ORIGINAL ARTICLE

Is physical activity possible and beneficial for patients with hepatitis C receiving pegylated interferon and ribavarin therapy?

L’activité physique est-elle possible et bénéfique chez les malades atteints d’hépatite chronique virale C traités par interféron pégylé et ribavirine

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Summary The great majority of patients with chronic viral hepatitis C are treated with pegylated interferon-ribavirin therapy. The aim of this study was to demonstrate that these patients were able to have some form of physical exercise, and that this activity can lead to an improvement in their quality-of-life. Twelve volunteer patients with hepatitis C, who were either sedentary or had become sedentary and who had been treated by combination therapy for the past few weeks, were recruited at hepatology clinics in the Midi-Pyrénées region of France early in 2006. All patients attended a sports medicine consultation for an initial evaluation: maximal aerobic power and maximal oxygen consumption tests, maximum heart rate (MHR), search for contraindications for participation in the proposed program of physical exercise. The patients were given a heart rate monitor so they could measure their heart rate during physical exercise and check that they exercised under safe conditions and remained within the so-called “endurance” zone. The patients came to a sports facility daily for 5 days for the exercise program. The activities were divided into four sessions each day: an individual physical exercise selected by the patient, team physical exercise, recreational physical exercise, lectures on the different types of hepatitis and their treatment, on nutrition and on sports medicine assessments. Data on hepatitis, results of the cardiorespiratory examination and personal history and record of past physical activity were collected for each patient. Quality-of-life (SF36) was assessed at enrolment in the study and one month after the training sessions. At the initial

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sports medicine consultation, all patients reached their MHR and were found capable of participating in the proposed physical exercise program. One enrolled patient was excluded from the analysis because of the presence of sinusitis on arrival. Seven men and four women, mean age of 46 years completed the full course of the study protocol. All participated in the three types of proposed physical activity with no problem. The score of the general perception item of the SF36 questionnaire increased from 63 on day 0 to 71 at one month ($p = 0.07$). In conclusion, patients with hepatitis C receiving pegylated interferon plus ribavirin may safely participate in a program of suitably supervised physical exercise. Taking part in physical exercise leads to clear changes in the way patients perceive their bodies and its capacities. Participating in sports activities could improve self-confidence and lead to far-reaching changes in the way patients perceive their disease and the constraints of treatment.

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Résumé La très grande majorité des malades atteints d’hépatite chronique C traités par bithérapie interféron pégylé et ribavirine devient totalement sédentaire. Le but de cette étude était de montrer qu’une reprise de l’activité physique était possible chez ces malades et qu’elle améliorait la qualité de vie. Début 2006, 12 malades sédentaires ou devenus sédentaires, ayant une hépatite C et recevant une bithérapie pégylée depuis quelques semaines ont été recrutés à partir des consultations d’hépatologie de la région Midi-Pyrénées. Pour chaque malade, une consultation dans un service de médecine du sport a permis : de mesurer la puissance maximale aérobie et la consommation maximale d’oxygène, de calculer leur fréquence cardiaque maximum (FCM); de délivrer un certificat de non contre indication à la pratique d’une activité physique et de régler individuellement un cardiofréquence mètre fourni pour l’activité physique. Ainsi, cette pratique était sans danger et réalisée dans la zone dite « d’endurance ». Les malades étaient accueillis cinq jours dans un lieu adapté à la pratique de l’activité physique. L’activité quotidienne était répartie en quatre temps dans la journée : activité physique individuelle choisie par le malade, activité physique collective, activité physique ludique et conférences sur les thèmes des hépatites virales et de leurs traitements, diététique, évaluation en médecine du sport. Les données pour chaque malade concernant sa maladie hépatique, ses antécédents personnels et sportifs, son examen cardiorespiratoire étaient colligées ainsi qu’une évaluation de la qualité de vie (SF36) prévue à l’entrée dans l’étude et à un mois après le stage. Au cours de la consultation de médecine du sport, les 12 malades étaient aptes à la pratique d’une activité physique et ont atteint la FCM. Un malade a été exclu car il avait une sinusite purulente à l’arrivée dans le stage. Sept hommes et quatre femmes, d’âge moyen 46 ans ont effectué le stage complet. Ils ont réalisé les trois types d’activité sans problème. Le paramètre perception générale du questionnaire SF36 est passé de 63 au jour zéro à 71 au mois 1 ($p = 0.07$). En conclusion, cette étude montre que la pratique d’une activité physique chez des malades atteints d’hépatite C traités par interféron pégylé et ribavirine est possible et sûre si elle est encadrée. Cette pratique entraîne un changement sensible pour les malades de leur perception de leur corps et de ses capacités. Elle pourrait améliorer la confiance en soi et transformer profondément le regard que les malades portent sur leur maladie et les contraintes du traitement.

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Introduction

The announcement of hepatitis C virus (HCV) infection has a profound effect on patients who associate the disease with diminished physical capacity, leading to a loss of self confidence [1]. A study conducted by the SOS hepatitis association entitled “Living with viral hepatitis” demonstrated that 64% of patients believe HCV infection is fatal; 50% have difficulty avowing their disease. Two-thirds of the patients reported that the disease affected their occupational, familial, relational and sexual lives, with 82% fearing they could not tolerate the antiviral treatment [2]. When compared with other populations affected by a chronic disease, patients with chronic hepatitis feel their physical and psychic capacities are signifi-

antly diminished [3—5]. This decline in quality-of-life is observed at the announcement of the diagnosis [6] and is more related to comorbid conditions and knowledge of the diagnosis than with transaminase level, viremia, genotype or degree of fibrosis, excepting cases of complicated cirrhosis [7—9]. Pegylated interferon plus ribavirin, the gold standard treatment of HCV infection, is poorly perceived by patients and healthcare professionals (general practitioners, non-hospital nurses) because it is a long with many adverse effects [10—14]. Problems in coping with the treatment are sometimes incriminated as the cause of dose reduction or poor observance, known to be prognostic factors of treatment efficacy [15,16]. Observance is not a natural human behavior [17]. Hepatologists consider that more than 95% of patients comply with pre-
scriptions, but information gathered from discussion groups and phone-in services reveals that patients readily adapt their treatments, lowering doses [18]. Achievement of virological response with a second treatment similar to a first treatment associated with non-response is an illustration of the impact of observance on treatment efficacy [19]. In order to improve patient quality-of-life and compliance with treatment, the 2002 consensus workshop recommended the development of units for patient education and treatment management [3,20—24]. The beneficial effect of physical exercise has been demonstrated in diverse pathological conditions [25—36], particularly after myocardial infarction [37]. The purpose of this pilot study was to evaluate the effectiveness of a 5-day physical activity program designed for patients with HCV infection taking pegylated interferon plus ribavirin for 12 weeks and to determine whether this intervention can improve quality-of-life as assessed by SF36 (Short Form 36 Health Survey Questionnaire) [38].

Patients and methods

Patient selection and inclusion criteria

Practitioners in hepatology clinics in the Midi-Pyrénées region of southern France recruited participants among their patients with HCV infection. During routine visits, participation in the study was proposed to patients aged 30 to 55 years taking a first treatment with pegylated interferon plus ribavirin for at least 12 weeks. Depending on the genotype, anti-HCV treatments were scheduled for 48 weeks. Volunteers capable of participating in individual or team sports, even if they had been sedentary for several months, were included sequentially. The participants were invited to attend a free consultation at the sports medicine center in order to ensure the absence of any contraindication for physical exercise and sports activities (see below). Using tests designed for persons wanting to resume or continue their physical activity, the sports medicine physicians determined the aptitude of the patients to participate in the proposed physical activity program and established an individualized program to renew or develop the patient’s physical activities. Exclusion criteria were: legal safeguard status, decompensated cirrhosis or beta-blocker treatment, treatment with erythropoietin for ribavirin-related hemolytic anemia.

Outcome

The main outcome was the patient’s capacity or lack of capacity to participate in a 5-day program of a physical activity. The secondary outcome was the impact of physical activity on quality-of-life assessed by the SF36 (before versus after participation). This being a non-randomized study, it was decided to include 12 patients in order to have at least ten patients with a complete data set (participation and evaluation). Considering that the main outcome was a qualitative criterion, necessary sample size was not calculated.

Baseline evaluation

Before inclusion in the study, the patients were seen by a sports medicine specialist who determined their aptitude for physical exercise. History taking and physical examination were conducted using a validated questionnaire [39]. The purpose of this visit was to detect any condition which might affect, limit, or contraindicate a specific type of physical activity. Patients performed a cardiorespiratory exercise test with measurement of gas exchanges in order to obtain an overall assessment of their tolerance to muscular exercise and evaluate their endurance capacity. Maximum oxygen uptake (\(V_{O2\text{max}}\)) was determined. The protocol for muscle exercise tests proposed by the French Societies of Sports Medicine and Pneumology was applied. Briefly, after setting the position of the ergometric bicycle and installing the monitoring equipment (12-lead and CM5 ECG) the patient performed a 3-minute warm-up at 30% theoretical \(V_{O2}\) and corresponding maximal aerobic power. Exercises were then performed with an increment load of 20% theoretical maximal aerobic power every two minutes until reaching \(V_{O2\text{max}}\) and the corresponding maximal aerobic power. The notion of symptom limited \(V_{O2}\) (\(V_{O2\text{sl}}\)) was used when a peak \(V_{O2}\) was measured but was sustained insufficiently to retain the qualification of \(V_{O2\text{max}}\). Beyond \(V_{O2\text{max}}\) or \(V_{O2\text{sl}}\), the patients continued for a 3-minute period of active recovery at 30% maximal aerobic power followed by two minutes of passive recovery. Exercise load to heart rate ratio was noted during the test.

Spirometry was performed before and after exercise in order to measure variations in airflow, and particularly to search for exercise-induced bronchospasm. During the exercise test, gas exchange was measured to determine the thresholds of ventilatory adaptation and inadaptation as defined by Beaver et al. [40]. Borg’s scale was used to assess patient-perceived exercise level [41]. A standard definition was retained for “difficult exercise level” using software applying the tangents method to the intensity-score curve.

The modalities for applying the reference intensities to optimize training were then applied. According to Karvonen’s principle, reserve heart rate is defined as the difference between maximal heart rate and resting heart rate, which is strongly correlated with exercise load. The patients were familiarized with heart rate monitoring so it could be used to establish an individualized exercise level and a relatively precise training program adapted to heart rate. The devise was calibrated for each patient as a function of the initial tests. The concept of heart rate reserve was applied to personalize the training program for each patient without the requirement of a maximal exercise test, coupled with gas exchange measurements, as long as the maximal theoretical heart rate was not too far from the real value.

The precise determination of the adaptation zones during muscle exercise using the Beaver ventilatory threshold method et al. [40] was used to validate the choice of the reference intensity level which was based on a chosen percentage of the reserve heart rate coupled to the index of perceived exercise level measured according to Borg [41].
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Quality-of-life assessment

The SF36 is a self-administered questionnaire used to determine a health-related quality-of-life profile, irrespective of the disease involved. The 36 items comprise eight subscales for the preceding month: physical activity (10 items), everyday life and relations with others (two items), physical pain (two items), perceived health (five items), vitality (four items), physical limitations (four items), mental health (five items), and evolution of perceived health (one question). Results are expressed as a standardized score for each subscore. The total score ranges from 0 to 100, a higher score corresponding to better quality-of-life [38].

Exercise program

Patients participated in the exercise program, which was organized daily in a sports facility for 5 days. Physical activities were divided into four categories:

- individual physical activity selected by the patient (walking, running, swimming), time allotted = 1h30;
- physical activity in a team setting (frisbee, racket sport, badminton, volleyball), time allotted = 1h30;
- recreational activity (ballroom dancing, African dancing, archery), time allotted = 1h30;
- lectures on the topic of hepatitis and treatments, evaluation in sports medicine, history of jaundice.

Data collected for each patient included: data on the liver disease, medical history, sports history, results of cardiorespiratory examination, SF36 results. A diary was used to check regular attendance, good tolerance, and quality of the physical exercise sessions. The following items were noted in the diary: day and time of the physical exercise session; physical status (shape) before starting the exercise session; type of physical exercise performed and duration of the session; general tolerance to muscular exercise during the session noted as average, best level, and worst level of tolerance perceived during the session using the Borg scale of perception of physical exertion.

Statistical analysis

Because of the sample size (n < 30 patients), items on the SF36 were analyzed using Student’s t test for paired data; p < 0.05 was considered significant.

Results

Between September 2005 and April 2006, 12 patients, eight men and four women, mean age 45.6 ± 12 years were included in this study. These patients were recruited from hepatology clinics of the Montauban hospital (seven patients), the Toulouse university hospital (three patients), the Albi hospital (one patient), and the Cèdres clinic of Cornebarieu (one patient). Among the 12 patients included, eleven completed the entire exercise program. One patient was excluded the first day of the program after the scheduled tests had ruled out any contraindication for physical activity because he presented purulent sinusitis. The main characteristics of the study population are summarized in Table 1.

During the sports medicine visit before the exercise sessions, all patients reached the maximal heart rate and were considered capable of performing the proposed physical activity. The results of the sports medicine visit are presented in Table 2. \( V_{O_{2\text{max}}} \) was 1.62 l/min on average (range 1–2.7); maximal heart rate was 156 bpm on average (range 122–175).

All participants performed the three types of physical activity (individual, team, recreational) with no problem. There was a trend to improved quality-of-life one month after these patients resumed physical activity (Table 3). The “general perception” item of the SF36 improved from 63 ± 8 on day 0 to 71 ± 12 at one month (p = 0.07).

Discussion

The usefulness of physical activity was studied in the 1980s in patients with acute viral hepatitis (mainly hepatitis B) who performed training exercises on an ergometer bicycle. The authors were unable to identify any beneficial or deleterious effects of physical exercise on the course of the liver disease [42]. The only study conducted in patients with HCV infection treated with pegylated interferon plus ribavirin was reported in an abstract. That study showed a decrease in perceived fatigue during treatment in patients participating in physical exercises [43]. Physical exercise, when started in a well-controlled context, is beneficial and free of risk for patients with chronic diseases such as diabetes or multiple sclerosis for example [25,29–36] or after myocardial infarction [27]. Because of these findings, physical exercise has become an important part of management practices for chronic disease [44]. We thus wanted to test the hypothesis that resumption of physical activity in patients treated with pegylated interferon and ribavirin for HCV infection would be free of risk and might have a beneficial effect. Considering the potential risk for patients, we wanted first to conduct a study in a small number of patients. Since all of the patients included in the present study were able to perform the initial physiological tests with no problem, these results suggest that physical activity is possible, and free of risk, in this context. This study thus allows the recommendation that patients treated with pegylated interferon plus ribavirin should continue or resume their physical activities. Although the statistical power is weak, our results show a trend for improved quality-of-life in patients who participate in physical activities. These results are in agreement with those obtained in studies conducted in patients with chronic disease practicing a physical activity [26–37].

We decided to report a relatively short follow-up of the SF36 quality-of-life assessment. This was because with treatment, certain patients eliminate the HCV definitively while others retain a certain viremia; this fact might introduce a major confounding factor for the statistical analysis. In addition, the effects of physical exercises are not sustained over time if the training sessions are not pursued [45]. Several reports have demonstrated that, because of the dif-
### Table 1  Baseline characteristics of patients included in the study.
**Principales caractéristiques des malades inclus dans l’étude.**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)</th>
<th>Gender</th>
<th>Body mass index (kg/m²)</th>
<th>Viral genotype</th>
<th>Viral load (Copies/ml)</th>
<th>Metavir score before treatment</th>
<th>Serum hemoglobin (g/100ml)</th>
<th>Sustained virological response (6 after treatment withdrawal)</th>
<th>Type of pegylated interferon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>M</td>
<td>23.87</td>
<td>1</td>
<td>14,383,160</td>
<td>A3F3</td>
<td>13.1</td>
<td>Non response</td>
<td>Alfa 2b</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>M</td>
<td>24.60</td>
<td>1</td>
<td>14,452,812</td>
<td>A2F2</td>
<td>11.3</td>
<td>Relapse</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>3</td>
<td>61</td>
<td>M</td>
<td>21.60</td>
<td>1</td>
<td>12,949,793</td>
<td>A2F4</td>
<td>12.3</td>
<td>Non response</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>4</td>
<td>59</td>
<td>M</td>
<td>22.31</td>
<td>1</td>
<td>900,564</td>
<td>A1F2</td>
<td>10.1</td>
<td>Relapse</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>F</td>
<td>19.53</td>
<td>1</td>
<td>450,678</td>
<td>A0F0</td>
<td>12.3</td>
<td>Prolonged response</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
<td>F</td>
<td>22.26</td>
<td>1</td>
<td>22,296,490</td>
<td>A1 F1</td>
<td>12.1</td>
<td>Relapse</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>7</td>
<td>57</td>
<td>M</td>
<td>22.32</td>
<td>4</td>
<td>4,778,675</td>
<td>A3F2</td>
<td>11.3</td>
<td>Prolonged response</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>F</td>
<td>21.21</td>
<td>1</td>
<td>450,000</td>
<td>A2F1</td>
<td>11.8</td>
<td>Prolonged response</td>
<td>Alfa 2b</td>
</tr>
<tr>
<td>9</td>
<td>59</td>
<td>M</td>
<td>22.02</td>
<td>1</td>
<td>2,453,456</td>
<td>A2F2</td>
<td>11.6</td>
<td>Non response</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>10</td>
<td>35</td>
<td>M</td>
<td>21.91</td>
<td>1</td>
<td>2,987,230</td>
<td>A2F2</td>
<td>11.3</td>
<td>Lost to follow-up</td>
<td>Alfa 2a</td>
</tr>
<tr>
<td>11</td>
<td>47</td>
<td>M</td>
<td>23.48</td>
<td>1</td>
<td>5,789,563</td>
<td>A1F2</td>
<td>10.5</td>
<td>Non response</td>
<td>Alfa 2a</td>
</tr>
</tbody>
</table>

* a M = Male; F = Female.
* b Taqman Roche Technique.

### Table 2  Characteristics of patients included in the study.
**Caractéristiques des patients inclus dans l’étude.**

<table>
<thead>
<tr>
<th>Patient</th>
<th>VO₂max (l/mn)</th>
<th>% Theoretical value</th>
<th>Maximum heart rate (beats/mn)</th>
<th>Maximum blood pressure at peak exercise (mmHg)</th>
<th>Endurance zone (beats/mn)</th>
<th>Threshold of ventilatory adaptation Load/heart rate (beats/mn)</th>
<th>Threshold of ventilatory inadaptation Load/heart rate (beats/mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.5</td>
<td>100</td>
<td>175</td>
<td>180/75</td>
<td>135—160</td>
<td>100/135—140</td>
<td>160/160—165</td>
</tr>
<tr>
<td>2</td>
<td>1.3</td>
<td>77</td>
<td>139</td>
<td>170/80</td>
<td>105—125</td>
<td>45/105—110</td>
<td>80/125—130</td>
</tr>
<tr>
<td>3</td>
<td>1.4</td>
<td>90</td>
<td>153</td>
<td>Not determined</td>
<td>100—125</td>
<td>40/100—105</td>
<td>60/125—130</td>
</tr>
<tr>
<td>4</td>
<td>1.2</td>
<td>98</td>
<td>156</td>
<td>185/75</td>
<td>95—120</td>
<td>30/95—100</td>
<td>60/120—125</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>70</td>
<td>122</td>
<td>130/80</td>
<td>100—110</td>
<td>45/110—115</td>
<td>Not reached</td>
</tr>
<tr>
<td>6</td>
<td>1.2</td>
<td>90</td>
<td>167</td>
<td>230/95</td>
<td>115—140</td>
<td>35/110—115</td>
<td>75/140—145</td>
</tr>
<tr>
<td>7</td>
<td>2.5</td>
<td>114</td>
<td>167</td>
<td>235/80</td>
<td>115—140</td>
<td>50/115—120</td>
<td>120/145—150</td>
</tr>
<tr>
<td>8</td>
<td>1.1</td>
<td>60</td>
<td>154</td>
<td>150/100</td>
<td>110—120</td>
<td>Not determined</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2.7</td>
<td>113</td>
<td>154</td>
<td>195/90</td>
<td>85—115</td>
<td>55/80—85</td>
<td>130/110—115</td>
</tr>
<tr>
<td>10</td>
<td>1.7</td>
<td>55</td>
<td>167</td>
<td>170/100</td>
<td>120—135</td>
<td>50/120—125</td>
<td>70/135—140</td>
</tr>
<tr>
<td>11</td>
<td>1.3</td>
<td>92</td>
<td>165</td>
<td>150/90</td>
<td>100—120</td>
<td>30/100—105</td>
<td>50/130—135</td>
</tr>
</tbody>
</table>
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Table 3  Quality of life data at inclusion (T0) and after 1 month (T1).

<table>
<thead>
<tr>
<th>Physical activity</th>
<th>T0 (Mean)</th>
<th>T1 (Mean)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>84.3 ± 15.6</td>
<td>85.2 ± 16.1</td>
<td>0.82</td>
</tr>
<tr>
<td>Physical handicap</td>
<td>29.5 ± 35.0</td>
<td>43.2 ± 43.4</td>
<td>0.19</td>
</tr>
<tr>
<td>Somatic pain</td>
<td>48.5 ± 23.9</td>
<td>63.6 ± 19.2</td>
<td>0.12</td>
</tr>
<tr>
<td>General perception</td>
<td>63.3 ± 8.1</td>
<td>71.3 ± 12.4</td>
<td>0.07</td>
</tr>
<tr>
<td>Vitality</td>
<td>54.5 ± 14.6</td>
<td>55.5 ± 18.8</td>
<td>0.86</td>
</tr>
<tr>
<td>Social functioning</td>
<td>70.5 ± 21.1</td>
<td>67.0 ± 27.5</td>
<td>0.66</td>
</tr>
<tr>
<td>Emotional handicap</td>
<td>63.6 ± 37.9</td>
<td>54.5 ± 34.2</td>
<td>0.49</td>
</tr>
<tr>
<td>Mental health</td>
<td>66.5 ± 17.6</td>
<td>63.6 ± 15.8</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Facility of the treatment schedule, therapeutic education must be included in the management scheme for patients given pegylated interferon and ribavirin for HCV infection in order to improve treatment observance and efficacy [3]. Physical activity should be an integral part of the support proposed for these patients since this type of activity favors self-confidence in one’s physical (and overall) capacities [46]. This has been reported in patients with NASH [31]. In any chronic disease such as HCV infection, NASH, or cardiovascular disease, the requirement for good observance of the prescribed treatment is an indispensable asset for good therapeutic efficacy. Physical activity should be more than just suggested. It should be favored and actively supported as a top priority for therapeutic management.

This study demonstrated that patients with HCV infection receiving pegylated interferon plus ribavirin can participate in an active well-controlled program of physical exercises with no undue risk. In our patients, participation in an exercise program led to a considerable change in their perception of their body and its capacities, with an improvement in their quality-of-life. Physical activity can be expected to improve patients’ self-confidence and have a strong impact on their perception of their disease helping them cope with the problems of a difficult treatment schedule.

Conflicts of Interest

Conflicts of interest: Jean-Louis Payen: no conflicts of interest; Fabien Pillard: no conflicts of interest; Véronique Mascarel: no conflicts of interest; Daniel Rivière: no conflicts of interest, Patrice Couzigou: no conflicts of interest, Natalia Kharlov: conflicts of interest with Roche laboratory.

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