Comparative Evaluation Between First and Second Trimester Aneuploidy Screening Tests with Amnio Synthesis Results

Parichehr Pooransari1, Mahboobeh shirazi1*

1. Assistant Professor, Shohada Hospital, Shahid Beheshti University of Medical Science (Shbmu), Tehran, Iran
2. Maternal Fetal and Neonatal Research Center, Tehran University of Medical Sciences, Yas Hospital, Tehran, Iran

ABSTRACT

Background & Objective: Screening tests for common aneuploidy, especially trisomies 21, 18, and 13, should be offered to pregnant people of all ages at first and second trimesters. These include combined tests (nuchal translucency (NT)+biochemical pregnancy-associated plasma protein-A (PAPP-A), free beta-human chorionic gonadotropin (β-hCG)) and quad test. If the tests are positive based on cut-off value of 1:250, diagnostic tests such as amniocentesis and chorionic villus sampling (CVS) are suggested. The current study aimed to comparatively evaluate the results of these screening tests and amniocentesis.

Materials & Methods: This practical-basic study was designed to evaluate the accuracy of first and second trimester screening tests with amniocentesis results. A total of 45 subjects were selected from the patients referred for abnormal screening tests to Shohadaya-ye-Tajrish hospital in Tehran, Iran, during 2014-2015. The results of tests (combined or quad) were positive based on cut-off value of 1:250. Data was collected through a questionnaire containing such information as age, gravidity, previous aneuploidy births, placenta location, blood group, amniotic fluid color, type of sampling needle, and mode of needle entrance.

Results: The mean age of patients was 33.16 years. There was significant p-value between positive results of amniocentesis and age of the patients. Out of 45 amniocentesis tests, four had abnormal results (two in the first trimester (2/17) and two in the second trimester (2/24). Also, three items were T21 and the forth was translocation between chromosome 11-22. We had one fetal loss due to amniocentesis procedure.

Conclusion: Diagnostic tests are suggested for better evaluation of abnormal results. These screening tests have false positive and negative results. We attempted to evaluate the real results with invasive tests. Further research is needed to investigate the accuracy of screening aneuploidy tests.

Keywords: Amniocentesis, Second trimester screening, First screening, Aneuploidy

Introduction

The birth of a neonate with chromosomal abnormalities (for example Down syndrome) can cause serious problems for the neonate, family, and society. Hence, it is necessary to perform prenatal screening tests to discover the most common chromosomal anomalies (1,2). Currently, aneuploidy screening is suggested for all pregnant women (1). In this regard, first and second trimester screening tests are relatively cheap and non-invasive methods (3). Invasive diagnostic tests such as amniocentesis and chorionic villus sampling (CVS) are expensive, and they have the risk of fetal loss. CVS is usually done between 11w-13w+6 days and amniocentesis between 15-20 weeks of gestational age (1).

Jeans Gekas et al. (2014) showed that first and second trimester screening tests and amniocentesis are some cost-effective methods, and the best options to confirm neonatal abnormalities (4). In a meta-analysis, Ojilvie, j BETA, R. AKOLEKAR (2015) evaluated 110 articles with 42,716 cases under amniocentesis and reported that there were 324 (0.81%) fetal losses (5). In a retrospective descriptive study, Kovoosi et al. (2015) showed that the incidence of aneuploidy was one in 491 births in Tehran, Iran and its prevalence increased with increasing maternal age (6). Moreover, Tara et al. (2016) reported that the rate of miscarriage following amniocentesis was 1% in Mashhad, Iran. They also concluded that there was no correlation
between the causes of amniocentesis and mother’s blood group, maternal underlying diseases, and miscarriage following amniocentesis (7).

Materials and Methods

This prospective cohort study was performed on IVF cases. This study compared the results of first and second trimester laboratory tests (FT1 and ST2) and amniocentesis results in 45 pregnant women (mean gestational age=16 weeks and 3 days) with positive FT1 or ST2 referred to Shohadaya-ye-Tajrish Hospital in Tehran, Iran during 2014 -2015. Using a questionnaire, the following information was collected: age, abnormal screening results, gravidity, previous aneuploidy baby, placental location, maternal blood group, color of amniotic fluid (AF), type of needle, and method of needle entrance. Patient satisfaction was obtained by an informed consent letter or phone calls. The results of amniocentesis and outcome of pregnancies were followed up by phone. The data was analyzed by IBM SPSS Statistics for Windows, version 19.0 (IBM Corp., Armonk, N.Y., USA).

Results

The average age of participants was 33.16 (standard deviation=5.4; minimum and maximum age=22 and 44 years). Among the participants, 17 and 24 subjects had positive results for FT1 and ST2, respectively; furthermore, the results of both tests in four subjects were positive. Also, 44.4% of participants were older than 35 years and one patient had a previous history of Down syndrome birth. The average gestational age when performing amniocentesis was 16 weeks and 3 days. In the study group, one patient was high-risk for T18, four samples were abnormal, three had a history of Down syndrome birth, and one item was translocation 11-22 chromosome. We had one fetal loss due to amniocentesis. There was no correlation between the outcome of diagnostic tests and gravidity, previous history of Down syndrome birth, blood group, and color of AF. In correlation with placenta location and fetal loss there is no study. In our study, out of two abortions, one case was posterior placenta and the other one was posterolateral. The mean age for abnormal amniocentesis results was 33.75 years (standard deviation=5.45 years). Therefore, there was a significant correlation between abnormal results of amniocentesis and older age ($P<0.05$). The study was approved by the Research Ethics Committee of Shahid Beheshti University of Medical Sciences, Iran (code: 336).

Discussion

Performing amniocentesis is necessary when screening results are positive. Niromanesh et al., nin a study about pregnancy outcome in amniocentesis and CVS; ten years report, between amniocentesis and outcome of pregnancy there is definite correlation (9). The sensitivity of amniocentesis for diagnosing chromosomal disorders was 100% (8,9). In addition, stress management of pregnant women with positive screening tests is very important to improve pregnancy outcome (10). Shirazi et al. (2015) compared the complications, indications, and results of screening methods with amniocentesis and CVS, and concluded that both methods are quite safe, logical, and cost-effective (11). Another study carried out in 2019 showed that these diagnostic tests do not increase the adverse pregnancy outcomes such as gestational diabetes mellitus and preeclampsia (12). Maternal stress because of positive aneuploidy Screening Serum Analytes may affect on color Doppler ultrasound and pregnancy outcome; so, diagnostic tests are obligatory (13). Specially in misdiagnosis in ultrasound evaluation and limitations of screening tests. It seems that diagnostic tests should be offered to all pregnant women with positive screening tests. The main limitation of this study is its small sample size. Since second trimester screening tests such as prenatal cell-free DNA screening tests are expensive, and even unavailable, in Iran, amniocentesis and CVS are the best options for positive screening tests. It is recommended that new studies be conducted on pregnancy outcome in positive screening tests that their diagnostic test are negative also pregnancy loss in these groups in a larger sample size.

Acknowledgments

The authors would like to thanks all participants.

Conflict of Interest

Authors declared no conflict of interests.

References

1. Cunningham, L. B, SPONG, Dash, Hoffman, Casey, Sheffield, Williams obstetric. 24th ed. Vol.1. 2018, 419-455
2. Godino L, Pompilii E, D'anna F, Morselli-Labate AM, Nardi E, Seri M, Rizzo N, Pila G, Turchetti D. Attitudes of women of advanced maternal age undergoing invasive prenatal diagnosis and the impact of genetic counselling. Eur J Hum Genet. 2016;24(3):331-7. [DOI:10.1038/ejhg.2015.116] [PMID] [PMCID]
Trimester Aneuploidy Screening Tests

3. Nicolaides KH. Nuchal translucency and other first-trimester sonographic markers of chromosomal abnormalities. Am J Obstet Gynecol. 2004;191(1):45-67. [DOI:10.1016/j.ajog.2004.03.001] [PMID]

4. Gekas J, Langlois S, Ravitsky V, Audibert F, van den Berg DG, Haidar H, Rousseau F. Identification of trisomy 18, trisomy 13, and Down syndrome from maternal plasma. APP Clin Genet. 2014;7:127. [DOI:10.2147/TACG.S35602] [PMID] [PMCID]

5. Akolekar R, Beta J, Picciarelli G, Ogilvie C, D’Antonio F. Procedure-related risk of miscarriage following amniocentesis and chorionic villus sampling: a systematic review and meta-analysis. Ultrasound Obstet Gynecol. 2015;45(1):16-26. [DOI:10.1002/uog.14636] [PMID]

6. Kavoosi ES, Younesi S, Farhud DD. Screening of fetal chromosome aneuploidies in the first and second trimester of 125,170 Iranian pregnant women. Iran J Public Health. 2015;44(6):791.

7. Tara F, Lotfalizadeh M, Moeindarbari S. The effect of diagnostic amniocentesis and its complications on early spontaneous abortion. Electro Physic. 2016;8(2):2787. [DOI:10.19082/2787] [PMID] [PMCID]

8. Shirazi M, Sarmadi S, Niromanesh S, Rahimi Sharbaf F, Sahebdeh B, Golshahi F, Asadi L, Rahmandazadeh M. Assessment of the Sensitivity and Specificity of Screening Tests Performed in the First and Second Trimester in the Pregnant Women. J Obstet Gynecol Cancer Res (JOGCR). 2019;4(1):12-5. [DOI:10.30699/jogcr.4.1.12]

9. Niromanesh S, Mousavi Darzikolaei N, Rahimi-ShaarbaF F, Shirazi M. Pregnancy outcome in amniocentesis and chorionic villous sampling: ten-year report. Tehran Uni Med J TUMS Pub. 2016;74(6):400-7.

10. Shirazi M, Azadi F, Shariat M, Niromanesh S, Shirazi M. Effectiveness of stress management training on stress reduction in pregnant women. Tehran University Medical Journal TUMS Publications. 2016;74(7):493-9.

11. Shirazi M, Mohseni M, Ghajarzadeh M. Complications, indications and results of two screening methods: amniocentesis and chorionic villus sampling. Aca J Surg. 2015;2(1-2):23-6.

12. Shirazi M, Rabiei M, Rahimi F, Niromanesh S, Golshahi F, Yazdi ME. Does chorionic villus sampling increase the risk of preeclampsia or gestational hypertension? Int J Prevent Med. 2019;10. [DOI:10.4103/ijpvm.IJPVM_83_16] [PMID] [PMCID]

13. Shirazi M, Poornsari P, Sharbaf FR, Niromanesh S, Sahebdeh B, Shariat M, Pahlavan Z, Shirazi M, Ahmadian M. Correlation of maternal stress because of positive aneuploidy screening serum analytes and uterine arteries’ doppler ultrasound index: a prospective cohort study. International journal of fertility & sterility. 2019;12(4):329.

14. Torkzaban M, Kalateh A, Rajabpour Nikoo N, Shirazi M. Analysis of Ultrasonographic Misdiagnosis of Cephalothoracopagus Janicops Conjoined Twins: A Case Report. J Obstet Gynecol Cancer Res. 2020;5(1):8. [DOI:10.30699/jogcr.5.1.27]

15. Odibo AO, Stamilio DM, Nelson DB, Sehdev HM, Maceson GA. A cost-effectiveness analysis of prenatal screening strategies for Down syndrome. Obstet Gynecol. 2005;106(3):562-8. [DOI:10.1097/01.AOG.0000174581.24338.6f] [PMID]

16. Merkatz IR, Nitowsky HM, MacN JN, Johnson WE. An association between low maternal serum α-fetoprotein and fetal chromosomal abnormalities. Am J Obstet Gynecol. 1984;148(7):886-94. [DOI:10.1016/0002-9378(84)90530-1]

17. Snijders RJ, Noble P, Sebire N, Souka A, Nicolaides KH. UK multicentre project on assessment of risk of trisomy 21 by maternal age and fetal nuchal-translucency thickness at 10-14 weeks of gestation. The Lancet. 1998;351(9125):343-6. [DOI:10.1016/S0140-6736(97)11280-6]

18. Crossley JA, Aitken DA, Cameron AD, McBride E, Connor JM. Combined ultrasound and biochemical screening for Down's syndrome in the first trimester: a Scottish multicentre study. Int J Gynecol Obstet. 2002;109(6):667-76. [DOI:10.1016/j.ijgo.2002.01.094] [PMID] [PMCID]

19. Lewis G, Drife J, Botting B, Carson C, Cooper G, Hall M, et al. Why mothers die 1997-1999. The fifth report of the confidential enquiries into maternal deaths in the United Kingdom. London: RCOG Press, 2001.

20. Drife J, Lewis G. Why mothers die, 1997-1999: The Fifth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. London: Royal College of Obstetricians and Gynaecologists. 2001.

21. Marteau TM, Kidd J, Cook R, Johnston M, Michie S, Shaw RW, Slack J. Screening for Down's syndrome. Br Med J. 1988;297(6661):1469-1469. [DOI:10.1136/bmj.297.6661.1469-b] [PMID] [PMCID]

22. Marteau TM. Screening, ethics and the law. Br Med J. 1992 Dec 5;305(6866):1433-1434. [DOI:10.1136/bmj.305.6866.1433-e] [PMID] [PMCID]

23. Spencer K. Antenatal screening for Down's syndrome. BMJ. 1992;305(6856):769-771. [DOI:10.1136/bmj.305.6856.769] [PMID] [PMCID]

24. Marteau TM, Johnston M, Shaw RW, Slack J. Factors influencing the uptake of screening for open neural-tube defects and amniocentesis to test for Down's syndrome. Br J Obstet Gynaecol. 1989;96(6):739-741. [DOI:10.1111/j.1475-0328.1989.tb03295.x] [PMID] [PMCID]

25. Sheldon TA, Simpson J. Appraisal of a new scheme for prenatal screening for Down's syndrome. BMJ. 1991;302(6785):1133-1136. [DOI:10.1136/bmj.302.6785.1133] [PMID] [PMCID]
