Non-invasive prenatal diagnosis. Analysis of free fetal DNA in maternal blood. Spreading and population response analysis.

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Introduction

In 1997, Lo et al. demonstrated that fetal DNA circulates within the plasma and serum of pregnant women. This discovery was a breakthrough in the field of prenatal diagnosis and nowadays, non-invasive prenatal diagnosis is a reality but raises ethical, social and legal implications.

Fetal DNA coexists with maternal DNA in the blood of pregnant women. Fetal DNA comes from apoptosis of trophoblasts due to the maternal immune system interaction. The test consists in 5-10 ml maternal blood sample extraction from which fetal DNA is isolated, to proceed with fetus genetic analysis and detect possible aneuploidy. Two results are possible: positive test or negative test; however, in any case, 100% reliability result can be obtained. In addition, test allows fetal sex detection and Rh factor. This test allows the establishment of security and prevention measures during all pregnancy period.

[1]

Fetal DNA isolation

[2]

Fetal DNA analysis

[3]

Obtaining results

[4]

Autosomal aneuploidy
- 21 Trisomy (Down Syndrome)
- 18 Trisomy (Edward Syndrome)
- 13 Trisomy (Patau Syndrome)

Sexual chromosome aneuploidy
- X Monosomy (Turner Syndrome)
- XXY (Klinefelter Syndrome)

THE TEST IS RECOMMENDED FOR:

- ✓ Pregnant women over 35 years old.
- ✓ Women who had a previous pregnancy with a child affected by an aneuploidy.
- ✓ Carrier parents of a chromosome abnormality.
- ✓ Fetal ultrasonographic findings indicating and increased risk of aneuploidy.

Non – invasive prenatal diagnosis vs. invasive prenatal diagnosis

Non-invasive prenatal diagnosis	
Fetal free DNA in maternal blood	
There isn't risk of miscarriage. There isn't risk to the mother or fetus.	
It can be done from tenth week of pregnancy.	
Maternal blood sample extraction.	
Variability reliable	
Results can be obtained in 10 days.	

Vs.

Invasive prenatal diagnosis	
Amniocentesis	**Chorionic villus sample**
0.5-1% risk of miscarriage.	1-2% risk of miscarriage.
It can be performed from 15 week of pregnancy.	It can be performed between tenth and fourteenth week of pregnancy
Obtaining of amniotic fluid by a tap in the abdomen.	Obtaining chordal tissue vaginally.
Reliable over 99%	Reliable of 99%
Results are obtained in 3 weeks.	Results are obtained in 48-72 hours.

Pre-test and post-test genetic counseling is essential to inform patients.

Objective

The aim of the project is the popularization of the non-invasive prenatal diagnosis by a leaflet to increase the level of knowledge about this technique, as well as, analyze the population knowledge and clinical application nowadays.

Materials & Methods

The spreading of the technique has been performed by a leaflet that contains principal characteristics about the approximation; the information was obtained from NCBI (National Center for Biotechnology Information) searching articles in PubMed database.

The leaflet has been distributed to 90 individuals. To analyze population knowledge, people have answered a short survey after they received the leaflet. Moreover, to analyze clinical application, I separated a subsample corresponding to pregnant women and recent mothers, who had to answer a few more questions about their pregnancy.

Results

[5]

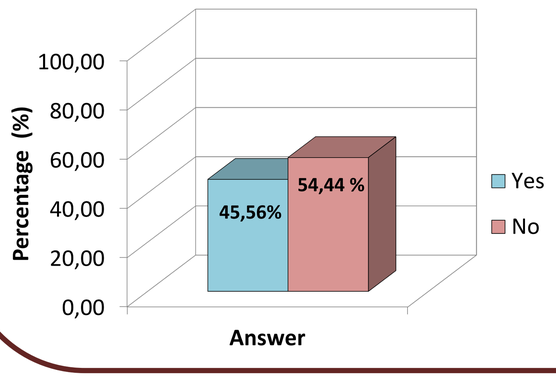
90 individuals

62 women

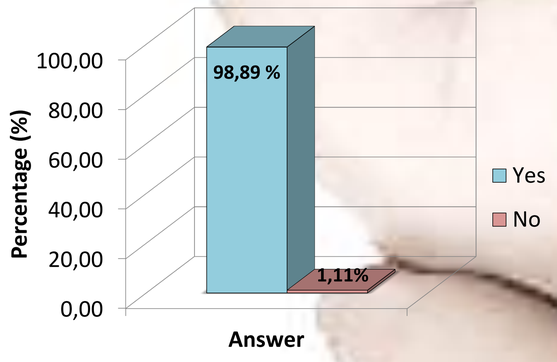
28 men

Average age: 37,46

Did you know this non invasive prenatal diagnosis technique before receiving the leaflet?



Has the leaflet allowed you to understand what the technique is and which are main features?



GENERAL POPULATION AND PREGNANT WOMEN AND RECENT MOTHERS

90 individuals

62 women

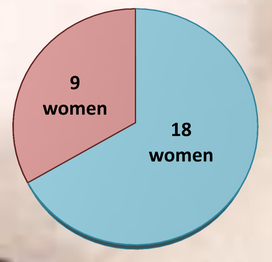
[6]

27 women

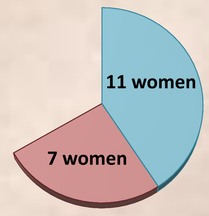
Average age of pregnancy: 32,59

Has this test been offered to you?

100% of women had been informed about prenatal diagnosis approaches.

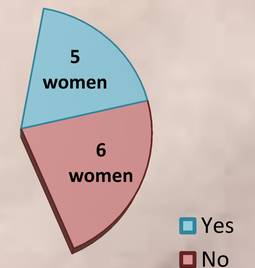


Have you executed this test to reject fetus alterations?



- ✓ To reject any fetal abnormality.
- ✓ To avoid invasive test and abortion risk associated.
- ✓ Presence of preliminary tests altered.
- ✓ Positive family history for some abnormality.

Have you been offered genetic counseling?



Discussion & Conclusions

- Free fetal DNA in maternal blood test is a safe approach, and is accurate and reliable, in the early detection of fetal autosomal and sexual chromosome aneuploidy.
- Analysis of free fetal DNA has advantages but it has got inconvenient too.
- There are a lot of ethical, legal and social implications that have to be taken into account.
- The leaflet has been a good method to approach non-invasive prenatal diagnosis to population. The level of knowledge about technique has been increased after people received the leaflet.
- Most people have understood the leaflet and have been satisfied with design.
- The test is offered to women to reject any fetal abnormalities and avoiding invasive tests, but not in all cases it's carried out.
- Less than half of women who performed the test receive genetic counseling. It should be provided in all cases.
- The sample size corresponding to pregnant women is small. The study can be realize again with a bigger size sample.

References

Lo YM, Corbetta N, Chamberlain PF et al. Presence of fetal DNA in maternal plasma and serum. Lancet 1997; 350:485-487

[1] Image taken from: http://www.ariosadx.com/expecting-parents/technology/ with modification.

[2][3] Image taken from: http://www.downstest.com/how-it-works/ with modification.

[4] Image taken from: http://www.swissdiagnosys.com/pruebas-geneticas-hpv-prueba-de-septin-9-y-hpv-en-madrid/prueba-genetica-sindrome-down-trisomia-21-18 with modification.

[5] Image taken from: http://www.clipartbest.com/man-woman with modification.

[6] Image taken from: http://www.freepik.es/iconos-gratis/mujer-embarazada_741191.htm