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# Fetal death: obstetric, placental and fetal necroscopic factors

## *Óbito fetal: fatores obstétricos, placentários e necroscópicos fetais*

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### ABSTRACT

**Introduction:** Fetal death is defined as the death of the product of conception, regardless of gestational age. **Objectives:** The objective of this study was to investigate the maternal (obstetrical and placental) risk factors and the necropsy findings associated with fetal death, based on data obtained from the Verification of Death Service [Serviço de Verificação de Óbito (SVO)] in Florianópolis, Santa Catarina, Brazil. **Material and method:** This is an observational, cross-sectional study using secondary data. Were included the reports released between 2010 and 2015, with a diagnosis of fetal deaths at gestational age of 20 weeks or more. **Results:** During the period evaluated, 210 autopsies were performed. From these, 15.2% ( $n = 32$ ) presented umbilical cord abnormalities, 22.4% ( $n = 47$ ) placental abnormalities, 49.5% ( $n = 104$ ) maternal health problem related to pregnancy, and 10% ( $n = 21$ ) previous maternal disease. Among the fetal characteristics involved, it was observed that 6.7% ( $n = 14$ ) presented meconium aspiration and 5.2% ( $n = 11$ ) fetal malformations. In this study, 21.9% ( $n = 46$ ) did not have their *causa mortis* defined. **Discussion:** The findings of this study show a statistically significant association ( $p < 0.05$ ) between meconium aspiration and full term pregnancy, hospital origin and normal birth weight. Such information is in agreement with the literature, which shows signs of intrauterine hypoxia, such as the presence of meconium, which are more prevalent in full term pregnancy. **Conclusion:** Among the causes of fetal death, ascending infection was the most prevalent; the maternal death related to pregnancy were the ones that stood out the most.

**Key words:** stillbirth; fetal death; pregnancy complications; placental diseases; fetal distress; autopsy.

### RESUMO

**Introdução:** Óbito fetal se define como morte do produto da concepção independente do tempo da gestação. **Objetivos:** O objetivo deste estudo foi investigar os fatores de risco maternos (obstétricos e placentários) e os achados de necropsia associados ao óbito fetal a partir de dados obtidos no Serviço de Verificação de Óbito (SVO) de Florianópolis, Santa Catarina, Brasil. **Material e método:** Trata-se de um estudo observacional, com delineamento transversal, que utilizou dados secundários. Foram incluídos laudos com diagnóstico de óbito fetal e idade gestacional de 20 semanas ou mais, realizados entre 2010 e 2015. **Resultados:** No período avaliado, foram realizadas 210 autópsias. Destas, 15,2% ( $n = 32$ ) apresentaram alterações de cordão; 22,4% ( $n = 47$ ), de placenta; 49,5% ( $n = 104$ ), doenças maternas relacionadas com a gestação; e 10% ( $n = 21$ ), doenças maternas prévias. Entre as características fetais implicadas, observou-se que 6,7% ( $n = 14$ ) apresentaram aspiração meconial e 5,2% ( $n = 11$ ), malformações fetais. Neste estudo, 21,9% ( $n = 46$ ) não tiveram sua *causa mortis* definida. **Discussão:** Os achados desta pesquisa mostram associação estatisticamente significativa ( $p < 0,05$ ) entre aspiração meconial e gestação a termo, procedência hospitalar e peso adequado ao nascer. Tais informações estão em concordância com a literatura, que traz sinais de hipóxia intraútero, como a presença de mecônio, mais prevalentes em gestação a termo. **Conclusão:** Entre as causas de óbito fetal, a infecção ascendente foi a mais prevalente; as causas de morte materna relacionadas com a gestação foram as que mais se destacaram.

**Unitermos:** natimorto; morte fetal; complicações na gravidez; doenças placentárias; sofrimento fetal; autópsia.

## RESUMEN

**Introducción:** Muerte fetal se define como muerte del producto de la concepción independientemente de la duración del embarazo. **Objetivos:** El objetivo de este trabajo fue investigar los factores de riesgo maternos (obstétricos y placentarios) y los hallazgos de la autopsia asociados a muerte fetal con base en los datos obtenidos en el Servicio de Verificación de Muerte [Serviço de Verificação de óbitos (SVO)] de Florianópolis, Santa Catarina, Brasil. **Material y método:** Este es un estudio observacional, de diseño transversal, que utilizó datos secundarios. Se incluyeron informes de autopsia de fetos con edad gestacional de 20 semanas o más, practicadas entre 2010 y 2015. **Resultados:** En el período evaluado se realizaron 210 autopsias. Entre estas, 15,2% (n = 32) presentaron alteraciones de cordón umbilical; 22,4% (n = 47), de placenta; 49,5% (n = 104), enfermedades maternas relacionadas con el embarazo; y 10% (n = 21), enfermedades maternas previas. Entre las características fetales implicadas, se encontró que 6,7% (n = 14) presentaron aspiración meconial y 5,2% (n = 11), malformaciones fetales. En este estudio, 21,9% (n = 46) no tuvieron sus causas de muerte determinadas. **Discusión:** Los hallazgos de esta investigación muestran una relación estadísticamente significativa ( $p < 0,05$ ) entre aspiración meconial y gestación a término, procedencia hospitalaria y peso adecuado al nacimiento. Estas informaciones están de acuerdo con la literatura, que trae señales de hipoxia intrauterina, como la presencia de meconio, más frecuentes en los embarazos a término. **Conclusión:** Entre las causas de muerte fetal, infección ascendente fue la más común; las causas de muerte materna relacionadas con el embarazo fueron las que más se destacaron.

**Palabras clave:** mortinato; muerte fetal; complicaciones en el embarazo; enfermedades placentarias; sufrimiento fetal; autopsia.

## INTRODUCTION

According to the Brazilian Ministry of Health, fetal death means “death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy”<sup>(1)</sup>. This definition therefore includes the definition of abortion, which is the product of conception prior to the 20<sup>th</sup> week of gestation – or up to 500 g – when gestational age is uncertain. However, the fetus will receive a death certificate and will be part of the calculation of the stillbirth coefficient only when the death occurs after 20 weeks’ gestation<sup>(2)</sup>.

It is estimated that about 2.6 million fetal deaths occur each year, of which 98% are in low- and middle-income countries. It is expected that most fetal deaths are caused by preventable causes<sup>(3)</sup>. Among the causes of fetal death, maternal etiologies, both previous (such as obesity, drug use) and related to pregnancy [such as specific pregnancy-induced hypertension (PIH), gestational diabetes *mellitus*], placental complications, including umbilical cord disorders (such as retroplacental hematoma, cord stenosis), fetal malformations and trauma at birth<sup>(4-8)</sup>.

There are few studies that investigate the underlying cause of fetal death, and in those found, the percentage of ill-defined causes is high<sup>(9)</sup>. For appropriate counseling and prevention of future episodes, an accurate assessment of the cause of fetal death based on necropsy findings and clinical data is required<sup>(8)</sup>, which justifies research in this area.

## OBJECTIVES

The objective of this study was to investigate the maternal risk factors and the necropsy findings associated with fetal death from data obtained at the Verification of Death Service [Serviço de Verificação de Óbito (SVO)] in Florianópolis, Santa Catarina, Brazil, between 2010 and 2015. Based on in these data, it was intended: a) to present the maternal sociodemographic and clinical characteristics; b) to analyze the fetal clinical characteristics; and c) to verify the causes of death pointed out from autopsy and anatomical pathology reports.

## MATERIAL AND METHOD

It is an observational, cross-sectional study using secondary data. The documents used were autopsy reports obtained at the SVO in Florianópolis, issued by the State Department of Health of Santa Catarina, Brazil, between January 1, 2010 and December 31, 2015. These included the reports of the period with diagnosis of fetal death which were at 20 weeks of gestational age or older, and those with incomplete information were excluded.

In the service concerned, the protocol of fetal referral is performed by the health services, with authorization from the family, in order to elucidate the cause of fetal death, as well as to investigate the presence of malformations. When crime is

suspected, the body is referred to the Institute of Forensic Medical. In the Florianópolis SVO, fetuses are classified according to the Brazilian Ministry of Health criteria for autopsy performance (gestational age after 20 weeks or weight above 500 g), and those that do not meet the criteria are considered as a surgical specimen. In the autopsy, gross and microscopical examinations of the fetal organs are performed; placenta is also examined when it is referred. The death certificate presents the fetal and maternal sociodemographic data and the fetal death diagnoses (final and provisional).

Upon receiving stillbirth, ectoscopic analysis and some tests may be performed to diagnose whether or not the death was intrauterine. The most popular test in the expertise services is the Galen hydrostatic test of the lungs or docimasia (lung float test). This safe method is based on lung density compared to that of water. If it floats, it means that the lung has a lower density, which indicates that the newborn had breathed. Otherwise, it is possible to infer that there was intrauterine death. Ideally, this test should be performed within 24 hours after birth, and some confounding factors, such as attempted resuscitation, should be reported to the pathologist so that he can improve the critical eye to look at the test<sup>(10)</sup>.

In this study, maternal age was categorized from the ideal reproductive age group – adult women aged 20 to 34 years – and their extremes: adolescents (10 to 19 years of age) and women at advanced age ( $\geq 35$  years)<sup>(11)</sup>. Gestational age was grouped as follows: early preterm ( $\geq 20$  and  $< 34$  weeks); late preterm ( $\geq 34$  and  $< 37$  weeks); full term ( $\geq 37$  and  $< 42$  weeks); and postterm ( $\geq 42$  weeks)<sup>(12)</sup>. The fetal weight was stratified as: extremely low birth weight ( $< 1000$  g); very low birth weight ( $\geq 1000$  and  $< 1500$  g); low birth weight ( $\geq 1500$  and  $< 2500$  g); normal weight ( $\geq 2500$  g and  $< 4000$  g); and fetal macrosomia ( $\geq 4000$  g)<sup>(13)</sup>. The placental index was determined by calculating the quotient of the placenta weight in grams in air by the newborn weight in grams<sup>(14)</sup>.

In relation to the classification of cause of death, some disagreements with the literature were found: oligohydramnios, polyhydramnios, placental infection of hematogenous origin and ascending infection (related to chorioamnionitis). In this study, such causes were grouped into maternal etiologies related to pregnancy. Nuchal cord was also considered as a cause of intrauterine death.

Data analysis was performed on the SPSS software v.21 (IBM SPSS Statistics for Windows, Armonk, NY, USA). In the data description, we used measures of central tendency and dispersion for the quantitative variables and percentage for the qualitative variables. The existence of association between the presence of

the outcomes of interest (fetal death and obstetric, placental, fetal characteristics) was evaluated by the chi-square test. For the comparison of the mean values of the quantitative variables, Student's *t*-test for independent samples (unpaired) was used. The level of significance adopted in the statistical tests was 5% [confidence interval (CI): 95%].

The research protocol is in compliance with The Resolution 466/12 of the National Health Council and was approved by the Research Ethics Committee of the Universidade do Sul de Santa Catarina under protocol no. 2.564.705, dated March 26, 2018, which exempted the use of the term of free and informed consent.

## RESULTS

Between 2010 and 2015, the Florianópolis SVO performed autopsy of 210 stillbirths at gestational age older than or equal to 20 weeks, with a mean of 35 cases/year. The annual autopsy distribution is shown in **Figure**.

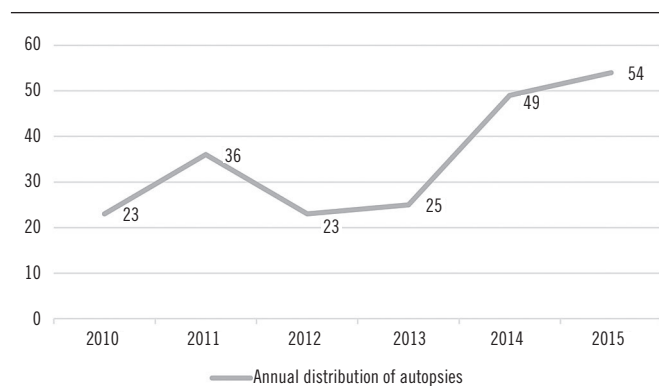


FIGURE – Distribution of autopsies in the period

The sociodemographic and clinical characteristics of the sample are shown in **Table 1**. The mean maternal age was 27 years [standard deviation (SD): 7], ranging from 14 to 45 years. The fetal weight had a median of 1550 grams, varying between 166 and 4850 grams; and the placental weight, median of 340 grams, varying between 40 and 1010 grams. The calculation of the placental index showed a median of 0.192, which varied between 0.06 and 1.75.

**Table 2** shows the causes of death found in the reports in a detailed manner. It should be emphasized that not all individuals had the definition of the cause of death, but some had more than one reason involved in the etiology of the fetal death.

**Table 3** shows the comparison of the causes of death grouped according to the variables studied. When we observed the causes involved in the etiology of the fetal death in a grouped form, it was verified that 15.2% ( $n = 32$ ) presented umbilical cord alterations; 22.4% ( $n = 47$ ), placental alterations; 49.5% ( $n = 104$ ), maternal health problem related to pregnancy; and 10% ( $n = 21$ ), previous maternal disease. Among the fetal characteristics involved, it was observed that 6.7% ( $n = 14$ ) presented meconium aspiration and 5.2% ( $n = 11$ ), fetal malformations. In this study, 21.9% ( $n = 46$ ) did not have their cause defined.

In the analysis between the gestational age and the causes of death, it was verified that the meconial aspiration was associated to the full term pregnancies ( $p = 0.005$ ); the other gestational ages presented no association ( $p > 0.05$ ).

When comparing the type of delivery with the causes of death, it was noted that vaginal birth was linked to placental diseases ( $p = 0.018$ ). There was also a tendency for the association between vaginal birth and meconium aspiration ( $p = 0.057$ ). The other causes were not related to the type of delivery ( $p > 0.05$ ).

Maternal age (continuous and categorical variable) showed no association with the causes of death ( $p > 0.05$ ).

Regarding the place of delivery, the hospital presented a statistically significant association with meconial aspiration ( $p = 0.04$ ); the other locations were not associated with the causes ( $p > 0.05$ ).

**TABLE 1 – Sociodemographic and clinical characteristics of the sample**

Variables	<i>n</i>	%
Place of birth	Hospital	190
	Home	11
	Other health facilities	9
Maternal age	Adolescents	29
	Adult women 20 to 34 years old	102
	Women at advanced age	38
Sex of the fetus	Female	114
	Male	96
Gestational age	Early preterm	109
	Late preterm	30
	Full Term	40
	Postterm	3
Type of birth	Vaginal	140
	Cesarean	45
Fetal weight	Extremely low birth weight	63
	Very low birth weight	29
	Low birth weight	56
	Normal weight	50
	Fetal macrosomia	5

**TABLE 2 – Etiology of the fetal death indicated in the autopsy and anatomic pathology reports**

Etiology		<i>n</i>
Related to the umbilical cord	Umbilical cord stenosis*	15
	Intrauterine nuchal cord	12
	Single umbilical artery	5
Placenta and annexes	Placental abruption	22
	Unspecified placental insufficiency	13
	Battledore placenta	9
	Circumvallate placenta	7
	Subchorial thrombosis	1
Related to the pregnancy	Ascending infection	42
	PIH	32
	Chronic placental infection of hematogenous origin (STORCH)**	18
	Prenatal care not carried out	12
	Gestational diabetes <i>mellitus</i>	8
	Oligohydramnios	3
	Chronic pyelonephritis	2
	Vaginal bleeding	2
	Urinary tract infection	1
	Focal renal sepsis	1
	Polydammium	1
	Kidney infection	1
	Systemic arterial hypertension	7
	Syphilis	4
	Isoimmunization	4
Previous	Illicit drugs use/addiction	3
	Obesity	1
	Death***	1
	Systemic lupus erythematosus	1
	Hepatitis B	1
	HIV positive	1
	Treating Melanoma	1
Aspiration	Meconium aspiration	14
	Congenital heart disease	3
	Trisomy 21	3
	Hydrocephalus	1
	Gastroschisis	1
	Cystic hygroma	1
	Trisomy 18	1
	Not Specified	1
	Undetermined	46

PIH: pregnancy-induced hypertension; HIV: human immunodeficiency virus; \*umbilical cord stenosis: coarctation, external compressive forces, true cord knot, spiralization;

\*\*STORCH: syphilis, toxoplasmosis, rubella, cytomegalovirus and herpes simplex virus infection; \*\*\*maternal death was due to acute non-hemorrhagic abdomen not related to pregnancy.

**TABLE 3** – Comparison of fetal death causes with clinical and sociodemographic characteristics

Variables <i>n</i> (%within the group)		Causes											
		Placenta and annexes				Maternal				Fetal		Undetermined	
		C	<i>p</i>	Pl	<i>p</i>	P	<i>p</i>	Pr	<i>p</i>	A	<i>p</i>	M	<i>p</i>
GA	EPT	14 (51.9)		26 (61.9)		61 (67)		10 (55.6)		2 (16.7)		8 (80)	
	LPT	4 (14.8)	0.562	9 (21.4)	0.087	13 (14.3)	0.26	2 (11.1)	0.591	3 (25)	0.005*	2 (20)	0.348
	FT	8 (29.6)		5 (11.9)		16 (17.6)		6 (33.3)		6 (50)		0 (0)	
	PT	1 (3.7)		2 (4.8)		1 (1.1)		0 (0)		1 (8.3)		0 (0)	
Type of birth	VB	22 (81.5)	0.477	26 (61.9)	0.018*	67 (75.3)	0.904	16 (76.2)	0.953	7 (53.8)	0.057	9 (100)	0.076
	CS	5 (18.5)		16 (38.1)		22 (24.7)		5 (23.8)		6 (46.2)		0 (0)	
Maternal age	Adolescent	6 (25)		7 (17.5)		19 (22.4)		2 (11.1)		0 (0)		1 (12.5)	
	Adult	15 (62.5)	0.322	22 (55)	0.658	47 (55.3)	0.181	13 (72.2)	0.548	9 (81.8)	0.222	4 (50)	0.578
	Advanced age	3 (12.5)		11 (27.5)		19 (22.4)		3 (16.7)		2 (18.2)		3 (37.5)	
Location	Hospital	30 (93.8)		39 (83)		96 (92.3)		20 (95.2)		10 (71.4)		11 (100)	
	Home	1 (3.1)	0.785	4 (8.5)	0.126	4 (3.8)	0.628	1 (4.8)	0.586	1 (7.1)	0.004*	0 (0)	0.543
	Outther**	1 (3.1)		4 (8.5)		4 (3.8)		0 (0)		3 (21.4)		0 (0)	
Fetal weight	ELBW	11 (35.5)		19 (43.2)		37 (36.3)		7 (33.3)		1 (7.1)		2 (18.2)	
	VLBW	6 (19.4)		2 (4.5)		14 (13.7)		2 (9.5)		1 (7.1)		4 (36.4)	
	LBW	4 (12.9)	0.389	12 (27.3)	0.1	31 (30.4)	0.028*	8 (38.1)	0.58	4 (28.6)	0.038*	3 (27.3)	0.28
	NW	9 (29)		11 (25)		16 (15.7)		3 (14.3)		8 (57.1)		2 (18.2)	
	FM	1 (3.2)		0 (0)		4 (3.9)		1 (4.8)		0 (0)		0 (0)	

*C: related to the cord; Pl: related to the placenta; P: related to pregnancy; Pr: maternal health problem/characteristic previous to pregnancy; A: meconium aspiration; M: malformation; GA: gestational age; EPT: early preterm; LPT: late preterm; FT: full term; PT: post term; VB: vaginal birth; CS: cesarean section; ELBW: extremely low birth weight; VLBW: very low birth weight; LBW: low birth weight; NW: normal weight; FM: fetal macrosomia; \*statistically significant association ( $p < 0.05$ ); \*\*other health facilities.*

Regarding fetal weight, it was verified that extreme low weight had a statistically significant association with maternal diseases related to pregnancy ( $p = 0.028$ ). In addition, normal birth weight was associated with meconium aspiration ( $p = 0.038$ ).

It was also possible to observe that women with PIH had a mean of 0.191 placental index versus mean of 0.264 in those without the disease ( $p = 0.02$ ). PIH was not associated with gestational age ( $p = 0.277$ ), type of delivery ( $p = 0.212$ ), maternal age ( $p = 0.863$ ), origin ( $p = 0.137$ ) and stratified fetal weight ( $p = 0.134$ ).

Although there was no statistical significance ( $p > 0.05$ ), all cases of malformation occurred in preterm infants.

## DISCUSSION

### Maternal and pregnancy-related characteristics

Knowing the profile of pregnant women is essential in prenatal care. In this study, a prevalence of 13.8% of adolescents, 48.6% of adult women and 18.1% of women at advanced age was found. In a similar study conducted in Florianópolis between 2000 and 2009, the prevalence of the age groups was 14.4%, 73% and 12.6%, respectively<sup>(15)</sup>. As it is the same population, there is a slight trend towards increasing maternal age, a fact that has been

observed according to national statistics<sup>(16)</sup>. This scenario is due to factors, such as effective birth control, a higher level of maternal education, advances in health care and assisted reproduction technology, and higher rates of divorce followed by new unions<sup>(17)</sup>. As a consequence, there is an increased risk of numerous unfavorable outcomes for the fetus and the mother, such as PIH, abortion and more cesarean indications<sup>(18)</sup>.

Regarding the type of delivery, a higher prevalence of vaginal birth was observed in relation to cesarean section. It is considered that only stillbirths were included in this study and, when the diagnosis is made intrauterine, vaginal birth is the preferred route. Even before disagreements in the literature, it is important to emphasize that cesarean section brings less morbidity to the fetus in relation to vaginal birth, especially in preterms<sup>(19)</sup>; the benefit to the fetus should also be highlighted when choosing the way of delivery. Regarding home birth, it is pointed out that, although studies show greater maternal satisfaction, there is a higher prevalence of unfavorable outcomes for newborns in home deliveries<sup>(20)</sup>.

### Causes of intrauterine death

Knowing the direction of stillbirth by gestational age is fundamental, since it is a marker of gestational health. In this study, there was a greater tendency (51.9%) of death in early



preterm, a finding consistent with a large population-based study conducted in the United States between 2006 and 2012<sup>(21)</sup>.

Regarding the prenatal follow-up, it was observed that in the study population 12 pregnant women did not perform it, representing 5.7% of the total. Considering the population of live births in the Grande Florianópolis during the period of this study, statistics show that only 1.3% did not present prenatal care<sup>(16)</sup>, which represents a lower prevalence than that which culminated in fetal death.

In addition to clinical data related to previous maternal history and with complications of pregnancy, placental analysis is imperative. The placental membranes can be infected by the accession of microorganisms, causing chorioamnionitis, and by the hematogenous route. The inflammatory reaction caused in these situations is associated with classic anatomopathological findings. In chorioamnionitis, for example, there are polymorphonuclear infiltrates that affect both the amniotic membrane and the villi<sup>(22)</sup>. In this study, among all the outstanding causes of intrauterine death, ascending infection was the most prevalent (20%), corroborating the findings of Man *et al.* (2016)<sup>(23)</sup>. In cases of placental infection of hematogenous origin, some conditions are considered major, such as syphilis, toxoplasmosis, rubella, cytomegalovirus and infection with herpes simplex virus, known as STORCH. In addition to these, it is important to highlight the participation of listeriosis, related to gestational infection by hematogenous spread, which causes features detectable in the anatomical pathology examination<sup>(24)</sup>.

PIH, while pre-eclampsia, affects 3%-5% of pregnancies. Its diagnosis is traditionally made by high blood pressure and the presence of proteinuria. When improperly managed, it can be lethal<sup>(25)</sup>. In the present study, PIH was among the main causes of intrauterine death (15.2%). In the pathophysiology of the disease, failure of the second trophoblast invasion acts leading to high-resistance artery of the uteroplacental circulation, which culminates in the occurrence of placental infarction. It is not uncommon in clinical practice to find ultrasound degrees of placenta previa in patients with PIH compared to those without the disease. Such alterations are also observed in the anatomopathological analysis, which shows white and red areas, which indicates old and recent infarctions, respectively. Therefore, a lower placental weight is expected in patients suffering from this condition, as well as a lower placental index. In this study, it was verified that the presence of PIH was associated with a lower placental index ( $p = 0.02$ ) without a statistically significant change in fetal weight ( $p = 0.134$ ), when compared with deaths from other causes.

The detailed study of the causes of death brings very important information in the investigation of fetal death, as well as when the causes are grouped together. In the present study, 22.4% of the individuals had changes in the placental bed that culminated in intrauterine death. Stanek *et al.* (2014)<sup>(6)</sup> state that these abnormalities are less common in the second trimester; in addition, they reinforce that chronic hypoxic lesions are more prevalent in the preterm and that signs of intrauterine hypoxia, such as meconium, arise mainly in full term pregnancy<sup>(26)</sup>. Corroborating these data, the present study showed a significant relationship between meconial aspiration and full term pregnancies, as well as between hospital origin and normal birth weight. It should be pointed out that such associations were possibly due to the fact that most of the deliveries occurred in a hospital environment, either because the diagnosis of intrauterine death had been made previously, or because many of the pregnant women had diseases that needed continuous monitoring, and the hospital was the appropriate place to act in these high-risk pregnancies.

### Investigation of fetal death

In the literature, studies indicate a rate of approximately 60% of fetal deaths without a specific cause<sup>(9, 27)</sup>. In this study, only 21.9% remained with no justification. It is suggested that this data could be even smaller with the correct completion of the referral and the complete previous information sent to the SVO. According to fetal death investigation flowcharts, autopsy, placental examination, cytogenetic analysis and coagulation tests are essential in the investigation of fetal death. Based on these initial results, other tests may be indicated<sup>(28)</sup>.

### Limitations of this study

As a limitation of this study, we highlight the non-obligatory referral of stillbirths to the SVO and the poor quality of the information transmitted to the doctor of the service that performs the necroscopic examination. It is emphasized that not only the referral of the fetus, but also that of the placenta, are essential for an appropriate investigation of the cause mortis, and that these data associated with a detailed clinical history make the analysis more complete and reliable.

### CONCLUSION

Among all causes of fetal death, ascending infection was the most prevalent. The main cause of death related to the umbilical cord was stenosis, and premature placental abruption was

related to the placenta. Regarding the pregnancy, the ascending infection stands out, for previous maternal health problem, systemic arterial hypertension. The fetal causes were the meconial aspiration and the consequences related to trisomy 21 and congenital heart disease. Only 21.9% of the reports did not present the definite cause of death, which is below the average found in the literature.

It was verified that meconial aspiration was associated with full term pregnancy, normal birth weight and hospital origin; vaginal birth was associated with placental diseases. It was noted that extreme low birth weight was associated with maternal

diseases; PIH presented a placenta index statistically lower than that in relation to women without this disease. Among all the variables investigated, maternal age showed no association with the causes of death studied.

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