

Bowel Cleansing Protocol in Colonoscopy: Does It Affect Blood Thiamine Level?

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ABSTRACT

Background: The burden of vitamin B1 or thiamine deficiency in patients undergoing digestive surgery is quite enormous. In the field of gastroenterology, pre-colonoscopy preparation might affect thiamine level. However the burden is not well defined. This study was conducted to confirm whether there is significant decrease of blood thiamine level in post-colonoscopy compared to pre-colonoscopy group.

Method: This cross-sectional study was carried out at gastrointestinal endoscopy center of Cipto Mangunkusumo National General Hospital, Jakarta from October 2018 to January 2019. The inclusion criteria were patients equal or more than 18-year-old who underwent colonoscopy. The exclusion criteria were malnutrition, history of post-gastrointestinal resection, definitive diagnosis of cancer, and chronic alcoholism.

Results: The median value of blood thiamine level is 58 (20-78) for pre-colonoscopy group and 58 (25-79) for post colonoscopy group ($p=0.31$).

Conclusion: There was no significant decrease of blood vitamin B1 level in post-colonoscopy compared to pre-colonoscopy group.

Keywords: blood thiamine, colonoscopy, bowel preparation

ABSTRAK

Latar belakang: Kondisi defisiensi vitamin B1 atau tiamin darah pada pasien yang menjalani operasi saluran cerna merupakan masalah yang sangat signifikan. Di bidang gastroenterologi, persiapan prakolonoskopi kemungkinan dapat memengaruhi kadar tiamin darah, namun isu tersebut belum sepenuhnya terbukti. Penelitian ini dilakukan untuk mengonfirmasi apakah terdapat penurunan kadar tiamin darah yang signifikan pascakolonoskopi jika dibandingkan dengan prakolonoskopi.

Metode: Studi potong lintang ini dilakukan di pusat endoskopi saluran cerna (PESC) RSUPN dr. Cipto Mangunkusumo Jakarta dari bulan Oktober 2018 sampai dengan Januari 2019. Kriteria inklusi pada penelitian ini adalah pasien dengan usia lebih atau sama dengan 18 tahun yang menjalani kolonoskopi. Kriteria eksklusi yaitu malnutrisi, riwayat pascareseksi gastrointestinal, subjek terdiagnosis kanker, dan alkoholisme kronik.

Hasil: Nilai median kadar tiamin darah adalah 58 (20-78) pada kelompok prakolonoskopi dan 58 (25-79) pada kelompok pascakolonoskopi ($p = 0,31$).

Simpulan: Tidak didapatkan penurunan kadar tiamin darah yang signifikan pada kelompok pascakolonoskopi dibandingkan dengan kelompok prakolonoskopi.

Kata kunci: tiamin darah, kolonoskopi, persiapan bersihan usus

INTRODUCTION

Vitamin B1 or thiamine is a water-soluble vitamin which cannot be synthesized by human body and therefore its supply should be filled with food intake. It is well known as co-enzyme for energy metabolism and neurological function.¹⁻³ Thiamine deficiency is prevalent in high risk conditions such as alcoholism, malnutrition, post-gastric bypass surgery, chronic diarrhea, and inflammatory bowel disease (IBD).^{1,4} The clinical manifestations are fatigue, lactate acidosis, beri-beri, peripheral neuropathy, Wernicke encephalopathy, and Wernicke-Korsakoff syndrome.⁵⁻⁸

In daily digestive surgeon practice, thiamine deficiency are often found in pre-operative evaluation. Fukushima, et al⁹ showed that 14 (61%) from 23 patients were thiamine-deficient. Post-operatively, the thiamine levels decreased and did not reach normal value although the oral intake had been given.⁹ Thiamine deficiency is a huge problem in the field of digestive surgery as previously described. But there is no data available yet for thiamine deficiency in gastroenterology patients. Nunes, et al.¹⁰ described nutritional deficiency in general (without thiamine data) in patients undergoing colonoscopy. They showed energy and protein deficiency in 59% subjects undergoing colonoscopy using polyethylene glycol as bowel preparation regiment.

The nutritional deficiency may occur due to the low residue diet 2-3 days before the colonoscopy, the consumption of bowel preparation regiment, and pre-procedural fasting. The pre-colonoscopy preparation might have implication on specific vitamin loss such as thiamine. Loss of thiamin may cause deleterious effects such as fatigue and heart failure. A pilot study is needed to confirm the forementioned hypothesis.

METHOD

This cross-sectional study was carried out at gastrointestinal endoscopy center of Cipto Mangunkusumo National General Hospital, Jakarta from October 2018 to January 2019. The inclusion criteria were patients equal or more than 18 years old who will undergo colonoscopy. Patients were excluded if they had malnutrition (subjective global assessment B or C), history of post-gastrointestinal resection, definitive diagnosis of cancer, and chronic alcoholism. Calculation of sample size was performed using paired 2 times measurement with $\alpha = 0.05$ and $\beta = 0.2$ and the minimal required sample size was 25 subjects. Patients were selected consecutively.

Before colonoscopy, patients were assessed for demographic characteristics, clinical characteristics and blood thiamine level. In this study, Agilent 6460 Triple Quad LCMS System with 1290 Binary Pump was utilized as the blood thiamine level examination tool. The fatigue (in clinical characteristic group) was assessed using fatigue assessment scale (FAS). After colonoscopy, blood thiamine was checked. The collected data were analyzed using IBM SPSS version 22.0. Data normality was assessed by Shapiro-Wilk test. Wilcoxon test was performed to assess the comparison of vitamin B1 levels in pre and post-colonoscopy group. For additional analysis, association between blood thiamine level and FAS score were analyzed using Mann-Whitney U test.

RESULTS

There were 25 subjects in this study (7 male subjects and 18 female subjects). The mean age of the subjects is 47.76 ± 14.30 years. (Table 1)

Table 1. Demographic characteristics of the subjects

Characteristic	n (%)
Sex	
Male	7 (28)
Female	18 (72)
Age (years \pm SD)	47.76 ± 14.30
Occupation	
Unemployed	3 (12)
House wife	12 (48)
Private employees	4 (16)
Medical workers	2 (8)
Retirement	3 (12)
Government employees	1 (4)
Education	
Elementary school	1 (4)
Junior high school	1 (4)
Senior high school	14 (56)
Diploma	2 (8)
Bachelor	5 (20)
Master	2 (8)

Four subjects had no symptoms. Twenty-one subjects had symptoms with 11 subjects complained one symptom, 5 subjects complained two symptoms, 4 subjects complained three symptoms and 1 subject complained four symptoms as described in Table 2.

Two subjects who underwent colonoscopy had normal results and were diagnosed as having functional constipation. The details of diagnosis are described in Table 3.

Description of blood thiamine level in pre-colonoscopy and post-colonoscopy group is described in Table 4. After colonoscopy, there were 13 subjects with increasing blood thiamine level, 10 subjects with decreasing blood thiamine level, and 2 subjects with persistent blood thiamine level. The diagnosis from subjects with decreasing blood thiamine level were

external hemorrhoid in 1 subject, ulcerative colitis in 5 subjects, Crohn's disease in 3 subjects, and tuberculosis ileitis in 1 subject.

Table 2. Clinical symptoms of the subjects

Complaints	n (%)
No symptom	4 (16)
1 symptom	
Chronic diarrhea	1 (4)
Hematochezia	2 (8)
Abdominal pain	5 (20)
Constipation	3 (12)
2 symptoms	
Chronic diarrhea and hematochezia	1 (4)
Chronic diarrhea and nausea	1 (4)
Hematochezia and abdominal pain	2 (8)
Hematochezia and weight loss	1 (4)
3 symptoms	
Chronic diarrhea, hematochezia and weight loss	1 (4)
Chronic diarrhea, hematochezia and abdominal pain	1 (4)
Chronic diarrhea, weight loss and abdominal pain	2 (8)
≥ 4 symptoms	
Chronic diarrhea, weight loss, abdominal pain and fever	1 (4)

Table 3. Diagnosis of the subjects

Diagnosis	n (%)
Functional constipation	2 (8)
External hemorrhoid	1 (4)
Ulcerative colitis	12 (48)
Crohn's disease	5 (20)
Tuberculosis ileitis	1 (4)
Colonic pedunculated polyp	1 (4)
Non-specific infectious colitis	2 (8)
Grade II internal hemorrhoid	1 (4)

Table 4. Description of blood thiamine level in pre-colonoscopy and post-colonoscopy group

	Pre-colonoscopy group	Post-colonoscopy group
Blood thiamine levels, n (%)		
≤ 29.5 µg/L	3 (12)	1 (4)
29.6 – 76.2 µg/L	20 (80)	23 (92)
≥ 76.3 µg/L	2 (8)	1 (4)

The median value of blood thiamine level was 58 in both groups ($p = 0.31$). The comparison of blood thiamine median levels in both groups are described in Table 5.

Table 5. Comparison of blood thiamine median level between pre-colonoscopy and post-colonoscopy group

	Median (minimum-maximum)	p
Blood thiamine level in pre-colonoscopy group (n=25)	58 (20-78)	0.31
Blood thiamine level in post-colonoscopy group (n=25)	58 (25-79)	

Wilcoxon test, 13 subjects had increasing blood thiamine level, 10 subjects had decreasing blood thiamine level, and 2 subjects had persistent blood thiamine level

We did additional analysis to find association between blood thiamine level and fatigue (FAS score). Subjects were divided into 2 group, group 1 consists of subjects who were not fatigue (FAS 10-21) and group

2 consists of subjects who were substantially fatigue (FAS 22-50). The mean rank in group 1 and group 2 were 13.88 and 12.59, respectively ($p = 0.68$) as seen in Table 6.

Table 6. Comparison of pre-colonoscopy blood thiamine level in non-fatigue and fatigue subjects group

	Median (minimum-maximum)	p value
Subjects without fatigue (n = 8)	60 (26-78)	0.68
Subjects with fatigue (n = 17)	58 (20-77)	

Mann-Whitney test. Mean rank of subjects without fatigue 13.88; subjects with fatigue 12.59

DISCUSSION

In this study most of the subjects were female (72%) with mean age of 47.76 years old. The majority of the patients who underwent colonoscopy from study by Basch, et al¹¹ showed similar demographic characteristics. Most of the subjects were female (80.6%) with mean age 59.8 years. Study by Jain, et al¹² also showed similar characteristics in outpatients who underwent colonoscopy which mostly were female (62.4%) with mean age 57.9 years. Since the most subjects were women, most subjects' occupation in our study were housewives (48%). Most subjects (56%) had senior high school education. Abdominal pain (44%), chronic diarrhea (32%) and hematochezia (32%) were the most frequent symptoms in this study. Study in South Korea by Kwak et al¹³ also showed same result that abdominal pain (41.6%) and bowel habit changes (28.9%) were the most frequent symptoms for the indications of colonoscopy. Another study by Frandy, et al¹⁴ in West Borneo showed that hematochezia (38%) and chronic diarrhea (19%) are the most frequent indications of colonoscopy.

Our study showed that there was no significant decrease of post-colonoscopy blood thiamine level compared to pre-colonoscopy group. There were some subjects who had increased blood thiamine level. There was an inconsistent thiamine level change in post-colonoscopy compared to the pre-colonoscopy group. From 10 subjects who had decreased level of thiamine, 5 of them had chronic diarrhea. Chronic diarrhea may interfere with thiamine absorption and causes loss of thiamine.¹⁵ As far as the authors acknowledge, there is no study of blood thiamine level in patients underwent colonoscopy to be compared to our study.

Most of the subjects with decreased blood thiamine level in our study were diagnosed as having inflammatory bowel disease. There could be a possible correlation between blood thiamine level and IBD as

reported by Yoon SM¹⁶ in South Korea. The reported case was a patient with Crohn's disease who developed Wernicke encephalopathy after prolonged total parenteral nutrition. The thiamine deficiencies in such case may be caused by Crohn's disease, prolonged total parenteral nutrition. Active inflammation in Crohn's disease caused intracellular thiamine deficiency due to dysfunction of the thiamine active transport.¹⁶ In total parenteral nutrition, the intravenous glucose solution would increase carbohydrate metabolism that requires increasing amount of thiamine and eventually lead to thiamine deficiency.^{16,17}

Fatigue is a symptom indicating thiamine deficiency. In this study, only 3 subjects had thiamine deficiency and two of them were substantially fatigue (FAS 22-50). Our analysis showed there was no statistically significant difference of pre-colonoscopy blood thiamine level between non-fatigue subjects compared to fatigue subjects. Clinically, the median value of pre-colonoscopy blood thiamine level of fatigue subjects was lower compared to the non-fatigue subjects.

The fatigue in our subjects who had normal blood thiamine level may be explained by intracellular thiamine deficiency. In intracellular thiamine deficiency, there would be normal concentration of blood thiamine but there was dysfunction of thiamine active transport mechanism. The thiamine cannot be used intracellular and lead to symptoms of thiamine deficiency.¹⁸

There is limitation from our study. The samples were small. In the future, we suggest to conduct study to evaluate relationship between fatigue and blood thiamine level in specific population such as IBD patients.

CONCLUSION

There was no significant decrease of post-colonoscopy blood thiamine level compared to pre-colonoscopy group. Clinically the median value of pre-colonoscopy blood thiamine level in fatigue subjects was lower compared to non-fatigue subjects although it was statistically insignificant.

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