Efficacy of Two Helicobacter Pylori Eradication Regimens (Queen Rania Children Hospital)

Mohammad AlRwala, MD; Mohammad Shatanawi, MD*; Hosam Alshurafa MD*; Baraa Alfalahat, MD*; Mohammad Shakatra, MD*; Mohammad Quraan, MD*; Lara Mikhi, MD*;*

ABSTRACT

OBJECTIVE: This study aimed to evaluate the eradication success and resistance rates of the most commonly used first-line eradication antibiotic regimens for H. pylori infection among paediatric Jordanian patients.

METHODS: Data were collected retrospectively from electronic medical records and the endoscopy archives at Queen Rania Children's Hospital, Amman, Jordan. The study period, from January 2022 to December 2023, included a group of 100 Jordanian paediatric patients aged between 4 and 14 years of both genders and confirmed the diagnosis of H. pylori gastritis by histopathological examination. Patients were treated with one of two first-line eradication regimens for 14 days. Successful eradication was confirmed by negative stool antigen or complete clinical resolution of symptoms

RESULTS: The first regimen consists of metronidazole, was used in 64 patients (64%), while 36 patients (36%) were treated with the second regimen consists of clarithromycin. Stool antigen negativity was detected after 4–6 weeks, with a complete eradication rate achieved in 90 cases (90%). Positive stool antigen was found in 10 patients: 7 patients (7%) who used metronidazole, and 3 (3%) who used clarithromycin. the success rate was not statistically significantly different between the two treatment regimens, as evidenced by the chi-square test X2=0.174, p=.677.

CONCLUSION: We analysed the eradication rate of each regimen, this retrospective analysis showed a high eradication rate of 88.3% for metronidazole and 92.7% for clarithromycin, which are considered good worldwide success rates. Both regimens can still be used as first-line eradication treatments for H. pylori infection in Jordanian children, with low resistance to treatment.

KEYWORDS: H. pylori, gastritis, metronidazole, clarithromycin, resistance rate, success rate.

Vol 35 (2) August 2026
DOI:10.12816/0062644

INTRODUCTION

Helicobacter pylori (H. pylori) is the most common cause of paediatric infectious gastritis. Colonisation of H. pylori in the stomach causes chronic gastritis that can remain asymptomatic or evolve into more severe diseases. Transmission primarily occurs within family members (1,2). The modes of transmission are not clarified, but person-to-person contact through oral-oral, faecal-oral, or gastric-oral routes is suggested (3). In developing countries, H. pylori infection is acquired predominantly during early childhood, whereas in developed areas , the infection

* *Royal Medical Services. - Paediatric Gastroenterology Team*
Main Author Dr. Mohammad ALRwala E-mail: alrwala@yahoo.com

gradually increases with age, with the highest incidence rate in childhood and adolescence (4). Children differ from adults with respect to H. pylori infection in terms of prevalence, complications, and the near absence of gastric malignancies, age-specific problems with diagnostic tests and drugs, and a higher rate of antibiotic resistance (5). H. pylori infection is declining worldwide (6,7). It is postulated that the infection will die out in due course (8), Notably, in some parts of the world, infection remains in 28% to 64% of subjects, depending on the population tested and due to the combined effect of poor living conditions, poor hygiene, and overcrowding (9). Study from north of Jordan checked the prevalence of h-pylori infection by urea breath test which showed there's declining infection rate between Jordanian children (10). Clinical presentations mainly include recurrent abdominal pain (50%), epigastric pain (45%), cramps and nausea (15%), Such symptoms are non-specific and can be seen in various organic or functional gastrointestinal disorders. Large epidemiological studies found an association between recurrent abdominal pain and different social and familial factors, such as single-parent households, family history of peptic ulcer, or functional pain (11). On the other hand, some children present with extra-intestinal manifestations like iron- deficiency anaemia (12) and growth failure (13).

The diagnostic procedures based on ESPGHAN /NASPGHAN evidence-based guidelines for H. pylori testing in children should be performed in properly selected patients and with an adequate diagnostic procedure (14). Tests that detect H. pylori are divided into invasive and non-invasive testing, requires endoscopy and gastric tissue biopsy for detecting the bacterium, and include culture, rapid urease test, histopathology, polymerase chain reaction, and fluorescence in situ hybridisation tests. Endoscopy findings may show normal gastric mucosa or reveal erythema, erosions, ulcers, and antral nodularity, especially in children. On the other hand, non-invasive tests include different methods for the detection of H. pylori antigens in stool, and the widely used 13C-urea breath test (15). The stool antigen test which uses in our study as monitoring of eradication success has sensitivity and specificity of over 90%, Meta-analysis on stool antigen-detection tests revealed that ELISA monoclonal antibodies have the best performance, with a sensitivity and specificity of 97% (16). The updated evidence-based guidelines from ESPGHAN/NASPGHAN recommend treatment for H. pylori in all children in whom peptic ulcer was detected during endoscopy (14). Whether it is necessary to eradicate H. pylori in children with gastritis but without peptic ulcer disease is unclear. Current evidence suggests that in high-risk populations for gastric cancer, eradication of H. pylori can decrease the cancer risk, even in precancerous lesions (17). It is recommended that duration of triple therapy should be 7–14 days, and factors like costs, compliance, and adverse events should be considered. Emerging evidence suggests the development of secondary antibiotic resistance in children who failed initial eradication therapy (18). Eradication therapy reduces the number of H. pylori in the stomach, even when eradication fails. Because of this, antibiotic or PPI therapy can cause false-negative test results (19). Therefore, assessment of eradication should be performed with a non-invasive test at least 4–8 weeks following the completion of treatment (14).

Our investigation aimed to compare the efficacy of two first-line regimens for H. pylori eradication used with paediatric patients who attended the GI clinic and had confirmed H. pylori infection by gastric biopsy. They received two triple therapy regimens: the first regimen included metronidazole, while the second contained clarithromycin. The efficacy of the eradication course was observed after 6–8 weeks by negativity of stool antigen test or clinical improvement.

METHODS:

This retrospective statistical analytical study of 100 cases of H. pylori gastritis was conducted using data from the archive of the GI endoscopy department at Queen Rania Children's Hospital, Amman Jordan, and patients' medical electronic files (Hakeem) for the period between January 2022 and December 2023. This study was registered by the institutional ethics committee of Royal Medical Services under number 32/212024. As this was a retrospective analysis, the requirement for patients' consent was waived. Collected data included 100 paediatric patients diagnosed with H. pylori gastritis, aged between 4 and 14 years, of both genders. Gastroduodenal biopsies confirmed H. pylori infection, and a triple therapy regimen applied to all patients for h-pylori eradication. The eradication success was checked by stool antigen test and clinical resolution of symptoms. Patients were divided into two groups regarding the triple therapy regimen used. Group A (GA, N=64) included patients who received the metronidazole regimen, while Group B (GB, N=36) used the clarithromycin regimen. The inclusion criteria comprised patients with symptoms suggestive of H. pylori gastritis or duodenitis (Abdominal pain, epigastric pain, vomiting, and GI bleeding), histopathologically confirmed H. pylori infection, and those who had selected triple therapy involving either metronidazole or clarithromycin. The eradication efficacy was observed after 6–8 weeks of treatment by stool antigen test. The exclusion criteria involved patients with incomplete clinical or pathological data, other gastroduodenal infections, gastric biopsies without H. pylori infection, patients who received a different triple therapy regimen, patients who did not attend follow-up, or those diagnosed with other disorders. The collected data were documented and organized in a Microsoft Excel worksheet. Statistical analyses were performed using the Statistical Package for the Social Sciences software version 22 for Windows. The Chi-square test of independence was used to find the association between categorical data in the contingency table. A cut-off p-value of 0.05 for statistical significance was presumed.

RESULT

A total of 100 children attended the paediatric gastroenterology clinic with various clinical symptoms, including epigastric pain, vomiting, anaemia, and lower and upper GI bleeding. All were scheduled for upper gastroduodenal endoscopy, and biopsies confirmed infection with H-pylori bacteria. The study included 53 female patients (53.0%) and 47 male patients (47.0%). The paediatric age range was from 4 to 14 years, with an average of 9.8 years (SD=2.77). Figure 1 illustrates the distribution of patients' ages in the sample, with the most dominant age being 11 years old (n=20). Furthermore, the patients were divided into two groups after endoscopy and confirmed H. pylori infection by histopathology. The first group, G1, included 64 patients, comprising 32 males and 32 females, who received an anti-Helicobacter pylori triple therapy regimen including metronidazole. The second group, G2, included 36 patients, 21 females and 15 males, who received a clarithromycin-based regimen. The distribution of patients' genders according to study groups were not statistically significant, as evidenced by the chi-square test $X^2=0.642$, p=.423 (Table 1).

Table 1: Distribution of patients' gender according to study groups

Gender	Treatment group		Chi-square	p-value
	METRONIDAZOLE	CLARITHROMYCIN	0.642	.423
Females	32 (60.4%)	21 (39.6%)		
Males	32 (68.1%)	15 (31.9%)		
Total	64	36		

Table 2 shows the distribution of the observed symptoms between our patients, with the main symptom being abdominal pain (50%), followed by epigastric pain (45%). Upper and lower GI bleeding was a less common complaint, noted in only 3% of cases.

Table 2: Symptoms distribution in patients with h-pylori infection

Complaint	Percentage (%)
Abdominal pain	50%
Epigastric pain	45%
Vomiting	15%
Dysphagia	9%
Anaemia	9%
Others	7%
Upper & Lower GIB	3%

H. pylori eradication rate:

Two first-line regimens for H. pylori eradication were applied to the patients. The first regimen, consisting of metronidazole, amoxicillin, and omeprazole, was used in 64 patients (64%). Meanwhile, 36 patients (36%) were treated according to the second regimen (clarithromycin, amoxicillin, and omeprazole). The duration of the treatment course lasted up to 14 days to improve the eradication success rate. After completing the treatment course, a stool antigen test was conducted to confirm the success of eradication. Stool antigen negativity was observed in 90 patients, reflecting a 90.0% success rate for the total sample. Among the groups, a negative stool antigen was detected in 57 patients receiving metronidazole, amoxicillin, and omeprazole, resulting in an 89.1% success rate, compared to 7 patients who still had H. pylori with a resistance rate of 10.9%. Moreover, a negative stool antigen was detected in 33 patients in the clarithromycin, amoxicillin, and omeprazole group, yielding a 91.7% success rate, with 3 patients still having H. pylori with a resistance rate of 8.3%. However, the success rate was not statistically significantly different between the two treatment regimens, as evidenced by the chi-square test X^2=0.174, p=.677 (Table 2).

Table 2: Success rate of H. pylori eradication between two study groups

Stool antigen for	Treatment groups		Chi-square	p-value
H. pylori	METRONIDAZOLE	CLARITHROMYCIN	0.174	.677
Negative	57 (89.1%)	33 (91.7%)		
Positive	7 (10.9%)	3 (8.3%)		
Total	64	36		

DISCUSSION

The Queen Rania Children Hospital (QRCH) is a tertiary paediatric hospital in Jordan, considered the referral hospital for the military hospitals at the Royal Medical Services and governmental hospitals, as well as from the private sector across Jordan. QRCH treats advanced and complex cases, making our study sample widespread and representative of the entire paediatric Jordanian population. Differences in the consequences of H. pylori infection could be at least partially Explained by the high variability of colonising H. pylori strains, virulence factors and the host response to this microbe (20). Compared to global prevalence, that in Jordan remains significantly high. A recent meta-analysis systematic review revealed a global H. pylori prevalence of 44.3%, ranging from 50.8% in developing countries to 34.7% in developed ones (21,33). Studies from Tunisia, Turkey, and the Netherlands have reported childhood H. pylori prevalence rates of 51.4%, 30.9%, and 1.2%, respectively (22,23,24). Eradication of *H. pylori* infection has become an important concern because it can cause many gastroduodenal disorders, such as atrophic gastritis, peptic ulcer, lymphoma (MALT), or gastric adenocarcinoma at later stages in life (18). Standard triple therapy, a combination of two antibiotics and a PPI, has been recommended as first-line therapy since the first published paediatric guidelines. The goal of treatment is at least a 90% eradication rate at the first attempt (14). However, reported eradication rate is much lower, mainly due to antibiotic resistance, compliance and side effects of antibiotics. Antibiotic resistance is mostly found with clarithromycin and metronidazole. The overall incidence of clarithromycin resistance in children in Western countries are high, and current reports indicate a prevalence of more than 20% in treatment-naïve patients (25,26,27). with the resistance rate being even higher in some countries like China, were the clarithromycin resistance rate is higher than 80% (28). Similarly, some areas also have high levels of resistance to metronidazole, more than 20% (25,26,29,30). Based on the Negative effect of antibiotic resistance on treatment outcomes, the rate of resistance in the area was the child lives should be taken into account when deciding on the initial therapeutic regimen for eradication (14). In areas with high or unknown primary antibiotic resistance rates, culture and susceptibility testing should be performed to select the proper treatment regimen (14). The North American and European societies of Paediatric Gastroenterology, Hepatology, and Nutrition guidelines for managing H. pylori infection in children recommend triple therapy as a first-line eradication regimen. This treatment regimen should include either clarithromycin or metronidazole as the antimicrobial antibiotic. The therapy course should be administered for 7 to 14 days. However, the development of antibiotic-resistant strains might lead to treatment failure. Therefore, understanding the resistance rate of H. pylori infection is essential for implementing eradication strategies. Our study showed that Group A, consisting of 62 received a triple therapy regimen including metronidazole for H. pylori eradication, with 7 of them failing to eradicate the infection as they had a positive stool antigen test (resistance rate 11.3%). The second group, totalling 38 patients, received triple therapy including clarithromycin, with 3 of them failing to eradicate the infection as they had a positive stool antigen test (resistance rate 7.9%). In patients treated with clarithromycin, our study revealed a significant successful eradication rate, better than the worldwide paediatric H. pylori resistance rate. We reviewed multiple studies worldwide to assess the resistance rate and compare it with our results. A study from Southeast Asia region for *H. pylori* antibacterial resistance pointed out a primary clarithromycin-resistance rate of 10%, which is identical to the American region but lower than in Europe and the Eastern Mediterranean regions (>15%). The primary resistance to metronidazole in the same Asian region was indicated at a rate of 51%. Studies performed in Turkey indicated high rates of H. pylori resistance to clarithromycin and metronidazole, revealing an eradication rate of only 60% or less as a result of the standard triple therapy.

Moreover, the resistance rates were reported to vary between 24.8% to 36.7% for clarithromycin and 33.7% to35.5% for metronidazole in the same Asian countries (31,32). The increasing resistance rate, mainly with the metronidazole regimen in Asian regions, may be related to the multiple uses of metronidazole for other parasitic infections, which are common infectious agents within the Asian population. A report from America regarding resistance rates in children is scarcer. Savoldi et al. highlighted in their recent review a clarithromycin resistance rate of 10% in the American region, while 23% resistance rate with metronidazole regimen (31). Based on these findings, we consider it highly important to implement continued surveillance of the prevalence of H. pylori antimicrobial resistance in each country to choose the most effective first-line eradication regimen tailored to the needs of that particular population. The H. pylori eradication resistance rate among Jordanian children using two regimens that included metronidazole or clarithromycin is respectively 11% and 7%, which is considered a low eradication resistance rate of H. Pylori infection compared to worldwide countries, mainly within our Asian region. We consider the use of the clarithromycin regimen as superior and the best first choice for eradicating H. pylori infection among Jordanian children due to its high success rate. The relatively elevated resistance rate observed with the metronidazole regimen may be due to the overuse of metronidazole in Jordan for other bacterial or parasitic infections. Our commendations for proper eradication of H. pylori infection are to use the clarithromycin regimen as the first-choice triple therapy and to improve the eradication rate of metronidazole regimen by decreasing the use of metronidazole empirically or for non-confirmative parasitic infections.

ETHICAL APPROVAL Institutional review board approval was obtained from the ethical committee at Royal Medical Services No 32/212024. Patient data privacy and confidentiality were maintained as this study was conducted in compliance with the ethical standards per the Helsinki declaration.

LIMITATION OF STUDY The main limitation of our study was the unavailability of antimicrobial sensitivity tests for H. pylori bacteria in gastric biopsies, which would allow for the selection of the best regimens based on sensitivity tests and decrease the resistance rate.

REFERENCES

1-Bontems P, Kalach N, Oderda G, Salame A, Muyshont L, Miendje DY, et al.
Sequential therapy versus tailored triple therapies for *Helicobacter pylori* infection in children. J Pediatr Gastroenterol Nutr 2011;53(6):646–650.

2-Bontems P, Devaster JM, Corvaglia L, Dezsofi A, Van Den Borre C, Goutier S, et al.
Twelve-year observation of primary and secondary antibiotic-resistant *Helicobacter pylori* strains in children. Pediatr Infect Dis J 2001;20(11):1033–1038.

3-Koletzko S, Jones NL, Goodman KJ, et al. Evidence-based guidelines from ESPGHAN and NASPGHAN for Helicobacter pylori infection in children. J Pediatr Gastroenterol Nutr 2011;53(2):230–243.

4-Eusebi LH, Zagari RM, Bazzoli F. Epidemiology of Helicobacter pylori infection. *Helicobacter* 2014;19(suppl 1):1–5.

5. Koletzko S, Jones NL, Goodman KJ, Gold B, Rowland M, Cadranel S, et al. Evidence-based guidelines from ESPGHAN and NASPGHAN for *Helicobacter pylori* infection in children. J Pediatr Gastroenterol Nutr 2011;53(2):230–243.

6-Rowland M, Daly L, Vaughan M, Higgins A, Bourke B, Drumm B. Age-specific incidence of Helicobacter pylori. Gastroenterology 2006;130(1):65–72.

7-Goodman KJ, O'Rourke K, Day RS, et al. Dynamics of Helicobacter pylori infection in a US–Mexico cohort during the first two years of life. Int J Epidemiol 2005;34(6):1348–1355.

8-Burucoa C, Axon A. Epidemiology of Helicobacter pylori infection. Helicobacter 2017;22(suppl 1).

9-Queiroz DM, Carneiro JG, Braga-Neto MB, Fialho AB, Fialho AM, Goncalves MH, et al. Natural history of *Helicobacter pylori* infection in childhood: eight-year follow-up cohort study in an urban community in northeast Brazil. Helicobacter 2012;17(1):23–

10- Eyad Altamimi [a,b,*], Noor Alsharkhat [c], Afnan AlJawarneh [d], Moh`d Rawhi Abu Hamad [e], Anas Abu Assi [f], Sarah Alawneh [g], Majd Al-Ahmad [h]

11-Weyermann M, Rothenbacher D, Brenner H. Acquisition of *Helicobacter pylori* infection in early childhood: independent contributions of infected mothers, fathers, and siblings. Am J Gastroenterol 2009;104(1):182–189.

12-Spee LA, Madderom MB, Pijpers M, van Leeuwen Y, Berger MY. Association between *Helicobacter pylori* and gastrointestinal symptoms in children. Pediatrics 2010;125(3):e651–669.

13-Homan M, Hojsak I, Kolacek S. *Helicobacter pylori* in paediatrics. Helicobacter 2012;17(Suppl 1):43–48.

14-Mera RM, Bravo LE, Goodman KJ, Yepez MC, Correa P. Long-term effects of clearing *Helicobacter pylori* on growth in school-age children. Pediatr Infect Dis J 2012;31(3):263–266.

15-Koletzko S, Jones NL, Goodman KJ, Gold B, Rowland M, Cadranel S, et al. Evidence-based guidelines from ESPGHAN and NASPGHAN for *Helicobacter pylori* infection in children. J Pediatr Gastroenterol Nutr 2011;53(2):230–43.

16-Guarner J, Kalach N, Elitsur Y, Koletzko S. *Helicobacter pylori* diagnostic tests in children: review of the literature from 1999 to2009. Eur J Pediatr 2010;169(1):15–25.

17-Leal YA, Cedillo-Rivera R, Simon JA, Velazquez JR, Flores LL, Torres J. Utility of stool sample-based tests for the diagnosis of *Helicobacter pylori* infection in children. J Pediatr Gastroenterol Nutr 2011;52(6):718–728.

18. Zarrilli R, Ricci V, Romano M. Molecular response of gastric epithelial cells to *Helicobacter pylori*-induced cell damage. Cell

19. Delahay RM, Rugge M. Pathogenesis of *Helicobacter pylori* infection. Helicobacter 2012;17(Suppl 1):9–15.

20-Kivi M, Tindberg Y. *Helicobacter pylori* occurrence and transmission: a family affair? Scand J Infect Dis 2006;38(6–7):407–417.

21-Kalach N, Serhal L, Asmar E, Campeotto F, Dehecq Bergeret M, E, et al. *Helicobacter pylori* primary resistant strains over 11 years in French children. Diagn Microbiol Infect Dis 2007;59(2):217–221

22-Siai K, Ghozzi M, Ezzine H, Medjahed N, Azzouz MM. Prevalence and risk factors of Helicobacter pylori infection in Tunisian children: 1055 children in Cap-Bon (northeastern Tunisia). Gastroenterol Clin Biol 2008;32(11):881–886.

23-SÜOglu ÖD, GÖKÇE S, Saglam AT, SÖKÜCÜ S, Saner G. Association of Helicobacter pylori infection with gastroduodenal disease, epidemiologic factors, and iron-deficiency anaemia in Turkish children undergoing endoscopy, and impact on growth. Pediatr Int 2007;49(6):858–863.

24-Oleastro M, Cabral J, Ramalho PM, Lemos PS, Paixao E, Benoliel J, et al. Primary antibiotic resistance of *Helicobacter pylori* strains isolated from Portuguese children: a prospective multicentre study over a 10-year period. J Antimicrob Chemother 2011;66(10):2308–2311.

25-Wong BC, Lam SK, Wong WM, Chen JS, Zheng TT, Feng RE, et al. *Helicobacter pylori* eradication to prevent gastric cancer in a high-risk region of China: a randomised controlled trial. JAMA 2004;291(2):187–194.

26-Koletzko S, Richy F, Bontems P, Crone J, Kalach N, Monteiro ML, et al. Prospective

multicentre study on antibiotic resistance of *Helicobacter pylori* strains obtained from children living in Europe. Gut 2006;55(12):1711–1716.
27-Miendje Deyi VY, Bontems P, Vanderpas J, De Koster E, Ntounda R, Van den Borre C, et al. Multicentre survey of routine determinations of resistance of *Helicobacter pylori* to antimicrobials over the last 20 years (1990 to 2009) in Belgium. J Clin Microbiol 2011;49(6):2200–2209.
28-Oleastro M, Cabral J, Ramalho PM, Lemos PS, Paixao E, Benoliel J, et al. Primary antibiotic resistance of *Helicobacter pylori* strains isolated from Portuguese children: a prospective multicentre study over a 10-year period. J Antimicrob Chemother 2011;66(10):2308–2311.
29-Mourad-Baars PEC, Verspaget HW, Mertens BJA, Luisa Mearin M. Low prevalence of Helicobacter pylori infection in young children in the Netherlands. Eur J Gastroenterol Hepatol 2007;19(3):213–2163
30-Liu G, Xu X, He L, Ding Z, Gu Y, Zhang J, et al. Primary antibiotic resistance of *Helicobacter pylori* isolated from Beijing children. Helicobacter 2011;16(5):356–362.
31-Savoldi A, Carrara E, Graham DY, Conti M, Tacconelli E. Prevalence of antibiotic resistance in *Helicobacter pylori*: a systematic review and meta-analysis in World Health Organization regions. Gastroenterology 2018;155:1372–1382.e17. doi: 10.1053/j.gastro.2018.07.007.
32-Caliskan R, Tokman HB, Erzin Y, Saribas S, Yuksel P, Bolek BK, Sevuk EO, Demirci M, Yılmazli O, Akgul O., et al. Antimicrobial resistance of *Helicobacter pylori strains* to five antibiotics, including levofloxacin, in northwestern Turkey. Rev Soc Bras Med Trop 2015;48:278–284. doi: 10.1590/0037-8682-0027-2015.
33-Abdallah Majed Ghanma, MD. Helicobacter pylori infection in Jordanian children: prevalence, endoscopic findings, and relationship with dyspepsia