Original Article

Aetiology and Maternal Outcome in Pregnancies complicated by Acute Kidney Injury; A Tertiary Care Single Centre Experience

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Abstract

Objective: To determine the aetiology and maternal outcomes of Pregnancy-Related AKI.

Methodology: This Prospective observational study was carried at CMH Kharian in the department of nephrology and department of gynae and obs between January to June 2019. Pregnant Women with normal renal profile at the time of enrolment in the study and no previous history of kidney disease or renal procedure in the recent past (at least 3 months) before conception were included. All participants had serum creatinine tested at enrolment and were inquired specifically about any history of renal disease or any renal procedure in the recent past (at least 3 months). Those mothers who developed creatinine above the normal range (> 110 umol/L) during the study period or decreased urine output underwent serial assessment and evaluation in addition to investigations for determining aetiology of kidney injury. AKI was diagnosed and staged by Kidney Disease Improving Global Outcomes (KDIGO) criteria.

Results: A total of 720 patients were included. The mean maternal age was 27.5 (+ 6.447) years. A substantial n=504 patients had an uneventful pregnancy course from a kidney perspective but a surprising n = 216 (30%) of mothers developed renal injury of varying severity. While most of the patients recovered completely, a small n=24 (11%) number of patients required dialysis. Most of these dialysis patients recovered completely, however, a significant portion n=23 (11%) remained dialysis-dependent permanently. (CKD)
A major chunk (56%) of our patients came from Lower Socio Economic Class. Regarding maternal outcomes n= 166 (77%) mothers recovered completely. However n= 42 (20%) patients had some degree pf azotaemia. Importantly enough 7(3%) mothers died due to causes related to renal dysfunction and dialysis.

Conclusions: The Pregnancy related-AKI and its complications have an alarmingly high rates in the population living around Grand trunk road. Post-partum haemorrhage (PPH) in addition to Sepsis is the leading causes of Pregnancy related-AKI. With tertiary nephrology and obstetric care, the most AKI resolved with no residual effect but a substantial number of patients developed CKD which culminated in dialysis in the future, placing a huge financial and health care burden on family and Health care resources.

Keywords: Acute Kidney Injury, Global Health, Preeclampsia, Pregnancy.

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Introduction

Pregnancy-related acute kidney injury (AKI) is believed to be a main contributor to the overall burden of Acute Kidney Injury in low income settings, leading to significant but preventable morbidity and mortality. However, epidemiological data to support these hypotheses is sparse especially in our country

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Pregnancy related AKI is ever growing problem and is contributing to maternal as well as foetal mortality and morbidity. Although both developed and under-developed countries are affected but consequences for Under developed countries are enormous.[1,2] In addition to high mortality, the requirement of renal replacement therapy further complicates the picture. The cost of care for chronic kidney disease (CKD) and Renal replacement therapy is draining health resources of many poor countries. It is increasingly acknowledged as a condition that is both treatable and preventable, mostly with simple and inexpensive interventions.[3] In developed countries, the incidence of AKI in pregnancy has been dramatically reduced. The International Society of Nephrology recently launched an initiative, which aims to eradicate avertible deaths from AKI by 2025.[4] An initial goal is to reduce the global burden of AKI, particularly in low-income backgrounds. Over 80% of worldwide maternal deaths occur in Sub-Saharan Africa (SSA) and 3rd world countries, but the influence of kidney disease to these is unknown.[5]

To the best of our knowledge, there are not many preceding studies investigating Pregnancy related AKI outside intensive care and dialysis units in Asian countries. The causes and consequences of AKI for mother and foetus are unknown to a large extent.[6-10] This study aimed to determine the incidence proportion, aetiology and maternal and renal outcomes in obstetric patients admitted to a tertiary care hospital in Kharian. It will also assist in evaluating the renal diseases in the short and long term which will further help in predicting the likely outcome of the disease and better management decision will be possible because of the knowledge obtained. Knowing the likely outcome may help in reducing the anxiety factor in mothers which is extremely common in these patients.

Methodology

This study was conducted in Combined Military Hospital Kharian from1st JAN till 30th Jun 2019. CMH Kharian is a tertiary care hospital with fully functional Nephrology division and well established High risk pregnancy management set up

All women, who reported for antenatal visit and underwent delivery in our gynae department and were having normal Real function tests at the time of enrolment and no history of kidney disease or any renal procedure in the recent past (at least 3 months) were included in the study. Baseline clinical data was recorded, and screening serum creatinine (SCr) was measured to determine the presence/absence of kidney disease.

Serum Creatinine SCr > 110 umol/L was considered to be significantly elevated and labelled as AKI as this was the upper limit of normal for an average adult females in our laboratory. Similar AKI definition was adopted in another study carried out by Williams D, Davison J et al.[11] AKI was diagnosed and staged according to Kidney Disease Improving Global Outcomes (KDIGO)but staging part was omitted as it was not directly related to our study aim and design.[12]

Women with elevated SCr on admission (> 110 umol/L) or other features of AKI such as oliguria/anuria were followed up with daily measurement of S Cr and urine output. Detailed evaluation and management by both the nephrology and obstetric teams was ensured.

We tried to discover the most likely causes of renal impairment centred around the evaluation of the patients detailed history, physical examination and available clinical data and laboratory investigations. Patients with normal SCr (< 110 umol/L) at enrolment were managed by obstetricians and not routinely seen by the study team. However, the Nephrology team was involved when there were certain alarming features such as low urine output or rising renal parameters such as BUN and creatinine.

Renal outcomes were documented after following patients for 3 months following discharge, delivery and death were also documented.

All patients with pre-existing derangement of RFTS with a previously documented record of more than 3 months renal impairment were considered Chronic kidney disease (CKD) and were excluded from the study.

All patients with elevated creatinine at the time of enrolment but NO previous history or record of RFTS exceeding3 months were considered to have Acute kidney disease, however, they were not included in study as they had pre existing kidney disease which may or may not be linked to present pregnancy.

All patients who did not undergo delivery in our hospital or left pre- maturely before the given time frame were also excluded.

Patients having solitary kidney, congenital anomalies of kidney, ectopic kidneys, and having nephrolithiasis but having normal RFTs were also excluded to keep focus limited to the truly normal population as these factors might have implications on AKI and renal outcome.

AKI: AKI was defined as per KDIGO definition of AKI and the lowest value of creatinine documented at the time of enrolment or previous three months was considered to be baseline.

CKD: Women having persistent azotemia for 3 or more months were labelled as suffering from Chronic Kidney disease.

Complete Renal Recovery: Women who developed a various degree of renal dysfunction and later on returned to completely normal baseline values were labelled having complete renal recovery.

RRT: Patients requiring renal replacement therapy i.e. dialysis at any stage of the study were grouped as requiring RRT. However, indications for RRT differed but RRT modality in our hospital is Haemodialysis only

Primary outcome measures were the Frequency proportion and aetiology of AKI. Secondary outcomes were maternal survival, need for maternal dialysis (RRT), kidney recovery (complete, partial or none) and maternal length of stay in the hospital.

Other causes of AKI: In this group, we included Nephrotoxic medications, Drug allergy, Transfusion reaction, surgical injury to ureters and kidney and any other cause not already defined in the study.

Variables are reported as mean ± standard deviation (SD) or median ± frequencies. We compared variables between women with and without AKI, using the independent sample t test. A p value of < 0.05 was considered to be statistically significant.

Results

A total of n=720 patients were included in our study. Mean maternal age was n=27.5 (+6.447) years. A surprising n=216 (30%) of mothers developed renal injury (AKI) of varying severity and types. N=504 patients had uneventful pregnancy from renal perspective. (Table I)

Among those n=216 patients who developed AKI, n=122 (55.5%) recovered completely, while n= 47 (22%) continued to have persistent azotaemia for more than 3 months in the follow up period and developed Chronic kidney disease of various stages but they did not require Renal Replacement Therapy (RRT) (at least in the follow up duration). A small n=24 (11 %) number of patients required one or more dialysis but recovered later on and they were not dialysis dependent. They were labelled to be temporary dialysis dependent. However, another portion n=23 (11%) became permanently dialysis dependent.

The observations in Socio Economic Class category and age group distribution of AKI and Non AKI Patients were described in Table II & Table III

Mean Creatinine fluctuated widely in all trimesters. It dropped to mean 112meq/L in 2nd trimester after starting at a mean 130 meq/L in 1st trimester. It peaked to a mean of 158 meq/L in the last trimester of pregnancy.

Regarding maternal outcomes in patients who developed Pregnancy related-AKI n=166 (77%) mothers recovered completely. However, 42(20%) patients had some degree pf azotaemia including a few cases requiring permanent renal replacement therapy.

Table I: Number and percentages of AKI and NON AKI Patients (n=720)

		Frequency	%	Valid Percent	Cumulative Percent
Valid	NO AKI	504	70.0	70.0	70.0
	AKI	216	30.0	30.0	100.0
	Total	**720**	**100.0**	**100.0**	

Table III: Age Group Distribution of AKI and Non AKI Patients.

			25 years and below	Above 25 years	
AKI OR NOT	NO AKI	Count	240	264	504
		% within AKI OR NOT	47.6%	52.4%	100.0%
	AKI	Count	48	168	216
		% within AKI OR NOT	22.2%	77.8%	100.0%
Total		Count	288	432	720
		% within AKI OR NOT	40.0%	60.0%	100.0%

Table II: Socio Economic Class in AKI and NO AKI group.

			Socio Economic Class			
			Upper class	Middle class	Lower class	Total
AKI OR NOT	NO AKI	Count	144	288	72	504
		% within AKI OR NOT	28.6%	57.1%	14.3%	100.0%
	AKI	Count	24	72	120	216
		% within AKI OR NOT	11.1%	33.3%	55.6%	100.0%
Total		Count	168	360	192	720
		% within AKI OR NOT	23.3%	50.0%	26.7%	100.0%

Importantly enough 7 (3%) mothers died due to causes related to renal dysfunction.

Similarly, patients with AKI were more likely to stay for longer duration(Mean Hospital Stay duration 13 days) than mothers who did not have AKI (mean hospital stay duration just over 4 days) and the difference was highly significant statistically (P value was <0.05)

Discussion

The frequency of AKI is increasing in Low income countries even though a few studies have noticed a decline in the frequency of AKI. Pregnancy-related AKI is causing a huge financial and healthcare resource burden on already struggling 3rd world countries. Even well developed countries have noticed an increase in Pregnancy related AKI (Pr-AKI) in the recent past, although, it is attributed to more advancement in diagnosis rather than an actual increase in the incidence of the disease. A similar study was carried out by Ahmed SU, Chowdhury AA. Roy AS et al in a tertiary care hospital in Blantyre, Malawi in 2015. Their primary outcomes were the incidence fraction and causes of AKI. Secondary outcomes were in-hospital maternal death, need for renal replacement therapy, kidney recovery and length of stay in hospital. In comparison, our study was under-power as we focused mainly on the frequency of AKI and its effects on short and long-term renal outcomes such as complete recovery, development of CKD and need for temporary or permanent dialysis. Their study population size was very big, with 2300 deliveries compared to only 720 deliveries in our setup. In their study, The incidence of AKI 8.1% which was very low compared to our local studies.[14] In our study the proportion of AKI was 30% which appears to be exceptionally high but similar rates have been quoted in India also especially in older studies.[15] This high frequency of Pregnancy related-AKI may have been because our hospital is located at Kharian which evacuates high risk pregnancies from a vast area and only complicated and very high risk cases are managed in this hospital. The predominant prevalence of only high risk pregnancies in our hospital naturally cause selection bias. Furthermore, they sub classed AKI in various stages which was not the case in our study. Regarding aetiology of kidney diseases in their study, the primary causes of AKI were preeclampsia/eclampsia (n = 19, 73.1%), antepartum haemorrhage (n = 3,11.5%), sepsis (n = 3, 11.5%) and cardiac failure (n = 1, 3.8%). We encountered similar causes but the relative contribution/ proportion of each cause differed. In our study's primary cause of Pregnancy, related-AKI was Post-partum haemorrhage which was underlying pathology in (24%) of the cases. It was followed by Sepsis being responsible for just under (19%) cases, HUS/TTP, gestational hypertension and Ante-partum haemorrhage were other important causes contributing around 10% each. Similar causes were reported in a Chinese study also.[16] So various aetiologies responsible for AKI were in keeping with most of the international literature.[6,17-21]

Another local study carried out in 2014 in Pakistan also quoted similar causes of AKI in Pregnancy. The frequency of Pregnancy related AKI was 31% in the first trimester which was similar to our study (30%). However, they subdivided the frequency of AKI in each trimester which was not the case in our study. Septic abortion (31%) and Post-partum haemorrhage (14%) were the commonest causes of AKI during pregnancy, same was the case in our study.[22] However individual percentages for Sepsis were 19% and PPH 29% in our study. Mean maternal age was 26 years which was parallel to our study population (27 years). So, the findings of our study were in keeping with most of the international literature and where they differed, they were in keeping with local studies.

Conclusion

The frequency of Pregnancy related -AKI in Kharian and Gujrat districts is significantly greater than in many developed countries and even from other areas of Pakistan. The renal outcome is not particularly good, adding to disease burden and exhaustion of meager health resources of our country. So, our study provides novel and important data for obstetricians, nephrologists and government agencies, and Non-Government Organizations in planning and provision of healthcare facilities. The majority of AKI was caused by PPH and APH in addition to sepsis, a potentially preventable and treatable disease.

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