ARTICLE

Characterization of Diaper Dermatitis in the United States

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Background: Diaper dermatitis is the most common dermatologic disorder of infancy. This study evaluates the frequency of outpatient visits resulting in this diagnosis, specialties of physicians providing services, demographics of patients, and leading agents used in treatment.

Design: Records of 272841 encounters from the National Ambulatory Medical Care Survey (1990-1997) were examined for visits in which diaper dermatitis was diagnosed in children. The likelihood of diagnosis in the general pediatric population was calculated and the leading treatment agents were ranked.

Results: There were approximately 8.2 million visits in which diaper dermatitis was diagnosed. For the pediatric population in the at-risk age range, there was a 1 in 4 likelihood of being diagnosed with the skin disorder. Pediatricians provided 75% of services for the treatment of diaper dermatitis; the demographics of patients were similar to those of comparably aged individuals in the general population. Nystatin was the leading treatment agent prescribed (27% of visits), followed by clotrimazole (16%), a combination product of nystatin and triamcinolone (16%), hydrocortisone (8%), and a combination product of clotrimazole and betamethasone dipropionate (6%).

Conclusions: Visits for diaper dermatitis are frequent, and pediatricians are the physicians most often called on to provide treatment. No portion of the pediatric population is disproportionately diagnosed. The frequent use of potent corticosteroids contained in combination agents is a potential target for improving the management of diaper dermatitis.

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DIAPER DERMATITIS is a broad term used to describe an acute inflammatory skin reaction in the diaper area. It is the most common dermatologic disorder of infancy,[1] resulting in a large number of visits to physicians each year. The prevalence in infants has been estimated to be 7% to 35%,[2] with a peak in incidence between ages 9 and 12 months.[3] Recently however, a large-scale study in Great Britain demonstrated an incidence of 25% in the first 4 weeks of life alone.[4] This skin disorder is certainly not limited to infants and can occur in persons of any age who wear diapers.[5] In fact, although the incidence of diaper dermatitis in adults is unknown, it is likely quite high, given that 13 million American adults suffer from urinary incontinence, and adult diaper sales exceeded $1.5 billion in 1996.[6]

Diaper dermatitis is a geographic diagnosis, encompassing a range of dermatoses of various causes.[7] In most cases, it is thought to be a reaction to irritants in the diaper environment, such as friction, occlusion, dampness, maceration, urine, feces, or chemicals.[8-12] There has also been an association with bottle-feeding, maturity of the infant, and intestinal carriage of *Candida albicans*.[3] Treatment usually involves increasing the frequency of diaper changes, using superabsorbent disposable diapers, and applying topical agents such as corticosteroids and barrier ointments or creams.[8] When secondary *C albicans* infection is present, a topical antifungal agent is beneficial.[9]

The purpose of this study is to characterize diaper dermatitis in US children with respect to frequency of office visits, specialties of physicians providing treatment, demographics of patients, and therapy prescribed. We specifically attempt to evaluate the appropriateness of treatment and the potency of topical corticosteroids when these medications are prescribed.

MATERIALS AND METHODS

Each year, the National Ambulatory Medical Care Survey (NAMCS) is conducted by the National Center for Health Statistics. Extensive data are collected in an ongoing effort to characterize outpatient physician services in the United States. The sampling is limited to non–federally employed physicians principally engaged in outpatient care activities. The multistage probability in sampling design is stratified by primary sampling unit (county, contiguous counties, or standard metropolitan statistical area), then by physician practices within the sampling unit, and finally by patient visits within the 52 weekly randomized periods. Within small practices, a 100% sample of 1 week's visit was possible. For very large practices, 20% of patient visits were randomly sampled. The resulting national estimates describe the use of ambulatory care services in the United States.[13]

The study interval of 1990 to 1997 was chosen because these were the most recent data available. A total of 272841 records collected from 1990 to 1997 are representative of the more than 5.68 billion outpatient physician visits in the United States during this period. For each visit sampled, a 1-page patient log was completed that included demographic data, reason for visits, physicians' diagnoses, services provided, and referral practices. For normalization with national estimates, each individual record was assigned an inflation factor called the patient visit weight, which was then used to predict the total number of office visits made in the United States. All estimates from the NAMCS are related to the number of patient visits and are subject to sampling variability. The relative SE is used to measure the sampling variability. Representative relative SEs for the 1990 NAMCS are as follows: 8% for estimates of 10 million visits, 22.4% for estimates of 1 million visits, 31.5% for estimates of 500000 visits, and 69.7% for estimates of 100000 visits.[13] Relative SE rates from other years are similar to these and can be obtained from National Center for Health Statistics published information. When considering the reliability of estimates, the National Center for Health Statistics considers an estimate to be reliable if it has a relative SE of 30% or less of the estimate.[13]

In this study, the NAMCS data were reviewed for all visits in which the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*)[14] code for diaper dermatitis (691.0) was designated as the primary, secondary, or tertiary diagnosis. To capture other diaper dermatitis visits that were not diagnosed with *ICD-9-CM* code 691.0, we also examined visits for diagnoses including balanitis (112.1), vulvovaginitis (112.2), intertrigo (112.3), and candidiasis of an unspecified site (112.9). An age limit of less than or equal to 4 years was used to eliminate visits from older patients in which these diagnoses would not be related to diaper dermatitis.

The number of births from 1990 to 1997 was obtained,[15] and this population was designated as the population at risk for diaper dermatitis during the period when the NAMCS data were gathered. The total number of outpatient office visits in which diaper dermatitis was diagnosed was divided by the number of children in the at-risk population to obtain the risk that a child in the United States would be diagnosed with diaper dermatitis in an outpatient visit.

The frequency of mentions of primary, secondary, and tertiary drugs for each diagnosis was determined. Trade-name drugs were converted to their generic equivalent, and drugs with different trade names but the same generic equivalent were grouped into 1 generic group. All data management and analysis was performed with Statistical Analysis System software, version 6.12 (SAS Institute, Cary, NC).

RESULTS

Using the most restrictive classification of diaper dermatitis (691.0), there were an estimated 4.8 million outpatient visits from 1990 to 1997 (approximately 600000 per year). When we incorporated the additional *ICD-9-CM* codes for balanitis (112.1), vulvovaginitis (112.2), intertrigo (112.3), and candidiasis of an unspecified site (112.9), there were an estimated total of 8.2 million outpatient visits (approximately 1.0 million per year). Children born during these years had a risk of 1 in 4 (25%) of being diagnosed with diaper dermatitis. Of the visits, 75% were to pediatricians, whereas 20%, 2.4%, 1.6%, and 1.4% were to family physicians, internists, dermatologists, and other specialists, respectively. Patients were 51% male and 49% female. The racial distribution was as follows: 82.0% white, 12% black, 4.7% Asian/Pacific Islander, and 0.8% American Indian/Eskimo/Aleut. The ethnicity distribution was 79% non-Hispanic and 16.4% Hispanic. In 91.5% of the visits, patients were younger than 2 years (60.3% were aged <1 year). The remaining 8.6% were between 2 and 4 years of age.

Nystatin, prescribed in 27% of the visits, was the leading agent used to treat diaper dermatitis. Other leading agents included clotrimazole (16%), a combination product of nystatin and triamcinolone (16%), hydrocortisone (8%), and a combination product of clotrimazole and betamethasone dipropionate (6%) (**Table**).

COMMENT

Diaper dermatitis, with our broadest inclusion criteria, is diagnosed in more than a million office visits per year in the United States. Many additional cases are likely never called to the attention of a physician, since fewer than 10% of episodes are specifically referred for treatment.[3] The estimate that 25% of at-risk children are diagnosed assumes that each child can only be diagnosed once, but remains an indicator that the frequency of diaper dermatitis in infants and young children is substantial. The skin disorder generates discomfort for the child, concern in the parents, and a large number of physician visits.

According to the NAMCS data, pediatricians and family physicians provide more than 90% of physician services for patients with diaper dermatitis; very few visits were to dermatologists. This pattern of care is in contrast to that provided for many other cutaneous conditions for which dermatologists have greater experience in diagnosis and treatment. In the era of managed care, patients are less likely to see dermatologists for skin prob-

lems,[16] and studies have demonstrated that approximately 60% of patients with dermatologic complaints are seen by nondermatologists.[17] These observations, coupled with the fact that diaper dermatitis is a disorder that requires an accurate etiologic assessment, underscore the importance of dermatologic education in the training of primary care physicians.

Population statistics reveal that for US children aged 4 years or younger, the racial distribution in 1997 was as follows: 79.3% white, 15.1% black, 4.5% Asian/Pacific Islander, and 1% American Indian/Eskimo/Aleut. The ethnicity distribution was 17.4% Hispanic and 82.6% non-Hispanic. Of this population, 51% were male and 49% female.[18] When these statistics for the general population are compared with the demographics of those diagnosed with diaper dermatitis in our study, the data are strikingly similar. Although previous data on US children have shown significant racial and ethnic differences in health and the use of physician services,[19] our study suggests that for diaper dermatitis, males and females, all races, and Hispanics and non-Hispanics are nearly proportionately diagnosed in outpatient visits.

Nystatin was by far the leading agent used to treat diaper dermatitis. This agent has been used for nearly 50 years for the treatment of candidal infections,[20] and has been shown to be safe and effective in the treatment of cutaneous candidiasis in infants.[21] Furthermore, *C albicans* is rarely recovered in infants without diaper rash, but is found in 41% to 77% of infants with diaper dermatitis.[22,23] Therefore, the use of this agent in the treatment of diaper dermatitis is certainly appropriate. Clotrimazole, which ranked second, has also been shown to be effective in the treatment of candidal skin infections,[24] and has been curative in dermatomycoses resistant to nystatin and other antifungal therapies.[25]

Low-potency topical corticosteroids, such as hydrocortisone and hydrocortisone acetate, are generally safe in children when used in moderation, and are commonly recommended in the treatment of moderate to severe diaper dermatitis.[26] However, the findings of this study indicate that combination agents containing mid- to high-potency halogenated topical corticosteroids are being used to treat diaper dermatitis. The combination products containing nystatin and triamcinolone (Mycolog; Bristol-Myers Squibb, Wallingford, Conn; and Mytrex; Savage Laboratories, Melville, NY) were ranked third overall, and the combination product containing clotrimazole and betamethasone dipropionate (Lotrisone; Key Pharmaceuticals, Kenilworth, NJ) was fifth. Together, these combination agents were ranked the second most common group of agents used, and this finding should be cause for concern. The absorption of topical corticosteroids is significantly increased in areas of thin skin,[27] and the potential for atrophy in the groin must be considered. In 1963, Epstein et al[28] described 5 patients who developed inguinal atrophic striae after using a combination product of nystatin and triamcinolone (Mycolog) to treat intertrigo. Additionally, children have a larger skin surface area to body weight ratio, thereby increasing the likelihood of topical corticosteroids causing significant systemic effects such as Cushing syndrome and hypothalamic-pituitary axis suppression.[29,30] The manufacturer of a combination product of clotrimazole and betamethasone dipropionate (Lotrisone) explicitly states that this agent should not be used in diaper dermatitis or where occlusive dressings are worn, and that its safety has not been established in children younger than 12 years.[29] Similar precautions are warranted for the combination of nystatin and triamcinolone because it contains a mid-potency corticosteroid. Approximately 56% of clotrimazole–betamethasone dipropionate prescriptions are for children aged 0 to 4 years.[31] In view of this, overuse of combination agents may provide a target for improving the management of diaper dermatitis.

Leading Agents Used to Treat Diaper Dermatitis

Rank	Agent	No. of Drug Mentions (in Thousands)	Percentage of Visits in Which the Agent Was Used
1	Nystatin	2230	27
2	Clotrimazole	1346	16
3	Nystatin-triamcinolone	1303	16
4	Hydrocortisone	679	8.3
5	Clotrimazole–betamethasone dipropionate	504	6.2
6	Ketoconazole	324	4.0
7	Triamcinolone	173	2.1
8	Zinc oxide	168	2.1
9	Miconazole	138	1.7
10	Triple antibiotic	131	1.6

The sole agents specifically indicated for diaper dermatitis are over-the-counter skin protectant barriers, which have long been one of the mainstays of therapy. Barrier products contain active ingredients such as zinc oxide, petrolatum, cod liver oil, dimethicone, or lanolin. Topical zinc oxide, one of the top 10 therapies according to this study, provides a water-impermeable barrier that reduces friction and maceration. The Federal Register states that skin protectant products such as this one help by "protecting the skin, acting as a physical barrier to irritants, and absorbing or adsorbing moisture."[32] Additionally, studies have demonstrated the ability of topical zinc oxide to enhance healing in skin.[33,34] This skin protectant is effective for prophylaxis or treatment of mild diaper dermatitis, but when the involved skin is more severely affected, an antifungal agent and low-potency topical corticosteroid such as hydrocortisone may be used as well.[24] However, as previously discussed, current antifungal-corticosteroid combination preparations contain potent, halogenated corticosteroids that are contraindicated for use in diaper dermatitis. Novel agents that provide protective, antifungal, and anti-inflammatory properties would be a valuable addition.

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