

# Effect of Outpatient Bowel Preparation On Preoperative Electrolytes

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## Abstract

**Study Objective:** With the shift to outpatient and same-day admit surgery, preoperative bowel preparation is now also performed on an outpatient basis. This practise has the potential to cause electrolyte disturbances and for this reason, patients have their electrolytes re-measured on the day of surgery in order to detect and rectify any abnormalities. Though the ability to do this on an outpatient basis has been studied, to our knowledge the effect on preoperative bloodwork has not been documented and was our goal.

**Design:** A retrospective observational analysis of charts of patients 18 years of age and older, who underwent outpatient bowel preparation for an elective bowel resection in 2006.

**Setting:** The Perioperative services of two sites of a tertiary care institution.

**Patients:** Medical records identified 119 patients who met the specified inclusion criteria.

**Interventions:** Patients that had both preadmission (PAC) and day of surgery (DOS) bloodwork obtained (standard practise) were reviewed and regression analysis performed.

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**Measurements:** Serum chemistry (sodium, potassium, chloride, bicarbonate, creatinine, blood urea nitrogen and haemoglobin) were noted in the PAC and on DOS as well as their demographic data including comorbidities.

**Main Results:** There was a statistically significant decrease in chloride, bicarbonate, potassium (K<sup>+</sup>) and blood urea nitrogen (BUN) and an increase of creatinine (Cr). There were 9 patients whose K<sup>+</sup> was < 3.0 on DOS that had been > 3.0 in PAC and 13 patients whose creatinine was >100 on DOS that had been <100 in PAC. No correlation between demographic factors (including age, gender, type of bowel preparation or comorbidity) and day of surgery hypokalemia or elevated creatinine were noted.

**Conclusions:** We documented statistically significant but clinically insignificant changes in potassium, chloride, bicarbonate, BUN and creatinine. There were no predictive factors for either hypokalemia or elevated creatinine. No changes in patient management occurred. There appears to be no value in repeating serum chemistries after bowel preparation performed at home.

## Introduction

Prior to undergoing an elective bowel resection, patients receive a bowel preparation to clean out the normal intestinal bacteria flora. This bowel preparation is performed to minimize potential surgical infectious complications. In the past, this practise was performed on an inpatient basis with concomitant intravenous rehydration. With the shift to outpatient surgery, this bowel preparation must now also be performed on an outpatient basis. The feasibility and general safety of this has been studied though the effect on serum biochemistry was not documented [1–4]. Concurrent with this change in practise was a change from obtaining routine bloodwork in all patients to only testing those patients likely to have expected abnormalities [5–7]. These bowel preparations have the potential to cause electrolyte abnormalities especially in elderly patients [8–11]. For this reason, patients have their electrolytes re-measured on the day of surgery in order to detect and rectify any abnormalities. It was our impression that rarely however, are any abnormalities detected and to our knowledge the effects on serum biochemistry of outpatient preoperative bowel preparations has not been studied. The goal of this study was therefore to determine if repeat day of surgery (DOS) blood work was necessary. If changes are minimal or non-existent, patients are needlessly receiving phlebotomies and the medical system is wasting money on unnecessary laboratory testing.

## Materials and Methods

Following research ethics board (REB) approval we performed a retrospective, observational analysis of the charts of patients who underwent outpatient bowel preparation for an elective bowel resection in 2006 at two sites of a tertiary care institution. Written informed consent was not deemed necessary by the REB. Patients were included if they were 18 years of age and older and had both preadmission (PAC) and day of surgery (DOS) blood work obtained (which is standard practise at our institution). Patients not having DOS bloodwork, those having emergency surgery or those who were inpatients prior to the procedure were excluded. Demographic data, coexisting medications and diseases, the type, timing and amount of bowel preparation as well as preadmission clinic and then day of surgery bloodwork were recorded.

Statistical analysis included paired t-tests to compare PAC and DOS lab results and chi-squared analysis for demographic data. Multiple logistic regression was used to determine if there were any predictive factors (age, type of bowel preparation, gender, coexisting disease, use of diuretic) for patients who developed hypokalemia, defined as a potassium (K<sup>+</sup>) < 3.0 or elevated creatinine (Cr), defined as > 100 after having normal PAC bloodwork. A p value < 0.05 was considered significant.

## Results

Our hospital medical records department identified 119 patients who met the specified inclusion criteria. The demographic data of these patients are shown in Table 1. Table 2 compares the preadmission clinic and day of surgery bloodwork data. There was a statistically significant decrease in bicarbonate, potassium and BUN and an increase of chloride and creatinine as shown.

**Table 1** Demographic Data – All Patients. Values are n (%) except age – mean ± SD.

Age	65.0 ± 14.6
Gender (M/F)	52/67
<b>Procedure</b>	
Colectomy	81 (68)
Colectomy + Other general surgery	23 (19)
Colectomy + Other gynaecologic/ genitourinary	15 (13)
<b>Bowel Preparation</b>	
Sodium picosulfate po	43 (36)
Sodium phosphate po	67 (56)
Clear fluids only	5 (4.2)
Polyethylene glycol po	4 (3.4)
<b>Comorbidities</b>	
Bowel cancer	76 (64)
Gynecologic cancer	6 (5)
Inflammatory bowel disease	50 (42)
Cardiovascular	59 (50)
Metabolic	29 (24)
Respiratory	20 (17)
Renal	4 (3.4)
Cerebrovascular	10 (8.4)

**Table 2** Comparison of Preadmission Clinic (PAC) & Day of Surgery (DOS) blood work. Values are mean ± SD.

	PAC	Day OR	P Value
Na+	138.6 ± 2.0	138.9 ± 2.5	0.38
Cl-	101.6 ± 3.4	102.8 ± 3.9	< .001
HCO <sub>3</sub> <sup>-</sup>	28.2 ± 2.0	26.6 ± 2.7	< .001
K+	4.0 ± 0.4	3.9 ± 0.5	< .001
BUN	4.8 ± 1.9	1.2 ± 1.2	< .001
Cr	84.9 ± 20.5	91.3 ± 24.7	< .001
Hgb	127 ± 23	120 ± 21	0.67

**Table 3** Demographic Data – Patients DOS K < 3.0 (n=9). Values are n (%) except age – mean ± SD.

Age	77.1 ± 7.0
Gender (M/F)	1/8
<b>Procedure</b>	
Colectomy	5 (56)
Colectomy + Other general surgery	1 (11)
Colectomy + Other gynaecologic/ genitourinary	3 (33)
<b>Bowel Preparation</b>	
Sodium picosulfate po	2 (22)
Sodium phosphate po	6 (66)
Clear fluids only	1 (11)
Polyethylene glycol po	0
<b>Comorbidities</b>	
Bowel cancer	6 (66)
Gynecologic cancer	1 (11)
Inflammatory bowel disease	2 (22)
Cardiovascular	8 (89)
Metabolic	3 (33)
Respiratory	4 (44)
Renal	0
Cerebrovascular	0

**Table 3** Demographic data – Patients DOS CR > 100 (n=13). Values are n (%) except age – mean ± SD.

Age	62.5 ± 18.0
Gender (M/F)	6/7
<b>Procedure</b>	
Colectomy	7 (54)
Colectomy + Other general surgery	3 (23)
Colectomy + Other gynaecologic/ genitourinary	3 (23)
<b>Bowel Preparation</b>	
Sodium picosulfate po	4 (31)
Sodium phosphate po	8 (62)
Clear fluids only	1 (7.7)
Polyethylene glycol po	0
<b>Comorbidities</b>	
Bowel cancer	5 (38)
Gynecologic cancer	1 (7.7)
Inflammatory bowel disease	10 (77)
Cardiovascular	6 (46)
Metabolic	6 (46)
Respiratory	1 (7.7)
Renal	1 (7.7)
Cerebrovascular	1 (7.7)

There were 9 patients whose K<sup>+</sup> was < 3.0 on DOS that had been > 3.0 in PAC and 13 patients whose creatinine was > 100 on DOS that had been < 100. Their demographic data is shown in Tables 3 and 4. No correlation between demographic factors (including age, gender, type of bowel preparation or comorbidity) and day of surgery hypokalemia defined as K < 3.0 or elevated creatinine defined as Cr > 100 were noted. The lowest preoperative K<sup>+</sup> was 2.3 in a patient whose PAC K<sup>+</sup> was 5.1. This patient was 74 years old, with coexisting cardiac and respiratory disease but was not taking a diuretic. The surgery proceeded as planned and the first postoperative K<sup>+</sup> was 4.4, later on the day of surgery. The highest preoperative Cr was 176 in a patient whose PAC Cr was 84. This patient was 60 years old with coexisting cardiac, metabolic and cerebrovascular disease and was also not taking a diuretic. A review of the charts indicated that there appeared to be no change in management of either of these cases.

## Discussion

We documented statistically significant changes in potassium, chloride, bicarbonate, BUN and creatinine in patients having outpatient bowel preparation for bowel resection either alone or in conjunction with urologic or gynecologic surgery. These changes were however clinically insignificant. More significant electrolyte changes were found in a previous study by Holte [8]. However that study involved elderly inpatients, a group who by definition have more medical comorbidities than the elective surgical patients being admitted from home in our study.

Nine patients developed hypokalemia defined as a K<sup>+</sup> < 3.0 and 13 patients developed creatinine > 100 the latter of which suggests dehydration or pre-renal syndrome. There was however no evidence that any change in clinical management had occurred, which also questions the need to repeat bloodwork in these patients. In an attempt to determine if a subset of patients existed that would warrant repeat testing, we performed multiple logistic regressions. However there were no predictive factors for hypokalemia and elevated creatinine. Specifically, age and coexisting disease were not correlated with these changes and the biggest rise in creatinine occurred in a 60 year old who was not on a diuretic as was the patient with the lowest K<sup>+</sup>.

Our institution initiated the repeat DOS blood sampling based on the suggestion of the ASA practise parameter that notes one should consider biochemical testing in patients undergoing perioperative therapies which we felt would include bowel preparation [5]. This testing would also fall under the British NICE guideline of group 4 surgeries which recommends a similar assessment [6]. These guidelines were however created with the acknowledgment that they are not evidence based.

Bowel preparations at our institution were not standardized and consisted of various combinations and doses of sodium picosulphate, sodium phosphate or polyethylene glycol enemas, or simply clear fluids for 24–48 hours. The majority of our patients however received either oral sodium picosulphate or sodium phosphate preparations. A recent study showed that both of these regimens to produce electrolyte abnormalities in a similar patient population when measured intra or postoperatively though no preoperative

bloodwork was performed [8]. However, by this time in the procedure the patients had likely sustained further fluid losses and rehydration efforts making the results non-comparable to ours. Studies have noted clinically significant abnormalities after more aggressive bowel cleaning regimens in volunteers [9], or in hospitalized inpatients [10], or in case reports of similar patients with comorbidities [12]. In these studies and case reports the patients or the bowel preparations were clearly different than the elective outpatients we studied.

Our study's major weakness is its retrospective design. As such, patient's who had significant electrolyte abnormalities could have had their surgery postponed until corrected and would not have been included in our analysis. One could also question the validity of the lack of standardization of both the bowel preparation and the fluid intake of patients. The corollary is that our study's results reflect the conditions present in hospitals with more than one surgeon whose bowel preparation practises are not standardized.

In conclusion our findings question the need for repeating phlebotomy for electrolyte analysis on the day of surgery for patients having an outpatient bowel preparation. Although statistically significant abnormalities were noted they are clearly clinically insignificant and did not lead to changes in patient management.

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