Helicobacter pylori in the critically ill patient

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Chapter 10

**Gut decontamination of critically ill patients reduces *Helicobacter pylori* acquisition by intensive care nurses**

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Abstract

Introduction: The prevalence of *H. pylori* is increased in health care workers and in intensive care nurses. Exposure to *H. pylori* by gastric secretions and faeces are probably the main sources of transmission of *H. pylori* infection to health care workers. Routine use of selective decontamination of the digestive tract (SDD) at an intensive care unit suppresses *H. pylori* in critically ill patients. It was questioned whether this suppression and the subsequent decreased exposure to *H. pylori* of intensive care nurses would lead to a lower prevalence of *H. pylori* infection among these nurses.

Methods: The *H. pylori* infection prevalence in intensive care nurses from a unit routine using SDD (group I) was compared to that of intensive care nurses from a unit not using SDD (group II). Health care workers from other departments of the hospital where no SDD was used (group III) served as a control group. Both intensive care nurses and controls were included on a voluntary basis. Persons using proton pump inhibitors were excluded. *H. pylori* was detected by Laser Assisted Ratio Analyser - $^{13}$C-urea breath test (UBT) and serology.

Results: Of all UBT's (n=169), in group I (n=64) three UBT's could not be processed, in group II (n=55) five and in group III (n=50) five. The prevalence of *H. pylori* infection was 11% (7/61) in group I and 25.5% (14/50) in group II (p=0.027, Chi-Square). In group III the prevalence of *H. pylori* infection was 16% (8/45) which was not significantly different from both group I and II. Seroprevalence in group I was 18.6%, in group II 27% (NS) and in group III 24%. Mean age in the three groups was 35.9, 37.8 and 36.6 yrs respectively (NS).

Conclusion: The prevalence of *H. pylori* infection among intensive care nurses is lower in nurses from units using SDD compared to non SDD-using units. Acquisition of *H. pylori* by transmission from critically ill patients appears to be diminished through SDD use.

Introduction

*Helicobacter pylori* is known for its causative role in gastric and duodenal ulcer disease [1]. *H. pylori* is also associated with gastric carcinoma [2,3]. Thusfar the exact mode of *H. pylori* transmission is unknown. Both oro-oral and faeco-oral transmission have been suggested [4]. Acquisition of *H. pylori* occurs in childhood and is relatively rare in adults [5]. However, health care workers in general are at increased risk for the acquisition of *H. pylori* [6]. Endoscopists may also have an increased risk of infection but data are conflicting [7,8]. In these studies serology has been used to detect *H. pylori*
infection which is not an accurate method to detect active \textit{H. pylori} infection. In contrast, a recent study used the $^{13}$C-urea breath test for the detection of \textit{H. pylori} infection and did not find a higher prevalence in endoscopists compared with a control group [9]. However, nurses are more often infected with \textit{H. pylori} than healthy volunteers [10]. Intensive care nurses may be more often exposed to gastric secretions than most other nurses as they frequently manipulate naso-gastric tubes. Consequently, they may be at increased risk for the acquisition of \textit{H. pylori}. Robertson and co-workers found a higher incidence of \textit{H. pylori} in intensive care nurses compared to healthy volunteers [11]. The risk of acquisition of \textit{H. pylori} by intensive care nurses may be reduced when this micro-organism is suppressed in critically ill patients. Selective decontamination of the digestive tract (SDD) was developed to effectively prevent ventilator associated pneumonia and a recent meta-analysis showed a mortality reduction of 20\% in unselected critically ill patients [12,13]. Previously we have shown that SDD effectively suppresses \textit{H. pylori} infection [14]. We hypothesised that the suppression of \textit{H. pylori} infection in critically ill patients by SDD may also lead to a reduced transmission rate of \textit{H. pylori} from patients to intensive care nurses. To test this hypothesis, the \textit{H. pylori} prevalence was compared between 1) intensive care nurses from a unit where SDD was routinely used, 2) nurses from an intensive care unit where SDD was not used and 3) other health care workers.

\textbf{Methods}

The study design was a cross-sectional observational study. Intensive care nurses from a unit where SDD was used (group I) and intensive care nurses from a unit where SDD was not used (group II) were included on voluntary basis. Nurses in training were excluded. Nurses using proton pump inhibitors were also excluded. The control group (group III) consisted of nurses, physiotherapists and doctors from other wards from the hospital where SDD was not used. Information about abdominal complaints, use of medication and duration of intensive care nursing were obtained by a written questionnaire. The local ethical and scientific committees approved the study.

\textit{H. pylori} detection

\textit{H. pylori} was detected by Laser Assisted Ratio Analyser (LARA)-$^{13}$C-urea breath test and serology. The LARA-$^{13}$C-urea breath test is an easy and reliable method to detect current \textit{H. pylori} infection. In ambulant patients the sensitivity and specificity were 95 and 94\% respectively with a positive predictive value of 95\% and a negative predictive value of 94\% [15]. IgG antibodies
against *H. pylori* were detected by enzyme linked immunosorbent assay (HM-CAP™ ELISA Enteric Products, Inc. Stony Brook, NY). A cut off level of 1.8 U/l was used. Sensitivity of this test compared to urea breath test in ambulant patients was 98.7%, specificity and positive predicting value were both 100% and negative predicting value was 98.6% [16,17].

**Statistical analysis**
A comparison of continuous data with a normal distribution was performed by T-test. A comparison of categorical data of the groups was performed by the Chi Square test. The statistical analysis was made with the SPSS statistical analyser release 8.0.0 (SPSS inc.1997). A p value < 0.05 was considered to be statistically significant.

**Results**
The main results are summarised in table 1. Sixty four nurses were included in group I (ICU nurses with SDD), 55 nurses were included in group II (ICU nurses without SDD) and in group III 49 controls were included. Three LARA-¹³C-urea breath tests were unable to be processed in group I, 5 in group II and 5 in group III because of an incorrect breath sample collection. The LARA-¹³C-urea breath test was positive for *H. pylori* in 7 out of the 61 eligible persons of group I (11%), 14 out of the 50 (25.5%) in group II, and 8 of 44 (18%) in group III. The *H. pylori* prevalence was significantly higher in group I compared to group II (p=0.027, RR 2.44, 95% CI: 1.06 – 5.59). In group III, *H. pylori* prevalence was not significantly different from both group I and II.

Serology was performed in 61 out of 64 persons from group I, 52 out of 55 persons from group II and 35 out of 49 persons from group III. In group I eleven out of 61 had a positive *H. pylori* serology (18.0%) compared to 15/52 (28.8%) in group II (p=0.173, RR 1.6, 95% CI: 0.81 - 3.17). In group III 8/35 (23%) had a positive *H. pylori* serology which was not significantly different from either group I or II. The mean antibody titre in group I was 1.44 U/l (range 0.315 - 7.23 U/l and SD 1.49). In group II the mean antibody titre was 1.93 U/l (range 0.23 - 7.86, SD 2.09); p=0.11. In group III the mean antibody titre was 1.88 (range 0.30 - 7.66, SD 2.08) which was not significantly different from either group 1 and group 2 (p=0.2 and 0.8 respectively).

The duration of intensive care nursing was determined for group I and II. In group I the mean duration of ICU nursing was 7.97 yrs (range 1- 22, median 7.0, SD 5.51), in group II 10.5 yrs (range 1 – 24, median 9.0, SD 6.46;p=0.03). The distribution of *H. pylori* infection over nursing time is shown in figure 1 and 2.
The prevalence of gastro-intestinal complaints was 34% in group I, 49% in group II and 34% in group III. In group I 43% of the nurses with a positive LARA-13C-urea breath test had upper gastrointestinal complaints (3/7), compared to 30% of the nurses with a negative LARA-13C-urea breath test \( (p=\text{NS}) \). In group II 71% of \( H. pylori \) infected nurses II had upper gastrointestinal complaints compared to 40% of nurses not infected with \( H. pylori \) in that group \( (p=0.07) \).

In group I, 5 of the 61 nurses (8%) who returned their questionnaires used medication for upper gastrointestinal complaints. Histamine-2-receptor antagonists were used by two nurses, antacids by another two and sucralfate by one nurse. None of the \( H. pylori \) positive persons did use antacids on a regular basis. In group II, 11 of the 53 persons (20%) used medication for upper gastrointestinal complaints. Seven of them used histamine-2-receptor antagonists and 4 used antacids. Thirty-five percent of the \( H. pylori \) positive nurses in group II used medication compared to 16.7% of the \( H. pylori \) negative nurses in group II \( (p=\text{NS}) \). In group III 4 out of the 32 persons who returned their questionnaires used medication for upper gastrointestinal complaints, all of them histamine-2-receptor antagonists.

**Discussion**

The lowest prevalence of \( H. pylori \) infection was found in intensive care nurses from the unit where SDD was used. In contrast, intensive care nurses from a unit where SDD was not used had the highest \( H. pylori \) prevalence. A higher \( H. pylori \) sero-prevalence in intensive care nurses compared to age matched controls was reported by Robertson and co-workers [11]. The authors also found an increase in \( H. pylori \) prevalence with increased duration of nursing time [11]. It was hypothesised that \( H. pylori \) was acquired from infected patients. The transmission and acquisition from patients to intensive care nurses may occur by gastric secretions or stools. The longer the nursing time, the higher the \( H. pylori \) acquisition rate. Consequently, transmission may be reduced when \( H. pylori \) is suppressed in critically ill patients. In a previous study we found that \( H. pylori \) is effectively suppressed in intensive care patients during selective decontamination of the digestive tract (SDD) [12]. In 94% of the infected patients, \( H. pylori \) was effectively suppressed within 7 days after admission to the intensive care [12]. This successful suppression of \( H. pylori \) probably results in a lower exposure of intensive care nurses in units where SDD is used which may reduce the risk of acquisition. This hypothesis is supported by the present study as we found a lower prevalence \( H. pylori \) infection in intensive care nurses from the unit where SDD is used. A weakness of the present study may be the cross sec-
Table 1

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
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<tbody>
<tr>
<td>ICU nurses SDD unit</td>
<td>61</td>
<td>50</td>
<td>45</td>
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<tr>
<td>Other ICU nurses</td>
<td></td>
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<tr>
<td>Health care workers</td>
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<tr>
<td>Number</td>
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<tr>
<td>Age mean (SD)</td>
<td>35.9 (5.8)</td>
<td>37.8 (6.6)</td>
<td>36.6 (8.6)</td>
</tr>
<tr>
<td>P=NS</td>
<td></td>
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<tr>
<td>Years of ICU nursing (median)</td>
<td>7.0</td>
<td>9.0</td>
<td>P=NS</td>
</tr>
<tr>
<td>Mean $H. pylori$ antibody titre</td>
<td>1.44</td>
<td>1.93</td>
<td>1.88</td>
</tr>
<tr>
<td>P=NS</td>
<td></td>
<td></td>
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<tr>
<td>Prevalence $H. pylori$ infection (%) by LARA-$^{13}$C-urea breath test</td>
<td>11</td>
<td>25.5</td>
<td>P=0.027</td>
</tr>
<tr>
<td>RR 2.44, 95% CI 1.06 - 5.59</td>
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Figure 1

Years of nursing for individual nurses in group I and result of LARA-$^{13}$C-urea breath test (LARA-UBT).

Missing: of 3 nurses with a negative urea breath test no data were available about years of nursing.
tional design of this study as it does not account for a potential bias due to community acquired \textit{H. pylori} infection before the exposure to infected critically ill patients. This community acquired \textit{H. pylori} infection rate is largely determined by age and socio-economic status. The mean age of group II is 2 years older compared to group I, which was not significant. In a Dutch cohort the seroconversion rate appeared to be 0.49\% per person year [18]. Extrapolating this seroconversion rate we would expect one person to convert from a negative into a positive \textit{H. pylori} test in two years. Therefore the two year difference in mean age can not explain the 15\% higher prevalence of \textit{H. pylori} among the ICU nurses from the unit where SDD was not used. Socio-economic status is an other determinant of \textit{H. pylori} prevalence. The absence of fixed hot-water supply in childhood and domestic crowding were found to be independent risk factors for the acquisition of \textit{H. pylori} infection [5]. Although this was not studied in detail, it is unlikely that major differences in socio-economic status determine the difference in \textit{H. pylori} prevalence in these homogenous groups of Dutch intensive care nurses with the same standard of education.

\textbf{Figure 2}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Years of nursing for individual nurses in group II and result of LARA-\textsuperscript{13}C-urea breath test (LARA-UBT). Missing: of 1 nurse with a negative urea breath test no data were available about years of nursing.}
\end{figure}
Duration of nursing time was related to *H. pylori* infection in a previous study [11]. In the present study as shown in figure 1, 3 out of 7 infected nurses from the SDD using unit worked on the intensive care for 2 years or less suggesting community acquired *H. pylori* infection. On the other hand, all the infected nurses from group II (figure 2) have a nursing time of at least 4 years, which may suggest acquisition of *H. pylori* on the intensive care. The greater exposure to *H. pylori* in the units where SDD is not used can lead to infection when hygienic measurements fail to prevent transmission from patients to nurses. Improving hygienic standards should therefore receive the highest attention to protect intensive care nurses from getting infected with *H. pylori* by their patients. The morbidity associated with *H. pylori* infection necessitates appropriate attention from intensive care units to prevent acquisition of this infection by their nurses.

In conclusion, we have shown that in intensive care nurses from a unit where SDD is used *H. pylori* prevalence is lower than in intensive care nurses from a unit where SDD is not used. SDD is known to suppress *H. pylori* effectively and therefore leads to reduction of exposure and transmission of *H. pylori* from patients to intensive care nurses.
References


