Chemical burn injury on a 17-month-old female

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The case

A 17-month-old female presented with a chemical burn injury to the chest. During the initial history, mother stated the 2-year-old sister sprayed a pH neutral cleaning solution, Bona, on the sister's chest. The story changed the next day. Was this case accidental or nonaccidental?

A previously healthy 17 month-old female presented to the emergency department (ED) with large burns on the chest that were believed to have occurred 1 day prior to admission. As per mother, the patient was at the babysitter's house the previous day. Mother remarks the patient was in her normal state of health that evening upon leaving the babysitter's home and had put the patient to bed without changing her clothes. The next morning, mom stated that the patient had felt warm, but no temperature was taken. When she changed the patient's clothes, she then noticed burns on her chest. The mother reported she was unsure how the burn occurred, as the injury was unwitnessed. However, the patient's mother reports she assumed the patient's 2 year-old sibling sprayed the child with Bona cleaner the day prior at the babysitter's home, as the substance was found on the couch where the children had been playing. Mother reports no one had noticed a wet T-shirt on the patient, but the shirt was made of dry-fit material, so she assumed it must have dried quickly or not appeared wet.

During the ED visit, it was explained to the mother that the Bona cleaner has a neutral pH and would not cause a severe chemical burn. Father then visited the babysitter's house and found another cleaner, Iron Out Liquid, which has a pH of <1.

The babysitter is the patient's maternal great-aunt and babysits the patient 3 days a week while mom is at work. There are 8 other children in the babysitter's home (ages 3-15 years) including the patient's 2-year-old sister. Mother and father are married and live at home with the patient and her sister. Prior to this incident, there was no previous child protective service (CPS) reported case or previous injuries to the patient. The patient's sister had a broken hand 2 months prior to this incident which in itself is a red flag for abuse however, there was no CPS report filed. Mother reports the injury occurred, when the patient's sister attempted to climb a bookshelf that fell on her hand.
Of note, developmentally, the patient started walking around 12 months of age and is currently attempting to climb.

Differential diagnoses:

Accidental Chemical Burn	Non-Accidental Trauma

Hospital course:

In the ED, patient was febrile and tachycardic on arrival. Patient's workup showed an increased white blood cell count (25.9) with mildly elevated C-reactive protein (10.9). Patient received Rocephin x1, Vancomycin x1, Tylenol x1, Motrin x1, and NS bolus x1. Plastics, social services, CPS, and child abuse/neglect specialists were consulted. After initial evaluation by plastic surgery, patient was noted to have partial thickness burns, requiring overnight observation. Patient's mother was given the option for transfer to a pediatric burn center but wished to stay in the state for care for family support. Patient was therefore admitted to pediatric service for wound care, fluid and pain management.

Initially on physical exam, this patient had a rectangular shaped burn lesion (5-6% total body surface area) present on the upper chest wall ~12x6cm in size with surrounding erythema present with fluid filled blisters. Additionally, a burn lesion was present on the inner part of left axilla, ~5x2cm with surrounding erythema and fluid filled blisters. As per the plastic surgery's note, the wound depth was indeterminate at this point as seen in figure 1.

Upon admission to pediatric inpatient service, patient was placed on antibiotics (Clindamycin) and pain control medications. The day following admission, plastic surgery reevaluated the patient's wound and felt it had further progressed to full thickness burns, which would likely require skin grafting as seen in figure 2 and 3. Mother was again given the option for transfer to a pediatric burn center given the progression of the wound and elected to transfer. Additionally, as per the child abuse pediatrician, a skeletal survey was completed prior to transfer which showed no abnormalities. As this was an unwitnessed event and the injury pattern was noted to be irregular, this was diagnosed as suspected child maltreatment.

Upon review of transferring facilities records, patient underwent wound debridement and dermal substrate (Primatrix) placement the day after arrival. She was continued on antibiotics (Clindamycin) and also IV fluids until her hydration improved. Child was then discharged after 3 days of admission. Burn team kept update on the patient via tele-med photos. Patient then followed up with her pediatrician with no further complications. Patient continues to be under the care of her parents.

Discussion:

Nonaccidental burns constitute about 5.8-20% of child abuse and neglect cases.[1-4] Among these, the most common type of burn is usually due to scalds whereas chemical burns are rare in comparison, 0.6%.[1-7] Additionally, chemical burns usually present via injury to the oral tract due

to ingestion of corrosive agents as opposed to dermatologic.[4] Literature is limited on non-accidental chemical burns due to their low incidence. Due to this, our case presents an important demographic that requires further reporting.

In addition to the rare nature of the burn, the initial presentation of the patient is also important for review. As seen in **Figure 1**, the burns were partial thickness and were not thought to require skin grafting by plastic surgery. However, the patient was diagnosed with full thickness burns as seen in **Figures 2** and **3** on day 2 of admission. Literature shows, burns are difficult to analyze in their beginning stages as skin necrosis can take several days to occur.[7] Partial thickness or second degree burns that meet a certain criterion can usually be cared for in an outpatient setting.[7] However, when there are concerns for chemical burns or suspected child abuse as in this patient, these children should be transferred to a burn center for focused care.[7] Literature has shown that transferring children to high volume pediatric burn centers reduces mortality and decreases financial burden due to specialized expertise.[8]

There are many risk factors to take into account when considering burns concerning for child abuse. One of the main risk factors include younger children aged from 0-6, which fits our patient's demographic.[1-7] This age group is more likely to be injured in an intentional manner especially patients that are non-mobile or toilet training.[4-5] Furthermore, as with other forms of child abuse, males are more likely to face this type of trauma vs females.[1-4] Low socioeconomic status, poor educational levels, non-Hispanic African Americans, patient's on public insurance, and history of abuse in the family were other risk factors which contribute to higher levels of non-accidental burns.[2-3,5-6]

Suspicions of child abuse should be raised when the history does not corroborate with the injury or when blame is placed on the sibling as seen in our case.[3,5] Concern was raised as the patient's mother changed the narrative of the injury after discovery that the Bona cleaner could not cause a chemical burn. Mother also blamed the 2-year-old sibling, despite the injury being unwitnessed. As per a child abuse specialist that was consulted, the patient was likely lying down when the injury occurred due to the distribution of the burn: smaller lesions noted in the axilla versus the abdomen or lower chest.

When a young patient presents with a burn, it should concern for other forms of physical abuse.[5] The American Academy of Pediatrics recommends a skeletal survey if the child is less than 2 years of age if abuse is a concern.[5,9] Pawlick et al found 14-16% of occult injuries in burn patients.[5] Our patient's skeletal survey presented with no abnormalities. Despite the findings in this case, skeletal surveys are an important study to consider when investigating a case of abuse in children less than 2 years of age.

Treatment for cases of burns varies upon depth and symptoms.[7] As mentioned previously, if criteria are met, second degree burns can be taken care of in an outpatient setting between a burn center and the primary care physician.[7] If burns are extensive in depth, affect certain areas of the body (face, hands, feet, genitalia, perineum, and major joints), or there is concern for other

injuries and abuse, patients should be transferred, as was done in our patient after agreement from the patient's mother.[7]

Conclusion:

Burns are an important cause of nonaccidental injuries in children. Important risk factors to take into account when considering nonaccidental burn is the history of the incident in addition to the age and development of the child. They can initially present as partial thickness and rapidly progress to a full thickness burn requiring further treatment. Due to this, it is critical to assess the burns and transfer the patient to a burn center to prevent delay in treatment.

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