AI predicts male infertility risk with blood test, no semen needed
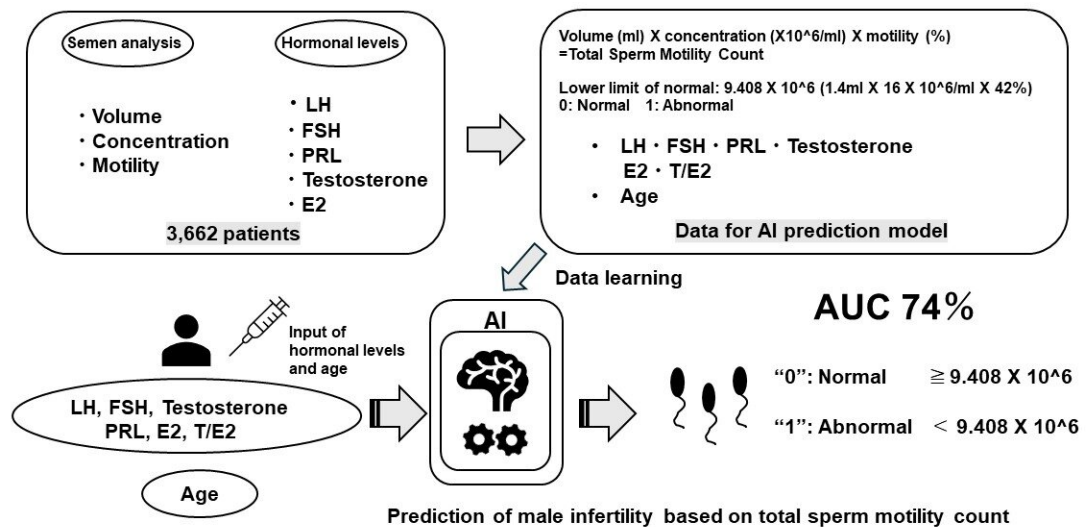
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New model for determining risk of male infertility from serum hormone levels. Credit: Dr. Kobayashi

According to a World Health Organization (WHO) study (2017), about half of all infertility is due to men. Semen analysis is considered essential for diagnosis of male infertility, but is not readily available at medical institutions other than those specializing in infertility treatment, and there is a high threshold for receiving it.

In a new study, a group led by Associate Professor Hideyuki Kobayashi of the Department of Urology, Toho University School of Medicine, Tokyo, Japan has developed an AI model that can predict the risk of male infertility without the need for semen analysis by only measuring hormone levels in a blood test. AI creation software that requires no programming was used for the model, and the study was reported in *Scientific Reports*.

The AI prediction model was based on data from 3,662 patients and had an accuracy rate of approximately 74%. In particular, it was 100% correct in predicting non-obstructive azoospermia, the most severe form of male infertility.

The current study collected clinical data from 3,662 men who underwent semen and hormone testing for male infertility between 2011 and 2020. Semen volume, sperm concentration, and sperm motility were measured in the semen tests, and LH, FSH, PRL, testosterone, and E2 were measured in the hormone tests. T/E2 was also added. Total motile sperm count (semen volume X sperm concentration X sperm motility rate) was calculated from the semen test results.

Based on the reference values for semen testing in the WHO laboratory manual for the examination and processing of human semen, 6th edition (2021), a total motile sperm count of 9.408×10^6 (1.4 mL X 16×10^6/mL X 42%) was defined as the lower limit of normal, assigning a value of "0" if the total motility sperm count for an individual patient was above 9.408×10^6 and a value of "1" when it was below. The accuracy of the AI model was approximately 74%.

Next, the AI model was validated using data from 2021 and 2022 for which both semen and hormone tests were available. Using the data of 188 patients in 2021, the accuracy was about 58%, while accuracy using the data for 166 patients in 2022 was about 68%. However, non-

obstructive azoospermia could be predicted with a 100% accuracy rate in both 2021 and 2022.

According to Associate Professor Kobayashi, "This AI prediction model is intended only as a primary screening step prior to semen testing, and while it is not a replacement for semen testing, it can be easily performed at facilities other than those specializing in infertility treatment.

"The AI prediction model used in this study was particularly accurate in predicting non-obstructive azoospermia, which is a severe form of azoospermia. When the prediction model detects abnormal values, since patients may possibly have non-obstructive azoospermia, this should be a trigger for them to undergo detailed testing at a specialist infertility clinic and receive appropriate treatment."

CreaTact, Inc. (Mito City, Ibaraki Prefecture, Japan; President: Iori Nakaniwa) is conducting software development and data analysis to develop a commercial original AI prediction model for the above purpose.

"In the future, we hope that clinical laboratories and health checkup centers will use our AI prediction model to screen for male infertility, thereby making testing for male infertility more accessible by overcoming hurdles to it," said Associate Professor Kobayashi.

More information: A New Model for Determining Risk of Male Infertility from Serum Hormone Levels, without Semen Analysis, *Scientific Reports* (2024).

Provided by Toho University