



Acute Kidney Injury Caused Due to Colistin Therapy: A Case Report Study Analysis

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| Article History | Abstract |
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| Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 01 Dec 2023 | <p>An abrupt bout of kidney damage or failure that lasts a few hours to a few days is referred to as acute renal failure (ARF) or acute kidney injury (AKI). Nephrotoxicity is classified into the following categories: R-risk, I-injury, F-failure, L-loss of function, and E-end stage renal failure. It is inherited, brought on by medications, and associated with diabetes, liver diseases, and heart issues. Typically, a drug's dose-dependent nephrotoxicity affects its severity. Multi-medication resistant (MDR) infections have led to an unprecedented increase in the use of Colistin medicine. <i>Pseudomonas aeruginosa</i>, <i>Klebsiella pneumoniae</i>, and other gram-negative bacteria are to blame. One type of bacteria is <i>Acinetobacter baumannii</i>. This paper will provide the case of a 62-year-old male patient who was admitted to the hospital after receiving a diagnosis of venous thromboembolism and anemia. Human-acquired pneumonia results from <i>Acinetobacter baumannii</i>'s multidrug resistance, which makes the bacteria only responsive to the antibiotics colistin and azithromycin meropenem. Two days after commencing the (Oliguria-500) medicine, there was a decrease in urine production. The renal parenchyma showed changes, and the levels of creatinine were elevated to 3.18 mg/dL. USG has been seen. Laboratory results indicate that he suffered from AKI Colistin and demonstrates strong (Naranjo score: 8) usually connected to AKI. Drug dosages were not changed. It was routine practice to monitor BUN and creatinine levels. The amount of urine produced increased to 2450 mL 15 days following treatment. Respiratory failure is one of the neurological side effects of colistin was ignored. On discharge day, the patient was stable and doing well. It seems from this that if the medication is beneficial and the risk is manageable, there is no reason to stop taking it; however, careful observation is needed. Diminish the quantity of adverse reactions.</p> |
| CC License CC-BY-NC-SA 4.0 | <p>Keywords: Acute Kidney failure, Virus Pneumonia, Drug Efficacy, Hospitalization, Risk factor, Laboratory techniques, Hospital admission, Bacteria, Drug overdose, Age, Clinical features.</p> |

1. Introduction

Acute kidney injury (AKI) is characterized by an abrupt loss of renal excretory function. Most of this is permanent or irreversible loss of nephrons and renal cells. This can be caused by a number of natural factors as well as drugs [1]. Antibiotic polymyxin colistin is thought to be the cause of AKI. Due to widespread drug resistance and multi-drug resistance, its use has resulted in a resurgence of infections

that are on the rise [2]. In the 1940s, the bacteria *Bacillus polymyxin* yielded the first isolate of colistin. It was the only polymyxin drug utilized in clinical trials throughout the 1960s, but it was withdrawn after 10 years due to dangerous side effects. Later, in the 1990s, it was used to treat MDR bacteria Gram-Negative infections brought on by pneumonia, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Klebsiella*, and other bacteria. Acute kidney injury or infection is still a treatable side effect of colistin, and most doctors will not recommend this medication to individuals who are more likely to get an acute kidney infection. According to earlier studies, the incidence of acute kidney infection caused by colistin ranged from 14.3% to 76.1% [2].

Kidney damage when nephrotoxicity is compared to unfavorable neurological effects, respiratory failure and heart failure are among the Colistin ADRs that occur more frequently. Patients often need five to twelve days on average to develop an acute kidney infection. The majority of the time, a patient's renal recovery happens naturally, but occasionally, renal replacement therapy may be necessary [2]. On the other hand, using pure Colistin-Colistimethate Sodium reduced the occurrence of ADR by 0 to 37%. The dosage influences the likelihood that an antibiotic's negative effects will materialize [3, 4]. When starting colistin medication, the right dosage should always be determined by taking the patient's age, weight, and other nephrological and neurological parameters into account. To determine the patient's bilirubin and creatinine levels, a correct RFT is required. The likelihood of injury is decreased if the dose is given in the appropriate dosage form [5].

While increased membrane permeability is a sign of oxidative damage, permeability, and acute tubular necrosis, the exact origin of nephrotoxicity is uncertain. Apoptosis can occur through a variety of mechanisms, including the death of the mitochondrial receptor, cell cycle arrest, autophagy, malfunctioning mitochondria, altered nitric oxide levels, endoplasmic reticulum pathways, and oxidative stress. The colistin nephrotoxicity risk variables are dose and duration. colistin treatment, concurrent use of other nephrotoxic drugs, factors particular to the patient, such as sex, age, hypoalbuminemia, severity of the underlying condition, hyperbilirubinemia, Patient ailment and also body weight. Nonetheless, there are still some disagreements regarding a person's body weight and how it relates to the dosage of medication prescribed. Acyclovir, Foscarnet sodium, Amphotericin B, Ganciclovir Vancomycin, Meropenem, and Penicillin are among the antibiotics, antidepressants, aminoglycosides, benzodiazepines, contrast imaging, antiretrovirals, and diuretics that can also cause nephrotoxicity. For end-stage renal failure, nephrotoxicity is measured in RIFLE (Risk, Injury, Failure, Loss, and Economic) categories [6,7].

The Case Description

A male patient, age 62, was brought to the emergency room two days ago with complaints of C/O swelling, pain, and total loss of sensation in his lower right limb. It was discovered that the patient's right lower limb was discolored and cold during the examination. Twenty milligrams of cilnidipine were administered to treat his CVA and H/O hypertension. Telmisartan 40 mg, Clonidine 0.5 mg, and Prazosin 5 mg BD were prescribed to him. Two days ago, the patient underwent knee replacement surgery. As a result, he was hospitalized with acute compartment syndrome symptoms. Fasciotomy was performed to treat compression disease.

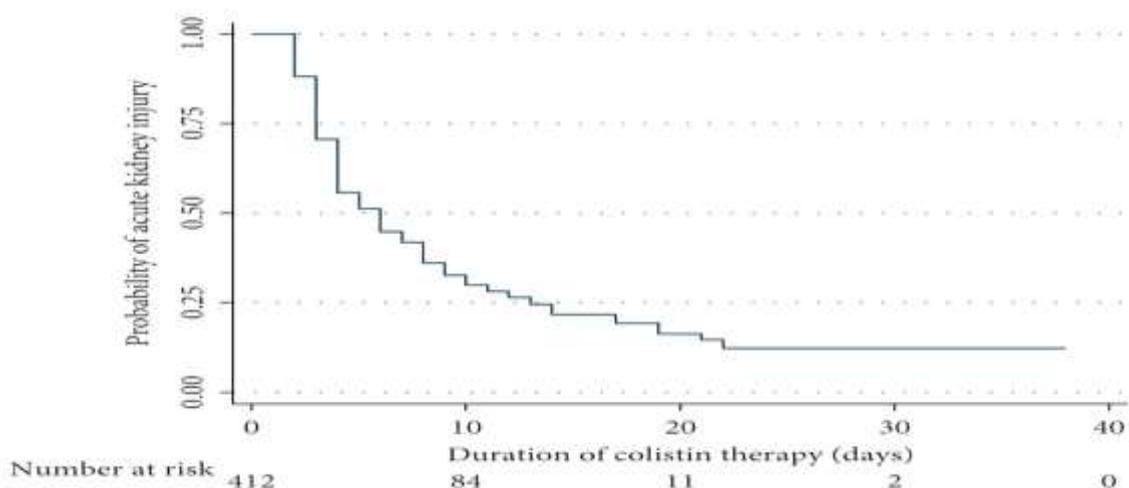


Fig. 1: The urine and creatinine output changes following colistin treatment delivery are depicted in the below figure.

Following the emergency operation, the patient got cardiac arrest and went into ventricular fibrillation shock. He was diagnosed with Venous thrombosis after undergoing a CT angiography. Due to which the knee had to be removed. Low molecular weight anticoagulant drug Cefoperazone sodium 1 gm, Apixaban 5 mg, heparin BID and Minocycline (100mg 2 times a day), and Pantoprazole (40mg once a day) were administered preventively. After three days in the intensive care unit, the patient was diagnosed on the basis of clinical signs, the hospital acquired pneumonia (Fever, chills and SOB) apart from the X-ray (Chest). Nebulizer was also administered. Following the same schedule as duolin 12th hourly and budecort 8th hourly was given same as initial 2 days, but in place of Acinetobacter antibiotic, Inj. Meropenem was administered. When a MDR gram- negative bacteria was then isolated from sputum, the culture was found to be sensitive to meropenem and colistin antibiotics therapy.

In relation to ongoing therapy on day 5, Colistin 3 IU BID was introduced to the regimen following 48 hours of Colistin. During therapy, the patient's urine production was decreased. By giving Oliguria (500 mL/h) his level of BUN was 93.3 mg/dL and his creatinine level was 3.09 mg/dL, with renal parenchymal alterations in the ultra-abdominal sonography revealed acute renal damage. The drug's dose was not changed and creatinine and BUN levels were measured timely. Changes in the readings were regularly monitored. On the Day 13, Aspirin (75mg) was also added to the regimen along with atorvastatin (40mg) to avoid blood clotting and the remaining therapy is being continued. RFTs were performed one week later (on day 14). BUN (92mg/ dL) and serum creatinine is (2.6 mg/ dL) measurements were repeated and urine output then found to be 800 mL/day, and levels were somewhat reduced.

The patient developed anemia with Hb levels of 7gm/dL. During surgery blood transfusions was done 4000 IU erythropoietin. Medication like folic acid, vitamin, chy moral forte once a week was included to the treatment regimen. On day 16, urine production reached 2500 mL/day, creatinine 1.8 mg/dL and BUN levels reduced to 1.75 mg/dL. The patient was discharged as all the values were getting into normal range. The values of output of creatinine and urine throughout hospitalization was noted as seen in the Figure 1. The patient is advised to come 10 days after the discharge, for a follow-up with RFT.

3. Results and Discussion

Case

Although colistin is useful during the treatment of gram-negative MDR infection's, it is only used as a last option. It produces potentially fatal neurotoxicity and nephrotoxicity. Some of the neurotoxic symptoms include weakness, dizziness, peripheral and facial paresthesia, and fatigue. Some other symptoms include vertigo, visual abnormalities, disorientation, neuromuscular dysfunction and ataxia [8,9,10]. The reports that prevalence of the neurotoxic symptoms which are estimated to be 7%, with paresthesia which was the most commonly seen symptom. In this case the patient developed nephrotoxicity within 48 hours after starting colistin. The results were diagnosed between 24 to 72hrs after the administration of initial drug dose. The development of nephrotoxicity was occurred by a combination of factors like age, the use of other nephrotoxic medications simultaneously, and mainly by the dose of colistin drug.

As per the Aydogan et al., noted that Age is not found to be a risk factor in the initiation of colistin nephrotoxicity [6]. The entire sum usage of colistin therapy for lung infection and concurrent usage of vasopressor and amphotericin was discovered to be a risk variable in every participant in the study. In this circumstance, the patient was not receiving loading dose. In each 12-hour period, 1M IU (2.67mg) colistin was administered. His entire period of hospital stay was 85MIU (22,695mg). Ghafur et al. and Feng et al. report that 52.5 percent of individuals who have taken both the loading and maintenance doses suffer nephrotoxicity; nevertheless, there is a paucity of data in this regard [10, 11].

Although the differences were not statistically significant, it was discovered that the patients without nephrotoxicity had an average standard dosage of the cumulative dose that was larger than that of the patients with nephrotoxicity. In order to prevent nephrotoxicity in this case, the patient was additionally given aspirin and meropenem prazosin. Compared to beta-lactams, which have a nephrotoxicity rate of 14%, colistin has a lower rate (36.2%). Vazin A, Spapen H et al., and Al-Abdulkarim et al. state that none of the patients had renal replacement therapy and a 14-day recovery occurred for an acute renal damage as well. In this case, the patient recovered from AKI within approximately 14 days. Complete recovery from renal toxicity can be achieved 21 days following initiation of therapy [12,13].

The Causality Assessment

The world health organization (WHO) and Naranjo's scales, which have been approved by the Uppasala Monitoring Center, are used to evaluate the high correlation between colistin and nephrotoxicity. Using the score of 8, this indicates the potential for improvement. The main benefit of this study was how simple it was to determine the risk-benefit ratio. Regular monitoring of renal function was necessary since colistin therapy was so important. A failed kidney can be deadly. There were no neurotoxic side effects during treatment. Consequently, there was no rechallenging.

4. Conclusion

This investigation has led us to the conclusion that therapy must end regardless of the prevalence of ADR. It is observed that a number of variables affect the development of Colistin-induced acute kidney injury (AKI). Age is one important element. Seniors who have high blood levels of creatinine and bilirubin are particularly vulnerable to acute kidney injury (AKI), which can range from a transient to permanent loss of kidney cells and nephrons. Only extreme caution should be used while administering colistin medication in such circumstances. The risk-benefit ratio should be determined before beginning colistin therapy. In cases where colistin therapy is highly recommended, it is advisable to closely monitor kidney functioning in order to prevent nephrotoxicity and promote recovery. It is necessary to retest the drug. Activities performed by clinical pharmacists are significant. Changes in dosage that have a major effect on severe ADRs.

Conflict of interest statement

Authors declare they do not have any conflict of interest.

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