



Research Paper

Geriatric patient with sudden sensorineural hearing loss undergoing hyperbaric oxygen therapy

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ABSTRACT

A Geriatric patient 63 years old was diagnosed with Sudden Sensorineural Hearing Loss (SSNHL). Clinical diagnosis of SSNHL was based on chief complaint of sudden hearing loss that occurred in less than 72 h with physical examination and audiometric tests. About 71% of sudden hearing loss is idiopathic with vascular involvement which plays an important role in causing SSNHL. Cochlear gets a blood supply from the labyrinthine artery and is an end artery that lacks collateral vascularization. Cochlear and stria vascularis are particularly susceptible to ischemia. The patient had done the medical treatment and undergone series of hyperbaric oxygen therapy with result of mild improvement of hearing loss. Hyperbaric oxygen therapy may increase cochlear oxygenation and perilymph by delivering oxygen with higher partial pressures to tissues that are sensitive to ischemic conditions. SSNHL in elderly patients is correlated with poor prognostic factor on hearing loss. The prognosis of patients with SSNHL depends on several factors such as age, degree of hearing loss, treatment performed, early onset of treatment and other predisposing factors.

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Key words: Geriatric, sudden sensorineural hearing loss, hyperbaric oxygen therapy.

INTRODUCTION

The aging process leads to decreased function of one's organ. The process of decreasing the function of organs by 1% every year starts from the age of 30 (Aryana, 2014). Presbycusis is a general term which signifies the decline of hearing neurosensory organ in old age (Aryana, 2014; Cunningham and Tucci, 2017; Fioretti et al., 2014). Presbycusis events increase with aging process.

Presbycusis is sensorineural hearing loss that occurs slowly and symmetrically due to the physiological process of aging, while Sudden Sensorineural Hearing Loss (SSNHL) is a sensorineural hearing loss that occurs suddenly in old age. This SSNHL occurs does not proceed according to the physiological process of hearing loss due to aging or presbycusis in general.

SSNHL is defined as a sudden hearing loss that occurs in a period of less than 72 h in one or both ears and is an autologous emergency (Aryana, 2014; Cunningham and Tucci, 2017; Walling and Dickson, 2012; Kitoh et al., 2017;

Pogson et al., 2016; Anil and Pasha, 2017; Novita and Yuwono, 2013; Souza et al., 2017; Verim et al., 2016; Konstantina et al., 2015).

Audiological examination shows a minimum of 30 decibels of hearing loss involving in at least three sound frequencies (Cunningham and Tucci, 2017; Konstantina et al., 2015). A study of epidemiology in Japan shows the incidence of SSNHL increases with age with a majority in the age group 60 to 69 years (Pogson et al., 2016). In the United States, SSNHL can occur at any age but more often at age 65 and above with an incidence rate of 5 to 27 per 100,000 population or 4,000 to 66,000 new cases per year (Cunningham and Tucci, 2017; Novita and Yuwono, 2013; Leung et al., 2016).

The cause of this hearing loss is 71% still idiopathic (Leung et al., 2016). SSNHL incidence in old age is associated with a poor prognosis and more severe SSNHL (Kitoh et al., 2017). Decreased hearing in the elderly can

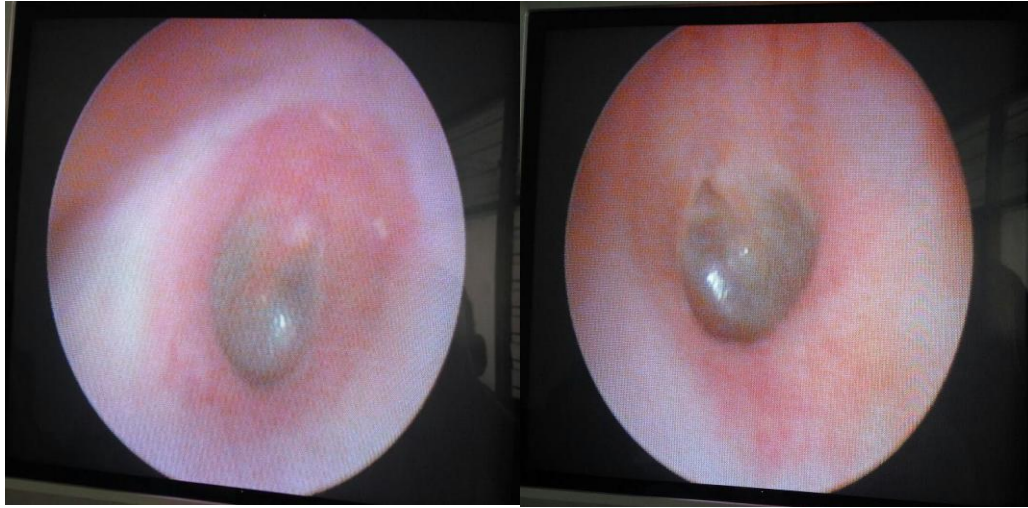


Figure 1: Left: Right ear endoscope; Right: Left ear endoscope.

lead to communication disorders, thus, affecting psychosocial sufferers that may lead to social isolation and decreased quality of elderly life (Aryana, 2014; Cunningham and Tucci, 2017). Hearing loss may also lead to fall, frailty, depression and death risk (Cunningham and Tucci, 2017). Hearing loss is a common cause of all four disabilities globally (Cunningham and Tucci, 2017). Treatment may be administered by medical treatment, surgical intervention or by hyperbaric oxygen therapy. A case of a geriatric patients in Bali with SSNHL who undergone hyperbaric oxygen therapy was reported.

CASE

This study included a case study of a geriatric male patient, aged 63 years, with a major complaint of hearing loss in the right ear which occurred instantaneously 10 days before admission to the private hospital. Hearing loss occurred in less than 1 h and then persisted continuously. Hearing loss occurred without a ringing sound. Initially, the patient had complained of fever and cough two days earlier before the hearing loss occurred. Fever is not too high and the patient had cough without sputum. The patient was a retirement pharmacist and had taken cefadroxil 2×500 mg and paracetamol 3×500 mg which he bought himself for his fever and cough complaints. Complaints of fever and cough improved but two days later the patient complained of vertigo and his right ear hearing suddenly dropped. The patient was treated at the private hospital for 7 days and thereafter referred to our hospital with improvement of vertigo complaint but decreased hearing was still felt. The patient had a history of high cholesterol and takes cholesterol-lowering drugs regularly. There is no history of any particular disease in the patient's family.

The patient was fully alert during physical examination

with blood pressure 120/70 mmHg, pulse 90 beats per min, respiratory rate 22 breaths per min and axillary temperature of 36.6°C. On the examination of the ear, nose and throat region decreased earing was observed in the right ear with fork and hum test.

Complete blood count result with leukocyte was $10.37 \times 10^3/\mu\text{l}$, hemoglobin level: 16.26 g/dl, hematocrit: 47.21%, MCV: 96.96 fL, MCH: 33.44 pg, platelet: $256.80 \times 10^3/\mu\text{l}$, Albumin: 4.0 g/dl, BUN: 18.2 mg/dl, creatinine: 0.98 mg/dl, sodium: 134 mmol/L, 4.0 mmol/L potassium and blood glucose 98 mg/dl. Patients were checked for lipid profiles with a total cholesterol of 209 mg/dl, triglycerides: 93 mg/dl, HDL cholesterol: 42 mg/dl and LDL cholesterol: 139 mg/dl. ECG and chest radiograph examination showed normal regular sinus rhythm.

An examination of the patient's ear endoscopy was obtained as illustrated in Figure 1 with the conclusion of the right and left ear endoscopic results within normal limits. Patient performed audiometric examination at Sanglah General Hospital Denpasar as illustrated in Figure 2 and found on right ear AC (Air Conduction) 96 db, BC (Bone Conduction) 63.75 db and on the left ear AC 15 db, BC 11.25 db with conclusion of very severe hearing loss on the right ear and normal hearing on the left ear.

The patient was diagnosed with SSNHL and given 2×62.5 mg methylprednisolone, 2×50 mg ranitidine, 3×500 mecobalamin mcg, pentoxifylin 2×400 mg, simvastatin 1×20 mg and was planned for hyperbaric oxygen therapy. On the 7th day of illness, the patient was discharged from the hospital and undergone hyperbaric oxygen therapy in the hyperbaric chamber.

The patient received hyperbaric therapy for two sessions, with each session for 5 consecutive days. The first hyperbaric therapy was on July 31st, 2017 to August 4th, 2017. The patient then performed re-audiometric examination (on August 4th, 2017) as illustrated in Figure 3.



Figure 2: Patient undergone hyperbaric oxygen therapy.

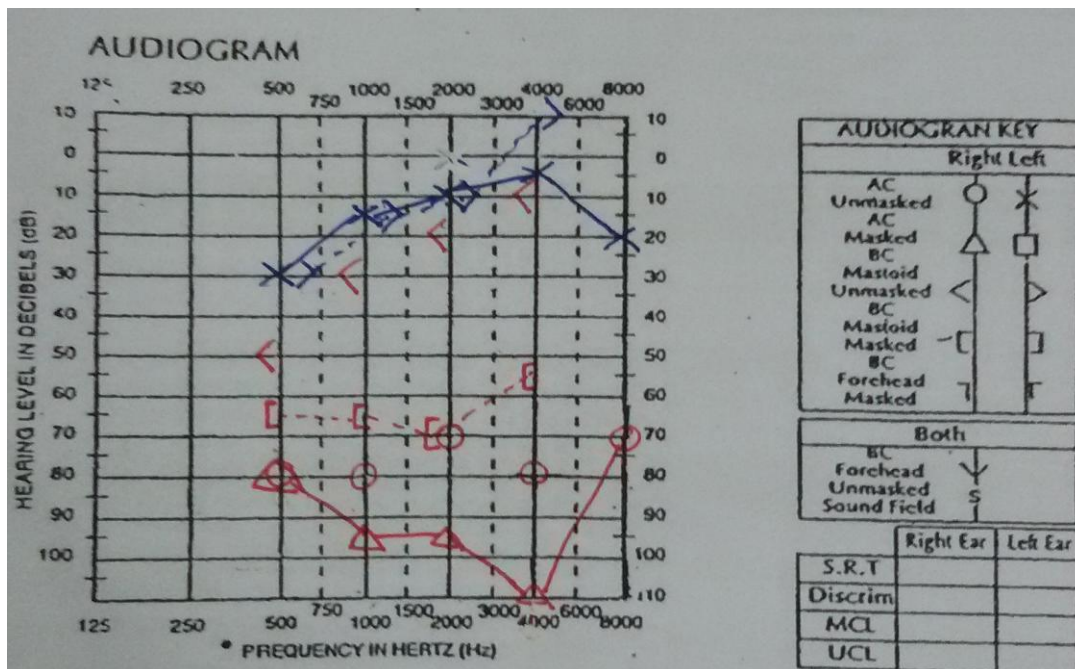


Figure 3: Audiometric patient on first admission at Sanglah General Hospital Denpasar. Right ear: AC:380/4 = 95 db, BC:255/4 = 63.75 db. Left ear AC:60/4 = 15 db, BC:45/4 = 11.25 db.

The conclusion was severe sensorineural hearing loss of the right ear and normal hearing of the left ear. Hyperbaric therapy of the second session was performed again for 5 days on August 7th, 2017 until August 11th, 2017. Patients then performed an audiometric evaluation (on August 11th, 2017) with the results as illustrated in Figure 4. The conclusion was severe sensorineural hearing loss of right ear and normal hearing of the left ear.

DISCUSSION

Incidence of SSNHL increases with age with a majority in the age group being 60 to 69 years (Kitoh et al., 2017). SSNHL definition is sudden hearing loss or in periods less than 72 h on one or both ears with a minimum of 30 dB hearing loss involving at least 3 voice frequencies (Aryana, 2014; Cunningham and Tucci, 2017; Kitoh et al., 2017).

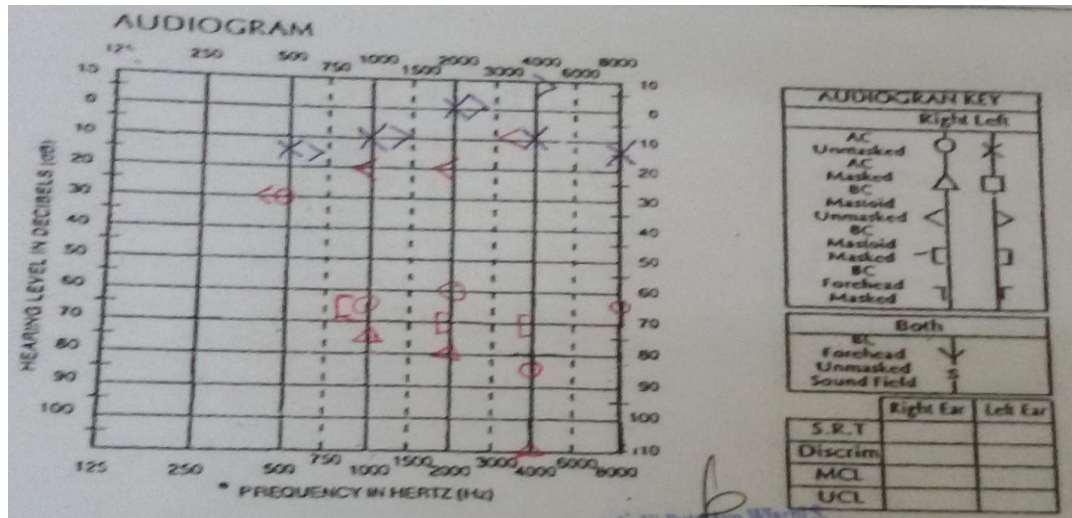


Figure 4: Audiometric Patient after Undergoing First Hyperbaric Oxygen Therapy. Right ear: AC:295/4 = 73.75 db, BC:235/4 = 58.25 db. Left ear AC:35/4 = 8.75 db, BC:15/4 = 3.75 db.

Hearing loss occurs more often in males and heavier than in females (Aryana, 2014; Walling and Dickson, 2012). The majority of cases of SSNHL or more than 95% are unilateral (Pogson et al., 2016). Walling and Dickson (2012) mentioned that hearing loss occurring on one side of the ear may be due to local pathology or idiopathic obstruction of hearing loss. Sensorineural hearing loss in old age is most common in the inner ear. The cause for hearing loss are the presence of cochlear degeneration, cortical organ, stria vascularis and auditory nerve disorders (Aryana, 2014).

The cochlea consists of three interconnected tubes of circles that are vestibular scale, media scale and tympanic scale. Vestibular scale and media scale are separated by vestibular membrane (Reissner), while media scale and tympani scale are separated by basilar membrane. The media scale is filled with endolymphic fluid. Endolymphs contain different fluids secreted by striae vascularis and areas with the highest vascularization. There is potential of endocochlea and thought to increase the sensitivity of hair cells in response to the most delicate sound (Guyton, 2006).

Further on cochlea, media scale and tympani scales are separated by the basilar membrane. This bacillary membrane is the most important part of the cochlea because it has cortic organ that have the innervation of hair cells and is the final recipient that generates nerve impulses to the cerebral cortex (Cunningham and Tucci, 2017; Guyton, 2006). The physiological processes of aging in the elderly leads to decreased cochlear cells in the cortic organ and degeneration of the auditorius nerve path (Fioretti et al., 2014).

Neural sensory hearing loss due to aging is included in the peripheral Age Related Hearing Impairment (ARHI). Peripheral ARHI such as ARHI sensory type is a major disorder of hair cells causing hearing loss in high-pitched

voice and the disturbances affect the afferent nerve (Aryana, 2014). The voice cannot be transmitted by the afferent nerve even when it has reached the cortic organ. ARHI neural type occurs with very low incidence in old age and it is more common with ARHI sensory type so-called sensorineural ARHI or hearing loss (Aryana, 2014).

The cause of SSNHL in this patient is still idiopathic. Leung et al. (2016) mentioned that 71% of the causes of SSNHL are idiopathic, not much different from the report of Novita and Yuwono (2013) with 80 to 85% of which the etiopathogenesis is not known (Leung et al., 2016). Verim et al. (2016) mentioned that the cause of hearing loss can only be identified in 7 to 45% of cases. There are other known causes of infectious diseases (12.8%), ear diseases (4.7%), trauma (4.2%), vascular and hematologic (2.8%), neoplasms (2.3%) and other causes (2.2%) (Novita and Yuwono, 2013).

The patient had complains of a fever that is not too high 2 days before the occurrence of hearing loss. In most cases, it is said that the virus plays an important role of 5 to 6% of the cases (Konstantina et al., 2015). Viruses known to be the cause of hearing loss are mumps, rubella and measles (Novita and Yuwono, 2013). Mechanisms that cause sudden hearing loss are not known for sure, but viral infections and vascular phenomena are an important cause causing disruption of vascular supply, edema and tissue hypoxia (Konstantina et al., 2015).

Causes of sudden hearing loss include the presence of hypoperfusion (microemboli, venous stasis and vascular disorders), infection (virus) or immunological processes (autoimmune) (Cunningham and Tucci, 2017; Walling and Dickson, 2012; Anil and Pasha, 2017; Leung et al., 2016). In this case, the patient complaint of fever and cough improved without detection of any other sources of focal infection.

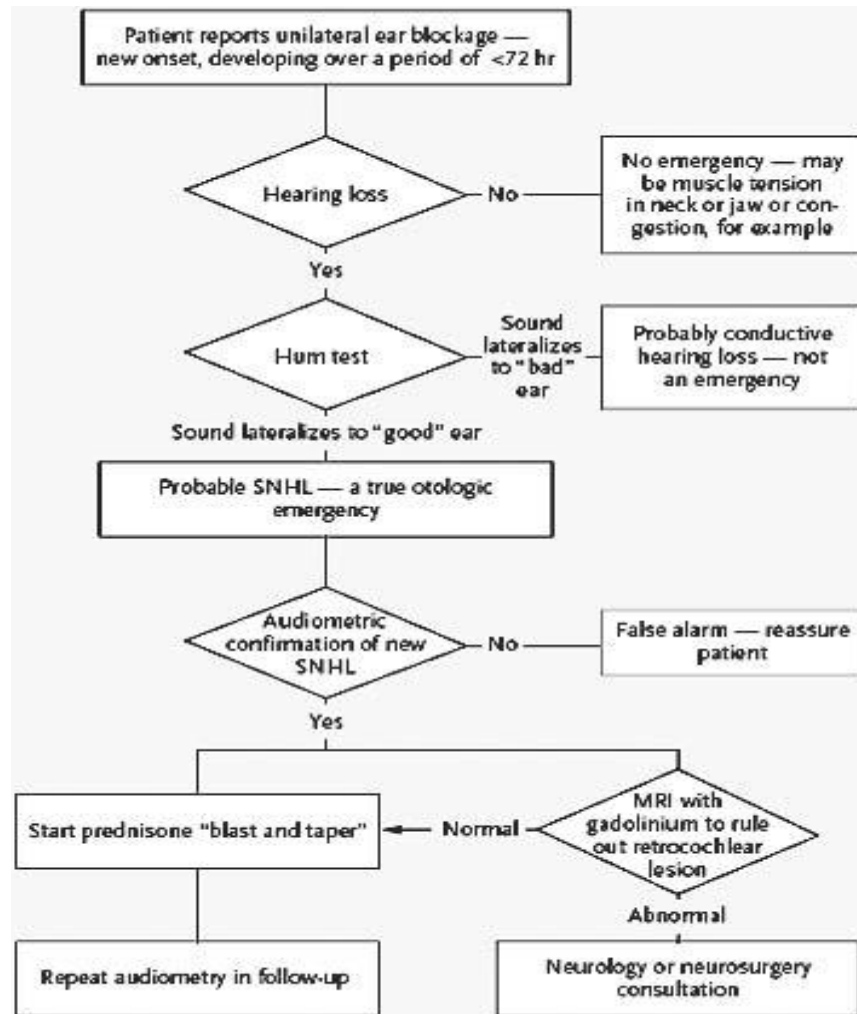


Figure 6: SSNHL Diagnosis and handling flow (Novita and Yuwono, 2013)

oxygen therapy. Hyperbaric oxygen therapy should be performed within 2 weeks to 3 months from the time of diagnosis (Novita and Yuwono, 2013). The patient receives two-time hyperbaric therapy, with each session for 5 consecutive days. Hyperbaric therapy is performed in a space of 100% O₂ at 2 ATA pressures for 120 min once daily for 5 times. Konstantina et al. (2015) mentioned improved hearing function is obtained after 25 times of hyperbaric therapy or one session per day. In SSNHL, optimal hyperbaric therapy was performed at 2.0 to 2.8 ATA for 90 to 120 min (Konstantina et al., 2015). Hyperbaric therapy at 2.5 ATA is similar to 15 m depth. Hyperbaric therapy can not replace medical therapy, but complements the management of SSNHL.

Hyperbaric therapy alters ion exchange mechanisms and reduce inner ear hypoxia (Konstantina et al., 2015). Hyperbaric oxygen therapy may increase cochlear oxygenation and perilymph in order to deliver oxygen with higher partial pressures to tissues or cochlea that are particularly sensitive to ischemic conditions (Novita and

Yuwono, 2013). Hyperbaric therapy is also said to have broad effects on body immunity, oxygen exchange and hemodynamic body and increased body's immune response to infection (Novita and Yuwono, 2013). Hyperbaric oxygen therapy on the other hand also has side effects such as damage to the ear, sinus and lungs due to the worsening of oxygen flow temporarily such that supervision of hyperbaric therapy needs to be done strictly (Novita and Yuwono, 2013).

The patient received hyperbaric therapy for two sessions. There was re-audiometric examination (on August 4th, 2017) after the first hyperbaric therapy with right ear AC 73.75 db and BC 58.25 db with conclusion severe sensorineural hearing loss of right ear. Hyperbaric therapy of the second session was again performed for 5 days on August 7th, 2017 until August 11th, 2017. Audiometric results (on August 11th, 2017) had the same result with right ear AC 68.75 db and BC 57.5 db with conclusion severe sensorineural hearing loss of the right ear. WHO classification of hearing loss are 0 to 25 dB normal, 25 to 40

dB mild hearing loss, >40 to 60 dB moderate hearing loss, >60 to 80 dB severe hearing loss and >80 dB very severe hearing loss (Akil et al., 2017). There was only mild improvement of hearing from very severe hearing loss to severe hearing loss of the right ear.

A study describes more satisfactory result from combination of systemic steroids, intra-therapeutic steroids and hyperbaric therapy that led to complete healing in 18.4% of patients after a 1-month treatment period and 23.2% of patients on long-term follow-up monitoring over a 1 to 6 year period (Verim et al., 2016).

Patients with SSNHL may experience hearing recovery without any treatment of 28 to 65% and most occur within 2 weeks after onset of symptoms (Novita and Yuwono, 2013). Hyperbaric response in patients aged 50 to 60 years old is poorly compared to younger patients (Novita and Yuwono, 2013). The prognosis of patients with SSNHL depends on several factors such as age, degree of hearing loss, treatment performed, early onset of treatment and other predisposing factors. Treatment initiated earlier or within the first 7 days is associated with a better hearing recovery prognosis. Hypertension, vertigo, diabetes and hyperlipidemia also in the presence of microvascular dysfunction in cochlea have a poorer prognosis value (Kitoh et al., 2017; Novita and Yuwono, 2013).

Screening is essential before any hearing loss occurs. Lycke et al. (2016) in the Journal of Geriatric Oncology studied the use of practical screening tools in elderly patients to detect hearing loss in the elderly using a handheld mobile device through the uHear™ application as compared with audiometry conventional as gold standard.

CONCLUSION

A case of a geriatric male patient, 63 years old, who came with a sudden hearing loss in the right ear was reported. Patient diagnosed with SSNHL with audiometric showed severe sensorineural hearing loss in the patient's right ear. The patient received corticosteroid therapy, antioxidants, blood viscosity reduction agents and undergone hyperbaric oxygen therapy. Sudden hearing loss in the elderly is associated with a poor prognosis. In this patient, there was hearing repairment from very severe sensorineural hearing loss to severe sensorineural hearing loss after undergoing hyperbaric oxygen therapy. The hearing loss does not fully return to its original state. Handling and prevention of hearing loss in the elderly is an important in avoiding the emergence of other comorbidities that can reduce quality of life in the elderly.

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