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Case Report

Pregnancy in a peritoneal dialysis patient undergoing intermittent peritoneal dialysis during the third trimester of pregnancy: a case report and literature review

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Summary

For patients undergoing peritoneal dialysis (PD), the rate of successfully carrying a pregnancy to term is low. Herein, we describe the pregnancy course of a patient with end-stage renal disease on peritoneal dialysis. The information presented may make better undestanding in the knowledge and management of such high-risk pregnancies in this patient population. We report the successful completion of pregnancy in a patient who underwent continuous ambulatory peritoneal dialysis (CAPD) and then switched to intermittent peritoneal dialysis (IPD) during her third trimester. She became pregnant after undergoing CAPD for almost 1 year, using four 1.5 L exchanges of 1.5% bags per day. At 30 weeks of gestation, she switched from CAPD to IPD, using six 0.5 L exchanges of 1.5% bags per day with daily ultrafiltration of 100-300 mL. Her total Kt/V was 1.72 (dialysate 1.2, residual kidney 0.5) during her first and second trimesters and her total Kt/V decreased to 1.63 (dialysate 1.15, residual kidney 0.48) during her third trimester. She was admitted to our hospital at 35 weeks of gestation for a planned lower segment caesarian section. We report the successful completion of pregnancy in a patient on IPD. We have shown that rather than pursuing an adequate weekly default value of Kt/V, the most important criterion for the optimization of dialysis treatment for pregnant patients is their medical condition.

Key words: Pregnancy; Intermittent peritoneal dialysis; Chronic kidney disease.

Introduction

In women with end-stage renal disease (ESRD), pregnancy rates are low [1]. A previous study reported a pregnancy rate of only 0.3 per 100 patient-years (15 cases in 1472 females of childbearing age over 4545 patient-years) in hemodialysis (HD) patients [2]. The documented pregnancy rates for patients undergoing peritoneal dialysis (PD) are even lower, occurring at approximately half the rate of that reported for HD patients [3]. Therefore, clinicians often advise women of reproductive age on dialysis against pregnancy. However, with the progress made in maternal and fetal care and dialysis systems, the rate of successful pregnancies with delivery of surviving infants is reported to reach 70% [4]. However, very few details of the pregnancies or medical and obstetrical management were included in the reports of pregnancies in PD patients. Herein, we present the case of a pregnant woman with ESRD who was maintained on intermittent PD (IPD) even during her third trimester. Results of the adequacy of dialysis (Kt/V) are also presented in the report. So far as we know, such data have rarely been reported in a pregnant PD patient.

Case Report

We present the case of a 29-year-old patient ESRD. She had been on CAPD since August 2016 using four 1.5 L exchanges of 1.5% bags per day. Her residual urine output was about 1000-2000 mL/d during her entire three trimesters. Eight months after her initiation of CAPD, she presented to our PD unit pregnant.

She was confirmed to be 17 weeks into her pregnancy. After counseling for the potential complications associated with ESRD, the patient and her spouse decided to resume the pregnancy. She got antenatal clinic reviews every month during her first trimester. And the reviews interval were shortened to fortnightly from her second trimester. During her pregnancy, she also took regular fetal surveillance while her medication list was carefully evaluated. Her routine medications, which included polyferose 150 mg twice per day, folic acid 5 mg three times per day, vitamin B complex one tablet three times per day, and calcium carbonate 0.6 g once a day, were maintained.

She changed PD prescription from four 1.5 L exchanges of 1.5% bags for each exchange per day to five 1.2 L exchanges of 1.5% bags for each exchange per day at 18 weeks of gestation with daily ultrafiltration of 100-300 mL. At 30 weeks of gestation, her PD prescription changed from CAPD to IPD, using six 0.5 L exchanges of 1.5% bags for each exchange per day. Her blood pressure remained well-controlled between 105-110/60-70 mmHg without the administration of any anti-hypertensives. Her erythropoietin was 10000 IU weekly during the entire trimester. She was

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Table 1. — *Pregnancy outcomes in end-stage renal disease patients treated with peritoneal dialysis.*

Reference	Year	Pregnancies reported	Infant Survival(%)	Gestational age at delivery(weeks)	Delivery type	Infant Weight(g)	PD complications
Tuncer *et al*. [7]	2000	1	100	38	Vaginal	1900	Peritonitis
Chang *et al*. [8]	2002	1	100	33	Vaginal	994	Drain pain
Smith *et al*. [9]	2005	1	100	33	Vaginal	1730	Hemoperitoneum
Chou *et al*. [10]	2006	1	0	19	c-section	NR	Hemoperitoneum
Tan *et al*. [11]	2006	1	100	33	Vaginal	2060	Post-tartum peritonitis
Lew [12]	2006	1	0	21	Vaginal	NR	Hemoperitoneum
Asgari *et al*. [13]	2007	1	100	36	c-section	NR	None reported
Altay *et al*. [14]	2007	1	100	39	Vaginal	2480	Hemoperitoneum
Gomez Vazquez *et al*. [15]	2007	2	100	36-38	Vaginal	1925-2700	None reported
Jefferys *et a*l. [16]	2008	5	100	24-38	Vaginal(3) c-section(2)	478-2735	Catheter displacement
Chou *et al*. [17]	2008	3	33	22-35	NR	440-2388	None reported
Current paper	2017	1	100	35	c-section	2100	None reported

NR = not reported.

able to increase her hemoglobin from 60 to 95 g/L following three blood transfusions she received during the entire trimester. Her total Kt/V was 1.72 (dialysate 1.2, residual kidney 0.5) during her first and second trimesters and then decreased to 1.63 (dialysate 1.15, residual kidney 0.48) during her third trimester after she switched to IPD. Her serum albumin levels fluctuated between 30 and 36 g/L. As her obstetric condition was steady, she took a trans-peritoneal lower segment caesarian section (LCSC) at 35 weeks of gestation. She kept her PD catheter future used. She born a healthy boy of 2.1 kg weight.And his Apgar score was 10. Both mother and baby were discharged in stable conditions the day after delivery. An arteriovenous fistuloplasty was created during her second trimester which she used for hemodialysis (HD) after delivery. She Resumed PD afer her LSCS scar healing completely.

Discussion

Several disadvantages of PD have been reported: drain pain, gastroesophageal reflux, dialysate flow disturbance, and abdominal fullness by catheter displacement. Conversely, PD also has some advantages: smooth urea removal and stable metabolic balance, minimizing changes in maternal intravascular volumes, and gentle daily ultrafiltration that can compromise placental blood flow [5, 6]. PD has other potential benefits such as evading anticoagulation and having a more liberal diet, i.e., no restriction of potassium-rich foods. Table 1 shows a summary of successful pregnancies in ESRD patients undergoing PD [7-17].

The success of pregnancy in PD patients is largely influenced by preserved residual renal function, early diagnosis of pregnancy, pextended dialysis, and relevant multidisciplinary team management including nephrologists, dialysis nurses, obstetricians, nutritionists and so on [18].

The frequency of pregnancy among childbearing age women with ESRD undergoing long-term periodic dialysis ranges from 1% to 7% [1]. However, the pregnancy rate tends to be much higher among women with more residual renal functions [19] and shorter dialysis intervals (less than 10 years) [20]. Besides,patients undergoing PD are less likely to get pregnant than those on HD [21]. This lower rate of pregnancy may be attributed to several factors such as prior episodes of peritonitis, the presence of hypertonic dialysate in the peritoneum, and the inability of the ovum to reach the fallopian tubes in the presence of intraperitoneal dialysate [22]. Nevertheless, the fertility rate of women with chronic renal disease is greatly reduced by anemia and hyperprolactinemia [23]. Anemia also contributes to decreased libido and poor health status. Conversely, hyperprolactinemia may contribute to amenorrhea, reduced sexual function, anovulation, depression, and menstrual irregularities. The administration of erythropoietin is suggested to correct anemia, suppress prolactin levels, stimulate regular menstruation, improve general health status, induce sexual drive, and ultimately, promote fertility [24].

Regarding the function of the flexible Tenckhoff-type catheter, PD does not cause technical problems during the first trimester of pregnancy; however, because of the different positions of the catheter owing to the growth of the pregnant uterus, peritoneal fluid might be difficult to perfuse or drain from the second trimester till term [25]. Thus, the position of the distal end of the catheter should be located just between the pelvic floor and fetal presentation, while other sites should be regarded as anomalous positions. PD may be performed without problems if the catheter is in the correct position [7].

Several maternal objectives of PD, such as hemoglobin $\geq$ 8 g/dL, inter-dialytic weight gain $\leq$ 1 kg, blood pressure $\leq$ 140/90 mmHg, BUN $\leq$ 80 mg/dL, and creatinine between 5 and 7 mg/dL, should be taken into consideration [25]. Jungers *et al*. [26] recommend a pre-dialysis value of BUN $\leq$ 50 mg/dL should be achieved beyond 16-20 days of gestation. Therefore, it is necessary to increase dialysis frequency, which is difficult to carry out in clinical practice [8].

In addition to the nitrogen blood levels, the weekly value

Table 2. — *Maternal objectives of PD.*

Parameter	Objective Clinical/laboratory situation
Interdialytic weight gain	≤ 1 kg weight
Edema	Minimal or absent
Blood pressure	≤ 140/90 mmHg
Central venous pressure	6-10 cm of water
Hemoglobin	≥ 8 g/dL or 10-11 g/dL
BUN	≤ 80 mg/dL or ≤ 50 mg/dL
Serum creatinine	5-7 mg/dL
Energy intake	35-40 kcal/kg weight/day
Protein intake	1 g/kg weight/day + 20 g protein/day to 1.8 g/kg weight/day
Medications (antihypertensives, diuretics, etc)	Reduction of number and dosage
Transfusion	Avoid or reduce its necessity

of dialysis urea clearance (Kt/V) t has been proposed to indicate adequate PD during pregnancy. Chang *et al*. [8] suggest a weekly Kt/V value of 3.7 should be maintained for pregnant patient by using a cycler machine. While Okundaye *et al*. [18] suggest that it is adequate for pregnant women undergoing PD to maintain 2.2-2.4 Kt/V weekly by using manual peritoneal dialysis. To achieve this, Okundaye *et al.* recommend the volume of the dialysate infusion should be increased to 19.5 L/day. Tison *et al*. [27] recommended that it is adequate to achieve a Kt/V of 2.2-2.4 with an exchange volume > 20 L/day, but in our case, the patient was doing well with Kt/V 1.7 and the exchange volume at 4.8 L/day in the first two trimesters of pregnancy. This was partly attributed to the significant high residual kidney function (RKF) and low BMI of the patient. Because of her RKF and BMI, she was able to switch to IPD during her third trimester and the Kt/V at that time was 1.63. The present review suggests that compared with pregnant patients on long-standing PD, CKD patients get pregnant and initiate PD later have better maternal and fetal outcomes [28]. The degree of RKF tend to affects pregnancy outcomes positively. And our case also likely implies that for maternal patients on PD with significant RKF, higher dialysate infusion volumes might not be fully necessary [10].

Therefore, for pregnant patients on PD, the most important criterion to optimize dialysis treatment is their medical condition such as level of blood nitrogen, creatinine, hemoglobin, inter-dialytic weight gain, and blood pressure, rather than to achieve a target weekly Kt/V value (Table 2) [6, 22].

A pregnant ESRD woman undergoing PD has higher fetal and maternal morbidity and mortality rates than women with normal renal function. Lots of obstetrical complications may occur during the whole pregnancy, such as preterm birth, intrauterine growth retardation, preeclampsia/eclampsia, placental abruption, anemia, hemorrhage, miscarriage, and maternal death. For patients undergoing PD, hypertension and anemia are the most reported maternal complications, when intrauterine death and preterm infants were consider as the most frequent fetal complications [8].

One of the common complications in a pregnant PD patient is polyhydramnios, probablely due to maternal and fetal plasma volume expansion, combined with fetal urea osmotic diuresis [29]. In studies of pregnant patients on HD, aggressive ultrafiltration was suggested the treatment of polyhydramnios. Nevertheless, excessive ultrafiltration may compromise perfusion of the fetal kidneys and placental circulation, leading some authors to consider that mild-to-moderate polyhydramnios should be tolerated as an indicator of uteroplacental sufficiency [30]. As there is few studies on polyhydramnios among pregnant PD patient, further investigation into this is also needed.

Another complication that physicians often encounter is premature delivery (especially frequent when met with low birth weight infants). It is suggested that there is still a high risk in PD patients undergoing pregnancies. And the management of the pregnancy need to be improved for the PD patients.

Conclusions

Management of PD in a pregnant patient still remain a challenge for physicians, as perinatal complications are more common than in patients not on dialysis. Compare with keeping a target weekly Kt/V value, it is more important to optimize dialysis treatment of pregnant patients by their medical condition. Further studies are still needed to get better outcomes for pregnant patients undergoing PD.

Ethics Approval and Consent to Participate

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Shenzhen second people's hospital (approval number: 20200601040-FS01).

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Conflicts of Interest

The authors declare no conflict of interest.

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References

[1] Holley J.L., Reddy S.S.: "Pregnancy in dialysis patients: a review of outcomes, complications, and management". *Semin. Dial*., 2003, *16*, 384.
[2] Bagon J.A., Vernaeve H., De Muylder X., Lafontaine J.J., Martens J., Van Roost G.: "Pregnancy and dialysis". *Am. J. Kidney. Dis*., 1998, *31*, 756.
[3] Shahir A.K., Briggs N., Katsoulis J., Levidiotis V.: "An observational outcomes study from 1966-2008, examining pregnancy and neonatal outcomes from dialysed women using data from the ANZDATA Registry". *Nephrology (Carlton)*, 2013, *18*, 276.
[4] Piccoli G.B., Conijn A., Consiglio V., Vasario E., Attini R., Deagostini M.C., *et al*.: "Pregnancy in dialysis patients: is the evidence strong enough to lead us to change our counseling policy"? *Clin. J. Am. Soc. Nephrol.*, 2010, *5*, 62.
[5] Cabiddu G., Castellino S., Gernone G., Santoro D., Giacchino F., Credendino O., *et al*.: "Best practices on pregnancy on dialysis: the Italian Study Group on Kidney and Pregnancy". *J. Nephrol.*, 2015, *28*, 279.
[6] Lim T.S., Shanmuganathan M., Wong I., Goh B.L.: "Successful multigravid pregnancy in a 42-year-old patient on continuous ambulatory peritoneal dialysis and a review of the literature". *BMC Nephrology*, 2017, *18*, 108.
[7] Tuncer M., Trak B., Sapan M., Ozcan S., Süleymanlar G., Yakupoglu G., *et al*.: "Successful pregnancy complicated with peritonitis in a 25-year old Turkish CAPD patient". *Perit. Dial. Int*., 2000, *20*, 349.
[8] Chang H., Miller M.A., Bruns F.J.: "Tidal peritoneal dialysis during pregnancy improves clearance and abdominal symptoms". *Perit. Dial. Int*., 2002, *22*, 272.
[9] Smith W.T., Darbari S., Kwan M., O'Reilly-Green C., Devita M.V.: "Pregnancy in peritoneal dialysis: a case report and review of adequacy and outcomes". *Int. Urol. Nephrol.*, 2005, *37*, 145.
[10] Chou C.Y., Ting I.W., Hsieh F.J., Lee C.N.: "Haemoperitoneum in a pregnant woman with peritoneal dialysis". *Nephrol. Dial. Transplant*., 2006, *21*, 1454.
[11] Tan L.K., Kanagalingam D., Tan H.K., Choong H.L.: "Obstetric outcomes in women with end-stage renal failure requiring renal dialysis". *Int. J. Gynaecol. Obstet*., 2006, *94*, 17.
[12] Lew S.Q.: "Persistent hemoperitoneum in a pregnant patient receiving peritoneal dialysis". *Perit. Dial. Int*., 2006, *26*, 108.
[13] Asgari E., Bramham K., Shehata H., Makanjuola D.: "Successful pregnancy in a patient with end-stage renal failure secondary to HIV nephropathy on peritoneal dialysis". *Nephrol. Dial. Transplant*., 2007, *22*, 3671.
[14] Altay M., Akay H., Parpucu H., Duranay M., Oguz Y.: "A rare case: full-term delivery in a lupus patient on CAPD". *Perit. Dial. Int*., 2007, *27*, 711.
[15] Gómez Vázquez J.A., MartínezCalva I.E., MendíolaFernández R., Escalera León V., Cardona M., Noyola H.: "Pregnancy in end-stage renal disease patients and treatment with peritoneal dialysis: report of two cases". *Perit. Dial. Int*., 2007, *27*, 353.
[16] Jefferys A., Wyburn K., Chow J., Cleland B., Hennessy A.: "Peritoneal dialysis in pregnancy: a case series". *Nephrology (Carlton)*, 2008, *13*, 380.
[17] Chou C.Y., Ting I.W., Lin T.H., Lee C.N.: "Pregnancy in patients on chronic dialysis: a single center experience and combined analysis of reported results". *Eur. J. Obstet. Gynecol. Reprod. Biol*., 2008, *136*, 165.
[18] Okundaye I., Abrinko P., Hou S.: "Registry of pregnancy indialysis patients". *Am. J. Kidney. Dis.,* 1998, *31*, 766.
[19] Schmidt R.J., Holley J.L.: "Fertility and contraceptionin end-stage renal disease". *Adv. Ren. Replace. Ther*., 1998, *5*, 38.
[20] Giatras I., Levy D.P., Malone F.D., Carlson J.A., Jungers P.: "Pregnancy during dialysis: case report and management guidelines". *Nephrol. Dial. Transplant*., 1998, *13*, 3266.
[21] Shahir A.K., Briggs N., Katsoulis J., Levidiotis V.: "An observational outcomes study from 1966-2008, examining pregnancy and neonatal outcomes from dialysed women using data from the ANZDATA Registry". *Nephrology (Carlton)*., 2013, *18*, 276.
[22] Dimitriadis C.A., Bargman J.M.: "Gynecologic issues in peritoneal dialysis". *Adv. Perit. Dial*., 2011, *27*, 101.
[23] Furaz-Czerpak K.R., Fernández-Juárez G., Moreno-de la Higuera M.Á., Corchete-Prats E., Puente-García A., Martín-Hernández R.: "Pregnancy in women on chronic dialysis: a review". *Nefrologia*, 2012, *32*, 287.
[24] Abu-Zaid A., Nazer A., Alomar O., Al-Badawi I.A.: "Successful pregnancy in a 31-year-old peritoneal dialysis patient with bilateral nephrectomy". *Case Rep. Obstet. Gynecol*., 2013, *2013*, 173405.
[25] Vázquez Rodríguez J.G.: "Peritoneal dialysis and pregnancy". *Cir. Cir*., 2010, *78*, 177.
[26] Jungers P., Chauveau D.: "Pregnancy and renal disease". *Kidney. Int*., 1997, *52*, 871.
[27] Tison A., Lozowy C., Benjamin A., Usher R., Prichard S.: "Successful pregnancy complicated by peritonitis in a 35 year old CAPD patient". *Periton. Dialysis Int.*, 1996, *16*, 489.
[28] Asamiya Y., Otsubo S., Matsuda Y., Kimata N., Kikuchi K.A.N., Miwa N., *et al*.: "The importance of low blood urea nitrogen levels in pregnant patients undergoing hemodialysis to optimize birth weight and gestation age". *Kidney. Int*., 2009, *75*, 1217.
[29] Batarse R.R., Steiger R.M., Guest S.: "Peritoneal dialysis prescription during the third trimester of pregnancy". *Perit. Dial. Int*., 2015, *35*, 128.
[30] Luders C., Castro M.C., Titan S.M., De Castro I., Elias R.M., Abensur H., *et al*.: "Obstetric outcome in pregnant women on long-term dialysis: a case series". *Am. J. Kidney. Dis.*, 2010, *56*, 77.

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