

Telemedicine: Current Concepts and Future Perceptions

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Keywords: telemedicine, telecardiology, telemonitoring

Cardiovascular diseases are the leading cause of morbidity and mortality worldwide. Despite serious advances in the treatment options, there were 83.5 million people suffering from cardiovascular diseases in European countries in 2015 (1). In this context, innovative strategies have been considered in a privileged position with its promising potential to reduce health care costs, improve patient-centered care and, thus, increase the quality of the life of the patients. As a rising star of the past decade, telemedicine has been centralized the most of the evaluated innovative interventions.

Definition of telemedicine

Telemedicine is an extended definition with including procedures for transmitting crude or refined medical information to provide or improve general well-being of the patients. It is divided into four main parts; telemonitoring, mobile-health (m-Health), electronic-health (e-Health) and telehealth. Telemonitoring is defined as the use of audio, video, information technology and telecommunications to follow-up the patients while performing daily activities by using digital technology in the distance (2). m-Health is marked out by the use of personal digital instrumentals such as phones and wireless devices for individualized health (3). e-Health is the application of telecommunications to improve the health and activities associated with health (4). Nonetheless, telehealth is described as the use of digitalized systems to direct the approach of the patients to their own diseases (3).

Application of telemedicine in cardiology and current concepts

Similar to other medical sciences, telemedicine is roughly applied in three main areas in cardiology; pre-hospital (emergency or outpatient), in hospital, post-hospital (home care). In addition, telecardiology can also be sectioned according to dis-

ease spectrum such as diagnosis, heart failure, acute coronary syndrome and cardiac rehabilitation.

In the diagnosis era, tele-consultation programs have a value to decrease the number of unnecessary outpatient services despite the risk of higher number of communications to a specialist. One of the largest series of tele-consultation has been reported in pediatric tele-echocardiography by transmission of echocardiograms, either in real-time or using store-and-forward technology (5). It has been presented that tele-echocardiography increases the quality of care and prevents unnecessary patient transport following 15-year of experience. Electrocardiographic diagnosis of myocardial infarctions (MI) or arrhythmias has also been the most common method of telecardiology. There is moderate quality evidence that telemedicine procedures, particularly electrocardiography transmission, are linked to lower in-hospital mortality reported in a recent meta-analysis including 16.960 patients (6). Considering the arrhythmias, continuous tele-electrocardiography has detected cardiac arrhythmias better in outpatients than standard cardiac rhythm holter test and cardiovascular emergencies were less frequently misdiagnosed by the use of tele-electrocardiography (7).

Heart failure is an important and frequent reason of impairment that resulted in 290.000 deaths per year in the United States (8). Several telemedicine-based studies have been applied in order to struggle against the heart failure reasoned hospital admissions and their related health costs. Telemedicine can assist heart failure patients by tracking, decreasing hospital visits, increasing medication adherence and quality of life. The devices used in telemonitoring bring self-directed lifestyle forward to heart failure patients by monitoring data regarding the vital signs (9). Klersy et al have also proved that telemedicine programs in heart failure reduce the all-cause mortality and hospital admissions. These results has also been validated by Comin-Colet J et

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DOI:10.14744/AnatolJCardiol.2019.12525



al whose study has been reported lower number of heart failure and cardiovascular readmissions in the management chronic heart failure patients with telemedicine (10). Another serious point of heart failure patient management is adherence to medical treatment. Also, senescence and polypharmacy are the main obstacles encountered in heart failure follow-up. Administration of well-adjusted health care schedules has been tested and put across with remarkable success by improving adherence to treatment (10). Moreover, telephone follow-up has been found to improve the quality of life and satisfaction in heart failure patients (11).

The treatment of acute MI and cardiorespiratory arrest necessitates rapid solutions in order to obviate the reversible myocardial damage. Pre-hospital triage with telecardiology is strongly related to a near halved onset-to-door time in acute MI in a meta-analysis (12). In Denmark, a network has been organized and succeeded to use telemedicine and helicopters to provide the optimal treatment within the time limits suggested by the recent guidelines (13).

Cardiac rehabilitation involves all the actions applied to cardiac patient to provide the general well-being prior to pilot cardiac disease. The implementation of a cardiac rehabilitation web portal has been shown to be helpful for patients' telerehabilitation education and have a remarkable effect to increase patient's eHealth literacy skills (14). Telemedicine methods have been demonstrated to be valid and reliable in patients with chronic heart failure, in addition video-based tele-rehabilitation programs have provided better outcome measures included functional test (15).

Future perceptions of telemedicine in cardiology

There have been serious developments of telemedicine in cardiology in the last decade however there is still an inevitable demonstrability between data obtained, clinical trials enrolled and prosperity of new telemedicine technologies into the public domain. Particularly smartphones will become the milestone of future cardiology with the help of its sophisticated effects. Telemedicine technologies will be easily accessible via smartphones and the lack of accuracy of the new technologies will be the key concern. Considering the rapid and continuous flow of data in telemedicine, the other important preoccupations will be the data security and generalizability. The new telemedicine technologies will also be convenient to national and social characteristics to be used worldwide.

As a result, telecardiology has a promising power to appear in the guideline-directed prevention and treatment methods in a close future, thus it will not be a surprise to encounter telecardiology-based recommendations as higher class of evidence in the future guidelines.

Conflict of interest: None declared.

References

1. Timmis A, Townsend N, Gale C, Grobbee R, Maniadakis N, Flather M, et al. European Society of Cardiology: Cardiovascular Disease Statistics 2017. *Eur Heart J* 2018; 39: 508–579.
2. Escobar-Curbelo L, Franco-Moreno AI. Application of Telemedicine for the Control of Patients with Acute and Chronic Heart Diseases. *Telemed J E Health* 2018 Dec 15.
3. Cowie MR, Bax J, Bruining N, Cleland JG, Koehler F, Malik M, et al. e-Health: a position statement of the European Society of Cardiology. *Eur Heart J* 2016; 37: 63–6.
4. Nguyen HH, Silva JN. Use of smartphone technology in cardiology. *Trends Cardiovasc Med* 2016; 26: 376–86.
5. Krishnan A, Fуска M, Dixon R, Sable CA. The evolution of pediatric tele-echocardiography: 15-year experience of over 10,000 transmissions. *Telemed J E Health* 2014; 20: 681–6.
6. Marcolino MS, Maia LM, Oliveira JAQ, Melo LDR, Pereira BLD, Andrade-Junior DF, et al. Impact of telemedicine interventions on mortality in patients with acute myocardial infarction: a systematic review and meta-analysis. *Heart* 2019. pii: heartjnl-2018-314539.
7. Marcolino MS, Santos TMM, Stefanelli FC, Oliveira JAQ, E Silva MVRS, Andrade DF Júnior, et al. Cardiovascular emergencies in primary care: an observational retrospective study of a large-scale telecardiology service. *Sao Paulo Med J* 2017; 135: 481–7.
8. de la Torre Díez I, Garcia-Zapirain B, Méndez-Zorrilla A, López-Coronado M. Monitoring and Follow-up of Chronic Heart Failure: a Literature Review of eHealth Applications and Systems. *J Med Syst* 2016; 40: 179.
9. Klersy C, De Silvestri A, Gabutti G, Regoli F, Auricchio A. A meta-analysis of remote monitoring of heart failure patients. *J Am Coll Cardiol* 2009; 54: 1683–94.
10. Comín-Colet J, Enjuanes C, Verdú-Rotellar JM, Linas A, Ruiz-Rodríguez P, González-Robledo G, et al. Impact on clinical events and healthcare costs of adding telemedicine to multidisciplinary disease management programmes for heart failure: Results of a randomized controlled trial. *J Telemed Telecare* 2016; 22: 282–95.
11. Fernandez-Moyano A, Vallejo-Maroto I, López-Jimeno W. Telehealth. *N Engl J Med* 2018; 378: 401–402.
12. Brunetti ND, De Gennaro L, Correale M, Santoro F, Caldarella P, Gaglione A, et al. Pre-hospital electrocardiogram triage with telemedicine near halves time to treatment in STEMI: A meta-analysis and meta-regression analysis of non-randomized studies. *Int J Cardiol* 2017; 232: 5–11.
13. Clemmensen P, Schoos MM, Lindholm MG, Rasmussen LS, Steinmetz J, Hesselheldt R, et al. Pre-hospital diagnosis and transfer of patients with acute myocardial infarction-- a decade long experience from one of Europe's largest STEMI networks. *Journal of Electrocardiology* 2013; 46: 546–52.
14. Melholt C, Joensson K, Spindler H, Hansen J, Andreassen JJ, Nielsen G, et al. Cardiac patients' experiences with a telerehabilitation web portal: Implications for eHealth literacy. *Patient Educ Couns* 2018; 101: 854–61.
15. Hwang R, Mandrusiak A, Morris NR, Peters R, Korczyk D, Russell T. Assessing functional exercise capacity using telehealth: Is it valid and reliable in patients with chronic heart failure? *J Telemed Telecare* 2017; 23: 225–32.