

Evaluation of the prescription pattern of ferrous sulfate as a therapy for preventing iron deficiency anemia in infants

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Abstract

Background: Iron deficiency prevalence in infants is high. Therefore, iron supplementation has been recommended and specified as a program. This study aimed to determine the characteristics of the prescription of ferrous sulfate as a preventive therapy for iron deficiency anemia in young infants. **Methods:** We conducted a descriptive cross-sectional study of clinical records of young infants with eight visits per year. We analyzed a total of 287 records. The prescription characteristics included five criteria: prescription indication, age at prescription, dosage, periodicity, and time. These characteristics were scored as follows: 1 point when it was considered adequate and 0 when it was considered inadequate; the minimum possible score was 0, and the maximum possible score was 5 points. Statistical analysis included percentages and 95% confidence intervals (CI). **Results:** The prescription pattern of ferrous sulfate as preventive therapy in infants under one year of age was indicated in 100% of the records reviewed. All five criteria were met in 18.1% of the reviewed records (95%CI 13.6–22.6). The lowest compliance corresponded to adequate dosage (29.2%; 95%CI 23.9–34.5). Age at prescription was correct in 75.9% (95%CI 70.9–80.9); duration of prescription was correct in 44.2% (95%CI 38.4–50.0), and periodicity was proper in 31.1% (95%CI 25.9–36.7) of the files reviewed. **Conclusions:** Compliance with the prescription of ferrous sulfate as a preventive measure for anemia in infants was not as expected; interventions are needed to reverse this behavior.

Keywords: First prescription. Primary prevention. Anemia. Infant care.

Evaluación del patrón de prescripción de sulfato ferroso como terapia de prevención de anemia ferropénica en el lactante

Resumen

Introducción: Debido a que la prevalencia de deficiencia de hierro en el lactante es alta, el aporte de hierro se ha recomendado como suplemento y se ha concretado como programa. El objetivo del estudio fue determinar las características de la prescripción de sulfato ferroso como terapia de prevención de anemia ferropénica en el lactante menor. **Métodos:** Se llevó

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Date of reception: 12-04-2022

Date of acceptance: 28-06-2022

DOI: 10.24875/BMHIM.22000081

Available online: 25-11-2022

Bol Med Hosp Infant Mex. 2022;79(6):376-380

www.bmhim.com

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a cabo un estudio descriptivo con diseño transversal de expedientes clínicos de lactantes menores con ocho consultas al año. Se analizaron 287 expedientes. Las características de prescripción incluyeron cinco criterios: indicación de prescripción, edad de indicación, dosificación, periodicidad y tiempo. Se calificó con 1 punto cuando la característica se consideró adecuada y con 0 cuando se consideró inadecuada; la puntuación mínima posible fue 0 y la puntuación máxima posible de 5 puntos. El análisis estadístico incluyó porcentajes e intervalos de confianza (IC) al 95%. **Resultados:** El patrón de prescripción del sulfato ferroso como terapia preventiva en el menor de un año se encontró indicado en 100% de los expedientes revisados. Se cumplió exactamente con los cinco criterios en el 18.1% de los expedientes revisados (IC95% 13.6-22.6); el cumplimiento más bajo correspondió a la dosificación adecuada (29.2%; IC95% 23.9-34.5). La edad de inicio fue correcta en el 75.9% (IC95% 70.9-80.9); la duración de la prescripción fue correcta en el 44.2% (IC95% 38.4-50.0) y la periodicidad fue correcta en el 31.1% (IC95% 25.9-36.7) de los expedientes revisados. **Conclusiones:** El cumplimiento de la prescripción de sulfato ferroso como medida preventiva de la anemia en lactantes no fue el esperado, por lo que se requiere adoptar intervenciones para revertir este comportamiento.

Palabras clave: Primera prescripción. Prevención primaria. Anemia. Cuidado del lactante.

Introduction

The National Health Survey (ENSANUT, for its Spanish acronym) identified a 38% prevalence of iron deficiency anemia in infants under one year of age¹⁻⁴.

During the first 4 to 6 months of life, iron stores maintain the infant's developmental requirements; after this time, iron supply will depend on daily dietary intake⁵.

Although the importance of dietary intake is evident, the prescription of ferrous sulfate as preventive therapy for iron deficiency anemia is recommended in infants from 4 months of age when they are full-term newborns and from 2 months of age in preterm infants^{2,5}.

The decrease in iron reserves in the first months of life is associated with hypomyelination and alterations in the regulation and conduction of neurotransmitters [serotonin, dopamine, gamma amino butyric acid (GABA)], leading to alterations that can cause deficits in psychomotor development, cognitive alterations, and developmental delay⁶⁻¹⁶.

Faced with this situation, organized associations have proposed actions to prevent ferrous sulfate deficiency in young infants, which have been included in the Official Mexican Standard for Child Health Care NOM-031-SSA2-1999 and the Guidelines for the Care of Children^{1,9,16-24}. In addition, the Food and Drug Administration (FDA) of the United States has specified the indication, age of onset, prescription time, periodicity, and dosage of ferrous sulfate²⁵⁻³⁰. This proposal has been incorporated into daily clinical practice as a preventive action program^{20,23,24,27}.

Based on this scenario, the objective of this article was to determine the characteristics of ferrous sulfate prescription as a preventive therapy for iron deficiency anemia in clinical records of infants.

Methods

We conducted a descriptive cross-sectional study on the clinical records of infants who attended follow-up visits from January 1st to December 31st, 2019. Care was provided by 20 family physicians and four specialized nurses in a Family Medicine Unit in Mexico with ten offices for medical care and four for nursing care.

We included records of infants who had eight follow-up visits during the study year (7 and 28 days, and 2, 4, 6, 8, 10, and 12 months after birth). We excluded records of infants diagnosed with anemia who were on treatment with ferrous sulfate.

The sample size was calculated using the percentage formula for a finite population with a 95% confidence level for two zones of rejection of the null hypothesis ($Z_{\alpha} = 1.96$), assuming 95% correct prescription of ferrous sulfate ($p = 0.95$), with a margin of error of 2% ($d = 0.02$) and a total infant population of 774 ($n = 774$). The calculated sample size was 287 infant records.

The 287 files in the sample were divided into the 12 months of 2019: 24 files corresponding to each month during the first 11 months and 23 files in the last month. The 24 files were obtained from 20 family physicians and four nurses in the maternal-child area, one file per individual. We chose the first record in the physician's or nurse's productivity report.

We recorded the sex of the infant and the weeks of gestation (term, preterm). The prescription characteristics of the studied sample comprised five criteria: ferrous sulfate prescription (present, absent); the age of indication assuming as ideal before four months in term infants and before two months in preterm infants (adequate, inadequate); dosage of 10 drops orally for term infants and 15 drops orally for preterm infants (adequate, inadequate); periodicity of daily prescription

(adequate, inadequate), and prescription time of 90 days or more (adequate, inadequate). The information was scored 1 point when it was considered adequate and 0 when it was considered inadequate; the minimum possible score was 0, and the maximum was 5.

The statistical analysis included percentages and 95% confidence intervals.

The protocol was approved by the ethics and research committee of the health institution. The principal researcher accessed the electronic clinical record and reviewed the information. When the clinical history met the selection criteria, it was incorporated into the previously designed survey and printed on paper. The data was then entered into the statistical program for analysis. Forty-nine files were eliminated because they did not meet the specified criteria.

Results

Male sex predominance was observed in 52.6% (95%CI 46.8-58.4), and 94.0% (95%CI 91.3-96.8) were term newborns.

All five criteria were met precisely in 18.1% (95%CI 13.6-22.6) of the files reviewed, and one criterion was met precisely in 15.0% (95%CI 10.9-19.1) (Table 1).

Ferrous sulfate was prescribed in 100% of the files; the lowest compliance corresponded to adequate dosage in 29.2% (95%CI 23.9-34.5). Table 2 shows the percentage of compliance with the rest of the criteria.

Discussion

The prescription of ferrous sulfate is an option to prevent anemia in infants, for which its role in the individual's future health has been described. It has been documented that anemia causes hypomyelination, affecting the regulation and conduction of neurotransmitters¹⁰⁻¹². Furthermore, it is associated with impaired cognitive development when present in the first two years of life. It has also been stated that the damage can be irreversible if it exceeds the critical stage of development³¹. Given this scenario, the infant ferrous sulfate supplementation program becomes relevant and requires a permanent evaluation by the clinician and the health system management. This research is an incursion into the subject.

Studies on the prescription of ferrous sulfate to prevent or correct anemia are oriented toward evaluating the behavior of the patient³² and leave aside the study of the physician who prescribes the treatment. It should be recognized that the behavior of the patient-physician

Table 1. Compliance with ferrous sulfate prescription by criteria

Criteria	Percentage (%)	95% confidence interval	
		Lower	Upper
Indication of prescription (present)	100.0	100.0	100.0
Age upon indication (adequate)	75.9	70.9	80.9
Time of prescription (adequate)	44.2	38.4	50.0
Periodicity of prescription (adequate)	31.1	25.9	36.7
Dosage (adequate)	29.2	23.9	34.5

Table 2. Percentage by number of met criteria

Criteria met	Percentage (%)	95% confidence interval	
		Lower	Upper
Exactly 1	15.0	10.9	19.1
Exactly 2	34.5	29.0	40.0
Exactly 3	23.3	18.4	28.2
Exactly 4	9.1	5.8	12.4
Exactly 5	18.1	13.6	22.6

binomial will impact adherence to the prescription and the results obtained. The present research addresses the behavior of the prescribing physician.

The literature on this subject describes that compliance with the prescription of ferrous sulfate by health professionals is not as expected³³, as observed in this study. Two possible explanations can be considered. The first possibility is related to physicians' decisions based on their clinical criteria and the established regulations; this scenario invites ongoing updating of the regulations and the prescriber. The second possibility is the lack of recording of medical indications in the clinical record. This condition is of concern given that the clinical history is a legal document used in decision-making to regulate public policies. In turn, the indications would reflect the treating physician's behavior and conceptualization of the importance of recording the activities performed on the patient in the medical record.

Based on the information obtained from this research, it is impossible to conclude which one of the two alternatives reflects reality, which could be considered a limitation of this work. However, it should be recognized that the research was not designed to determine association but to establish the situational diagnosis of the prescriptive behavior, assuming that what is found in the clinical history is a reliable reflection of reality.

From the biochemical perspective, it has been described that a weekly intake of ferrous sulfate has the same efficacy as a daily intake. However, patient adherence to a daily intake of ferrous sulfate is poor³⁴. Regardless, our work did not analyze infants' behavior but rather that of the prescribing physician. Our results show noncompliance with the guidelines, but we do not know if this has a supporting clinical rationale or if it corresponds to a defect in prescribing behavior. This suggests the need to ponder the prescribing periodicity and, consequently, the updating of the guidelines or that of healthcare personnel.

The literature has indicated the age to initiate the prescription of ferrous sulfate in term and preterm infants. In addition, the role of hemoglobin in oxygen uptake for the development of the central nervous system has been documented. In this process, oligodendrocytes are responsible for the production of myelin. With a decrease in iron reserves in the first months of life, hypomyelination is induced, thereby affecting the regulation and conduction of neurotransmitters (serotonin, dopamine, GABA), leading to alterations in neurodevelopment. This point is of concern considering that the initiation of ferrous sulfate prescription was outside the period established as adequate in 25% of infants¹⁰⁻¹⁵.

In this research, the criteria evaluated for the preventive prescription of ferrous sulfate in infants are far from ideal, despite a regulation with academic support. The scenario is worrisome because of all the clinical implications for the infant and because it underutilizes an available and proven therapeutic resource. It has been shown that educational intervention modifies behavior and favors adequate dosing^{35,36}. Based on our findings, this could be an alternative to improve compliance with the criteria for prescribing ferrous sulfate in infants.

The first step in preventing infant anemia involves the health service, specifically the prescribing physician. The health problem will persist even if the patient fully adheres to the physician's prescription if the physician does not comply with clinically accepted guidelines.

In conclusion, as compliance with the prescription of ferrous sulfate as a preventive measure for anemia in

infants was not as expected, it is necessary to evaluate an intervention to correct this behavior.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. This study involved a retrospective review of medical records, for which approval was obtained from a formally constituted review board (Institutional Review Board or Institutional Ethics Committee).

Conflicts of interest

The authors declare no conflicts of interest.

Funding

No funding.

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