Pregnancy in End Stage Renal Disease

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ABSTRACT

The ovulatory menstrual cycle is known to be affected on multiple levels in women with advanced renal disease. Menstrual irregularities, sexual dysfunction, and infertility worsen in parallel with the renal disease. Pregnancy in women with ESRD on dialysis is therefore uncommon. Furthermore, when pregnancy does occur, it can prove hazardous to both mother and baby owing to a multitude of potential complications including accelerated hypertension and preeclampsia, poor fetal growth, anemia, and polyhydramnios. Data are emerging, however, to suggest that pregnancy while on intensified renal replacement regimens may result in better pregnancy outcomes, and emerging trends include the decreased rate of therapeutic abortions probably reflecting a change in counseling practices over time. Nevertheless, a pregnant woman on intensive dialysis requires meticulous follow-up by a dedicated team including nephrology, obstetrics, and a full multidisciplinary staff. In this article, we will address fertility issues in young women with ESRD, review pregnancy outcomes in women on both hemodialysis and peritoneal dialysis, and provide suggestions for the management of the pregnant women on intensive hemodialysis.

Fertility and ESRD

The ovulatory menstrual cycle reflects normal function and physiology of the hypothalamic–pituitary–gonadal axis, which is known to be affected at multiple levels in women with advanced renal disease. Menstrual irregularities, infertility, and sexual dysfunction are known to occur in patients with ESRD and worsen in parallel with the renal disease. As an example, menstrual cycle irregularities begin as a patient’s GFR falls below 15 ml/minute and progresses to amenorrhea when GFR falls below 5 ml/minute (1). Even in those dialysis patients who menstruate, their cycles are often anovulatory and the median age of menopause has been documented to be 47 years of age (1).

There are numerous documented endocrine abnormalities that affect fertility in young women with ESRD. During the follicular phase, follicular-stimulating hormone (FSH) levels are comparable to or slightly lower than those in nonuremic controls, whereas luteinizing hormone (LH) levels are elevated (2,3). Despite the elevated baseline LH levels, women on hemodialysis fail to have the luteal surge in LH (3). Both progesterone and estradiol levels are extremely low (2), and prolactin levels are higher as a result of prolonged plasma half-life from decreased clearance (4,5). In fact, levels have been found to correlate with serum creatinine (5). Finally, the incidence of subclinical hypothyroidism has been documented to increase with reduced GFR (6), and may impact fertility. These hormonal abnormalities,
menstrual abnormalities, and fertility have been documented to improve both after conversion to daily hemodialysis (7,8) and by 3–6 months after kidney transplantation (9,10).

Compounding the hormonal alterations, which can render these women infertile, medications, anemia, fatigue, and depression can contribute to a lack of libido (11,12). As infertility and sexual dysfunction typically accompany poor kidney function, preconception counseling is not part of routine care in either women approaching ESRD or women on hemodialysis (1,13). However, the literature describing female fertility in dialysis patients is extremely dated with the vast majority of the studies conducted decades ago, and therefore not reflective of more intensive hemodialysis practices and the use of erythropoietin-stimulating agents. Thus, this is certainly an area of woman’s health worthy of future study.

**Pregnancy Incidence**

Given the many reasons for impaired fertility and sexual dysfunction in patients with ESRD on dialysis, it is not surprising that conception is uncommon. Conception rates have been determined from registry data that rely on questionnaire responses from multiple centers and are therefore often incomplete. Furthermore, pregnancy is often diagnosed so late in dialysis patients that early losses are unlikely to be properly accounted for in these registries. In fact, diagnosis has been documented to be delayed into the second trimester in many reports (14,15). Thus, the incidence of pregnancy has been documented to range from <1% to approximately 7%, but there are data to suggest improvement over time that is probably related to widespread use of erythropoietin-stimulating agents and more intensive hemodialysis regimens.

The earliest registry data, collected in the 1970s, come from the European Dialysis Transplant Association (16). That registry collected data from 67 centers in 16 countries (approximately 13,000 women), and reported pregnancy to be an exceedingly rare event (<1%). The most complete registry data were collected from all hemodialysis units in Belgium in 1996, as it included all 32 dialysis centers, representing 4135 patients of whom 1472 were women of childbearing age (17). They noted an incidence rate of pregnancy progressing beyond the first trimester to be 0.3 per 100 patient-years (15 cases in 1472 women of childbearing age treated, for a total of 4545 patient-years). During the same year, a Japanese national registry received responses from 65% of eligible dialysis patients and noted a similarly low incidence rate with only 172 pregnancies occurring in 38,889 women on dialysis (18), a calculated conception rate of only 3.4%.

Data from the United States and Saudi Arabia do suggest that the conception rate might be improving over time. Representing approximately 10% of the US dialysis population, a slightly higher rate of 2.4% of hemodialysis patients became pregnant over a 4-year period (1992–1995) (19) in contrast to earlier data from the same group, wherein a 1.5% rate of pregnancy in hemodialysis patients was described over a 2-year period (1990–1992) (20). In the last decade, higher pregnancy rates of 5–7.9% were noted on questionnaire data collected from dialysis units in Saudi Arabia (21,22). The authors concluded that these higher pregnancy rates might reflect a decreased use of contraception, as well as a deep cultural desire to have offspring, but inadequate data are available to determine changes in dialysis regimens over time. Most recently, data from our center, wherein we augment clearance with more intensive nocturnal hemodialysis, indicate higher conception rates—seven pregnancies in 45 women of childbearing age on nocturnal hemodialysis for a pregnancy rate of 15.9% (8). All these women were previously on conventional hemodialysis, but none conceived, suggesting that fertility can be improved with more intensive clearance.

With fewer case reports of pregnancy occurring in peritoneal dialysis as compared with hemodialysis patients, the potential to conceive actually appears significantly lower on peritoneal dialysis. However, to date, there are very few studies that have attempted to systematically collect this data. In Saudi Arabia wherein the highest rates of conception were noted in conventional hemodialysis patients, data were also collected on peritoneal dialysis and no patients conceived (21). In the US dialysis registry that reported data from 930 dialysis centers including 1699 women of childbearing age on peritoneal dialysis, the pregnancy rate was only 1.1% (19). In addition to the hormonal and functional causes of infertility in ESRD patients described before, experts in the field have hypothesized additional etiologies for decreased conception rates in peritoneal dialysis patients. Peritonitis could conceivably damage fallopian tubes, but the rate of ectopic pregnancies reported in this patient population is not increased. Alternatively, hypertonic solutions in the intraperitoneal space may interfere with ovum transport from the ovaries to the fallopian tubes (23).

**Pregnancy Outcome—Hemodialysis**

The first successful pregnancy reported in a patient on chronic hemodialysis occurred in 1970 (24). The young woman had been on chronic hemodialysis in Italy for 3 years, and 2 years after initiating dialysis, menstruation returned. Prior to and during pregnancy, she received twice-weekly dialysis for a total of 24 hours per week. With the exception of the need for repeated blood transfusions, the pregnancy was largely uncomplicated and she delivered a healthy 1950 g baby at term. It was suggested that her favorable outcome was probably secondary to her substantial residual kidney function, common in patients starting chronic hemodialysis in Italy at that time. However, this was speculative as a pre-pregnancy clearance was not reported and she had been on hemodialysis for a number of years before conceiving.

Initial enthusiasm was tempered following the first registry report from the European Dialysis and Transplant Association published a decade later (16). Of the original 115 reported pregnancies, 45 were electively terminated and there were only 16 viable pregnancies of the
remaining 70 women for a live birth rate of 23%. A majority of those whose pregnancies succeeded were noted to have residual renal function, and four pregnancies occurred prior to the initiation of hemodialysis. The report described very difficult-to-manage hypertension in most cases, and noted a mean birth weight of 1900 g with a mean gestational age of 33.2 weeks. A number of case reports followed with variable outcomes including both women with established ESRD and cases wherein dialysis was initiated in women with stage 5 CKD to possibly improve pregnancy outcome (14,15,25).

One might presume that the high rates of termination influenced the poor live birth rate, but subsequent data from the US (20) and Saudi Arabian Registry (26), wherein termination was unlikely, did not reflect a much better outcome with a live birth rate of only 37%. However, even in these early data, the relationship between time of dialysis and outcome began to emerge. Those cases that progressed beyond 28 weeks had their dialysis time increased from an average of 9.4 ± 2.3 to 12.0 ± 2.6 hours, whereas unsuccessful pregnancies did not have their dialysis time increased after conception. The importance of enhanced clearance was also noted in the second registry from the United States, wherein infant survival was 40.2% in women who conceived on hemodialysis compared with 73.6% in women who conceived prior to initiating hemodialysis (19). Still, overall maternal and fetal outcomes were poor with documented maternal deaths, high rates of severe uncontrolled hypertension, and prematurity. A similar discrepancy in outcome between established dialysis patients (live birth rate: 50%) and those who started dialysis after conception (live birth rate: 80%) was noted in the Belgian registry (17). In addition, this study noted a correlation between birth weight and dose of dialysis. Still, the incidence of prematurity was 100% with high rates of complications adding growth restriction and polyhydramnios to the list of potential adverse outcomes.

More recently, however, live birth rates have improved as it has become standard practice to increase the dose of delivered dialysis after conception. In 2005, Haase et al. (27) described a systematic approach, in which intensive hemodiafiltration 6 days a week was prescribed for five pregnant patients with ESRD. They received an average of 28.6 ± 6.3 hours per week and were able to maintain urea levels consistently at < 50 mg/dl. All had a live birth and the mean gestational age was 32.8 ± 3.3 weeks with a mean birth weight of 1765 ± 554 g. A subsequent publication on fetal surveillance noted intrauterine growth restriction in four fetuses and two with pathological umbilical artery flow velocity waveforms (28). However, the authors felt that convective clearance was important to outcome by enhancing the clearance of both large and small solutes. Our group, however, utilized nocturnal home hemodialysis to provide intensified clearance after conception (8). The amount of hemodialysis was increased from a weekly mean of 36 ± 10 to 48 ± 5 hours. Six live births after seven pregnancies were documented with a mean gestational age of 36.2 ± 3 weeks and a mean birth weight of 2417.5 ± 657 g. One pregnancy was terminated as it was mistakenly diagnosed as molar pregnancy. Complications were minimal and included two babies who were small-for-gestational-age, a single preterm birth (< 32 weeks), and a single shortened cervix. Hypertension was either absent or easily managed.

The success of intensified regimens appears to be directly related to enhanced clearance of urea and probably other solutes. An early study prior to the widespread dialysis noted fetal mortality to be directly related to the blood urea nitrogen (BUN) level with no documented successful pregnancies once the BUN exceeded 60 mg/dl (21.4 μmol/l) (29). More recently, in a series of 28 pregnant women receiving hemodialysis with 18 surviving infants, a significant negative relationship was noted between BUN and birth weight \( r = -0.533, p = 0.016 \) as well as gestational age \( r = -0.504, p = 0.023 \) (30). A birth weight of at least 1500 g was achieved at a BUN < 49 mg/dl (17.9 μmol/l), and a gestational age of at least 32 weeks was achieved at a BUN < 48 mg/dl (17.1 μmol/l). Thus, the authors recommended adequately intensified dialysis to maintain the BUN at < 48 mg/dl. In the most recent and largest series to date, 52 pregnancies with an 87% overall successful birth rate were described (31), with mean gestational age being 32.7 ± 3.1 weeks.

A summary of pregnancy outcomes from studies with >10 pregnancies is given in Table 1. Obvious trends include the decreased rate of therapeutic abortions probably reflecting a change in counseling practices over time secondary to an observed improved live birth rate as the decades pass and dialysis is routinely intensified. Preeclampsia, anemia, and polyhydramnios remain challenges that impact maternal and fetal wellbeing requiring further study to determine the optimal mode of delivery as well as time on dialysis (31).

### Pregnancy Outcome—Peritoneal Dialysis

In the early 1980s, the first reported outcomes of pregnant women on chronic ambulatory peritoneal dialysis (CAPD) were mixed with a successful pregnancy delivering at 33 weeks of gestation (32), as well as a reported intrauterine fetal death at 30 weeks of gestation (33). The largest, early series by Redrow et al. (34) concluded that peritoneal dialysis is superior to hemodialysis, and therefore, the preferred option for young pregnant women, but their own data did not clearly support that conclusion. They described 14 pregnancies of which 4 ended in spontaneous abortion. The spontaneous losses occurred in one woman on established CAPD.

### Table 1. Series reporting on greater than 20 pregnancies in hemodialysis patients

<table>
<thead>
<tr>
<th>Year</th>
<th>Geographic region</th>
<th>Terminations (%)</th>
<th>Losses (%)</th>
<th>Live births (%)</th>
</tr>
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<tbody>
<tr>
<td>1980 (16)</td>
<td>Europe</td>
<td>39</td>
<td>38</td>
<td>23</td>
</tr>
<tr>
<td>1992 (20)</td>
<td>Saudi Arabia</td>
<td>0</td>
<td>63</td>
<td>37</td>
</tr>
<tr>
<td>1994 (20)</td>
<td>United States</td>
<td>8</td>
<td>52</td>
<td>37</td>
</tr>
<tr>
<td>1998 (19)</td>
<td>United States</td>
<td>11</td>
<td>46</td>
<td>42</td>
</tr>
<tr>
<td>1999 (18)</td>
<td>Japan</td>
<td>19</td>
<td>24</td>
<td>49</td>
</tr>
<tr>
<td>2009 (30)</td>
<td>Japan</td>
<td>–</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>2010 (31)</td>
<td>Brazil</td>
<td>–</td>
<td>13</td>
<td>87</td>
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</table>
and in another woman on established hemodialysis, but
the other two losses occurred in hemodialysis patients
who were switched to peritoneal dialysis to potentially
improve their pregnancy outcome. Another patient had
three failed attempts to switch from hemodialysis to
peritoneal dialysis as a result of drainage failure, eventu-
ally delivering a preterm, small-for-gestational-age baby
weighing 780 g. Of the remaining nine pregnancies, four
were patients approaching ESRD who were started on
either peritoneal dialysis (n = 2) or hemodialysis
(n = 2), and therefore had significant residual renal
function, whereas established peritoneal and hemodial-
ysis patients accounted for only five patients. Of interest,
the three established peritoneal dialysis patients deliv-
ered babies weighing 1065–1720 g between 32 and
34 weeks of gestation, whereas the hemodialysis patients
delivered babies weighing 2044 and 2218 g at 35 and
36 weeks of gestation, respectively.

Subsequent case reports and series continued to dem-
strate mixed results with the vast majority of patients
consenting prior to the initiation of peritoneal dialysis,
and therefore having residual renal function (35–46).
Although early registry data from the United States did
not document a statistically significant difference in the
live birth rate in peritoneal versus hemodialysis patients
(19,47), a later single-center series noted worse outcomes
in peritoneal versus hemodialysis patients (48). Numbers
of peritoneal dialysis patients, however, are typically few
in single-center experiences (48,49).

In addition to the potential maternal and fetal compli-
cations already described in hemodialysis patients, a
number of maternal complications are unique to perito-
neal dialysis. Abdominal fullness, discomfort, catheter
drainage difficulties, and polyhydramnios necessitating
a progressive decline in fill volumes have been described
(34,35,37,45,46,50). Bloody dialysate can herald an
obstetric catastrophe including placental abruption (38),
or can be secondary to trauma to the expanding uterus
from the peritoneal dialysis catheter (45,51), and has
been documented to be severe resulting in significant
maternal morbidity with fetal demise (51,52). Preterm
delivery, premature rupture of membranes, and stillbirth
have also been documented to occur secondary to acute
peritonitis (41,43,53).

Peritoneal dialysis offers gentle daily ultrafiltration
along with fewer fluctuations in serum electrolytes, and
does not require systemic anticoagulation. Therefore,
theoretically at least, peritoneal dialysis might produce a
state more conducive to a healthy pregnancy. Following
early registry reports of very poor pregnancy outcomes
on hemodialysis, expert opinion suggested that perito-
neal dialysis might be the preferred option (34,37). While
a successful pregnancy on peritoneal dialysis is certainly
a possibility, especially in a woman with significant resid-
ual kidney function, there are remarkably fewer cases
reported in the literature as compared with women on
intermittent hemodialysis. Furthermore, there is the
potential for added risks unique to peritoneal dialysis.
Given improved pregnancy outcomes on intensive
hemodialysis, the early recommendation to switch
women on hemodialysis to peritoneal dialysis to improve
pregnancy outcomes cannot be justified at this time.

Management of the Pregnant Hemodialysis
Patient

A pregnant woman on intensive hemodialysis requires
meticulous follow-up by a dedicated team including
nephrology, obstetrics, and a full multidisciplinary staff.
Fetal follow-up includes careful screening for congenital
anomalies and follow-up of fetal growth. Amniotic fluid
and cervical status also need careful assessment and fol-
low-up. Issues for maternal care include the careful fol-
low-up and supplementation of electrolytes, vitamins
and minerals, the management of anemia, as well as the
management of volume status, and blood pressure
(Table 2).

Given menstrual irregularities and the high prevalence
of amenorrhea in women with ESRD, the diagnosis of
pregnancy can be challenging and is often quite delayed
(14,15). As human chorionic gonadotropin (hCG) is
partly cleared by the kidneys (54), false-positive serum
pregnancy tests have been documented in women with
renal disease (55). Furthermore, the first trimester
screen, which includes maternal serum β-hCG, maternal
serum pregnancy-associated plasma protein-A (PAPP-
A), and an ultrasound measurement of nuchal translu-
cency, must be interpreted with caution in women with
ESRD. β-hCG is inversely correlated with creatinine
clearance (r = −0.345; p = 0.002) (56), and PAPP-A

<table>
<thead>
<tr>
<th>Table 2. Toronto Pregnancy and Kidney Disease (PreKid) clinic protocol for management of intensive hemodialysis</th>
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<tbody>
<tr>
<td><strong>Fetal assessment and follow-up</strong></td>
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<tr>
<td>• First trimester screen (nuchal translucency,</td>
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<tr>
<td>PAPP-A, β-hCG) between 9 and 13 weeks</td>
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<tr>
<td>• Maternal serum screen (AFP, total hCG, inhibin</td>
</tr>
<tr>
<td>A and unconjugated estriol) between 15 and 18 weeks</td>
</tr>
<tr>
<td>• Level II US to measure cervical length and assess for anomalies at 18–20 weeks</td>
</tr>
<tr>
<td>• Placental US with Doppler assessment at 22 weeks</td>
</tr>
<tr>
<td>• Weekly US and BPP from 26 weeks until delivery</td>
</tr>
<tr>
<td><strong>Vitamins, minerals, and diet</strong></td>
</tr>
<tr>
<td>• Double dose of MVI</td>
</tr>
<tr>
<td>• Folic acid, 5 mg daily</td>
</tr>
<tr>
<td>• Unrestricted diet</td>
</tr>
<tr>
<td>• Daily protein intake, 1.5–1.8 g/kg/day</td>
</tr>
<tr>
<td>• Sodium phosphate (flext enema) to dialyse</td>
</tr>
<tr>
<td><strong>Electrolytes</strong></td>
</tr>
<tr>
<td>• 3 mEq/l potassium bath</td>
</tr>
<tr>
<td>• 25 mEq/l bicarbonate bath</td>
</tr>
<tr>
<td><strong>Bone health</strong></td>
</tr>
<tr>
<td>• Dialysate calcium, 1.75 mmol/l</td>
</tr>
<tr>
<td><strong>Anemia</strong></td>
</tr>
<tr>
<td>• Intravenous and oral iron to maintain normal stores</td>
</tr>
<tr>
<td>• Erythropoietin-stimulating agent to target a hemoglobin of 110 g/l</td>
</tr>
<tr>
<td><strong>Volume status</strong></td>
</tr>
<tr>
<td>• Monthly, then weekly volume assessments</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
</tr>
<tr>
<td>• Target postdialysis blood pressure &lt; 140/90 mmHg</td>
</tr>
</tbody>
</table>

PAPP-A, pregnancy-associated plasma protein-A; β-hCG, human chorionic gonadotropin; AFP, α-fetoprotein; US, ultrasound; MVI, multivitamin; BPP, biophysical profile scores.
levels are higher in patients on both peritoneal and hemodialysis (57), and can be further augmented by the intravenous administration of heparin (58).

Fetal follow-up beyond the first trimester includes the maternal serum screen or the quadruple test performed between 15 and 18 weeks of gestation, which includes z-fetoprotein, total hCG, inhibin A, and unconjugated estriol (uE3). Abnormal values are associated with adverse pregnancy outcomes such as preterm labor, pre-eclampsia, and intrauterine growth restriction. Between 18 and 20 weeks of gestation, a level II ultrasound is performed to measure cervical length and to assess for fetal anomalies. At 22 weeks of gestation, a placental ultrasound to assess placental length, thickness, and the placental cord insertion along with uterine and umbilical artery Dopplers to quantify pulsatility indices (PI) is performed in some centers. From 26 weeks of gestation, weekly ultrasounds to follow biophysical profile scores (2 points for amniotic fluid volume, 2 for fetal tone, 2 for fetal movements, and 2 for fetal breathing movements), biometry (estimated fetal weight), amniotic fluid index, and umbilical artery PI are recommended. Thus, these women are best managed by high-risk obstetricians.

First trimester maternal care includes a careful medication review, as the use of teratogenic medications like blockers of the renin–angiotensin system is common in this patient population and needs to be promptly discontinued. Water-soluble vitamins and minerals can be removed by intensified dialysis, and it is our practice to double the usually prescribed dose of daily multivitamin and prescribe 5 mg of folic acid. The excellent clearance associated with intensified hemodialysis allows for an unrestricted diet. Dialysate potassium concentration is typically increased to 3.0 mEq/l, and phosphate is supplemented by the addition of sodium phosphate (fleets enema) to the dialysate. Nutritional assessment and counseling may be necessary to ensure adequate protein and caloric intake, as the protein recommendation for pregnant women is 1.1 g/kg/day and 10–15 g of amino acids can be lost daily in the dialysate (59). Caloric intake requirements increase as pregnancy progresses, and healthy maternal weight gain in a woman with a normal body mass index should range from 25 to 35 pounds. Calcium intake must include an additional 30 g primarily during the third trimester for fetal skeletal development. Thus, the dialysate calcium concentration often needs to be increased to 3.25 mEq/l (1.75 mmol/l) or higher to ensure adequate influx (8). Close follow-up of parathyroid hormone (PTH) and alkaline phosphatase can guide calcium balance. Dialysate calcium should be adjusted so that PTH is kept within Kidney Disease Outcomes and Quality Initiative guidelines and bone-derived alkaline phosphatase remains normal. Serum phosphorus may be lower than expected as a result of its incorporation into the fetal skeleton. This should be addressed by further increase in dialysate phosphate as needed to normalize predialysis and post-dialysis values. A lower bicarbonate bath is usually necessary to maintain a physiological bicarbonate level typical of pregnancy.

Anemia is a common issue among pregnant women with ESRD. Prior to the advent of erythropoietin, frequent supportive transfusions were necessary to maintain hemoglobin (16,24). The etiology of anemia in pregnant women with ESRD is multifactorial, including the high demand for red blood cell production to support placental and fetal growth, the loss of iron and red blood cells during frequent, intensive dialysis, as well as erythropoietin resistance presumably from cytokine production that accompanies a high-risk pregnancy. Thus, erythropoietin requirements can be expected to at least double and typical iron requirements exceed the usual 30 mg/day recommended for healthy pregnant women (8). Careful follow-up of complete blood count (CBC) and iron stores can guide both IV erythropoietin and iron supplementation, both of which are safe to administer during pregnancy.

Hypertension can prove a particular challenge in the pregnant hemodialysis patients. The dry weight of pregnant women on dialysis can be difficult to ascertain. During the first trimester, expected weight gain is minimal, while during the second and third trimesters, the dry weight can be expected to increase by up to 0.5 kg/week. Careful clinical assessments of fluid status remains the best mechanism to determine appropriate ultrafiltration goals and guide blood pressure treatment, and is critical to assist with the diagnosis of preeclampsia.

In the absence of urine output revealing proteinuria, the diagnosis of preeclampsia relies on the assessment of worsening blood pressure. Other helpful clues might include alterations in placental Doppler blood flow, fetal growth restriction, and hematological alterations suggestive of the HELLP Syndrome (elevated liver transaminases and decreased platelets). Recent insights into pathophysiology of preeclampsia indicate that maternal endothelial dysfunction results from the release of soluble factors from an ischemic placenta that bind to vascular endothelial growth factor and placental growth factor, preventing interaction with their endogenous receptors (60). To date, a single study has utilized these factors to assist with the diagnosis of preeclampsia in a woman on hemodialysis, but this may prove a useful diagnostic test in the future (61). Of interest, in our series and in our growing experience with intensive dialysis, hypertension was managed without difficulty (8). In summary, intensive hemodialysis might improve fertility along with maternal and fetal outcomes, but requires careful follow-up and management from a multidisciplinary team that includes nephrology professionals working closely with professionals from obstetrics.

References

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