# Is antibiotic therapy necessary for the management of acute uncomplicated diverticulitis ? A prospective comparative study

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# IS ANTIBIOTIC THERAPY NECESSARY FOR THE MANAGEMENT OF ACUTE UNCOMPLICATED DIVERTICULITIS? A PROSPECTIVE COMPARATIVE STUDY

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## ABSTRACT:

### BACKGROUND:

The standard of care for acute uncomplicated diverticulitis (AUD) today is hospitalization antibiotic treatment. Outpatient management of this disease is now gaining acceptance amongst some surgeons. However, random use of antibiotics is associated with many side effects, including life threatening allergic reaction as well as development of multi-drug resistant organisms. Despite encouraging results from multicentre randomized control trials showing no advantage to antibiotic utilization, many surgeons are still hesitant to practice non-antibiotic treatment of AUD diverticulitis. The aim of this study was to investigate the need for antibiotic treatment in acute uncomplicated diverticulitis, the treatment failures, complications and recurrence rate with an average follow up of 23.6 months.

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## METHODS:

This is a prospective single centre study involving five surgical units at the San Fernando General Hospital of Trinidad and Tobago between the periods June 2012 to June 2016, recruiting 72 patients with computed tomography-verified AUD. The patients were informed about the pros and cons of antibiotic treatment and their entry into a trial. Thirty-eight patients agreed with this non-antibiotic therapy and were compared with 34 patients who chose to have antibiotic therapy. Both of the groups were followed up with an average of 23.6 months.

## RESULTS:

Age, sex, co-morbidities, body temperature, pulse, white blood cell count and C-reactive protein level on admission and discharge were recorded; these were comparable in both groups. There was no treatment failure or worsened clinical condition noted in any of our patients treated without antibiotics. Hence, none of them had to start antibiotic therapy or proceed to surgery. The mean hospital stay in both groups was 4 days. Recurrent diverticulitis necessitating readmission to hospital at the 23.6 months follow-up was nil in both groups.

## CONCLUSION:

Acute uncomplicated diverticulitis can be safely managed without antibiotic therapy. Antibiotic therapy neither accelerates recovery nor prevents complications or recurrence. It should therefore be reserved for the treatment of complicated diverticulitis.


**Key Words:** Acute uncomplicated diverticulitis, antibiotic and non-antibiotic management

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## INTRODUCTION:

Diverticulosis of the colon is an increasingly common, benign disorder in Western countries. It occurs in about one-third of the population older than 45 years, and in up to two-thirds of the population aged above 85 years [1]. Even in some developing countries, like ours, it is quite common [2].

Diverticulitis is defined as inflammation or infection in a diverticula-bearing colonic segment. Although the majority of individuals with diverticulosis remain asymptomatic, 10–25 per cent will develop diverticulitis during their lifetime [3].Uncomplicated diverticulitis presents most frequently with abdominal pain, fever and raised inflammatory parameters, and more than 70 per cent of patients are treated conservatively [4, 5]. AUD is a costly disease with an increasing incidence and a decreasing age at acute admission [5-7]. Antibiotics have been used in the treatment of uncomplicated diverticulitis since their introduction, as the condition is thought to be caused by bacterial infection. Despite the lack of controlled studies and previously demonstrated disease resolution without antibiotic therapy [8-10], treatment with antibiotics has become the standard of care for AUD. Some authors, however, have suggested that diverticulitis could be a form of inflammatory bowel disease and not the result of micro-perforation [11, 12], questioning the rationale behind prescribing antibiotics for the treatment of uncomplicated diverticulitis. Moreover, a recent prospective, blinded study showed no advantage of antibiotic treatment for AUD [13].

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It is widely believed that the unnecessary use of antimicrobials is a major cause of the widespread emergence of resistant organisms, which is beginning to threaten the continued effectiveness of antibiotics. Although resistance to antibiotics is a natural phenomenon, it has been aggravated by their overuse (European Antimicrobial Resistance Surveillance Network (EARS-Net) [14].

The aim of our study was to evaluate whether antibiotic treatment for acute uncomplicated diverticulitis is necessary.

## METHODS:

### STUDY DESIGN:

This was a prospective study conducted in a single centre, with the participation of all five surgical units of the San Fernando General Hospital in Trinidad and Tobago. The 4 year study period was between 1st July 2012 and 30th June 2016. Patients aged over 18 years with acute AUD irrespective of location of pain were eligible. Inclusion and exclusion criteria are shown in Table 1. AUD was defined as an episode with a short history, with clinical signs of diverticulitis, without systemic sepsis, with or without an increased body temperature and with inflammatory parameters, verified by computed tomography (CT), and without any sign of complications such as abscess, free air or fistula. Patients with clinical signs of acute diverticulitis irrespective of site of pain were evaluated by clinical examination, blood tests, and CT of the abdomen and pelvis. CT scans were assessed by the radiologist on duty.

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Table 1 Study inclusion and exclusion criteria

| Inclusion criteria |
|---|
| Adult patient aged over 18 years |
| Acute abdominal pain with tenderness |
| Raised WBC and C-reactive protein level, or at least increased WBC if short history |
| Signs of diverticulitis on CT |
| Informed consent |
| **Exclusion criteria** |
| Signs of complicated diverticulitis on CT with abscess, fistula or free air in abdomen or pelvis |
| Signs of other diagnosis on CT |
| Immune-compromised patients |
| Patients receiving immunosuppressive therapy |
| Pregnancy |
| On-going antibiotic therapy |
| High fever, worsening general condition, peritonitis or sepsis |

After confirmation of the diagnosis of AUD by CT and screening for eligibility, informed consent was obtained. In each unit, one surgical resident was given responsibility for recruiting patients. Following admission the coordinator was informed to verify the screening process and inclusion in this study. A case record form (CRF) was completed for each patient, including demographic data, medical history, previous symptoms of diverticulitis, physical examination and laboratory results, and abnormalities on CT. Pain was recorded on a visual analogue scale (VAS, 0–10) and abdominal tenderness at palpation on a scale of 0–4 (Table 2).

The study was carried out in all five surgical units of San Fernando General Hospital in July 2012 and continued up to 30$^{th}$ June 2016. This hospital serves a total of only 500,000 - 600,000 people. The study was approved by the ethics committee of the Faculty of Medicine, University of West Indies, St Augustine Campus, Trinidad and Tobago and followed the Declaration of Helsinki guidelines.

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Table 2: Demographic data and patient characteristics

| | No antibiotics(n = 38) | Antibiotics(n =34) |
|---|---|---|
| Age (years) | 62 | 63.2 |
| Sex ratio (M: F) | 16:22 | 14:20 |
| Co-morbidity | 12 of 38 | 8 of 34 |
| Previous diverticulitis | 04 of 38 | 06 of 34 |
| WBC (× 109 cells/l) | 12.27 | 12.72 |
| CRP (mg/l) | 14.49 | 11.68 |
| Body temperature (°C) | 37.19 | 37.58 |
| Abdominal pain | 6.2(4–9) | 6.58 (5–9) |
| Tenderness score | 1.3 (1–3) | 1.66 (1–3) |

*Visual analogue scale (VAS, 1–10 score), median tenderness score: 0, none; 1, mild local tenderness; 2, moderate local tenderness; 3, severe local tenderness; 4, local peritonitis. Morbidity includes cardiovascular disease, pulmonary disease, renal failure and diabetes mellitus. WBC (white blood cell count), CRP (C-reactive protein).*

## STUDY PROCEDURE:

Patients who wished to undergo treatment without antibiotics group were put in one group, and those who preferred antibiotics were selected for the antibiotic group.

Once any patient was enrolled into this study, this was announced in our weekly audit meeting and also was followed for complications and possible readmission. The non-antibiotic group was given intravenous fluids only, and the antibiotic group was treated with broad-spectrum

antibiotics, a second or third generation cephalosporin (cefuroxime or cefotaxime) and metronidazole, or ertapenem or piperacillin–tazobactam depending on availability. Orally administrated antibiotics such as ciprofloxacin or co-amoxiclav combined with metronidazole followed after 2 days on the ward or at discharge. The total duration of antibiotic therapy was at least 7 days. The decision to discharge patients was made by the attending surgeon based on an improvement in clinical status, as well as a reduction in the white blood cell count (WBC), C-reactive protein (CRP), and the absence of fever. These were taken as signs of improvement and reflected the pragmatic design of the study. Complications during hospital stay were defined as bowel perforation with free air, abscess or fistula. Any complications during follow-up i. e. admission due to recurrence and need for emergency or elective surgery were recorded.

## FOLLOW UP:

Patients were closely followed up at 6 weeks, 6 months, 12 months, 24 months and 36 months after discharge. Patients had a colonic investigation by barium enema and / or colonoscopy if none of these had been done within 1 year before admission. Results of the investigations were registered and the extent of diverticular disease noted. After a minimum of 12 months as well as 36 months (those who completed the duration) patients were requested to complete a questionnaire regarding abdominal pain, bowel symptoms or recurrence demanding readmission to hospital. If no answer was received after three reminders, the patient was registered as a dropout from follow-up.

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## STATISTICAL ANALYSIS:

Sample size was calculated from an estimated complication rate with antibiotic therapy of 1.5 per cent. An increase in the complication rate in the non-antibiotic group to a maximum of 6.5 per cent was regarded as acceptable. The results were analysed on an intention-to-treat and per-protocol basis. Pearson's $\chi 2$ test was used for discrete variables. The study arms were compared using an independent-samples t-test for continuous variables with normal distribution. The Mann–Whitney U test was used for ordinal data or for data without normal distribution.

A multivariable binary logistic model was performed to analyse relationships between the different variables and the occurrence of complications and recurrence. In the primary analysis, short-term results regarding the occurrence of complications, need for surgery, hospital stay, abdominal pain, fever and abdominal tenderness were analysed. In the follow-up analysis, recurrence, need for surgery, changes in bowel habit, abdominal pain and results of colorectal examinations were analysed. Statistical significance was set at P <0· 050, two-sided tests. All data analysis was performed using the SPSS software package version 14.0.

## RESULTS:

In total, 83 patients were selected, of whom 11 were excluded. Seven patients interrupted participation and 4 patients were excluded because of protocol violation. None of the patients needed to be excluded due to any complication. Seventy-two patients (30 male and 42 female) with CT verified AUD were enrolled in the study: 38 in the no-antibiotics and 34 in the antibiotics group .The median age was 61.95 (range 40–83) years in non-antibiotic and 63.6



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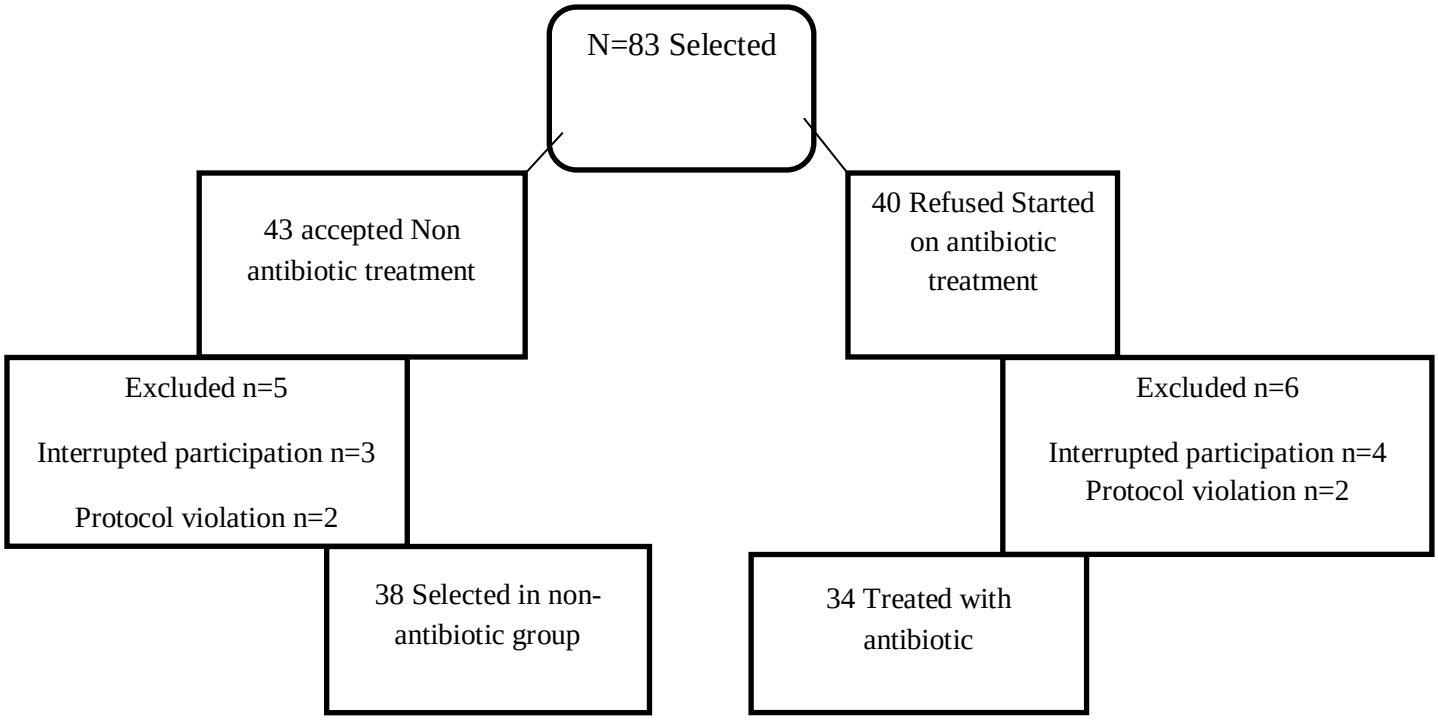
(range 43-80) years in the antibiotic groups. 49.39 per cent of our patients (41 patients) were East Indian, 43.37 per cent (36 patients) Afro-Trinidadian and 7.22 per cent (6 patients) mixed. Admission and discharge pulse, temperature, WBC, CRP level, VAS and tenderness score were recorded for both groups.




## CLINICAL CHARACTERISTICS:

Both groups of our patients presented with a similar signs and symptoms on admission. 70.83 per cent (51of 72) of our patients had left lower abdominal pain, 23.61 per cent (17 of 72) had right lower abdominal pain and 2.77 per cent (2 of 72) in each groups had right upper quadrant and left upper quadrant pain. 45.83 % (33 of 72) of our patients presented with fever and (48.61 per

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cent (35 of 72) of our patients reported to have change in stool habit with constipation or loose stools. There were no differences between the two groups with regard to these parameters.

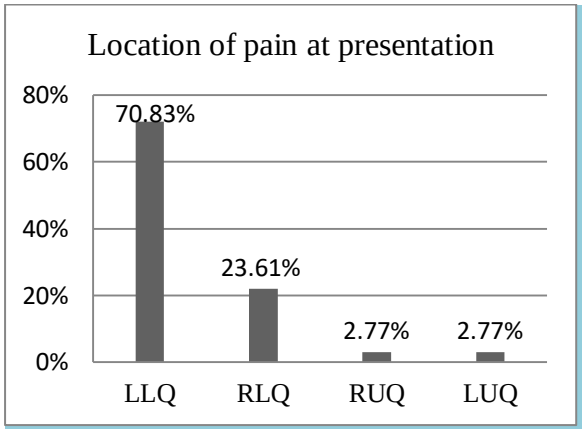


*Fig1: Location of pain at presentation*

Clinical details are listed in Table 2. The two groups were equally balanced regarding age, sex, co-morbidity and inflammatory parameters such as WBC, CRP level and body temperature. Only 5 patients in each group had a history of previous diverticulitis; 62 of 72 (86.11 per cent) patients presented for the first time with this condition. Clinical bedside signs, such as pain measured by VAS and tenderness on abdominal palpation at admission, did not differ between the groups. Abdominal pain, body temperature and abdominal tenderness on palpation decreased rapidly in both groups during the hospital stay (Fig. 2). Differences from baseline (the time of admission) for every patient were calculated for VAS, body temperature and tenderness score for each day in hospital. There were no differences between the groups for VAS, tenderness score Normalization of body temperature after 2 days was similar in the two groups. The median hospital stay for non-antibiotic group and for antibiotic group was similar 3.9 (range 2-6) days.

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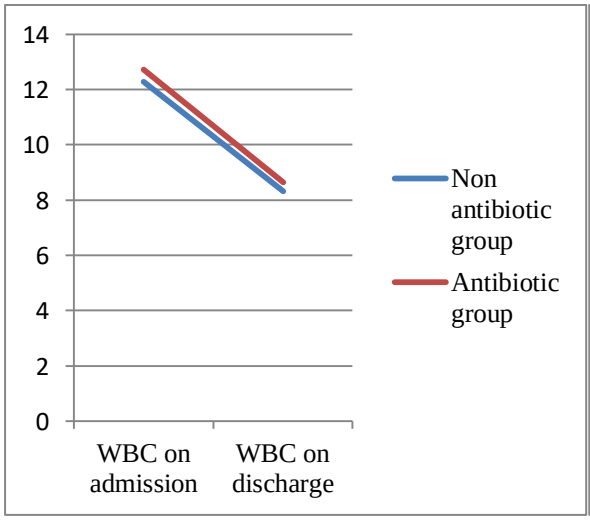
## PRIMARY ANALYSIS:

Complications and Emergency surgery during hospital stay:

None of our patients (0 per cent) had suffered from any complication i.e.-perforation, abscess formation, percutaneous drainage or emergency colonic resection. Therefore, none of our patients in non-antibiotic group had to be started on antibiotic treatment. One patient in the antibiotic group had to terminate antibiotic therapy on the second day because of allergic side-effects.

Table 3: Complications, surgery, hospital stay and recurrent diverticulitis

| Non-antibiotic (n=38) | Antibiotic (n=34) |
|---|---|
| Hospital Stays (days) 3.91 (range 3-6) | 3.91 (range-3-5) |
| Recurrent diverticulitis NIL | NIL |
| Complications (abscess formation, perforations, recurrent admission, percutaneous drainage, surgical resections)<br>During admission NIL<br>During follow up at 36months NIL | <br><br>NIL<br>NIL |



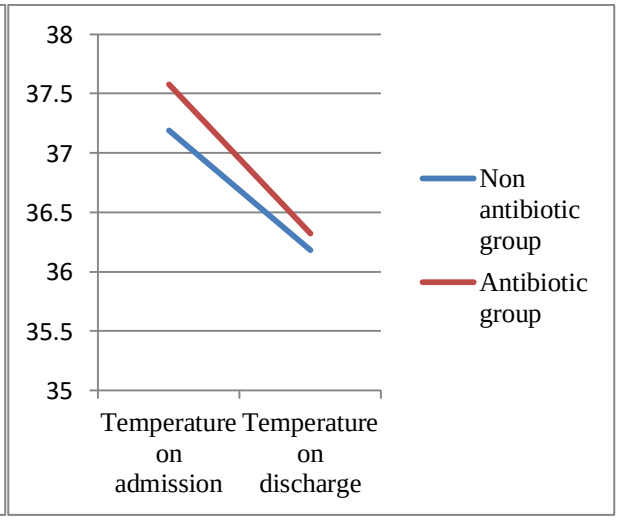



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*Fig 2: Comparative analysis of Mean WBC, Temperature (0C) on admission and discharge*

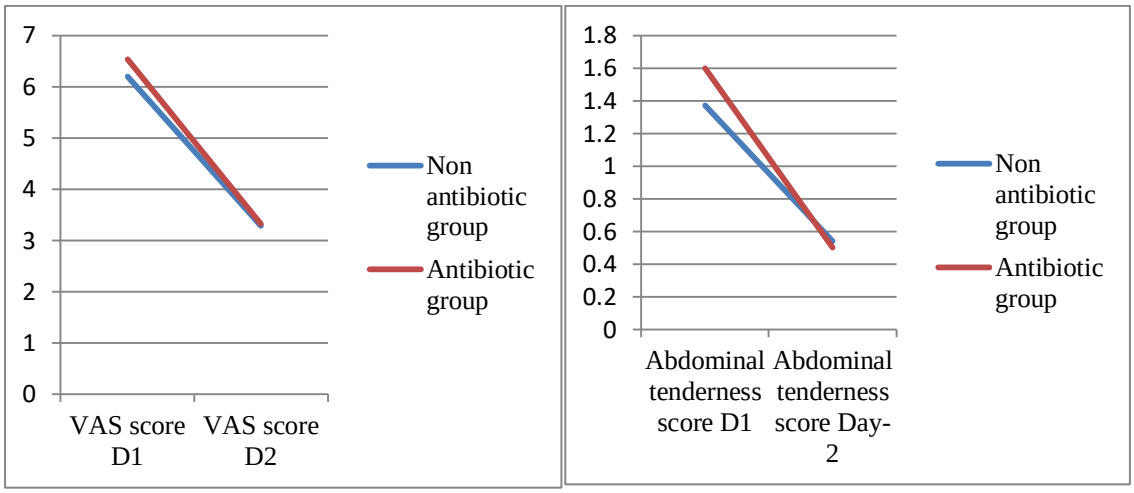


*Fig 2: Mean abdominal pain (VAS) score, Mean abdominal tenderness score day-1 and day -2*

*Clinical bedside signs after admission for acute uncomplicated diverticulitis: a mean abdominal pain according to the visual analogue scale (VAS) score (0–10); b mean body temperature; c mean abdominal tenderness score at palpation (0–4)*

## FOLLOW UP ANALYSIS:

Follow up analysis at the end of 36 months, none of our patients in either group had any recurrent episodes of diverticulitis that required antibiotic treatment or hospitalization. Although 8 (11.11 per cent) patients in non-antibiotic group and 10 (13.88 per cent) patients in antibiotic group had mild intermittent abdominal pain, however none of them had to use any antibiotics. 5 of 43 (11.62 per cent) patients in non-antibiotic group, and 6 of 40 (15 per cent) patients in the antibiotic group defaulted from follow up. At the 3-years follow-up, only fewer patients had symptoms of abdominal pain and changes in bowel habit but it did not differ between the groups. Colonic investigations were performed in 49 patients by barium enema and / or colonoscopy. 81 per cent of our patients had barium enema and 44 per cent had colonoscopy. There was no

significant difference between the groups with respect to the findings or extent of diverticulosis. 31 (43.05 per cent) of 72 patients had pan diverticulosis, 23 (31.94 per cent) patients had left sided diverticulosis and 18 (25 per cent) patients had right sided diverticulosis. None of our patients had colorectal malignancy or inflammatory bowel diseases.

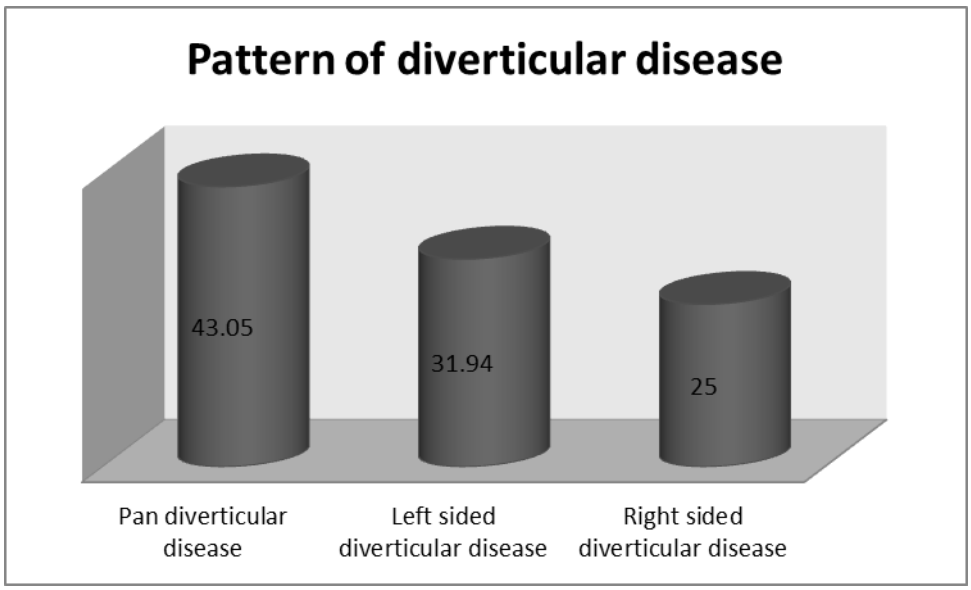


*Fig 3: Disease pattern in our study groups.*

## DISCUSSION:

Diverticular disease is a common gastrointestinal condition. Since its first description in the 1800s, colonic diverticulosis has been recognized as an increasingly common clinical condition in industrialized countries. It predominantly affects the left colon in developed world. On the contrary, right sided lesions are noted in the developing world. In an earlier study by Naraynsingh et al in Trinidad and Tobago, the incidence of diverticular diseases is documented as 24.6%. The sigmoid colon was involved alone in 36.4% and in combined with other regions in

82% of the cases. The right colon was involved in 10% of the cases [2]. It can affect patients of all age groups but the prevalence increases with age, most commonly seen in the elderly above age 70 and usually do not cause symptoms. Cases in young individuals are more likely to be complicated. The mean age of the patients in our study was 62 years. Although majority of our patients presented with left sided UD, right sided lesions were also noted in about 25 per cent of our study population (which correlates with our ethnic composition). Diverticular disease was noted to be the fifth most important gastrointestinal disease in terms of direct and indirect cost. The burden of diverticular disease has been estimated at US $2.66 billion per year [15]. Even though diverticular disease can manifest significant symptoms and complications, about 80–85% of the people with this condition are asymptomatic. Of the 15–20% symptomatic patients, 75% of them will have painful diverticular disease without inflammation, 1–2% will require hospitalization and 0.5% will require surgery [16, 17]. Diverticulitis has traditionally been viewed as an infection with bacterial overgrowth in the colon and has therefore been treated with antibiotics. The incidence of diverticular disease and its associated complications has increased in recent years, placing a significant burden on the healthcare system. Over the past decade, there have been a number of challenges to the traditional management of diverticulitis, all with the potential to mitigate against this increased burden on health resources.

Laparoscopic lavage, as opposed to resection, has been used successfully used in selected groups of UD patients [18]. The role of elective surgical resection after acute diverticulitis has been revised in light of data suggesting a low risk of subsequent recurrence and complications [19]. Most recently, the need for routine colonoscopy after computed tomography-proven uncomplicated diverticulitis has been questioned [20]. Similarly, Chabok and colleagues have

challenged another long-held principle of the management of diverticular disease: the use of antibiotics in acute diverticulitis [13].

A proper classification system can improve mutual communication between doctors of different specialties and support clinical decision making. Uniform classification in clear subgroups of diverticular disease could help the clinician in predicting outcomes and prognosis more accurately. In 1978, Hinchey et al. published their classification for acute diverticulitis [21]. The Hinchey classification has traditionally been used in international literature to distinguish four stages of perforated disease. This most widely used classification was actually based on an earlier clinical division of acute diverticulitis published by Hughes et al (1963) [22]. Since the introduction of the computed tomography (CT scan) in the 1980s, this imaging modality has established itself as the primary diagnostic tool in the assessment of diverticular disease. The much more detailed information provided by CT scans led earlier to modifications of the original Hinchey classification. Subcategories could be defined by taking the radiological findings into account [23]. Hence, in 1997, Sher et al. introduced the first modification for distinguishing between a peri-colic abscesses (stage I), distant abscesses amendable for percutaneous drainage (stage IIa), and complex abscesses associated with a possible fistula (stage IIb) [24]. This modification also implied the use of new treatment strategies, such as CT-guided percutaneous drainage of abscesses.

In 1999, Wasvary et al. published another modification, which since then has been widely adopted [25]. This modification broadened the original Hinchey classification by not only addressing perforated disease, but also including mild clinical disease (stage 0). Additionally, a

difference was made between confined peri-colic inflammation or phlegmon (stage Ia) and a confined pericolic abscess (stage Ib).

Also in 1999, Köhler et al. published a consensus statement drawn up by the European Association of Endoscopic Surgeons, entailing a clinical classification that differentiated symptomatic uncomplicated disease, recurrent symptomatic disease, and complicated disease [26].

In German literature since 1998, the Hansen/Stock classification has been mainly used. This is also a clinical classification accounting for asymptomatic diverticulosis as well as complicated diverticulitis in different stages, depending on the severity of the complications [27]. These aspects make it probably the most useful classification in clinical practice; however, it has rarely been adopted in international literature. Another German classification published in 1995 by Siewert et al. followed a similar delineation for complicated disease [28]. Recently, Naraynsingh et al (2011) proposed a new classification system of acute diverticulitis incorporating the presence of bowel wall thickening, mesenteric contracture and stricture formation that remains to be clinically validated and which differs from the Hinchey and modified Hinchey classification systems. He further subdivided modified Hinchey stage 4 diverticulitis into 4 different stages i.e. IV a- underlying healthy bowel segment, IV b-healthy bowel with adhesions but no wall thickening, IV c- Scarring and bowel wall thickening + mesenteric contraction, IV d- mass +stricture [29].

Each classification accentuates different aspects of diverticular disease, creating its own strength and limitation. Moreover, some of these classifications appear to be used at random in today's literature,

thereby hampering adequate interpretation and comparison. Despite this variety of classifications, still a few clinical manifestations comprised by “diverticular disease” seem to be lacking; for example recurrent diverticular bleeding and post-inflammatory stenosis

The use of antibiotics to treat diverticulitis is based on the longstanding premise that it is caused by colonic micro-perforation [6]. However, recently it has been proposed that diverticulitis represents a form of inflammatory bowel disease and limited data suggests that mesalazine may be effective in preventing recurrent attacks [7]. Establishing the aetiology of inflammation in diverticulitis will be an important step in determining the most appropriate therapeutic strategy. To date, the standard therapy used for acute episodes of uncomplicated sigmoid diverticulitis has been a 7-10-day antibiotic treatment regimen. We found 3 randomized controlled trials (RCTs) on the use of antibiotics for uncomplicated diverticulitis tested on hospitalised patients. The newest trial investigated the actual need for antibiotics when compared to no antibiotics, a second investigated two different antibiotic cures and a third investigated the length of IV antibiotic treatment. None of the studies found a statistical difference in the tested antibiotic regimes. The newest trial found no difference in the occurrence of complications like abscesses and perforations needing surgery. Schug-Pass et al (2010) in a prospective randomized trial of 106 patients showed that short-term ertapenem therapy (4 days) was as effective as standard therapy (7 days) for treatment of uncomplicated sigmoid diverticulitis [30]. In another prospective study of 103 patients, (n=40 outpatient management with 4 days of oral antibiotics and n=63 inpatient management with intravenous antibiotics 7 days). Houng-Chul Park et al, noted that outpatient management with short-term oral antibiotic therapy for the treatment of

uncomplicated right colonic diverticulitis is as effective as inpatient management in regard to preventing disease recurrence [31].

However, the value of antibiotics in the treatment of acute uncomplicated left-sided diverticulitis is not well established. de Korte et al (2011) in a Cochrane database review noted no randomized or prospective studies on the topic of effect on outcome [10]. One retrospective cohort study was retrieved that compared a group treated with antibiotics with observation alone. This study showed no difference in success rate between groups. Only one RCT of moderate quality compared intravenous and oral administration of antibiotics, and found no differences. One other RCT of very poor quality compared two different kinds of intravenous antibiotics and also found no difference. A small retrospective cohort study comparing antibiotics with and without anaerobe coverage showed no difference in group outcomes. The author concluded that evidence on the use of antibiotics in mild or uncomplicated diverticulitis is sparse and of low quality. There is no evidence mandating the routine use of antibiotics in uncomplicated diverticulitis, although several guidelines recommend this.

Shabanzadeh et al (2012) in another Cochrane review found a strong argument for limiting the use of antibiotics. However, the author concluded that the result of the new trial needs further confirmation from other similar trials. Ongoing trials will in the next few years be published on the subject [32].

Chabok et al, in a multicentre randomized trial involving ten surgical departments in Sweden and one in Iceland recruited 623 patients with computed tomography-verified acute uncomplicated left-sided diverticulitis. Patients were randomized to treatment with (314 patients) or without

(309 patients) antibiotics. Complications such as perforation or abscess formation were found in six patients (1·9 per cent) who received no antibiotics and in three (1·0 per cent) who were treated with antibiotics (P = 0·302). The mean hospital stay was 3 days in both groups. Recurrent diverticulitis necessitating readmission to hospital at the 1-year follow-up was similar in the two groups (16 per cent, P = 0·881).Antibiotics treatment for acute uncomplicated diverticulitis neither accelerates recovery nor prevents complications or recurrence. It should be reserved for the treatment of complicated diverticulitis [13]. David A Westwood (2013) in a commentary on this trial stated that antibiotics may not improve short term or long term outcomes in acute uncomplicated diverticulitis [33].

Our single centre prospective clinical trial of patients with CT-verified acute uncomplicated left-sided diverticulitis demonstrated an overall excellent outcome of no complication in either treatment group. Moreover, no differences were found between the groups with regard to frequency of surgery, length of hospital stay, recurrence of diverticulitis, abdominal pain, or changes in bowel habit after 24 months of follow-up. From these results it may be postulated that antibiotic treatment of acute uncomplicated diverticulitis does not prevent complications, accelerate recovery or prevent recurrence.

According to current guidelines by American colon and rectal surgeons, the recommended treatment of acute uncomplicated diverticulitis is bowel rest or intake of oral fluids and a 7–10-day regimen of broad spectrum antibiotics [34, 35]. This treatment strategy has been reported to be successful in 85–100 per cent of patients [36, 37]. The recommendations of antibiotic therapy are based on tradition and expert opinions, and not on evidence derived from controlled trials.

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There are some prospective studies regarding choice and duration of antibiotic therapy, but none challenging the use of antibiotics in this condition. There are only one RCT and two retrospective studies evaluating the need for antibiotics in uncomplicated that did not show any benefit of antibiotics [38, 39].

Overall, the few existing studies suggest that a subset of patients with acute uncomplicated diverticulitis can be managed safely without antibiotics [32]. This approach has already been embraced in Europe where a survey found that 90 % of Dutch surgeons and gastroenterologists manage mild diverticulitis without antibiotics [39]. In addition, recently published Danish national guidelines for treatment of diverticular disease do not recommend routine antibiotics for uncomplicated diverticulitis in patients without sepsis, significant comorbidity, pregnancy or immunosuppression [40]. Another large, multi-center trial of antibiotics versus no antibiotics is currently on-going in Europe and promises to shed more light on this issue [41].

Isacson D et al 2014 in their retrospective population-based cohort study identified 246 patients (195 with primary AUD and 51 with acute complicated diverticulitis) with CT scan. 178(91.3%) of the AUD were treated without antibiotic with a success rate of 91.3% and readmission rate of 3.4%. The remaining 17 patients (8.7%) in the AUD group were treated with antibiotics and one developed an abscess. The recurrence rate in the AUD group was 12.8% within 1 year [42].

Similarly findings were also noted in the Brochmann ND et al cohort study of 244, 73% (177) were managed without antibiotics with a failure rate of 4%, recurrence rate of 5%. The recurrence rate in the antibiotic group was 11% [43].

Strong arguments exist for limiting the use of antibiotics. Antibiotics can cause serious adverse events for patients, like allergic reactions and can even cause other life threatening infections of

the bowel. There is an escalating problem with antibiotic resistance among bowel pathogens [44]. As antimicrobial use generally precedes the emergence of resistance, preventing the spread of resistant pathogens clearly requires optimal use of antibiotics [45].

During the past decade, the prescription of antibiotics for children has been reduced by approximately 50 per cent in Sweden for certain diagnoses [46]. A similar policy with strict indications for antibiotic use might be adopted for uncomplicated diverticulitis.

Our study as well as the randomized controlled trials [13, 33] showed no, benefit of antibiotics. Although, these findings are very new, we think antibiotics can be safely withheld in appropriately selected patients with acute uncomplicated diverticulitis.

Apart from allergic reactions, we did not register any antibiotic side-effects such as antibiotic-associated abdominal pain, nausea, or diarrhoea with or without a Clostridium difficile infection. The possible development of such symptoms provides another important reason for reducing the use of antibiotics in these patients. There was no selection bias in this study as this study was conducted in five surgical teams in one hospital following unique selection criteria. Whoever wanted to be treated without antibiotics was placed in one group, whereas those who preferred to be treated with antibiotics were put in the other group. However, both study groups were similar with regard to important clinical symptoms, fever, inflammatory parameters, grade of abdominal pain and tenderness score, co-morbidity, age, sex and previous episodes of diverticulitis. Some studies have reported that perforation is most frequent during the first attack [47-49]. However, most of our patients presented for the first time and none of them had any perforation documented while in hospital or during follow up. Although one might argue that these patients would have been excluded initially by the CT scan findings during the selection process.

# IS ANTIBIOTIC THERAPY NECESSARY FOR THE MANAGEMENT OF ACUTE UNCOMPLICATED DIVERTICULITIS? A PROSPECTIVE COMPARATIVE STUDY

Our patients were grouped according to their wish, therefore, the finding of this study is a true reflection of the disease process and there was no selection bias. We were unable to detect any relationship for the eventual episodes of previous diverticulitis with complications as no complications were noted during our study period. In terms of symptoms and laboratory parameters, this cohort of patients was comparable to those of other studies that, in different ways, have evaluated antibiotic therapy in uncomplicated diverticulitis [37, 50]. Moreover, there were no differences between the groups regarding complications or recurrence of diverticulitis in patients with more severe symptoms and higher values for inflammatory parameters.

An important limitation of our study is the small number of patients in the study groups. The reason behind this is that, Trinidad and Tobago is small twin island with a population of only 1.3 million and also it is single centre study serving of only 500,000 to 600,000 people. However, the strong point was that we were able to register all of our eligible patients at our hospital, because of excellent coordination between the surgical units, supervised by a single clinician. The next point was that the selection process was verified by the coordinator, before enrolment of any patient in our study. We think the most important strength of our study was that our cases have to be discussed in our weekly audit meetings. Therefore, case and complications are 'publically' and accurately documented.

The results indicate that antibiotics do not prevent complications. An interesting finding in this study was that none of our patients underwent elective surgery, which reflects the recommendation of surgery only for complicated diverticulitis. Our study (zero per cent) along with Swedish study (1.4 per cent) indicates that patients with CT-proven uncomplicated diverticulitis have a very low risk of developing severe complications such as perforations or

abscesses. The question is whether or not hospital admission is necessary, and whether patients could return home without antibiotics.

The concept of outpatient non antibiotic management of the AUD patient is also emerging. Recently Isacson D et al in a prospective study of 155 patients with CT scan verified AUD, went on one step ahead and managed these patients in the outpatient's clinic without using any antibiotics with a failure rate of 2.6%. These 2.6% patients were managed successfully as inpatients without surgery. They had a similar and close follow up protocol like ours. The author concluded that the new policy of outpatient management without antibiotics in AUD is now shown to be feasible and safe [51].

In a recent systematic review comparing antibiotic versus non antibiotic treatment in patients with AUD, Mayl J et al 2017 found that the results were comparable and there was no difference in complication rates or recurrence in any of these studies [52].

The encouraging results of the two RCTs along with Isacson D et al prospective study as well as findings of our study should break the traditional dogma of mandatory antibiotic management of AUD. Therefore surgeons should avoid using unnecessary antibiotics for the management of their AUD patients. At present trials are on-going to investigate this (Clinical trial-2014) [53].

## CONCLUSION:

The aetiology of inflammation in acute diverticulitis remains unclear. The lack of effect of antibiotics demonstrated here suggests that the emerging theory that diverticulitis is, in fact, a type of inflammatory bowel disease deserves further consideration. In addition to the role of antibiotics, studies investigating the efficacy of anti-inflammatory agents are warranted. Our

study evaluated the need for antibiotic treatment in acute uncomplicated diverticulitis. It clearly showed that antibiotic therapy does not prevent surgical complications or recurrence, and does not shorten hospital stay. We think our study along with Chabok's and Isacson D et al study represent another successful challenge to the traditional management of acute uncomplicated diverticulitis. It is now the right time for the surgeons to manage all of their AUD patients conservatively without using antibiotic in hospital Antibiotics should only be reserved mainly for patients with complicated diverticulitis.

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