Current Science International Volume : 04 | Issue : 04| Oct.-Dec.|2015
ISSN 2077-4435 Pages: 714-723

Helicobacter pylori and Egyptian blood group types

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ABSTRACT

Helicobacter pylori (*H. pylori*) infection is one of the most common bacterial infections in humans and major cause of gastritis. Blood group antigen has been implicated as a putative receptor for *H. pylori* in the gastric mucosa. Aim: investigating the association of *H. pylori* with ABO/Rh blood groups in Egyptians. Method: Blood and stool specimens of 76 Subjects were included in this study. The stool samples were analyzed for *H. pylori* antigen using rapid anti *H. pylori* test. Every subject's blood group and Rhesus factor were determined by Lewis blood group phenotyping and haemagglutination inhibition test. Results: From the total 76 studied subjects: 37 (48.7%) were males (89.1% of them infected with *H. pylori*) and 39 (51.3%) were females (94.9% of them infected with *H. pylori*); whose age ranged from 1.5-70 years; Subjects with blood group A were 34 (94% of them infected with *H. pylori*); Blood group B were 10 (90% of them infected with *H. pylori*); Blood group O were 26 (96% of them infected with *H. pylori*); Blood group AB were 6 (67% of them infected with *H. pylori*); Subjects with positive Rh were 73 (96% of them infected with *H. pylori*) and the 3 subjects with negative Rh were all infected with *H. pylori*. Conclusion: The results of this study suggest that: subjects with AB type of blood groups are more resistant to infection with *H. pylori* while those with A, O type or Rh negative are more susceptible to this infection; B types are at high risk of the infection.

Key words: Blood groups, Helicobacter pylori, Egyptian.

Introduction

Helicobacter pylori (*H. pylori*) is a Gram-negative bacterium, it is one of the most common bacterial infections in humans. It is known to cause chronic gastritis and peptic ulcers and to increase the risk of gastric cancer (Goodman and Correa 1995; Kusters *et al.,* 2006; Sethi *et al.,* 2013).

Infection with *H. pylori* has a reported annual incidence of 0.3-0.7% in developed countries and 6-14% in developing countries. It is estimated that the percentage of universe population that are affected by *H. pylori* is 50%. Its prevalence is extremely high among Egyptian school children and is one of the main causes of their growth (Logan and Walker 2001; Kazemian *et al.,* 2014).

Blood group is a clinical significance for transfusion and transplantation. It is becoming increasingly apparent that ABO antigens are of biological significance and may be associated with predisposition to, or protection from, many diseases (Reid and Bird, 1990).

H. pylori bacteria can recognize and bind to blood group antigens expressed on the surface of the gastric mucosa. The involvement of blood group carbohydrates as facilitating factors for infection by this bacillus may play a critical role in the persistence of infection (Loffeld and stobbering 1991; Boren *et al.,* 1993). In Brazilian patients submitted to upper gastrointestinal endoscopy, it has been demonstrated that infection by this gram-negative bacillus is associated with ABO blood groups (Borén *et al.,* 1993; Mattos *et al.,* 2002).

The first convincing study relating ABO blood group and gastric cancer, which is more common in group A can be traced back to 1953 (Aird *et al*., 1953; Iodice *et al.,*2010). Association between ABO blood group and risk of pancreatic cancer has been known for more than 40 years but received little attention (Aird *et al.,* 1953; Aird *et al*., 1960). The ABO phenotype has been linked with stomach ulcers, which are more common in group O individuals and gastric cancer (Clark *et al.,* 1956; Iodice *et al.,* 2010). In contrast, the relevance of the interaction between the ABO blood group and *H. pylori* infection for the development of pancreatic cancer was recently analyzed by Risch *et*

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al., 2010. They reported that the increased risk of pancreatic cancer among the individuals with non-O blood group was even higher if they were also seropositive for CagA-negative *H. pylori*.

However, many studies recorded significant association between O blood group and *H. pylori* infection (Mattos *et al.,* 2002; Mattos *et al.,* 2010; Jaff, 2011) while many others failed to establish such an association (Tadege *et al.,* 2005; Moges *et al.,* 2006; Rasmi *et al.,* 2011; Zhub *et al.,* 2011). The current study has investigated the association of *H. pylori* with ABO/Rh blood groups in a group of Egyptians.

Patients and Methods

A total of 76 Subjects (37 were males and 39 were females) exhibiting symptoms related to gastro-intestinal troubles participated in this study at abdomen clinics of Alexandria University hospitals. Consent was taken from all patients before sampling. From these subjects, 76 Blood and 76 stool specimens were collected. The stool samples were analyzed for *H. pylori* antigen using: Rapid Anti *H. pylori* test. Every subject's blood group and Rhesus factor were determined by Lewis blood group phenotyping and haemagglutination inhibition test.

Collection of blood sample

The skin was cleaned with a 70% alcohol swab and allowed to dry before being punctured. Blood samples were taken by sterile venipuncture: 2.5ml of blood was drawn from the vein into tube containing 50µl Ethylene Diamine Tetra Acetic acid (EDTA).

Collection of stool samples

Samples were transferred to vials with the extraction fluid, vigorously agitated, and stored at 4ºC until used.

Rapid H. pylori Stool Antigen Test

Stool test was performed in the immuneparasitlogy laboratory, department of Zoology, Central laboratories, Faculty of Science, Al-Azhar University, using One Step *H. pylori* Card test.

Cold extracted stool samples were left for two minutes for settling of suspended particulates. Two drops were then transferred into the circular port hole of the test cassette and results were recorded after 10 min of incubation at room temperature. Two red lines at the middle of the strip indicate a positive result, while negative result is an indication of only one red line.

Determination of ABO blood group antigens

The ABO blood group phenotypes were identified by hemagglutination using commercial anti-A, anti-B and anti-D (Fresenius Kabi, Brazil), the ABO blood grouping procedure is based on the principle of agglutination as the patient's blood is reacted with anti-A, anti- B and anti-D antibodies separately.

Statistical analysis

Analysis and interpretation data were entered and analyzed using (Minitab ® 18.1). Chi square test was applied and P-values less than 0.05 were considered as statistically significant.

Results

Blood groups

The total studied subjects were 76: blood group A represented by 34 (44.7%); type O by 26 (34.2%); type B by 10(13.2%) and type AB by 6(7.9%) subjects, table 1.

Table1: Association of ABO/Rh blood groups with *H. pylori* infection in 76 subjects (1-70 years old, 37 males and 39 females).

Characteristic		**O** (26) 34.2%	**A** (34) 44.7%	**B** (10) 13.2%	**AB** (6) 7.9%	**Total** (76) 100%	**P-Value** 0.000*
Gender	**Male**	15 (19.7%)	11 (14.5%)	7 (09.2%)	4 (05.3%)	37 (48.7%)	0.065
	Female	11 (14.5%)	23 (30.3%)	3 (03.9%)	2 (02.6%)	39 (51.3%)	0.000*
Age Group	**1 -20**	3 (03.9%)	4 (5.3%)	3 (03.9%)	0 (00%)	10 (13.2%)	0.199
	21- 40	20 (26.3%)	22 (28.9%)	5 (06.6%)	5 (06.6%)	52 (68.4%)	0.005*
	41- 70	3 (03.9%)	8 (10.5%)	2 (02.6%)	1 (01.3%)	14 (18.4%)	0.034*
Rh	**Positive**	24 (31.6%)	33 (43.4%)	10 (13.1%)	6 (07.9%)	73 (96.1%)	0.000*
	Negative	2 (02.6%)	1(01.3%)	0 (00%)	0 (00%)	3 (03.9%)	0.691
H. pylori	**Positive**	25 (32.9%)	32 (42.1%)	9 (11.8%)	4 (05.3%)	70 (92.1%)	0.001*
	Negative	1 (01.3%)	2 (02.6%)	1 (01.3%)	2 (02.6%)	6 (07.9%)	0.002*

**Significant P<0.05. ABO and Rh blood type distribution by Egypt population averages: O^+ (52%); A^+ (24%); B^+ (12.4%); AB^+ (3.8%); O^- (52%); A^- (24%); B^- (12.4%) and AB^- (3.8%) according to CIA World Factbook.*

H pylori

The total rate of infection with *H. pylori* was 70 (92.1%), table 1 and figure 1-A. The ABO blood groups were significantly distributed as follow: in infected patients, O (32.9%), A (42.1%), B (11.8 %) and AB (05.3%) while in non-infected subjects, O (01.3%), A (02.6%), B (01.3%) and AB (02.6%), table 1 and figure 1-B. Also, 94% of cases were significantly associated with H. pylori infection in type A; 96% in type O; 90% in type B and 67% in type AB (table 2 and figure 2).

Gender

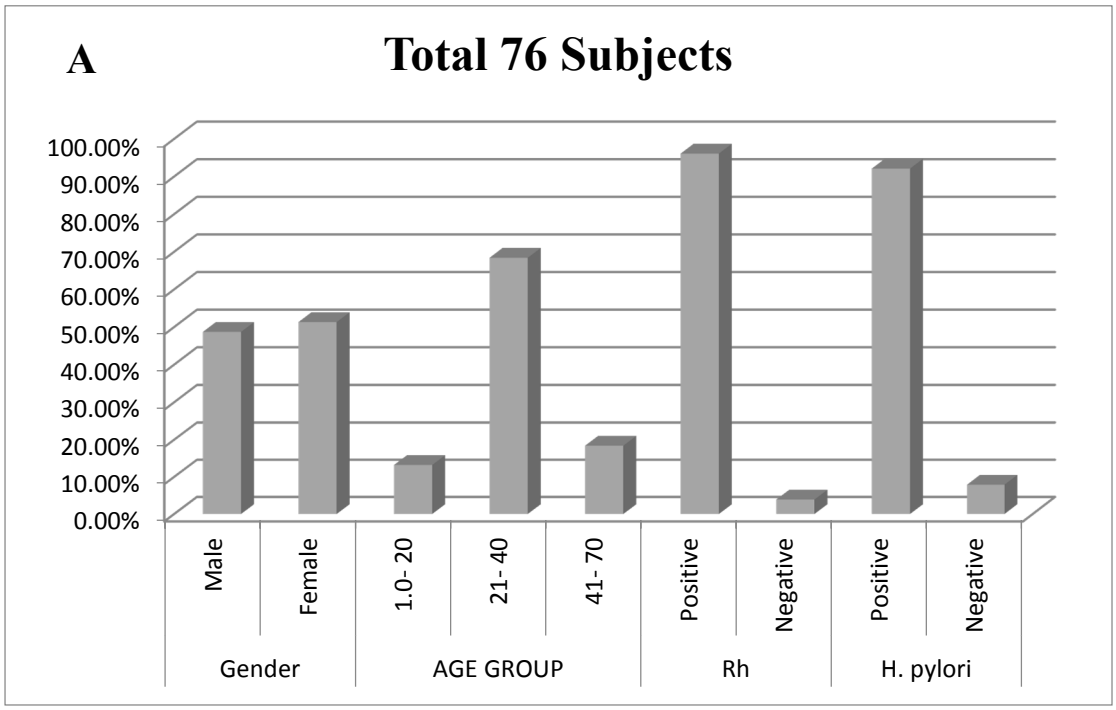
From the total of 76 Subjects: 37 (48.7%) were male and 39 (51.3%) were female (Table 1 and Figure 1-A). The non-significant difference in the rate of infection with *H. pylori* was 89.1% in males and 10.9% in females (table 2 and figure 2). The ABO blood groups distribution (non-significant in males but significant in females) was as follow: O (19.7% males; 14.5% females), A (14.5% males; 30.3% females), B (09.2% males; 03.9% females), AB (05.3% males; 02.6% females), table 1 and figure 1-B.

Age groups

The age of the studied subjects ranged from 1.5-70 years and was divided into three age groups: young (1-20), middle (21-40) and old (41-70) years. The distribution of subjects between age groups was significant: the young group represented 13.2%, the middle age 68.4% and the old age 18.4% of the total studied subjects (Table 1 and Figure 1-A). The significant difference in the rate of infection with *H. pylori* was 81.8% in young group, 92.3% in middle age group and 100% in old age group (table 2 and figure 2). The ABO blood groups were significantly distributed as follow: among young, O (30%), A (40%), B (30%); among middle age, O (38.5%), A (42.3%) B (9.6%) AB (9.6%) and among old age, O (21.4%), A (57.1%), B (14.3%) AB (7.1%), table 1 and figure 1-B.

Rh status

A total of 73 (96.1%) of subjects were Rh-positive and only 3 (3.9%) of them were Rh-negative (table 1 and figure 1-A). The significant rate of infection with *H. pylori* was 91.8% in the Rh positive and 100% in Rh negative patients (table 2 and figure 2). The ABO blood groups were distributed as follow: for Rh positive (significant), O (31.6%), A (43.4%), B (13.1%) and AB (07.9%) while for Rh Negative (non-significant), O (02.6%), A (01.3%), B (00.0%) and AB (00.0%), table 1 and figure 1-B.



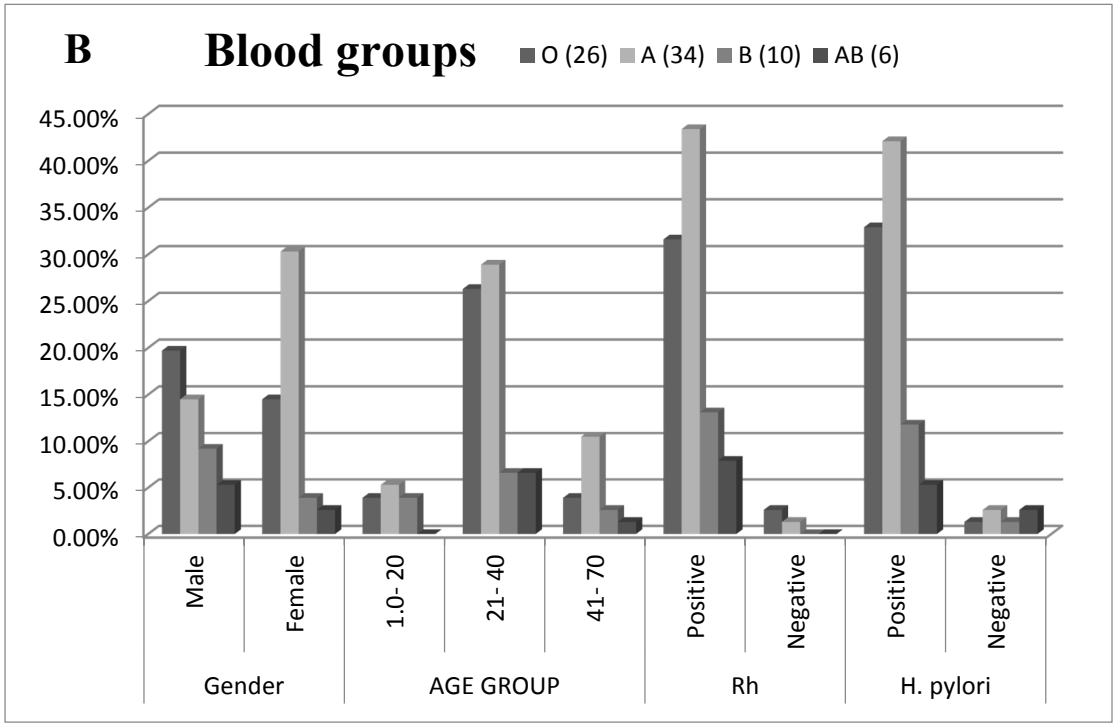


Fig. 1: A- Percentage of gender, age groups, Rh and *H. pylori* status, B- percentage of ABO blood groups associated with gender, age groups, Rh and *H. pylori* status in a total of 76 subjects.

Table 2: Prevalence of *H. pylori* infection related to Gender, Age Group, Blood group and Rh- factor in 76 subjects.

Characteristics		**H. pylori**	
		Positive (70)	**Negative** (6)
Gender	**Male** (37)	33 (89.1%)	4 (10.9%)
	Female (39)	37 (94.9%)	2 (5.1%)
P-Value	0.819	0.633	0.414
Age group	**1 – 20** (11)	9 (81.8%)	2 (18.2%)
	21 – 40 (52)	48 (92.3%)	4 (7.7%)
	41 -70 (13)	13 (100%)	0 (00.0%)
P-Value	0.000*	0.000*	0.135
Blood group	**O** (26)	25 (96.0%)	1 (4%)
	A (34)	32 (94.0%)	2 (6%)
	B (10)	9 (90.0%)	1 (10.0%)
	AB (6)	4 (67.0%)	2 (33.0%)
P-Value	0.000*	0.001*	0.002*
Rh- Factor	**Positive** (73)	67 (91.8%)	6 (8.2%)
	Negative (3)	3 (100%)	0 (00.0%)
P-Value	0.002*	0.003*	0.258

**Significant P<0.05*

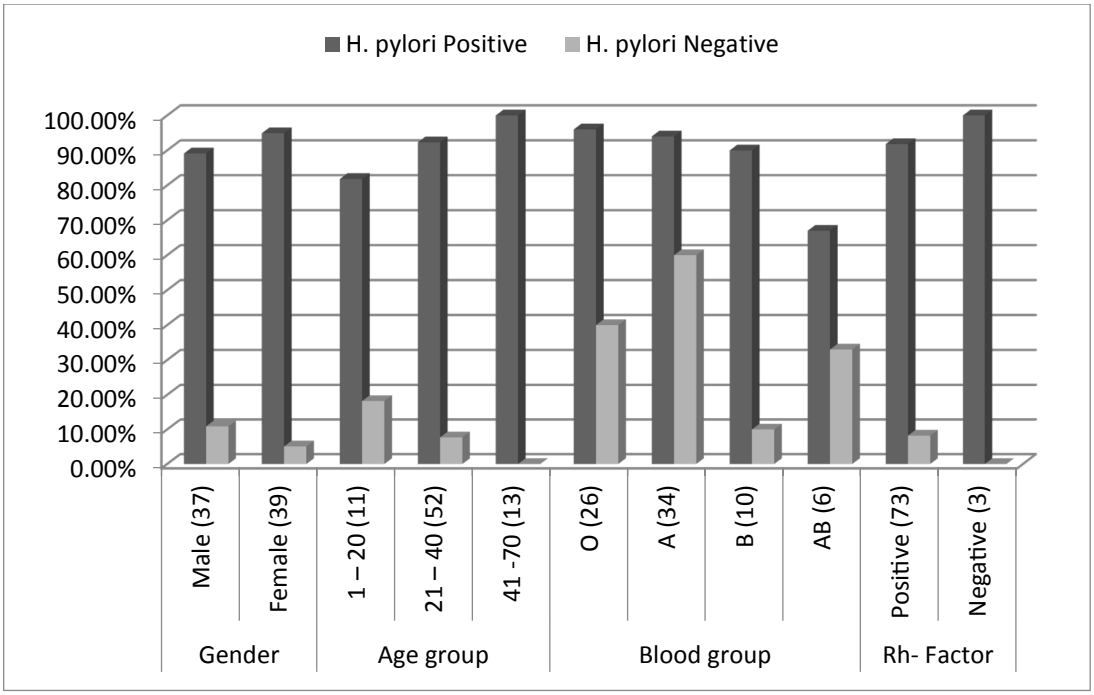


Fig. 2: Prevalence of H. pylori infection related to Gender, Age Group, Blood group and Rh- factor in 76 subjects.

Discussion

In the present study, the overall prevalence of *H. pylori* was 92%. These findings indicate that *H. pylori* infection is highly prevalent in Egypt. Escobar-Pardo *et al.* (2011, in India) has also found as high prevalence of *H. pylori* as 73.5% than in the present study. The variation among percentages of infection in the different studies could be due to the sample size, the studied population characteristics and climate changes.

The frequency of Blood group type A was the highest (44.7%) followed by type O (34.2%) and B type (13.2%). The lowest frequency blood type was group AB (7.9%). Also, the highest (96%) association with H. pylori infection was in type O; 94% in type A; 90% in type B and the lowest (67%) association with H. pylori infection was in type AB.

The results of this study showed that there was a significant association between ABO blood groups and *H. pylori* infection, in which types A and O have greater tendency towards infection and type AB to non-infection.

The ABO blood group antigens confer advantage of resistance against certain infectious disease (Reid and Bird, 1990). If colonization density of *H. pylori* infection is mediated either in whole or in part by host ABO blood group phenotype, then significant implications arise as a result. Bacterial eradication following antibiotic treatment of infection might be more difficult due to greater bacterial density and would explain in part why some individuals have recrudescence of infection (Crabtree *et al.,* 1994).

In agreement with the data obtained in the current study, Alkout *et al,* (2000) explained that Lewis A antigens can act as receptors for *H. pylori* on the gastric mucosa and Linde 'N *et al.* (2002) concluded that *H. pylori* expresses lipopolysaccharides on its outer membrane including blood group antigen-binding adhesion A, which causes adhesion of bacteria to gastric epithelium and to allow persistent colonization.

Two recent studies, in agreement also with the current work, evaluated the association between ABO histo-blood groups and infection by cagA-positive *H. pylori* strains. One of them, in Lebanon, reported a significant relationship among three factors, namely, infection by this strain, the A blood group and the risk of gastric malignancy (Sharara *et al.,* 2006). The other one, in Iran, demonstrated that the anti-cagA antibody was also slightly more prevalent among infected children with A and O blood groups (Jafarzadeh *et al.,* 2007).

Liumbruno and Franchini (2013) suggested that, blood group A is indeed associated the higher risk of gastric cancer compared to blood group O. Also, Wang and co-workers (2012) published a case-control study which showed that the risk of gastric cancer in individuals with blood group A was significantly higher than that in subjects with non-A groups (O, B, and AB). Different studies reported that gastric carcinoma and gastric ulcer are related with blood group A (Edgren *et al.,* 2010).
Other researchers showed greater susceptibility of blood group O to *H. pylori* infection (Kanbay *et al*., 2005 and Mattos *et al*., 2002) and strong association with duodenal diseases (Mentis *et al.,* 1991). Kanbay *et al.* (2005) observed that individuals with blood groups A and O were more prone to *H. pylori* infection, and those with AB blood group were less prone.

Aspholm-Hurtig *et al.* (2004) showed that Lewis B antigen acts as a receptor for *H. pylori* attachment, which assists in microbial adhesion to the gastric epithelium and enhances bacterial colonization (in contrast to the current research). Replacement of the Lewis B antigen with blood group AB determinants might result in weak attachment of *H. pylori* to gastric epithelium. Therefore, reduction of the Lewis B epitope in persons with blood group AB could result in decreased risk of *H. pylori* infection and an increased rate of *H. pylori* infection in individual of blood group O (in agreement to the current research). Other studies have revealed no association between the ABO blood groups and *H. pylori* serological status either in healthy (Klaamas *et al*., 1994; Robertson *et al.* 2003) or in symptomatic subjects (Moges *et al.,* 2006; Wu et al. 2003).

In a way to solve the previous contradictions an explanation can be made where presence of blood group antigen-binding adhesion A lipopolysaccharides (supposed by Linde 'N *et al.,* 2002) on *H. pylori* outer membrane is crucial. In case of subjects with blood group type A or O, bacteria will adhere easily to the gastric epithelium while this adhesion will not be easy in case of AB or B blood group types.

The current research showed females more susceptible to infection with H. pylori than males. These results on gender disagree with other studies: Some authors indicated that males were associated with a higher risk of acquiring *H. pylori* infection than females (Ndip *et al*., 2004 and Ndip *et al*., 2009) while others showed that males and females are infected at the same rate (Nwodo *et al*., 2009 and Rasmi *et al*., 2009).

The current work also showed that middle age group, 21– 40 years' old, was highly (68.6%) susceptible to infection with *H. pylori* compared to other young or old age groups. These data agree with the findings of Kaore *et al.* (2012, India); Shokrzadeth *et al.* (2012, Iran), where they have found that *H. pylori* positivity increased with age of 20-40 years, and disagree with Escobar-Pardo *et al.* (2011, India) who has found that the infection rate of *H. Pylori* is high affecting 60% of children in the first 3 years of life and rising to 85.3% between 8 and 9 years of age.

The present study showed that 96.1% of all studied subjects were Rh+, 88.2 % of them were infected with *H. pylori*. All Rh- subjects were also infected with *H. pylori.* However, a previous study by Petrovic *et al.* (2011) did not relate Rh factor to the infection with *H. pylori*.

Conclusion

The results of this study suggest that: subjects with AB type of blood groups are more resistant to infection with *H. pylori* while those with A, O type or Rh negative are more susceptible to this infection; B types are at high risk of the infection. Females are more susceptible to *H. pylori* infection than males.The *H. pylori* infection is predominant in middle aged subjects than young or old subjects.

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