

# Return to Work in Driver with Diabetes Mellitus Type 2 on Oral Anti Diabetic with a History of Hypoglycaemia

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## Abstract

**Background:** Patients with type 2 diabetes might be vulnerable to hypoglycemia, especially those treated with insulin secretagogues such as sulfonylurea and glinide, or insulin. Hypoglycemia compromises driving performance, causes slower response times, and reduces cognitive function. A return-to-work assessment needs to be done after a history of severe hypoglycemia or intractable episodes requiring hospitalization before resuming driving.

**Case presentation:** A 44-year-old man, a commercial vehicle driver with a history of Oral antidiabetic drugs (OAD), was admitted to the hospital with severe hypoglycemia and pre-renal acute kidney failure. After being hospitalized for seven days, the patient was planned to be discharged and intended to return to work as a driver in a car rental company after recovery.

**Discussion:** In determining return-to-work status, a proper analysis is needed in the form of seven steps to establish the return-to-work status. Job description, job demand, current medical status, disability, risk, and tolerance must be discussed before determining fit to work status. References related to how severe hypoglycemia relates to driving tasks could be valuable information in deciding fit-to-work status.

**Conclusion:** Return-to-work assessment has concluded that the patient is temporarily unfit as a commercial vehicle driver for six weeks. Education regarding hypoglycemia; including recognizing symptoms early, how to treat promptly, and avoid further devastating accident should be discussed thoroughly between patient and physician. Close monitoring by Occupational Medicine Specialists in hypoglycemia state and symptoms as a return-to-work- program would be a valuable step.

**Keyword:** type 2 diabetes mellitus oral antidiabetic agents, hypoglycemia, driving

## Abstrak

**Latar Belakang:** Pasien dengan diabetes tipe 2 dapat berisiko mengalami hipoglikemia, terutama mereka yang diobati dengan sekretagog insulin seperti sulfonilurea dan glinide, atau insulin. Hipoglikemia dapat mengganggu kinerja mengemudi, menyebabkan waktu respon yang lebih lambat dan menurunkan fungsi kognitif. Penilaian Kembali Kerja pada pengemudi perlu dilakukan, setelah adanya riwayat hipoglikemia berat yang membutuhkan perawatan, sebelum kembali mengemudi.

**Presentasi kasus:** Laki-laki, 44 tahun, seorang pengemudi kendaraan komersial dengan riwayat obat antidiabetik oral (OAD), dirawat di rumah sakit dengan hipoglikemia berat dan gagal ginjal akut pre-renal. Setelah menjalani perawatan selama tujuh hari, pasien direncanakan pulang, dan ia berniat kembali bekerja sebagai pengemudi di perusahaan rental mobil setelah sembuh.

**Pembahasan:** Dalam menentukan status kembali bekerja diperlukan analisis yang tepat berupa tujuh langkah untuk menetapkan status kembali bekerja. Deskripsi pekerjaan, tuntutan pekerjaan, status medis saat ini, kecacatan, risiko, dan toleransi harus dikaji sebelum menentukan status kelaikan kerja. Referensi yang terkait dengan bagaimana hubungan hipoglikemia dengan tugas mengemudi dapat menjadi informasi berharga dalam memutuskan status kelaikan kerja.

**Kesimpulan:** Penilaian kembali bekerja menyimpulkan bahwa pasien untuk sementara tidak layak sebagai pengemudi kendaraan komersial selama enam minggu. Edukasi mengenai hipoglikemia, termasuk mengenali gejala sejak dini, cara penanganan yang tepat, dan bagaimana menghindari komplikasi lebih lanjut, harus didiskusikan secara menyeluruh antara pasien dan dokter. Pemantauan ketat oleh Dokter Spesialis Kedokteran Okupasi terkait kondisi dan gejala hipoglikemia, sebagai bagian dari program kembali bekerja akan menjadi langkah yang berharga.

**Kata kunci:** diabetes mellitus tipe 2, agen antidiabetik oral, hipoglikemia, mengemudi

## Background

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both.<sup>1</sup> Complications that occur due to DM can be in the form of disturbances in the blood vessels, both macrovascular and microvascular, as well as disorders of the nervous system or neuropathy.<sup>2</sup> Acute complications include hypoglycemia, diabetic ketoacidosis, hyperglycemic hyperosmolar state, and hyperglycemic diabetic coma. Chronic microvascular complications are nephropathy, neuropathy, and retinopathy, whereas chronic macrovascular complications are coronary artery disease (CAD), peripheral artery disease (PAD), and cerebrovascular disease (CVD).<sup>2</sup>

The Workgroup on Hypoglycemia of the American Diabetes Association suggests that patients at risk for hypoglycemia (i.e., those treated with a sulfonylurea, glinide, or insulin) should be alert to the possibility of developing hypoglycemia at a self-monitored plasma glucose concentration of  $\leq 70$  mg/dL.<sup>3</sup> Severe hypoglycemia is an event where assistance from another person to actively administer carbohydrates, glucagon, or other corrective actions is required.<sup>4,5</sup> Acute hypoglycemia in patients with diabetes can lead to confusion, loss of consciousness, seizures, and even death. Early symptoms of hypoglycemia may include sweating, tremulousness, hunger and tingling around the mouth.<sup>5</sup> Recurrent hypoglycemia was shown to reduce the glucose level that precipitates the counterregulatory response necessary to restore euglycemia during a subsequent episode of hypoglycemia. This would mean that patients with frequent hypoglycemia do not experience the symptoms in response to a drop in blood glucose level until it reaches lower and more harmful levels.<sup>6</sup>

Driving is a complex instrumental activity of daily living, which involves a complex and rapidly repeating cycle that requires a level of skills and the ability to interact with both the vehicle and the external environment simultaneously.<sup>5</sup> Performance of visual tasks, decision-making ability based on auditory processes, aspects of attention, speed of performance on attention-requiring tasks, and slower reaction response were found to be adversely affected at low blood glucose levels.<sup>4</sup>

For many people with diabetes, a driver's license is essential to work and all other aspects of life, such as: taking care of family, securing access to public and private facilities, interacting with friends, and/or performing many other functions of daily life.<sup>7</sup> There has been a considerable debate about whether diabetes may be an extent factor determining a driver's ability and eligibility for a license. Diabetes may affect a person's ability to drive, either through a 'severe hypoglycemic event' or from the chronic course of Diabetes Mellitus on the end-organ of relevant functions.<sup>5</sup> The main hazard in people treated with insulin, or several OADs (e.g. sulfonylurea, glinide), is the unexpected occurrence of hypoglycaemia.<sup>5</sup> Epidemiologic research suggests that patients at risk for hypoglycemia-related motor vehicle accidents may have some characteristics in common, including a history of severe hypoglycemia or hypoglycemia-related driving mishap.<sup>8</sup>

To date, no law is available yet to specifically regulate people with certain medical conditions, including diabetes, in obtaining a driver's license or performing driving tasks in Indonesia. Thus, there is no system to validate a driver's medical fitness to drive, nor would any restriction be implemented due to one's health condition.<sup>9,10</sup>

The aim of determining fitness to drive is to balance minimizing any driving-related road safety risks for the individual and the community posed by the driver's permanent or long-term injury or illness and maintaining the driver's lifestyle and employment-related mobility independence. The critical question would be: "Is there a likelihood the person will be unable to control the vehicle and act or react appropriately to the driving environment in a safe, consistent and timely manner?"<sup>5</sup> Thus, in assessing someone's fitness to drive in people with diabetes, any medical conditions that could raise possibilities of that person being unable to control the vehicle and act or react appropriately to the driving environment in a safe, consistent and timely manner should be considered.

## Case

A 44-year-old male, with type 2 Diabetes Mellitus on OAD (metformin 500 mg bid and glimepiride 1 mg od), presented with complaints slurry speech, weakness, and deterioration of consciousness for one

day before being admitted to the hospital. The patient had a history of diarrhoea for the last week prior to admission (up to 10 times per day) and been treated by two physicians on an outpatient basis. During this, the patient was still consuming his OAD agents (metformin 500 mg bid and glimepiride 1 mg od), with no additional fluid consumption, which rendered him in a severe dehydration state. Laboratory results at the time of admission showed low blood sugar (35 mg/ dL), increased ureum (119.1 mg/ dL) and creatinine (2.77 mg/ dL) levels and decreased Estimated Glomerular Filtration Rate (EGFR) (26.59 mL/ min/1.73m<sup>2</sup>). The patient was then admitted to the hospital with a diagnosis of Hypoglycaemia and Pre-renal Acute Kidney Injury.

The patient has hypertension, a history of PTCA (2019), CABG (2016), and cerebrovascular accidents suspected to be Reversible Ischemic Neurological Deficit (2005). Besides OAD, the patient also consumed furosemide, candesartan, clopidogrel, and simvastatin, as prescribed by his physician in a private hospital. The history of visual impairment and neuropathy was denied by the patient. The patient eats regularly by taking his lunch from home, with sometimes snacking too. The patient consumes an average of 1,200 mL of water during his work.

The patient works as a driver in a car-rental company for four years. The patient drove an MPV with automatic as well as a manual transmission. The patient worked 6 days a week, from 8 am to 5 pm, with an hour of break. Overtime of up to 4 hours a week was sometimes scheduled. The patient started his day at the workplace with a 40-minute ride on a motorcycle. Then he cleaned the car before he started driving the vehicle. On average, the patient was behind the car wheel for at least 4 hours every day but additional hours may apply if he had to drive out of town.

While working as a driver, the patient has several potential hazards. Physical hazards include dust, UV light, hand-arm vibration, whole body vibration, as well as the cold and dry air from the air conditioner. For chemical hazards, the patient is exposed to vehicle smoke on the street, car air freshener, and car shampoo. No apparent biological hazard was exposed to the patient. As for ergonomic hazard, there are gripping on both hands, an extension of the elbow with a raised arm more than 45°, prolonged sitting, repetitive movement of the ankle to plantar extension, overhead work, repetitive movement of the shoulder and wrist, frontal bending,

squatting, and unsupported back on a motorcycle. In the psychosocial aspect, the hazard mainly stresses during driving due to traffic.

After being hospitalized for seven days, the patient was planned to be discharged by his physicians. At that time, the patient's general condition was markedly improved, with no more complaints, alert, and able to mobilize himself for activity of daily living. The vital signs showed high blood pressure (160/ 87 mm Hg), with a normal pulse, respiratory rate, and temperature. His blood glucose level monitoring was within normal range. Eye examination showed clear lenses on both eyes, normal visual fields and eye movement, and no color blindness. Ears, neck, chest, and abdomen were within normal limits. On the extremities, the patient had normal motoric strength, distal pulses, and sensory. Laboratory markers on the last day of hospitalization showed normal blood ureum, creatinine, e-GFR, and blood sugar levels. The patient was discharged with the final diagnosis of type 2 diabetes mellitus on an oral antidiabetic agent with a history of hypoglycemia, uncontrolled hypertension stage 2, pre-renal Acute Kidney Injury on improvement, and Coronary Arterial Disease, with a history of CABG (2016) and PCI (2019). The patient was given metformin 500 mg twice daily, Nifedipine gastrointestinal therapeutic system

(GITS) 60 mg once daily, Candesartan 16 mg once daily, Bisoprolol 5 mg once daily, Atorvastatin 40 mg once daily, Acetylsalicylic acid 80 mg once daily, Nitroglycerine 5 mg once daily as take-home medication. Patients are advised to make their dietary modifications. The patient intended to return to work as a driver in a car rental company after he recovered.

## Discussion

In determining the return-to-work status of a driver with type 2 Diabetes Mellitus, a proper analysis is needed in the form of seven steps to establish the return-to-work status. As the first step, the job description for this patient should be elaborated. The patient worked as a driver in a car rental company for approximately four years. Patients work Monday-Saturday from 08 am to 5 pm, with a 1-hour break between 12 pm – 1 pm. Patients sometimes must work overtime, up to 4 hours per week. The patient goes and comes home from work by motorcycle, with a 40-minute ride. Then he cleaned the car before he started driving the vehicle. On average,

everyday patient was behind the wheel for at least 4 hours in total but maybe added if he had to drive out of town. Patient drove an MPV with automatic as well as a manual transmission. The patient must have a type A driver's license, a good attitude while driving and giving service to customers, and good endurance associated with a long period spent on roads as special preparation.

To understand more about the nature of the job task, job demand needed to be discussed in step two. In the physical aspect, based on The 2011 Compendium of Physical Activities<sup>11</sup>, the patient's activities include truck, driving a delivery truck, taxi, shuttlebus, and school bus, which required 2.0 METs as sustained work, and cleaning, heavy or major (e.g. wash the car, wash windows, clean garage), moderate effort, which required 3.5 METs as brief work. Thus, The minimum physical capacity required for sustained work in this job is 5.25 METs. The patient's work requires light-moderate mobility and sufficient muscle strength in the left and right upper and lower extremities to sit, walk, and hold the steering wheel with motoric strength of 5/5/5/5. In the motoric aspect, the patient's job demands gross motor skills in both hands and feet; a good range of motion ability in both arms and lower legs to stand, walk, and power grip the steering wheel. Good fine motor skills demand fine finger coordination skills; normal flexion-extension abilities of the fingers; no muscle weakness, stiffness, tremors, and joint pain; and no limitations in the scope of movement of the fingers and wrists. The patient is expected to have excellent hearing ability and be able to express their opinions verbally and non-verbally. Good near and far vision capabilities, with or without correction, must achieve an optimal vision of 6/12, no narrowing of the visual field, no color blindness, and no double vision are also required. Patients are required to have a normal cognitive function and good mental state; the ability to work in a closed and air-conditioned environment inside a vehicle; the ability to communicate well, especially with customers, supervisors, and co-workers; to work from 8 am – 5 pm, six days a week, and overtime about 4 hours a week; and ability to work in a long sitting position, as well as wrist flexion, gripping, with elbows extended and arms raised > 45 degrees.

The third step would be the assessment of the patient's medical status. On admission, the patient had severe diarrhoea up to 10 times per day. With a lack of fluid rehydration and lack of oral intake, this condition caused the patient to experience severe dehydration and

eventually a pre-renal acute kidney injury due to its hypovolemia state. This pre-renal acute kidney injury condition could cause an imbalance of glucose utilization which exceeds glucose intake, glycogenolysis, and/or gluconeogenesis. Additionally, the patient was still taking oral anti-diabetic agents (sulfonylurea and metformin) during this period. The result of this imbalance is potentially the reason why hypoglycemia may occur in this patient.<sup>12</sup> Physical capacity has not been assessed and should be done after the treating physician declares that the patient has stabilized blood glucose. However, according to the patient, the patient has no complaints in physical activity, where the patient has no obstacles in walking for long distances or even climbing stairs. There was no obstacle to hearing function. Color blind test, eye movement, and visual field were found normal. A detailed visual acuity test could not be performed due to a lack of facilities in the ward. Still, the patient claims that he has no complaints about visualizing far objects or reading at a near distance. Meanwhile, no obstacle was found in the motoric, emotional, mental, or ergonomic aspects. With the currently normal level of HbA1C, blood glucose as targeted, normal kidney function but high blood pressure, regular meal, and drives mainly inside the town, it is concluded that this patient has a *dubia-ad-bonam* prognosis both clinically and occupationally.

Impairment, disability, and handicap assessment is the fourth step in assessing a patient's return to work. Impairment in this patient is related to his diabetes, hypertension, and history of Coronary Arterial Disease. Based on the patient's history of type 2 diabetes mellitus, currently being treated with 1 type of oral antidiabetic drug (Metformin 500 mg twice daily), HbA1C result of 5.3%, total BOTC (Burden of Treatment Compliance) points for this patient is 4, whole person impairment rating for Diabetes Mellitus for this patient is 2% (class 1B).<sup>13</sup> Based on the patient's hypertensive condition, namely normal results for ureum and creatinine, stage 2 hypertension even with candesartan and furosemide drugs (at admission), and no complaints of shortness of breath, the whole person impairment rating for hypertension condition of the patient is 23% (class 2E).<sup>13</sup> As for the Coronary Arterial Disease (CAD) condition of this patient, namely the presence of a history of Coronary artery bypass graft (CABG) and Percutaneous coronary intervention (PCI) with continuous treatment, physical examination within normal limits, and a documented history of myocardial infarction, the whole person impairment rating for the

patient is 14% (class 2B).<sup>13</sup> There were no disabilities or handicaps found in this patient, as the patient can walk long distances and climb stairs without difficulty (equivalent to 4 METs). This means the patient can do the physical activity by washing a car, which requires 3.5 METs, and driving a vehicle which requires 2 METs.

The fifth step in assessing return to work is determining risks for the patient, his colleague, and the working environment. Uncontrolled hypertension and a history of recent hypoglycemia in this patient may put him at risk for a medical emergency (hypoglycemia stupor, hypertension, CAD, or stroke) and risk of a traffic accident in his current job. Hypoglycemia unawareness in this patient could risk the patient to experienced recurrent hypoglycemia. Recurrent hypoglycemia was shown to reduce the glucose level that precipitates the counterregulatory response necessary to restore euglycemia during a subsequent episode of hypoglycemia. This would mean that patients with frequent hypoglycemia do not experience the symptoms in response to a drop in blood glucose levels until the blood glucose reaches lower and more harmful levels.<sup>5</sup> The risk of traffic accidents at work if a medical emergency occurs in the patient due to uncontrolled hypertension and a history of recent hypoglycemia, may pose a risk to the environment. The patient was given metformin 500 mg bid as take-home medication for his diabetes instead combination therapy of glimepiride (sulfonylurea) and metformin. According to the profile of oral antihyperglycemic drugs available in Indonesia, metformin's main side effect does not include hypoglycemia.<sup>1</sup> This means that the patient's latest anti-diabetes regimen of single metformin therapy should reduce the patient's risk of recurrent hypoglycemia. Nevertheless, education and monitoring regarding hypoglycemia awareness and hypoglycemia state during the recovery period need to be done to ensure the patient is safe to return to work.

The sixth step is to determine the tolerance from the worker as well as from the workplace. Both parties, the patient and workplace management, expected the patient to return to work as before as soon as the patient's condition improved.

Determining a fit-to-work status for this patient is the seventh step and the goal of a return-to-work assessment. A prospective cohort study in 2013 by Signorovitch et al. found hypoglycemia was associated with significantly increased hazards for any accident

[hazard ratio (HR) 1.39, 95% CI 1.21–1.59,  $p < 0.001$ ] and motor vehicle accidents (HR 1.82, 95% CI 1.18–2.80,  $p = 0.007$ ).<sup>14</sup> Another experimental cohort study from Stork et al. in 2007 also found that in the type 2 diabetes mellitus group, patients using oral hypoglycemic agents answered that they would make an unsafe decision (drive) during perceived hypoglycemia more frequently than patients using insulin ( $x_2 = 4.44$ ;  $P = 0.04$ ).<sup>15</sup> According to the fitness to drive standard from the United Kingdom government, a commercial vehicle driver may drive if there has been no more than 1 episode of severe hypoglycemia while awake in the last 12 months and the most recent episode occurred more than three months ago.<sup>16</sup> Another reference from a fitness-to-drive guideline in Australia explained that after a severe hypoglycemic event occurs, the person should not drive for a significant period and must be urgently assessed. The minimum period before returning to driving is generally six weeks because it often takes many weeks for patterns of glucose control and behavior to be re-established and for any temporary 'reduced awareness of hypoglycemia' to resolve.<sup>5</sup> Additionally, a review from Gurayat Diabetes Center, Saudi Arabia, suggest that drivers should be strongly advised against risk-taking behavior. If the history suggests hypoglycemic unawareness, the driver should be advised to stop driving until the condition is reversed by scrupulously avoiding further hypoglycemia for at least two weeks.<sup>4</sup> Based on several references above, the patient is temporary unfit as a commercial vehicle driver for six weeks, with biweekly evaluation, until controlled blood glucose without hypoglycemia state for at least two weeks and controlled blood pressure is achieved, which, stated by the Internal Medicine Specialist. A close monitoring of the patient by an Occupational Medicine Specialist for hypoglycemia state and hypoglycemia awareness through self-monitoring of blood glucose level and self-administered daily log of hypoglycemia symptoms at the time of blood glucose test, with biweekly evaluation, could be done as part of return-to-work program. At the following return-to-work re-assessment, physical capacity and detailed visual acuity assessment should also be done.

## Conclusion

Hypoglycemia is one of the acute complications that could happen to individuals with Diabetes Mellitus

(especially those treated with sulfonylurea, glinide, or insulin.<sup>6</sup>), which compromises driving performance, resulting in slower response times, and reduced cognitive function.<sup>4</sup> Hypoglycemia unawareness develops if there are frequent events of hypoglycemia (level < 55 mg/ dL).<sup>4</sup>

Return-to-work assessment done through Seven Steps of Return-to-Work Assessment for patient with Diabetes Mellitus Type 2 on oral antidiabetic agents (metformin and sulfonylurea) and a history of hypoglycemia has concluded that he is temporary unfit as a commercial vehicle driver for six weeks, until controlled blood glucose without hypoglycemia state for at least two weeks and steady blood pressure is achieved, which stated by the Internal Medicine Specialist. The patient needs several weeks for patterns of glucose control and behavior to be re-established and for any temporary 'reduced awareness of hypoglycemia' to resolve. The minimum period before returning to drive is generally six weeks.<sup>5</sup>

Education to the patient regarding hypoglycemia, namely recognizing symptoms early, how to treat promptly, and avoid further or recurrent episodes, should discuss thoroughly between the patient and physician; close monitoring by Occupational Medicine Specialists in hypoglycemia state and symptoms as a return-to work- program would be a valuable step.

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