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INDICATIONS AND POSITIVITY RATES OF 14C-UBT FOR HELICOBACTER PYLORI DETECTION

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ABSTRACT

Background: In order to diagnose *H. pylori* infection, the 14C-UBT (14 Carbon Urea Breath Test) has become a popular non-invasive diagnostic method. Understanding the 14C-UBT indications and the associated positivity rates can offer helpful insights on the frequency of *H. pylori* infection in various clinical settings. The purpose of this study was to determine the prevalence of *H. pylori* infection as determined by the 14C-UBT and to analyze the causes of the patterns seen in various clinical presentations.

Methods: From 2012 through 2019, pertinent data, including biodata, symptoms, and test results, were obtained from the authorized register. Statistical software for social sciences (SPSS) v22 was used to examine the data once they had been entered into a spreadsheet.

Results: The findings revealed that the prevalence of *H. pylori* infection was highest in people between the ages of 41 and 50, with 45 of 167 patients testing positive. The most frequent reason for performing the 14C-UBT was dyspepsia, with a high positive rate of almost 63.29%. This result can be related to the recognized relationship between *H. pylori* and chronic gastritis and peptic ulcer disease, both of which are known to produce dyspeptic symptoms.

Conclusion: In addition to highlighting dyspepsia as the most frequent indication for the 14C-UBT, this study sheds light on the greater frequency of *H. pylori* infection in the 41–50-year age group. The diagnosis and treatment of illnesses linked to *H. pylori* can be aided by understanding these patterns and relationships, ultimately leading to better patient care.

INTRODUCTION

The bacteria *H. pylori*, commonly called *Helicobacter pylori*, is found in the stomach and is a recognized etiologic agent for a variety of gastrointestinal disorders, including gastritis, peptic ulcers, and even gastric cancer¹⁻². For the proper diagnosis and treatment of these disorders, *H. pylori* infection must be promptly and accurately detected³. The urea breath test (UBT) is an invaluable, non-invasive diagnostic tool in the diagnosis of *H. pylori* infection. Understanding the 14C-UBT indications and the associated positivity rates can offer helpful insights on the frequency of *H. pylori* infection in various clinical settings. *H. pylori* has been linked to a number of symptoms and diseases, including gastroesophageal reflux disease (GERD), dyspepsia, gastrointestinal bleeding, and abdominal pain⁴⁻⁶. Healthcare providers can better grasp the association between *H. pylori* infection and particular clinical presentations by examining the indications and positivity rates of the 14C-UBT. This knowledge will help them choose and interpret diagnostic tests appropriately.

An established non-invasive diagnostic technique for identifying *H. pylori* infection has emerged⁷. It is known as the 14C-UBT (14 Carbon Urea Breath Test). This test is based on the hypothesis that *H. pylori* has the urease enzyme, which may convert urea into ammonia and carbon dioxide (CO₂)⁷.

If *H. pylori* is present in the stomach, it metabolizes the labeled urea, resulting in the production of labeled CO₂. This principle is used in the 14C-UBT, which involves ingesting a small amount of a labeled carbon isotope (14C-labeled urea). The presence of labeled CO₂ in the exhaled breath is indicative of the presence of *H. pylori* infection⁸⁻⁹.

This study's objectives were to review the rationale for using the 14C-UBT and assess the corresponding positive rates in a particular patient group. By examining this data, the study sought to determine the prevalence of *H. pylori* infection among patients who presented with a range of reasons and to shed light on the clinical usefulness of the 14C-UBT in identifying *H. pylori* in varied circumstances. The findings of this study may aid in the diagnosis and treatment of gastrointestinal illnesses linked to *H. pylori*, thereby improving patient outcomes and enabling more focused treatment approaches.

METHODOLOGY

Study area and setting

The study was conducted at the University of Ilorin Teaching Hospital, a federal government-owned teaching hospital, located in Ilorin Metropolis, the capital city of Kwara State in North-central geopolitical zone of Nigeria. The study facility offers specialist medical, surgical, emergency, delivery, pediatric and immunization services. It also receives referrals from other lower cadre healthcare facilities in the state.

Study design and population

We conducted a retrospective study by reviewing a dedicated register for UBT conducted in University of Ilorin Teaching Hospital, Ilorin, Nigeria over a seven-year period (2012-2019). Patients included in this study were referred for UBT from the clinical departments in the hospital on account of various symptoms or disease conditions.

Sample size and sampling procedure

A whole population study of 259 patients, who took the 14C-UBT, was conducted in a teaching hospital in Ilorin Metropolis. The choice of facility of study was due to availability of

captured biodata, indications and test results for 14C-UBT. The hospital is the only tertiary health facility in the state and referrals for UBT are received from the clinical departments in the hospital, other hospitals in the state and neighboring states. This is the first report on the indications and results of UBT from this hospital since the procurement of the UBT machine (HELIPROBE®) in the year 2012. The information retrieved from the register between March 2012 and February 2019 (7-year period) included the age and sex of the patients, year the test was conducted, indications, and the results. The UBT test results were either reported as positive, negative or indeterminate.

Data collection

The selected facility keeps a hard copy dedicated register which contains the following information: patient name, age, folder number, address, sex and date, in which the test was conducted, indications for UBT and test results.

Data analysis

In a tertiary healthcare center, a retrospective study of the indications for UBT and the results during a 7-year period was conducted. Details on the patients' age, gender, test year, UBT indications, and test results were obtained from a special record. The statistical software for social sciences (SPSS) version 22 was used to conduct the analysis after the data were

entered into a spreadsheet. Frequency tables and charts were used to display the results.

Ethical considerations

Ethical approval was obtained from the Ethics and Research Committee of the University of Ilorin Teaching Hospital, Ilorin, Kwara State with approval number: ERC PAN/2021/10/1004. The study complied with all ethical protocols as contained in the Helsinki declaration.

RESULTS

Table 1 shows data on different variables, age groups, and gender, along with the number of participants and the number of positive 14C-UBT results for detecting *H. pylori* infection. The age distribution of the participants is shown across different age groups ranging from less than 20 years old to 71-80 years old. The largest age group was 41-50 years old, with 67 participants, closely followed by the 31-40 years old group with 65 participants. The gender distribution of the participants is also shown in the table. Of the 259 patients, 120 (46.3%) were males. The number of participants in each age group who tested positive for *H. pylori* using the 14C-UBT is also shown in the table. With 45 people testing positive, the 41 to 50 age group has the largest percentage of positive outcomes. The group of those aged 31 to 40 comes next, with 42 patients testing positive.

Table 1
Demographic data and Hp prevalence according to age, n

Variable	Total	Age group (years)						
		< 20	21-30	31-40	41-50	51-60	61-70	71-80
Number	259	24	42	65	67	45	11	5
Male gender	120	7	20	36	32	20	1	4
Female gender	139	17	22	29	35	25	10	1
Positive 14C-UBT	167	19 (11.4%)	28 (16.8%)	42 (25.1%)	45 (26.9%)	25 (15.0%)	6 (3.6%)	2 (1.2%)

Table 2 provides information on the 14C-UBT (14 Carbon Urea Breath Test) indications and accompanying test findings. The information in the table is displayed as percentages or frequencies.

Table 2
Helicobacter pylori prevalence according to indication for 14C-UBT, n (%)

Indication	N (%)	UBT Result			Total	%Positive 14C-UBT
		Positive	Negative	Indeterminate		
Dyspepsia	188 (72.59)	119	67	2	188	63.29
GERD	7 (2.7)	6	1	0	7	85.71
GI bleeding	3 (1.16)	1	2	0	3	33.33
Chronic urticaria	16 (6.18)	13	3	0	16	81.25
Chronic prurigo	1 (0.39)	1	0	0	1	100
Chronic Hepatitis B	4 (1.54)	3	1	0	4	75
Abdominal pain	18 (6.95)	13	5	0	18	72.22
Acute glomerulonephritis	1 (0.39)	1	0	0	1	100
Enteritis	2 (0.77)	2	0	0	2	100
Fainting attack	1 (0.39)	1	0	0	1	100

H. pylori was found in 13 out of the 18 patients with abdominal pain using the 14C-UBT. Consequently, 72.22% of the time the test was successful. Only one patient had acute glomerulonephritis, and that patient's 14C-UBT was positive. Similar to that, there was just one patient with chronic prurigo, and in that case, 14C-UBT detected *H. pylori* infection. Of the 16 patients with chronic urticaria, 13 (81.25%) tested positive to *H. pylori*. In 119 (63.29%) of the 188 patients referred on account of dyspepsia, the 14C-UBT revealed a positive

result thus confirming *H. pylori* infection. Surprisingly, two patients with enteritis were referred for UBT, and both tested positive for *H. pylori*. One person experienced a fainting attack, and the 14C-UBT revealed that the patient had *H. pylori*. Six subjects tested positive for *H. pylori* using the 14C-UBT, yielding a positivity rate of about 85.71% out of the 7 cases of GERD. One of three patients who had GI bleeding tested positive for *H. pylori* using the 14C-UBT, yielding a positivity percentage of about 33.3%. Three patients

tested positive for *H. pylori* using the 14C-UBT out of the four patients with chronic hepatitis B, yielding a positivity percentage of about 75.0%.

DISCUSSION

This study demonstrated that the prevalence of *H. pylori* infection, as determined by the 14C-UBT, is highest in those between the ages of 41 and 50, with 45 patients testing positive. The greater prevalence of *H. pylori* infection in this age group may be due to a number of factors including: (a) Person-to-person transmission of *H. pylori* infection frequently occurs throughout childhood or the early stages of adulthood, typically within families⁹. By the time people are in their 40s, they may have been exposed to *H. pylori* for a longer period of time, increasing the possibility that they would become infected¹⁰, and (b) through time, people may acquire several risk factors that lead to *H. pylori* infection.

Socioeconomic position, living circumstances, dietary preferences, personal hygiene routines, and lifestyle choices are some examples of these risk variables^{11,12}. By the time people are in their 40s, they may have come into contact with more of these risk factors, increasing the prevalence of *H. pylori* infection; (c) different people may react differently to *H. pylori* infection. Age-related immune system changes could make it more difficult to manage or get rid of the *H. pylori* infection¹³. A higher frequency of *H. pylori* infection in the 41–50-year-old age group may be caused by this impaired immune response, and (d) diagnostic bias may also play a role in this increased prevalence¹⁴. This age group may be more likely to undergo diagnostic tests like the 14C-UBT or visit a doctor if they experience gastrointestinal issues. It is important to keep in mind that a variety of factors, such as socioeconomic status, lifestyle, and geographic

location, can influence the prevalence of *H. pylori* infection¹⁵. More research and analysis would be needed to confirm and better understand the precise mechanisms generating the observed pattern in this particular study population.

Dyspepsia, commonly referred to as indigestion, is characterized by recurrent or chronic pain or discomfort in the upper abdomen. Chronic gastritis and peptic ulcer disease, which can both present with dyspepsia, have been linked to *H. pylori* infection¹⁶. The role of *H. pylori* in the pathophysiology of both diseases has been well established.¹⁷As a result, testing for *H. pylori* infection using the 14C-UBT becomes a typical diagnostic strategy when patients complain of dyspeptic symptoms. The results of the study revealed that patients with dyspepsia had a high positivity rate for *H. pylori* (63.29%). Persons with GI bleeding are more likely to be referred for upper GI endoscopy than for 14C-UBT because the former unlike the latter will help unravel the source of the bleeding hence the fewer number of requests for UBT on account of GI bleeding compared to when the patient has dyspepsia only. The rising use of the 14C-UBT for identifying *H. pylori* infection in people presenting with dyspepsia may be due to the high prevalence of *H. pylori* among dyspeptic patients¹⁸. Again, recommendations and guidelines from the medical community have a big impact on clinical practice with most guidelines recommending the use of a non-invasive test such as UBT or stool antigen test (SAT) for *H. pylori* detection in dyspeptic patients in the absence of alarm symptoms¹⁹. When recommending testing for *H. pylori* in patients with dyspepsia, guidelines frequently take the incidence of *H. pylori* infection in various clinical settings into account²⁰. This may also be a factor in why dyspepsia was

observed as the commonest indication for 14C-UBT in our study.

Abdominal pain can be a symptom of peptic ulcer disease and *H. pylori*-associated gastritis²¹⁻²². A significant relationship between *H. pylori* and abdominal pain in the study population is suggested by the 72.22% positive rate.

A skin disorder called chronic urticaria is characterized by repeated welts or hives that persist more than six weeks²³. Despite the fact that the precise pathogenetic mechanisms are not fully understood, certain studies have indicated a connection between chronic urticaria and *H. pylori* infection²⁴. According to some theories, *H. pylori* infection may set off an immunological response that releases histamine, ultimately resulting to urticaria²⁵. The high *H. pylori* positive rate of 81.25% among the patients with chronic urticaria in our study suggests a possible association between *H. pylori* infection and this skin condition.

However, more research effort would be required to demonstrate causality.

CONCLUSION

In conclusion, this study showed that the highest frequency of *H. pylori* detection using 14C-UBT was observed in the 41–50-year age group. This observation may be explained by a number of factors, including long-term *H. pylori* infection, the accumulation of risk factors from childhood, modifications to the immune system, and potential diagnostic bias. Given the well-established relationship between *H. pylori* infection and gastrointestinal disorders that commonly present with dyspepsia, dyspepsia was observed to be the most frequent indication for performing the 14C-UBT in our hospital. High *H. pylori* positive rates were observed in patients with

chronic urticaria, GERD, dyspepsia and abdominal pain, indicating a possible association between these diseases or underlying diseases responsible for the symptoms and *H. pylori* infection. However, more studies are needed to examine these relationships and comprehend the precise variables affecting *H. pylori* prevalence in various age groups and clinical manifestations.

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