



Clinical features of campylobacter-associated benign convulsions with mild gastroenteritis compared with rotavirus convulsions

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ABSTRACT

Purpose: The aim of the present study was to compare the clinical features of campylobacter-associated benign convulsions with mild gastroenteritis (BCWG) with rotavirus-associated BCWG in China.

Methods: The medical records of BCWG patients admitted to Children's Hospital of Jiangxi Province in China between January 2015 and January 2017 were reviewed in this retrospective study.

Results: Ultimately, 318 patients were diagnosed with BCWG. Two hundred and two cases were tested for Campylobacter jejuni antigen, and seven (3.47%) were positive. A total of 248 cases were tested for rotavirus antigen, and 44 (17.74%) were positive. Campylobacter-associated BCWG occurred in summer and autumn. In contrast, rotavirus-associated BCWG mainly occurred in winter. In the campylobacter-associated BCWG group, five patients (71.43%) had two or more seizures. In one patient (14.29%), the seizure occurred on the first day of gastroenteritis; three patients (42.86%) had seizures on the second day, and three (42.86%) had seizures on the third day or later. Thirteen seizures were observed in the campylobacter-associated BCWG group; of these, 11 (84.62%) lasted less than 5 min, and 11 (84.62%) were generalized seizures. Phenobarbital (5 mg/kg/time) was effective in all 6 cases (100%) in which it was used. Other than the different seasonal distributions, the clinical features of campylobacter-associated BCWG and rotavirus-associated BCWG may be similar.

Conclusions: Campylobacter is one of the pathogens responsible for BCWG, especially in summer and autumn. Other than the different seasonal distributions, the clinical features of campylobacter-associated BCWG and rotavirus-associated BCWG may be similar.

1. Introduction

Benign convulsions with mild gastroenteritis (BCWG) is recognized as a distinct clinical entity. Since it was first described in 1982 by Morooka [1], it has been mainly reported in East Asian countries such as Japan, China, and South Korea and occasionally reported in Western countries [2–6]. BCWG has been defined as a syndrome characterized by afebrile convulsions occurring in otherwise healthy children with mild gastroenteritis who do not have meningitis, encephalitis, encephalopathy, dehydration, electrolyte imbalances or hypoglycemia and who have a benign prognosis [7,8].

Many previous reports have shown that rotavirus was the most prevalent pathogen in BCWG, accounting for approximately 40–50% of cases. After the introduction of the rotavirus vaccine, rotavirus-associated BCWG decreased, but the incidence of norovirus-associated BCWG has increased, accounting for approximately 63–71% of cases [4,5,9]. To date, a large number of studies on the relationship between viruses and BCWG have been published [4,5,10]. However,

campylobacter-associated BCWG, which refers to BCWG caused by Campylobacter jejuni, has rarely been examined. Therefore, the aim of the present study was to compare the clinical features of campylobacter-associated BCWG with rotavirus-associated BCWG in China. Long-term follow-up, including assessments of neurological development and recurrence, was also performed. The results will be helpful for the clinical diagnosis and treatment of patients with BCWG, especially campylobacter-associated BCWG.

2. Methods

In this retrospective study, we enrolled all patients with BCWG who were hospitalized at Children's Hospital of Jiangxi Province in China between January 1, 2015, and January 1, 2017. The inclusion criteria for the present study were as follows: (1) all subjects must conform to the diagnostic criteria of BCWG; (2) rotavirus or Campylobacter jejuni antigens must be detected and positive in a fecal sample. Patients who were diagnosed with meningitis, encephalitis, encephalopathy, and

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epilepsy were excluded from the study. BCWG was diagnosed when a patient met all of the following criteria [5]: (1) afebrile seizures accompanied by acute gastroenteritis symptoms; (2) normal laboratory examinations (cerebrospinal fluid results, serum electrolytes, and blood glucose levels) were observed; (3) normal or slow background of electroencephalography(EEG); (4) normal brain imaging findings and development. Our study was approved by the ethics committee of Children's Hospital of Jiangxi Province in China.

We divided eligible patients into two groups according to the pathogen results. If the *Campylobacter jejuni* antigen was positive, the patients were classified into the campylobacter-associated BCWG group, and if the rotavirus antigen was positive, the patients were classified into the rotavirus-associated BCWG group. Pathogens were detected in stool samples, and the rotavirus and campylobacter *jejuni* antigens were detected by latex agglutination tests. The campylobacter test kit was provided by Microgen Bioproducts, Ltd. The sensitivity and specificity of the campylobacter *jejuni* kit which adopted direct fecal test were 80.8% and 99.3%, respectively [11]. The rotavirus antigen test kit (sensitivity 85.9% and specificity 97.7%) [12] was provided by ABON Biopharm Co., Ltd. Pathogen detection was conducted strictly in accordance with the kit instructions.

For every patient, we collected clinical data, including age, sex, season, total course of disease, incidence of gastrointestinal symptoms, interval between gastrointestinal symptom onset and seizure onset, seizure characteristics (duration, frequency, type, and time from onset of first seizure to last seizure), previous history of seizures, birth history, and treatment (the use of antiepileptic drugs, the efficacy of phenobarbital). The efficacy of phenobarbital in the acute phase referred to the rate of remission (seizure free) between admission to the hospital and remission of gastroenteritis symptoms. Laboratory results (blood cell counts, hepatase, myocardial enzyme, and C-reactive protein), positivity rate of pathogens in stool (number of positive cases of rotavirus or campylobacter / number of cases of rotavirus or campylobacter tested \times 100%), brain imaging findings, and EEG findings were also reviewed. EEG was performed immediately on the first day after admission to hospital. EEG reports were read by trained and qualified doctors who were not researchers, and they were not blinded to the diagnosis. Long-term follow-up, including assessments of neurological development and recurrence, was also performed in this study. At the end of the follow-up period, neurological development was assessed using the Gesell Developmental Scale(GDS) (China revised edition) by trained and qualified doctors, and the results are reported as developmental quotient (DQ) (normal values \geq 75) [13]

All statistical analyses were performed using SPSS version 19.0. Data for categorical variables are summarized as numbers and percentages. Data for continuous variables are summarized as the mean \pm SD or median (25th percentile, 75th percentile), and its abbreviation is $M(P25,P75)$.

3. Results

3.1. Pathogen (*campylobacter* or *rotavirus*) detection and seasonal distribution of BCWG

Initially, 334 patients met the diagnostic criteria for BCWG between January 1, 2015, and January 1, 2017. However, during the long-term follow-up, six patients refused to be followed up. Two patients were diagnosed with encephalopathy. Research data of 8 patients were incomplete. No case was diagnosed with epilepsy during the long-term follow-up. Therefore, these 16 patients were excluded from the study. Ultimately, 318 patients conformed to the diagnostic criteria and the exclusion criteria; However, in these 318 cases, although 70 cases met the diagnostic criteria, they were excluded from the study because stool pathogen detection was not ordered. Two hundred and two cases were tested for campylobacter *jejuni* antigen, and seven (3.47%) were positive; and 248 cases were tested for rotavirus antigen, and 44 (17.74%)

Table 1

Identification of pathogens (rotavirus and campylobacter) in patients with BCWG.

	n (%)
Number of patients with BCWG	318
Tested for rotavirus antigen	248
Positive (rotavirus)	44 (17.74%)
Tested for campylobacter antigen	202
Positive (campylobacter)	7 (3.47%)
Not tested	70

Positivity rate of 3.47% for campylobacter-associated BCWG was lower than the rotavirus group (17.74%).

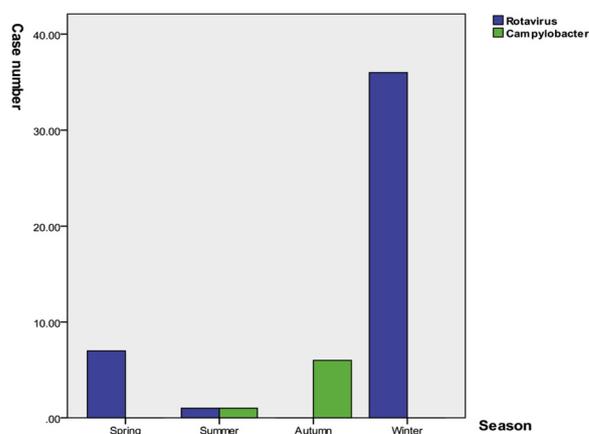


Fig. 1. The seasonal distribution of campylobacter-associated BCWG and rotavirus-associated BCWG. (March to May was grouped as spring, June to July as summer, September to November as autumn, and December to February as winter) Campylobacter-associated BCWG occurred in summer and autumn. In contrast, rotavirus-associated BCWG mainly occurred in winter.

were positive (Table 1).

In terms of seasonal distribution, campylobacter-associated BCWG occurred in summer and autumn. One case of campylobacter-associated BCWG occurred in summer, and six occurred in autumn, but none occurred during spring and winter. In contrast, rotavirus-associated BCWG mainly occurred in winter. Seven cases of rotavirus-associated BCWG occurred in spring, one in summer, 36 in winter and none in autumn (Fig. 1).

3.2. Clinical characteristics of campylobacter-associated BCWG and rotavirus-associated BCWG

Of the 51 patients who met the inclusion criteria, seven were diagnosed with campylobacter-associated BCWG (four boys and three girls; 17.29 ± 4.23 months old), and 44 were diagnosed with rotavirus-associated BCWG (16 boys and 28 girls; 18.89 ± 5.02 months old) (Table 2).

Among the 51 patients, 32 (62.75%) had two or more seizures, ranging from one to eight episodes. Five patients (71.43%) in the campylobacter-associated BCWG group had two or more seizures, ranging from one to three episodes; while 27 patients (61.36%) in the rotavirus-associated BCWG group had two or more seizures, ranging from one to eight episodes (Table 2).

Among the 51 patients, six (11.76%) had seizures on the first day of gastroenteritis, 22(43.14%) had seizures on the second day and 23 (45.10%) had seizures on the third day or later. Of the seven patients in the campylobacter-associated BCWG group, one (14.29%) had a seizure on the first day of gastroenteritis, three (42.86%) had seizures on the second day, and three(42.86%) had seizures on the third day or later. Of the 44 patients in rotavirus-associated BCWG group, five (11.36%)

Table 2
Comparison of clinical characteristics between the campylobacter-associated BCWG and rotavirus-associated BCWG groups.

	Campylobacter-associated BCWG (n = 7)	Rotavirus-associated BCWG (n = 44)
Age (months)	17.29 ± 4.23	18.89 ± 5.02
Male gender	4(57.14%)	16(36.36%)
Interval from the onset of gastroenteritis to the onset of seizures		
First day	1(14.29%)	5(11.36%)
Second day	3(42.86%)	19(43.18%)
Third day or later	3(42.86%)	20(45.45%)
Number of seizures per patient		
1	2(28.57%)	17(38.64%)
≥ 2	5(71.43%)	27(61.36%)
Time from onset of first seizure to last seizure(h)	9.60 ± 8.32	8.63 ± 6.38
Seizure duration		
< 5 min	11(84.62%)	90(92.78%)
≥ 5 min	2(15.38%)	7(7.22%)
Seizure type		
Generalized	11(84.62%)	78(80.41%)
Focal	1(7.69%)	10(10.31%)
Unknown	1(7.69%)	9(9.28%)
EEG findings		
Normal	7(100%)	31(70.45%)
Background slowing	0(0.00%)	13(29.55%)
Brain imaging findings		
Normal	7(100%)	44(100%)
Abnormal	0(0.00%)	0(0.00%)
Efficacy of phenobarbital		
5 mg/kg		
Seizure-free	6(100%)	33(91.67%)
Persistent seizures	0(0.00%)	3(8.33%)
10 mg/kg		
Seizure-free	0	4(100%)
Persistent seizures	0	0(0.00%)
No antiepileptic drugs		
Seizure-free	1(100%)	2(50%)
Persistent seizures	0(0.00%)	2(50%)
Course of disease (days)	5.29 ± 1.11	5.48 ± 1.13

Data are N (%) or mean ± SD values. The clinical features of campylobacter-associated BCWG and rotavirus-associated BCWG was similar.

had seizures on the first day of gastroenteritis, 19 (43.18%) had seizures on the second day, and 20 (45.45%) had seizures on the third day or later (Table 2).

The time from the onset of the first seizure to the last seizure was 9.60 ± 8.32 h in the campylobacter-associated BCWG group and 8.63 ± 6.38 h in the rotavirus-associated BCWG group. In all cases, the interval from the first to the last seizure was less than 24 h.

A total of 110 seizures were observed in the 51 patients with BCWG. Among the 110 seizures, 13 were observed in the campylobacter-associated BCWG group, and 97 were observed in the rotavirus-associated BCWG group; 101 seizures (91.82%) lasted less than 5 min. Only one patient had a seizure that lasted longer than 15 min; none of the seizures lasted longer than 30 min. Most of the seizures lasted less than 5 min (84.62% of those in the campylobacter-associated BCWG group and 92.78% of those in the rotavirus-associated BCWG group). A total of 89 generalized seizures (80.91%) were observed among the 110 seizures (84.62% of the campylobacter-associated BCWG group and 80.41% of the rotavirus-associated BCWG group) (Table 2).

None of the patients showed epileptic discharges on the interictal EEGs or had abnormal results in the neuroimaging analysis. The disease course was 5.29 ± 1.11 days in the campylobacter-associated BCWG group and 5.48 ± 1.13 days in the rotavirus-associated BCWG group (Table 2).

Use of antiepileptic drugs in the acute phase are shown in the Figs. 2 and 3. Since the purpose of this study was to assess the efficacy of

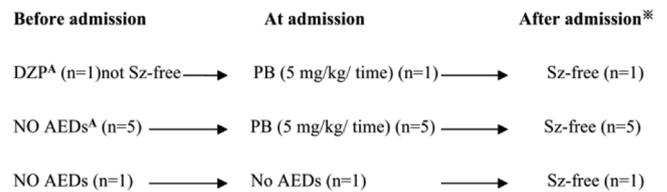


Fig. 2. AEDs administered to patients with campylobacter-associated BCWG. AEDs, antiepileptic drugs; Sz, seizure; DZP, diazepam; PB, phenobarbital. A: Phenobarbital (5 mg/kg/ time) group; *: After admission to hospital Phenobarbital (5 mg/kg/time, once, intravenous injection before or at admission) was effective (100%) in 6 of the 6 cases in which it was used in the campylobacter-associated BCWG group.

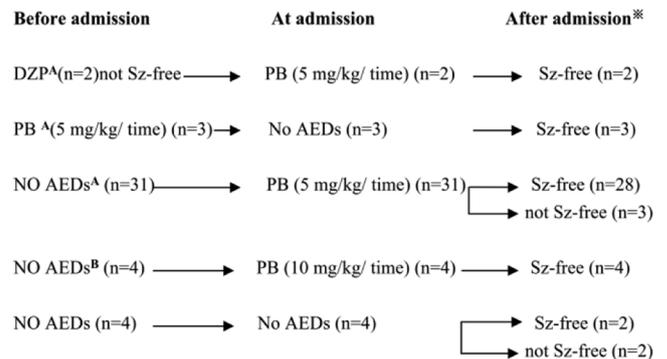


Fig. 3. AEDs administered to patients with rotavirus-associated BCWG. AEDs, antiepileptic drugs; Sz, seizure; DZP, diazepam; PB, phenobarbital. A: Phenobarbital (5 mg/kg/ time) group B: Phenobarbital (10 mg/kg/ time) group *: After admission to hospital. Phenobarbital (5 mg/kg/time, once, intravenous injection before or at admission) was effective (91.67%) in 33 of the 36 cases in which it was used in the rotavirus-associated BCWG group, and phenobarbital(10 mg/kg/ time, once, intravenous injection before or at admission) was effective in all 4 patients (100%).

phenobarbital, which referred to the rate of remission (seizure free) between admission to the hospital and remission of gastroenteritis symptoms, the use of antiepileptic drugs was counted only before and at admission to the hospital. Of the 51 cases, forty-six were treated with antiepileptic drugs, including 6 in the campylobacter group and 40 in the rotavirus group before and at admission to the hospital. In the campylobacter group, One patient never used any antiepileptic drugs before or at admission, and 6 cases were given phenobarbital (5 mg/kg/ time, once, intravenous injection before or at admission to the hospital). In the rotavirus group, four patients never used any antiepileptic drugs before or at admission, 36 cases were given phenobarbital (5 mg/kg/ time, once, intravenous injection before or at admission to the hospital), and 4 cases were given phenobarbital (10 mg/kg/ time, once, intravenous injection before or at admission to the hospital). Among the 51 patients, phenobarbital (5 mg/kg/ time) was effective (92.86%) in 39 of the 42 cases (100% of campylobacter-associated BCWG group and 91.67% of rotavirus-associated BCWG group). Phenobarbital (10 mg/kg/ time) was effective in all 4 patients (100%) with rotavirus-associated BCWG group; however, this dose of phenobarbital was not used in the campylobacter-associated BCWG group.

Antiepileptic treatments were discontinued, and the patients were followed up in terms of seizures for up to two years. Only one patient had recurrent seizures of BCWG seven months later, and no case was diagnosed with epilepsy during the long-term follow-up. All the patients had a good prognosis (DQ 98 ± 9). DQ was 97 ± 12 in the campylobacter-associated CwG group and 99 ± 9 in the rotavirus-associated CwG group.

Table 3
Comparison of laboratory findings between campylobacter-associated BCWG and rotavirus-associated BCWG groups.

	Campylobacter-associated BCWG(n = 7)	Rotavirus-associated BCWG(n = 4)
WBC (10 ⁹ /L)	8.10 ± 2.77	7.75 ± 2.12
ALT(U/L)	52.86 ± 52.88	34.84 ± 13.74
AST(U/L)	68.43 ± 36.16	72.73 ± 17.49
Ck (U/L)	143.14 ± 74.13	195.77 ± 102.45
CKMB (U/L)	37.29 ± 25.39	53.61 ± 24.43
CRP (mg/L)	0.1(0.1,0.1)	4.50(1.85,10.65)
Stool Routine ^a		
Normal	6(85.71%)	44(100%)
Abnormal ^b	1(14.29%)	0(0.00%)
Stool culture ^c		
Negative	7(100%)	44(100%)
Positive	0(0.00%)	0(0.00%)

Abbreviations: WBC, white blood cell. ALT, alanine aminotransferase. AST, aspartate aminotransferase. CK, creatine kinase. CKMB, creatine kinase isoenzyme MB. CRP, C-reactive protein.

^a Stool routine tests generally include fecal traits fecal white blood cells, fecal red blood cells, fecal color, fecal parasitic worm eggs, fecal occult blood test (OBT).

^b Abnormal stool routine in the table refers to white blood cells is detected in stool.

^c Stool culture refers to the detection of fecal bacterial culture; C-reactive protein (CRP) was lower in the campylobacter-associated BCWG group compared with the rotavirus-associated BCWG group. Other laboratory tests was similar between the two groups.

3.3. Laboratory findings for the campylobacter-associated CwG and rotavirus-associated CwG groups

A comparison of the laboratory results showed that C-reactive protein (CRP) was lower in the campylobacter-associated BCWG group compared with the rotavirus-associated BCWG group (0.1(0.1,0.1) vs. 4.50(1.85,10.65) mg/L). Other laboratory tests was similar between the two groups (Table 3).

4. Discussion

Convulsions associated with campylobacter enteritis were first described in 1980 by Havalad in Britain [14]. Since then, an increasing number of cases of convulsions associated with campylobacter enteritis were reported in the 1980s [15–17]; however, most of the cases that have been reported were febrile seizures associated with campylobacter enteritis; in contrast, the campylobacter-associated BCWG or BCWG (afebrile seizures) caused by campylobacter jejuni has been rarely reported before. Therefore, the present study first summarized the clinical characteristics of campylobacter-associated BCWG and compared them with those of rotavirus-associated BCWG. Long-term follow-up was also performed.

Many previous reports have shown that rotavirus is the most prevalent pathogen in BCWG. In Japan, Kawano et al. reported 30 cases (48.4%) that were positive for rotavirus among 62 BCWG patients [18]. However, since introduction of the rotavirus vaccine, rotavirus-associated BCWG has decreased. For example, Study of Kim et al showed a positivity rate of 7.5% for rotavirus-associated BCWG among 40 BCWG patients [5]. Our current study showed a positivity rate of 17.74% for rotavirus-associated CwG. The positive rate for rotavirus was higher than that of previous studies, which may be influenced by various factors in different regions, such as the social environment and public health factors. Our current study also showed a positivity rate of 3.47% for campylobacter-associated BCWG, which was lower than the rotavirus group. In China, a previous study showed a positivity rate of 4.9% for campylobacter enteritis among 412 patients with diarrhea [19]. However, the positive rate of campylobacter-associated BCWG has not

been reported to date.

In our study, among the 51 patients, seven were diagnosed with campylobacter-associated BCWG (17.29 ± 4.23 months old), and 44 were diagnosed with rotavirus-associated BCWG (18.89 ± 5.02 months old). Consistent with previous reports, BCWG peaked at 1–2 years of age in our cohort [5,20]. Kim et al. found that the proportion of male patients in their rotavirus-associated BCWG group was 50% [5]. However, in our present study, the proportion of male patients in the rotavirus-associated BCWG group was 36.4% (16 boys and 28 girls); this was lower than previous study, likely because of selection bias. In our study, the proportion of male patients in the campylobacter-associated BCWG group was 57.1% (four boys and three girls), which has not been reported before. Previous studies reported that rotavirus-associated BCWG was more common in winter and spring [18,20]. Consistent with previous reports, our observations clearly indicated that the number of patients with rotavirus-associated BCWG showed a distinct winter/spring peak. Our current study also indicated that campylobacter-associated BCWG was more common in summer and autumn, which has not been previously reported. However, it has been reported that human campylobacteriosis is more likely to occur in summer and that it is related to contaminated water and milk [21].

A distinctive clinical feature of patients with BCWG is clustered seizures which was defined as at least two seizures in a course of gastroenteritis [5,8,18,22–24]. Consistent with previous reports, 32 (62.75%) had two or more seizures (71.43% of the campylobacter-associated BCWG group and 61.36% of the rotavirus-associated BCWG group) and the two groups were similar. Consistent with previous reports [20,22], our current study also indicated that the time from the onset of the first seizure to the last seizure was 9.60 ± 8.32 h in the campylobacter-associated BCWG group and 8.63 ± 6.38 h in the rotavirus-associated BCWG group, and the interval from the first to the last seizure was shorter than 24 h in all cases.

Regarding the interval from the onset of gastroenteritis to that of seizures, Li et al. reported that gastroenteritis preceded seizures by the first, second, third day or later in 3 (9.37%), 13 (40.63%), and 16 (50.00%) patients, respectively [22]. Consistent with previous reports [22], among the seven patients in the campylobacter-associated BCWG group, one seizure (14.29%) occurred on the first day of gastroenteritis, three (42.86%) occurred on the second day, and three (42.86%) occurred on the third day or later. The rotavirus group is similar to the campylobacter group by 11.36%, 43.18%, and 45.45%, respectively. Although a previous study found that seizures preceded enteric symptoms in BCWG patients [20], our study did not find this phenomenon.

Yorulmaz et al. reported that 15 patients (93.75%) with rotavirus-associated BCWG presented with generalized seizures, and one patient presented with focal seizures (6.25%) [10]. Consistent with previous reports [10], in our study, a total of 89 generalized seizures (80.91%) were observed among the 110 seizures (84.62% of the campylobacter-associated BCWG group and 80.41% of the rotavirus-associated BCWG group). However, Maruyama et al. reported that ictal EEGs were recorded in six patients with BCWG, and generalized tonic-clonic seizure was observed in five of six patients. However, Ictal EEGs demonstrated that all seizures were of focal onset and evolved into secondarily generalized seizures [25]. It was difficult to determine whether these seizures were primary or secondary generalized seizures due to the lack of ictal EEGs in our study. Some of the seizures are likely to be focal seizures with secondary generalization. In further studies, ictal video EEG will be particularly important for classification of seizure types. Regarding the interictal EEG findings, 13 patients (25.49%) showed background slowing, which was consistent with previous reports [20]. The interictal EEG findings was similar between the campylobacter group and the rotavirus group. None of the patients showed epileptic discharges in the interictal EEGs.

Of the 110 seizures observed in our study, 101 (91.82%) lasted less than 5 min, Seizures lasted longer than 15 min in only one patient, and none of the seizures lasted longer than 30 min. Most of the seizures

lasted less than 5 min (84.62% of those in the campylobacter-associated BCWG group and 92.78% of those in the rotavirus-associated BCWG group), which was consistent with previous reports [5,10].

Previous studies reported that phenobarbital was effective (83.33%–100%), and phenobarbital therapy was therefore strongly recommended for the treatment of BCWG [22,26]. In our current study, phenobarbital (5 mg/kg/time) was effective (92.86%) in 39 of the 42 cases in which it was used (100% of the campylobacter-associated BCWG group and 91.67% of the rotavirus-associated BCWG group), which was consistent with previous reports [22,26]. However, in our current study, three patients had never used antiepileptic drugs and had no seizures, which suggests that some BCWG convulsions are self-limited. Because of the self-limitation of convulsions, some scholars may question whether it is necessary to use phenobarbital in the acute phase. Our previous research can further explain this problem [27]. Our previous study was a retrospective study that collected a total of 139 patients who met the criteria for BCWG. The purpose of this study was to assess the efficacy of phenobarbital, which referred to the rate of remission (seizure free) between admission to the hospital and remission of gastroenteritis symptoms. All patients were divided into 3 groups according to the dosing of phenobarbital, namely group A (n = 40, 10 mg/kg/ time, once, intravenous injection before or at admission), group B (n = 56, 5 mg/kg/ time, once, intravenous injection before or at admission) and group C (n = 43, never used any anti-epileptic drugs before or at admission). Group A was effective in 37 of the 40 cases (92.5%), and Group B was effective in 46 of the 56 cases (82.14%), and 18(41.86%) patients in group C had no seizures after admission. The efficacy of phenobarbital in group B (82.14%) and group A (92.5%) was significantly higher than that of group C(41.86%). Therefore, our previous study indicated that although some convulsions in BCWG were self-limited, the use of phenobarbital changed the natural history of disease in these children in the acute phase. Further studies are needed to determine whether phenobarbital improves the long-term prognosis of BCWG.

All of the patients in our study had a good prognosis (DQ98 ± 9), and DQ of the two groups was similar (campylobacter 97 ± 12 vs. rotavirus 99 ± 9). The patients were followed up in terms of seizures. Only one patient had recurrent seizures of BCWG seven months later, and the recurrence rate of BCWG was low, which was consistent with previous reports [6]. Long-term AED treatment is not required for patients with BCWG because both the current study and previous studies have shown that the prognosis of BCWG is benign, and the recurrence rate of BCWG is low.

5. Conclusions

The current study has several limitations. Firstly, this study was a retrospective study, and baseline developmental testing was not available on the patients. In addition, due to the low incidence of campylobacter-associated BCWG, the campylobacter sample was small. However, in summary, our results showed that campylobacter was one of the pathogens of BCWG. Campylobacter -associated BCWG was probably more likely to occur in summer and autumn. Other than the different seasonal distributions, the clinical features of campylobacter-associated BCWG and rotavirus-associated BCWG may be similar. Clinical features of campylobacter-associated BCWG and differentiation from the rotavirus group should be further determined by a large sample study.

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