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A NOVEL ONLINE SYSTEM LINKING AT-HOME SMARTPHONE SEMEN TESTS WITH EMBRYOLOGISTS. Yoshimoto Kobori, MD, PhD, Akiyoshi Osaka, MD, Toshiyuki Iwahata, MD, PhD, Kei-ichiro Uemura, MD, PhD, Hiroshi Okada, MD, PhD. Dokkyo Medical University Saitama Medical Center, Koshigaya, Japan.

OBJECTIVE: Infertility is a serious disease requiring timely treatment. If treatment is delayed, the condition of patients may deteriorate over time. The coronavirus (COVID-19) pandemic has seriously affected couples in need of immediate infertility treatment. Because of stay-at-home guidance, fewer people are visiting medical facilities, and thus it may become necessary to provide online medical services, including infertility treatment. Male-factor infertility contributes to about 50% of the incidence of infertility in couples. Semen analysis is key to diagnosing reproductive potential in men. In current practice, men must visit a clinic or other medical facility for semen analysis. However, there are cases in which visiting a medical facility is problematic, as in the current pandemic. To address this issue, many devices for at-home testing of semen samples have been developed and commercialized. We have developed a service enabling infertility patients to receive medical advice by allowing them to easily share at-home smartphone semen test data with embryologists. To verify the effectiveness of this system, we evaluated the correlation between at-home smartphone semen test data analyzed by embryologists and semen test results measured by computer assisted semen analysis (CASA).

DESIGN: Laboratory investigation.

MATERIALS AND METHODS: We developed an online system that allows patients to record videos of semen using a smartphone microscope to be uploaded and shared with embryologists. After receiving training on the online system, the embryologists viewed the videos on a large computer screen and recorded motile and static sperm counts. Because the appearance of sperm captured in videos can differ depending on the type of smartphone, the embryologists measured sperm concentration and motility by estimating the size of the sperm head and tail. A total of 45 human semen samples were analyzed using both the developed system and CASA software. Each test was evaluated for compliance with World Health Organization semen testing criteria.

RESULTS: Sperm concentration measured using the online system showed a very strong correlation with CASA results (P < 0.01, r = 0.89). Sperm motility analyzed by embryologists using the online system were significantly correlated with CASA results (P < 0.01, r = 0.74).

CONCLUSIONS: Online medical care will likely become increasingly important during the COVID-19 pandemic. The system we developed is a useful service allowing infertility patients to share at-home semen test data with embryologists. Analysis of the test data by embryologists resulted in few mistakes compared with automatic machine analysis. The system enables patients to connect with doctors and receive medical treatment online. Services like this one could become more common in the future.

SUPPORT: none.

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MALE INFERTILITY DIAGNOSES AMONG PATIENTS WHO USED ASSISTED REPRODUCTIVE TECHNOLOGY IN THE UNITED STATES, 2016-2018.

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OBJECTIVE: To describe patient and treatment characteristics among assisted reproductive technology (ART) cycles with a male infertility diagnosis in the United States (US).

DESIGN: Cross-sectional analysis of the US National ART Surveillance System (NASS).

MATERIALS AND METHODS: We used data from NASS for reporting years 2016-2018 to describe patient and treatment characteristics of ART cycles with infertility patients with a male factor. Groups of male infertility include medical condition, genetic or chromosomal abnormality, abnormal sperm parameters (azoospermia, oligospermia, low motility or low morphology, other abnormal sperm parameters), other male factor (less common diagnoses), and more than one male factor.

RESULTS: Among 596,044 cycles started with the intent to transfer an embryo between 2016 and 2018, 30.9% (n = 184,060) reported a diagnosis of male factor infertility as a reason for using ART. Abnormal sperm parameters were the most commonly reported diagnoses for male infertility (58.7%), including low motility or low morphology (34.9%), oligospermia (11.5%), other abnormal sperm parameter (6.3%), and azospermia (5.9%). Other reasons for male factor infertility included other male factor (35.2%), medical condition (2.9%), genetic or chromosomal abnormality (0.5%), and more than one male factor (2.7%). In only 40% of the cycles with male factor infertility, male age was not reported. When reported, the age distribution for male among cycles using a commercial spin column kit. Pilot paired-end 76bp RNA-Seq using Illumina platform (NextSeq 500) was performed to 60M reads. Comparisons were made to a fertile donor and between the two specimens from the same individual according to abstinence time.

RESULTS: Twenty-three couples (paternal age, 36.7±6.6 years; maternal age, 35.8±5.5 years) underwent 2 ICSI cycles. The initial ICSI cycles (LongA) had an abstinence of 10.9±3.2 days, a concentration of 66.8±73 10⁶/ml, 27.0±15% motility, and an SFC of 23.2±17%. Fertilization and implantation rates were 71% (152/214) and 6.7% (4/60), respectively, and the clinical pregnancy rate was 17.39%. Epigenetic analysis of this group showed a total imbalance of 71 genes, with most underexpressed (74.6%). These included genes associated with fertilization (SMCP, ADAM21), calcium ion concentration (PLCZ1, TRPC1), motility (PKG2), and fetal organ development (ZNHI2, CA2).

The subsequent cycles (ShortA) had an abstinence period of 51.9±19 minutes. These specimens had a comparable concentration and motility (55.2±64 10⁶/ml, 31.2±15%), and a lower SFC (10.2±0.6%; P<0.05). There was improved fertilization (162/203; 79.8%; P<0.03), implantation (13/53; 24.5%; P<0.01), and clinical pregnancy rates (51.7%; P<0.05). There were 67 imbalanced genes for this group, with only 26 underexpressed; none of these are associated with fertilization, implantation, or embryo development.

When comparing the LongA and ShortA specimens for each individual, 16-68 genes were imbalanced. For the couples with successful clinical pregnancies, the ShortA had a high expression of genes associated with DNA repair (CHEK1), fertilization (CHEK1, SERPINAS5), and embryo development (ENDOG) compared to couples in the LongA group.

CONCLUSIONS: This analysis shows that specimens with shorter abstinence times yield spermatozoa with higher genomic integrity, leading to enhanced fertilization, implantation, and clinical pregnancy rates. Transcriptomic analysis confirms this finding and indicates that a specific gene imbalance is associated with a better ICSI outcome in couples where the semen sample used has a shorter abstinence time.