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Original Research Paper

Case Report: 60-Year-Old Female with Ischemic Stroke, Type 2 Diabetes Mellitus, and Hypertension

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ABSTRACT

Background: Ischemic stroke remains a leading cause of death and disability worldwide, with increasing incidence each year. Patients with comorbidities, such as Type 2 diabetes mellitus (DM), pose additional treatment challenges due to a higher risk of drug-related problems (DRPs), particularly drug interactions. **Objective:** This study aims to describe pharmaceutical care in female patients diagnosed with ischemic stroke and Type 2 DM, with a focus on identifying and evaluating DRPs. **Method:** A descriptive case study was conducted. Data were collected through medical records and patient monitoring, focusing on the identification and analysis of potential DRPs in the context of pharmaceutical care. **Results:** The study found drug interactions as the most prominent DRP. An interaction between potassium slow-release (KSR) and candesartan was identified as requiring monitoring. Additionally, moderate interactions were found between atorvastatin and clopidogrel, as well as atorvastatin and amlodipine. These interactions have the potential to influence therapeutic outcomes. **Conclusion:** The prescribed medication regimen was generally appropriate for the patient's condition. Nevertheless, the presence of DRPs highlights the importance of regular monitoring and dose adjustments. Optimizing pharmaceutical care through early detection and management of DRPs is essential to ensure treatment safety and effectiveness in patients with complex conditions.

Introduction

Stroke is defined as a functional brain disorder that occurs focally or globally where this condition occurs acutely and lasts more than 24 hours, originating from cerebral blood flow disorders[1]. Ischemic stroke has an incidence of 85% of all strokes and consists of 80% atherothrombotic strokes and 20% cardioembolic strokes. Ischemic stroke is caused by focal occlusion of cerebral blood vessels which causes a decrease in oxygen and glucose supply to the part of the brain that is experiencing occlusion[2,3,4].

Ischemic stroke is one of the leading causes of death and disability worldwide, with the incidence continuing to increase from year to year[5]. Atherosclerosis is the main cause of ischemic stroke and can be triggered by a number of risk factors including hypertension, diabetes mellitus, hypercholesterolemia, obesity, and lack of physical activity[6]. Hypertension itself can increase the risk of ischemic stroke two-fold, while diabetes mellitus can increase it by 3.8 times compared to individuals without diabetes[7].

Increased blood pressure (Hypertension) is still one of the biggest risk factors for cardiovascular disease that can occur including stroke, dementia and heart disease which is one of the leading causes of death in the world[8]. The death rate due to increased blood pressure is proportional to the severity of cardiovascular disease and its progression will increase to more than 80% in a year in patients who do not receive adequate treatment[9,10,11].

Diabetes mellitus (DM) is a chronic metabolic disorder caused by the pancreas not secreting enough insulin hormone, or it could also be because the body is unable to use the insulin hormone that has been produced[12]. Insulin itself is a hormone that regulates the balance of blood sugar levels in the body[13]. As a result, there will be a condition of increased blood glucose levels or commonly called hyperglycemia[14,15,16].

Kadar glukosa darah yang tinggi pada penderita stroke akan memperbesar luasnya area infark (sel mati) karena terbentuknya asam laktat akibat metabolisme glukosa yang dilakukan secara anaerob yang merusak jaringan otak[17]. Rusaknya jaringan otak akan mempengaruhi fungsional pasien stroke iskemik baik secara motorik maupun sensorik[18].

High blood glucose levels in stroke patients will enlarge the area of infarction (dead cells) due to the formation of lactic acid due to anaerobic glucose metabolism which damages brain tissue[17]. Damage to brain tissue will affect the functionality of ischemic stroke patients both motorically and sensorily[18].

Both conditions can interact in a complex way and mutually increase the risk of ischemic stroke. Research shows that diabetes mellitus has a significant relationship with ischemic stroke, with a risk 3.8 times higher compared to individuals without diabetes mellitus[19].

In recent years, metabolic diseases such as hypertension, diabetes mellitus, and stroke have experienced an increasing trend. This is often caused by unhealthy lifestyles, lack of physical activity, and genetic factors[20]. Therefore, it is important to understand these risk factors and take preventive measures to prevent the occurrence of these diseases. In this study, we will review further the relationship between hypertension, diabetes mellitus, and ischemic stroke.

The increasing incidence of ischemic stroke, especially in patients with comorbidities such as diabetes mellitus and hypertension, indicates the need for special attention in the management and prevention of this disease. The combination of hypertension and diabetes mellitus not only increases the risk of ischemic stroke, but also contributes to the severity and extent of damage experienced by patients, which has an impact on quality of life and productivity[21,22]. This study has novel value in providing insight into the complex interactions between diabetes mellitus, hypertension, and ischemic stroke management, which is expected to be a reference in developing more comprehensive and personalized therapeutic strategies for patients with similar conditions.

This study aims to understand how hypertension and diabetes mellitus contribute to each other in increasing the risk of ischemic stroke in patients. Both of these conditions not only worsen the risk, but also have the potential to increase the severity and extent of brain tissue damage experienced by ischemic stroke patients. In addition, this study also explores drug-related problems (DRPs), especially drug interactions, which often occur in pharmaceutical therapy in patients with ischemic stroke and type 2 diabetes mellitus. A deeper understanding of the relationship between these risk factors and the DRPs that arise will provide a basis for improving the quality of therapy management and reducing complications in patients with complex conditions.

Materials and Methods

Research Design

This study used a descriptive case study design, which aims to describe the condition of patients with ischemic stroke and comorbidities of type 2 diabetes mellitus and hypertension. Descriptive case studies were chosen to provide an in-depth description of the care and pharmaceutical interventions applied to patients and to identify potential drug-related

problems (DRPs) that occurred during treatment.

Sample

The subject of the sample in this study was a 60-year-old female patient who was treated at Achmad Mochtar Hospital Bukittinggi, with a primary diagnosis of ischemic stroke, type 2 diabetes mellitus, and hypertension. This patient was selected as a sample because she met the inclusion criteria, namely a patient with ischemic stroke who had a history of type 2 diabetes mellitus and uncontrolled hypertension, thus allowing for an in-depth analysis of the patient's condition and therapeutic management.

Data Collection Techniques

Data were collected through interviews and direct observation of the patient's condition. Interviews were conducted to obtain information related to medical history, drug use history, and patient perceptions of their treatment. Observations were made of the patient's physical condition and vital signs as well as monitoring of drug interactions given. Other supporting data, such as CT Scan results and patient medical records, were also collected to strengthen the findings in this case study.

Data Analysis Techniques

The data obtained were analyzed descriptively to identify DRPs that occurred, especially in terms of drug interactions consumed by patients. Data analysis was carried out by classifying drug interactions based on severity categories (monitoring, moderate, and others) and evaluating the relevance of these interactions to the patient's condition. These findings were then presented in narrative form to provide a clear picture of the pharmaceutical care received by patients.

Ethical Consideration

This study has obtained ethical approval from the ethics committee at RSUD Achmad Mochtar Bukittinggi to ensure that all research procedures comply with the ethical principles of medical research. Written informed consent from patients or authorized parties was also obtained prior to data collection, ensuring that patient participation was voluntary and in accordance with applicable ethical standards in clinical research.

Results

A 60-year-old female patient with a history of hypertension and type 2 diabetes mellitus came to the hospital on May 20, 2024 and was treated in the Neurology room HCU 1 at Achmad Mochtar Hospital, Bukittinggi. The patient had experienced decreased consciousness since the day before, accompanied by weakness in the left limbs. Based on medical records, the patient had a history of uncontrolled hypertension for the past six years and only in the past year had her blood pressure been controlled. In addition, the patient had been diagnosed with type 2 diabetes mellitus for seven years. The results of the CT scan showed that the patient had an ischemic stroke, and her vital signs upon admission were body temperature 37.1°C, pulse 81 beats per minute, respiratory rate 22 breaths per minute, and blood pressure 142/72 mmHg.

Medical management of this patient involved a number of drugs to control hypertension, diabetes mellitus, and stroke conditions that he experienced. The drugs given included KSR, candesartan, atorvastatin, clopidogrel, and amlodipine. From the analysis results, several Drug-Related Problems (DRPs) were found in the form of drug interactions that have the potential to affect the effectiveness and safety of therapy.

The interaction between KSR and candesartan is categorized as an interaction that requires monitoring, because it can affect the effectiveness of lowering blood pressure. In addition, the interaction between atorvastatin

and clopidogrel and between atorvastatin and amlodipine is categorized as an interaction with moderate severity. These interactions have the potential to increase the risk of side effects or reduce the effectiveness of therapy so that close monitoring is required during treatment.

Overall, the drug therapy given to this patient was considered appropriate for his clinical condition, but DRPs in the form of drug interactions need to be monitored to prevent potential adverse side effects. This shows the importance of optimal pharmaceutical care management, especially in cases with complex comorbidities such as ischemic stroke, hypertension, and diabetes mellitus.

Discussion

Hypertension is one of the risk factors for stroke[23]. Abnormal blood pressure and continuous increase can cause damage to the artery walls or wounds that encourage plaque buildup in the arteries and cause disruption of blood flow to the brain so that it can cause blockage or rupture of blood vessels in the brain and cause stroke[24].

Ischemic stroke therapy includes intravenous thrombolytics, regulation of blood sugar levels, temperature, blood pressure control, reduction of intracranial pressure, and neuroprotection[25,26].

Administration of Asering Infusion fluid containing NaCl, CaCl2, KCl, and Na acetate can be used as an electrolyte fluid to balance electrolytes and fluids in the body. On the first day, administration of Asering Infusion fluid can help overcome dehydration, and Clopidogrel tablets are also given which function as antiplatelets to prevent the formation of new clots and are useful for the treatment of acute ischemic stroke, this therapy can prevent patients within 90 days after the first incident[20]. The purpose of giving clopidogrel is also to restore blood flow to the brain as quickly as possible, namely in the first few hours after the onset of stroke symptoms[27].

The patient had an ischemic stroke with a history of hypertension, on the first day the patient's blood pressure was 210/105mmHg so that Nicardipine 52 iv was given, for the first administration, 0.5ml was given, followed by a dose of 1ml after 15 minutes 3 times to lower the patient's blood pressure by 15%. Then continued with combination therapy of Amlodipine 1x1 (5 mg) and Candesartan 1x1 (8mg), while amlodipine works by inhibiting the entry of extracellular calcium ion channels across the myocardial cell membrane and smooth muscle cells[28]. Candesartan is also given to patients where candesartan is an antihypertensive ARB (Angiotensin II Receptor Blocker) which can reduce the risk of stroke[29]. Patients were also given citicoline 2x1 (500mg) to reduce cell death by repairing brain cells, reducing bleeding, edema volume, and providing nutrition to the brain which is useful for symptoms of neurological dysfunction, citicoline works by stimulating the biosynthesis of structural phospholipids of nerve membranes, inhibiting apoptosis and stimulating the synthesis of acetylcholine can increase blood flow and oxygen consumption in the brain.

The patient also experienced hyperlipidemia, so on the first day the patient was admitted to the hospital, Atorvastatin was also given to overcome the patient's condition. Atorvastatin works competitively by inhibiting reductase – 3 - hydroxy3methylglutaryl - coenzyme A (HMG-CoA), which functions to lower LDL levels and also has the effect of increasing HDL levels and lowering Triglyceride levels. The choice of statin therapy in overcoming hyperlipidemia is the most effective for lowering LDL levels and has been proven safe without significant side effects, in addition, the use of statins can immediately lower lipid levels so that it can improve outcomes and reduce the risk of stroke. This is due to the pleiotropic effects of statins. The pleiotropic effects of statins can improve

endothelial function through increased production of nitric oxide and antioxidants and anticoagulant effects[30].

Based on the results of the examination that has been done, it was found that the potassium levels in the patient were also low, therefore KSR therapy 2x1 (600mg) was given which functions as a potassium supplement. Some of the above therapies were also given consistently until the last day the patient was in the hospital, but on the second day the patient experienced an increase in body temperature, so Paracetamol iv therapy 1x1g/100ml was given to treat the patient's fever.

The patient's laboratory results showed an HbA1C value of 5.9% with a normal value of less than 5.7% and a uric acid level of 7.0 mg/dL. The patient was diagnosed with controlled type 2 DM, so on the third day the patient received a combination therapy of metformin 1x1 (500mg) and Fonylin MR 1x1 (60mg) as 53 antidiabetics which were then consistently given until the patient's last day in the hospital. Then to overcome the condition of Hyperuricemia, the patient was given allopurinol therapy 1x1 (100 mg) which works by inhibiting xanthine oxidase, an enzyme in the purine catabolism pathway that converts hypoxanthine to xanthine to uric acid, reducing uric acid production without interfering with purine synthesis.

On the fourth day in the hospital, the patient experienced a cough with phlegm so that Bisolvon IV therapy was given as a mucolytic agent that works by breaking down the molecular structure that forms mucus, so that the mucus becomes more liquid and easy to cough out. Bisolvon was given consistently 3x1 while the patient was in the hospital.

Based on the therapy that has been given to the patient during treatment, overall it is appropriate and in accordance with the patient's condition. The choice of therapy, indication of therapy, and dosage regimen of treatment given to the patient are appropriate. However, it is necessary to monitor blood pressure, blood sugar levels, cholesterol levels, uric acid levels and also pay attention to interactions between drugs, especially interactions with the Major category that can endanger the patient's condition. In addition, education for the patient's family regarding the therapy given and compliance is carried out in the use of drugs to increase the success of patient therapy.

DRPs in this case found an interaction. The interaction that occurs between KSR and Candesartan with the monitor category[28]. The combination of KSR and candesartan can increase potassium levels in the blood. So patients need closer and more frequent monitoring. Monitoring can be monitored through symptoms such as nausea, vomiting, weakness, tingling, or irregular heartbeat. Drug interactions Atorvastatin and clopidogrel, this combination of drugs can reduce the therapeutic effect of clopidogrel. So it is necessary to adjust the dose. And there is a drug interaction between atorvastatin and amlodipine, this combination of drugs can increase atorvastatin levels in the blood.

Conclusion

Pasien di diagnosa menderita stroke iskemik, terdapat DRPs pada terapi yang diberikan. DRPs yang ditemukan adalah terdapat interaksi antar obat yaitu KSR dengan candesartan, atorvastatin dengan clopidogrel dan interaksi atorvastatin dengan amlodipine. Sehinggga perlu dilakukan pemantauan terhadap gejala yang timbul dan penyesuaian dosis penggunaan obat.

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