour urine was lower); the presence of preeclampsia, as well as severe preeclampsia, had a $p < 0.001$; acute renal lesion was statistically significant, as was the need for initiation of substitution therapy of renal function, whether peritoneal dialysis or hemodialysis. Regarding fetal outcomes, restriction of intrauterine growth was the only one that showed statistical significance, although the trend, possibly due to the low number of patients in each group, in cases or miscarriage and fetal death was more frequent according to the reduction in GFR. In the case of acute chronic kidney disease, the AKIN (Acute Kidney Injury Network) scale was used as a form of classification. 6 patients that required substitution renal therapy with an AKIN 3; the others recovered, although permanent damage to renal function was evident in some. It is important to stress here that many pregnancies in stage V have better results than patients in stage IV, for example; however, this is due to the fact that women in stage V (although delayed) start SRFT with dialysis or hemodialysis, and this

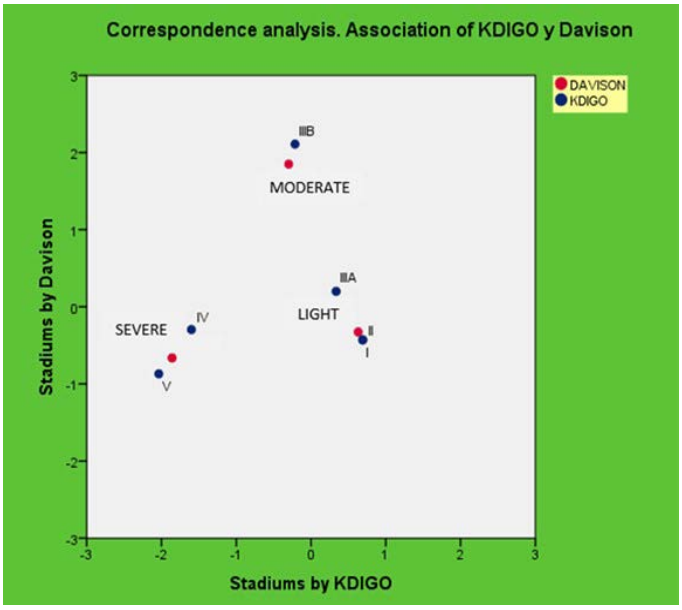

Figure 1: Correspondence analysis.

Table 4: Bivariate analysis work against outcomes. KDIGO stages in number of patients and percentage.

Outcomes/ KDIGO stage*	I (47 patients)	II (19 patients)	IIIA (22 patients)	IIIB (18 patients)	IV (18 patients)	V (10 patients)	p
Premature birth	35 (74.5%)	14 (73.7%)	21 (95.5%)	18 (100%)	18 (100%)	10 (100%)	0.004
Cesarean	34 (72.3%)	16 (84.2%)	21 (95.5%)	17 (94.4%)	15 (83.3%)	8 (80.0%)	0.191
Preeclampsia	20 (42.6%)	13 (68.4%)	17 (77.3%)	15 (83.3%)	16 (88.9%)	10 (100%)	0.001
Severe preeclampsia	9 (19.1%)	6 (31.6%)	9 (40.9%)	9 (50.0%)	14 (77.8%)	8 (80.0%)	0.001
RIUG	26 (55.3%)	10 (52.6%)	17 (77.3%)	17 (94.4%)	16 (88.9%)	8 (80.0%)	0.005
Miscarriage	4 (8.5%)	1 (5.3%)	1 (4.5%)	0 (0.0%)	2 (11.1%)	2 (20.0%)	0.473
Fetal death	11 (23.4%)	3 (15.7%)	3 (13.6%)	6 (33.3%)	4 (22.2%)	3 (30.0%)	0.497
ARL	11 (23.4%)	2 (10.5%)	9 (40.9%)	9 (50.0%)	10 (55.6%)	5 (50.0%)	0.014
AKIN 1	6 (12.8%)	1 (5.3%)	6 (27.3%)	7 (38.9%)	5 (27.7%)	1 (10.0%)	0.066
AKIN 2	1 (2.1%)	0 (0.0%)	2 (9.1%)	1 (5.6%)	2 (11.1%)	1 (10.0%)	-
AKIN 3	4 (8.5%)	1 (5.3%)	1 (4.5%)	1 (5.6%)	3 (16.7%)	3 (30.0%)	-
Required SRFT	2 (4.3%)	1 (5.3%)	1 (4.5%)	0 (0.0%)	6 (33.3%)	6 (60.0%)	0.001
Required SRFT PD	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.6%)	0 (0.0%)	0.001
Required SRFT HD	2 (4.3%)	1 (5.3%)	1 (4.5%)	0 (0.0%)	0 (0.0%)	6 (60.0%)	-

Note: RIUG: restriction of intrauterine growth; ARL: acute renal lesion; AKIN: acute kidney injury network; SRFT: Substitution renal function therapy. *Data presented in frequencies and percentages; KDIGO: Kidney Disease Improving Global Outcomes; PD: peritoneal dialysis; HD: Hemodialysis.

Table 5: Correspondence analysis, which shows the correlation between the two classifications, with an inertia of 0.833 and significance of 0.001. Dimension 1 represents KDIGO stages and Dimensions 2 Davison stages (relative position of qualitative variables and the association among them).

Davison classification	KDIGO Classification
Slight (Cr < 1.4 mg/dl)	I (GFR > 90 ml/min)
	II (gFR from 90 to 60 ml/min)
	IIIa (GFR from 59.9 to 45 ml/min)
Moderate (Cr from 1.4 to 2.5 mg/dl)	IIIb (GFR from 44.9 to 30 ml/min)
Severe (Cr > 2.5 mg/dl)	IV (GFR from 29.9 to 15 ml/min)
	V (GFR < 15 ml/min

improved their clinical conditions, as well as the fact that they received more continuous care every 2 weeks during pregnancy, under the watch of a multidisciplinary team as is customary. The complete data are seen in table 4.

Finally, in table 5, we see the correlation that exists between Davison and KDIGO classifications, determined by reduction of dimensions for categoric variables, in a correspondence analysis study.

Discussion

The impact of the deterioration of renal function, as measured by GFR in 24-hour urine, is significantly associated with greater morbidity in cases of premature birth and restriction of intrauterine growth in fetal outcomes, and in maternal outcomes it is significant in the development of preeclampsia and severe preeclampsia, acute chronic kidney disease and the need for substitution renal therapy; these outcomes are also described as being greater in women with CKD in other studies [25].

The most important condition to describe is the use of stratification of renal function based on GFR, above all because only using creatinine levels is inaccurate, since fluctuations in creatinine levels depend on muscle mass and the consumption of protein with high biological value in the day-to-day diet. This shows the enormous difference in the slight stage in Davison, where there are apparently levels lower than 1.4 mg/dl in serum creatinine, the elevation not appearing very important, but its correlation with GFR with a range of 100 and up to 45 ml/min associated with the classification by KDIGO. With this, we wish to stress the importance of performing GFR during pregnancy, particularly in patients with serum creatinine levels lower than 1.4 mg/dl. This is not a comparison of the two scales (Davison vs KDIGO), since creatinine is the parameter that Davison classification uses, and this within the parameters that allow the calculation of GFR in KDIGO; in addition to creatinine, the latter uses weight, height, gender, etc. We can observe that the KDIGO classification can orient us to a better sense of the gravity of kidney disease in pregnant women through the use of GFR measured in 24-hour urine, than only using a serum level such as creatinine.

The precise stratification of renal function takes on greater importance in a pregnant state, due to the fact that it deals with handling a mother-child pair, and also represents a standard of quality at all global economic levels, by lowering maternal and fetal mortality in a country.

The complications in this work were distributed differently in regards to global possibilities than observed by Dr. Picolli [21], where she observed 34.1% complications in stage I against 90% in stage V; we, on the other hand, found that complications were 36.41% in stage I and stage V was 68.88%, with progressive values according to the decline in renal function, which may be due to the fact that we considered a greater number of outcomes within global complications. In the case of outcomes such as premature birth, development of hypertension disease associated with pregnancy, it was very similar to that reported in other Mexican literature, as in the case of Dr. Vázquez [18] in the intensive care unit of the Hospital de Ginecología of "La Raza", but that based on the Davison classification. In this study, the number of patients was a third of the population contemplated for study. We also corroborated that women with renal function over 90 ml/min showed adverse results compared with the general population, results similar to those observed in other studies which analyzed this same condition in pregnancy without vs with kidney disease in stage I [3].

One of the largest comparative series of pregnant women with and without CKD is that of Dr. Kendrick [3], a sample of over 700 patients in each group; the problem with said study is that he did not separate by stage, only by the presence or absence of CKD, finding a mean of complications of 52%, similar to our finding, if we use an average of all groups. In contrast to almost all previous studies, we did not follow up on newborns entered into NICU, or their days of stay, complications within said hospitalization and even less on their release.

Based on this, authors like Sahay [26] state that the severity of CKD during gestation is due to various factors, above all creatinine over 2.0 mg/dl; in our study, we show that levels of creatinine of 1.4 mg/dl already exists in a GFR between 60 and 45 ml/min, so that 2 mg/dl is already

fairly high, and this cut-off point is not a good predictor. Singh R et al. [27] came to determine that before and after resolution of pregnancy renal function declines from 71 to 55 ml/min average GFR, translating to a loss of 16 ml/min during gestation, condition also observed in our study (we had a reduction of 22 ml/min, starting at 58 ml/min in the first trimester to 36 ml/min at the end of pregnancy). Finally, there are different results from the study by Dr. Vázquez [18], more so because the population is similar (Mexican), where outcomes such as prematurity, restriction of intrauterine growth and fetal death were reported as 25, 7, and 7%, respectively, with a population of 28 women using the Davison classification for severity. For our part, these same complications were observed in 86.56% in all stages for prematurity, 70.14% for restriction of intrauterine growth, and fetal death was 28.35%, distributed equally among the KDIGO stages, numbers that vary widely from those obtained by Dr. Vázquez [18], but our study had a population almost 5 times greater, which involves greater statistical power by sample size.

The pregnant patients in stages IV (and acute) and V showed better results than in general for patients in stage IIIb, due to the fact that the former initiated (although delayed) SRFT with a higher number of evaluations by medical specialists and a more multidisciplinary team, which covered nutrition, perinatology, nephrology and obstetrics. In contrast, patients in stages IIIa, IIIb, for their status as "moderate" in regards to the severity of CKD during pregnancy, were not watched as strictly, had fewer appointments, and acute events that ended in more serious outcomes.

The number of patients with preeclampsia was highly elevated (91 patients), of whom only 15 were known to suffer chronic hypertension, which later added to preeclampsia, although there is also the possibility that the preeclampsia was nothing more than a reflection of the renal damage manifested with hypertension, as well proteinuria; Dr. Picolli likewise speaks of the global prevalence of preeclampsia in normal population, and the fact that CKD evidently increases this prevalence [28]. However, this confusion is no more than a reflection in a developing country like Mexico, where the population often does not have health insurance and often does not receive preventative care.

Limitations

Within the limitations of the present study are the following: (1) Many of the patients received delayed medical attention in spite of having been sent to the third-level hospital in a timely manner, due to the urgency of hypertensive disease, condition very culturally present in our country, so it is supposed that many of the outcomes with greater morbidity may have been influenced by this condition; (2) this study did not record levels of hemoglobin in the patients, so anemia and the requirement for erythropoietin was not measured either; (3) the study did not consider nutritional advice in many patients and, as it was retrospective, this problem was observed especially in subsequent care for this group of patients in nephrology and perinatology; (4) A data collection sheet was not recorded, nor was pulmonary maturity or the dose of medications; and (5) Intrahospital stay of products with extreme and low birth weight was not evaluated, nor were complications presented in them.

Conclusion

Kidney disease directly influences the greater number of adverse outcomes, both maternal and fetal, so the detection of renal pathology, which does not only consider creatinine levels but also determines renal function with creatinine clearance with proteins commented in 24-hour urine is important, and it is also important to make the population aware of preventative review before the decision to become pregnant, in the determination of renal function in a population at risk or with susceptibility factors, more in developing countries like Mexico.

Such adverse results, below that reported in the world literature, in this case, mainly fetal deaths and episodes of acute chronic kidney disease, obtained in our group of patients was due to rejection by the patient and/or relative of specialized therapy by a perinatologist, nephrologist and nutrition service, and even to accepting dialysis or hemodialysis therapy, due to elevated nitrogen (up to one month's delay in some patients).

The results of the correspondence analysis demonstrate that between the slight stage of Davison classification and stages I, II and IIIa of KDIGO (this is the correlation between creatinine levels below 1.4 mg/dl and GFR of 140 to 45 ml/min); likewise, it establishes the correlation between the Davison moderate stage and stage IIIb of KDIGO (likewise, there was correlation between creatinine levels of 1.5 to 2.5 mg/dl and GFR of 44.9 to 30 ml/min), and finally there was correlation between the severe Davison stage with stages IV and V of KDIGO (with creatinine levels over 2.5 mg/dl and GFR less than 29.9 ml/min).

Adverse events can be improved, creating a culture in the at-risk population of timely intervention by those involved; likewise, it should show the data of women who immediately take management therapy in the case of kidney damage (as in the most successful series in this group of women) to motivate taking this path of timely, multidisciplinary treatment and timely visit to a specialized care unit.

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None.

Conflict of Interest

None.

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