Diagnosis of Wilson's disease: an experience over three decades

The paper by Gow et al (Gut 2000;46:415–19) discussed the diagnosis of Wilson's disease in 30 patients presenting to two different clinical facilities over 28 years (1971–1998). Because a paper of this type is likely to be viewed as an authoritative guide, it is important that the information be valid. For that reason, I call attention to the following significant errors in the paper.

The authors report urine copper values of 5, 4, 7, 4, 5, 2, and 2 µg per 24 hours in seven patients in table 1. These data cannot possibly be valid. The normal range for urine copper is 20–50 µg per 24 hours, and these patients are far below the lower limit of normal. In performing several thousand 24 hour urine copper tests on patients and normal subjects in our own laboratory, I have never seen one below 10 µg per 24 hours, except in copper deficiency. The patients in table 1 have Wilson's disease, the opposite of copper deficiency, making the data even more unbelievable. I also do not believe the data for two additional symptomatic patients in their table 1 who are reported to have urine copper values of 55 and 44 µg per 24 hours. Urine copper values in untreated symptomatic Wilson's disease patients are invariably over 100 µg. That is our experience in all of 88 newly diagnosed neurologically presenting patients (urine copper range 106–1880 µg/24 hours) and in all of 18 newly diagnosed patients with hepatic presentation (urine copper range 106–1880 µg/24 hours). Not all liver disease patients with urine copper values over 100 µg will have Wilson's disease but all untreated patients with Wilson's disease with clinically presenting liver disease will have a value over 100 µg. If a patient with liver disease does not have a value that high, then look to another diagnosis, or to a laboratory error. No doubt the latter is the case here because the values in seven of the patients are not biologically reasonable. One caveat: if the patient has been treated with a chelating agent, even briefly, and then the drug stopped, there is often a rebound period when urine copper will drop below 100 µg.

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The editors will decide as before whether to also publish it in a future paper issue.

Small intestinal bacterial overgrowth, intestinal permeability, and non-alcoholic steatohepatitis

In a recent issue, Wigg and colleagues (Gut 2001;48:206–11) reported that small intestinal bacterial overgrowth (SIBO), as diagnosed by a combined "C-o-xylene/lactulose breath test, is significantly more common in patients with non-alcoholic steatohepatitis (NASH) than in control subjects without liver disease. The authors investigated the possible pathogenic significance of this observation by examining whether SIBO influenced intestinal permeability and circulating levels of endotoxin and tumour necrosis factor α in NASH patients with SIBO compared with those without. No significant differences in any of these parameters could be demonstrated in the two groups.

An important factor influencing the validity or otherwise of these findings is the diagnostic accuracy of the "C-o-xylene and lactulose breath tests for SIBO. Our experience, using a sterile endoscopic technique to sample small intestinal secretions under direct vision, is that these breath tests lack sensitivity and specificity for culture proven SIBO. Endogenous CO₂ production and colonic metabolism of o-xylene are important factors inherently limiting the accuracy of the "C-o-xylene breath test for SIBO. Furthermore, reliance on the finding of "double peaks" in serial breath hydrogen or methane levels after ingestion of lactulose to improve the accuracy of the "C-o-xylene breath test, or as a diagnostic marker in its own right, is problematic. In a study in which a scintigraphic tracer was administered concurrently...
with lactulose, we found that each of the double peaks in breath hydrogen values may occur after the arrival of the test meal at the caecum, paralleling delivery patterns of fermentable substrate to caecal bacteria. A caecal source of each peak was suggested on 50% of occasions, rather than the first peak necessarily reflecting small intestinal metabolism of lactulose by overgrowth flora as purported. Conversely, a single rise in breath hydrogen levels commencing before the test meal reached the caecum was evident in 22% of subjects with culture proven SIBO. Thus both false positive and false negative diagnoses of SIBO may result. Indeed, as pointed out in the accompanying commentary (Gut 2001;48:168–9), the prevalence of SIBO as diagnosed by breath testing, in control subjects in Wigg et al’s study seems remarkably high.

Rather than seeking to establish the prevalence of SIBO in patients with NASH, as in the study of Wigg et al, we have investigated the prevalence of liver damage, as reflected by elevated liver enzyme levels in serum, in patients with culture proven SIBO. Biochemical evidence of liver injury was found in 0/11 patients with SIBO with salivary type bacteria and only 0/21 patients with SIBO with facultative anaerobic (Enterobacteriaceae) but not obligate anaerobic (Bacteroides spp) colonic type bacteria, and 1/8 patients with SIBO including Bacteroides spp, Alkaline phosphatase and gamma glutamyl transferase levels were elevated in this patient, although liver ultrasonography and cholangiography revealed no abnormality. Small intestinal permeability was increased and, together with liver enzyme abnormalities, normalised following eradication of SIBO with a metronidazole based antibiotic regimen. We concluded that liver injury, reversible with antibiotic treatment, occurs uncommonly in patients with SIBO, and only when the overgrowth flora includes obligate anaerobes such as Bacteroides spp, in keeping with earlier findings implicating such flora in the pathogenesis of liver injury associated with experimental SIBO in rodents. Liver injury associated with SIBO with Bacteroides spp was not a necessary consequence of increased small intestinal permeability, which was also observed in 50% of patients with SIBO with Bacteroides spp who had no evidence of liver damage.

Based on these observations, we suggest that future studies examining the prevalence of SIBO in patients with NASH and its possible pathogenic significance should use culture of small intestinal aspirate rather than breath testing as the diagnostic modality and focus on the presence or absence of overgrowth with obligate anaerobic flora such as Bacteroides spp. Such an approach would be preferable to simply assessing for any improvement in NASH following a therapeutic trial of metronidazole. SIBO with Bacteroides spp and other obligate anaerobes is not always eradicated by a single course of antibiotic treatment. As small intestinal colonisation with Bacteroides spp depends on underlying intestinal dysmotility, factors other than SIBO are likely responsible for NASH in patients in whom intestinal motility is normal.

When both the \( \text{C}-\text{o}-\text{xylose} \) breath test and the combined breath test were done in a group of 11 patients, only four had positive combined tests compared with nine positive \( \text{C}-\text{o}-\text{xylose} \) breath tests (Gut 2001;48:206–11). This suggests that the combined test has achieved a greater specificity. We feel that the combined \( \text{C}-\text{o}-\text{xylose} \)-lactulose breath test is a sensitive and specific non-invasive alternative to culture of small intestinal aspirates.

We note the concern of Riordan et al. on the use of double \( H_2 \) peaks for the diagnosis of SIBO, based on their observations with scintigraphic studies. In very severe SIBO, a double peak of \( H_2 \) and \( CH_4 \) may be produced due to lactulose catabolism by bacteria in both the small intestine and colon. As suggested by Riordan et al, double peaks may reflect catabolism of lactulose by colonic bacteria rather than by bacteria in the small intestine and then the colon. Diagnosis of SIBO in our study was based on early \( \text{CO}_2 \) expiration before the appearance of a \( H_2 \) or \( CH_4 \) peak in all cases. Double \( H_2 \) or \( CH_4 \) peaks were observed in only one of the 16 breath tests recorded as positive in our study. In this patient, significant \( \text{CO}_2 \) was expired prior to the first peak. The studies quoted by Riordan et al have used cultures of small intestinal aspirates as the gold standard for the diagnosis of SIBO. Since the isolation of intestinal aspirates in clinical conditions a satisfactory gold standard for the diagnosis of SIBO? This diagnostic method is not universally accepted. It is likely that the small volume of aspirated intestinal contents aspirated does not accurately represent the bacterial flora of the entire small intestine. This may explain the problems with sensitivity and reproducibility described by some investigators. Lack of a standard protocol of specimen collection and the invasive nature of the test are further problems, particularly in the setting of studies involving a healthy control population. The use of culture of small intestinal aspirates as a gold standard to assess the performance of breath tests may therefore not be valid.

In view of the difficulties associated with diagnosing SIBO, the association of SIBO with NASH found in our study requires confirmation by other investigators. Studies using culture of small intestinal aspirate to diagnose SIBO, which can also provide qualitative bacterial information, will be complementary to our study using a combined \( \text{C}-\text{o}-\text{xylose} \)-lactulose breath test.

Authors’ reply

We thank Riordan et al for their own observations concerning the diagnosis of small intestinal bacterial overgrowth (SIBO) and liver injury associated with SIBO.

We agree with the suggestion that Bacteroides spp may be more important than other bacterial species in causing liver injury. This may be an explanation for our failure to detect endotoxin elevations in those patients diagnosed with both NASH and SIBO (endotoxin is derived only from Escherichia coli bacteria and not Bacteroides spp) (Gut 2001;48:206–11). We must however correct their statement that no significant differences were found in our study between NASH patients and control subjects for tumour necrosis factor \( \alpha \). A statistically significant difference was found between these groups (p<0.0011) (Gut 2001;48:206–11).

Their comments highlight the longstanding difficulty in gastroenterology of diagnosing SIBO. Although the traditional \( \text{C}-\text{o}-\text{xylose} \) breath test has been associated with a high sensitivity in some studies, the specificity of this test is unacceptable in our experience. The high false positive rate associated with this breath test probably relates to catabolism of unabsorbed \( \text{C}-\text{o}-\text{xylose} \) by the colon, resulting in \( \text{CO}_2 \) expiration. In an attempt to retain sensitivity and improve specificity, we have developed a combined \( \text{C}-\text{o}-\text{xylose} \)-lactulose breath test. Lactulose, which is not absorbed and requires large bacterial concentrations for its catabolism to \( H_2 \) and \( CH_4 \), acts as an internal transit marker of colonic metabolism. Smaller bacterial concentrations only are required for the catabolism of \( \text{C}-\text{o}-\text{xylose} \) to \( \text{CO}_2 \). Thus in SIBO, catabolism of \( \text{C}-\text{o}-\text{xylose} \) is small, which results in an early \( \text{CO}_2 \) peak prior to the colonic \( H_2 \) and \( CH_4 \) peaks. Specificity is improved because \( \text{CO}_2 \) peaks due to colonic metabolism of unabsorbed \( \text{C}-\text{o}-\text{xylose} \) can be identified when they rise simultaneously with \( H_2 \) and \( CH_4 \) colonic peaks.

References


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3 Rumessen JJ, Gudmund-Hoyer E, Bachmann E, et al. Diagnosis of bacterial overgrowth of the small intestine. Comparison of the \( \text{C}-\text{o}-\text{xylose} \) breath test and jejunal cultures in


CORRECTION

Abstract 6/12 in Gut 2001;49(suppl II):A33 contained an error. Q Song should be affiliated with institution 1 (University of Ulm). In abstract 8/09 (Gut 2001;49(suppl II):A47), the author list should read AT Dubois1, C Seminomora, H Woreta1, S Doi1, I Carlstedt1. 1USUHS: Bethesda, MD, USA; 2University of Lund: Lund, Sweden.

NOTICES

Broad Medical Research Program—Inflammatory Bowel Disease Grants

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GI Malignancies Can be Prevented and Treated: from the Bench to the Bedside

This international meeting will be held on 15–20 January 2002 at the Dead Sea, Israel. Further information: Secretariat, GI Malignancies, PO Box 29041, Tel Aviv 61290, Israel. Tel: +972 3 5175150; fax: +972 3 5175155; email: gi@targetconf.com

Malignant Liver Tumours: Basic Concepts and Clinical Management

This Falk Workshop will be held on 24–25 January 2002 in Leipzig, Germany. Further information: Falk Foundation e.V. Congress Division, Leinenweberstr. 5, PO Box 6529, D-79041 Freiburg, Germany. Tel: +49 761 15 14 0; fax: +49 761 15 34 359; email: symposia@falkfoundation.de

European Association for the Study of the Liver: 37th Annual Meeting

The EASL Annual Meeting will be held on 18–21 April 2002 in Madrid, Spain. Further information: EASL Liaison Bureau, c/o Kernes International, 17, rue du Cendrier, PO Box 1726, CH-1211 Geneva, Switzerland. Tel: +41 22 908 04 88; fax: +41 22 732 28 50; email: info@easl.ch; website: www.easl.ch

Falk Symposium No 128: Exogenous Factors in Colonic Carcinogenesis

This will be held on 2–3 May 2002 in Würzburg, Germany. Further information: see Falk Workshop details above.

Endoscopic Oncology: Gastrointestinal Endoscopy and Cancer Management

This ASGE Annual Postgraduate Course will be held on 22–23 May 2002 in San Francisco, USA. Further information: American Society for Gastrointestinal Endoscopy. Tel: +1 978 526 8330; fax: +1 978 526 7521; email: asge@shore.net

11th International Symposium on Hepatic Encephalopathy and Nitrogen Metabolism

This meeting will be held on 30 May to 1 June 2002 in Amsterdam, The Netherlands. Further information: Secretariat, Nicolaes Tulp Institute, Academic Medical Center, PO Box 23123, 1100 DS Amsterdam, The Netherlands. Tel: +31 20 566 8585; fax: +31 20 696 3228; email: tulpinst@amc.uva.nl. Deadline for receipt of abstracts: 1 February 2002.

Gastroenterology and Endotherapy European Workshop: XXth Anniversary

This course will be held on 17–19 June 2002 in Brussels, Belgium. Further information: Nancy Beauprez, Gastroenterology Department, Erasme Hospital, Route de Lennik 808, B-1070 Brussels, Belgium. Tel: +32 (0)20 555 49 00; fax: +32 (0)20 555 49 01; email: beauprez@ulb.ac.be
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