

# A Comparison of Metoclopramide and Ondansetron Efficacy for the Prevention of Nausea and Vomiting In Patients Suffered From Renal Colic

Abolfazl Jokar<sup>1</sup>, Peyman Khademhosseini<sup>2</sup>, Koroosh Ahmadi<sup>2</sup>, Alireza Sistani<sup>1</sup>, Mohammad Amiri<sup>3</sup>, Arash Gorji Sinaki<sup>4\*</sup>

<sup>1</sup>Department of Emergency Medicine, Arak University of Medical Sciences, Arak, Iran; <sup>2</sup>Department of Emergency Medicine, Karaj University of Medical Sciences, Alborz, Iran; <sup>3</sup>Department of Emergency Medicine, Azad Tehran University of Medical Sciences, Azad, Tehran, Iran; <sup>4</sup>Department of Emergency Medicine, Bam University of Medical Sciences, Bam, Iran

## Abstract

**Citation:** Jokar A, Khademhosseini P, Ahmadi K, Sistani A, Amiri M, Sinaki AG. A Comparison of Metoclopramide and Ondansetron Efficacy for the Prevention of Nausea and Vomiting In Patients Suffered From Renal Colic. Open Access Maced J Med Sci. 2018 Oct 25; 6(10):1833-1838. https://doi.org/10.3889/oamjms.2018.302

**Keywords:** Metoclopramide; Ondansetron; Nausea and vomiting; Renal colic

**\*Correspondence:** Arash Gorji Sinaki, Department of Emergency Medicine, Bam University of Medical Sciences, Bam, Iran. Tel.: 00989125268868. E-mail: Gorjiarash5@gmail.com

**Received:** 13-Aug-2018; **Revised:** 26-Sep-2018; **Accepted:** 27-Sep-2018; **Online first:** 18-Oct-2018

**Copyright:** © 2018 Abolfazl Jokar, Peyman Khademhosseini, Koroosh Ahmadi, Alireza Sistani, Mohammad Amiri, Arash Gorji Sinaki. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

**Funding:** This research did not receive any financial support

**Competing Interests:** The authors have declared that no competing interests exist

**BACKGROUND:** Renal stones are the third common disease of the urinary system after infections and diseases of the prostate. One of the most common manifestations of this disease after acute pain is nausea and vomiting.

**AIM:** To compare the efficacy of metoclopramide and ondansetron in improving nausea and vomiting in patients referred to the emergency department with a chief complaint of nausea and vomiting.

**METHODS:** This randomised double-blind clinical trial was conducted on patients referred to the emergency department of Vali-e Asr Hospital. Mg5 intravenous morphine and ketorolac ampoule were injected to control renal colic. Then, patients were randomly divided into two groups. Group 1 consisted of 90 subjects receiving 10 mg intravenous metoclopramide and group 2 including 90 subjects receiving 4 mg intravenous ondansetron. Vital signs were also measured and recorded.

**RESULTS:** The mean and standard deviation of nausea in 0, 15, 30, 45, 60 and 120 minutes showed no significant difference between the two groups. Mean and standard deviation of vomiting at 0 minutes showed no significant difference between the two groups, but the remaining minutes, 15, 30, 45, 60 and 120, exhibited significant difference as a comparison of two groups, indicating that vomiting in the metoclopramide group was higher than ondansetron group.

**CONCLUSION:** Our findings indicated that ondansetron was more effective than metoclopramide in preventing and improving vomiting in patients referred to emergency renal colic, where can be used with more efficacy and more acceptable side effects to improve nausea and vomiting.

## Introduction

Nausea and vomiting are among the most common complaints of patients referred to the emergency department, and kidney stones are the third most commonly reported urinary tract infection after infections and prostate diseases [1]. One of the most common manifestations of this disease after acute pain is nausea and vomiting [2].

Currently, Treatments such as venous morphine and NSAIDs (Ketorolac) are currently used for the treatment of renal colic [3] [4] [5]. Although these drugs are widely used in the treatment of renal

colic, however, these drugs are applied to treat acute pain. There is little evidence for the treatment of nausea and vomiting in renal colic patients (in particular) referred to the emergency department. Treatment of nausea and vomiting in patients, in addition to facilitating the patient's well-being and better collaboration, prevents complications such as dehydration, hypokalemia, aspiration [6]. Treatment of nausea and vomiting in patients, in addition to facilitating the patient's well-being and better collaboration, prevents complications such as dehydration, hypokalemia, aspiration [7]. Although evidence is available on the use of antiemetic drugs in oncology, post-operative nausea and vomiting [8], and

other conditions associated with nausea and vomiting [9], however, little research has been done to apply these medications for the treatment of nausea and vomiting in patients referred to an emergency such as patients with renal colic [6]. Although metoclopramide is one of the most widely employed drugs for the improvement of nausea and vomiting in patients [6]; however, the occurrence of extrapyramidal side effects due to the use of this drug has always been a factor in the cautious use of the drug [10] [11].

Nevertheless, the increasing trend of the use of ondansetron in improving nausea and vomiting in emergency rooms is seen in comparison with metoclopramide [6] [10] [11]. Further evidence has focused on the Preventive or therapeutic roles of these drugs in patients undergoing chemotherapy and surgery [6] [7] [8], where there is little evidence for comparing these two drugs in the treatment of patients presenting to the emergency department [6]. It has recently been reported that the use of serotonin receptor antagonist (Granisetron) can be significantly more effective than metoclopramide in preventing nausea and vomiting in patients undergoing cataract surgery [12].

To prevent postoperative nausea and vomiting after laparoscopic cholecystectomy surgery, it has been shown that patients receiving ondansetron with dexamethasone before surgery had a lower prevalence of postoperative nausea and vomiting than the dexamethasone group alone [13]. The importance of improving nausea and vomiting in patients referred to an emergency such as patients with renal colic is well known. The prevention of complications from continuous nausea and vomiting and the lack of evidence for drug therapies in the emergency department, such as metoclopramide and serotonin receptor antagonists (ondansetron), suggest that comparative studies are required about these drugs.

Therefore, the present study was aimed to compare the efficacy of metoclopramide and ondansetron in the improvement of nausea and vomiting in patients referred to the emergency department.

## Material and Methods

A randomised, double-blind, clinical trial study was conducted among patients referring to the emergency ward of Vali-e-Asr Hospital in Arak, Iran with renal colic and nausea and vomiting. The occurrence of renal colic was determined based on the medical history of the subjects and the clinical manifestations of these patients (type and severity of pain and blood in the urine) (3 and 14). The sampling method was carried out using available samples based on inclusion and exclusion criteria.

The inclusion criteria were considered as follow: 1) patients with renal colic and complained of nausea and vomiting; 2) patients classified as ASA I and II; 3) patients 18 to 80 years; 4) obtaining informed consent from patients.

The exclusion criteria included: 1) hypotension (systolic blood pressure < 90) and unstable hemodynamics in general; 2) drug addiction; 3) uncontrolled underlying disease (Parkinson's disease, restless leg syndrome, epilepsy, gastrointestinal bleeding, Pheochromocytoma, etc.) [2]; 4) recent use of central nervous system depressants; 5) recent use of anti-nausea and vomiting drugs (at least the past 8 hours); 6) a previous known allergic reaction to metoclopramide or ondansetron.

Patients willing to participate in the study were evaluated regarding the inclusion and exclusion criteria, and basic information (age and sex) was then obtained. For all patients, 5 mg intravenous morphine was injected with distilled water to a final volume of 10 cc, and patients received Ketorolac ampules for controlling renal colic [4] [5]. Then, the patients were randomly divided into 2 groups: group 1 (90 subjects receiving 10 mg intravenous metoclopramide) and group 2 (90 subjects receiving 4 mg intravenous ondansetron). It should be noted that the patients of the two groups were matched regarding age and sex. Patients were evaluated for the response variables at the 0 and 30 minutes after drug injection, that were considered as follow: 1) the severity of nausea; 2) the number of vomiting; 3) vital signs (systolic, diastolic and patient temperature); 4) the need for additional drug therapy after 30 minutes to improve nausea and vomiting; 5) drug side effects. It is worth noting that the patients were matched in two groups according to their age, sex and severity of nausea (5-10 cm based on VAS).

The severity of nausea in the two groups was evaluated before the injection of drugs (0), and 30 minutes after taking the drugs by VAS (Visual Analogue Scale). This criterion consists of a 10 cm ruler extending longitudinally between zero and 10, in which the zero number indicates no pain, and the number 10 indicates an unbearable pain. Patients were asked to mark their pain in this ruler the patient's markup distance from point 0 indicates the patient's pain level [15].

The frequency of vomiting was also evaluated from patients 30 minutes before injection and up to 30 minutes after medication administration based on patient information and medical history. The vital signs of the patients were measured at 0 and 30 minutes. Drug complications were also documented by the presence of the following variables or other symptoms (based on the diagnosis of an emergency physician) after the injection of drugs based on the patient's history and doctor's visit.

Criteria for metoclopramide included

akathisia, dyskinesia, and other extrapyramidal side-effects, dizziness, restlessness, muscle spasm, sweating, etc. The ondansetron criteria were as follows: dizziness, abdominal pain, rash, diarrhoea, etc. It is noteworthy that the task of selecting patients and prescribing drugs for patients was to the emergency medicine specialist. The resident researcher is responsible for reviewing and recording the clinical response variables of patients. In this study, assistant specialist and patients are blind to the type of injectable treatment. For this reason, the drug content in the 10 cc syringes was first prepared by a nurse and administered by the assistant specialist who was blind to the type of treatment.

Because in the treatment of patients referred to the emergency department the first exposure to anaesthetics and vomiting drugs (such as metoclopramide or ondansetron) is used, the placebo group was not considered to be due to the deprivation of these patients. Regarding the treatment of patients referred to the emergency department in the first step with anti-nausea and vomiting drugs (such as metoclopramide or ondansetron), the placebo group was not considered in the study due to the deprivation of these patients from treatment.

Data analysis was performed using SPSS 21 software. To analyse the results, we used mean indexes, standard deviation, standard error, the percentage of frequency. Moreover, the covariance analysis test, Chi-square and Independent T-test or its nonparametric equation or its nonparametric equation were used to compare the mean.

## Results

In this double-blind clinical trial, 180 patients were enrolled, and 90 patients were randomly assigned to receive metoclopramide and 90 patients to the ondansetron group.

The mean and standard deviation in the metoclopramide group and ondansetron group determined to be  $34.56 \pm 8.98$  and  $33.2 \pm 8.5$ , respectively. There was no statistically significant difference between the two groups regarding age ( $P = 23.88$ ). Mean, and standard deviation of metoclopramide group was calculated as  $171.48 \pm 6.26$  while this level was determined to be  $172.77 \pm 5.32$  for ondansetron group, no statistically significant difference was found between the two groups regarding height ( $P = 307$ ). As shown in Table 1, the mean and standard deviation of pain score at 0, 30, and 60 minutes did not show a significant difference. This suggests that the severity of pain in the ondansetron group was less than the metoclopramide group at these moments.

**Table 1: Mean and standard deviation of pain score in control and case groups; T indicates the time**

	Group	Mean	Standard Deviation	P value
T 0	Metoclopramide	97.8	83.0	0.408
	Ondansetron	07.9	78.0	
T 30	Metoclopramide	97.4	46.1	0.001
	Ondansetron	13.4	90.0	
T 60	Metoclopramide	07.3	54.0	0.001
	Ondansetron	58.2	49.0	

The mean and standard deviation of systolic blood pressure in 0 minutes were determined in the metoclopramide and ondansetron groups as  $136.74 \pm 10.15$  and  $137.03 \pm 7.54$ , respectively, where there was no statistically significant difference between the two groups for systolic blood pressure ( $P = 0.829$ ).

The mean and standard deviation of systolic blood pressure of 30 minutes in metoclopramide and ondansetron groups were  $130.62 \pm 7.81$  and  $128.75 \pm 8.22$ , respectively. There was no significant difference between the two groups regarding systolic blood pressure at 30 min ( $P = 0.120$ ). The mean and standard deviation of systolic blood pressure during 60 minutes in the metoclopramide group were determined as  $124.91 \pm 9.05$ , while these values for the ondansetron group was calculated to be  $124.73 \pm 6.24$ . However, there was no significant difference between the two groups regarding systolic blood pressure ( $P = 0.088$ ).

On the other hand, the mean and standard deviation of diastolic blood pressure in 0 minutes was determined in metoclopramide and ondansetron groups as  $81.68 \pm 6.61$  and  $81.33 \pm 6.78$ , respectively, which demonstrated no significant difference between the two groups regarding diastolic blood pressure ( $p = 722$ ).

Furthermore, the mean and standard deviation of diastolic blood pressure were determined in the metoclopramide group during the 30 and 60 minutes as  $77.51 \pm 7.63$  and  $73.58 \pm 7.44$ , respectively, while these values in the ondansetron group were  $76.22 \pm 7.10$  and  $73.33 \pm 6.75$  were calculated. According to the P value, there was no significant difference between the two groups regarding diastolic blood pressure in the mentioned minutes ( $P = 0.243$ ;  $p = 0.810$ ).

**Table 2: Mean and heart rate deviation in case and control groups; T shows time**

	Group	Mean	Standard Deviation	P value
T 0	Metoclopramide	14.96	41.3	0.686
	Ondansetron	90.95	59.4	
T 30	Metoclopramide	64.82	19.4	0.001
	Ondansetron	33.79	51.3	
T 60	Metoclopramide	31.77	77.5	0.001
	Ondansetron	78.73	99.2	

The mean and standard deviation of heart rate at 0, 30, and 60 minutes after receiving metoclopramide and ondansetron by patients are summarised in Table 2. The results of this study revealed that there was a significant difference in

heart rate between the two groups receiving the drug 30 and 60 minutes after the intervention, indicating that the heart rate in the metoclopramide group was higher as compared to the ondansetron group ( $p = 0.001$ ;  $p = 0.001$ ).

Based on the results presented in Table 3, the mean and standard deviation of body temperature in 0, 30 and 60 minutes after intervention were calculated in metoclopramide and ondansetron groups. There was a statistically significant difference between the two groups regarding body temperature after 0 and 30 minutes ( $p = 0.001$ ;  $p = 0.002$ ). This finding suggests that body temperature was lower in the metoclopramide group when comparing with the ondansetron group in times above. Nevertheless, the mean and standard deviation of body temperature after 60 minutes in two groups did not exhibit significant difference ( $p = 1.000$ ).

**Table 3: Mean and deviation of morphine in both case and control groups**

	Group	Mean	Standard Deviation	P value
Morphine at 0 min	Metoclopramide	96.6	92.0	0.653
	Ondansetron	91.6	71.0	
Morphine at 30min	Metoclopramide	76.0	31.1	0.484
	Ondansetron	0/63	1/23	

The mean and standard deviation of the need for morphine at 0 and 30 minutes in both groups were shown in Table 4, where no significant difference was observed between the two groups at both times.

**Table 4: Mean and standard deviation of morphine in both case and control groups; T indicates the time**

	Group	Mean	Standard deviation	P value
Morphine T0	Metoclopramide	96.6	92.0	0.653
	Ondansetron	91.6	71.0	
Morphine T30	Metoclopramide	76.0	31.1	0.484
	Ondansetron	63.0	23.1	

As indicated in Table 5, the mean and standard deviation of nausea in 0, 15, 30, 45, 60 and 120 minutes after intervention in the two groups did not show a significant difference.

**Table 5: Mean and standard deviation of nausea rate in case and control groups; T indicates the time**

	Group	Mean	Standard deviation	P value
Vomiting at 0 min	Metoclopramide	02.3	62.0	1.000
	Ondansetron	03.3	73.0	
Vomiting at 15 min	Metoclopramide	51.1	50.0	0.001
	Ondansetron	35.1	52.0	
Vomiting at 30 min	Metoclopramide	65.0	47.0	0.001
	Ondansetron	36.0	48.0	
Vomiting at 45 min	Metoclopramide	38.0	49.0	0.001
	Ondansetron	04.0	20.0	
Vomiting at 60 min	Metoclopramide	12.0	32.0	0.001
	Ondansetron	08.0	36.0	
Vomiting at 120 min	Metoclopramide	07.0	26.0	0.001
	Ondansetron	02.0	31.0	

Furthermore, the results of the present study showed that the mean and standard deviation of vomiting in both groups were not statistically significant at 0 minutes, while after intervention, there

was a significant difference between the two groups, where vomiting in minutes after intervention (Time: 0, 16, 30, 45, 60, 120) was significantly higher in the metoclopramide group than the ondansetron group.

## Discussion

Renal colic is one of the most common urological emergencies that is very painful for the patient. The renal colic annually affects 1.2 million people, accounting for about 1% of hospital admissions [16]. The incidence of kidney stones for men and women is about 12% and 4% throughout life, respectively, which the disease is affected by age, family history, race, place of residence, occupation [17].

This double-blind clinical trial was conducted to compare the efficacy of Metoclopramide and ondansetron in the treatment of nausea and vomiting in patients with renal colic. The results of our study showed that there was no statistically significant difference between the two groups regarding age, height and weight, where the two groups were matched. There was no statistically significant difference between the mean score of pain in 0 minutes in the intervention and control groups. However, there was a significant difference between the two groups regarding mean pain score in the 30th and 60th minutes, which indicates the severity of pain in the ondansetron group was less than the metoclopramide group.

Moreover, there was no significant difference between systolic and diastolic blood pressure in the two groups at 0, 30 and 60 minutes. Furthermore, no significant difference was found between the two groups in terms of heart rate at 0 minutes; however the mean difference was statistically significant between the two groups in terms of heart rate at 30 and 60 minutes, indicating that the heart rate was lower in the metoclopramide group at 30 and 60 minutes as compared to the ondansetron group.

Based on the data presented here, the mean and standard deviation of body temperature at 0 and 30 minutes exhibited a significant difference between the two groups, indicating that the body temperature in the metoclopramide group was lower than the ondansetron group. The mean and standard deviation of initial morphine and morphine levels of 30th minutes did not reveal any significant difference between the two groups. Also, the mean and standard deviation of nausea in minutes 0, 15, 30, 45, 60 and 120 were not significantly different between the two groups. Mean, and standard deviation of vomiting was not significantly different between the two groups at 0 minutes, while the remaining minutes, 15, 30, 45, 60 and 120, demonstrated a significant difference

between the two groups, indicating that the vomiting rate in the metoclopramide group was higher when comparing with ondansetron group.

As other previous study indicated the decreased rate of nausea severity for nausea and vomiting were determined to be similar for 20 mg intravenous metoclopramide, and 4 mg intravenous ondansetron, as well as placebo. However, this was not significant, and the changes were not significant in the two drug groups compared to the placebo group [6], while, the rate of nausea was similar in both groups in our study, but the vomiting rate in the ondansetron group was lower than the metoclopramide group [6].

Zahedi study has shown that both metoclopramide and ondansetron have been significantly and prominently effective in preventing nausea and vomiting in these patients during spinal anaesthesia for cesarean section, and their effect on reducing nausea and vomiting is significantly greater compared with placebo group. While our findings revealed that the effect of ondansetron on nausea and vomiting was more than metoclopramide, which our results were not consistent with the findings of the study above [18]. It has been reported that droperidol was more effective than metoclopramide or prochlorperazine in patients with moderate to severe nausea, but extrapyramidal symptoms could be increased, where metoclopramide and prochlorperazine have had a proportional effect on the improvement of nausea and vomiting of patients referred to the emergency department, as well as we're not seen to be more effective compared to the saline placebo [19]. Our study on nausea recovery was consistent with the study above. Contrary, the results of vomiting improvement were not similar to the present study.

Another study showed that ondansetron and metoclopramide, plus dexamethasone, did not show a significant effect on postoperative nausea and vomiting after laparoscopic cholecystectomy surgery and was not consistent with our results [20].

The findings of our study revealed that ondansetron was more effective than metoclopramide in preventing and improving vomiting in patients referred to emergency suffering from renal colic. Therefore, ondansetron can be used with more efficacy and more acceptable side effects to improve nausea and vomiting.

## Reference

- Mee MJ, Egerton-Warburton D, Meek R. Treatment and assessment of emergency department nausea and vomiting in Australasia: a survey of anti-emetic management. *Emerg Med Australas*. 2011; 23:162-168. <https://doi.org/10.1111/j.1742-6723.2011.01386.x> PMID:21489163
- Ahmed HU, Khan AA, Bafaloukas N, Shergill IS, Buchholz NP. Diagnosis and management of renal (ureteric) colic. *Br J Hosp Med (Lond)*. 2006; 67(9):465-9. <https://doi.org/10.12968/hmed.2006.67.9.21998> PMID:17017608
- Serinken M, Eken C, Turkcuier I, Elicabuk H, Uyanik E, Schultz CH. Intravenous paracetamol versus morphine for renal colic in the emergency department: a randomised double-blind controlled trial. *Emerg Med J*. 2012; 29(11):902-5. <https://doi.org/10.1136/emmermed-2011-200165> PMID:22186009
- Jalili M, Fathi M, Moradi-Lakeh M, Zehtabchi S. Sublingual buprenorphine in acute pain management: a double-blind, randomised clinical trial. *Annals of emergency medicine*. 2012; 59(4):276-80. <https://doi.org/10.1016/j.annemergmed.2011.10.021> PMID:22115823
- Song SW, Kim K, Rhee JE, Lee JH, Seo GJ, Park HM. Butylscopolammonium bromide does not provide additional analgesia when combined with morphine and ketorolac for acute renal colic. *Emerg Med Australas*. 2012; 24(2):144-50. <https://doi.org/10.1111/j.1742-6723.2011.01502.x> PMID:22487663
- Egerton-Warburton D1, Meek R2, Mee MJ3, Braitberg G1. Antiemetic use for nausea and vomiting in adult emergency department patients: a randomised controlled trial comparing ondansetron, metoclopramide, and placebo. *Ann Emerg Med*. 2014; 64(5):526-532. <https://doi.org/10.1016/j.annemergmed.2014.03.017> PMID:24818542
- Carlisle J, Stevenson CA. Drugs for preventing postoperative nausea and vomiting. *Cochrane Database Syst Rev*. 2006; (3): CD004125. <https://doi.org/10.1002/14651858.CD004125.pub2>
- Billio A, Morello E, Clarke MJ. Serotonin receptor antagonists for highly emetogenic chemotherapy in adults. *Cochrane Database Syst Rev*. 2010; (1):CD006272. <https://doi.org/10.1002/14651858.CD006272.pub2>
- Hendey GW, Donner NF, Fuller K. Clinically significant changes in nausea as measured on a visual analogue scale. *Ann Emerg Med*. 2005; 45:77-81. <https://doi.org/10.1016/j.annemergmed.2004.07.446> PMID:15635314
- Lussos SA1, Bader AM, Thornhill ML, Datta S. The antiemetic efficacy and safety of prophylactic metoclopramide for elective cesarean delivery during spinal anaesthesia. *Reg Anesth*. 1992; 17(3):126-30. PMID:1606094
- Kestin IG1. Spinal anaesthesia in obstetrics. *Br J Anaesth*. 1991; 66(5):596-607. <https://doi.org/10.1093/bja/66.5.596>
- Nesioonpour SH, Pipelzadeh MH, Mohtadi AR, Rezai S, Fegghi M, Malekshoar M. A Comparative Study of Dexamethasone, Granisetron and Metoclopramide for Prevention of Nausea and Vomiting after Cataract Surgery. *Bina J Ophthalmol*. 2009; 14(4):413-19.
- Gautam B, Shrestha BR, Lama P, Rai S. Antiemetic prophylaxis against postoperative nausea and vomiting with the ondansetron-dexamethasone combination compared to ondansetron or dexamethasone alone for patients undergoing laparoscopic cholecystectomy. *Kathmandu Univ Med J (KUMJ)*. 2008; 6(23):319-28.
- Shokeir AA1. Renal colic: pathophysiology, diagnosis and treatment. *Eur Urol*. 2001; 39(3):241-9. <https://doi.org/10.1159/000052446> PMID:11275712
- Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual analog scale for pain (vas pain), numeric rating scale for pain (not pain), mcgill pain questionnaire (mpq), short-form mcgill pain questionnaire (sf-mpq), chronic pain grade scale (cpgs), short form-36 bodily pain scale (sf-36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). *Arthritis care & research*. 2011; 63(S11):S240-52. <https://doi.org/10.1002/acr.20543> PMID:22588748
- Grasso AA, Cozzi G. Etiology, diagnosis and treatment of renal colic during pregnancy. *Urologia*. 2014; 81(1):12-5. <https://doi.org/10.5301/urologia.5000048> PMID:24557816

17. Gul Z, Monga M. Medical and dietary therapy for kidney stone prevention. *Korean J Urol*. 2014; 55(12):775-9.  
<https://doi.org/10.4111/kju.2014.55.12.775> PMID:25512810  
PMCID:PMC4265710

18. Zahedi H, Rouzbeh Kargar L. Comparing the prophylaxis effect of Ondansetron and Metoclopramide against intraoperative nausea and vomiting during spinal anesthesia for cesarean section. *JBUMS*. 2004; 6(3):32-36.

19. Braude D, Soliz T, Crandall C, et al. Antiemetics in the ED: a

randomized controlled trial comparing 3 common agents. *Am J Emerg Med*. 2006; 24:177-182.

<https://doi.org/10.1016/j.ajem.2005.08.017> PMID:16490647

20. Mortazavi Y. Effect of metoclopramide and ondansetron plus dexamethason on postoperative nausea and vomiting in cholecystectomy laparoscopic surgery. *Journal of Gorgan University of Medical Sciences*. 2014; 16(1):9-13.