HCV INFECTION AND DIABETES MELLITUS: INFLUENCE OF THE USE OF FINGER STICK DEVICES ON NOSOCOMIAL TRANSMISSION


SUMMARY - An increased prevalence of hepatitis C virus (HCV) infection in patients with diabetes mellitus has suggested a link between these two conditions and the possibility of patient-to-patient HCV transmission during hospital admissions in diabetes units. We investigated the prevalence of HCV antibodies in 259 patients with diabetes mellitus consecutively admitted to our diabetic unit in 1998. The control group was composed of 14,100 volunteer blood donors. We divided the diabetic patients into two groups according to their HCV antibody status and also analysed patients for the following variables: age, disease duration, diabetes treatment, previous hospital admissions in a diabetes unit and use of finger stick devices. Anti-HCV antibodies were detected in 8 diabetic patients and 6 blood donors (3.09% vs 0.04%, p < 0.001). No differences were observed between anti-HCV-positive and anti-HCV-negative diabetic patients in terms of mode of treatment, previous hospital admissions in a diabetic unit and use of finger stick devices for capillary blood sampling. Our findings indicate that these medical practices play no role in nosocomial transmission of HCV in diabetic patients.

Key-words: Finger stick devices, hepatitis C virus, diabetes mellitus, nosocomial transmission, SMBG.


Un lien entre la maladie diabétique et l’infection à hepatitis C (HCV) a été récemment décrit. Les individus porteurs d’un diabète sucré présentent une augmentation de la prévalence de l’hépatite C. La possibilité d’une transmission du virus HCV d’un patient à l’autre durant les hospitalisations en service de diabétologie a été évoquée. Nous avons recherché la présence d’anticorps anti-HCV chez 259 patients diabétiques consécutivement admis dans notre unité de diabétologie en 1998. Un groupe de contrôle était constitué par 14 100 donneurs de sang volontaires. Les patients ont été divisés en 2 groupes selon la positivité ou non des anticorps anti-HCV. Les variables suivantes ont été analysées pour chaque groupe de patients : âge, durée du diabète, traitement du diabète, antécédents d’hospitalisation en unités de diabétologie, utilisation d’un lecteur de glycémie. Les anticorps anti-HCV sont positifs chez 8 patients diabétiques et chez 6 donneurs de sang (3,09 % vs 0,04 %, p < 0,001). Nous n’avons pas observé de différences significatives entre les patients anti-HCV positifs et anti-HCV négatifs en terme de mode de traitement, antécédents d’hospitalisation en service de diabétologie et d’utilisation de lecteur de glycémie. Nos résultats n’établissent pas qu’une pratique particulière aux services de diabétologie soient à l’origine d’une transmission nosocomiale de l’hépatite C aux patients diabétiques.

Mots-clés : Bandelettes glycémiques, virus hépatite C, transmission nosocomiale, autosurveillance glycémique.

A link between diabetes mellitus and hepatitis C virus (HCV) infection has recently been suggested [1-6]. Several studies have reported a higher prevalence of HCV in diabetic patients, compared to a control group [1, 2]. Other studies have found a higher prevalence of diabetes mellitus in-patients with chronic HCV infection [3-6]. It remains to be determined whether HCV infection leads to diabetes or vice-versa. It has been argued that patients with diabetes mellitus have an increased risk of exposure to HCV infection. An outbreak of hepatitis B virus attributable to finger stick devices for capillary blood sampling has been reported [7], and the possibility of patient-to-patient HCV transmission during hospital admissions in a diabetic unit has also been suggested [8]. The purpose of our descriptive study was to specify the prevalence of HCV infection in diabetic patients and to investigate nosocomial transmission, especially in relation to the use of capillary blood sampling devices during previous hospital admissions in a diabetic unit.

**PATIENTS AND METHODS**

*Patients* – A total of 259 diabetic patients consecutively admitted to our ward for evaluation were recruited for the study. Diabetic patients were classified as Type 1 or 2 according to World Health Organisation criteria. The patients were divided into two groups according to their HCV antibody status and analysed for the following variables: age, sex, type of diabetes, disease duration, diabetes treatment, previous hospital admissions in a diabetes, medical or surgical unit, and use of finger stick devices for capillary blood monitoring. The control group was composed of 14,100 volunteer blood donors. Informed written consent was obtained from all participants, and the study was approved by the hospital’s human ethics committee.

*Tests and laboratory determinations* – Serological testing for anti-HCV was done using a commercial microparticle enzyme immunoassay (AxSYM HCV version 3.0, Abbott Laboratories, Chicago, IL) according to the manufacturer’s instructions. This test was designed using HCV recombinant Ag corresponding to regions of the core, NS3, NS4 and NS5 HCV proteins. In our study each reactive specimen was retested for confirmation, using a microplate ELISA (Monolisa anti-HCV plus, Diagnostic Pasteur). Specimens reactive to both techniques were considered as positive. Aliquots of seropositive specimens were tested for RNA of HCV by reverse-transcriptase polymerase chain reaction (RT-PCR; Amplicor HCV, Roche) for RNA detection followed by reverse hybridisation (Inno-lipa HCVII, Innogenetics, Zwijndrecht, Belgium) for genotyping.

*Statistics* – Results are expressed as means ± SD. Comparisons between groups were done using Student’s t-test or the Mann-Whitney U test for continuous variables and the χ² or Fisher’s exact probability test for categorical data.

**RESULTS**

The clinical and epidemiological characteristics of diabetic patients are shown in Table I. Anti-HCV antibodies were detected in 8 diabetic patients and 6 blood donors (3.09% vs 0.04%, p < 0.001). Table II shows the results of the epidemiological variables considered in diabetic patients according to HCV antibody status. No differences were observed between anti-HCV-positive and anti-HCV-negative diabetic pa-

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### Table I. Clinical and epidemiological characteristics of diabetic patients.

<table>
<thead>
<tr>
<th></th>
<th>Diabetic population</th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>259</td>
<td>45</td>
<td>214</td>
</tr>
<tr>
<td>Age</td>
<td>58.55 ± 15.5</td>
<td>38.95 ± 14.6</td>
<td>62.6 ± 12.2</td>
</tr>
<tr>
<td>Sex ratio M/F</td>
<td>147/112</td>
<td>22/23</td>
<td>125/89</td>
</tr>
<tr>
<td>Disease duration</td>
<td>12.6 ± 8.9</td>
<td>13.6 ± 8.6</td>
<td>12.5 ± 9.0</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oral agents</td>
<td>136 (52.5 %)</td>
<td>0 (0 %)</td>
<td>136 (63.5 %)</td>
</tr>
<tr>
<td>insulin</td>
<td>123 (47.4 %)</td>
<td>45 (100 %)</td>
<td>78 (36.4 %)</td>
</tr>
<tr>
<td>Using finger stick devices</td>
<td>154 (59.4 %)</td>
<td>41 (91.1 %)</td>
<td>111 (51.8 %)</td>
</tr>
<tr>
<td>Hospital admissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diabetic units</td>
<td>186 (71.8 %)</td>
<td>41 (91.1 %)</td>
<td>145 (67.7 %)</td>
</tr>
<tr>
<td>surgery units</td>
<td>198 (76.4 %)</td>
<td>34 (75.5 %)</td>
<td>164 (76.6 %)</td>
</tr>
<tr>
<td>medical units</td>
<td>110 (42.4 %)</td>
<td>11 (24.4 %)</td>
<td>99 (46.2 %)</td>
</tr>
</tbody>
</table>
tients in terms of mode of treatment, previous hospital admissions in a diabetic unit, disease duration and use of finger stick devices for capillary blood sampling (Table III). Among the 8 anti-HCV-positive diabetic patients, 7 presented a major risk of HCV transmission with a previous blood transfusion (3), a previous major surgical procedure (3), or a professional transmission (1). In this study, none of the patients had an intravenous drug addiction.

HCV genotype 2a was detected in 1 of the 8 seropositive diabetic patients, genotype 1b was found in 6, and one patient was HCV-RNA negative by RT-PCR.

**DISCUSSION**

Diabetes mellitus is one of the more recent additions to the long list of extrahepatic manifestations attributed to HCV infection [3]. Several studies have suggested an epidemiological association between HCV infection and diabetes [1-6]. Simo et al. observed 11.5% of HCV infection in diabetic patients, with an estimated risk for HCV infection in this population of 4.39 compared to the control group [1]. Ozyilkan et al. found 8% of HCV antibodies in a diabetic population (no Type 1 patients), a higher prevalence than that reported for the normal Turkish population [2]. In a recent study, Mason et al. reported a prevalence of 4.2% HCV infection in a diabetic cohort, with 8% Type 1 and 92% Type 2 diabetes [3]. Other studies have shown an increased prevalence of diabetes mellitus in patients with chronic HCV infection [4-6]. Only one study found no link between diabetic patients and HCV infection, with only two factors independently associated with diabetes mellitus in HCV-infected patients: cirrhosis and age [9]. In our study, 3.09% HVC infection was detected in our diabetic population, which is in agreement with other publications [1-3], although most reported a higher prevalence than ours. We found a higher prevalence of HCV antibodies in diabetic patients than the control group. However, these results should be interpreted with caution as the prevalence of HCV antibodies in our control group was low. Blood donors were volunteers screened for exposure to blood products, accounting for the low prevalence of HCV.

**TABLE II.** Epidemiological and clinical variables considered in diabetic patients grouped according to HCV antibody status.

<table>
<thead>
<tr>
<th></th>
<th>Anti-HCV-negative</th>
<th>Anti-HCV-positive</th>
<th>p</th>
</tr>
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<tbody>
<tr>
<td><strong>n</strong></td>
<td>251</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>58.4 ± 15.5</td>
<td>65.7 ± 11.3</td>
<td>0.19</td>
</tr>
<tr>
<td><strong>Sex ratio M/F</strong></td>
<td>145/106 (57.7%/42.3%)</td>
<td>2/6 (25%/75%)</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Type of diabetes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1</td>
<td>45 (17.9%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Type 2</td>
<td>206 (82.1%)</td>
<td>8 (100%)</td>
<td>0.39</td>
</tr>
<tr>
<td><strong>Disease duration</strong></td>
<td>12.6 ± 8.9</td>
<td>10.5 ± 9.7</td>
<td>0.54</td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oral agents</td>
<td>131 (52.1%)</td>
<td>5 (62.5%)</td>
<td></td>
</tr>
<tr>
<td>insulin</td>
<td>120 (47.8%)</td>
<td>3 (37.5%)</td>
<td>0.82</td>
</tr>
</tbody>
</table>

**TABLE III.** Relationship between HCV antibodies plus use of finger stick devices and hospital admission in a diabetic unit.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Anti-HCV-positive</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Using finger stick devices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>154</td>
<td>6 (3.9%)</td>
<td>0.62</td>
</tr>
<tr>
<td>no</td>
<td>101</td>
<td>2 (1.9%)</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital admission in a diabetic unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>186</td>
<td>5 (2.6%)</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>70</td>
<td>3 (4.2%)</td>
<td>0.80</td>
</tr>
<tr>
<td><strong>Using finger stick devices during hospital admission</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes</td>
<td>191</td>
<td>7 (3.6%)</td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>53</td>
<td>1 (1.8%)</td>
<td>0.83</td>
</tr>
</tbody>
</table>
It remains to be determined whether HCV infection leads to diabetes or vice-versa. None of the studies to date have evaluated the possible mechanisms by which HCV triggers or predisposes to diabetes mellitus in infected individuals. The possibility of patient-to-patient hepatitis virus transmission during hospital admissions in a diabetic unit has been suggested [7]. Unexpected material in needles and cartridges after a single insulin injection has been detected, including squama and epithelial cells [10]. Desenclos et al. recently described nosocomial transmission of HCV infection from patient to patient by use of finger stick devices for capillary blood sampling during hospital admission in a diabetic unit [8], and an outbreak of hepatitis B in a diabetic unit has also been reported owing to unremoved disposable finger guards [7]. In our study, the possibility of nosocomial transmission of HCV during previous hospital admission in a diabetic unit was evaluated in relation to the use of a finger stick device. No differences were observed between anti-HCV-positive and anti-HCV-negative diabetic patients in terms of mode of treatment, previous hospital admissions in a diabetic unit, duration of diabetes mellitus, and use of finger stick devices for capillary blood sampling. Our findings do not indicate that these medical practices play a role in the increased prevalence of anti-HCV antibodies in diabetic patients. No hepatitis antibodies were found in patients with Type 1 diabetes mellitus, even though this population is frequently hospitalised and uses finger stick devices intensively. Thus, Type 2 diabetes mellitus seems to be associated with greater HVC prevalence than Type 1, and Type 2 appears to be a risk factor for HVC infection. These results are more favourable to the hypothesis that HCV infection can be considered as a cause of diabetes rather than vice-versa.

The prevalence of HCV infection in the French population is around 1%, with a majority of genotype 1b. However, genotype 2a has been found at the same frequency as genotype 1b in the south of France [11]. Mason et al. have noted increased frequency of HCV infection (particularly with genotype 2a) in diabetic patients [3]. Thus, the possibility of a link between genotype 2a and diabetes mellitus needs to be evaluated. Genotype 2a could be preferentially associated with extrahepatic syndromes during HCV infection [3]. In our study, only 1 of the 8 diabetic patients had genotype 2a.

In conclusion, this study did not show that the use of finger stick devices for capillary blood sampling during hospital admission in a diabetic unit was responsible for the increased prevalence of HCV infection in a diabetic population. A prevalence of 3.09% anti-HCV-positive antibodies was found in patients with diabetes mellitus, especially Type 2. These results clearly indicate that the use of disposable materials for insulin injection, including finger stick devices and an insulin delivery system, should be strictly individual. A screening of HCV antibodies in patients with diabetes mellitus is not recommendable for all patients, but must be considered in case of drug addiction, prior blood transfusion or a major surgical procedure.

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REFERENCES