

Pregnancy Outcome in Patients with Solitary Kidney

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Received: 3 June 2016 / Accepted: 26 September 2016 / Published online: 17 October 2016
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Abstract

Background Solitary kidney may be congenital or as a result of nephrectomy. There is a lot of literature available on quality of life in these patients, but there is limited data on pregnancy outcome.

Objectives To study pregnancy outcome in patients with solitary kidney either congenital or due to nephrectomy.

Materials and Methods Study Design This is a retrospective observational study conducted at tertiary health center in Ahmedabad, from 2011 to 2014. **Sample Size** There were 164 patients of solitary kidney, out of which two patients had congenital solitary kidney and the remaining had solitary kidney due to nephrectomy. Among 164 patients, 96 (58.53 %) patients had completed family, 37 (22.56 %) patients did not try for pregnancy, 15 (9.14 %) patients

have conceived, 12 (7.3 %) were lost to follow up and 4 (2.43 %) patients were infertile. *Method* Patients in reproductive age group (20–40 years), with solitary kidney either congenital or due to nephrectomy, were included. Maternal and fetal outcome was studied, and patients were followed up till 2 years postpartum. *Exclusion Criteria* Patients with solitary kidney due to post-renal transplant were excluded.

Results There were 15 (9.14 %) patients who had conceived, out of which 11 (73.33) patients delivered and 4 (26.67 %) patients had spontaneous abortion. Two patients developed gestational hypertension and one had preeclampsia. On follow-up, all babies were normal and none of them had delayed developmental milestones.

Conclusion Preconceptional counseling should be done in these patients regarding risk of developing preeclampsia during pregnancy and preterm delivery. These patients can have good pregnancy outcome with close monitoring during antenatal period.

Keywords Solitary kidney · Pregnancy · Nephrectomy

Introduction

Solitary kidney may be congenital or as a result of nephrectomy due to non-functioning kidney, living donors or other reasons like tumor, tuberculosis and renal calculi [1]. The incidence of congenital solitary kidney is 1:1500 [2]. The numbers of female donors are increasing and are most commonly donating kidney to their spouses. Most of these patients are in reproductive age group who will sooner or later conceive.

Materials and Methods

Study Design

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Sample Size

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Method

Patients in reproductive age group (20–40 years), with solitary kidney either congenital or due to nephrectomy, were included. Maternal and fetal outcome was studied in terms of deliveries, abortion, fetal maturity and birth weight. During the antenatal period, these patients were followed up monthly till 20 weeks, thereafter every fortnight till 28 weeks and weekly till term. Routine antenatal investigations like complete blood count, random blood sugar, HIV and HbsAg were done. At each antenatal visit, patient's serum creatinine, urinary protein and renal sonography were done. Fetal growth was closely monitored at each antenatal visit. Second trimester anomaly scan was done in every patient around 20–22 weeks of gestation. These patients were followed up in OPD with serum creatinine and urinary protein at 6 weeks and 3 months postpartum. Thereafter, they were followed up annually for 2 years in gynecology department. Babies of mothers with congenital solitary kidney underwent abdominal sonography within 48 h of delivery to detect any renal anomaly. All babies were followed up in pediatric OPD at interval of 6 months till 2 years of age, to detect any delay in developmental milestones.

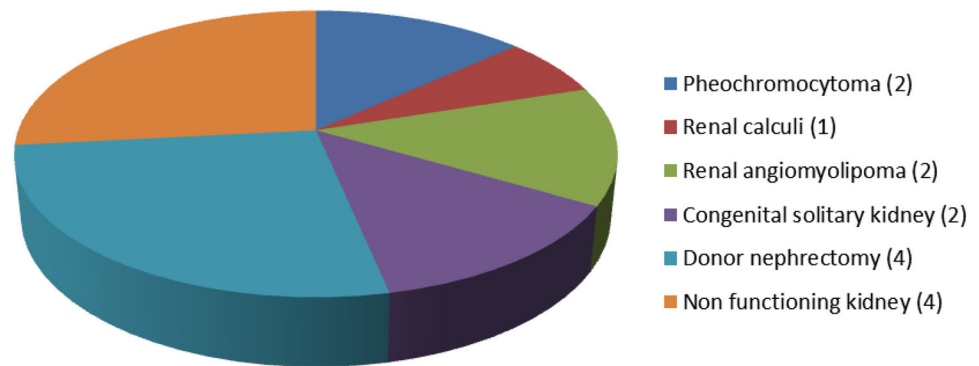
Exclusion Criteria

Patients with solitary kidney due to post-renal transplant were excluded.

Results

There were 15 (9.14 %) patients who had conceived, out of which 10 (66.67 %) patients had term deliveries, 1 (6.67 %) patient had preterm delivery and 4 (26.6 %) patients had spontaneous abortion. The mean age of patients was 28.19 ± 4.13 years. Figure 1 represents distribution of patients according to the cause of solitary kidney. There were two patients with congenital solitary kidney, 4 patients were donors who had undergone nephrectomy, and remaining patients underwent nephrectomy for non-functioning kidney, pheochromocytoma, angiomyolipoma and renal calculi. The mean interval between nephrectomy and pregnancy was 4.46 ± 1.05 years.

Pregnancy outcome with respect to serum creatinine level was studied (Table 1). It was found that deliveries were higher in patients with pre-pregnancy serum creatinine <1.2 mg/dl. The number of abortions was more in patients with serum creatinine ≥ 1 mg/dl during antenatal period, while the number of deliveries were more in patients with serum creatinine <1 mg/dl.

Fig. 1 Causes of solitary kidney**Table 1** Effect of serum creatinine on pregnancy outcome

Category	S. creatinine	Number (Percentage)	Number (Percentage)	p value
Pre-pregnancy	S. creatinine <1.2 mg/dl	10 (90.91 %)	2 (50 %)	0.15 (NS)
	S. creatinine ≥1.2 mg/dl	1 (9.09 %)	2 (50 %)	
During pregnancy	S. creatinine <1 mg/dl	9 (81.81 %)	1 (25 %)	0.08 (NS)
	S. creatinine ≥1 mg/dl	2 (18.18 %)	3 (75 %)	

Correlation between duration since nephrectomy and pregnancy outcome was analyzed (Table 2). Statistically no difference was found in both groups in terms of deliveries and abortion.

Pregnancy outcome with respect to cause of solitary kidney was studied (Table 3). All patients were normotensive before pregnancy.

Among antenatal complications, two patients developed gestational hypertension from 28 weeks of gestation onwards. They remained mildly hypertensive throughout pregnancy, and were managed with tablet methyldopa. They had normal vaginal delivery and healthy babies. One patient developed preeclampsia around 30 weeks, and underwent cesarean delivery at 32 weeks of gestation. Three patients had recurrent urinary tract infection throughout pregnancy, which was managed according to urine culture-sensitivity report.

There were a total of 11 deliveries, out of which eight were vaginal deliveries and three were cesareans. One patient underwent cesarean section for obstructed labor, and one patient underwent cesarean section due to cephalo pelvic disproportion.

Among fetal outcomes, there was one preterm delivery with baby birth weight <2.5 kg and rest were term deliveries. The preterm baby was in neonatal intensive care for

20 days. None of the babies had any anomaly. On follow-up, none of them had delayed developmental milestone.

Discussion

The number of female patients in reproductive age group, who are undergoing donor nephrectomy, are increasing with time. Hence the incidence of pregnancy in this group is also rising. Patients with solitary kidney during pregnancy are at risk of developing gestational hypertension, preeclampsia and preeclampsia-associated maternal and fetal complications [2]. In our study too, two patients had gestational hypertension and one developed preeclampsia. Stress of pregnancy is similar to that of multi-fetal pregnancy in patients with two kidneys [3]. During pregnancy, there is significant increase in effective renal blood flow and the glomerular filtration rate. It does not affect patients with normal renal function, but it increases stress on a single kidney which might induce some degree of renal impairment, which may or may not be reversible [4, 5].

Congenital solitary kidney can be due to renal agenesis or dysplasia. It more commonly involves left kidney [6]. The long-term effects of congenital solitary kidney are proteinuria (19 %), hypertension (47 %) and mild renal insufficiency (13 %) [7]. These patients may have associated reproductive tract anomalies in 30 % of cases [8]. Unicornuate uterus, bicornuate uterus, obstructed hemivagina and didelphys uterus can be found in these patients, whereas in acquired solitary kidney, no such anomaly is seen. Patients with nephrectomy have compensatory increase in size and functional capacity of kidney [9]. These patients are more vulnerable to additional stress than

Table 2 Duration since nephrectomy and pregnancy outcome

Duration of nephrectomy (n – 13) (years)	Delivery (N = 9)	Abortion (N = 4)	p value
≤2	5 (55.56 %)	2 (50 %)	1.00 (NS)
>2	4 (44.44 %)	2 (50 %)	

Table 3 Pregnancy outcome with respect to causes of solitary kidney

Maternal and fetal outcome	Congenital solitary kidney	Donor nephrectomy	Others causes of nephrectomy
Abortion		Two spontaneous abortion	Two spontaneous abortions
Antenatal complications	Gestational HT—1	Gestational HT—1 Recurrent UTI—1	Preeclampsia—1 Recurrent UTI—2
Delivery	Normal delivery—1 LSCS—1	Normal delivery—2	Normal delivery—5 LSCS—2
Fetal maturity (weeks)			
<34	1		
≥34	1	2	7
Fetal weight (kg)			
<2.5	1		3
≥2.5	1	2	4

congenital forms of solitary kidney. The glomerular filtration rate is reduced by about 35 % over a period of time [10].

Preexisting diabetes, obesity, advanced maternal age (>40 years), hypertension, presence of antiphospholipid antibodies and history of preeclampsia in previous pregnancy are risk factors for development of preeclampsia [11, 12]. Preeclampsia-related maternal complications include renal failure, liver failure, HELLP syndrome (hemolysis, elevated liver enzymes and thrombocytopenia), eclampsia, stroke and even maternal mortality. In fetus, it can result in small for gestational age, preterm delivery, hypoxic injury and even fetal loss [13]. Vikse et al. found that women who have preeclampsia and deliver offspring with low birth weight have substantially increased risk of having a later kidney biopsy and may progress to end-stage renal disease [14].

Apart from above-mentioned complications, these patients are also at increased risk for developing pyelonephritis which can lead to abortion or preterm deliveries [15]. These patients should have regular antenatal follow-up. They need to be screened for infection and early signs of preeclampsia. Along with antenatal sonography, blood pressure monitoring, serum creatinine, urine protein loss, urine routine microbiology examination and total counts should be done. In our study, three patients had recurrent urinary tract infection, but all of them had full-term vaginal deliveries. Fetal growth should be monitored to diagnose intrauterine growth retardation and uteroplacental insufficiency at the earliest.

Over time, patients with solitary kidney with time develop hyperuricemia, which causes afferent arteriopathy and renal fibrosis, resulting in CKD (chronic kidney disease) [16]. A study by Reisæter et al. concluded that pregnancy after kidney donation is safe, but rate of preeclampsia in pregnancies after kidney donation was 5.7 %. Hence, these patients require close monitoring

during their antenatal period. These patients can deliver vaginally; cesarean is done for obstetric indication only. Postpartum, most of the patients remain uneventful, however their blood pressure should be monitored and they should be scrutinized for the presence of any infection.

Conclusion

Patients with solitary kidney due to congenital causes or nephrectomy need to be counsel regarding risks of developing pyelonephritis, preeclampsia and its associated complications during pregnancy. These patients require close monitoring throughout their antenatal and postpartum period to avoid any deterioration of renal function. Multidisciplinary approach is required to have good pregnancy outcome in these patients.

Compliance with Ethical Standards

Conflict of interest None.

Human and Animal Rights It is an observational study carried at IKDRC, Ahmedabad. The study does not involve experiment on any animal or human being.

Ethical Approval Ethical approval was obtained for the study.

Informed Consent Informed consent was obtained for the study.

References

1. Basturk T, Koc Y, Ucar Z, et al. Renal damage frequency in patients with solitary kidney and factors that affect progression. *Int J Nephrol.* 2015;2015:876907.
2. Doroshov LW, Abeshouse BS. Congenital unilateral solitary kidney: report of 37 cases and a review of the literature. *Urol Surv.* 1961;11:219.
3. Ibrahim H, Akkina S, Leister E, et al. Pregnancy outcomes after kidney donation. *Am J Transplant.* 2009;9(4):825–34.

4. Dafnis E, Sabatini S. The effect of pregnancy on renal function: physiology and pathophysiology. *Am J Med Sci.* 1992;303:184.
5. Gluhovschi G, Gadalean F, Gluhovschi C, et al. The solitary kidney—a nephrological perspective. *Rom J Intern Med.* 2013;51(2):80–8.
6. Argueso LR, Ritchey ML, Boyle ET Jr, et al. Prognosis of patients with unilateral renal agenesis. *Pediatr Nephrol.* 1992; 6(5):412–6.
7. Thompson DP, Lynn HB. Genital anomalies associated with solitary kidney. *Mayo Clin Proc.* 1966;41(8):538–48.
8. Ben-Haim S, Sopov V, Stein A, et al. Kidney function after radical nephrectomy: assessment by quantitative SPECT of ^{99m}Tc-DMSA uptake by the kidneys. *J Nucl Med.* 2000;41(6): 1025–9.
9. Poggio ED, Braun WE, Davis C. The science of stewardship: due diligence for kidney donors and kidney function in living kidney donation—evaluation, determinants, and implications for outcomes. *Clin J Am Soc Nephrol.* 2009;4:1677–84.
10. Haas JS, Fuentes-Afflick E, Stewart AL, et al. Prepregnancy health status and the risk of preterm delivery. *Arch Pediatr Adolesc Med.* 2005;159(1):58–63.
11. Sibai BM, Lindheimer M, Hauth J, et al. Risk factors for preeclampsia, abruptio placentae, and adverse neonatal outcomes among women with chronic hypertension. National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. *N Engl J Med.* 1998;339(10):667–71.
12. Baumwell S, Karumanchi SA. Pre-eclampsia: clinical manifestations and molecular mechanisms. *Nephron Clin Pract.* 2007;106: c72–81.
13. Vikse BE, Irgens LM, Bostad L, Iversen BM. Adverse perinatal outcome and later kidney biopsy in the mother. *J Am Soc Nephrol.* 2006;17:837–45.
14. Shekhtman MM, Petrova SB. Pregnancy and labor in females with solitary kidney. *Ter Arkh.* 2000;72(6):39–42.
15. Kim IY, Lee DW, Lee SB, Kwak IS. The role of uric acid in kidney fibrosis: experimental evidences for the causal relationship. *BioMed Res Int.* 2014;2014:638732.
16. Reisaeter AV, Røislien J, Henriksen T, et al. Pregnancy and birth after kidney donation: the Norwegian experience. *Am J Transplant.* 2009;9:820–4.