Insulin initiation in type 2 diabetic patients admitted in hospital in France and follow-up at 1 year

The “IDAHO 2” study

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SUMMARY

Objectives and methods: The IDAHO 2 epidemiological survey was conducted in departments of diabetology in insulin-naïve type 2 diabetics for whom insulin was initiated. The objective was to assess the patients’ profile, the treatments proposed during hospital stay and after one year.

Results: 797 patients were analysed. Their characteristics were: age 64±12 years, 49% males, weight: 78±17 kg, BMI: 29±6 kg/m², diabetes duration 11 years, prevalence of complications: 68%, fasting blood glucose 13±6 mmol/l, HbA1c: 10±2.2%; treatment prior to insulin comprised: at least 2 OHA: 71% of cases, one: 21%, no OAD: 8%. At hospital discharge, 54% of the patients used basal insulin. After 1 year, 670 continued on insulin. The insulin initiation was accompanied by a decrease in the FGB level (baseline: 13±6 mmol/l; final: 8±2.75 mmol/l; P<0.0001) and a HbA1c improvement (baseline: 10±2.2%; final: 7.9±1.4%; P<0.0001). This was observed during the first 6 months (HbA1c: 7.8%, P<0.0001 versus baseline). 80% of the patients remained on the same insulin regimen after 1 year: 35% had 1 injection/day, 44% had 2, 12% had 3 and 9% had a complex regimen. The weight gain, the final daily dose and hypoglycaemias increased with the number of injections. The mean daily insulin dose was 33 U/day (24 U with 1 injection/day).

Conclusion: The IDAHO study shows that insulin is effective in type 2 diabetics however, management is inadequate with insulin therapy being initiated too late and at doses which are low after one year.

Key-words: Type 2 Diabetes · Insulinothérapie · Initiation · Management · Hospitalisation.

RÉSUMÉ

Instauration d’une insulinothérapie à l’hôpital en France chez des patients diabétiques de type 2 avec étude de suivi à 1 an. L’étude IDAHO 2

Méthode et objectifs : L’étude épidémiologique IDAHO 2 prévoyait l’inclusion exhaustive des diabétiques de type 2 hospitalisés, nécessitant l’insuline. Les caractéristiques des patients, les traitements et les données à 12 mois ont été recueillis.

Résultats : 797 patients ont été analysés : 49 % d’hommes, âge : 64±12 ans, poids : 78±17 kg, IMC : 29±6 kg/m², ancienneté du diabète : 11 ans (médiane), au moins une complication : 68 %, glycémie à jeûn à l’inclusion : 13±6 mmol/l, HbA1c : 10±2.2 %. Le traitement avant l’insuline comportait deux antidiabétiques oraux dans 71 % des cas, un antidiabétique oral dans 21 %, aucun dans 8 %. À la sortie de l’hôpital, 54 % des patients sont sous insuline basale. Après un an de suivi, 670 patients restent sous insuline avec : glycémie à jeûn : 8.5±2.75 mmol/l (P<0.0001 versus inclusion), HbA1c : 7.9±1.4 % (P<0.0001 versus inclusion). Dès 6 mois, l’HbA1c est à 7.8 % (P<0.0001 versus inclusion). Le schéma insulinaire à 1 an est inchangé pour 80 % des patients : 35 % ont une injection/jour, 44 % ont deux injections/jour, 12 % ont trois injections/jour et 9 % ont un schéma complexe. Les hypoglycémies, le poids, la dose finale augmentent avec le nombre d’injection. La dose moyenne d’insuline à 1 an est de 33±21 U/j (24 U si une injection/jour).

Conclusion : La mise sous insuline des diabétiques de type 2 entraîne une amélioration de l’HbA1c dès 6 mois, amélioration qui persiste à 1 an mais l’insuline est instaurée tardivement pour un niveau d’HbA1c élevé. Les doses journalières d’insuline sont faibles à l’issue d’une année de suivi.

Mots-clés : Diabète de Type 2 · Insulinothérapie · Initiation · Prise en charge · Hospitalisation.
Introduction

Type 2 diabetes is a chronic disease, the severity of which depends on the degree of morbidity caused by macroangiopathic or microangiopathic complications.

The prevalence of type 2 diabetes worldwide is 4%, and will rise to 5.4% in 2025 [1]. Currently, in France there are almost 2 million patients suffering from this disease and the prevalence of the disease is around 3.2% [2]. Type 2 diabetes involves both peripheral insulin resistance and pancreatic deficiency. Most patients with type 2 diabetes mellitus progressively lose β cell function making insulin therapy unavoidable even though the initial management of type 2 diabetics involves dietary measures and oral antidiabetic drugs (OADs).

ADA recommendations [3] have defined insulin’s place in the management of the disease: when the HbA1c level is uncontrolled with a combination of OADs at an optimum dose, insulin is indicated, to obtain an HbA1c below 7%. According to the French guidelines [4], insulin is indicated in such patients when HbA1c is greater than 8% and could be considered if the benefit/risk ratio is positive when HbA1c ranges from 6.5 to 8%. In France, approximately 450,000 diabetic patients are treated with insulin (20% of the whole treated diabetic population) 300,000 of whom are of type 2 and the prevalence of T2DM patients treated by insulin has increased from 12.3% to 16.5% between 1998 and 2002 [5]. However, a population of type 2 diabetic patients at least as vast is still inadequately controlled under the whole treated diabetic population) 300 000 of whom are of type 2 diabetics for whom in-hospital insulin treatment was initiated, over a 1-month period, in France.

Patients were included if they met the following criteria:
- Patients with type 2 diabetes (fasting blood glucose ≥1.26 g/l on two occasions), treated or not with oral antidiabetics and insulin-naïve.
- Patients hospitalised in the diabetes unit in a day hospital or traditional hospital ward, whatever the reason for admission.
- Patients for whom long-term insulin therapy was initiated during the hospital stay.

Before the study started, the patient was provided with appropriate information on the study and his or her written consent was obtained.

Methods

The study was proposed to approximately 400 French hospital departments known to initiate insulin treatment in type 2 diabetic patients; 303 accepted the study, the centers which refused the survey were not used to initiate insulin routinely, the majority of them practiced internal medicine and not exclusively diabetology. Finally, 225 centers (77%) participated and had to include all consecutive patients admitted from June 1st to June 30th, 2001.

Data collection during the hospital stay

Demographic data, diabetes history, current treatment and cardiovascular risk factors were recorded for each patient (high blood glucose pressure was defined by a blood pressure above 140/90 mmHg) and the presence of a dyslipidemia was defined by a total cholesterol above 2.5 g/l or the use of lipid-lowering treatment. As this was an observational survey, biological assays such as urinary albumin excretion, serum cholesterol and serum triglycerides, fasting blood glucose or HbA1c were collected when assessed. When available, the HbA1c value was corrected in order to take into account the between-laboratory discrepancies in dosing methods: each value was divided by the upper limit of local normal range and then multiplied by 6.0%, the latter being the upper limit of usual normal range. Microvascular complication was defined by the presence of either retinopathy or nephropathy; retinopathy was classified into 4 categories: non-proliferative, preproliferative, proliferative or macular edema; nephropathy was defined by the presence of either microalbuminuria or macroproteinuria. Macrovascular complications included coronary artery disease (previous myocardial infarction, angina pectoris,
coronary angioplasty or coronary artery by-pass graft), heart failure, previous stroke or peripheral arterial disease. Painful neuropathy was considered separately as it involves both nervous and arterial disorders. Current oral antidiabetic drugs on admission and at hospital discharge were recorded.

Data collection during the 1-year follow-up

As the study was observational, the patients were not invited to follow-up visits. The informations were updated by investigators with the visits of usual clinical practices. The eventual changes in insulin regimen were recorded since insulin initiation. Blood glucose control was assessed by HbA1c and fasting blood glucose at 6 months and at 1 year when available. Body weight was measured at 6 months and at 1 year. Deaths, cardiovascular events (myocardial infarction, hospitalization for angina, hospitalization for heart failure, stroke) and symptomatic episodes of hypoglycaemia were recorded during the follow-up.

Statistical analysis

Qualitative data were described in terms of their numbers and percentage. The bilateral 95% confidence limits are given.

Quantitative data were described in terms of their numbers, their mean, median, standard deviation and extreme values. The bilateral 95% confidence limits are given.

The comparisons were made using McNemar tests for paired alternatives for qualitative variables and Student's tests or rank sum tests for paired data for quantitative variables. Significance threshold was set at \( \alpha = 5\% \).

Results

The description of the study population and of the hospital stay concerns the whole study population (n=797 patients), the evolution at one year concerns the patients who had continued insulin during one year without interruption (n=670).

Study population

882 patients with type 2 diabetes were included in the study. 85 had to be excluded from the analysis (77 because the inclusion date was not correct or no signed consent had been obtained, 5 because they did not meet inclusion criteria and 3 because there was insufficient data regarding the insulin regimen). A total of 797 patients were analysed, of whom 670 continued on insulin without a break for 1 year, 60 stopped taking insulin, 23 died (6 because of cardio-vascular events, 9 for neoplasia, 8 for other reasons) and 44 were lost to follow up. The patients’ main characteristics are summarised in table I. The average age of the 797 analysed patients was 64±12 years, with a majority between 60 and 80 years of age (38%<60 years, 54% between 60 and 80 years, 7%>80 years). The sex ratio was balanced: 392 men (49%) and 405 women (51%). Diabetes had been known about for 11 years (median), discovered by a routine biological test (79% of cases), at the onset of symptoms (17%) or more rarely through a complication (4% of cases). A family history of diabetes was found in 1 case out of 2. In terms of complications, 1% of the patients had suffered an acute metabolic complication during the 6 months prior to hospitalisation: 8 hyperosmolar comas and 3 severe hypoglycaemias. 68% of the patients presented with at least one chronic microvascular or macrovascular complication. The prevalence of complications was as follows: retinopathy: 20%, microalbuminuria: 31%, macroalbuminuria: 15%, coronary artery disease: 21%, arteriopathy of the lower limbs: 11%, heart failure: 7%, painful neuropathy: 12%, foot lesions: 4%. The cardiovascular risk factors identified on inclusion were: smoking (at least one cigarette per day) for 12% of the patients, high blood pressure in 67% of the patients, the presence of hypercholesterolemia (total cholesterol >2.5 g/l or lipid-lowering treatment) in 50% of the cases, a family history of sudden death before the age of 50 years for 5% of the patients. The mean weight of the patients was 78±17 kg. The mean BMI was 29±6 kg/m² (BMI <25 : 26% of cases, 25<BMI<35 : 59% of cases and >35 : 15% of cases). The glycaemic control prior to initiation of the insulin therapy was very poor, 85% of the patients had a HbA1c level >8% with a mean level of 10.1%±2.2 and the mean fasting plasma glucose level was 13±6 mmol/l (2.3±1.0 g/l). In 81% of cases poor glycaemic balance was the main reason for the patient being treated with insulin; in 7% of cases there was a contra-indication to oral treatment and in 12% of cases presented a complication. These last two reasons were mainly found in the minority of patients who had an HbA1c level <7% at inclusion.

Description of the treatment regimens for the whole study population during the hospital phase

Of the 797 patients analysed, 704 patients benefited from traditional hospitalisation and 93 from a day hospital, the mean duration of the stay being 8±5 days.

Evolution of OAD treatment during hospital stay

Most of the patients had been treated with two oral antidiabetic drugs or more. Conversely, on hospital discharge, the oral treatment was markedly reduced: 43% patients were no longer taking oral treatment (compared with 8% on admission), 25% were taking one oral antidiabetic drug (compared with 21%), 25% took two oral antidiabetic drugs (compared with 50%), and 6.5% were taking more than three oral antidiabetic drugs (compared with 21%).
Evolution of insulin treatment during hospital stay

During hospitalisation, 101 patients out of 797 received insulin by subcutaneous pump, the other 696 were given insulin via subcutaneous injections. On hospital discharge, none of the patients still carried the subcutaneous pump.

On discharge from hospital:
- For 85% of the patients, insulin therapy was similar to that offered on admission with the following distribution: 45% of regimens involved 2 injections per day (biphasic insulin in 2 out of 3 cases, without oral antidiabetic drugs), 42% of regimens involved one injection per day (intermediate insulin at bedtime in 2 out of 3 cases with oral antidiabetic drugs) and 13% “multi-injection” regimens.
- The mean dose of insulin was 27.55 ± 18 U/day (0.36 ± 0.24 U/kg/day).
- The injector pen was preferred, the insulin syringe was only prescribed in 3% of cases. Most the patients (73%) were able to do their injections themselves, in the other cases, mainly in patients over 80 years; a nurse came or the family provided the injections.

Clinical and biological 1-year outcomes for patients on insulin during 1 year without interruption

The initiation of insulin therapy was accompanied by a very significant improvement in the glycemic control evaluated by the decrease in the mean fasting blood glucose level (baseline FBG: 13±6 mmol/l; final FBG: 8.5±2.75 mmol/l, delta: -4±5 mmol/l, P<0.0001 and the improvement in the HbA1c (baseline HbA1c: 10±2%; final: 7.9±1.4%; delta: -2±2%, P<0.0001). This improvement was observed after the first 6 months of treatment (HbA1c: 7.8%, P<0.0001 versus baseline). At one year, the percentage of patients with an HbA1c level >8% was 41% (instead of 85% on inclusion and 39% at 6 months) and 27% had an HbA1c level <7% (instead of 3% on inclusion and 20% at 6 months).

Only 25% of the patients had at least one hypoglycaemic episode during the year following the initiation of insulin therapy with mainly daytime episodes and only 1% of the patients experienced severe hypoglycaemia.

The weight gain by % of HbA1c decrease was around 1.5 kg/1% HbA1c decrease (P<0.05)

Treatment changes during follow-up (n=670)

The oral and insulin treatments change was evaluated during the hospitalisation and after 1 year: figure 1 shows the progress of oral treatment between admission to hospital discharge and the year following the initiation of insulin. On admission, the majority of the patients were treated with 2 oral antidiabetic drugs or more, and when only one OAD had been prescribed, in three-quarters of cases this was a sulfonylurea. Oral antidiabetic treatment in the year following insulin initiation remained similar to what it was on leaving hospital, but when one OAD was prescribed, it was a biguanide.

Table I
Characteristics of the patients on inclusion in the study.

<table>
<thead>
<tr>
<th>n</th>
<th>Total 797</th>
<th>Group 1 Insulin continued 670</th>
<th>Group 2 Insulin stopped 60</th>
<th>Group 3 deaths 23</th>
<th>Group 4 Not followed 44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>64±12</td>
<td>64±11</td>
<td>60±13</td>
<td>76±8</td>
<td>63±12</td>
</tr>
<tr>
<td>Sex (M/W)</td>
<td>392/405</td>
<td>322/348</td>
<td>34/26</td>
<td>11/12</td>
<td>25/19</td>
</tr>
<tr>
<td>Duration of diabetes (years) (median)</td>
<td>11</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Age at the onset of diabetes (years)</td>
<td>51±12</td>
<td>51±12</td>
<td>52±15</td>
<td>63±13</td>
<td>52±13</td>
</tr>
<tr>
<td>Family history of diabetes</td>
<td>424 (54%)</td>
<td>372 (56%)</td>
<td>27 (45%)</td>
<td>5 (22%)</td>
<td>20 (48%)</td>
</tr>
<tr>
<td>Complications (macro- or microvascular)</td>
<td>462 (68%)</td>
<td>394 (68%)</td>
<td>25 (54%)</td>
<td>18 (86%)</td>
<td>25 (73%)</td>
</tr>
<tr>
<td>Smoking</td>
<td>99 (12%)</td>
<td>82 (12%)</td>
<td>8 (14%)</td>
<td>1 (4%)</td>
<td>8 (19%)</td>
</tr>
<tr>
<td>Blood pressure increase</td>
<td>534 (67%)</td>
<td>458 (69%)</td>
<td>37 (62%)</td>
<td>16 (70%)</td>
<td>23 (52%)</td>
</tr>
<tr>
<td>Cholesterol increase</td>
<td>395 (50%)</td>
<td>346 (53%)</td>
<td>20 (33%)</td>
<td>10 (43%)</td>
<td>19 (44%)</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>78±17</td>
<td>78±17</td>
<td>87±20</td>
<td>72±16</td>
<td>79±16</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29±6</td>
<td>29±6</td>
<td>31±6</td>
<td>27±5</td>
<td>29±5</td>
</tr>
<tr>
<td>Mean HbA1c (%)</td>
<td>10.2±2.2</td>
<td>10.2±2.1</td>
<td>10.5±2.2</td>
<td>10.0±2.0</td>
<td>10.4±2.1</td>
</tr>
<tr>
<td>Mean fasting blood glucose (mmol/l)</td>
<td>13±6</td>
<td>12.6±6</td>
<td>14±6</td>
<td>12.5±5</td>
<td>15±6</td>
</tr>
</tbody>
</table>
Figure 2 describes the insulin treatment and shows the great variety of initial regimens. Insulin was often started with 1 injection per day, with in most cases one insulin NPH at bedtime with two oral antidiabetic drugs (combination of a sulfonylurea and a biguanide). When two injections per day were started straight away, these were preferably 2 biphasic insulins and in this case the oral antidiabetic drugs were stopped in the majority of the cases.

The vast majority of patients (80%) remained on the same insulin regimen between leaving hospital and the follow-up at 1 year. This made it possible to link the number of insulin injections on hospital discharge with the results at one year (table II): the reduction in HbA1c seen at 1 year increased with the daily insulin dose and with the number of daily injections (reduction in HbA1c of between 1 and 2% with 1 injection per day and between 2 and 3% with 2 or 3 injections per day). Weight gain, the final daily dose of insulin and the frequency of hypoglycaemia all increased with the number of daily injections. Nevertheless, patients treated with 1 injection per day initially had a lower baseline HbA1c (<10%) and an insufficient daily insulin dose at one year. Patients treated with 1 injection per day gained less weight and had half the number of hypoglycemic episodes than the patients treated with 2 or 3 daily injections. The weight gain by% of HbA1c decrease is particularly low in this group (1.2 kg/1% HbA1c decrease) compared to group 2 and 3 (respectively 1.7 kg/1% and 1.8 kg/1%) with a statistically significant difference (P<0.05).

Discussion

This survey is the first prospective epidemiological study which gives an overview of the profile of type 2 diabetic patients at the moment of insulin initiation. In this study, these type 2 diabetics were elderly when insulin therapy was started (64 years of age on average), overweight (mean BMI of 29) and at an advanced state of the disease: diabetes had been developing for 11 years with raised blood pressure in 67% of the patients and at least one complication was present in 68%. Insulin was started at a late stage of the disease: 85% of the patients had an HbA1c level > 8% with a high glycemic level: the mean fasting glycaemia was 13 mmol/l, and the mean level of HbA1c was 10%. There were many initial regimens of insulin but two were chosen over the others: either 2 injections per day straight away in 45% of cases (biphasic insulin in 1 case out of 2) or in 42% of cases 1 injection per day associated with oral antidiabetic drugs. Basal insulin was used in 54% of all cases. When insulin therapy was started, most patients were on two oral antidiabetic drugs (mainly sulfonylurea and biguanide at the maximum dosages). The characteristics of our patients were very similar to those of the populations already described. Transversal epidemiological studies have described the type 2 diabetic population, but irrespective of treatment [6] or insulin usage [7]. The ECODIA survey [6] described 4 119 type 2 diabetic patients, with a mean age of 66, a mean BMI of 28.8 having diabetes for on average 9 years. 61% of the patients were hypertensive, 10.6% suffered from retinopathy and 15% from angina. The SCHEMA survey [7] revealed a mean period between diagnosis and insulin use of 11 years.
and the presence of at least one complication linked to diabetes in 66% of the type 2 diabetics. Two others studies, one retrospective in the Netherlands [8] and the other a prospective controlled study in Germany [9] have evaluated the efficacy and cost of putting type 2 diabetics on insulin according to different types of management (care networks, outpatient clinics, hospital). In the first study [8], the patients started on insulin with a HbA1c level of 10% which dropped to 8.2% at 1 year, 76% of patients had a HbA1c baseline level >8.5% as against 36% at 1 year. When placed on insulin in a hospital setting in the German study [9], the patients had a mean age of 62±14 years, a BMI of 27.5, progressive diabetes for 9 years and a delta HbA1c observed at 1 year of -1.85%. Our results as well as those of the others studies indicate inadequate management of type 2 diabetics in other countries in the years 1990-1995 and in France in the years 2000. A comparison carried out between France and the “main developed countries” (USA, Italy…) shows a much lower consumption of insulin per head compared with other countries, which suggest underuse of insulin in France [10]. Nevertheless, as the study was observational, the results should be interpreted with caution.

Another barrier for insulin initiation is the psychological insulin resistance on patients’ and health professionals’ side. This aspect is well highlighted in the DAWN study (Diabetes Attitudes Wishes and Needs, [11]. More than 5 000 people with diabetes and 300 health care diabetes professionals in 13 countries participated. In this study, more than half of all type 2 patients not using insulin worry about having to start insulin and 40% of health care professionals agreed that they prefer to delay the initiation of insulin until it’s absolutely essential with only 34% expressing a belief that earlier introduction of insulin would decrease the overall cost of diabetes in the long term. ADA guidelines recommend an HbA1c level <7%, and 6.5% in case of macrovascular complications [3], the U.K expert statement recommends an HbA1c level <6.5% [12]. The French recommendations [4] are on line with these international guidelines: “The indication for insulin therapy is therefore recommended when the HbA1c level is >8% on two successive tests with treatment by a combination of sulfonylurea and metformin at the optimum dosage; the HbA1c target is 6.5%”. Our study therefore shows that these recommendations are not being followed: insulin is started very late in the progress of the disease at a level of HbA1c which is very much above the recommended threshold. This is probably why the early introduction of a single basal insulin injection that is usually recommended as first line strategy [12,13,14] was only used in 42% of cases in the study, as the patients were seen too late in the disease. Our study confirms that initiating insulin therapy is accompanied by an improvement in glycemic control, with a decrease of an average of 2 points of HbA1c. This improvement in glycemic control has been found in other randomised studies in patients naïve to insulin [13,15]. In our study, for patients on 1 injection per day, the HbA1c level seems to drop less than with 2 or 3 injections per day but the initial glycemic level is lower. These data correspond to what has already been

<table>
<thead>
<tr>
<th>HbA1c (%)</th>
<th>1 inj/day</th>
<th>2 inj/day</th>
<th>3 inj/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>9.7±1.9</td>
<td>10.2±2.4</td>
<td>10.2±2.5</td>
</tr>
<tr>
<td>M12</td>
<td>8.1±1.5</td>
<td>7.9±1.5</td>
<td>7.3±1.3</td>
</tr>
<tr>
<td>(\Delta)</td>
<td>-1.63±2.1</td>
<td>-2.3±2.6</td>
<td>-2.8±2.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>1 inj/day</th>
<th>2 inj/day</th>
<th>3 inj/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>80±18</td>
<td>76±16</td>
<td>78±16</td>
</tr>
<tr>
<td>M12</td>
<td>82±17</td>
<td>80±16</td>
<td>83±14</td>
</tr>
<tr>
<td>(\Delta)</td>
<td>+2±6</td>
<td>+4±6</td>
<td>+5±7</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Dose (U/day)</th>
<th>1 inj/day</th>
<th>2 inj/day</th>
<th>3 inj/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0</td>
<td>13±6</td>
<td>34±14</td>
<td>46±17</td>
</tr>
<tr>
<td>M12</td>
<td>24±17</td>
<td>39±21</td>
<td>46±22</td>
</tr>
<tr>
<td>(\Delta)</td>
<td>+10.5±16</td>
<td>+5±16</td>
<td>-0.5±21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% patient with at least 1 hypoglycaemia at 1 year</th>
<th>17%</th>
<th>29%</th>
<th>35%</th>
</tr>
</thead>
</table>

Table II
Link between the number of injections on hospital discharge and the results at 1 year. n=670 patients.
described [13], i.e. an improvement in HbA1c proportional to the baseline glycemic level. The weight gain observed in the group treated with one injection/day (+1.2 kg/1% HbA1c decrease) is less important than usually described (+2 kg/1% HbA1c decrease, [13]). The combination of a single insulin injection per day with the oral treatment is re-cognised as being the insulin regimen which leads to a lesser weight gain with equivalent efficacy, provided that titration is “aggressive” [12,13,16]. In the IDAHO study, despite a better dose optimisation in the group with one injection/day, the lowest initial and final daily dose of insulin was in this same group.

**Conclusion**

The IDAHO study shows that insulin at 1 year is truly effective in type 2 diabetic patients and that in France, management is inadequate with insulin therapy being initiated too late and not titrated as aggressively as it should be. This emphasises the need for better adherence to the recommendations on glycaemic targets for initiating insulin therapy and during follow-up.

The arrival of long-term insulin analogues (which were not available during the IDAHO Study) may facilitate this therapeutic approach, limiting the incidence of hypoglycaemia and weight gain without loss of efficacy. A future epidemiological survey could re-evaluate long-term insulin analogue use in France.

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