ECRONICON OPEN ACCESS

EC PAEDIATRICS
Research Article

Metabolic Screening: Experience in Second Level Attention Hospital

Alejandra Itzel Contreras Rivas[1]* and Gaston Eduardo Estudillo Jimenez[2]

[1]Pediatric-Neonatology, Neonatal Intensive Therapy Unit, Maternal and Infant Hospital "Miguel Hidalgo Y Costilla", Mexico

[2]Gynecology-Obstetric, Maternal-Fetal Medicine and Fetal Surgery Fellow, Maternal Health Program Manager, Mexico

***Corresponding Author**: Alejandra Itzel Contreras Rivas, Pediatric-Neonatology, Neonatal Intensive Therapy Unit, Maternal and Infant Hospital "Miguel Hidalgo Y Costilla", Mexico.

Received: February 04, 2020; **Published:** March 30, 2020

Abstract

The neonatal sieve is a very valuable tool of preventive medicine, through the analysis of various substances in blood drops collected on specific filter paper, currently, the Ministry of Health carries out the neonatal sieve for the detection of six diseases: hypothyroidism congenital, congenital adrenal hyperplasia, phenylketonuria, galactosemia, cystic fibrosis and glucose 6-phosphate dehydrogenase deficiency. The following article was carried out with the purpose of knowing the statistics of confirmed cases through the conduct of metabolic screening.

Keywords: *Metabolic Screening; Newborn; Hypothyroidism Congenital; Congenital Adrenal Hyperplasia; Phenylketonuria; Galactosemia; Cystic Fibrosis and Glucose 6-Phosphate Dehydrogenase Deficiency*

Background

In medicine, screening means "straining" or "filtering" in a population with the purpose of separating or distinguishing individuals who present some characteristic different from others. The neonatal sieve is a study that "narrows" or "separates" children, born with alterations of Metabolism that makes them different from others, to treat them in a timely manner to avoid the consequences that would not bring them in time to enter Others may be mental retardation or death.

The purpose of the neonatal screen is to detect the existence of a congenital disease or deficiency, before it manifests itself, to install or initiate the appropriate treatment that avoids its consequences [1].

The history of neonatal screening began with Robert Guthrie in the 1960s, when developing a fast and economical method, whose additional advantage is the use of filter paper as a means of transporting the sample, which gives it stability and facilitates its shipment to a laboratory for analysis [2].

In Ireland, the country with the greatest history of systematization of metabolic sieve and world model with a report of detection of cases of phenylketonuria since 1979 with an incidence of 1: 4500. Having a phenylketonuria diagnostic program only 4 years later to the pioneers in the state of New York in the US [4].

In Ontario, the program for the detection of hypothyroidism began in 1978, however, it was not until 2005 that the taking of all newborns from the metabolic screen was recorded as such [5].

In Slovakia, it started in 1985, after a 6-year pilot study of hypothyroidism, taking shape in 2003 [7].

In Spain since 1995 in preterm infants, a second paper shot is recommended at 14 days of age and in very premature infants (under 27 weeks), at hospital discharge. Likewise, it is currently accepted that thyroid function can be compensated between the two twins, resulting in a false negative in the case of being one of them congenital hypothyroid. The need to repeat the test after 14 days in all twin births is deduced from the data presented [8].

In Asia and the Pacific Region, particularly those with underdeveloped economies, they are just beginning with these screening programs for metabolic diseases and congenital disorders. The first work occurred in the Philippines in 2008, the second only in 2010 [9].

In Mexico, 18 years after the Health Secretariat Program, variations in the regional prevalence of HC have been observed, as in Quintana Roo of 8.13 x 10,000 and Sinaloa of 0.62 x 10,000. In general, the observed incidence has remained high, as shown by the records of the Ministry of Health in 2005 and 2006, the incidence is 1: 1,300. For the year 2008, one case is recorded for every 1,900 newborns alive (1: 1,900) [10].

For congenital adrenal hyperplasia it is considered that in Mexico, its classical form occurs in 1 of every 12,000 live births, and is the main cause of the disorder in the differentiation of genitals in newborns with chromosomal formula XX and of a high mortality rate in newborns with XY chromosomal formula due to lack of opportunity in diagnosis and treatment [11].

The incidence of galactosemia is uncertainty in Mexico, however it is estimated in two cases per 100,000 live newborns, with a neonatal lethality that can reach up to 20% [12].

Phenylketonuria (FCU) is a progressive and severe disease with autosomal recessive transmission whose overall incidence is 1: 10,000 - 20,000 live newborns (RNV). In Mexico the incidence is not known exactly, however there are publications that estimate it between 1: 20,000 - 1: 70,000 newborn [13].

Introduction

It is currently carried out in all countries, through the analysis of blood drops collected on specific filter paper, the first neonatal screening programs were aimed at the timely detection of phenylketonuria.

The neonatal sieve is a very valuable tool of preventive medicine, through the analysis of various substances in blood drops collected on specific filter paper, currently, the Ministry of Health carries out the neonatal sieve for the detection of six diseases: hypothyroidism congenital, congenital adrenal hyperplasia, phenylketonuria, galactosemia, cystic fibrosis and glucose 6-phosphate dehydrogenase deficiency [2].

Neonatal sieve material

Filter paper: There are several types of filter paper available in the world and accredited by international organizations for the taking of the neonatal sieve, so your choice is subject to the administrative procedures in force in relation to the importation of the product and its distribution in our country, the filter paper is 100% pure cotton of controlled quality for absorption: basic weight 185 g/m^2, thickness 0.545 mm, water absorption 4.7 $ml/100\ cm^2$, ashes 0.06%, densimeter 3.0 sec. And medium smooth surface. The paper must meet these characteristics and be registered with the SSA.

Sample collection technique: It is important to note that the blood sample should be taken on the heel between the third and fifth day of life, in order to identify different metabolites present in congenital metabolic diseases.

Technique: 1. Immobilize the foot, make two imaginary lines, one that goes from the middle of the first finger to the heel and the other that goes from the interdigital fold of the fourth or fifth finger to the heel. 2. The external areas of the line is an area with numerous capillaries that provides a good amount of blood, and also prevents injury to the calcaneus bone. 3. Clean the area to be punctured with alcohol-impregnated cotton, let the excess evaporate. 4. Insert the tip of the lancet with a single fast and safe movement in a direction almost perpendicular to the surface of the foot. 5. Blood drops should be large, that fill the entire circle and that permeate the back side of the filter paper card. 6. Bring the surface of the filter paper into contact with the drop of blood until the card circles fill. Take care that the filter paper does not touch the skin of the child. 7. Wait for a new drop, contact the filter paper again with the drop of blood to fill all the circles on the card. 8. Let the sample dry on filter paper for 3 hours at room temperature in a horizontal position and never close to a direct source of heat or dry it by other physical means. 9. Do not touch the circles that contain the drops of blood. 10. Store the sample on filter paper with the identification card in an envelope and store it in a cool place or in the refrigerator wrapped in paper in a plastic bag with a desiccant envelope until they are sent to the laboratory [1].

To achieve the optimization of a Neonatal Screening Program it is mandatory that the laboratories that process the samples apply internal control programs at the different stages of the process: pre analytical, analytical and post analytical.

Pre-analytical stage: Sample collection, Sample drying and sample delivery. At this stage each action will be performed correctly. The samples must be sent within a period not exceeding 5 days, it is important to ensure the integrity of the samples and their data.

Analytical stage: Reception and selection of samples, Perforation of samples, Preparation of plates, Analysis of plates and Emission of results.

Post-analytical stage: Delivery of results, Location of suspicious cases, Conduct of confirmatory tests to suspicious children and Follow-up of positive cases [3].

The quality of the sample is due to well-identified reasons that include: the ability of the personnel taking the sample, the sharp instrument with which the puncture is performed which is internationally standardized, the technique of drying the sample and the conditions of conservation, packaging and time of sending of the sample to the laboratory that processes, reason why it is necessary to verify that all these aspects cover efficiently to avoid lost opportunities.

In the maternal and child Hospital Miguel Hidalgo y Costilla in the department of preventive medicine, this procedure is carried out according to national and international guidelines. Performing in all newborns (healthy or not) the detection of inborn errors of metabolism through the metabolic sieve test.

Objective of the Study

The objective of this article is to present the evolution of the neonatal metabolic sieve program in the Miguel Hidalgo y Costilla Maternal Hospital, the obstacles and achievements in the normative, technical-operational and financial aspects.

Material and Methods

Daily the nurses of the Preventive Medicine service take all healthy newborns who have graduated from the joint housing the sample to carry out a metabolic sieve, on the fourth day of life. Like all hospitalized newborns, regardless of their pathology, this sample is taken.

In suspicious cases, it is carried out by the personnel responsible for the laboratory that processed the sample, immediately notifies the corresponding institutional state instance by the fastest available route. In addition, the national coordination is informed. The corresponding state and/or jurisdictional instances urgently locate the patient for confirmatory studies. Once the diagnosis has been confirmed by the state authorities or, if applicable, the treating hospital, they must complete and send the case notification form at the state

and national central level. In exceptional cases, if the person responsible for the program or the unit that took the sample is not located, the patient's parents are notified directly, not forgetting to notify the state managers of the program. Confirmed cases are recorded in the weekly epidemiological surveillance information system.

The integral objective in each patient is to ensure optimal neurodevelopment, growth, pubertal development, avoid or limit the damage due to deficient metabolic processes and favor the acquisition of skills and abilities, to strengthen the emotional and intellectual bonds of the mother-child binomial. It is important to emphasize that the follow-up of cases affected with congenital metabolic disease is for life.

Results and Discussion

Between January 2016 and June 2019, 10,205 were taken at the Miguel Hidalgo and Costilla Maternal and Child Hospital. With a total of suspicious cases in 2016: 131 cases, 2017: 136 cases, 2018: 102 cases and in 2019: 68 cases. In 2016 with a total of 16 confirmed cases, in 2017 a total of 14 confirmed cases, first congenital hypothyroidism with a total of 11 cases, adrenal hyperplasia with a total of 2 confirmed cases, and one case of fibrosis cystic; In 2018, a total of 18 confirmed cases: hypothyroidism topping the list with 12 cases, secondly adrenal hyperplasia with 4 cases, phenylketonuria 1 confirmed case and 1 confirmed case of galactosemia. In 2019, a total of 14 confirmed cases, again leading the list of hypothyroidism with 11 cases, 2 cases of adrenal hyperplasia, and 1 case of cystic fibrosis. So far in 2019, a total of 12 confirmed cases, there is the highest reporting rate of confirmed cases of cystic fibrosis with a total of 7 cases, 2 cases of glucose 6 phosphate dehydrogenase, 1 case of phenylketonuria, 1 case of galactosemia and a case of adrenal hyperplasia.

2016

Innate metabolism error	Women	Man	Total
Congenital Hypothyroidism	2	5	7
Cystic Fibrosis	0	0	0
Suprarrenal Hyperplasia	6	2	8
Glucose Deficiency 6 Phosphate Dehydrogenase	0	1	1
Galactosemia	0	0	0
Phenylketonuria	0	0	0
Total	8	8	16

2017

Innate Metabolism Error	Women	Man	Total
Congenital Hypothyroidism	5	6	11
Cystic Fibrosis		1	1
Suprarrenal Hyperplasia	2	0	2
Glucose Deficiency 6 Phosphate Dehydrogenase	0	0	0
Galactosemia	0	0	0
Phenylketonuria		0	0
Total	7	7	14

2018

Innate Metabolism Error	Women	Man	Total
Congenital Hypothyroidism	4	8	12
Cystic Fibrosis			
Suprarrenal Hyperplasia	3	1	4
Glucose Deficiency 6 Phosphate Dehydrogenase			
Galactosemia	1		1
Phenylketonuria		1	1
Total	8	10	18

2019

Innate Metabolism Error	Women	Man	Total
Congenital Hypothyroidism	0	0	0
Cystic Fibrosis	5	2	7
Suprarrenal Hyperplasia	1	0	1
Glucose Deficiency 6 Phosphate Dehydrogenase	0	2	2
Galactosemia	1		1
Phenylketonuria		1	1
Total	7	5	12

Conclusion

The benefits of early detection of various medical conditions have long been found; Such is the case of metabolic disorders in newborns, In our study we determined that the prevalence of congenital metabolic diseases in children without apparent (healthy) risk factors, was three times greater than that reported in the world literature, coupled with this, it is likely that in preterm infants or with various morbidities the prevalence will increase. Therefore, It is essential to educate health providers at all levels of care for the newborn, and the high relevance of metabolic screening with an early detection the importance of its detection before the main organs are affected, as well as send it in a timely manner and To receive multidisciplinary management involving specialist in genetic, metabolic disease and neonatology; in order to promote the increase in the quality of life of these patients, increase the opportunity to integrate in a successful and productive way in Mexican society, reduce the costs of care and the socioeconomic cost that causes the country to maintain a problem like the metabolic diseases [14-18].

Bibliography

1. Tamiz Neonatal Detección, Diagnóstico, Tratamiento y Seguimiento de los Errores Innatos del Metabolismo.
2. Erika Paola García-Flores., *et al*. "Avances y logros del programa de tamiz metabólico neonatal (2012-2018)". *Acta Pediátrica de México* 39.1 (2018): 57S-65S.
3. NOM-166-SSA-1997.
4. A Practical Guide to Newborn Bloodspot Screening, In Ireland. 7th Edition (2018).

5. Newborn Screening Manual: A guide for newborn care providers, edition 2.1 (2018).

6. Martina Cornel., *et al*. "Newborn screening in Europe. Expert Opinion document".

7. Maria Knapkova., *et al*. "Reliability of Neonatal Screening Results". *International Journal of Neonatal Screening* 4.3 (2018): 28.

8. Gema Matilde Calderón López and Francisco Jiménez Parrilla. "Screening neonatal". Protocolos Diagnóstico Terapéuticos de la AEP: Neonatología.

9. Bradford L Therrell and Carmencita David Padilla. "Current status of newborn screening worldwide: 2015". *Seminars in Perinatology* 39.3 (2015): 171-187.

10. Marsden D. "Newborn screening for metabolic disorders". *Journal Pediatrics* 148.5 (2006): 577-584.

11. Cardosa Martens IR and Sotelo Crúz N. "Hiperplasia suprarrenal congénita: diagnóstico y tratamiento en 20 casos". *Revista Mexicana de Pediatría* 74.6 (2007): 251-256.

12. Fernhoff PM. "Newborn screening for Genetic Disorders". *Pediatric Clinics of North America* 56.3 (2009): 505-513.

13. Vela-Amieva M., *et al*. "Frecuencia de enfermedades metabólicas congénitas susceptibles de ser identificadas por el tamiz neonatal". *Acta Pediátrica de México* 30.3 (2009): 156-162.

14. CENETEC. Tratamiento dietético nutricional del paciente pediátrico y adolescente con fenilcetonuria en 1°, 2° y 3er nivel de atención. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica. México (2016).

15. CENETEC. Galactosemia. Tamizaje, diagnóstico, tratamiento médico de las complicaciones e intervención nutricional. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica. México (2017).

16. IMSS. Deficiencia de glucosa 6 fosfato deshidrogenasa. Tamizaje, diagnóstico y tratamiento 1er, 2° y 3er nivel de atención. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica. México (2016).

17. ISSSTE. Prevención, detección y diagnóstico de hipotiroidismo congénito en el primer nivel de atención. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica. México (2015).

18. Secretaría de Salud. Tamizaje, diagnóstico y tratamiento del paciente con hiperplasia suprarrenal congénita por deficiencia de 21 hidroxilasa. Guía de Evidencias y Recomendaciones: Guía de Práctica Clínica. México (2014).

Volume 9 Issue 4 April 2020
© All rights reserved by Alejandra Itzel Contreras Rivas and Gaston Eduardo Estudillo Jimenez.