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Silveira Pinho, Ana Paula; Aerts, Denise; Lahorgue Nunes, Magda
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Ana Paula Silveira Pinho¹

Denise Aerts^{II}

Magda Lahorgue Nunes¹

Risk factors for sudden infant death syndrome in a developing country

Fatores de risco para síndrome da morte súbita do lactente em um país em desenvolvimento

ABSTRACT

OBJECTIVE: To analyze whether previously identified risk factors for sudden death syndrome have a significant impact in a developing country.

METHODS: Retrospective longitudinal case-control study carried out in Porto Alegre, Southern Brazil. Cases (N=39) were infants born between 1996 and 2000 who died suddenly and unexpectedly at home during sleep and were diagnosed with sudden death syndrome. Controls (N=117) were infants matched by age and sex who died in hospitals due to other conditions. Data were collected from postmortem examination records and questionnaires answers. A conditional logistic model was used to identify factors associated with the outcome.

RESULTS: Mean age at death of cases was 3.2 months. The frequencies of infants regarding gestational age, breastfeeding and regular medical visits were similar in both groups. Sleeping position for most cases and controls was the lateral one. Supine sleeping position was found for few infants in both groups. Maternal variables, age below 20 years (OR=2, 95% CI: 1.1; 5.1) and smoking of more than 10 cigarettes per day during pregnancy (OR=3, 95% CI: 1.3; 6.4), significantly increased the risk for the syndrome. Socioeconomic characteristics were similar in both groups and did not affect risk.

CONCLUSIONS: Infant-maternal and socioeconomic profiles of cases in a developing country closely resembled the profile described in the literature, and risk factors were similar as well. However, individual characteristics were identified as risks in the population studied, such as smoking during pregnancy and maternal age below 20 years.

DESCRIPTORS: Sudden Infant Death. Prone Position. Smoking. Risk Factors. Case-Control Studies.

¹ Departamento de Neurologia. Hospital São Lucas. Pontifícia Universidade do Rio Grande do Sul. † Porto Alegre, RS, Brasil

^{II} Secretaria Municipal da Saúde. Porto Alegre, RS, Brasil

Correspondence:

Ana Paula Pinho
Centro Clínico – Hospital São Lucas – PUCRS
Av. Ipiranga, 6690/706
90610-000 Porto Alegre, RS, Brazil
E-mail: anaspinho@uol.com.br

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RESUMO

OBJETIVO: Analisar se fatores de risco previamente identificados para a síndrome da morte súbita do lactente têm impacto significativo em um país em desenvolvimento.

MÉTODOS: Estudo retrospectivo, longitudinal, de caso-controle pareado realizado em Porto Alegre, RS. Os casos (N=39) foram lactentes nascidos entre 1996 e 2000 que morreram subitamente e inesperadamente em casa, ao dormir, com diagnóstico final da síndrome; o grupo controle (N=117) foi composto de lactentes pareados por idade e sexo que morreram em hospitais, por outra doença. Os dados foram coletados de registros médicos *postmortem* e respostas a questionários. Utilizou-se modelo de regressão logística para identificar os fatores associados ao desfecho.

RESULTADOS: A idade média dos casos no momento da morte dos lactentes foi de 3,2 meses. As frequências de idade gestacional, amamentação e visitas regulares a unidades básicas de saúde foram similares nos dois grupos. A posição de dormir mais comum nos casos e controles foi a lateral. A posição supina foi encontrada em alguns lactentes em ambos grupos. As variáveis maternas idade inferior a 20 anos (OR=2, IC 95%: 1,1;5,1) e consumo de mais de 10 cigarros/dia durante a gravidez (OR=3, IC 95%: 1,3;6,4) aumentaram significativamente o risco para a síndrome. As características socioeconômicas foram similares entre os grupos e não afetaram o risco.

CONCLUSÕES: Os perfis lactente-materno e os fatores de risco foram similares aos encontrados em outros países. Todavia, foram identificadas características individuais quanto aos riscos de fumar durante a gravidez e da idade materna inferior a 20 anos.

DESCRIPTORIOS: Morte Súbita do Lactente. Decúbito Ventral. Tabagismo. Fatores de Risco. Estudos de Casos e Controles.

INTRODUCTION

Sudden infant death syndrome (SIDS) is defined as “the sudden death of any infant under one year of age which remains unexplained after a thorough case investigation, including complete postmortem examination, review of clinical history and examination of death scene.”²³ The pathology of SIDS has not been established, but many hypotheses have been raised in the last years.¹⁹ Advances in the knowledge about SIDS are associated with the identification of environmental risk factors, the so-called “triggers,” that may favor this lethal outcome in an organically predisposed child.⁷ Currently, many risk factors are associated with SIDS, some of which are definitely correlated with this syndrome. The implications of other factors, however, still need to be further explored. Prone sleeping position and maternal smoking are well-established risk factors for SIDS in developed countries. A 50% reduction in SIDS incidence in countries that have adopted the recommendation of supine sleeping position is well documented in the literature.^{2,4}

Pediatricians and health providers in developing countries, such as Brazil, have little knowledge on risk

factors for SIDS since it is not seen as an important cause of death in the first year of life.¹⁵ Therefore, the incidence of SIDS is unknown in Brazil, except in the city of Porto Alegre, southern Brazil. A previous study reported that SIDS affects 0.4:1000 live births, and is the probable cause of 6.3% of infant deaths before 12 months of age.¹⁵

Since risk factors for SIDS may vary or gain greater importance depending on the population studied,^{11,20} developing countries also need to know the impact of each risk factor on its own population so that preventive measures can be implemented.

The present study aimed at investigating whether previously identified risk factors for sudden infant death syndrome have a significant impact in developing regions. It is hypothesized that risk factors for SIDS should be similar to those found for non-SIDS cases in developing countries since they are closely associated with poverty.

METHODS

The local Health Department of the municipality of Porto Alegre (Southern Brazil) keeps a Mortality Surveillance Program named *Prá-Viver*. The program expert team visits all families of children who died in the first year of life and information is collected on the history of disease and death. Most parents agree to participate in the program, and the refusal rate is 2.5%. The questionnaire consists of questions about well-established SIDS risk factors and general risk factors for infant mortality in Brazil. SIDS diagnosis was based on an extensive review of clinical history, family report on the circumstances of death, and negative postmortem examination, following the US National Institute of Child Health and Human Development (NICHD) definition.⁷ Autopsy reports were provided by a medical examiner of the Forensic Medical Institute of Porto Alegre and included macroscopic examination of all organs.

Records from the program were retrospectively reviewed and all children who died under 12 months of age in the city between January 1996 and December 2000 (N=837) were identified. Data from infants who died during sleep at home (N=142) were selected. Out of these deaths, 39 were identified as SIDS cases and included in the study. The control group of infants (N=117) was selected from the same database (*Prá-Viver* Program) and matched by sex and age at a 3:1 ratio to SIDS cases. Controls died in the same months as SIDS cases, and causes of death were clearly defined during hospital stay. All children with congenital malformations were excluded from the study.

To establish risk factors for SIDS, the study variables were divided into three groups: maternal, infant, and socioeconomic factors.

Maternal factors studied were: age below 20 years (adolescent mother; yes or no), interpregnancy interval (<1 year = short interval; yes or no), prenatal care (no if <6 visits), vaginal delivery (yes or no), smoking during pregnancy (more than 10 cigarette per day = proven risk for SIDS),^{6,23} alcohol or marijuana use during pregnancy (yes or no) and urinary infection during pregnancy (yes or no).

Infant factors assessed were gestational age (delivery <37 weeks), Apgar score (risk if <7), breastfeeding (at time of death), regular pediatric care (at least one visit per month), usual sleeping position (lateral, prone or supine), apnea (yes or no), SIDS sibling (yes or no), ethnicity (white, black, Asian).

Socioeconomic factors included: weather conditions (death during a cold or hot month), income (low if <1 minimum wage), father and mother schooling (low if <4 years), father living with the family (yes or no).

The measure of association in the univariate analysis was odds ratio (OR) and 95% confidence interval (95% CI). A multivariate analysis was subsequently carried out to identify the best model to explain risk factors. For that purpose, a conditional logistic model was used for the variables statistically associated with SIDS in the univariate analysis ($p \leq 0.05$), as well as for the most important variable reported in the literature — sleeping position.

All tests were carried out using the SPSS 9.0.

The study protocol was approved by the Research Ethics Committees of “Pontificia Universidade do Rio Grande do Sul” University Hospital, the “Instituto de Medicina Forense of Porto Alegre”, and the “Secretaria de Saúde do Município de São Paulo”.

RESULTS

Age at death of SIDS cases ranged from 1 to 9 months (median=2 months), and male sex was slightly predominant at a 1:1.4 ratio. Birthweight in the SIDS group ranged from 1,200 to 3,600 g (median=2,800 g). In the control group, birthweight ranged from 700 to 4,300 g (mean=2,600 \pm 800, median=2,650 g).

Gestational age below 37 weeks, breastfeeding and regular medical visits were similar in both groups. Previous episodes of apnea were more frequently seen among controls, but there was no significant difference between the groups. No SIDS siblings were identified in the control group. None of the SIDS cases had 5-min Apgar score below 7 (Table 1).

Most SIDS cases and controls regularly slept in the lateral position. Although lateral position was not identified as a risk factor for SIDS, it was also not protective since 67% of SIDS cases regularly slept in the lateral position. Few infants regularly slept in supine position in both groups. Although not significant, there was a predominance of prone sleeping position among SIDS cases (Table 1).

The analysis of maternal variables showed that age below 20 years and smoking more than 10 cigarettes per day during pregnancy significantly increased SIDS risk (OR=2.3 and 3 respectively, Table 3). Short interpregnancy intervals and alcohol abuse were more frequently seen among SIDS mothers, but differences were not significant between the groups. Prenatal care and route of delivery were similar in both groups. Urinary tract infection and marijuana use were more prevalent among control mothers, but the difference was not statistically significant (Table 2).

Socioeconomic characteristics were similar in both groups and did not increase SIDS risk (Table 1).

Table 1. Frequency of risk factors for sudden infant death syndrome in cases and controls. Porto Alegre, Southern Brazil, 1996–2000.

Variable	SIDS N (%)	Control N (%)
Infant factor		
Ethnicity		
Black	10 (25.6)	53 (25.2)
White	29 (74.4)	64 (74.8)
Gestational age <37 weeks	9 (23)	33 (27.3)
Apgar score <7	-	22 (18.8)
Breastfeeding	14 (35.8)	45 (38.4)
Regular pediatric care	29 (74.4)	88 (75.2)
SIDS sibling	1 (2.5)	-
Sleeping position		
Prone	12 (30)	26 (22.2)
Lateral	26 (67)	89 (76)
Supine	01 (3)	02 (1.8)
Apnea	5 (12.8)	27 (25.6)
Maternal factor		
Age below 20	18 (40.2)	30 (25.5)
Interpregnancy interval <1 year	03 (7.7)	01 (0.8)
Prenatal care	23 (58.9)	65 (55.5)
Smoking*	25 (64.5)	43 (36.7)
Alcohol*	12 (30.8)	33 (28.2)
Marijuana*	-	10 (8.5)
Urinary Infection*	3 (7.6)	16 (13.6)
Socioeconomic factor		
Cold months	24 (61.5)	77 (65.8)
Father schooling – 4th grade	31 (79.5)	94 (80.4)
Mother schooling – 4th grade	31 (79.5)	96 (82.1)
Father living with the family	32 (82.1)	99 (84.6)

SIDS: sudden infant death syndrome

* During pregnancy

DISCUSSION

Although SIDS is the main cause of infant mortality in developed countries and more frequently affects low income populations,¹ its characteristics and incidence rates are still not known in developing countries, characterized by very low income population. As infant mortality is still quite high in poor countries and generally associated with infectious diseases and malnutrition, pediatricians and health providers have little knowledge on SIDS. Consequently, SIDS is often misdiagnosed and information about SIDS risk factors is not usually provided to parents.^{3,5}

Table 2. Crude odds ratio for sudden infant death syndrome. Porto Alegre, Southern Brazil, 1996–2000.

Variables	SIDS x Control Odds ratio (95% CI)
Infant variable	
Ethnicity: black	0.9 (0.4–1.3)
Gestational age <37 weeks	0.7 (0.4–0.9)
SIDS sibling	0.2 (0.06–0.4)
Apgar score <7	0.8 (0.2–1.4)
Apnea	0.3 (0.08–0.6)
No breastfeeding	0.8 (0.2–1.4)
No pediatric care	0.8 (0.2–1.4)
Prone sleeping position	0.9 (0.2–1.0)
Maternal variable	
Age <20 years	2 (1.7–4.9)
Interpregnancy <1 year	0.8 (0.2–1.4)
Prenatal care	0.8 (0.2–1.4)
Smoking*	3 (2.1–7.9)
Alcohol**	0.8 (0.2–1.4)
Marijuana**	-
Urinary infection*	0.9 (0.6–1.2)
Socioeconomic variable	
Cold month	0.8 (0.2–1.4)
Income < 1 wage	0.8 (0.2–1.4)
Father's schooling – 4th grade	0.8 (0.2–1.4)
Mother's schooling – 4th grade	0.7 (0.3–1.7)
Father living with the family	0.8 (0.2–1.7)

* During pregnancy

** Use during pregnancy

Table 3. Multivariate analysis of relative risk for sudden infant death syndrome. Porto Alegre, Southern Brazil, 1996–2000.

Variable	Case x control OR (95%CI); p-value
Prone sleeping position	1.4 (0.6–3.4); p=0.41
Maternal age <20 years	2.3 (1.1–5.1); p=0.03
Smoking*	3.0 (1.3–6.4); p=0.005

* During pregnancy

A previous study found that the epidemiological profile of SIDS cases in Porto Alegre was similar to that described in developed regions. It also reported that none of the infants regularly used to sleeping in supine position, and 71% of mothers smoked during pregnancy.¹⁵

Supine sleeping position is not common in Brazil. Parents are generally advised to place their babies to

sleep on lateral position.¹⁶ Thus, it was not surprising that lateral position was the most prevalent sleeping position in both SIDS and control groups. This position did not increase SIDS risk in the present study. Sleeping in prone position, one of the main risk factor for SIDS,⁸⁻¹⁰ was similar in both SIDS and non-SIDS cases studied.

The ethnicity variable is a well-known risk factor for SIDS in developed countries where racial miscegenation is modest.¹⁸ But, in the present study, it was not confirmed as a risk factor probably due to the great racial miscegenation in Brazil.

Other well-established risk factors for SIDS, such as gestational age below 37 weeks, low birthweight, low Apgar scores, no breastfeeding, no regular pediatric care, sibling victim of SIDS, and previous episodes of apnea,¹²⁻¹⁴ were not associated with increased SIDS risk in the present study. In developing countries, these characteristics may perhaps be associated with poverty and increased infant mortality risk regardless of death causes.

Variables of maternal risk factors were associated with SIDS in the population studied. The main risk factor identified was smoking during pregnancy, followed by low maternal age. Cigarette smoking during pregnancy has been repeatedly identified as a major risk factor for SIDS.^{6,10,21} In the NICHD study, 70% of SIDS mothers smoked during pregnancy.⁷ Other maternal variables, such as route of delivery, alcohol abuse, use of illicit drugs (marijuana) and urinary tract infection during pregnancy were not associated with increased risk of SIDS.^{17,21}

None of the socioeconomic characteristics assessed were associated with increased SIDS risk since their prevalence was similar in both groups. This finding reflects the epidemiological pattern of mortality in Brazil. Poor economic, social and cultural conditions

in which most people in developing countries live may contribute to increased overall infant mortality but not specifically in SIDS.^{17,18,24}

Most SIDS studies were conducted in developed countries and reported higher risk in lower socioeconomic populations.^{22,25} Since most Brazilians have lower socioeconomic conditions, it was hypothesized that SIDS risk factors would be related to poverty and thus would not be specifically related to SIDS but rather to overall infant mortality. To test it, it was chosen to study a control group of children deaths. Children who died subsequently to a SIDS case, but the death cause has been clearly determined, were selected. Based on the findings, the study hypothesis was confirmed since poverty-related SIDS risk factors were similar in both groups. Based on that, it can be assumed that poverty-related SIDS risk factors in developing countries may not be specifically related to SIDS but to overall mortality. Further investigation using a control group of live children at 12 months of life may help confirm these findings.

The results of the present study suggest that, in developing regions, risk factors for SIDS and non-SIDS cases overlap because they are closely associated with poverty. Risk factors for SIDS in Brazil were associated with maternal factors such as low age and smoking during pregnancy. These factors should be targeted in preventive campaigns.

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