ORIGINAL ARTICLE

Prevalence of acute kidney injury in patients treated with intravenous colistin

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Abstract

Objective: To determine prevalence of acute kidney injury in patients treated with intravenous colistin.

Study design: Cross sectional study

Study settings & duration: Study was conducted at Department of Medicine, King Salman Armed Forces Hospital, Tabuk, Kingdom of Saudi Arabia. Study duration was 6 months (June 2017-November 2017).

Material & methods: Sample size of 147 patients was calculated using WHO calculator. Patients were selected using non probability consecutive sampling. Patients received intravenous colistin, were undergone through venous blood samples of creatinine. Patients with creatinine >2mg/dl were diagnosed with acute kidney injury. SPSS software was used for data analysis. Descriptive and inferential statistics were calculated. Chi-square test was applied with p-value ≤0.05 significant.

Results: Total 147 patients were included in study. There were 94(64%) female and 53(36%) males. Mean age of patients was 55±2.4 SD. Among all the patients 147 (100%), 20(14%) patients are at risk of acute kindney injury (AKI), 63(43%) had acute kindney injury while 5(3%) were diagnosed with kidney failure and 59(40%) remained intact with acute kindney injury diagnosis. Males, 40-80 years age group and BMI>30 kg/m2 had high proportion of acute kidney injury (p<0.05).

Conclusion: Prevalence of acute kidney injury following colistin administration is very high as compare to previous thought. Further evidence is required for service planning and provision of information to clinicians to prevent deterioration of renal function.

Keywords: Acute kidney injury, intravenous colistin, renal failure

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Introduction:

Acute kidney injury (AKI) is defined as reduction in kidney function usually within 48 hours. Incidence of Acute kidney injury in United States is 2-5%.[1] However out of all patients admitted to hospital, 1% are diagnosed with Acute kidney injury in U.S.[2] Prevalence of Acute kidney injury in Saudi Arabia is 20-60%. Acute kidney injury is most challenging issue faced by general physicians and associated with fast changing disease burden, world wide.[3]

Acute kidney injury is manifested three main parameters including absolute increase in serum creatinine (≥0.3mg/dl from baseline), increase in creatinine 1.5 folds from baseline and urine reduction (<0.5ml/kg/h for > 6 hours).[4] Acute kidney injury is clinically categories as pre-renal, intrinisic and post-renal disease. Pre-renal Acute kidney injury is an adaptive response of kidney towards volume depletion/hypotension (structurally intact nephrons). Intrinsic Acute kidney injury results as an alternative response towards inflammation, ischemia and cytotoxicity (structural & functional damage). Post-renal acute kidney injury is result of urine passage obstruction.[5]

Table-1: Association between acute kidney injury, gender, age and BMI

Gender	Acute kidney injury		Total	Chi-Square	P-Value
	Yes	No			
Males	34(54%)	19(23%)	53(36%)	32.562	0.01
Females	29(46%)	65(77%)	94(64%)		
Age					
25-40 years	5(8%)	25(30%)	30(20%)	23.481	0.03
41-80 years	58(92%)	59(70%)	117(80%)		
BMI					
≤30 kg/m2	58(92%)	79(94%)	137(93%)	35.213	0.00
>30 kg/m2	5(8%)	5(6%)	10(7%)		
Total	63(43%)	84(57%)	147(100%)		

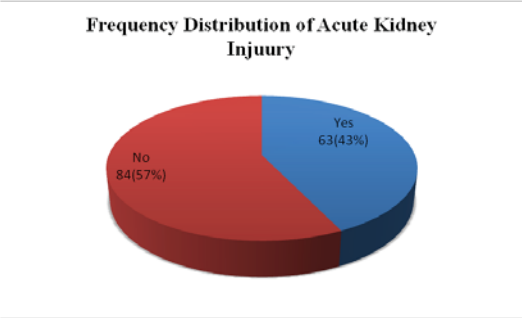

Fig. 1: Frequency distribution of acute kidney injury

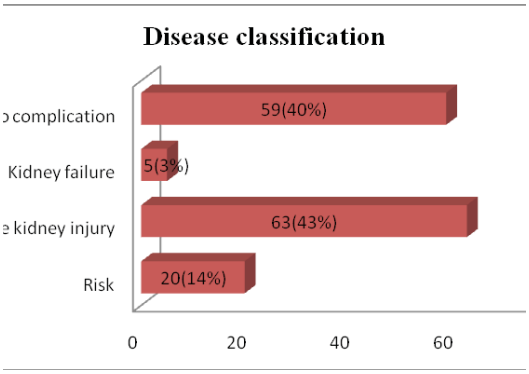

Fig. 2: Frequency distribution of disease classification

Hartzell et al. reported that after receiving cloistin injection 61% patients did not have injury, 19% were at risk, 17% had injury and 3% had kidney failure.[6] Kwon et al reported that Acute kidney injury is common complication of colisti-methate sodium (CMS) associated with male gender, hypo-albuminaemia and hyper-bilirubinaemia as independent predictors.[7]

Deryke et al reported a relatively high incidence of nephrotoxicity as a result of colisti-methate sodium. However, over estimation of kidney injury is due to sensitive criteria usage in study (RIFLE classification).[8] Sepan et al reported that potential nephro-toxicity associated with colistin injection could be reduced by lowering drug dose and treatment duration.[9] Falagas et al. reported that administration dose of colisti-methate sodium is statistically correlated with serum creatinine values.[10]

Limited literature is available on acute kidney injury in Tabuk. Present study aims to determine prevalence of acute kidney injury in patients treated with intravenous colistin.

Material & Methods:

Cross sectional study was conducted at Department of Medicine, King Salman Armed Forces Hospital, Tabuk, Kingdom of Saudi Arabia. Study duration was 6 months (June 2017-Novemeber 2017). Ethical Approval was taken from ethical review board of hospital. Sample size of 147 was calculated using WHO calculator with 35% prevalence,[11] 95% confidence interval and 7% margin of error. Non probability consecutive sampling is used for selection of participants. Patients with age 25-80 years, both genders and receiving intravenous colistin (>48 hours & for more than 6 days) were included in study. Exclusion criteria was based upon BMI <25kg/m^2, patients with kidney transplantation, receiving renal replacement therapy, receiving other nephrotoxic drugs, serum creatinine >2mg/dl from baseline and unstable creatinine values within 72 hours after intravenous colistin. Patients diagnosed for receiving intravenous colistin as treatment modality were undergone through venous blood sample of serum creatinine. Patients with serum creatinine value raise from 1.5 to 2 from baseline measurement were diagnosed at risk of Acute kidney injury, 2-3 from baseline Acute kidney injury, >3 from baseline kidney failure. Follow up was done after 7 days. SPSS version 22.0 was used for data analysis. Quantitative variables were calculated as mean & standard deviation. Qualitative variables were calculated as frequencies and percentages. Chi-square test was applied for measuring association. P-value ≥0.05 was considered significant.

Results:
Total 147 patients were included in study. There were 94(64%) female and 53(36%) males. Mean age of patients was 55±2.4 SD. There were 30(20%) patients in age group 25-40 and 117(80%) patients in 40-80 years age group. Mean BMI of patients was 29.5kg/m^2±0.9SD. Among all the patients 147(100%), 63(43%) patients had acute kidney injury while 84(57%) patients did not have acute kidney injury as shown in figure 1.

Among all the patients 147 (100%), 20(14%) patients are at risk of AKI, 63(43%) had Acute kidney injury while 5(3%) were diagnosed with kidney failure and 59(40%) remained intact with acute kidney injury diagnosis as shown in figure 2.

Among all the males 53(36%), 34(54%) had acute kidney injury while 19(23%) did not have acute kidney injury. Similarly among all females 94(64%), 29(46%) had acute kidney injury while 65(77%) did not have acute kidney injury (x^2 =32.562, p=0.01, df =2). Among all those in age group 25-40 years 30(20%), 5(8%) had acute kidney injury while 25(30%) did not have acute kidney injury. Similarly among all those in 41-80 years group 117(80%), 58(92%) had acute kidney injury while 59(70%) did not have AKI (x^2 =23.482, p=0.03, df =2). Among all those with BMI ≤30 kg/m^2 137(93%), 58(92%) had acute kidney injury while 79(94%) did not have acute kidney injury. Similarly patients with BMI>30 kg/m^2 10(7%), 5(8%) were diagnosed with AKI while 5(6%) did not have AKI(x^2 =35.213, p=0.03, df =2) as shown in table 1

Discussion:
Acute kidney injury is reversible decline in rate of glomerular filtration resulting in nitrogenous waste retention and significant imbalance in fluid and electrolyte. Acute kidney injury is major infectious disease with high mortality and morbidity worldwide.[7] Acute kidney injury as a result of nephrotoxicity following colistin administration is major challenge for clinicians.

Present study included 147 patients. There were 94(64%) female and 53(36%) males. Mean age of patients was 55±2.4 SD. Significantly high proportion of males is diagnosed with acute kidney injury as compare to females (⊠2 =32.562, p=0.01, df =2). Horkan et al. reported that a significant association was found between sex and acute kidney injury (p<005). However, males are more prone to develop acute kidney injury as compare to females.[12] Cerda et al. reported that boys are more likely to receive medical care associated with acute kidney injury as compare to girls (p<0.05).[13]

In present study, a high proportion of acute kidney injury was reported in age group 41-80 years as compare to 25-40 years age group (⊠2 =23.482, p=0.03, df =2). Chao et al reported that frequency of acute kidney injury following colistin administration is high in elderly population due to age related structural and functional deterioration of kidney.[11] Rodrigo et al. reported that age, mechanical ventilation and glomerular filtration rate are in-dependent predictors of acute kidney injury following colistin.[14]

In present study, among all the patients 147 (100%), 20(14%) patients are at risk of acute kidney injury, 63(43%) had Acute kidney injury while 5(3%) were diagnosed with kidney failure and 59(40%) had no acute kidney injury. McDonald et al. reported that 40% patients were at high risk of acute kidney injury regardless of contrast medium and diagnostic criteria of AKI.[15] Ali et al reported that relatively high incidence of acute kidney injury was found among patients treated with intravenous colistin as compare to controls.[16] Another similar study reported 45% frequency of acute kidney injury after colistin administration following RIFLE criteria.[5]

Limitation: Small sample size and short duration of follow up limits generlizability of study

Conclusion:
Prevalence of acute kidney injury following colistin administration is very high as compare to previous thought. Further evidence is required for service planning and provision of information to clinicians to prevent deterioration of renal function

Conflict of interest: None

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Role and contribution of authors:

Dr Muhammad Rauf, designing, data collection & analysis.

Dr Nadeem Akhtar, data management & interpretation of data.

Dr Naeem Akhtar, conception & acquisition of data.

Dr Anam Altaf, final revision and critical evaluation of intellectual content.

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