

The need for a new style of tele-fetal diagnosis with cloud storage in the post-COVID-19 era

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Main text

Congenital anomalies are one of the important causes of infant and childhood death, chronic disabilities. Since congenital anomalies are complicated with 3-5% of all births (Mai CT, et al. National population-based estimates for major birth defects, 2010-2014. *Birth Defects Res.* 2019;111(18):1420-35.), screening fetal echography for major anomaly should be routinely offered even for low-risk pregnant women in most of the high-income countries. However, the ongoing coronavirus disease (COVID-19) pandemic has jeopardized access to various types of maternal and neonatal care for fear of contracting COVID-19. As such, in the post-COVID-19 era, there is a growing trend of incorporating telemedicine in neonatology.

Historically, fetal tele-echography was first developed as a synchronous video visit with the spread of Internet technology since the 1990s. (Landwehr JB, et al. Telemedicine and fetal ultrasonography: assessment of technical performance and clinical feasibility. *Am J Obstet Gynecol.* 1997;177(4):846-8.) This has enabled doctors working in remote islands or rural areas to consult ultrasound specialists. (Soong B, et al. The fetal tele-ultrasound project in Queensland. *Aust Health Rev.* 2002;25(3):67-73.) The advantage of a synchronous video visit is that specialists can give a real-time guide for obstetrical sonographers through a complete evaluation. On the other hand, the disadvantage is that the capacity of specialists for consultation is limited because of the necessity for a secure and reliable tele-connection. (Bidmead E, et al. Service user and staff acceptance of fetal ultrasound telemedicine. *Digit Health.* 2020;6:2055207620925929.) Because of this disadvantage, it is difficult to apply it in low- or middle-income countries, where telemedicine is the most necessary since the equalization of perinatal medicine fall behind other countries. Therefore, increased needs in telemedicine would require a new style of tele-fetal diagnosis system instead of real-time synchronous connection regardless of the income level of countries.

One of the solutions to make tele-fetal diagnosis easily utilizable is to adopt the way of thinking in other fields of telemedicine, such as tele-radiology and tele-pathology. In these fields, images sent from other medical institutions at various time points can be accessed on demand by radiation and pathology specialists working remotely. In that respect, a way of storing movies from ultrasound on cloud and sharing them with other doctors or facilities could alleviate the above-mentioned problems.

In this context, we have constructed a novel system, called “LOOKREC”, with which doctors and mothers could see ultrasound data on cloud both in still image and video format. LOOKREC can store Digital Imaging and Communications in Medicine (DICOM) format images on Google cloud and is available to all the facilities using Picture Archiving and Communication Systems (PACS), one of the most common systems storing images worldwide. Thus, LOOKREC enables doctors to review ultrasound images and make diagnoses with various devices, such as PC, tablet, or smartphone, and regardless of time and place with affordable cost. Naturally, this would increase capacity and opportunities of tele-consultation in neonatology so that a safer pregnancy of a larger number of fetuses can be guaranteed globally. Actually, we have already utilized this system with patients who hope to share ultrasound images with their family since August 2020. Use of this system has steadily increased during the COVID-19 pandemic in Japan since family visits with

pregnant women in prenatal check-up have been limited. (Figure) Thus, to meet the increased demands of tele-fetal diagnosis during the post-COVID-19 pandemic era, establishing a new system for tele-fetal diagnosis with cloud storage like ours is warranted.

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YM has drafted the work, and other authors have revised the draft critically for important intellectual content. TN and TK have contributed to the acquisition of the data.

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