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CASE REPORT

Sudden Blindness as Post-Hemodialysis Complication Experienced by Patients at The End-Stage of Kidney Disease: a Case Report

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ABSTRACT

Introduction: Hemodialysis is the most preferred Renal Replacement Therapy (RRT) options for End-Stage Kidney Disease (ESKD) patients. Although it is safe and beneficial for patients, several complications may occur during hemodialysis process. One complication that is rarely found in the hemodialysis process is visual impairment. Visual impairment or even sudden blindness occured during or within 24 hours post hemodialysis. **Objective:** To describe the occurring sudden blindness as a rare complication in patients undergoing hemodialysis and its etiology.

Brief Case: 19 years old man with ESKD undergoing hemodialysis for 1 month with a complaint of sudden blindness in both eyes occurring <24 hours post hemodialysis.

Discussion: Fast and precise efforts are needed to diagnose the etiology of blindness, so that prevention and appropriate treatment can be immediately taken. Multidisciplinary teamwork is needed to diagnose the etiology of visual impairment.

Conclusion: Sudden blindness in this case may be caused by the 3rd degree hypertensive retinopathy caused by malignant hypertension and Posterior Reversible Encephalopathy Syndrome (PRES)

Keywords: *Acute Cortical Blindness, Chronic Kidney Disease, Hypertensive Retinopathy, Intradialytic Hypertension, Posterior Reversible Encephalopathy Syndrome*

ABSTRAK

Latar belakang: Hemodialisis merupakan salah satu pilihan Terapi Pengganti Ginjal (TPG) yang banyak dipilih pada pasien Penyakit Ginjal Tahap Akhir (PGTA). Meskipun aman dan bermanfaat, terdapat beberapa komplikasi yang dapat terjadi pada pasien yang menjalani hemodialisis. Salah satu komplikasi akut yang jarang ditemukan pada proses hemodialisis adalah gangguan visual. Gangguan visual dapat

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muncul sebagai penurunan penglihatan atau kebutaan yang terjadi mendadak pada saat proses atau 24 jam setelah hemodialisis berlangsung.

Tujuan: Melaporkan kasus kebutaan mendadak sebagai komplikasi yang jarang ditemukan pada pasien yang menjalani hemodialisis dan kemungkinan penyebab yang mendasarinya.

Laporan Kasus: Seorang laki-laki 19 tahun dengan keluhan kebutaan mendadak pada kedua mata. Keluhan muncul <24 jam pasca hemodialisis. Pasien memiliki riwayat Penyakit Ginjal Tahap Akhir dan saat ini menjalani hemodialisis 2 kali seminggu selama 1 bulan.

Diskusi: Diperlukan upaya yang cepat dan tepat untuk dapat menegakkan diagnosis agar dapat dilakukan tindakan pencegahan dan penanganan yang tepat. Diperlukan kerjasama multidisiplin untuk dapat mendiagnosis penyebab gangguan visual yang terjadi.

Kesimpulan: Kebutaan mendadak pada kasus ini kemungkinan disebabkan oleh hipertensi maligna yang mengakibatkan retinopati hipertensi derajat 3, dan *Posterior Reversible Encephalopathy Syndrome* (PRES).

Kata kunci: *Acute Cortical Blindness, Hipertensi Intradialisis, Posterior Reversible Encephalopathy Syndrome, Penyakit Ginjal Kronis, Retinopati Hipertensi*

INTRODUCTION

Hemodialysis is the most preferred Renal Replacement Therapy (RRT) by End-Stage of Kidney Disease (ESKD) patients (Kandarini, Widiana dan Suwitra, 2017). In Indonesia, 132.142 people experienced the End-Stage of Kidney Disease (ESKD) and greatly depends on hemodialysis therapy to survive (Pernefri, 2018). Although it is safe and beneficial for the patients, several complications may occur during the hemodialysis processes. One complication rarely found during hemodialysis processes is visual impairment (Widiana *et al.*, 2017). Visual impairment or even sudden blindness occurred within 24 hours post hemodialysis (Doluoglu *et al.*, 2013).

Sudden blindness is possibly caused by disruption in refractive media, retinal, or neuro-visual impairment. Refractive media disorder can be caused by hyphemia, lens luxation, corpus vitreous hemorrhage, and endophthalmitis. Retinal disorder is possibly caused by retinal vascular occlusion, retinal hemorrhage, and retinal detachment. While neuro-visual impairment is possibly caused by disruption in optical nerve*, chiasma opticum retrochiasma,* and primary visual cortex (Panakos, 2015). The causes of sudden blindness is greatly necessary to figure out in order to provide the appropriate treatments for the related patients (Sujoy *et al.*, 2021). This case report aimed to explain a sudden blindness case as complication after undergoing hemodialysis rarely found in patients at the End-Stage of Kidney Disease (ESKD). This research was a descriptive study with a case study approach. This report was arranged after obtaining permit from the related patients and health research ethics committee of Roemani Muhammadiyah Hospital of Semarang, with Health Research Ethics Number EA-020/KEPK-RSR/V/2021.

CASE REPORT

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A 19 years old man was admitted to the Emergency Room (ER) with the complaint of blurred vision suddenly occurring on both eyes. A night before admitted to ER, patient experienced blurred vision, yet without considering it as something serious and just then deciding to sleep. When waking up, the patient could not see anything except dark vision on his both eyes. In addition, the patient also complained feeling dizzy and headache since yesterday after undergoing hemodialysis. The patient diagnosed with End-Stage of Kidney Disease (ESKD) a month ago, using a dialysis (DL) cathether, and had routinely undergone hemodialysis twice a week since then. The patient did not complain feeling pain on his both eyes, movement weakness, nausea nor vomiting. The history of trauma around the area of head and eyes was also denied. The patient experienced hypertension since first diagnosed with End-Stage of Kidney Disease (ESKD), while the history of Diabetes Mellitus (DM) was previously unknown. The history related to the patient's vision disorder was also denied. Before diagnosed with End-Stage of Kidney Disease (ESKD), the patient worked as laborer whom frequently consuming energy drinks instead of mineral water.

Patient had no complaint before undergoing hemodialysis, a day before the complaint existed. The pre-dialysis examination data shown body weight of 50 kgs, Inter Dialytic Weight Gain (IDWG) of 1 kg, blood pressure of 172/121 mmHg, pulse rate of 97 times per minute, breathing rate of 18 times per minute, oxygen saturation of 98%, and temperature of 36.6 ^{0}C. The patient then underwent hemodialysis program using infiltration: the duration was 4 hours with heparin dosage Standard of 1000 iu/hour, Quick of blood (Qb) of 180 ml/minute, Quick of Dialysate (Qd) of 500 ml/minute, Ultrafiltration (UF) with the Total Volume of 1 liter with UF Rate of 250 cc/hour, and Double Lumen (DL) catheter access. Patient once complained having dizziness within 2 hours of intradialysis. The vital signs intradialysis examination were blood pressure of 192/95 mmHg, pulse rate of 98 times per minute, breathing rate of 20 times per minute, oxygen saturation of 98%, and temperature of 36.9 ^{0}C. The patient then consumed a paracetamol tablet of 500 mg, yet the dizziness did not reside, but followed by headache at the end of hemodialysis session. The vital signs examination post hemodialysis were blood pressure of 213/124 mmHg, pulse rate of 100 times per minute, breathing rate of 20 times per minute, oxygen saturation of 99%, and temperature of 36.9 ^{0}C. The patient then decided to rest for a while before went home.

The examination at the Emergency Room (ER) were body weight of 49 kgs, compos mentis, blood pressure of 162/112 mmHg, pulse rate of 91 time per minute, breathing rate of 20 times per minute, oxygen saturation of 98%, and temperature of 36.7 ^{0}C. The opthalmological examination found no abnormalities on anterior eye ball segments. The visus of occulus dextra sinistra (VODS) was 1/∞. The Intraocular Pressure (IOP) was normal in digity tonometry examination. In neurological examination, it was found that the superior extremity power was 555/555, while the inferior extremity was 555/555. No abnormalities were found in fascial nerve examination. The pathological reflect was negative, while the physiological reflect was at normal level.

The electrocardiography examination found the depiction of normo sinus rhytm with normo axis. The laboratory examination was presented in Table 1. In thorax rontgen examination, no abnormalities were found either in heart or lungs. Meanwhile, in the Computed Tomography Scan (CT-Scan) examination, the head without contrast had the depiction of vasogenic edema in parieto-occipital dextra sinistra regio without

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the increasing signs of Intracranial Pressure (ICP). The *CT-Scan* examination result shows the depiction of vasogenic edema in the symmetric bilateral of parieto-occipital regio (Figure 1).

Table 1. Laboratory Examination

Parameter	Result
Hemoglobin	7.4 g/dl
Hematocrit	21.3 %
Erythrocytes	2.67 x 10^6 /ml
Leucocytes	5800 /mm^3
Platelets	80000 /mm^3
Urea	78 mg/dl
Creatinine	11.4 mg/dl
Sodium	132 mEq/l
Potassium	5.2 mEq/l
Chloride	107 mEq/l
Calcium	9.5 mg/dl
Eosinophils	0.3 %
Basophils	0 %
Neutrophils	80.6 %
Lymphocytes	14.1 %
Monocytes	5 %

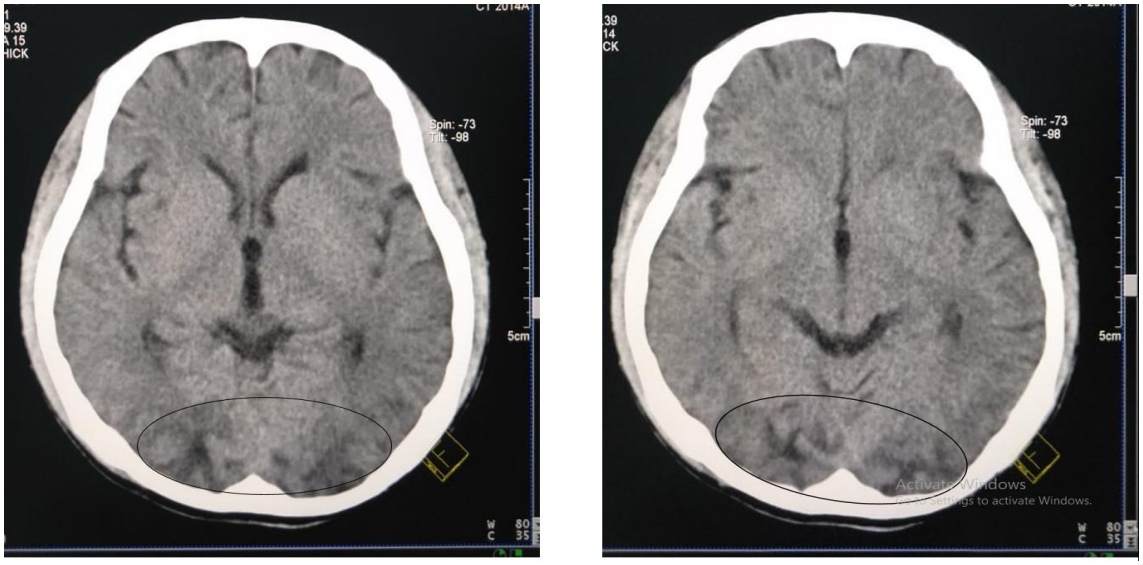

Figure 1. CT-Scan Examination Result of Head without Contrast showing Edema Vasogenic in Regio Parieto-Occipital (signed with black circles)

The inpatient experienced twice convulsions within less than 6 hours of treatment, intercovulsion time was 2.5 hours. Full body convulsion lasted <2 minutes. After the convulsion ended, the patient seemed to be anxious and angry. During the convulsion, injection of 5 mg diazepam intravenous was given in each convulsion period. The vital signs examination after the convulsion showed the blood pressure of 234/131 mmHg, pulse rate of 137 times per minute, breathing rate of 22 times per minute, oxygen saturation of 98% and temperature of 36.7^{0}C.

The patient was treated and given intra venous phenytoin therapy of 200 mg/24 hours in 100 cc NaCl 0.9%, intra venous citicoline injection of 500mg/12 hours, folic acid of 1 mg/24 hours, sulfas ferosus of 1

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tab/24 hours, aspirin of tab 80 mg/24 hours, vitamin B1 of tab/8 hours, vit B6 of tab/8 hours, vitamin B12 of tab/8 hours, amlodipine of 10 mg tab/24 hours, irbesartan of 300mg tab/24 hours. After being treated for 24 hours, the patient did not experience any convulsion, hence phenytoin drip was replaced with phenytoin capsule of 100 mg/12 hours. The patient was treated by nephrologist, neurologist, and ophthalmologist.

The ophthalmology examination on the second day, showed the result of VODS = 20/200, no abnormalities found in the anterior eye-ball segment. Funduscopic examination result showed optical nerve papil was round with firm border, *Cup Disc Ratio* (CDR) of 0.4, artery spasm +, retinal edema +, hemorrhage +. exudate +, and macular-foveal reflex +, concluded that there was the 3rd degree hypertensive retinopathy in the patient's both eyes.

Discussion

Sudden blindness is a rare complication of the hemodialysis processes (Widiana *et al.*, 2017). This complication can occur suddenly in 24 hours after hemodialysis (Doluoglu *et al.*, 2013). Based on the data of Indonesian Renal Registry (IRR), the frequently occurring intradialysis complications were hypertension, hypotension, and headache (Pernefri, 2018). This case study show that the patient did not only experience visual impairment in the form of sudden blindness, but also intradialysis hypertension and headache during and after hemodialysis processes.

Intradialysis hypertension is defined as the increasing Systolic Blood Pressure (SBP) of >10 mmHg or Mean Arterial Pressure (MAP) of >15 mmHg compared between before and after hemodialysis (Georgianos *et al.*, 2015). Intradialysis hypertension is related to the increasing mortality rate of 7.3 times in 6 months of patient undergoing hemodialysis (Perdhana, 2021). The patient in this case study experienced complication in the form of intradialysis hypertension shown by the increasing Systolic Blood Pressure (SBP) of 41 mmHg and MAP 15.7 mmHg.

The sudden visual impairment can be caused by the abnormality of refracta media, retinal problem, and Neuro-visual disorder. The abnormality of refractive media can be caused by hyphemia, lens luxation, corpus vitreum hemorrhage, and endophthalmitis. Endophthalmitis case was reported to the patient undergoing hemodialysis due to the spreading infection process caused by bacteremia, Catheter Related Blood Stream Infections (CRBSI) due to the utilization of dialysis DL catheter for hemodialysis vascular access (Panakos, 2015). CRBSI is a primary blood flow infection in a patient using a DL cathether, and the infection could not be detected from other sites (Pangalila *et al.*, 2019). The endophthalmitis was removed from differential diagnose, since there were no signs of CRBSI, nor abnormalities in anterior eye ball segment found.

Funduscopic examination is greatly required to possibly assess the retinal abnormality (Ilyas *et al.*, 2019). Funduscopic examination in the reported patient showed a smooth optical nerve papil and firm border, CDR 0.4, artery spasm +, retinal edema +, hemorrhage +. exudate +, macular foveal reflex + in both eyes. The results concluded of the 3rd degree of Retinopathy Hypertensive. Retinopathy Hypertensive is a retinal blood vessels abnormality, derived from hypertension, shown by the narrowing retinal artery, exudate, retinal edema and hemorrhage (Ilyas *et al.*, 2019). The funduscopic examination in this case was

performed by the ophthalmologist, yet due to the limited facilities owned by the hospital, the funduscopic depiction cannot be presented in this report.

Acute visual impairment happened during the hemodialysis processes due to the occurring Ischemic Optic Neuropathy (ION) (Doluoglu *et al.*, 2013). ION is a condition in which optical nerve does not obtain the appropriate blood flow and consequently damages the related nerves. One form of ION is Non Arthritic Anterior Ischemic Optic Neuropathy (NAAION) (Hayreh, 2011). The End-Stage of Kidney Disease (ESKD) patient risk 3.1 times higher of experiencing NAAION compared to general population (Chang *et al.*, 2016). AION is frequently found in elderly patients caused by the blockage found in the posterior of artery siliaris vascularizing the optical nerve papil (Bansal *et al.*, 2014). Hypotension is known as one factor causing AION. Visual impairment in AION is characterized by the suddenly decreasing vision, without any pain. The examination found was abnormality in pupil reflect and edema in the optical nerve papil, followed by the narrowing visual field. Bilateral AION is commonly related to much blood loss when experiencing trauma or undergoing operation. Bilateral AION was also found in patients undergoing hemodialysis (Sabt, 2013). This is considering the second most frequently intradialysis complication which was caused by hypotension of 14% (Pernefri, 2018). The blindness in this case suddenly happened in both eyes without any pain and red eye. The pupil reflect examination result was normal and in funduscopic examination, the edema in papil N. Opticus was also not found. In addition, the patient was still at the age of 19 years old and hypertension was not found as the trigger. Thus, the possible diagnosis of NAAION in this case can be removed.

One diagnosis to compare with the bilateral AION in the patient at End-Stage of Kidney Disease (ESKD) is uremic optic neuropathy. Uremic optic neuropathy is commonly found in patient with the undetected kidney disease. High toxic level in patient directly impacted and damaged the N. Opticus resulting in visual impairment. Visual impairment is commonly in the form of reversible vision loss when the patient's urea level decreases (Lee *et al.*, 2011). In this case, the patient had undergone hemodialysis for 1 month and the complaint lasted for <24 hours after undergoing hemodialysis. In addition to the laboratory examination result, the urea level was not too high for the patient undergoing the chronic hemodialysis of 78 mg/dl. Thus, the uremic optic neuropathy diagnosis is possibly removed.

Sudden blindness can be caused by the malignant hypertension (Ilyas *et al.*, 2019). Malignant Hypertension is defined as the very-high increasing blood pressure (Systolic Blood Pressure reaching ≥180 and or Diastolic Blood Pressure reaching ≥110 mmHg) followed by the bilateral retinopathy. Funduscopic examination is beneficial in this condition to detect the depiction of retinal hemorrhage, microaneurysm, and papilledema (Lukito *et al.*, 2019). The classifications developed by Keith-Wagner-Barker can be used to assess the degree of hypertensive retinopathy: (1) Degree 1: light construction in the retinal arteriole, (2) Degree 2 : Degree 1 + local narrowing in the retinal arteriole + arteriovenous nicking, (3) Degree 3 : Degree 2 + flame-shaped hemorrhages + cotton wool spots + hard exudate, (4) Degree 3 + inflammation of papil N. Opticus (Arsiwalla, 2022). The funduscopic examination in this case found that papil N. Opticus was round, firm limit, *Cup Disc Ratio* (CDR) 0.4, artery spasm +, retinal edema +, hemorrhage +. exudate +, macular foveal reflex + showing the depiction of 3rd degree hypertensive retinopathy.

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The other blindness cause is cerebrovascular accident in the occipital area where the primary visual cortex is (Ilyas *et al.*, 2019). The condition itself known as acute cortical blindness (Sujoy *et al.*, 2021). Stroke is frequently found in patients with hypertension. In addition , the End-Stage of Kidney Disease (ESKD) is a very high risk factor to the occurring cerebrocardiovascular (Lukito *et al.*, 2019). The patient at the End-Stage of Kidney Disease (ESKD) has 3-9 times higher risk to stroke when compared to the general population (McIntyre *et al.*, 2015). Based on IRR data, the mortality rate caused by the abnormality of cerebrovascular in patients undergoing hemodialysis has reached 8% (Pernefri, 2018). If stroke developed in the primary visual cortex, results in unilateral contralesion visual loss known as hemianopia. The impact to the occipital stroke is commonly chronic and permanent (Saionz *et al.*, 2020). The stroke occurring in older people is different with that in teenagers, since 50% of the stroke causes in older people is unknown. Meanwhile, 15% of stroke is caused by cardioembolic, 12% is caused by vasculitis and autoimmune, and 10% is caused by artery dissection (Rambaud *et al.*, 2020). The patient in this case aged 19 years old experiencing sudden blindness in both eyes. Meanwhile, the stroke which only hits one of brain sides resulting in contralesionally hemianopia. In addition, visual impairment caused by the occipital stroke is commonly chronic. The visual impairment commonly requires longer time for improvement. In some cases, visual impairment caused by the occipital stroke can be permanent (Saionz *et al.*, 2020). Meanwhile, in this case, visus repair was made from 1/∞ when the patient was examined at the Emergency Room (ER) to 20/200 in the next 30 hours. In Addition, the CT-Scan result showed the depiction of vasogenic edema in regio parieto-occipital, so that the occipital stroke diagnosis was removed.

Another cause of bilateral acute cortical blindness is Posterior Reversible Encephalopathy Syndrome (PRES) (Sujoy *et al.*, 2021). PRES is also known as Reversible Posterior Leukoencephalopathy Syndrome, Reversible Posterior Cerebral Edema Syndrome, and Reversible Occipital Parietal Encephalopathy. PRES is clinical-radiologic syndrome characterized by headache, convulsion, decreasing consciousness, and visual impairment due to the existence of vasogenic edema in the substantia alba in lobus parietal and occipital from the brain. There are various symptoms in PRES. The occurring visual impairment can be in the form of blurred vision, hemianopsia homonym, and acute cortical blindness. The decreasing consciousness varies from confusion, anger, and even coma (Sudulagunta *et al.*, 2017). The convulsion patterns in PRES also vary covering tonic clonic of 54-64%, partial convulsion of 3-28%, and epilepticus status of 3-17%. The PRES symptoms can be recovered within several hours to several days. However, in some cases, there are some permanent damages and even causing death. In brain imaging, there are vasogenic edema in cortex/ subcortex parts hitting the lobus parietal and bilateral occipital which are commonly seen clearer in the examination of Magnetic Resonance Imaging (MRI). The conditions related to PRES include kidney failure and fluctuating blood pressure. When the blood pressure rapidly and severely increases, cerebral autoregulation failure occurs and results in hyperperfusion condition, plasm extravasation, and macromolecule, so that cerebral edema then occurs. The decreasing sympathetic innervation in the posterior circulation is predicted becoming the mechanism enables parieto-occipital area involvement to experience PRES (Hinduja, 2020). The reported patient experienced headache, convulsion, anxiety, and blindness suddenly occurring after experiencing repair within 30 hours. In addition, the CT-Scan showed that there was a depiction of vasogenic edema in symmetric bilateral parieto-occipital. The patient also had the history

of End-Stage of Kidney Disease (ESKD) and hypertension as factors triggering PRES. The weaknesses of this case included that MRI examination on head was not performed due to the limited facilities owned by the hospital and CT-Scan re-examination on head was also not performed to evaluate the vasogenic edema experienced by the patient.

Intradialysis hypertension in this case is thought to be related to the PRES occurring <24 hours after hemodialysis. The main treatment to PRES is not only to avoid or decrease the triggering factors, but also provide supportive therapy by performing liquid management, electrolyte correction, monitor the patient's breathing. Meanwhile, to the patient with acute hypertension, the efforts made to decrease the blood pressure should immediately avoid the cerebral, coronary, and kidney ischemic risks with the target MAP of 105-125 mmHg (Hinduja, 2020). The increasing blood pressure occurs rapidly and significantly due to the intradialysis hypertension. Intradialysis hypertension negatively impacts on the patient's health, such as arising various complications on both cardiovascular dan cerebrovascular. In this case, the patient experienced PRES manifested as sudden blindness (visual impairment), and convulsion. Intradialysis hypertension should be comprehensively prevented and handled (Widiana *et al.,* 2017). The intradialysis hypertension prevention was performed by controlling the risk factors. The patient with intradialysis hypertension experienced the chronic liquid accumulation when compared to the other patients undergoing hemodialysis. In addition, vascular intradialysis resistence also occurs explaining why the blood pressure increases. Decreasing body weight to reach the dry body weight can be the first step in the intradialysis hypertension case. On one side, changing the pharmacological regiments from hypertension drugs easily dialyzed into antihypertension drugs not easily dialyzed into choices in preventing and handling the intradialysis hypertension. On the other side, decreasing the diasylate sodium level also has an important role in manitaining the blood pressure to become more stable in patients undergoing hemodialysis (Van Buren *et al.*, 2016). The research conducted by Perdhana showed that there was a significant relationship between hemoglobin level and intradialysis hypertension. The patients undergoing hemodialysis with the hemoglobin level of <10 g/dl has the risk of 5.9 times experiencing intradialysis hypertension when compared to those undergoing hemodialysis with the hemoglobin level of ≥10 g/dl. The correction to the factors related to the intradialysis hypertension is expected to prevent the intradialysis hypertension and avoid the negative impacts resulted from intradialysis hypertension (Perdhana, 2019).

CONCLUSION

One acute complication rarely found during the hemodialysis processes is visual impairment. Visual impairment can be manifested as the decreasing visual ability or blindness suddenly occurring during or within 24 hours after undergoing hemodialysis. Visual impairment possibly occurred in one or both eyes. a multidisciplinary collaboration is greatly necessary to diagnose the causes of occurring visual impairment. Sudden blindness in this case is possibly caused by malignant hypertension causing the 3rd degree hypertensive retinopathic and PRES conditions.

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