SPMRJ Volume 6 No. 1 February 2024 DOI: 10.20473/spmrj.v6i1.50232
SINTA 5 (Decree No: 200/M/KPT/2020) Available online at https://e-journal.unair.ac.id/SPMRJ

Case Report

Home Based Cardiac Rehabilitation in Cardiovocal Syndrome

Ida Ayu Wulan Kartika Dewi Manuaba[1], Bagus Diva Indra Dharma[1,2], Dedi Silakarma[3]

[1]*Wangaya Regional Hospital, Denpasar, Bali, Indonesia*

[2]*Cerebro Rehabilitation and Wellness Center, Denpasar, Bali*

[3]*Prof. dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Bali, Indonesia*

Corresponding Author:

Ida Ayu Wulan Kartika Dewi Manuaba, Department of Physical Medicine and Rehabilitation, Wangaya Regional Hospital, Denpasar, Bali, Indonesia.

E-mail: prabhudewi@gmail.com

Article info:

Received: October 1, 2023

Received in revised: November 20, 2023

Accepted: February 20, 2024

Published: February 28, 2024

Cite this as: Manuaba IAWKD, Dharma BDI, Silakarma D. Home Based Cardiac Rehabilitation in Cardiovocal Syndrome . SPMRJ Vol. 6 No. 1. 85-97.

Abstract

Cardiovascular disease is one of the highest causes of death and disability in the world. One of the treatments to reduce the disability from cardiovascular disease is Cardiac Rehabilitation (CR). CR is a multidisciplinary system and tailored made management for a patient with known cardiovascular disease. The goals of CR are to maximize physical endurance, modifying cardiac risk factors, and addressing returns to work. CR also plays the role as a secondary prevention for the new cardiovascular events that decreased the mortality of cardiovascular disease. This article reported a CR for a 22-year-old male patient with Cardiovocal syndrome also known as Ortner's syndrome, a rare condition characterized by a heart failure that accompanied by hoarseness caused by paralysis of the Left Recurrent Laryngeal Nerve (LRLN). The CR in this case was a phase two

CR that supposed to be done at the outpatient clinic or Center-Based Cardiac Rehabilitation (CBCR). We design a Home-Based Cardiac Rehabilitation (HBCR) due to some limitations of the patient to come to the outpatient clinic every day. The HBCR for the patient was tailored made exercise that consist of breathing exercises, endurance exercises, and muscles strengthening exercises. We performed the 6MWT for the patient to assess his physical endurance and provide an easy way for patient to communicate with us if he found difficulties during his HBCR. After three months patient has physical endurance was improved, his voice was back to normal and he was able to return to work. HBCR can be an alternative for CBCR where patient have limitation to come to the hospital or CBCR also gave flexibility for the patient to exercises every day.

Keywords: *cardiac rehabilitation, cardiovocal syndrome, heart failure, hoarseness, 6MWT, physical endurance.*

INTRODUCTION

Cardiovocal syndrome (CVD) or Ortner's Syndrome is one of the rare cases in cardiovascular disease. The cardiovascular disease is one of the leading causes of death in the world also the highest cause of disability. According to World Health Organization the number of deaths caused by CVD globally in 2019 was estimated about 17,9 million people represented 32% of all cause of death. In Indonesia, CVD remain the leading cause of death with the prevalence continues to increase every year.[1,2]

Based on data from The Basic Health Research of Indonesia, the incidence of CVD is increasing with 15 out of 1000 people suffering from CVD in 2018. This resulted an increase of prevalence from 0.5% to 1.5% in 2018. The changes in lifestyle, a sedentary lifestyle make the incidence of CVD also occurs in younger age groups, whereas the advanced of science in medical field also led to an increase in the number of patients who can survive after experiencing a severe CVD. With the increase of the incidence of CVD, the burden of health care services will be increase as well as the economic burden will also be increase due to a decrease in the productivity of patients suffering from CVD.[2,3,4]

Therefore, an adequate preventive and rehabilitative procedure are needed for the community. The preventive procedure themselves aim to prevent the occurrence of CVD by reducing the incidence of CVD while the rehabilitative procedure aim to prevent the recurrence of CVD by controlling risk factors, preventing and or reducing the disability in those who experience CVD by maximizing their physical abilities so they can remain productive that make them can return to work this will certainly help to reduce the economic burden and reduce the stress levels due to the disability after a CVD event, especially for patients who are in the productive age group.[3,4]

The treatment for CVD from the Physical Medicine and Rehabilitation (PMR) is CR. The CR is a treatment to reduce the disability that arise from a CVD which is a multidisciplinary system and a

tailored-made management for patient with known CVD. CR has also been approved by cardiologists as one of the treatments that must be given to patients with CVD. The goals of CR are to maximize physical endurance, modify cardiac risk factors, and address to returns to work. Based on these goals, CR will be very useful for CVD patients.[3,4,5]

CR itself is divided into 3 phases which are phase 1, the inpatient phase, phase 2, the outpatient phase and phase 3, the maintenance phase. Phase 1 or the inpatient phase is a phase when the patient is hospitalized, this includes to educate the patients about their disease, planning the initial management of medical rehabilitation, which consist of the early mobilization to minimize the effect of prolonged bed rest following the acute cardiac events and early exercise to prepare the patient's physical endurance and help the acceleration of the patient to be ready to discharge from hospitalization.[4,5,6]

Phase two or the outpatient phase is a phase given after the patient was allowed to go home, it is usually carried out in the outpatient clinic or known as Center-Based Cardiac Rehabilitation (CBCR). This phase includes the reassessment of patient's physical endurance after dismiss from hospital, the tailored made management based on the patient's reassessment and supervised exercise program. Also includes to educate the patient how to manage the cardiovascular risk factors, the healthy lifestyle and counseling about the importance of lifestyle modifications which includes dietary changes, smoking cessation, nutrition psychosocial management, and educate the patient to always self-monitor their symptoms. The goal in this phase is to regain their physical endurance so they can be able to return to work. Phase three or the maintenance phase, is an independent training phase for patients who are considered to have completed phase two. The phase three of CR is a continuous training phase both independently and community-based with the main goal of a sustainable maintenance of healthy lifestyle habits that will control the CVD risk factors. [5,6]

The Cardiovocal syndrome or Ortner's syndrome was discovered by Norbert Ortner in 1917, occurs in a patient who experienced heart failure with an additional symptom of hoarseness because of the paralysis of The Left Recurrent Laryngeal Nerve (LRLN) due to compression caused by enlargement of the heart.[4-10]

The incidence of Cardiovocal syndrome in the literatures that were recorded only around 1.5% to 6.3% of all causes of unilateral vocal cord paralysis made it a very rare case.[1,2,3,4.] CR has an important role in the management of heart failure cases as well as in patients with Cardiovocal syndrome. CR that consists of 3 phases, which are inpatient, outpatient and maintenance phase play an important role in helping to restore the patient's physical endurance also can control the risk factors and help patients prepare themselves to be able to return to work again, making them remain productive after experiencing a cardiac event as well as increase patient has happiness and satisfaction with the health services they had received in order to obtain their best abilities in improving the quality of life after a serious illness. The prognosis of Cardiovocal syndrome can be increased by CR. Here we present a unique case with tailored made cardiac rehabilitation at home.[7,8]

CASE REPORT

A 22 years old male referred to the PMR Outpatient Polyclinic from the Cardiovascular Polyclinic on February 27th 2023. The patient was diagnosed with Cardiovocal syndrome after experiencing a Heart Failure (HF) caused by perimyocarditis. The patient was hospitalized on January 19th 2023. He came to the Emergency Room (ER) of Wangaya Regional Hospital with complaints of fluctuating fever from January 14th, 2023. The patient has body skin look yellowish, he also said he got nausea and vomiting every time he ate, feeling shortness of breath and cough from one week before entering the hospital and said his voice became hoarse when he came to ER. When he arrived, the patient's general condition

looked weak but his consciousness was good.

Physical examination revealed that his blood pressure was 80/60 mmHG, heart rate was 99 times minute, body temperature was 38.1 degrees celcius, respiration rate was 20 times minute, his body weight was 70 kilograms. The electrocardiography at the ER showed Normal Sinus Rhythm (NSR) with the Left Bundle Branch Block (LBBB). The x-ray of the thorax showed the cardiomegaly. His blood test showed high White Blood Cells (WBC) 13.20 $x10^3$/ul, Haemoglobin 11.8 g/dL, Haematocrite 35.8%, Trombhocyte $275x10^3$/ul. Total billirubine was high as 5.64 mg/Dl, Direct billirubine was high as 4.7 mg/Dl, Indirect billirubine was normal as 0.94 mg/Dl. SGOT was high 72 U/L, SGPT was high 103 U/L. Serum Urea 38 mg/Dl, Cretinine was high as 2.4 mg/Dl. The abdominal ultrasonography on January 19th 2023 revealed that he had hepatomegaly, with mild splenomegaly, and cholecystitis. Uric acid was high as 9.5 mg/Dl. The HbsAg and Anti HCV examination was negative. The therapy given when admitted to the Emergency Room (ER) was oxygen with a nasal cannula two liters per minute, infusion of NaCl 0.9% 12 drops per minute, atorvastatin 1x 20 mg per orally, miozidine 35mg twice daily per orally, vascon (norepinephrine) with given dose was 0.05 meq/bw/hour. The patient was also consulted to the Internal Medicine Department because there was an increased in bilirubin levels and liver function. On the same day an echocardiography and whole abdominal ultrasound examination were carried out.

From the echocardiography on January 19th, 2023, the Ejection Fraction (EF) results were 35% with Mild Atrial Regurgitation, Mild Mitral Regurgitation and Mild Tricuspid Regurgitation. Abdominal ultrasonography revealed a hepatomegaly with cholecystitis. On the second day of hospitalization, the patient was consulted to the Pulmonology department for coughing and shortness of breath. The Pulmonology department stated that there was no pneumonia or other inflammation found in the lungs. The

patient's diagnosis at the time of hospitalization was HF caused by perimyocarditis, improved cardiogenic shock, cholecystitis, transaminitis and fatty liver. After being hospitalized for nine days, on January 27th, 2023 the patient was allowed to went home, where his complaints of shortness of breath and weakness had improved but his voice was still hoarse. January 30th, 2023 was scheduled for the patient to go to the Cardiovascular and Internal Medicine polyclinic after hospitalization. At that time, he still felt easy to get fatigue and hoarseness. The next scheduled visit was on February 3rd, 2023. At that time the patient was referred to the Ear Nose and Throat (ENT) polyclinic for further examination of his voice which was still hoarse. The ENT specialist diagnosed the patient with dysphonia and planned a diagnostic laryngoscopy to confirm the cause of his dysphonia.

On February 7th, 2023, the results of diagnostic laryngoscopy revealed that the cause of his dysphonia was left vocal cord paralysis caused by paralysis of the LRLN. From the ENT department there was no additional treatment, the suggested treatment was accordance to the Cardiovascular department. On February 27th, 2023, the patient was referred to the PMR department for evaluation of his limited physical abilities. When he came to the PMR polyclinic he was still having a limited physical endurance and hoarseness. He was easy to get fatigue and felt uneasy to breathe after five minutes of walking.

The patient was worked in the production unit of a pottery company which required him to do a heavy work such as lifting clay and pottery. He was also the bread winner in his family. He has tried to go work for two days before, and he felt uneasy at work like having palpitations dan difficulty in breathing while lifting pottery. Currently, with his limited physical endurance, the patient cannot return to work.

Physical examination revealed the blood pressure (BP) was 100/70 mmHg, resting heart rate (HR) was 70 beats per minute, respiration rate (RR) was 22 times per minute, oxygen saturation was 98%

room air. The echocardiography during hospitalization showed the Ejection Fraction (EF) for only 35% and the diagnostic laryngoscopy found the paralysis of left vocal cord due to LRLN paralysis. The first examination of his physical fitness was carried by the count test, sit to stand test and the six-minute walk test (6MWT). He can count 14 until 18 times for every single deep inhalation, he can sit to stand for 18 times in 30 seconds. At his first 6MWT, the patient can cover a distance of 204 meters, which results in VO_2max 16,59 and Metabolic Equivalents (METs) of 4.74. The vital signs after the exercises test were shown that his BP was 100/60 mmHG, HR was 92 beats per minute, RR was 22 times per minute and oxygen saturation was 98% room air. The patient was diagnosed with Cardiovocal syndrome based on the presence of cardiomegaly on x-ray due to HF caused by his perimyocarditis followed by hoarseness caused by LRLN paralysis.

A phase two CR program was tailored made for the patient following the pre-exercise testing at the hospital. The exercise program consists of breathing exercises, endurance exercises, and muscles strengthening. The breathing exercises was a deep breathing and chest expansion exercise. The deep breathing exercise should be repeated for ten times in three sessions also the chest expansion exercise. The endurance exercises following the FITT (Frequency, Intensity, Time and Type) prescription. The Frequency minimum was five times per week, the Intensity that we gave was the moderate intensity with the duration five until ten minutes that can be increased to a maximal 30 minutes. Type of the exercise was walking. The moderate intensity was measured using the Karvonen Formula with the targeted heart rate between 40% until 60% from the maximum heart rate. Based on the Karvonen Formula the targeted heart rate during exercises was between 80 and 100 beats per minute. Muscle strengthening exercises consist of three exercises, the first was tiptoeing with both legs for ten times in three sessions, the second was half squats for ten times in three sessions and the third was sit to stand

on a chair for ten times in one session. Ideally, phase two CR was planned to be center-based cardiac rehabilitation (CBCR) conducted in the hospital's outpatient clinic. However, due to distance constraints, the decision was made to implement a home-based cardiac rehabilitation (HBCR) program instead. There also some contraindications for the HBCR which are acute myocardial infarction, unstable angina, uncontrolled arrythmias, new onset of atrial fibrillation in congestive heart failure, aortic stenosis, active myocarditis, perimycarditis or endocarditis, regurgitant valvular heart disease need to surgery, acute pulmonary edema, uncontrolled asthma, uncontrolled diabetes, acute systemic illness and respiratory failure.

The patient was not having all the contraindications when we started the HBCR. The patient was instructed to terminate exercise immediately if they experienced any cardiovascular symptoms, including chest pain or discomfort, palpitations, or dyspnea. In addition, the patient asked to routinely record his exercise in a note regarding duration of the exercises. He also

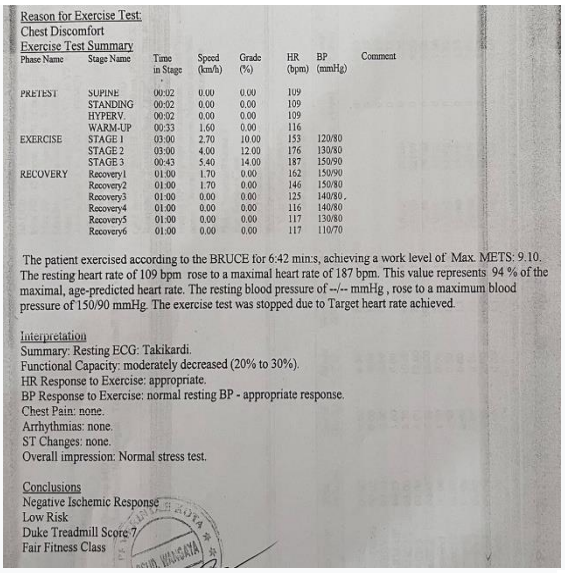
RESULTS

In the first month, the patient was directed to do moderate activity. When the patient came to visit the hospital, he felt better but his voice was still hoarse, he did the endurance exercise for about 15 minutes daily. Every time patient came to visit outpatient policlinic, we did the 6MWT to determine the patient's physical endurance progress during HBCR. The second echocardiography on March 23rd, 2023 revealed the improvement of EF from 35% to 59%. Entering the second month, the patient said he felt better and the hoarseness had decreased. Cardiology department also did the treadmill test, the result was fair fitness level (Figure 1). The following month, patient felt better and his voice has returned to normal. The changes of physical fitness level can be seen in table 1, his METs went from 4.75 on his first attempt. After three months of CR, on May 27th 2023, we did the 6MWT for the patient

and he scored METs 9.65. He was declared able to return to work.

DISCUSSION

CR consist of three phases which are phase one, the inpatient phase, phase two, the outpatient phase and phase three, the maintenance phase. The patient in this case was consulted from the Cardiovascular polyclinic to the PMR polyclinic after hospitalization so that the CR given was refers to phase two which is the outpatient phase. The goal is to gain their physical endurance so they can be able to return to work.[11-14]



Reason for Exercise Test:
Chest Discomfort
Exercise Test Summary

Phase Name	Stage Name	Time in Stage	Speed (km/h)	Grade (%)	HR (bpm)	BP (mmHg)	Comment
PRETEST	SUPINE	00:02	0.00	0.00	109		
	STANDING	00:02	0.00	0.00	109		
	HYPERV.	00:02	0.00	0.00	109		
	WARM-UP	00:33	1.60	0.00	116		
EXERCISE	STAGE 1	03:00	2.70	10.00	153	120/80	
	STAGE 2	03:00	4.00	12.00	176	130/80	
	STAGE 3	00:43	5.40	14.00	187	150/90	
RECOVERY	Recovery1	01:00	1.70	0.00	162	150/90	
	Recovery2	01:00	1.70	0.00	146	150/80	
	Recovery3	01:00	0.00	0.00	125	140/80	
	Recovery4	01:00	0.00	0.00	116	140/80	
	Recovery5	01:00	0.00	0.00	117	130/80	
	Recovery6	01:00	0.00	0.00	117	110/70	

The patient exercised according to the BRUCE for 6:42 min:s, achieving a work level of Max. METS: 9.10. The resting heart rate of 109 bpm rose to a maximal heart rate of 187 bpm. This value represents 94 % of the maximal, age-predicted heart rate. The resting blood pressure of --/-- mmHg , rose to a maximum blood pressure of 150/90 mmHg. The exercise test was stopped due to Target heart rate achieved.

Interpretation
Summary: Resting ECG: Takikardi.
Functional Capacity: moderately decreased (20% to 30%).
HR Response to Exercise: appropriate.
BP Response to Exercise: normal resting BP - appropriate response.
Chest Pain: none.
Arrhythmias: none.
ST Changes: none.
Overall impression: Normal stress test.

Conclusions
Negative Ischemic Response
Low Risk
Duke Treadmill Score:7
Fair Fitness Class

Figure 1. Result of the treadmill test of on April 25th, 2023

After experiencing an episode of heart failure, patient reported symptoms of fatigue and hoarseness. The patient was discharged from hospital for a month but still complained of fatigue and hoarseness. Cardiac Rehabilitation is an important treatment that must be given to a patient with heart problem to accelerate the recovery of physical fitness, control the risk factors and prepare the patient to return to work. The purpose for referred patient to Physical Medicine and Rehabilitation Department accordance with the function of CR.[4-9]

Table 1. The changes of METs during patient's exercise in the Outpatient Polyclinic Wangaya Regional Hospital.

Date	SpO2 (%)		Heart Rate X/mnt		Borg Scale	METs
	Before	After	Before	After		
02-28-2023	98	95	98	113	14	4.75
03-06-2023	96	95	98	111	14	7.63
03-13-2023	95	98	96	109	13	7.84
03-20-2023	97	98	86	128	13	8.97
04-11-2023	94	98	86	129	13	9.18
04-26-2023	98	99	85	119	11	9.45
05-27-2023	98	99	86	112	11	9.65

In this case, patient received phase two CR where the CR program consist of routine physical exercises carried out at the polyclinic or hospital that also called CBCR. However, due to distance limitations and patient needs someone to accompany him while doing exercises at

the polyclinic, we decided to make the exercises as a HBCR.[7,8,9]

Cardiac Rehabilitation program requires follow-up from 12 to 18 weeks. Home Based CR following scheduled hospital visit was chosen for the phase two CR in this case was an alternative for the patient to enable the patients to do cardiac exercise continously even though was distance constraints that inhibits patient's ability to do hospital visit regularly. With HBCR, patient has time flexibility and still felt comfortable at his own home. Patient's compliant to the exercise regiments was high due to flexibility exercises schedule and because its cost effective. Thus made the HBCR an alternative for the usual CBCR for him. Some studies said that HBCR was as good as CBCR in helping patient regain their physical endurance, another literature said that HBCR is more effective and efficient because it is easier to do and costs less. [9-12.]

During his visit to the polyclinic, we did the 6MWT exercises. The 6MWT is one of the methods be used to assess the exercise capacity when standard treadmill or cycle testing did not available. This method can be applied easily because it can be done anywhere as long as there is sufficient path length. Distance walk was the primary outcome of the test and best used in a serial manner to evaluate changes in exercise capacity, assess the improvements in his physical endurance.[5,6,13]

Cardiovocal syndrome or Ortner's Syndrome is a rare condition in patients who experience HF where hoarseness occurs due to pressure on the LRLN caused by an enlargement of the heart close to the path of the LRLN. This pressure caused a paralysis of the LRLN which further caused a paralysis of the vocal cords, made patient's voice to became hoarse. Paralysis of the LRLN can be returned to normal by reducing the size of the enlarged heart that would release the squeeze of the left RLN along with strengthening the skeletal muscles, with physical exercises. Patient's voice can return to normal as the skeletal muscles of the vocal cords have also been strengthened.[7-12.]

CONCLUSION

CR is one of the important managements for a patient with heart problem. It was proven to speed up the recovery of physical endurance, controlling the risk factors and helped the patient to gradually return to work. CR has three phases from the inpatient to the outpatient. Every phase has a specific purpose. For this case the CR was a phase two CR that should be done as a CBCR. The main purpose was to speed up the recovery of the physical endurance. We gave him the HBCR due to some constrictions. HBCR was proven to be an alternative for CBCR especially in some conditions like in this case where patient has some limitations to came to the hospital every day. HBCR also gave pleasant and flexibility for the patient to went exercises every day also seems to be a cost effective. Some literatures also said that HBCR gave an equal result as CBCR also more cost effective. In this case the HBCR was proven to gave the patient a good result in improving patient's physical endurance and control the risk factor for the CVD.

DISCLOSURES

Acknowledgements

We express our sincere gratitude to all members of Wangaya Regional Hospital's Physical Medicine and Rehabilitation Department for the expert advice and assistance given in every aspect of this report. We are also grateful to the Cardiology Department for their collaboration. Finally, we want to express our gratitude to the friends and colleagues who helped us write this manuscript.

Conflict of Interest

The author declares there is no conflict of interest regarding the publication of the current report.

Funding

The authors are responsible for the study's funding without the involvement of grants, scholarships, or any other resources of funding.

Author Contribution

All of the authors equally contributed to the report, from the data gathering, physical examination, supporting investigation, and reporting the results of the case.

References

1. World Health Organization. Cardiovascular Diseases (CVDs). [Internet]. 2023. Available from: https://www.who.int/newroom/fact-sheets/detail/cardiovascular-diseases-(cvds).
2. Prahasti SD, Fauzi Lukman. Resiko Kematian Pasien Gagal Jantung Kongestif (GJK): Studi Kohort Retrospektif Berbasis Rumah Sakit. Indonesian Journal of Public Health and Nutrition. 2021; 1(3): 388-395. doi: :10.15294/ ijphn. v1i3.48101.
3. Bartels MN, Prince DZ. Acute Medical Conditions: Cardiopulmonary Disease, Medical Frailty, and Renal Failure. In: Cifu, David X. (ed) Braddom's Physical Medicine and Rehabilitation. Philadelphia, USA: Elsevier Saunders; 2021. p. 511-534.
4. Bartels MN, Lehman YJ, Rashbaum IG. Cardiac Rehabilitation: Lifestyle, exercise and risk factors modification. In: Physical Medicine and Rehabilitation Secrets. Philadelphia, USA: Elsevier Saunders; 2023. p. 445-451.
5. Davis AM. Cardiac Rehabilitation. In: Essentials of Physical Medicine and Rehabilitation. Philadelphia, USA: Elsevier Saunders; 2019. p. 678-683.
6. Thomas RJ. Comprehensive Cardiac Rehabilitation. In: Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. Philadelphia, USA: Elsevier Saunders; 2022. p. 588-592.
7. Imran HM, Baiq M, Erqou Sebhat et al. Home-Based Cardiac Rehabilitation Alone and Hybrid with Center-Based Cardiac Rehabilitation in Heart Failure: A Systematic Review and Meta-Analysis. Journal of the American Heart Association. 2019; 8: e012779. doi: 10.1161/JAHA.119.012779.
8. Ye Y, Ma J, Zhang L et al. Effect of Home-based Cardiac Rehabilitation for Patients with Heart Failure: A Systematic Review and Meta-analysis. International Journal of Morphology. 2023; 41(1):246-256.
9. Madhuraj S, Gangadharan H, Manju R et al. A Rare Cause of Ortner's Syndrome and a Case-Based Review of Literature. Indian Journal of Otolaryngology and Head&Neck Surgery. 2022; 74(3): 5338–5341. DOI: 10.1007/s12070-021-02521-z.
10. Palanisamy V, Doshi KS, Ahmad TETN et al. Ortner's Syndrome: A Cause of Unilateral Vocal Cord Paralysis. Global Journal of Medical and Clinical Case Reports. 2017; 4(3): 069-071. doi: 10.17352/2455-5282.000051.
11. Goyal P, Gorodeski EZ, Marcum ZA et al. Cardiac Rehabilitation to Optimize Medication Regimens in Heart Failure. Clinics in Geriatric Medicine. 2019; 35: 549–560. doi: 10.1016/j.cger.2019.06.001.
12. Afilalo J. Evaluating and Treating Frailty in Cardiac Rehabilitation. Clinics in Geriatric Medicine. 2019; 35: 445-457. doi: 10.1016/j.cger.2019.07.002.

13. Forman DE, Sanderson BK, Josephson RA et al. Heart Failure as a Newly Approved Diagnosis for Cardiac Rehabilitation Challenges and Opportunities. Journal of The American College of Cardiology. 2015; 64(24): 2652-2659. doi: 10.1016/j.jacc.2015.04.052.

14. Borghi-Silva A, Mendes RG, Trimer R et al. Current Trends in Reducing Cardiovascular Disease Risk Factors from Around the World: Focus on Cardiac Rehabilitation in Brazil. Progress in Cardiovascular Diseases. 2014; 56: 536 – 542. doi: 10.1016/j.pcad.2013.09.008.