TELEMEDICINE IN FETAL DIAGNOSIS

a solution of congenital heart disease

Congenital heart disease (CHD)

- One of the most essential causes of infant mortality and morbidity. (2)
- Has been regarded as a public health issue. (2)
- Can be caused by both genetic and environmental factors. (2)
- Around 6-12 per 1000 newborns would be affected by CHD. (1)
- Usually, CHD requires life-long treatment.
- Early treatment can greatly improve patients' lifetime and life quality. (1)

Current solutions (1)

ultrasound (most common)

3- and 4-dimensional echocardiography

magnetic resonance

fetal electrocardiography and magnetocardiography

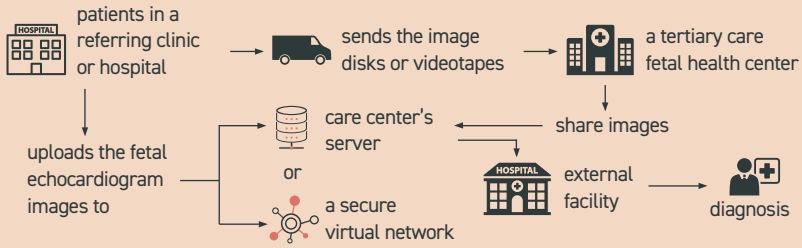
Disadvantages of the current solutions

- The financial cost would increase of families with a CHD diagnosis because of the transportation fee. (3)
- Pregnant women exposed to the hospital environment are more likely to infect other diseases. (4)
- Without medical professionals, people in the remote area might not be able to receive proper diagnosis and treatment. (5)

How telemedicine used in fetal diagnosis

Remote fetal tele-echocardiography provides a platform for doctors to conduct remote consultations. The ultrasound images of the fetus are transmitted to professional medical staff through the network, and the diagnosis results can be obtained in time. (5)

An example of remote fetal tele-echocardiography (5)



Evidence

- A study conducted in the British has proved using telemedicine for CHD diagnosis is reliable and can be accepted by service users. (6)
- With the establishment of a screening program for CHD diagnosis in Northeast Brazil from 2012 to 2016, pediatric cardiologists can provide support via telemedicine. And the diagnosis rate has been increased. (2)
- Telemedicine is used more often to diagnose CHD after the explosion of COVID-19. (4)

Advantages

- Improve fetal screening rate. (2, 3)
- Save money for the people who live far from hospitals. (3)
- No need for serves users to be present.
- Reduce the chance of contracting infectious diseases. (4)
- Can use resources from other institutions. (5)

Disadvantages

- Not suitable for emergency. Telemedicine always means an environment with rich knowledge but poor resources. Thus, telemedicine cannot help much until getting to the hospital. (4)
- Cannot provide complete evaluations as video may not be able to give slight signs like pulse quality and change in a murmur. (4)
- Depends on physical resources. Data can only be shared through hospitals and institutions under the same network.

Future development

- In order to obtain more comprehensive and accurate vital signs, users should be allowed to use medical equipment at home. These medical devices can be other wearable medical devices. It can also be equipment kits (4) that the hospital has prepared in advance and can be mailed.
- Use blockchain and big data to establish a unified hospital network system and database. This can provide a more powerful diagnostic basis for telemedicine. In the future, AI may be used to directly diagnose and screen the fetal cardiogram.

Reference:

1. Donofrio MT, Moon-Grady AJ, Hornberger LK, Copel JA, Sklansky MS, Abuhamad A, et al. Diagnosis and treatment of fetal cardiac disease: A scientific statement from the American heart association. Circulation. 2014;129(21).
2. de Ara û jo JSS, Regis CT, Gomes RGS, Mourato FA, Mattos SdS. Impact of Telemedicine in the Screening for Congenital Heart Disease in a Center from Northeast Brazil. Journal of Tropical Pediatrics. 2016;62(6):471-6.
3. Mistry H, Gardiner HM. The Cost-Effectiveness of Prenatal Detection for Congenital Heart Disease Using Telemedicine Screening. Journal of Telemedicine and Telecare. 2013;19(4):190-6.
4. Chowdhury D, Hope KD, Arthur LC, Weinberger SM, Ronai C, Johnson JN, et al. Telehealth for Pediatric Cardiology Practitioners in the Time of COVID-19.(Report). Pediatric Cardiology. 2020;41(6):1081.
5. Satou MG, Rheuban RK, Alverson SD, Lewin JM, Mahnke LC, Marcin AJ, et al. Telemedicine in Pediatric Cardiology: A Scientific Statement From the American Heart Association. Circulation. 2017;135(11):e648-e78.
6. McCrossan BA, Sands AJ, Kileen T, Cardwell CR, Casey FA. Fetal diagnosis of congenital heart disease by telemedicine. Archives of Disease in Childhood - Fetal and Neonatal Edition. 2011;96(6):F394.

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6. Eichinger J. business & network icons - Buy this stock vector and explore similar vectors at Adobe Stock [Internet]. Adobe Stock. 2020 [cited 26 September 2020]. Available from: https://stock.adobe.com/au/images/business-network-icons/302458957

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