EVALUATION OF DIAGNOSTIC FETOSCOPY

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SUMMARY

The Authors evaluate the efficacy and safety of fetoscopy on a series of 510 patients in which the procedure was carried out between the 18th and 20th week of gestation in order to obtain a suitable fetal blood sample for prenatal genetic diagnosis; the whole pregnancy could be completely followed up in them. The complication rate was low (1.7%) when the first attempt of fetoscopy was successful, but rose dramatically up to 17.9% on repeated attempts: however, they only amounted to 7.8% of all cases. The results of their study lead the Authors to propose fetoscopy as a powerful, accurate and safe addition to the presently available diagnostic methods, provided it is performed by well trained fetoscopists, under aseptic conditions and local anaesthesia.

Fetoscopy, a term which describes the direct visualisation of the fetus in its intrauterine environment, has been a useful diagnostic tool of the perinatologist and geneticist. It allows one to sample fetal cells directly either by biopsy or by blood sampling and has been useful in the diagnosis and evaluation of several genetic disorders, many of which were incompletely evaluated with amniocentesis or ultrasound alone ([1, 2, 3, 4]).

Fetal blood has been obtained in the second trimester by blind needling ([5]) or fetoscopy ([6]) and the aim of both methods was to puncture a fetal chorionic plate vessel and to aspirate amniotic fluid containing the blood that escapes. The contamination of fetal blood samples by amniotic fluid and also maternal blood, presents particular problems in conditions in which the constituents of fetal plasma provide the antenatal diagnosis ([7]).

In order to determine the efficacy and the safety of this procedure, it is essential to evaluate a series of patients in whom fetoscopy was performed for prenatal genetic diagnosis.

MATERIAL AND METHODS

Since 1977, at " Alexandra " Maternity Hospital Athens' University, 682 fetoscopies have been performed on 653 patients for diagnostic purposes. The results we present, are referred on 510 patients whose pregnancy follow up was completed.

The diagnostic indications for fetal blood sampling and fetal examination are shown in table I and II respectively.

Fetal blood sampling has been obtained by fetoscopy by puncturing a fetal chorionic plate vessel and aspirating amniotic fluid containing the blood that escapes, or from a fetal vessel on the region of insertion of the umbilical cord into the placenta.

Fetoscopy was performed between the 18th and 20th week of gestation and a preliminary ultrasonographic examination was mandatory to (a) diagnose multiple gestation (b) localize the placenta (c) verify the gestational age (d) determine the fetal position and (e) select the insertion site.

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Table 1. — *Indications for fetal blood sampling.*

β^{th} / B^{th}	468
β^{th} / $\delta\beta^{th}$	14
β^{s} / B^{s}	5
β^{s} / β^{th}	12
$(\alpha\alpha)^{th}$ / $(\alpha\alpha)^{th}$	1
Total	500

Table 2. — *Indications for fetal examination.*

Cleft lip and palate	3
Ecrodactyly (Lobster claw hands)	1
Limb deformities	3
Neural-tube defects	1
Hypoplasia of the nose (familiar)	1
Seckel's syndrome	1
Total	10

In this study the 1.7 mm Needlescope was used and this was inserted into the uterine cavity under local anaesthesia and real time ultrasound guidance (Rodeck and Campbell, 1978).

The procedure has been previously described by us and other investigators ([8, 9]).

RESULTS

Table 3 shows the acquisition of fetal blood samples. The success rate for obtaining fetal blood sample on one attempt was 92.2%. Nine of the 30 patients were required to repeat fetoscopy because the hematological results were difficult to interpret.

In case that fetoscopy failed, a repeated fetoscopy or the technique of "blind" placentocentesis were performed on 500 patients in order to obtain a suitable fetal blood sample for prenatal diagnosis of hemoglobinopathies.

The relative efficiency of drawing fetal blood is shown in table 4. Pure fetal blood was obtained (82.9%) in 382 of the 461 patients in whom one attempt was made to sample the fetus.

Thirty nine patients however required more than one procedure. In 13 of these, pure fetal blood was obtained (33.3%). The procedure failed in 8 patients in whom no fetal blood was obtained.

The outcome of diagnostic fetoscopies is shown in table 5. Fifteen (3%) miscarriages up to 28 weeks' gestation occurred due to fetoscopy (table 6). The repetition of fetoscopy or the use of placentocentesis after a failed fetoscopy, increased the fetal complication rate from 1.7% to 17.9%.

Intrauterine fetal death was more frequent after a repeated fetoscopy or a repeated placentocentesis.

In table 7 are shown the fetal and neonatal complications not due to fetoscopy. The incidence of these complications in normal pregnancy has not yet been established.

Table 3. — *Acquisition of fetal blood sample.*

No. of attemps	Procedure used	Total (%)
On one attempt	FET [a]	461 (92.2)
On two attempts	MET+FET	20[c] (4)
	FET+PLC[b]	11 (2.2)
On three attempts	2 FET+PLC	3 (0.6)
	FET+2 PLC	3 (0.6)
On four attempts	FET+3 PLC	2 (0.4)
		500

[a] FET: Fetoscopy.

[b] PLC: Placentocentesis.

[c] Nine patients required repeated fetoscopies because the results were difficult to interpret.

Table 4. — *Relative Efficiency of drawing Fetal Blood.*

Our study	On more than one attempt
100% Fetal RBCs 382/461	13/39
90-99% Fetal RBCs 48/461	—
5-90% Fetal RBCs 30/461	19/39
0% Fetal RBCs 7/461	7/39

Table 5. — *Outcome of diagnostic fetoscopies.*

	On one attempt			Fetoscopy group study 1980	
	Last 100 patients	Total	Fetal examin.	Fetal blood	Fetal examination
Patients studied	100	500	10	485	178
Number of therapeutic abortions	35	123	1	120	52
Number of pregnancies continued	65	387	9	365	126
Miscarriages up to 8 weeks *due to* fetoscopy	2	15 (3 %)	—	—	—
Miscarriages up to 28 weeks *not due* to fetoscopy	1	13 (3.3%)	—	—	—
Total miscarriages	3	28 (5.4%)	—	16 (3.3%)	13 (7.3%)
Stillbirths and neonatal deaths up to 7 days *not due* to fetoscopy	1	6 (1.5%)	—	11 (3 %)	18 (14.3%)
Total fetal loss	4	34 (6.8%)	—	27 (5.6%)	31 (17.4%)
Premature delivery	2 (3%)	16 (4 %)	1	—	—
Term delivery	58	339	8	—	—

DISCUSSION

The results of our study suggest that fetoscopy for fetal blood sampling and fetal examination is a valuable technique for prenatal diagnosis.

Fetal loss within 15 days of the procedure is presented to approximate the rest of fetal wastage in the immediate post procedure period. Although the majority of therapeutic abortions occurred after two weeks a few were performed within that period. The data in table 5 reflect the total experience of the fetoscopy group member as presented in the First Annual Meeting (Edinburgh, July 1980).

Table 6. — *Fetal complications up to 28 weeks due to fetoscopy.*

	On one attempt (%)	On repeated attempts (%)
Intrauterine infection	2	–
Premature rupture of membranes	2	1
Intrauterine fetal death	1	5
Miscarriage within 15 days	3	1
Total	8/461 (1.7%)	7/39 (17.9%)

In almost all cases the genetic indication for prenatal testing carried a fetal disease risk of 25%.

The miscarriages rate up to 28 weeks' gestation due to fetoscopy for blood sam-

Table 7. — *Fetal neonatal complications considered not due to fetoscopy.*

Stillbirth and neonatal deaths up to 7 days		7
1-4	Premature delivery 28-29 weeks of gestation	
5	I.U.F.D. 37th week. True umbilical cord knot	
6	I.U.F.D. 30th week. Erythroblastosis	
7	I.U.F.D. 33rd week. Meconium stained amniotic fluid already present the day of fetoscopy	
Premature rupture of the membranes		7
8	36 weeks later following tiring trip	
9	Two days later but mother Wasserman (++++)	
10-11	Fetoscopy done on threatened abortion +	
12-14	One month later. No apparent cause	
Premature delivery between 24 and 27 weeks of gestation		5
15-18	35-50 days later. No apparent cause	
19	60 days later. Hydramnion megacolon	
Total		19

The incidence of these complications in normal pregnancy has not yet been established.

pling was about 3% while the total miscarriage rate 5.4%. This incidence, with the experience gained, has been decreased and obstetrical complications definitely related to the procedure in the last 100 cases were approximately 2% while the total complication rate 4%.

Prematurity rate, after fetoscopy, was 4%. In cases where placentocentesis followed a failed fetoscopy, both the loss rate and prematurity rate rose dramatically.

The most serious maternal complication was intrauterine infection which occurred in 2 of the 510 women studied (0.3%).

In conclusion, fetoscopy is no longer in the research phase, but is clinically applicable. It is a powerful, accurate and safe addition to the presently available methods for prenatal diagnosis.

Fetoscopy should be performed in academic research centres, in conjunction with genetic counseling and ultrasound experts, in an operating room, under aseptic conditions, under local anaesthesia.

Training of fetoscopists is best accomplished in centres where experience can be attained with at least 25 midtrimester termination cases, before use in continuing pregnancies. Prior experience in ultrasonography and amniocentesis is an advantage in acquiring fetoscopic skill.

The application of fetoscopy has been limited thus far, but it is expected that future research efforts will lead to improvements in technology and expand the number of indications for its use. In addition fetoscopy appears to be an appropriate instrument for research into fetal physiology, pharmacology and surgery.

BIBLIOGRAPHY

1) Hobins C., Mahoney M.: *Fetoscopy in continuing pregnancies.* Am. J. Obst. Gyn., *129*, 440, 1977.
2) Rodeck C. H., Campbell: *Early prenatal diagnosis of neural tube defects by ultrasound guided fetoscopy. Lancet, 1*, 1128, 1978.
3) Benzie: *Fetoscopy.* In: *Embryology and Pathogenesis and Prenatal Diagnosis.* Eds. D. Bergoma and R. B. Lowry. *Birth Defects*: Original Article, Series *13*, 181, 1977.
4) Mahoney M., Hobbins C.: *Prenatal diagnosis of chondroectodermal dysplasia (Ellis van Creveld Syndrome) with fetoscopy and ultrasound.* N. Engl. J. Med., *297*, 258, 1977.
5) Kan Y. W., Valuti C., Cararra V., Guidotti R., Rieder: *Fetal blood sampling in utero.* Lancet, *1*, 79, 1974.
6) Hobbins C., Mahoney M.: *In utero diagnosis of hemoglobinopathies technique for obtaining fetal blood.* N. Engl., J. Med., *290*, 1065, 1974.
7) Rodeck C. H., Mibashan R. S., Peake I. R., Bloom A. L.: *Prenatal diagnosis of severe von Willebrand's disease.* Lancet, 2, 637, 1979.