CLINICAL RESEARCH

Prevalence of low high-density lipoprotein cholesterol and hypertriglyceridaemia in patients treated with hypolipidaemic drugs

Prévalence du HDL-cholestérol bas et de l’hypertriglycéridémie chez des patients traités par hypolipidémiant

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KEYWORDS
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Primary care;
Statin;
Fibrate;
Prevention

Summary
Aim. — To estimate the prevalence of triglyceride and/or high density lipoprotein cholesterol (HDL-C) disorders and their relationships with other cardiovascular risk factors among patients with dyslipidaemia on lipid-lowering therapy.
Methods. — In this cross-sectional study in dyslipidaemic patients receiving lipid-lowering therapy, lipid disorders were defined as triglyceride greater than 1.5 g/L, HDL-C lesser than 0.4 g/L and low-density lipoprotein cholesterol (LDL-C) above the recommended concentration according to French guidelines. Based on these disorders, patients were classified into four groups: group 1, no lipid disorders; group 2, low HDL-C and/or high triglyceride concentration with normal LDL-C; group 3, isolated elevated LDL-C; and group 4, elevated LDL-C and low HDL-C and/or high triglyceride. Patients’ cardiovascular risk levels were compared across groups.
Results. — Among the 2727 patients (mean age 64.7 years, 46.7% women), 28% did not reach the target LDL-C concentration as defined by French guidelines. Prevalence rates of high triglyceride and low HDL-C were 27.2 and 10.3%, respectively. Over half (51.2%) of the patients
were in group 1, 20.5% were in group 2, 16.2% in group 3 and 12.1% in group 4. Among patients meeting the target LDL-C, those with high triglyceride and/or low HDL-C exhibited a significantly higher number of risk factors (1.83 vs 1.68, \( p < 0.001 \)). Smoking, diabetes and hypertension were associated separately with low HDL-C and/or high triglyceride (\( p = 0.01 \), \( p < 0.0001 \), \( p = 0.03 \), respectively). Conversely, these associations were not observed in patients who did not achieve the target LDL-C, with the exception of smoking (\( p < 0.0001 \)).

**Conclusion.** — HDL-C and triglyceride disorders are relatively frequent among treated patients, particularly when cardiovascular risk level increased.

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**Abbreviations**

HDL-C  high-density lipoprotein cholesterol  
LDL-C  low-density lipoprotein cholesterol

**Background**

High concentration of LDL-C is a well-known cardiovascular risk factor. Many studies have shown that despite the use of statins, it can be difficult to achieve the therapeutic objectives for LDL-C in line with official recommendations [1,2] in everyday clinical practice [3]. Results from certain studies suggest that abnormal levels of HDL-C and triglycerides have an impact on cardiovascular disease, particularly when the two are found together [4—6]. Little information is available, however, about these abnormalities.

One recent French study involving a representative population of subjects with no history of cardiovascular disease or of lipid-lowering treatment showed that the prevalence of low HDL-C and high triglycerides was by no means negligible [7]. An earlier study suggested that there was an association between the presence of abnormal concentrations of LDL-C and/or HDL-C and triglycerides and greater cardiovascular risk [8]. The principal aim of the present study was to estimate the prevalence of abnormal levels of triglyceride and/or HDL-C in a population of patients with dyslipidaemia followed by their general practitioner (GP). The association between the presence of these abnormalities and the level of cardiovascular risk was a secondary objective.

**Methods**

**Study population**

A cross-sectional observational study (REALITY II) was conducted between July and September 2006 among patients treated with lipid-lowering drugs (statins, fibrates, ezetimibe) and followed-up by GPs affiliated to the Cegedim France network. Details of the study methods have been described previously [9].

To be eligible for inclusion, patients must have recently undergone a complete analysis of their lipid status (LDL-C, HDL-C and triglyceride), be receiving lipid-lowering therapy and have had their lipid status analysed during the six months before inclusion. Patients were ineligible for inclusion if their lipid treatment had been modified during the three months before the most recent lipid analysis. Patients were recruited during a consultation with their GP, after providing written informed consent. The protocol of the REALITY II study was approved by the Commission Nationale Informatique et
Triglyceride and HDL-C in patients treated with hypolipidaemic drugs

Libertés, the government body responsible for data protection.

Data collected

Information concerning cardiovascular risk factors and lipid analyses was collected by the GPs at the end of the consultation using a computerized questionnaire. The treatments prescribed were available on the Cegedim Longitudinal Patient Database.

Lipid abnormalities

Abnormalities in HDL-C and triglyceride concentrations were defined as HDL-C lesser than 0.4 g/L [1] and triglyceride greater than 1.5 g/L [10]. In our study, LDL-C was considered abnormal when the therapeutic objective according to the 2005 Agence Française de Sécurité Sanitaire des Produits de Santé (Afssaps) criteria for LDL-C had not been achieved [1].

Patients were categorized into one of four groups according to the lipid abnormalities found: normal lipid concentrations (group 1), high triglyceride and/or low HDL-C with normal LDL-C (group 2), isolated abnormal LDL-C (group 3), and abnormal LDL-C with high triglyceride and/or low HDL-C (group 4).

Cardiovascular risk

We used the cardiovascular risk factors defined by the Afssaps [1]: age (≥ 60 years for women; ≥ 50 years for men), current smoking or cessation within the previous three years, arterial hypertension, type 2 diabetes, family history of early myocardial infarction or sudden death and HDL-C lesser than 0.4 g/L. Arterial hypertension was defined as either high blood pressure recorded in the database (systolic ≥ 140 mmHg and/or diastolic ≥ 90 mmHg) or by the prescription of antihypertensive drugs (direct antihypertensive agent, diuretics, calcium-channel blockers, angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers, beta-blockers). Diabetes was defined as the diagnosis of diabetes on the database (or of one of the associated complications) or by the prescription of an oral antidiabetic drug or insulin.

Cardiovascular risk level was evaluated using two different approaches.

Classes of risk defined by the Afssaps

The Afssaps distinguishes between five classes of patients, according to the number of cardiovascular risk factors other than dyslipidaemia: no additional risk factors, one risk factor, two risk factors, more than two risk factor and high risk. For the first four categories, one risk factor was removed with HDL-C greater than 0.6 g/L. The “high-risk” category comprised patients with a history of cardiovascular disease, patients with high-risk type 2 diabetes (diabetes with at least two additional risk factors and/or renal failure), and primary prevention patients with a greater than 20% risk of an adverse coronary event in the forthcoming 10 years according to the Framingham equation [11].

Sum of non-lipid risk factors

In this study, as low HDL-C was both a cardiovascular risk factor taken into account in the Afssaps classification and one of the lipid abnormalities studied, we also compared the four groups of patients according to the cumulative number of these cardiovascular risk factors without HDL-C.

Statistical analyses

The prevalence of the four groups of lipid abnormalities (as defined above) was determined (Fig. 1). Complementary analyses were carried out by considering separately patients receiving statin monotherapy and those under fibrate monotherapy (Figs. 2 and 3). Then, the four groups of patients were compared for each risk factor, for the Afssaps class of risk and for the number of non-lipid risk factors (Table 2).

To determine the impact of abnormal HDL-C and/or triglyceride concentration independently of achieving the therapeutic objectives for LDL-C, specific comparisons were run in groups 1 and 2 (‘‘normal lipids’’ versus ‘‘high triglyceride and/or low HDL-C with normal LDL-C’’ on the one hand, and groups 3 and 4 on the other (‘‘isolated abnormal LDL-C’’ vs ‘‘abnormal LDL-C with high triglyceride and/or low HDL-C’’). Chi², Wilcoxon and Kruskal-Wallis tests were used for all of the analyses using SAS® version 9.1 software. The threshold for significance was p < 0.05.

Results

Patient characteristics

Over half of the 2727 patients were men (53.3%). Almost 40% of patients were at high cardiovascular risk. Most patients were receiving monotherapy with either a statin or a fibrate (Table 1). There was a statistically significant difference between the four groups with regard to distribution of treatments (p < 0.0001) but we found no major clinical differences. Statin monotherapy was used slightly less frequently in patients with an abnormal LDL-C concentration plus other abnormalities (group 4), whereas fibrate monotherapy or combination lipid-lowering drugs tended to be used more frequently. Patients on statin monotherapy were more likely to have isolated abnormal LDL-C concentration.

Lipid concentrations and abnormalities

The mean (standard deviation) overall lipid concentrations were 1.21 (0.35), 0.57 (0.16) and 1.30 (0.71) g/L for LDL-C, HDL-C and triglyceride, respectively. Given the thresholds selected, more than one-quarter (27.2%) of patients had high triglyceride concentrations while 10.3% had low HDL-C. Around 28% of patients did not reach the therapeutic target for LDL-C.

Overall, almost one-third of patients presented abnormal concentrations of HDL-C and/or triglyceride (groups 2 and 4, Fig. 1). Approximately 12% of patients presented these abnormalities even though they had not achieved the therapeutic target for LDL-C (group 4). In contrast, more than half of the patients had no lipid abnormalities while on treatment (Fig. 1). No major changes in results were observed when analyses were restricted to patients receiving a statin or a fibrate in monotherapy (Figs. 2 and 3).
Abnormal lipid levels and cardiovascular risk

Patients with isolated abnormal concentrations of LDL-C (group 3) were older than those in the other groups. Group 1 (normal lipid levels) had a higher proportion of women (Table 2). Women were also less likely to have abnormal triglyceride and/or HDL-C concentrations, notably in the absence of abnormal LDL-C (group 2 vs group 1, \( p < 0.0001 \)); the difference between groups 3 and 4 was not significant (\( p = 0.12 \)). Considered individually, the cardiovascular risk
Table 1  Patient characteristics (n = 2727).

<table>
<thead>
<tr>
<th></th>
<th>n (%) or mean (standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>1453 (53.3)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>64.7 (11.0)</td>
</tr>
</tbody>
</table>

**Cardiovascular risk factors**

- Age: men ≥ 50 years, women ≥ 60
- Smoking: current or cessation within 3 years
- Type 2 diabetes
- Arterial hypertension
- Family history of early myocardial infarction or sudden death

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: men ≥ 50 years, women ≥ 60</td>
<td>2219 (81.4)</td>
</tr>
<tr>
<td>Smoking: current or cessation within 3 years</td>
<td>365 (13.4)</td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td>605 (22.2)</td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>1626 (60.0)</td>
</tr>
<tr>
<td>Family history of early myocardial infarction or sudden death</td>
<td>386 (14.2)</td>
</tr>
<tr>
<td>History of cardiovascular disease</td>
<td>745 (27.3)</td>
</tr>
</tbody>
</table>

**Level of cardiovascular risk (Afssaps)**

- No additional risk factors: 398 (14.6)
- 1 risk factor: 637 (23.4)
- 2 risk factors: 119 (4.4)
- High risk: 1065 (39.1)

**Lipid-lowering treatment**

- Statin monotherapy: 1910 (70.0)
- Fibrate monotherapy: 664 (24.3)
- Statin + lipid-lowering agent other than a fibrate: 74 (2.7)
- Fibrate + lipid-lowering agent other than a statin: 39 (1.4)
- Other treatments or associations: 40 (1.5)

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**Factors varied principally according to whether or not the therapeutic target for LDL-C had been achieved (groups 3 and 4 vs groups 1 and 2, Table 2). Two factors appeared to be associated with the presence of abnormal concentrations of HDL-C and/or triglyceride: smoking and diabetes. There were more current or recent former smokers among patients with abnormal concentrations of HDL-C and/or triglyceride. This was true for both patients with normal concentrations of LDL-C (group 2 vs group 1, \( p = 0.01 \)) and with abnormal LDL-C (group 4 vs group 3, \( p < 0.0001 \)).

The proportion of diabetic patients was greater in group 2 than in group 1 (\( p < 0.0001 \)), and in group 4 compared to group 3, even though the difference between groups 3 and 4 was not significant (\( p = 0.09 \)). The proportion of diabetic patients in group 4 was threefold higher than that in group 1. Patients with abnormal triglyceride and/or HDL-C and normal LDL-C concentrations were more likely to present arterial hypertension than patients with a normal lipid status (group 2 vs 1, \( p = 0.03 \)). This was not the case for group 3 compared to group 4 (Table 2).

**Level of cardiovascular risk (Afssaps guidelines)**

The proportion of low-risk categories was greater (0 or 1 risk factor other than dyslipidaemia) in group 1 (57.9%), and a lesser degree, in group 2 (35.2%). In contrast, these patients were in the minority in groups 3 and 4 (4.5 and 3.0%, respectively). This is in keeping with the fact that groups 3 and 4 included essentially patients at high cardiovascular risk (Table 2).

Comparison of groups 1 and 2 showed that there was a greater proportion of high-risk patients in the low HDL-C and/or high triglyceride group (\( p < 0.0001 \)). In contrast, there were more high-risk patients in the isolated abnormal LDL-C group (group 3) compared with in group 4 (\( p < 0.01 \)). There were also more patients with history of cardiovascular disease in group 3.

**Number of non-lipid cardiovascular risk factors**

The number of non-lipid cardiovascular risk factors increased across the groups, especially in patients who had not achieved the therapeutic target for LDL-C. Among those who achieved the target, the number of risk factors also increased significantly in the presence of abnormal HDL-C or triglyceride (groups 1 and 2, \( p = 0.0004 \)). The difference was not significant in patients who had not achieved the target (groups 3 and 4, \( p = 0.15 \)).
Table 2  Patient characteristics and comparison of cardiovascular risk between groups.

<table>
<thead>
<tr>
<th>Group 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Group 2&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Group 3&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Group 4&lt;sup&gt;a&lt;/sup&gt;</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 1395</td>
<td>n = 560</td>
<td>n = 443</td>
<td>n = 329</td>
<td></td>
</tr>
<tr>
<td>LDL-cholesterol (g/L)</td>
<td>1.14 (0.30)</td>
<td>1.09 (0.32)</td>
<td>1.38 (0.33)</td>
<td>1.47 (0.39)</td>
</tr>
<tr>
<td>HDL-cholesterol (g/L)</td>
<td>0.62 (0.15)</td>
<td>0.50 (0.15)</td>
<td>0.59 (0.14)</td>
<td>0.47 (0.14)</td>
</tr>
<tr>
<td>Triglycerides (g/L)</td>
<td>0.96 (0.28)</td>
<td>1.92 (0.83)</td>
<td>1.05 (0.27)</td>
<td>2.00 (0.91)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>65.0 (10.7)</td>
<td>61.8 (11.1)</td>
<td>67.7 (10.6)</td>
<td>63.8 (11.3)</td>
</tr>
<tr>
<td>Women</td>
<td>55.0</td>
<td>40.5</td>
<td>38.6</td>
<td>33.1</td>
</tr>
</tbody>
</table>

**Lipid-lowering treatment**
- Statin monotherapy: 69.5, 70.0, 75.8, 64.4 <0.0001
- Fibrate monotherapy: 26.1, 20.7, 21.4, 27.4
- Other: 4.4, 9.3, 2.7, 8.2

**Level of cardiovascular risk (Afssaps)**
- No additional risk factors: 23.0, 12.3, 1.3, 0.6 <0.0001
- 1 risk factor: 34.9, 22.9, 3.2, 2.4
- 2 risk factors: 19.8, 27.3, 8.3, 12.8
- > 2 risk factors: 2.0, 9.1, 3.2, 7.9
- High risk: 20.3, 28.4, 84.0, 76.3

**Details for high-risk patients**
- High-risk primary prevention patients<sup>b</sup>: 3.9, 8.2, 26.2, 31.3
- History of isolated cardiovascular disease: 12.4, 12.3, 49.0, 34.3
- History of cardiovascular disease and high-risk diabetes: 3.9, 7.9, 8.8, 10.6

**Risk factors**
- Diabetes: 13.2, 21.2, 36.6, 42.5 <0.0001
- Age: men ≥ 50 years, women ≥ 60 years: 79.3, 76.4, 91.2, 85.4 <0.0001
- Arterial hypertension: 53.5, 58.7, 72.2, 70.2 <0.0001
- Family history of early myocardial infarction or sudden death: 11.8, 12.3, 19.6, 20.1 <0.0001
- Smoking (current or cessation within the previous 3 years): 10.0, 13.9, 14.2, 25.5 <0.0001
- History of cardiovascular disease: 16.3, 20.2, 57.8, 45.0 <0.0001
- Number of non-lipid risk factors<sup>c</sup>: 1.68 (0.88), 1.83 (0.96), 2.34 (0.91), 2.44 (0.95) <0.0001

Results are given as per cent or mean (standard deviation).
<sup>a</sup> Group 1: Normal lipid concentration; group 2: High triglyceride and/or low HDL-C with normal LDL-C; group 3: Isolated abnormal LDL-C; group 4: Abnormal LDL-C with high triglyceride and/or low HDL-C.
<sup>b</sup> Risk of experiencing an adverse coronary event in the coming 10 years greater than 20% (Framingham equation) and/or high risk diabetes.
<sup>c</sup> Except dyslipidaemia and HDL-C, and including women aged 60 years and over or men aged 50 years and over, current or recent smoking, arterial hypertension, type 2 diabetes, family history of premature death or early adverse coronary events.

**Discussion**

Prevalence of abnormal concentrations of HDL-C and/or triglyceride

Abnormal concentrations of triglyceride and HDL-C were not unusual in patients treated with lipid-lowering drugs in general medicine. Approximately 10% of patients had a low concentration of HDL-C (<0.4 g/L) and more than one-quarter had high concentrations of triglyceride (>1.5 g/L). Almost one-third of the patients in our study presented low HDL-C and/or high triglyceride, with the therapeutic target for LDL-C either achieved (20.5%, group 2) or not (12.1%, group 4).

Direct comparisons with Ferrières et al.'s study [7] are difficult because the thresholds for lipid concentrations were different as were the characteristics of the populations studied. It is possible to conclude, however, that abnormal concentrations of HDL-C and triglyceride identified in the general population [7] are also common in dyslipidaemic patients treated with lipid-lowering drugs. A high prevalence of low HDL-C (<0.4 mg/dL for men and <0.5 mg/dL for women) — that is 40% of women and 33% of men —has also been reported in a population of treated patients with severe dyslipidaemia (total cholesterol >2 g/L and/or triglyceride >1.8 g/L) followed-up in a specialized institution [12].

In our study, we found no major differences in the distribution of lipid abnormalities when we compared patients...
on statin monotherapy with those on fibrate monotherapy (Figs. 1–3). These results are difficult to interpret as the nature and severity of the abnormalities before treatment are unknown.

Abnormal concentrations of triglyceride and/or HDL-C and cardiovascular risk level

Overall, our results are in line with those of an earlier study in which we reported an association between the presence of mixed lipid abnormalities and high level of cardiovascular risk, even though direct comparison of the results is not possible because different reference values were used [8].

In our present study, level of cardiovascular risk varied particularly according to whether the therapeutic target for LDL-C had been achieved (Table 2). These findings could be explained by the choice of the Afssaps criteria to define normal concentrations of LDL-C. Indeed, the higher the patient’s level of cardiovascular risk, the lower the therapeutic target for LDL-C (according to the Afssaps criteria). As a result, the greater the risk, the more difficult it is to achieve the therapeutic objectives and thus to be placed in group 1 or 2. This led us to carry out stratified analyses in patients according to the therapeutic objectives for LDL-C (group 1 vs 2) and in those who had not achieved the therapeutic objectives (group 3 vs 4), in order to study the association between level of cardiovascular risk and HDL-C and or TG lipid abnormalities. Overall, independently of LDL-C, our results suggest the existence of an association between cardiovascular risk factors and presence of abnormal triglyceride and/or HDL-C concentration. There were more diabetic patients, current or former smokers and hypertensive patients in group 2 than in group 1. There were also more current or recent former smokers and, to a lesser degree, diabetic patients in group 4 than in group 3 (patients presenting isolated abnormal LDL-C). The association between diabetes and low HDL-C, and between diabetes and high triglyceride concentration, has been described previously [13], as has the higher frequency of abnormal HDL-C and triglyceride concentrations in patients with diabetes or hypertension and in smokers [14].

In patients with abnormal LDL-C concentrations (groups 3 and 4), the association between level of cardiovascular risk and presence of high triglyceride and/or low HDL-C concentration tended to be less marked. This difference in the results, compared with that between patients in groups 1 and 2, must be interpreted with caution. Indeed, it is possible that the already high level of cardiovascular risk in patients in groups 3 and 4 make it difficult to show any association between these levels of risk and the presence of abnormal HDL-C and/or triglyceride concentration. Furthermore, fewer patients were at high risk (according to the Afssaps criteria) in group 4 than in group 3. This result could be explained by the greater proportion of patients with a history of cardiovascular disease in the group with isolated hypercholesterolemia compared to those with mixed disorders (57.8 vs 45.0%, p < 0.001). Moreover, patients in group 3 were older than those in group 4. With this in mind, it would be interesting to check our results against other references for abnormal lipid concentrations, notably for LDL-C.

Other methodological limitations of our study must be highlighted. First, interpretation of the results relative to the cardiovascular risk level (according to the Afssaps criteria) was questionable; abnormal HDL-C concentration, which we included among the lipid abnormalities, was one of the risk factors in this classification. Because of this, we studied in parallel the total number of non-lipid risk factors. As there was no analysis of lipid concentrations before treatment, it is impossible to determine the nature and severity of the initial dyslipidaemia (LDL-C, HDL-C, triglyceride, mixed). It was not possible to evaluate the impact of lipid-lowering treatments on the initial abnormalities. Moreover, certain cardiovascular risk factors such as obesity, alcohol consumption or sedentary lifestyle were not taken into account. However, associations between these factors and the presence of low HDL-C concentration [7] and the combination of low HDL-C and high triglyceride concentrations have been identified already [14]. We did not have any data on the dietary habits of the patients either. Finally, given the cross-sectional nature of the study, it was not possible to study the combined impact of the various lipid abnormalities on the onset of heart disease.

Study implications

Failure to treat low HDL-C or high triglyceride can have consequences for the heart. Low HDL-C concentration is a predictor of adverse cardiovascular events [15–17] or death [18] in patients with a high level of cardiovascular risk. The involvement of triglycerides in the onset of coronary artery disease is more controversial [19], even though certain studies suggest they do play a role [20], notably in association with low HDL-C concentration [4]. Although correction of high LDL-C must remain a priority, physicians must not neglect abnormal levels of triglyceride and HDL-C. As suggested in our study, the higher the level of cardiovascular risk, the higher the proportion of patients with these abnormalities.

First, as with LDL-C, the priority is to ensure that patients adopt a healthy lifestyle, in particular by following an appropriate diet. The fight against a sedentary lifestyle is also an essential element. The beneficial impact of physical activity has been demonstrated with regard to both triglycerides [21,22] and HDL-C [22,23]. When necessary, advertising campaigns to alert patients to the risks could be useful. These measures go hand in hand with smoking cessation and treatment of associated risk factors such as diabetes and arterial hypertension. Then, should these initial measures prove to be insufficient even though they are respected, it may be necessary to adapt or reinforce lipid-lowering treatment on a case-by-case basis. Therapeutic issues may differ between patients on statin therapy, with its more limited effect on triglyceride and HDL-C concentrations (compared with LDL-C), and for those receiving a fibrate, as this class is less efficient than statins on LDL-C, but more effective with regard to the first two parameters.

Conclusion

The prevalence of abnormal concentrations of HDL-C and/or triglyceride is relatively high in patients treated with lipid-lowering drugs. The results of this study suggest that
patients who present this type of abnormalities tend to have a higher level of cardiovascular risk, particularly when they achieve therapeutic target for LDL-C. It would be useful to verify the robustness of our results using other criteria for lipid abnormalities, notably with regard to LDL-C.

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Conflicts of interest
There were no conflicts of interest for any author.

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References