

# A Home Made Rapid Urease Test in the Diagnosis of Helicobacter Pylori Infection

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## ABSTRACT

**Aim of Study:** To determine whether a homemade rapid urease test (RUT) (1 mL of 10% urea broth in distilled water plus one drop of 1% phenol red as indicator, cost/test USD0.19) was reliable when compared to histology in the diagnosis of HP infection.

**Method:** Prospective consecutive sampling of patients who underwent outpatient oesophagogastroduodenoscopy and antral biopsies from October 1996 to January 1997. RUT and histology examinations were done on all specimens. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the RUT were calculated accordingly.

**Results:** Amongst our 140 patients, the sensitivity, specificity, positive and negative predictive values and accuracy of RUT were 94%, 99%, 99%, 95% and 96% respectively. Seventy-seven percent of the positive RUTs can be detected within 1 hour.

**Conclusion:** Our homemade RUT is an inexpensive test with good sensitivity and specificity for HP infection.

**Keywords:** helicobacter pylori, rapid urease test

## INTRODUCTION

Helicobacter pylori (HP) has been shown to cause active chronic gastritis and has been implicated as a primary etiologic factor in duodenal ulcer disease, gastric ulcer and non-ulcer dyspepsia<sup>(1)</sup>. The diagnosis of HP infection is of clinical importance in recurrent duodenal ulcer since its eradication reduces the relapse rate<sup>(2,3)</sup>.

Although HP can be detected with histology or culture of gastric tissue, simple tests for the presence of urease enable more rapid and convenient diagnosis. Tests for gastric urease are specific for HP because mammalian cells do not produce urease and, except for HP, the stomach is usually sterile. Urease allows the utilisation of urea as a nitrogen source and also produces ammonia, which enables HP to tolerate a low pH. The commercially available CLOtest (Delta West Ltd, Australia), which detects the presence of urease, is convenient and gives results within 24 hours, with a sensitivity and specificity of 98% and 97%

respectively, but is expensive (USD4.23/test). The same principle can be applied to a homemade rapid urease test.

The aim of this study was to determine whether a homemade rapid urease test (RUT) was reliable when compared to histology in the diagnosis of HP infection.

## METHODS

Patients who underwent gastroscopy performed by the 3 authors from the period of October 1996 to January 1997 as outpatients, were all included in the study. Patients with active upper gastrointestinal haemorrhage (as manifested by haematemesis or passing malaena) and post-gastrectomy patients in whom antral biopsy was not possible, were excluded from the study. Patients with previous HP eradication, or receiving recent antibiotics therapy or proton pump inhibitors were not excluded. All included subjects had antral biopsy taken. The biopsy was taken midway between the incisura and pylorus. Two specimens were placed in the RUT reagent and two sent for histology. The RUT reagent was made up of 1 mL of 10% urea broth in distilled water (pH 6.8, unbuffered) placed in a microcurvette, to which was added one drop of 1% phenol red as an indicator. The indicator appeared colourless when the pH was neutral but changed to pink when the reagent became alkaline due to urease activity. The specimens were placed fully in the RUT reagent and were examined at 1 hour and 24 hours at the endoscopy room temperature of about 22°C. A pink coloration was interpreted as positive. The biopsies for histology were examined under haematoxylin and eosin stain.

A true positive case was defined as a patient who had HP detected on histological sections.

Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the RUT were calculated accordingly.

## RESULTS

One hundred and forty patients were included in the study. The mean age of the studied patients was 52 years (SD 15.8) and there were 79 males and 61 females. The prevalence of HP infection in the male and female patients was 53% and 48% respectively.

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The indications for endoscopy were: dyspepsia 80%, follow-up for gastric ulcer 11% and others (eg. dysphagia) 9%.

The endoscopic diagnoses were: 69 normal findings, 29 duodenal ulcers, 21 gastritis (with or without duodenitis), 9 gastric ulcers, 7 duodenitis, 1 duodenal polyp, 1 oesophageal diverticulum, 1 oesophageal erosion, 1 oesophageal ulcer and 1 oesophageal varix.

The results of RUT as compared to histology are listed in Table I. The results were further subclassified according to endoscopic diagnoses, are shown in Table II. RUT read at 24 hours picked up more true positive cases than at 1 hour but also gave 1 false positive case. The case showed only a halo of pink coloration around the tissue and was therefore regarded as RUT positive. The 4 cases of false negative RUT read at 24 hours all had only scanty HP in histological sections.

The sensitivity, specificity, positive and negative predictive value and accuracy of RUT read at 24 hours were 94%, 99%, 99%, 95% and 96% respectively.

## DISCUSSION

Invasive and non-invasive methods are currently available for the detection of HP. Invasive methods involve obtaining biopsy at endoscopy for histology, culture or urease test. Histology of gastric antral biopsies for HP remains the gold standard for the diagnosis of HP infection, although the commercially available CLOtest is being used increasingly because of its simplicity and convenience. Histology, culture

and CLOtest have a sensitivity of 91%, 70% and 77% – 98% respectively and specificity of 100%, 100% and 96% – 97% respectively<sup>(4,5)</sup>. However, CLOtest gives quick results and 80% of positive CLOtests changes colour before one hour<sup>(4)</sup>. Our homemade RUT when read at 24 hours, gave a comparable sensitivity and specificity of 94% and 99% respectively. Similarly, 77% of our positive RUTs has already changed colour by one hour. The result shows that RUT is suitable for use as a diagnostic test for HP.

False negative RUT may occur when very low numbers of HP are present, or when the bacterium has a patchy distribution. Biopsy from both the antral and body mucosa may improve the sensitivity. False positive RUTs are rare and they will usually not react before 3 hours because other urease-producing bacteria produce much less urease than HP<sup>(4)</sup>. In our series, we did not exclude patients with previous HP eradication, recent antibiotics therapy or proton pump inhibitor therapy. This may contribute to some of the false negative results.

The advantage of our RUT is that it is inexpensive and easy to make. One homemade RUT costs USD0.19, CLOtest USD4.23, and histology USD130 in our hospital<sup>(6)</sup>. Moreover, RUT can give quick result, as 77% of positive RUTs is detectable within 1 hour. This is extremely useful in an outpatient setting where HP eradication therapy can be started at once.

Histology, on the other hand, can give us information on morphological features like the presence or absence of gastritis. It is however more expensive and gives slower results. Culture is more demanding in terms of transport and more time-consuming, but may be worthwhile for resistant strains.

Non-invasive methods for detecting HP include serological test and urea breath test. Generally, both have good sensitivity and specificity: serology, 98% and 88% respectively, and urea breath test, 100% and 100% respectively<sup>(7)</sup>. The lower specificity of serological tests is largely due to previous treatment of HP and therefore it is not suitable within 6 – 12 months of eradication therapy. Urea breath test is useful in diagnosing and confirming HP infection as well as monitoring outcome of eradication therapy, but is expensive and not commonly available in general practice.

**Table I – Rapid urease test (RUT) results read at 1 hour and 24 hours compared to histology in 140 patients**

	RUT at 1 hour	RUT at 24 hours	Histology
True positive	51	67	70
False positive	0	1	0
True negative	70	68	70
False negative	19	4	0
Sensitivity	73%	94%	-
Specificity	100%	99%	-
Positive predictive value	100%	99%	-
Negative predictive value	79%	95%	-
Accuracy	86%	96%	-

**Table II – Rapid urease test (RUT) results read at 24 hours compared to histology in 140 patients, subclassifying into different endoscopic diagnoses**

Endoscopic diagnoses	True positive	True negative	False positive	False negative	Sensitivity	Specificity
Normal	25	40	1	3	89%	98%
Duodenal ulcer	25	3	0	1	96%	100%
Gastric ulcer	4	5	0	0	100%	100%
Duodenitis	4	3	0	0	100%	100%
Gastritis ± duodenitis	8	13	0	0	100%	100%
Others	1	4	0	0	100%	100%
Overall	67	68	1	4	94%	99%

In conclusion, our homemade RUT is an inexpensive test for HP infection with good sensitivity and specificity. It is useful in an outpatient setting because it gives quick result. Its routine use can be recommended.

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