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Magnetic FB injuries: An old yet unresolved hazard

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ABSTRACT

Rationale and aim: Among foreign bodies causing injuries in children, magnets have been reported to cause serious complications and being life-threatening. The aim of this study is to design a risk profile and an epidemiological figure of such injuries, for being used for prevention.
Methods: Data on 366 injuries have been collected from public surveillance databases and from published scientific literature, and compared with the data of the Susy Safe registry, which is a pan-European registry of foreign bodies injuries co-funded by the European Commission.
Results: A median age of 48 months was observed, with a 63% prevalence of males is characterizing the injuries. Magnets have a median volume of 87.9 mm^3 vs the median volume of 41.86 mm^3 of the overall foreign bodies of the Susy Safe registry). Only 43% of the magnets were involving only on piece or objects, with a median number of two objects per injury, up to a maximum of 32 objects. Children are referred to the medical care system with a median delay of 3 days after onset of symptoms. Median length of stay in the hospital was 7 days with respect to 1 day as in the Susy Safe registry.
Conclusion: Most of complications, and event the death of a child can be eventually re-conducted to either or both a delay in patient referral or appropriate diagnosis. Thus, it is an absolute priority that an information initiative is taken toward families and emergency doctors to avoid unnecessarily delays respectively in patient referral and in diagnosis.

1. Introduction

Magnets have been widely reported in the medical literature as an emerging, life-threatening source of potential injuries, in particular for children [1,2]. Indeed, the capability to attract, often strongly, each other, has the unique potential of causing perforation, fistula and ulceration when they reach the child's gastro-intestinal tract after ingestion [3–7]. Thus, if the mechanism of causing the injury is clear enough from the medical point of view, the issue is moving now in the prevention field. Both USA and EU have a deep regulation aimed at limiting the exposure of young children to small objects, with the aim to reduce the probability of swallowing or ingestion [8].

The aim of this work is to try to use the current evidence on injuries with magnets to understand if the epidemiological and risk framework of such accidents is different, and how, from the general framework of foreign bodies injuries in the upper aero-digestive tract. To this purpose, the data on 366 injuries involving magnets are compared with the Susy Safe registry, a large, pan-European registry of foreign body injuries conducted under the EU-DGSANCO (European Commission Directorate General for Health and Consumer Affairs) funding schemes.

2. Materials and methods

2.1. Data sources

2.1.1. The MagDB

The MagDB is an acronym for "Magnet DataBase", which is a collection of a heterogeneous group of sources of information regarding foreign body injuries due to magnets in children (up to 18 years of age). Data on 366 injuries have been collected at the 20th of August, 2007, from public surveillance databases (29 from the USA data bank of the CPSC, 270 from the UK surveillance system ROSPA, 4 from the European Registry of Foreign Body Injuries "Susy Safe", 1 from the Nederland VWA) and from published scientific literature, combining, in Pubmed search, the terms "magnet*" with "foreign body", "injur*" and "accident*" [1,3,4,6,7,9–33]. To ensure comparability with the Susy Safe registry, all self-resolved injuries which were not referred to the hospital of to the general practitioner were not included in the current version of the database.

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Table 1
Distribution of children's age at time of the injuries (months).

	Mean	5th pct	10th pct	I Q	Median	III Q	90th pct	95th pct	Max
Overall									
SS non-food	57.95	13.65	22	31	47	75	118	144	178
MagDB	62.43	9	12	24	48	96	132	156	408
Ears									
SS non-food	77.36	27.3	35	48	67	104	138	150.7	178
MagDB	71.45	12.6	24	36	60	114	130.8	143.4	
Nose									
SS non-food	44.07	20	24	29	39	52	70	85.2	168
MagDB	97.47	24	31.2	48	94	144	165.6	180	408
Upper airways (choking)									
SS non-food	69.12	9	11	18	50	120	150.8	159.8	178
MagDB	56.43	9	11	18	50	120	150.8	159.8	178
Digestive tract (ingestion)									
SS non-food	48.34	8	11	23	37	65	96.6	127.6	173
MagDB	49.58	6	11	12	36	72	108	132	211

2.1.2. The Susy Safe registry

The Susy Safe [34] is a EU funded Web-based registry collected data on FB injuries in children aged 0–14 according to the International Classification Disease ICD-9 931–935. At the end of March 2007, a total of 7296 cases were registered using hospital discharge records in one Pakistani and 28 European hospitals. Data encompassed four main aspects of the FB injuries: the characteristics of the children (age and gender); the characteristics of the object (foreign body type, shape, consistency and dimensions); circumstances of injury (presence of parents, the activity the child was engaged in at the time the accident occurred); hospitalization's details (experiencing a hospitalization, presence of complications, removal technique used). With regard to the FB dimension, the volume was calculated as the volume of the smallest regular geometrical solid containing the FB.

The Susy Safe registry has been used for the purpose of comparing the distributions of some relevant characteristics of the injured child and/or of the magnetic foreign body with the foreign bodies injuries stored in the non-food section of the Susy Safe registry (counting 5467 injuries).

2.2. Statistical methods

Data have been summarized using percentiles whenever possible. Robust location measures were preferred, adopting medians as standard. Difference among two or more groups of categorical variables was compared using a Chi-square test, and among continuous variables using a Wilcoxon test.

Difference in distribution between MagDB and Susy Safe was evaluated using the relative distribution methods [35]. Graphical inspection was presented using smoothed probability density function estimates and Lorenz curves. Quantitative comparisons were presented using the entropy measure, which is a measure of the dispersion of the distribution, and the median polarization index, which provides a mean of capturing distributional polarization. Entropy measure has been decomposed in median and shape effect and the median polarization index in upper and lower polarization indexes, representing the contributions made by components above and below median of the relative distribution of MagDB vs Susy Safe. All computations have been performed with the R system [36].

3. Results

3.1. Child characteristics

Injuries occurred at a median age of 48 months. Twenty-five percent of the injuries were involving children younger than 24 months (Table 1). Median age was higher for injuries in the upper airways (choking) and in particular in the ears and nose. Ingested foreign bodies characterized younger children with a higher median age of 36 months.

The distribution of injuries according to age is quite different from that of the Susy Safe registry. Indeed, even though the median age is almost the same in the two databases, the shape of the distribution is changing quite impressively toward the involvement of younger children (Fig. 1), with the Lorenz curve being always below that of the Susy Safe registry (Fig. 2). Indeed, as proven by the analysis of several entropy measures, the 97.6% of the difference in age between the injuries involving magnets and those of the Susy Safe registry are attributable to a modification in shape (Fig. 3 and Table 2).

Percentage of injuries involving females is definitely lower in MagDB than in the Susy Safe registry (37% vs 45%), and, conversely, the incidence of cases reported regarding males is higher (63% vs 55%). This might be attributable to the higher number of accidents involving magnetic building sets toys, perhaps more attractive to males. Incidence is higher in males older than 36 months (68% in MagDB vs 57% in Susy Safe registry) whereas in children younger than 36 moths gender distribution is not different among MagDB and the Susy Safe registry.

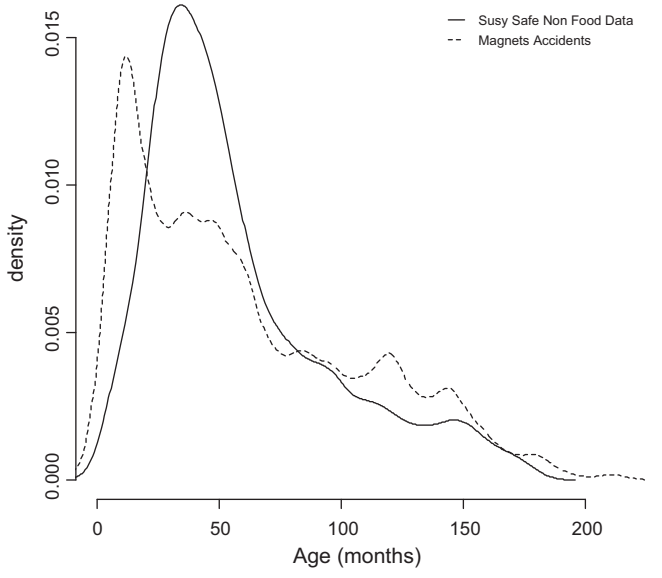

Fig. 1. Distribution of children's age at time of injury in the Susy Safe Database and in the MagDB.