This study focuses on the gestational age characteristics and ultrasound detection efficacy of different groups of fetuses, but does not delve into the ethical issues associated with prenatal testing. Based on the International Federation of Obstetrics and Gynecology (FIGO) Ethical Guidelines for Prenatal Testing and Screening (2018), the following additional analysis of relevant ethical dimensions is provided:

1. The core principles of parental decision-making power and informed consent

According to the FIGO guidelines (clause 1.2), prenatal testing must be based on voluntary, voluntary, and fully informed consent. In clinical practice, parents need to be informed of the following key information before testing:

Testing purpose and limitations: such as the sensitivity of ultrasound screening (21 cases detected in mid pregnancy and 7 cases detected in late pregnancy in this study) and the uncertainty of genetic testing (8 cases did not find pathogenic mutations);

The complexity of interpreting results: Abnormal gestational age may indicate multiple causes (such as different pathological mechanisms corresponding to PAD, NAD, and other groups involved in this study), and over interpretation or misdiagnosis should be avoided;

Medical and social impacts of subsequent choices: including legal and ethical disputes over continuing pregnancy, intervention measures, or termination of pregnancy (such as legislative differences in gestational age and abortion rights in different countries/regions).

2. Protection of vulnerable groups and issues of fairness

The FIGO guidelines (clause 3.1) particularly emphasize ethical protection for resource scarce areas and families with low levels of education. Although there was no statistically significant difference in the distribution of gestational weeks among the groups in this study (ANOVA, *p* = 0.8497), the UN group had the longest median gestational week (28 weeks), which may reflect delays or obstacles in accessing prenatal diagnostic resources such as high-end ultrasound equipment and genetic testing technology in this group of families. Suggestions for future research focus on:

Accessibility of testing: whether some pregnant women are unable to receive testing in early pregnancy due to economic costs or uneven distribution of medical resources;

Cultural sensitivity: In certain regions, parents' right to choose prenatal testing or termination of pregnancy may be restricted due to religious or traditional beliefs, and cultural and ethical assessments need to be included in the research design.

3. Balance between medical ethics and clinical practice

Regarding the uncertainty of the association between gestational age and pathology involved in this study (such as the wide range of gestational age but low median in the AR group), it is necessary to follow the "Non maleficence" principle of the FIGO guidelines (clause 4.4):

To avoid premature termination of pregnancy based solely on ultrasound results, it is necessary to make a comprehensive judgment by combining genetic testing and clinical manifestations;

For cases without detected pathogenic mutations (such as the 8 cases in this study), continuous prenatal monitoring and psychological support should be provided, rather than directly ruling out pathological risks.

4. Ethical limitations and future directions of research

This study did not systematically collect qualitative data on parental decision-making processes and lacked empirical analysis of ethical conflicts. In the future, in conjunction with the FIGO guidelines (clause 5.2), we can explore through questionnaire surveys or in-depth interviews:

The psychological burden and decision-making driving factors of parents when facing “uncertain test results”;

How can medical teams use the “ethical decision-making framework” in the guidelines (such as risk benefit assessment, respect for autonomy) to assist communication.