REMEDIAL ACTIONS FOR THE PHYSICAL INACTIVITY OF HOSPITALIZED PATIENTS WITH TYPE 2 DIABETES

Short title: physical inactivity in hospitalized patients with T2D.

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Objective: Physical inactivity is often suspected in hospitalized patients with Type 2 Diabetes (T2D), but has yet to be quantified.

Research Design and Methods: We measured the level of physical activity of 36 hospitalized (H) and 36 free-living non-hospitalized (NH) T2D subjects with actimeters (SenseWear® Arm-Band).

Results: The number of steps (H: 4381±3742 steps/24H, NH: 7220±4763; p<0.01), duration of physical activity (H:45±57 min/24H, NH: 148±116; p<0.005) and physical activity expenditure (H: 187±390 kcal/24H, NH: 1035±1006; p<0.005) were 2-3-fold lower in the hospitalized patients. Simple advice enabled us to increase their recorded levels of physical activity by ~+50% (p<0.005), and a further +50% (p<0.05) was obtained by the use of a pedometer.

Conclusions: The physical inactivity of hospitalized patients with T2D is significant, and remediable, although the advice given must take account of the existence of sensory neuropathy and silent myocardial ischemia.

The potential benefits of physical activity (PA) for patients with type 2 diabetes (T2D) are widely recognized (1), but their application to daily clinical practice remains to be determined (2). Physical inactivity is often suspected in hospitalized T2D patients, but to our knowledge this has not been quantified: traditional PA questionnaires are not an ideal tool for such an evaluation. Using actimeters (3), we compared the PA of 36 hospitalized (H) vs 36 ambulatory, free-living, non-hospitalized (NH) patients with T2D. The PA of the hospitalized patients was further recorded during a two stage remedial procedure: PA counselling followed by the use of a pedometer.

MATERIALS AND METHODS
The hospital admissions were indicated for poor glucose control (HbA1c for H: 8.8±1.8%; NH: 7.0±1.0%; p<0.001) and paraclinical investigations; patients with acute diseases requiring rest were excluded. The gender (H: 24/36 men, NH: 22/36), age (H: 55±10 years, NH: 60±10) and BMI (H: 34±6 kg/m²; NH: 31±5) did not differ between the two groups.

The physical activity levels were recorded with actimeters (SenseWear® Arm-Band, Body Media, Stanford USA), which have been validated vs doubly labeled water for the assessment of total energy expenditure in patients with T2D (4). Both groups carried the actimeters for one week. The ambulatory patients were not advised about physical activity, but were informed that it was recorded.

The hospitalized group underwent a two stage remedial procedure with PA measurement before (T1) and after advice on physical activity (T2) according to French recommendations (5), and finally wearing a pedometer (T3). Each period lasted at least 24 hours. The French recommendations for physical activity for patients with T2D include a medical examination to detect contraindications, awareness of the favorable role of exercise in the management of diabetes, and tailored counseling suggestions to change lifestyle, owing to daily exercise sessions (>30minutes) (5). In practice the
advice was simple ("take a walk instead of staying seated"), but it was customized as a function of the antidiabetic treatment (risk of hypoglycemia), and complications (peripheral neuropathy). The results are expressed as Mean± SD, and compared by ANOVA and t tests.

RESULTS

The actimeters were carried during 97±2% of the study. As shown in the table, the levels of PA were particularly low for the hospitalized patients; 2-3-fold lower than for the ambulatory group. The counseling led to a +50% increase, followed by a further +50% with the use of the pedometer; both significant increases. Although they did not reach the ambulatory results (except for the number of steps), the levels of PA were therefore doubled after the intervention.

CONCLUSIONS

Our study shows and quantifies, the marked sedentariness of hospitalized patients with T2D, as suspected by clinicians. This phenomenon probably concerns other patients, with other type of diabetes or without diabetes, but its practical implications are of specific importance in the case of T2D, as PA can be considered as a part of the treatment. The deleterious effect of physical inactivity on glucose control are probably hidden by the controlled diet during hospitalization.

The ability to remedy this inactivity by a simple intervention is encouraging. PA counselling must however take account of the clinical picture as mentioned by others (5). This is especially true for hospitalized patients, who usually have long history of diabetes with long term complications: we checked the sensitivity of the feet, the absence of proliferative retinopathy, and envisaged the existence of silent ischemic heart disease before advising our patients to walk. No significant adverse event occurred during our study, but one of our patients had to stop walking for a short time due to a cutaneous lesion of the foot. Further work will be required to find out whether the doubling in level of PA we obtained, could be safely maintained in the long term. For outpatients with T2D, durable (one-two years) increases in PA have been reported after counselling, based on questionnaires (6) or accelerometer records (7), with ~−0.5% HbA1C reductions, and benefits on blood pressure and serum lipids.

The increased number of steps while wearing the pedometer (+2115 steps/day at T3, p<0.001 vs T2), is in line with the improvement observed when a pedometer is used for a longer period: +2491 steps/day after 18 weeks (8). A walking-based, simple and low-cost intervention can lead to significant improvements (HbA1C, BMI) at one year (9), although more sophisticated interventions may be preferred for some patients. The fact that simple, well-accepted, actimeters, as we used, can readily detect the effect of an intervention, is also encouraging for future studies.

Author Contributions: S.P. collected data, and wrote the manuscript. S.F., C.F., and H.G. collected data and participated in the study design. V.R. conceived of the study, and participated in its design and coordination and wrote the manuscript. All authors read and approved the final manuscript.

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Physical inactivity in hospitalized patients with T2D

REFERENCES

Table. Levels of Physical Activity in 72 patients with T2D, 36 hospitalized vs 36 non-hospitalized. °, °°, °°° indicate p< 0.05, p< 0.01, p< 0.005 between the two groups. *, **, *** indicate p< 0.05, p< 0.01, p< 0.005 vs preceding measurement in the hospitalized group. NS: Not significant.

<table>
<thead>
<tr>
<th></th>
<th>Hospitalized T2D patients (n=36)</th>
<th>Non-hospitalized patients (n=36)</th>
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<tbody>
<tr>
<td></td>
<td>Time 1 Before counseling</td>
<td>Time 2 After counseling</td>
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<tr>
<td>Physical activity energy expenditure (kcal/24H)</td>
<td>287 ± 390 °°°</td>
<td>449 ± 400 *** °°°</td>
</tr>
<tr>
<td>Total energy expenditure (kcal/24H)</td>
<td>2136 ± 706 °°</td>
<td>2452 ± 530 *** °°°</td>
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<tr>
<td>Duration of physical activity (min/24H)</td>
<td>45 ± 57 °°</td>
<td>65 ± 59 *** °°°</td>
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<tr>
<td>Number of steps/24H</td>
<td>4381 ± 3742 °°</td>
<td>6567 ± 3943 *** NS</td>
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