

Successful pregnancy in a uremic patient treated with single needle hemodialysis

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ABSTRACT: Background: Pregnancy is uncommon in patients on maintenance hemodialysis (HD) and it carries a high risk of fetal and maternal complications. Several reports have shown that application of an intensive dialysis regimen is associated with improved infant survival and better clinical conditions of the mother.

Methods: We report the case of a 35-year-old black woman with a prosthetic cardiac valve who was treated daily with single needle HD because of difficult vascular access.

Result: A healthy full-term female infant with a normal birth weight was electively delivered at 37 weeks. We did not register any complications during or after pregnancy.

Conclusion: In our experience, single needle HD is able to provide the patient with adequate depuration during pregnancy, the delivery of a full-term healthy infant, and preservation of the arterial-venous fistula from twice-daily vein puncture. (*Int J Artif Organs* 2007; 30:)

KEY WORDS: Pregnancy, Hemodialysis

INTRODUCTION

Pregnancy is a rare occurrence in women on dialysis. Several factors appear to contribute to this subinfertility, such as uremia or comorbidities related to chronic renal failure. Based on recently published cases and registry reports, the outcome of these patients has markedly improved, with 30% to 50% of pregnancies resulting in the delivery of a surviving infant (1-7). Nevertheless, fetal mortality in pregnant women on dialysis is still much higher than in the general population (8). Dialysis-related complications that impair the utero-placental circulation, with outcomes ranging from premature delivery to fetal death, may be summarized as polyhydramnios, maternal blood pressure instability, shifts in acute fluid volume, anemia and electrolyte imbalance.

The complex and precarious condition of the pregnant woman on dialysis requires close collaboration between the patient, nephrologist, dialysis staff, obstetrician, and neonatologist to maximize the chance of a successful pregnancy. To date, no experience has been reported on the outcome, safety and efficiency of single needle hemodialysis (HD) in pregnant patients. We present our

case of successful delivery at week 37 in a 35-year-old black woman treated with single needle dialysis because of a difficult proximal arterial-venous fistula (AVF).

CASE REPORT

A 35-year-old black woman with uremia was started on hemodialysis (3 times/week) eight years previously in 1999 for an IgA nephropathy. Her medical and surgical history was remarkable for two previous miscarriages [AUTHOR: Please confirm this change to "aborto involontario"], during dialysis therapy at another nephrological center, and an aortic valve substitution in 2004. Her domiciliary therapy consisted solely of acenocumarol.

Her third pregnancy was diagnosed at 3 weeks of gestation from elevated β -hCG. Because of the history of miscarriage and the prosthetic valve, requiring home therapy with acenocumarol and traditional heparin during HD, a multidisciplinary nephrological, obstetric and cardiac surgery team was formed to achieve optimal maternal health and optimal fetal growth and development. Our goals were: a) to avoid hypotensive or hypertensive

episodes during and between HD; b) to maintain pre-dialysis urea <80 mg/dL (normal value 50 mg/dL), serum albumin >3.5 g/dL, hemoglobin between 10 and 12 g/dL; c) to administer the best anticoagulant regimen both for the prosthetic valve and for dialysis; d) to ensure the osmotic equilibrium with the best electrolyte concentrations and acid-base balance, the right dry weight, and comprehensive support therapy; e) to closely monitor fetal growth.

HD was performed using a low-flux dialyzer (polysulphone membrane with a 2 m² surface) with volume controlled ultrafiltration. Domiciliary therapy was changed from acenocumarol to Low Molecular Weight Heparin (LMWH) (4000 IU). Traditional Na heparin was used as the HD anticoagulant therapy at first, then, due to a vaginal bleeding event, it was changed to only subcutaneous LMWH (6000 IU two hours before HD), both for the prosthetic valve and HD anticoagulation.

To maximize dialysis adequacy, the HD schedule was increased from 4 hours three times weekly to 4 hours six times weekly. A superficialized, basilic native vein AVF was used as vascular access. Nevertheless, to optimize the use and duration of the fistula, we chose to attempt single needle HD.

To prevent alkalemia, a lower bicarbonate was used in the dialysate. Upon initiation of daily HD, the potassium content of dialysate was increased and the calcium content was decreased to prevent hypokalemia and hyper-

calcemia, respectively. Technical HD parameters are summarized in Table I. Estimations of the amount of ultrafiltration were based upon monitoring maternal blood pressure and heart rate before, during and after dialysis. The increase of the patient's weight was done using clinical signs and symptoms, revising the estimated dry weight to an expected weight gain throughout the course of the pregnancy, and evaluating the fetal and amniotic water weights using echographic evaluation. During the pregnancy, blood pressure was well controlled and biochemical, hematologic, and metabolic parameters were targeted to physiological levels. Urea and other laboratorial values are reported in Table II.

In order to maintain target hemoglobin levels of 10 to 12 g/dL and to counteract erythropoietin (EPO) hyporesponsiveness during pregnancy, EPO administration was increased from 6000 IU twice weekly to 10000 IU three times weekly. Our patient was given intravenous iron to maintain transferrin saturations over 30%. Initiation of daily HD allowed us to liberalize the diet with a higher protein content and to administer vitamins, doubling the water-soluble ones.

The course of the patient's pregnancy was smooth, fetal growth was monitored by abdominal sonography, performed every two weeks during the first and second trimesters and every week during the third trimester. At 37 weeks, a female infant (weight 2.7 kg, APGAR score 9/10) was electively delivered by Caesarean section without any complications for the patient or her daughter, and with only a few days of hospitalization.

TABLE I - TECHNICAL HD PARAMETERS

$Q_{b\ art}$ (ml/min)	370
$Q_{b\ ven}$ (ml/min)	390
Q_D (ml/min)	800
Dialysate: Na (mEq/L)	140
K (mEq/L)	4
Ca ²⁺ (mEq/L)	1.25
HCO ₃ ⁻ (mEq/L)	28
Time (minutes)	240
Filter (surface 2 m ²)	Polysulphone

DISCUSSION

It is well known that HD patients rarely conceive because ovulation is uncommon in women suffering from End-Stage Renal Disease (ESRD). The subinfertility of

TABLE II - METABOLIC AND UREMIA PROFILE DURING PREGNANCY

	months								
	1	2	3	4	5	6	7	8	9
postdialysis weight (kg)	61.5	61.5	62.5	63.5	65	67.5	70.5	72.5	74
hemoglobin (g/dL)	10.9	12	9.6	10.5	12.1	10.4	11.7	11.6	12.4
erythropoietin dose (U/wk)	18.000	18.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000
predialysis urea (mg/dL)	150	89	64	76	89	63	54	78	130
postdialysis urea (mg/dL)	57	30	21	12	15	12	15	22	49
albumin (g/dL)	4	3.8	4.2	4	3.8	4.1	3.9	3.6	3.8

these patients is thought to be multifactorial and several factors are correlated with renal replacement therapy. Hyperprolactinemia, GnRH pulsatility altered, increased LH levels, uremic toxins, uremic neuropathy, and pharmacological agents are probably involved in the infertility associated with HD (9). Moreover, women who were on dialysis for more than 10 years appeared less likely to conceive (10). Recent data suggest that infertility may be less common among contemporary women with ESRD (1) and the likelihood of a pregnancy resulting in delivery of surviving infants is in the range of 30% to 50% (11). This improved fetal survival is probably due to the care provided by multidisciplinary management teams closely collaborating between patient, nephrologist, dialysis staff, obstetrician, and neonatologist.

Nevertheless, when pregnancy occurs, it is associated with a decreased live birth rate (compared to healthy women), in addition to increased infant and maternal morbidity. Premature delivery, intrauterine growth retardation, polyhydramnios, possibly due to fetal solute diuresis caused by high placental urea concentration, a shift in acute fluid volume, electrolyte imbalance and maternal blood pressure instability can constitute major complications. Because these complex clinical situations have remained relatively rare, guidelines for the management of pregnant women on dialysis have been slow to evolve. Much of the experience is largely anecdotal, because pregnancy does not easily lend itself to randomized trials and the patient numbers are very small.

To date, intensified dialysis regimens may improve pregnancy outcomes, resulting in greater infant birth weight, improved chance of survival, and fewer long-term complications. Moreover, a careful assessment of anemia, electrolyte balance, acidosis and hyperparathyroidism contributes to prolong gestation (4, 5, 12). The mechanism by which the increase in dialysis time prolongs the gestational period is not clear, and is likely to be multifactorial (13). More frequent dialysis could reduce the incidence of polyhydramnios and dialysis hypotension episodes, minimizing shifts in maternal intravascular volume, with a consistent reduction in preterm labor and fetal distress.

According to the latest recommendations reported in the literature, we increased the dialysis dose. This ensured a less uremic environment for the fetus and allowed the mother a more liberal diet and fluid intake. It also helped to facilitate estimation of the dry weight,

lowering the risk of hypotension.

In our patient, the single-needle mode was chosen at first because of problematic vascular access and subsequently to minimize AVF bleeding risk during an intense anticoagulant therapy; also because, as it is known, black patients tend to develop rapid sclerosis of tissues and vessels. Despite the single-needle mode, patient predialysis urea was under 80 mg/dL and electrolytes were targeted to physiological levels. In addition, acid-basic disorders were prevented and the patient's vascular access was preserved.

Anticoagulant management was very difficult in this case because pregnancy is characterized by hypercoagulability; in addition, our patient had a mechanical valve requiring anticoagulation while reducing [AUTHOR: is this what you mean?] bleeding risk. Thus, to guarantee higher anticoagulation efficacy and longer action, following the recommendation of the cardiac surgery team, we chose a single dose of LMWH, both for anticoagulation of the mechanical valve and for HD, minimizing, at the same time, bleeding risk and thrombotic events. It well recognized that LMWH has a better bioavailability after subcutaneous injection and a more predictable anticoagulant response, nevertheless these advantages are lost in a pregnant woman with ESRD. Moreover, it is not possible to monitor its action with conventional laboratory parameters (14). On the other hand, LMWH was able to ensure the best anticoagulant regimen both for the prosthetic valve and for dialysis, while being easier to administer.

Daily HD regimen not only ensured adequate patient depuration but also, by stabilizing maternal hemodynamics, improved maternal and fetal outcomes, without causing any complications. Owing to her strong motivation, the patient's compliance with the intensive HD regimen was good. The result of this close collaboration between patient, nephrologist, dialysis staff, obstetrician, and neonatologist was a normal uncomplicated pregnancy and the delivery of a full-term infant of normal birth weight.

CONCLUSIONS

In conclusion, our experience shows that single needle HD is able to ensure the patient adequate depuration during pregnancy, the delivery of a full-term healthy infant, and preserve the AVF from twice-daily vein punc-

ture. As Levy et al wrote in an editorial comment: "the purpose of dialysis should not be only to maintain life, but also to allow this life to be as nearly normal as possible. The occurrence of a conception in a hemodialysis patient should be considered as a parameter of successful treatment."

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