Biometry and pathological ultrasound findings in multiple pregnancies

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Resumo

Objectives: to determine the prevalence of pathological findings according to the type of chorionicity in pregnancies in two institutions in Bogotá, Colombia.

Methods: descriptive, retrospective, cohort study. Biometric variables were calculated, and pathological findings were evaluated according to the type of chorionicity in multiple pregnancies. Statistical characterization was performed with absolute frequencies, calculation of relative frequencies in qualitative variables, standard deviation measures, median and interquartile range. In addition, a descriptive analysis of the information was carried out.

Results: 528 studies were carried out in 141 pregnant women, 98.5% (n = 139) twins and 1.4% (n = 2) triplets. A prevalence of 35.4% of fetal complications was calculated. The most frequent was fetal growth restriction (p=0.37). According to each type of chorionicity, fetal growth restriction was presented in 50% (1/2) of the trichorionics, 16.6% (7/42) of the monochorionics, and 11.3% (11/97) of the dichorionics.

Conclusion: fetal growth restriction was the most common finding, both in trichorionics, monochorionics and dichorionics pregnancies.

Key words *Twin pregnancy, Multiple pregnancies, Twins, Biometry, Ultrasonography, Twin diseases*

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Introduction

Twin pregnancy is about 3% of live births and 97% of multiple births.[1,2] It is a high-risk condition for pregnant patients, given the comorbidities and complications inherent and exclusive to this type of pregnancy.[1,3]

Multiple pregnancies are classified according to the chorionicity (e.g., monochorionic; dichorionic, trichorionic). Also, according to the amnionicity in monoamniotics, diamniotics, triamniotics. Or regarding zygosity (development from one or two zygotes) in monozygotic and dizygotic.[4,5]

Regarding morbidity and mortality in multiple pregnancies, 10% morbidity and twice the perinatal mortality have been described, being higher in pregnancies classified as monozygotic compared with dizygotic.[3,6,7] Admission to the neonatal intensive care unit due to prematurity is the most frequent condition in multiple pregnancies.[6] Other adverse outcomes are fetal growth restriction, congenital anomalies, aneuploidies, perinatal death, premature preterm rupture of ovular membranes, anemia, gestational diabetes, preeclampsia, postpartum hemorrhage, and thromboembolic events, among others.[8,9] Monochorionic twin pregnancies with single complications are rare. Including, twin-to-twin transfusion syndrome, the polycythemia anemia sequence, the twin reverse arterial perfusion sequence and the selective fetal growth restriction.[10,11] Therefore, the ultrasound identification of chorionicity and amnionicity, ideally performed in the first trimester, constitutes the cornerstone in the management of multiple gestations.[12,13]

In Colombia, research to determine biometrics and/or perinatal outcomes in twin pregnancies is scarce.[14,15] The lack of knowledge regarding this population of pregnant women could be an obstacle to determine the outcomes according to the sociodemographic, ultrasound, maternal perinatal morbidity, and mortality characteristics. Therefore, the main objective of the study was to determine the prevalence of pathological fetal ultrasound findings according to the type of chorionicity, also to describe the ultrasound characteristics of multiple pregnancies in two institutions in the city of Bogotá, Colombia.

Methods

Descriptive, retrospective, cohort study. The data were extracted in two institutions in the city of Bogotá, from the statistics of the ultrasound service of each center between January 2014 and December 2018. All pregnant women with multiple pregnancies were included without distinction of chorionicity or zygosity.

Ultrasonography in pregnant women was performed by six gynecologists trained in ultrasound and/or specialists in maternal-fetal medicine using the International Society of Ultrasonography recommendations.[16]

Demographic variables were included such as maternal age, fetal ultrasound observations such as chorionicity, gestational age, and fetal growth percentile, and biometric parameters such as crown rump length, biparietal diameter, head circumference, abdominal circumference, femoral length, and estimated fetal weight (EFW). Also, pathological findings in the ultrasound report were described, such as abortion, intrauterine fetal demise, congenital malformations, small for gestational age (if both twins have an EFW $<10^{th}$ centile),[16] twin-to-twin transfusion syndrome (diagnosed by polyhydramnios/oligohydramnios sequence: amniotic fluid pocket >8-10 cm in the amniotic sac of the recipient fetus and amniotic fluid pocket <2 cm in the amniotic sac of the donor fetus), anemia sequence polycythemia (maximum middle cerebral artery velocity >1.5 MoM in the donor fetus and maximum middle cerebral artery velocity <1 MoM in the recipient), twin reverse arterial perfusion sequence (in a monochorionic multiple gestation, a fetus with no cardiac activity or a rudimentary pump structure and Doppler demonstrating retrograde arterial flow to acardiac fetus), selective fetal growth restriction (a fetus with a monochorial gestation presents an estimated fetal weight $<10^{th}$ percentile, associated with weight discordance ≥25%) and fetal weight discordance (estimated fetal weight difference ≥25% based on the weight of the older twin, greater weight-lesser weight x 100/major weight).[16]

The universe of the population was considered according to the inclusion criteria. The sampling was non-probabilistic. The information was collected by reviewing ultrasound records in an Excel database. The information was analyzed, performing a statistical description of absolute frequencies, calculation of relative frequencies for the qualitative variables, and measures of mean and standard deviation or median and interquartile range.

The prevalence of complications was obtained by the total complicated multiple pregnancies/total pregnant women with multiple pregnancies by the years of the ultrasound. The analysis was performed using SPSS software. A chi-square test was used.

This research was considered a risk-free study. Any type of intervention to the patient was performed. The study was bases on information based on secondary sources, which are the ultrasound reports of each patient. Ethical principles for human research from the Helsinki Declaration and the Colombian resolution 8430 of 1993 were considered in this study, and it was classified as an investigation with minimum risk.[17] The project was approved the ethics committee in both institutions. Ethical endorsement of the research was emitted by one of the institutions (ad hoc ethics committee of the other institution).

Results

The study included 528 ultrasound reports of 141 pregnant women, 139 twins and 2 triple pregnancies. The average number of ultrasound evaluations in each pregnancy was 2.6 (SD= 1.5) with a range from 1 to 6 ultrasound evaluations for each patient. The mean maternal age was 25.2 (SD= 6.0) (range 14 to 41). The average gestational age at which the ultrasound was performed was 25.0 weeks (SD= 7.1) (5.6 to 37.0 weeks).

In the first trimester 8.1% (n=43) ultrasound studies were performed; in the second and third trimesters of pregnancy 46.2% (n=244) and 45.6% (n=241) ultrasounds were performed, respectively.

Pregnancies were classified according to their type of chorionicity and amnionicity, 68.7% (n=97) dichorionic diamniotic were found, monochorionic diamniotic in 27.6% (n=39) cases, and 2.1% (n=3) were monochorionic monoamniotic. The trichorials were 1.4% (n=2) (Table 1). Regarding the percentiles of the variables fetal biometrics and gestational age, the results are presented in Tables 2 to 4. Regarding the growth percentile according to estimated fetal weight, the average was 33.7% (SD=28.3) with a range of 0 to 97%.

The prevalence of fetal pathologies was 35.4%, fetal growth restriction in 13.4% (n=19) multiple pregnancies being the most frequent. At least one of the fetuses was affected by this condition. It was observed that 8.2% (n=8) and 7.1% (n=3) met the criteria for a small for gestational age in dichorionic and monochorionic gestations, respectively.

In the analysis of the complications and relating them to chorionicity, it was evidenced that in cases of dichorionic twin gestations, fetal growth restriction occurred in 11.3% (11/97) pregnancies and at least one of the fetuses, in monochorionic twins, 16.6% (7/42) met diagnostic criteria for selective fetal growth restriction. Regarding trichorionic pregnancies, 50% (1/2) of the pregnancies and at least one fetus presented fetal growth restriction (p= 0.37).

Eight (4.1%) cases of bichorionic pregnancies ended in abortion, which occurred between week 7 and week 19, and 4 cases (9.5%) in monochorionic pregnancies (p=0.33). In two of the twin pregnancies, abortion occurred in both fetuses, and the other cases had intrauterine death of a single fetus, there were no ultrasound studies after this finding.

There were 2 intrauterine deaths in one of the multiple pregnancy fetuses, one in a dichorionic pregnancy at week 23 and the other in a monochorionic pregnancy at week 33 of gestation (p=0.15) (without new ultrasound reports after death). In four fetuses, ultrasound findings of congenital malformations were identified. A discordant malformation was evidenced in a monochorial pregnancy, since in one fetus there was a suspicion of right renal agenesis and in the other fetus of unilateral renal pyelctasia. In another dichorionic pregnancy, findings consistent with Cantrell's pentalogy were identified in one of the fetuses, another dichorionic pregnancy, and one of the fetuses presented findings consistent with alobar holoprosencephaly (p=0.26).

Table 1

Multiple pregnancy classification according to chorionicity and amnionicity. Bogota-Colombia, January 2014-December 2018.

Chorionicity/Amnionicity	Cases (n)	%
Dichorionic- biamniotic	97	68.7
Monochorionic-biamniotic	39	27.6
Monochorionic-monoamniotic	3	2.1
Trichorionic	2	1.4
Total	141	100.0

Table 2

Gestational age and Crown Rump Length (CRL) in mm. Bogota-Colombia, January 2014-December 2018.

Gestational age (weeks)	Crown rump length (mm)					
	n	P5	P10	P50	P90	P95
7	5	10	10	12	72	72
8	3	13	13	16	19	19
9	2	19	19	19	19	19
10	2	33	33	33	33	33
11	7	31	31	39	43	43
12	10	49	49	54.5	63.5	65
13	8	61	61	66.5	71	71
14	8	74	74	80	82	82

Table 3

Gestational age and Head Circumference (HC), Abdominal Circumference (AC) and Femur Length (FL) in mm. Bogota-Colombia, January 2014-December 2018.

Gestational age (weeks)	Head circumference			Abdominal circumference			Femur length		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
14	72	90	97	71	77.5	86	12	12.5	13
15	106	112.5	145	78	86.5	92	15	16.5	26
16	110	118	130	97	103	114	18	20	23
17	122	132	146	106	113	127	21	23	25
18	135	144	151	112	122	134	20	26	27
19	17	158.5	169	128	136.5	147	19	28	30
20	163	175	183	142	149	157	29	32	34
21	171	181	191	146	155.5	171	31	34	37
22	185.5	198	209	161.5	169	185	34	37	40
23	197	204	222	173	185	206	36	40	43
24	209	220.5	232	181	191.5	202	40	42	44
25	225	233	242	192	206	214	44	46	47
26	231	242	254	199	219	228	44	47	50
27	244	251	263	196	221	238	46	49	54
28	242	263.5	278	221	230	253	50	52	55
29	258	272	280	221	244	255	49	55	58
30	267	278	286	242	254	263	51	56	60
31	266	288	297	242	269	282	53	58	62
32	275	291	301	250	279	291	56	61	64
33	278	300	312	263	289	302	58	63	65
34	303	312	318	282	298	306	62	65.5	68
35	289	309	325	269	289	323	59	66	69
36	316	325	340	300	317	342	64	67	71
37	302	312	322	274	297	320	68	68.5	69

Regarding the complications of monochorionic pregnancy, 11.9% (n=5) cases of twin-to-twin transfusion syndrome were found and 2.3% (n=1) met the criteria for weight discordance. There were no cases of polycythemia anemia sequence or twin reversed arterial perfusion sequence. Regarding chorionicity and the presentation of abnormal findings on ultrasound, no statistically significant differences were found, as evidenced in Table 5.

Discussion

Multiple pregnancies carry a high risk of adverse maternal and perinatal outcomes.[3,18-22] Ultrasound is an essential tool for determining the characteristics of two or more fetuses. Biometric variables can be considered conclusive factors for adverse perinatal outcomes, since they help determine the probability of complications in multiple pregnancies; for example, the risk of perinatal mortality in relation to the diagnosis of fetal growth restriction or weight discordance.[9,19]

In this context, fetal biometric variables as independent variables and collectively have prognostic value. In the meta-analysis by Leombroni *et al*.[23] 5826 women with twin pregnancies were evaluated for the ultrasonographic diagnostic precision of the discordance of fetal weights, concluding that this finding has a moderate, not optimal, diagnostic precision in these pregnancies, since the cut-off points were very diverse in the studies. Ideally, there should be specific cut-off points for each population to perform ultrasound measurements; made in an ideal setting, the measurement of fetal biometric parameters should be calculated for each population,[21,22] where the cut-off for diagnosing weight discordance was ≥25%, as reported in the literature.[18]

Furthermore, Araujo's[24] study in 2014, compared fetal biometric parameters in twins between 14 and 38 weeks of gestation, and these parameters were statistically different between monochorionic and dichorionic pregnancies. Our study calculated the same biometric parameters but, unlikely Araujo's[24] study, we determined the prevalence of

Table 4

Gestational age and estimated fetal weight in grams. Bogota-Colombia, January 2014-December 2008.

Gestational age (weeks)	Estimated fetal weight (grams)					
	n	P5	P10	P50	P90	P95
15	4	109	109	117	156	156
16	7	135	135	151	194	194
17	21	161	166	187	229	232
18	7	184	184	220	267	267
19	13	146	240	271	323	353
20	23	283	287	331	379	380
21	34	320	324	382.5	446	463
22	10	397	402	483.5	538	553
23	15	498	506	573	706	743
24	21	580	595	632	722	724
25	22	721	727	771	859	862
26	18	622	756	866.5	958	1052
27	19	850	866	1006	1136	1187
28	28	935	962	1157	1306	1312
29	34	720	982	1303.5	1405	1460
30	20	1221.5	1253.5	1454	1575.5	1628.5
31	35	1004	1470	1693	1845	1923
32	37	1407	1450	1890	2017	2034
33	29	1680	1681	2084	2262	2267
34	24	2085	2116	2308.5	2467	2505
35	10	1964	2012	2284	2773.5	2947
36	13	2190	2379	2710	3172	3300
37	2	2085	2085	2475.5	2866	2866

Table 5

Adverse outcomes in multiple pregnancies according to chorionicity. Bogota-Colombia, January 2014-December 2018.

Ultrasound findings	Chorionicity						*p*
	Dichorionic (N=97)		Monochorionic (N=42)		Trichorionic (N=2)		
	n	%	n	%	n	%	
Abortion	4	4.1	4	9.5	0	-	0.33
Discordance of fetal weight	0	-	1	2.3	0	-	-
SGA	8	8.2	3	7.1	0	-	0.35
Congenital malformations	2	2.0	2	4.2	0	-	0.26
Intrauterine fetal demise	1	1.0	1	2.3	0	-	0.15
FGR	11	11.3	7	16.6	1	50.0	0.37
TTTS	0	-	5	11.9	0	-	-
PAS	0	-	0	-	0	-	-
TRAP	0	-	0	-	0	-	-
Total	26	26.8	23	54.7	1	50.0	-

SGA= Small-for-gestational age; FGR=Fetal growth restriction; TTTS= Twin-to-twin transfusion syndrome; PAS= Polycythemia anemia sequence; TRAP= Twin reverse arterial perfusion sequence.

pathological findings according to the type of chorionicity in twins. Liao *et al*.[25] in 2016 evaluated 807 ultrasound reports of a total of 200 women with twin pregnancies, where the majority were dichorionic (82.4%). They also calculated ultrasound variables to determine fetal growth, like the analysis in our study, with 528 ultrasound reports of 141 multiple pregnancies where the majority were dichorionic pregnancies, and where the 5th, 10th, 50th and 95th percentiles of the biometric ultrasound variables were calculated as in Liao's study.[25]

Additionally, with respect to the studies carried out in Colombia, there is a descriptive one carried out at the Universidad del Valle where it is stated that performing an ultrasound diagnosis of twin pregnancy prior to week 32 of gestation significantly reduces perinatal mortality (OR= 3.58; CI95%= 1.61-7.92), due to timely prenatal care.[26] In the present study, the highest proportion of ultrasounds were performed in the second and third trimesters of pregnancy. However, the determination of chorionicity in all the reports was defined by early ultrasound characteristics, in the cases in which this evaluation was possible, taking into account that the determination of chorionicity is optimally established before the week 16, since after this week its sensitivity decreases.[1,4,13]

According to the classification of chorionicity and its association with adverse events, Cañas *et al*.[26] reported that the general intrauterine mortality in pregnancies with dichorionic placentas was 11.25% and in monochorionic ones, 8.6%, unlike the present study, where a lower intrauterine mortality rate was evidenced when related to chorionicity (especially in dichorionic), since it was found that the percentage of intrauterine death was 1.0% of all dichorionic pregnancies and 2.3% of the total of monochorionic pregnancies. Furthermore, our finding is also much lower than that reported in other studies such as that of Glinianaia *et al*.[20] where they found a fetal mortality of 31.8% studying exclusively monochorionic pregnancies. In 2015 Molina *et al*.[14] 438 pregnant women were evaluated in two highly complex institutions in Bogotá, different from those of the present study, where they showed a general fetal mortality of 7.7%, without classification according to chorionicity.

Concerning other Colombian studies, in 2017, Molina *et al*.[27] analyzed the perinatal results in monochorionic twin pregnancies, with fetal growth restriction and twin-to-twin transfusion syndrome being the most frequent complications. In our study, monochorionic pregnancies also had the most frequent complications, those mentioned in the work by Molina *et al*.[27]

A study of 382 multiple pregnancies, without differentiation according to chorionicity, found that weight discordance is the most frequent complication in this population.[26]In another study, in 2001, the most prevalent was fetal growth restriction, followed by a fetus that was small for gestational age.[28] We found that the most frequent fetal complication is fetal growth restriction, in the group of monochorionic, dichorionic and trichorionic pregnancies.[26-28] Furthermore, we found that morbidity was higher in dichorionic than in monochorionic pregnancies, in contrast to the study by Victoria *et al*.[29] where they found greater morbidity in monochorionic twins compared to dichorionic pregnancies.

The identification of ultrasound characteristics in multiple pregnancies, including the specific fetal growth profile of each population, is essential to recognize truly ill fetuses or those with a significant alteration in the growth curve, of fetuses in which these variations could be physiological.[19,22,24] On the other hand, the recognition of chorionicity is essential in the population of multiple pregnancies as a factor for the possible appearance of complications in both monochorionic and dichorionic.[22] Considering the limited sample size, difficulties in extrapolating the results and pathological fetuses of the studied population could be possible.

Given that multiple pregnancies present a high risk of adverse perinatal outcomes, the diagnosis of chorionicity, as well as other ultrasound characteristics, based on the fetal biometric parameters of each population, are essential to carry out a correct approach to diagnosis, follow-up, and management of multiple gestation, bearing in mind that it is the best way to anticipate the onset of complications and reduce perinatal morbidity and mortality rates. In the population studied, fetal growth restriction is the most common finding in multiple pregnancies in both trichorionic, monochorionic and dichorionic pregnancies.

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Author's contribution

All the authors contributed to the conception and structure of the article, the analysis and interpretation of data and critical revision, like:

Guzmán Yara YN: Protocol/project development, data management, data analysis, manuscript writing/editing; Montserrat UC: Protocol/project development, data collection and management, data analysis, manuscript writing/ editing; Beltrán SL: Protocol/project development, data collection; Bandera L: Protocol/project development; De la Hoz Valle J: Protocol/project development, data management, data analysis, manuscript writing/editing; Romero XC: Protocol/ project development, data collection and management, data analysis, manuscript writing/ editing.

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