

Telemedicine: A Valuable, Epidemiological, and Therapeutic Tool for Cardiovascular Diseases in Rural Areas

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ABSTRACT

Introduction: Cardiovascular diseases (CVDs) are the leading cause of death in India. These diseases often go unnoticed in the rural heartland because of their geographical location and low socioeconomic status. By using telemedicine as a tool for providing health care in rural areas, we may be able to address their cardiovascular problems better.

Objectives: To study the incidence of noncommunicable diseases (NCDs) in a rural region adjacent to National Capital Territory and to observe the incidence of smoking and smokeless tobacco in rural subjects attending tele sessions.

Materials and methods: The present study was conducted at the National Heart Institute, New Delhi, in collaboration with Health Foundation of India (HFI) in Jewar, Greater Noida, where the majority of people were from low socioeconomic strata. We conducted biweekly telemedicine sessions over a period of 9 months (June 2018–February 2019) in which a total of 120 new patients were presented to us by HFI. After the first interaction, a tentative diagnosis was made and every patient was advised relevant lab investigations and lifestyle measures and a follow-up visit.

Results: We found out that 46% of the cohort was having diabetes, 25.83% had diabetes with other CVDs, 6% suffered from hypertension (HTN), 3.32% had HTN along with other comorbid conditions, 3.33% had hypothyroidism, and 2.5% had diabetes with hypothyroidism. Interestingly, only one case of 0.83% had isolated coronary artery disease (CAD). Notably, 62.5% of patients came for follow up in which 5.8% actually followed advice for quitting smoking and oral tobacco at the first instance.

Conclusion: Diabetes, hypertension and/or hypothyroidism have emerged in a big way in the rural National Capital Region. Reasonably optimum health care can be provided to the rural areas with the help of telemedicine. This tool can also be used effectively to propagate healthy life style, particularly tobacco habit and importance of exercise in rural population; thus preventing further spread of NCDs.

Keywords: Noncommunicable diseases, Rural scenario, Tele-ECG, Telemedicine.

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INTRODUCTION

Telemedicine is used for imparting health care and spreading health awareness from distance using telecommunication and information technology. It is also used to save lives in critical care and emergency situations. It has been used to overcome distance barriers and to improve access to medical services that would often not be consistently available in distant rural communities. As cardiovascular diseases (CVDs) have emerged as major causes of morbidity and mortality in urban as well as rural India, these need to be tackled at both places in an effective manner. However, adequate healthcare facilities are not yet available in most rural areas of the country. The National Heart Institute and Health Foundation of India undertook a joint venture using telemedicine to provide optimum health advice to patients near the Jewar village situated in Greater Noida. The aim is to provide health advice as well as study the epidemiological profile of these cases coming to the Jewar Health Centre. We present our initial observations of this innovative venture using telemedicine as a tool for providing health care to a village community.

MATERIALS AND METHODS

Study Centre

National Heart Institute, Kailash Colony, New Delhi, in collaboration with Hospital Guide Foundation—NGO, eSanjeevni.in based at Jewar, Greater Noida.

Study duration: June 2018 to February 2019

Sample size: 120 patients

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Study Design

Telemedicine session was conducted at the National Heart Institute (NHI) on every Tuesday and Thursday between 12 and 1 pm. There were two separate teams: one at NHI and another at Jewar, Greater Noida. The NHI team included a doctor (SD), information technology technician, and a BSc. in Cardiac Lab Technologies (BCLT) trainee (KR). The Non-Governmental Organization (NGO) team included doctor, information technology technician, and coordinator of NGO. All subjects who presented themselves in the telemedicine session were included in this study. The basic details like name, age, sex, occupation, socioeconomic history, tobacco habit, height, weight, blood pressure, and blood sugar estimation of all cases were done

Flowchart 1: Operational mechanism of telemedicine session at NHI and Jewar. Real-time connection between the doctor at NHI and the patient at Jewar Health Centre



Store and forward data (investigations and lab reports) from Jewar health centre to NHI

Diagnosis is made, medicine prescribed and given and advised for a follow-up to evaluate the progress

by NGO and details beamed to telemedicine room at the NHI (flow chart real-time telemedicine session) (Flowchart 1).

Telecardiology basically involves the transmission of electrocardiograph (ECG) to the cardiologist *via* using the information and communication technology (ICT) platform. The ECG is essential for the screening diagnostic and monitoring for CVD¹ (Figs 1 and 2).

All relevant details like height, weight, blood pressure, blood sugar, etc., were maintained in separate computer files at Jewar and made available to the NHI team. Based on the history provided and interaction with the patient during the tele-session, a tentative diagnosis was made, investigations planned, treatment suggested, basic lifestyle measures like tobacco cessation, appropriate diet, proper exercise, and relevant investigations like total lymphocyte count (TLC), differential leukocyte count (DLC), hemoglobin (HB), erythrocyte sedimentation rate (ESR), routine urine examination,

stool, liver function test (LFT), kidney function test (KFT), lipid profile, X-ray chest PA view, ECG, and ultrasound abdomen and pelvis were advised for all cardiovascular/diabetic cases. The grades of obesity are based on the criterion described by Lavie, Arena, Alpert, Milani, and Ventura.² The standard for determining high blood pressure in our study is based on JNC 8.³ The diagnosis of diabetes in our study is based on the American Diabetes Association criterion 2018.⁴ These tests were carried out at Jewar itself coordinated by the NGO. Reports including ECG, X-ray, and ultrasound were scanned and sent to the NHI information system well before the tele-session. The patients were reviewed along with all reports in the second visit. The final diagnosis based on history and lab reports was made during the second visit. The revised treatment schedule was started and compliance to lifestyle measures was also noted. Patients were then advised to come for follow up after 12 weeks. It may be worth mentioning that during all three visits, patients were counseled about the necessity for healthy lifestyle particularly the use of tobacco both smoking and oral. The medicines were provided by the NGO team free of cost.

Inclusion Criteria

All the patients registered with the hospital guide foundation coming to the Jewar center and presented to us *via* a telemedicine link were included in this communication.

Exclusion Criteria

The patients who did not come up for the follow-up visit were excluded in this study.

Statistical Analysis

Since the study is conducted on a very small number of populations, analysis of the data was done on the Microsoft office excel 2016.

RESULTS

The present study includes 120 patients who presented to us *via* a telemedicine link. There were 62 (51.66%) males and 58 (48.33%) females. Ninety-eight (81.66%) were Hindus and 22 (18.33%) were Muslims. All patients belonged to low socioeconomic strata. About 28% of our study subjects were tobacco users, most being

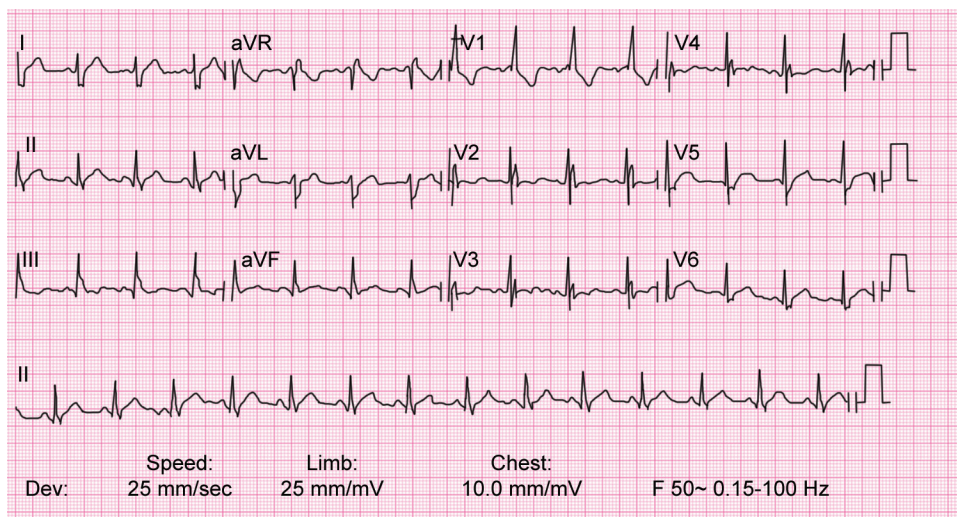


Fig. 1: Case 1: ECG report showing right bundle branch block (RBBB) sent by eSanjeevni.in during the telemedicine session

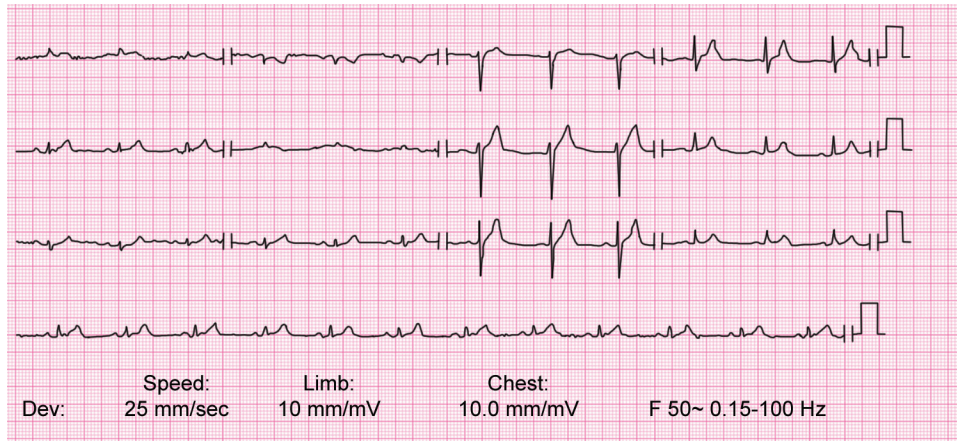


Fig. 2: Case 2: ECG sent during the tele-session. It shows ST elevation in L1, L2, V2–V5 possibly early repolarization

Table 1: SMO (smoker), SLT (smokeless tobacco), Ex-SLT (former smokeless tobacco user), Ex-smoker (former smoker) ($n = 120$). As regard the body mass index of the patients, it was observed that 56 (56.66%) of the study population had more than ideal weight (overweight, obese classes 1 and 2) (Table 2 and Fig. 3)

	Total (%)	Male (%)	Female (%)
Current smoker	19 (15.83)	18 (15)	1 (0.83)
SLT	4 (3.33)	3 (2.5)	1 (0.83)
SMO + SLT	3 (2.5)	2 (1.6)	1 (0.83)
SMO + Ex-SLT	2 (1.6)	2 (1.6)	0
Ex-SLT	1 (0.83)	1 (0.83)	0
Ex-smoker	5 (4.1)	5 (4.1)	0
Non-smoker + non-SLT	86 (71.66)	32 (26.66)	54 (45)

Table 2: Distribution of body mass index in study population

BMI	Total (%)	Male (%)	Female (%)
Underweight	6 (5)	3 (2.5)	3 (2.5)
Normal	46 (38.33)	25 (20.83)	21 (17.5)
Overweight	46 (38.33)	26 (21.66)	20 (16.66)
Obese class 1	19 (15.83)	8 (6.66)	11 (9.11)
Obese class 2	3 (2.5)	0 (0)	3 (2.5)

smokers (18.33%). Out of total tobacco users, only 2.49% were females (Table 1).

Disease Profile

More than 75% of the subjects had diabetes out of which 46% had diabetes alone and 29.99% had other comorbidities like hypertension, hypothyroidism and CAD. Most of them had uncontrolled blood sugar. Strikingly the prevalence of HTN alone was only 6%. These figures are eye openers for the health fraternity and health planners (Table 3 and Fig. 4). So, it is important to know that most of these diabetic patients were uncontrolled at the first visit because of noncompliance of medicine due to economic reasons. Even when the medicine is made available to them by the NGO team, there used to be a break in the continuity of taking medicine due to their unavailability to pick up medicine from the center in due time. Notably that many of the patients who were tobacco users particularly the smokers did not quit smoking and smokeless tobacco. These cases needed 3 to 5 tele-sessions to

Table 3: Disease profile: T2DM, HTN, CAD, and NCD ($n = 120$)

Disease	Total (%)	Male (%)	Female (%)
T2DM	56 (46)	27 (22.5)	29 (24.16)
HTN	8 (6)	6 (5)	2 (1.6)
CAD	1 (0.83)	1 (0.83)	0
Hypothyroidism	4 (3.33)	2 (1.66)	2 (1.66)
T2DM + other CVDs	31 (25.83)	21 (17.5)	10 (8.33)
T2DM + hypothyroidism	3 (2.5)	0	3 (2.5)
HTN + other CVDs	1 (0.83)	1 (0.83)	0
T2DM + HTN + hypothyroidism	2 (1.66)	0	2 (1.66)
Diseases other than NCD	14 (11.66)	4 (3.33)	10 (8.33)

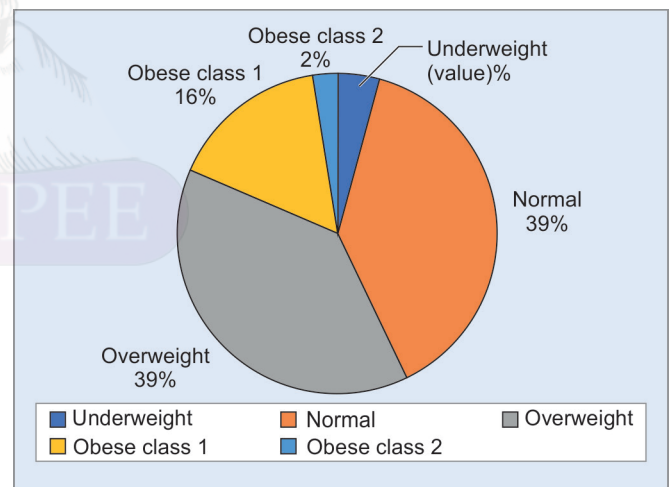


Fig. 3: Body mass index distribution ($n = 120$)

persuade them to stop smoking. Regrettably many of them did not stop tobacco even after persistent counseling.

DISCUSSION

According to the WHO, the goal of telemedicine is to provide good medical care to the people living remotely in a country like India where 75% of the population is poor and the number of health care professionals is not enough in remote areas.⁵ Telemedicine is

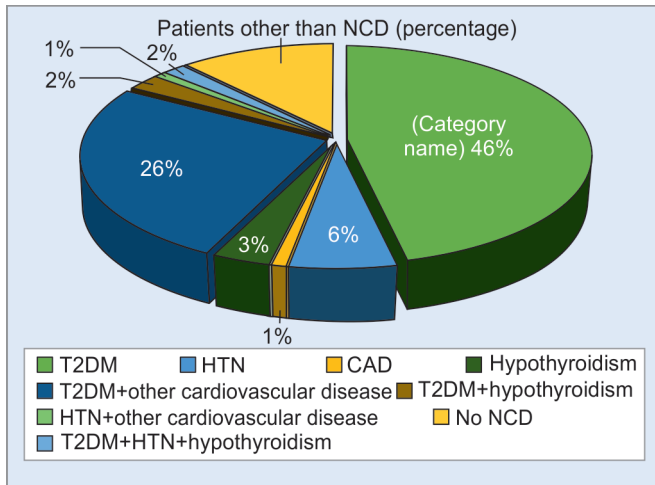


Fig. 4: Overall disease profile

an effective approach to deal with the problem.¹ It consists of five distinct domains:

1. Real time—this is the audiovisual ICT connection between the doctor and the patient.
2. Store and forward—in which the investigatory test reports are uploaded and transmitted through ICT to the doctor for examining.
3. Remote patient monitoring—this is a real-time transmission of data in which the patient is wearing wearable sensor capturing the vitals and transmitting them on the real-time basis.
4. Mobile health—various apps sending alerts to the patient by monitoring the vitals of the patient.
5. Health education delivered by ICT and online discussion with the health care professionals.¹

Our study was primarily meant to give health advice to the rural population of Jewar. This also gave us an opportunity to study the epidemiological profile and prevalence risk factors for various cardiovascular disorders. Besides giving medical advice, we used the tele-sessions to impart healthy lifestyle education. In developing countries like India, the rising incidence of noncommunicable diseases (NCDs) is causing an increase in the morbidity and premature mortality. Smoking is one of the major risk factors in India. Consumption of tobacco causing mortality is huge. Smokeless tobacco and smoking of *bidi* are the most common types of tobacco used in India and the prevalence of tobacco consumption in rural areas of India is alarming. Young kids under 15 years consume tobacco.⁶ Increasing tobacco use coupled with the rising incidence of diabetes and HTN are the major causes of concern for India. In the telemedicine, most of the diagnosis is done visually. The long-term effects of chronic smoking can be easily seen like darkening of lips, wrinkles, scarring pigmentation yellowing of teeth, and hair loss during visual sessions. The most noticeable immediate effects of smoking are stained teeth and tongue, gum discoloration (also called smoker's melanosis), and changes in the look of the roof of the mouth (palate). Our study revealed this in no less a manner wherein tobacco users among rural Greater Noida are as high as 28%. Also, an alarming prevalence of diabetes (75.32%) was seen. This is an eye opener for all of us. The irony is that most patients already knew that they have "sugar" (diabetes mellitus), "pressure" (HTN), and/or "heart attack" (CVD) but even then they failed to follow a healthy lifestyle. Most of them were not taking medicine for above

ailments at the time of first reporting to tele-sessions. In spite of the fact that NGO provides medications and lab tests free of cost, they did not take medications regularly, which led to uncontrolled type 2 diabetes mellitus (T2DM) in many of the patients. About 38% of the cases do not visit for a follow up.

As we all know very well that diabetes is one of the major risk factors of CVDs burden in India, the prevalence of diabetes quadrupled in the rural areas of India because diabetes awareness is poor.⁶ About 50% of people diagnosed with T2DM had at least one diabetes-related complication at the time of diagnosis.^{7,8}

Using the telemedicine to impart health education and making people aware of the risk of faulty lifestyle along with providing medical advice and drugs can help in reducing the burden of CVDs in rural India and in remote locations. NCDs account for almost half the deaths among the low-income group people, leading to serious economic consequences.⁹ Telemedicine assumes special relevance to reach such people and help them in reducing the prevalence of noncommunicable diseases like diabetes, HTN, CVDs, obesity, thyroid disorders, etc. It can be a very cost-effective tool.

Strengths and Limitations of the Study

The use of telemedicine for rural population, focusing on NCDs particularly CVDs and diabetes, has been done for the first time in India. The number being small is one of the lacunae which we hope to augment in the future. However, this study, though small, does give us useful information about the high prevalence of CVD and T2DM in a rural area of National Capital Region.

CONCLUSION

More than 76% of telemedicine patients had T2DM in the rural Jewar area. In most cases, blood sugar levels in follow-up visits were uncontrolled. People knew about diabetes and HTN but did not take it seriously as they failed to follow advice about lifestyle changes and did not take prescribed drugs properly. In most cases, urinalysis and other relevant workup were not done at the first instance. Uncontrolled T2DM had resulted in retinopathy, nephropathy, and neuropathy in some of our subjects. Telemedicine offers the opportunity of one-to-one interaction with visual images of both the patient and the doctor. In rural areas, people do not understand the severity of their condition. Telemedicine can be an effective tool for diagnostic care and prevention of CVD in rural areas.

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