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Effect of *Helicobacter pylori* Infection on Selected Biochemical Parameters of Hypertensive Patients at Dschang District Hospital in Cameroon

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Authors' contributions

This work was carried out in collaboration between all authors. Author JDDT designed the study, supervised laboratory work, wrote the protocol, performed the statistical analysis and wrote the first draft of the manuscript. Authors YATG and MEN participated in the data collection and analysis of the manuscript. Authors VLN and AKD helped in the data collection and managed the literature searches. Author JRK assisted in the conception and supervision of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: *Helicobacter pylori* infection is an important cause of peptic ulcer disease and other gastrointestinal disorders. The gastritis caused by *H. pylori* leads to lipid metabolism disorders that may act as risk factors for hypertensive patients. The aim of the study was to seek for possible correlation between *H. pylori* IgG seropositivity and the variations of some biochemical parameters amongst hypertensive patients in the District Hospital of Dschang.
Place and Duration of Study: Department of Biochemistry and District Hospital of Dschang, between November 2015 to March 2016.
Methods: We conducted a cross-sectional study from November 2015 to March 2016 consecutively enrolling 125 consenting patients of average age 54.36 ± 8 years attending the

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hospital for medical check-up. Two blood pressure measurements and the determination of IgG anti *H. pylori* by the indirect enzyme-linked immunosorbent assay (ELISA) technique, enabled us to distinguish four groups of patients: hypertensive (HT+), *H. pylori* IgG seropositive (HP+), *H. pylori* IgG seropositive and hypertensive (HT+HP+), and a group of patients free from the two pathologies (HT-HP -). Measurements of biochemical parameters such as total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, creatinine, CRP, glucose and albumin were done in serum/plasma by methods resulting from commercial kits.

Results: Analysis of biochemical data showed significant elevated levels ($p < 0.05$) of total cholesterol, creatinine, albumin and LDL cholesterol levels in the groups HT+ and HT+HP+ compared to the group of HT-HP -. Moreover, average rate of HDL cholesterol was significantly lower in the groups HT+, HT+HP+ and HP+ compared to the control group (HT-HP-). Abnormal high elevated levels of LDL cholesterol, HDL cholesterol, total cholesterol, trigylcerides, CRP and creatinine were observed in the groups HT+HP+, HP+ and HT+ as compared to the group HT-HP-.

Conclusions: Our findings suggest a significant association between *H. pylori* IgG seropositivity and hypertension and the joint effects of these two diseases on certain biochemical parameters studied. These results constitute an original contribution in the monitoring and handling the studied pathologies.

Keywords: H. pylori IgG seropositivity; hypertension; association; biochemical parameters.

ABBREVIATIONS

AT: antibody titers; BMI: Body mass index; BP: blood pressure; CI: 95% confidence interval; CRP: C-reactive protein; CVD: cardiovascular disease; DHD: District Hospital of Dschang; ELISA: indirect enzyme-linked immunosorbent assay; HDL: low density lipoprotein; Helicobacter pylori: H. pylori; HP+: Helicobacter pylori positive patients; HP+HT+: Helicobacter pylori positive and hypertensive patients; HT+: hypertensive patients; HT-HP-: Helicobacter pylori negative and normotensive patients; IgG: Immunoglobulin G; LDL: low density lipoprotein; OD: optical density; OR: odds ratio; SPSS: statistical package for social science.

1. INTRODUCTION

Helicobacter pylori is a Gram-negative, microaerophilic bacterium that can inhabit various areas of the stomach, particularly the antrum. The bacterium is present in saliva, gastric secretions, faeces, and dental plates and thus can be transmitted by oral-oral and oral-fecal routes [1,2]. More than 50% of the world's population harbor *H. pylori* in their upper gastrointestinal tract [3]. The prevalence of *H. pylori* infection increases with age world-wide [4]. In the United Kingdom about 30% of 30 year olds are infected while the proportion increases to 60% in those aged over 45 years [5,6]. Studies carried out in different regions of Cameroon found the prevalences of this infection equal to 72.50% [7], 68.3% [8] and 79.82% [9]. The prevalence of *H. pylori* was 50% in HIV^+ patients and 55% in HIV^- patients with gastro-intestinal symptoms in the University Teaching Hospitals in Cameroon [10]. Infection is strongly associated with gastric cancer, duodenal and gastric ulcerations [11]. Gastritis is a common disease in whole world and almost 10% of people of the world are suffering from it. *H. pylori* colonization from childhood may relate to cardiovascular disease (CVD) risk [6]. Indeed, *H. pylori* is a bacterium with effects like endothelial injury, smooth muscle proliferation, and local inflammation on the vascular wall. The bacterium has indirect effects as proinflammatory, procoagulant, and atherogenic action; these can change risk factors (lipid profile, coagulation, levels of oxidative metabolites), production of cross-reactive antibodies, malabsoprtion of nutrients and vitamins, and metabolic factors such as overproduction of ammonia [12]. It has been also found that a significant decrease in blood pressure values, in particular in diastolic blood pressure values, occurs after *H. pylori* eradication in hypertensive patients [13]. Arterial hypertension is a pathology affecting about 20% of the world's population [14] and represents the most important risk factor for cardiovascular diseases. Numerous studies have showed that *H. pylori* infection might modify serum lipid concentrations [15-18]. These alterations promote atherogenesis, which have been attributed to the action of bacterial lipopolysacchride [19]. However, other studies have not confirmed these findings [20-22].

Moreover, the predictive role of *H. pylori* infection in atherosclerosis which is a risk factor for high blood pressure is still a matter of debate. The aim of this study was to seek for possible correlation between *H. pylori* IgG seropositivity and the variations of selected biochemical parameters amongst hypertensive patients at Dschang District Hospital in Cameroon.

2. METHODOLOGY

A cross sectional study was carried out from November 2015 to March 2016 on hypertensive patients on which biochemical parameters and *H. pylori* IgG titer were measured.

The study was carried out in the District Hospital of Dschang (DHD), Western Region of Cameroon. The DHD is one of the well-equipped hospitals in the Western Region of Cameroon. Moreover, hypertensive center is present and function well. One hundred and twenty five volunteer' patients were enrolled in this study and divided into four groups according to the diagnosis of *H. pylori* IgG seropositivity and hypertension. They were hypertensive (HT+), *H. pylori* positive (HP+), both *H. pylori* positive and hypertensive (HP+HT+) and *H. pylori* negative and normotensive (HT-HP-) patients attending the hospital for medical check-up or admitted in the hospital. The groups were matched for age and gender was equal in each group. To minimize confounding factors, we excluded patients with pre-history of specific disorders like hepatic diseases, diabetes, thyroid abnormalities, renal failures as well as smokers, alcoholics and people with low activities. Blood pressure (BP) was recorded using a manual sphygmomanometer after the patient rested for 15 minutes. BP was taken three times on the left arm in the supine position at the level of the heart, by the same trained physicia, following the World Health Organization (WHO) guidelines [23].

Specific anti–*Helicobacter pylori* IgGs were measured by use of a commercial ELISA (Golden Bio Technologies Corp – USA) according to the manufacture's instructions. Titers were defined as positive or negative according to a cutoff value of 20 U/ml (sensitivity and specificity 95%). The study was approved by the Ethics Review and Consultancy Committee of the Cameroon Bioethics Initiative. All subjects were informed about the study and their written consent was obtained.

2.1 Collection of Blood and Biochemical Analysis

Blood collection was specifically done by a qualified technician. The antecubical vein of the forearm was selected and disinfected with 70% alcohol cotton wool swab. Five millilitres of venous blood were collected into a dry tube pre-labelled with an anonymised patient codes. The blood sample was allowed to clot completely before centrifugation at 3000 rpm for 15 min to obtain serum. Serum was separated from the clot into tightly screwed microfuge tubes and stored at -20 °C. These frozen sera were later analyzed for the biochemical parameters. Fasting albumin, glucose, potassium, creatinine, triglycerides, HDL cholesterol and total cholesterol were measured in serum while glucose was measured in plasma by using INMESCO commercial kits (INMESCO Gmbh – Germany). LDL cholesterol was determined by calculation using Friedewald's formula [24]. The CRP-latex which is a slide agglutination test was used for the qualitative detection of C - reactive protein (CRP) in patient serum.

2.2 Statistical Analysis

Statistical analysis was carried out using Statistical Package for Social Science (SPSS for Windows, Version 20.0, SPSS Inc, Chicago, IL). The data were expressed as the mean ± Standard Deviation (SD). Biochemical parameters were subjected to analysis of variance and when a difference existed for each biochemical parameter taken individually, the test of Waller Duncan to the threshold of probability 5% was used to separate these averages. The bivariate correlation of Pearson was used to determine association between pathological status of patients and variations of the biochemical parameters.

3. RESULTS

A total of 125 volunteer's patients (average age 54.36 ± 8 years) of the two sexes, who attended the hospital for medical check-up, were enrolled into the study. The patients consisted of 41 (32.80%) hypertensive (HT+), 15 (12.00%) *H. pylori* positive (HP+), 36 (28.80%) hypertensive and *H. pylori* positive (HT+HP+) and 40 (26.40%) normotensive and *H. pylori* negative (HT-HP-). These data give a prevalence of 46.75% of *H. pylori* IgG seropositivity amongst hypertensive patients versus 27.27% in non hypertensive

patients. Measurements of biochemical parameters such as total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, creatinine, CRP and albumin were done with sera while glucose was measured with plasma. Average rates of studied biochemical parameters in target population are summarized in Table 1. The analysis of results showed that total cholesterol, creatinine, albumin and LDL cholesterol rates were significantly higher ($p < 0.05$) in the groups HT+ and HT+HP+ compared to the groups HP+ and HT-HP-. Moreover, average rate of HDL cholesterol was significantly lower in the groups HT+, HT+HP+ and HP+ compared to the control group (HT-HP-). On the other hand, average rates of potassium and triglycerides were not influenced by *H. pylori* infection.

Since the average rates of biochemical parameters could hide some existing abnormalities, the proportions of abnormal values of participants were calculated for each biochemical parameter (Table 2). It appears from the results that high prevalences of abnormal LDL cholesterol, HDL cholesterol, total cholesterol, trigylcerides, CRP and creatinin were observed in the groups HT+, HP+, and HT+HP+ as compared to the group HT-HP- (Table 2). Moreover, the proportion of participants with abnormal albumin and potassium was less important in all the groups. The total cholesterol /HDL cholesterol and LDL/HDL cholesterol ratios were significantly high in the patients groups (HT+, HT+HP+ and HP+) compared to control group (HT-HP-).

The correlations between some studied biochemical parameters have been established (Table 3). It was observed in general that a significant correlation ($p < 0.01$) exist between these biochemical parameters. As such, a significant positive correlation exists between total cholesterol, LDL cholesterol and albumin. Furthermore, albumin was also positively correlated to potassium.

4. DISCUSSION

The high prevalence of 46.75% of *H. pylori* IgG seropositivity amongst hypertensive patients may show that this infection is a risk factor for hypertension. Previous studies suggested that *H. pylori* infection may cause lipid alteration and at least partially contribute to the process of atherosclerosis which is a risk factor of hypertension [25]. This may be due to the release of cytotoxic substances either of bacterial origin or produced by the host in the host system [13]. In the present study, we showed that *H. pylori* IgG seropositivity induces high LDL cholesterol, high total cholesterol and low HDL cholesterol levels in accordance with the findings of Takashima *et al*. [26] who realized that patients infected with *H. pylori* showed an atherogenic lipid profile characterized by an increase LDL cholesterol and/or decreased HDL due to systemic inflammation caused by *H. pylori* infection. This was further supported by Aando et al. [27] who suggested that infection with *H. pylori* may play an important role in decreasing serum HDL-Cholesterol and increasing serum LDL-Cholesterol. These results support the fact that biochemical parameters of atherosclerosis in the serum are associated with *H. pylori* infection and hypertension. The total cholesterol/HDL cholesterol ratio, known as the atherogenic or Castelli index and the LDL/HDL cholesterol ratio are two important components and indicators of vascular risk, the predictive value of which is greater than the isolated parameters [28]. In this respect, patients of groups HT+, HP+ and HT+HP+ with the total cholesterol/HDL cholesterol ratio and the LDL/HDL cholesterol ratio significantly high, have an atherogenic risk greater than those of control group. These findings are similar to those reported in the literature [15,18]. The speculation of the exact relationship between *H. pylori* and hypertension might be an important issue in an attempt to reduce the cardiovascular disease incidence.

High prevalences of abnormal LDL cholesterol, total cholesterol and triglycerides were observed in the groups HT+, HP+ and HT+HP+ as compared to the group HT-HP-. This results are in the same line with those of Kim et al. [25] who showed that *H. pylori* is independently associated to elevated LDL cholesterol levels. The other two parameters (total cholesterol and triglycerides) were instead influence by hypertension and the joint effect of these two pathologies greatly influence these parameters [29]. Further, abnormal high prevalence of HDL cholesterol was observed in all the groups. In normal conditions, insulin facilitates the catabolism of LDL cholesterol by acting directly on its receptors and induces the metabolism of HDL cholesterol by the activation of lecithine cholesterol acyltransferase, inhibiting the activity of transfer proteins of phospholipid and by modulating the action of hepatic lipase [30]. This would eventually reduce the rate of LDL cholesterol and increase the rate of HDL

Table 1. Biochemical parameters according to *H. pylori* and Hypertension status

Biochemical parameters (normal range)	Hypertensive and *H. pylori* positive group	Hypertensive group	*H. pylori* positive group	*H. pylori* negative and normotensives
Total cholesterol in g/l (< 2)	1.81 ± 0.94[b]	1.74 ± 0.92[b]	1.42 ± 0.21[b]	1.17 ± 0.52[a]
HDL cholesterol in g/l (> 0.6)	0.22 ± 0.15[a]	0.21 ± 0.10[a]	0.24 ± 0.16[a]	0.36 ± 0.21[b]
LDL cholesterol in g/l (< 1.3)	1.74 ± 0.93[b]	1.65 ± 0.91[b]	1.46± 0.49[ab]	0.84 ± 0.39[a]
Triglycerides in g/l (< 1.5)	0.74 ± 0.42[a]	0.88 ± 0.10[a]	0.96 ± 0.20[a]	1.06 ± 0.65[a]
Creatinin in g/l(0.6-1.30)	1.52 ± 0.74[c]	2.95 ± 0.35[b]	0.89 ± 0.27[a]	0.85 ± 0.21[a]
Albumin in g/dl (2.9-6.1)	3.63 ± 1.27[b]	3.86 ± 1.10[b]	2.82 ± 0.43[a]	2.69 ± 0.61[a]
Potassium in mEq/l (2-7)	4.62 ± 1.95[a]	4.55 ± 1.26[a]	4.02 ± 1.04[a]	4.20 ± 1.09[a]
Total Cholesterol/HDL-C (≤ 4.5)	8.22 ± 1.84[a]	8.29 ± 2.03[a]	5.91 ± 2.41[a]	3.26 ± 1.15[b]
LDL-C/HDL-C (≤ 3.6)	7.91 ± 1.24[a]	7.86 ± 2.57[a]	6.08 ± 2.17[a]	2.32 ± 1.33[b]

On the same line, values affected by different letters (a, b, c) differ significantly at the threshold of probability 5%

Table 2. Distribution of biochemical abnormalities in the various groups of the study population

Biochemical parameters	Hypertensive and *H. pylori* positive group	Hypertensive group	*H. pylori* positive group	Control group	P value
HDL Cholesterol n (%)	31 (86.11%)	41 (100%)	15 (100%)	13 (36.36%)	< 0.05*
LDL Cholesterol n (%)	29 (80.55%)	33 (80.48%)	14 (93.33%)	9 (27.27%)	< 0.05*
Triglycerides n (%)	35 (97.22%)	39 (95.12%)	13 (86.66%)	17 (51.51%)	< 0.05*
Total cholesterol n (%)	28 (77.77%)	33 (80.48%)	11 (73.33%)	2 (6.06%)	< 0.05*
Creatinin n (%)	34 (94.44%)	39 (95.12%)	15 (100%)	11 (33.33%)	< 0.05*
Albumine n (%)	5 (5.55%)	1 (2.43%)	0 (0.0%)	4 (12.12%)	NS
Potassium n (%)	4 (11.11%)	3 (7.31%)	1 (6.66%)	2 (6.06%)	NS
CRP n (%)	16 (44.44%)	15 (36.58%)	6 (40.00%)	3 (9.09%)	< 0.05*

**on the same line, values of the test groups are significantly different to the control group; NS: no significant*

Table 3. Correlation between some studied parameters

Parameters	Total cholesterol	LDL cholesterol	Albumine	Potassium
Total Cholesterol		0.963**	0.409**	
LDL cholesterol	0.963**		0.432**	
Albumine	0.409**	0.432**		0.328**
Potassium			0.328**	

***: correlation is significant at p < 0.01*

cholesterol. As such, if insulin comes to be altered by mechanism such as chronic inflammation induced by *H. pylori*, abnormalities in the lipid profile arises [31]. It is also have to note that some biochemical parameters (HDL cholesterol, LDL cholesterol, triglycerides and creatinine) were abnormally high in the control groups. This situation of abnormality in the control group could occur due to other factors other than the two pathologies studied. As such, further studies shall enable us to evaluate these factors.

5. CONCLUSION

Our study was led with the main goal to evaluate the possibility of using biochemical parameters in the monitoring of hypertensive patients suffering from *H. pylori* infection at the District Hospital of Dschang. The results obtained showed that the average rate and abnormal prevalence of LDL cholesterol were higher in *H. pylori* IgG seropositive patients than in seronegative patients. Abnormal high prevalences of LDL cholesterol, total cholesterol and HDL cholesterol were observed in the groups HT+, HT+HP+ and HP+ as compared to the group HT-HP-. These parameters are influenced by both hypertension and *H. pylori* IgG seropositivity suggesting a significant association between *H. pylori* and hypertension as well as the effects of *H. pylori* IgG seropositivity on hypertension and LDL cholesterol. Our results thus provide additional evidence that *H. pylori* may play a role in inducing atherosclerosis with lipid metabolism by elevating LDL cholesterol level. Based on these results, it is conceivable that *H. pylori* infection is a predisposing factor for the process of atherosclerosis and can be a reliable indicator for the assessment of cardiovascular problems such as hypertension.

6. STUDY LIMITATIONS

Dependence on only serological evidence for presence of *H. pylori* infection and small sample size could be the limitations of this study. Its strength, however, is its cross sectional design with suitable adjustments for confounding factors.

CONSENT AND ETHICAL APPROVAL

All participants willingly provided informed consent either by signing or placing their thumbprint on the consent form. This investigation was approved by the Ethics Review and Consultancy Committee of the Cameroon Bioethics Initiative.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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