

ORIGINAL ARTICLE

Respiratory and gastrointestinal complications of caustic ingestion in children

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Objectives: To determine circumstances surrounding the ingestion of caustic substances, the incidence of respiratory and gastrointestinal symptoms at presentation, and the degree of investigation and active treatment during hospitalisation. Long term respiratory and gastrointestinal sequelae were also studied.

Design: Retrospective case note study covering a 10 year period.

Setting: Tertiary children's hospital.

Patients: Children and adolescents presenting following caustic ingestions to the Royal Children's Hospital, Melbourne.

Main outcome measures: Requirement for interventional oesophagoscopy/bronchoscopy, respiratory support or admission to intensive care, and long term gastrointestinal or respiratory sequelae noted.

Results: Thirty two cases of caustic ingestion were identified in 31 patients (median age 2.6 years; 78% boys). The average time in hospital was 2 days. Two patients (6%) required intensive care nursing, and both required intubation with mechanical ventilation (average 33 hours). Thirty patients (97%) underwent diagnostic oesophagoscopy, and two underwent laryngoscopy or bronchoscopy for visualisation of the upper airway. No patient had long term respiratory consequences. Two patients (6%) sustained significant oesophageal injuries requiring interventional oesophagoscopy.

Conclusions: Caustic ingestion is overrepresented in boys. Most ingestions involve household cleaning products. Symptoms on admission do not usually require intensive care admission. Gastrointestinal symptoms predominate at presentation, however, these are usually mild. Respiratory symptoms are uncommon and respiratory involvement requiring intervention is rare, although the presence of respiratory symptoms should be viewed as potentially serious. Long term sequelae of caustic ingestion are rare and in this series only affected the gastrointestinal tract. The indications for diagnostic endoscopy need further evaluation.

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Ingestion of caustic agents by children is an uncommon but potentially serious event. Corrosive agents present in household materials such as dishwashing powders are damaging to mucosal surfaces. The mucosal surfaces of the upper airway and gastrointestinal tract are most likely to come in contact with such agents. We hypothesised that upper respiratory consequences of caustic ingestion were uncommon and therefore we decided to examine our hospital's experience with caustic ingestion. We aimed to describe:

- the epidemiological presentation of caustic ingestions to the Emergency Department
- the spectrum of symptoms present immediately following ingestion
- the level of medical support required following ingestion
- the requirement for and findings of investigations such as oesophagoscopy and bronchoscopy
- the long term consequences of caustic ingestion in children.

METHODS

We conducted a retrospective case note study, using the computerised discharge coding system for all cases of caustic ingestion attending the Royal Children's Hospital, Melbourne. A caustic agent was defined as any substance capable of burning or corroding tissue by chemical action. We examined records from 1993 to 2003 of patients up to and including the age of 18 years and reviewed the medical files

of all cases. Files were reviewed using free hand interpretation of free hand files. Caustic ingestions were confirmed by patient or parental history and clinical examination. We retrieved the patients' epidemiological data including age at presentation, sex, and the agent ingested (see table 1, Results), and recorded the symptoms and signs of respiratory and gastrointestinal involvement (see table 2, Results) and any requirement for ventilatory support (oxygen therapy, intubation, and mechanical ventilation).

We recorded the findings of all procedures including chest x rays, barium swallow, oesophagoscopy, and bronchoscopy. Any underlying pre-existing medical condition which has a direct influence on oropharyngeal clearance mechanisms or respiratory function—for example, cerebral palsy or asthma, was also noted. We also recorded the requirement for further or repeat investigations at follow up as well as any residual difficulty with upper airway or oesophageal function.

RESULTS

A total of 32 episodes of caustic ingestion were identified in 31 (78% (24/31) boys) patients. The median age was 2.6 years (range 11 months to 18 years) (table 1). Three cases involved adolescents, all of which were deliberate self-harm attempts. Two patients had underlying asthma. None of the patients had cerebral palsy or significant learning difficulties.

The commonest agents involved were dishwashing tablets/powder (31%) and household bleach (18%) (see table 1). The commonest symptoms were drooling of saliva and oropharyngeal ulceration (present in 62% of cases) (table 2). Signs and symptoms suggestive of airway involvement such as stridor, wheeze, and oxygen requirement were rare. However,

Table 1 Details of ingested material, and age and sex of patients

Ingested material	Number*	Boys: girls	Median age (months)
Ammonia based household disinfectant	3	3:0	32
Dishwasher powder	10	8:2	20
Caustic soda granules	5	5:0	59
Household bleach	6	3:3	15
Sterilising tablets	1	1:0	35
Oven cleaner	1	0:1	28
Potassium hydroxide based cleaner	2	2:0	116.5
Paint thinner	1	1:0	15
Industrial cleaning agent	3	2:1	90
Total	32	25:7	31 (range 11 months to 18.6 years)

*The total number of ingestion episodes was 32, however only 31 patients presented as one child had two episodes of ingestion.

these symptoms were associated with severe airway involvement. Two patients (6%) required intubation and mechanical ventilation for respiratory distress. These were the only patients who developed stridor and required oxygen. Wheeze and tachypnoea were also unusual signs (two patients each) and were also associated with the need for intubation (table 2). One patient with asthma required intubation, however, this was for stridor rather than asthma. The average length of time of intubation and mechanical ventilation was 33 hours (19 hours and 48 hours, respectively). The patients requiring oxygen therapy and intubation involved ingestion of ammonia and paint thinner. The average length of stay in hospital was two days. Systemic steroids were administered to two patients, both of whom were intubated.

Thirty patients (97%) had oesophagoscopy on the day following ingestion (within 24 hours of ingestion); 64% of patients (20/31) had mucosal swelling and ulceration in the oropharynx. Oesophageal involvement was present in 45% of patients (14/31), of whom 23% (3/14) had severe ulceration of the oesophagus and 77% (11/14) had superficial inflammation. None of the patients underwent barium swallow. The subglottic area was examined by bronchoscopy in one patient. Direct laryngoscopy was performed in one patient. The findings included lower pharyngeal, epiglottic, and subglottic oedema and both patients required intubation. Chest x rays were taken in four patients (13%). All were normal except one that revealed lobar collapse following intubation.

Of 31 patients, 58% (18/31) were seen for follow up at the hospital; the other 42% (13/31) were not followed up by the

hospital team as their initial oesophagoscopy was either normal or clinically insignificant although all patients records were available for review (fig 1). Children were seen on average two weeks after the ingestion episode and further follow up determined on clinical findings. This ranged from no further follow up to three years' follow up. None of the patients was documented as having experienced long term respiratory sequelae. Two patients reported long term sequelae related to gastrointestinal dysfunction. Both had residual oesophageal strictures requiring multiple dilatations. In both patients the first oesophagoscopy had revealed severe ulceration. Of the patients who experienced long term gastrointestinal complications one had accidentally ingested an industrial ammonia based cleaning solution and the other had ingested caustic agents on two separate occasions (both times dishwasher powder) within one month (deliberate self-harm attempts).

DISCUSSION

This report documents 32 cases of caustic ingestion in children. There is a heavy preponderance of young infants and boys in this study as well as ingestion of common household agents. Although this may reflect the commonest environmental site for children of this age it reinforces the safety messages concerning the correct storage of these dangerous agents, out of reach of young children.

The routine use of endoscopy following caustic ingestions is a matter of some debate.¹ In the present series all but one of the patients underwent oesophagoscopy within 24 hours of admission. Although oesophageal involvement was identified in nearly 50% of cases this was usually mild. Despite almost all the children in this study undergoing oesophagoscopy, the therapy was adjusted on the basis of these findings in only two patients (6%), and in both these cases the circumstances surrounding ingestion were unusual (ingestion of industrial cleaner and multiple ingestions). In the patients requiring intervention severe oesophageal injury was present from the outset. None of the patients with minor oesophagoscopy findings later developed clinical oesophageal problems, and none of those who had ingested simple household cleaning agents developed significant oesophageal injuries requiring intervention. This suggests that a more targeted use of endoscopy may be possible, and it is in keeping with findings in other studies.^{2,3} Given the relatively small number of patients and the retrospective nature of this study we were unable to determine specific consistent factors that would allow for accurate risk stratification.

Respiratory complications of caustic ingestions have been described before⁴ but usually in the setting of the individual case report.⁵ In common with these reports significant respiratory symptoms and signs were uncommon at presentation

Table 2 Presenting clinical symptoms and signs

Presenting symptoms and clinical signs	No of episodes (n = 32)	Pre-existing asthma (n = 2)	Patients with significant airway involvement requiring intubation (n = 2) v total number with signs/symptoms (%)
Stridor	2	1*	2/2 (100)
Cough	5	1	1/5 (20)
Drooling of saliva	20	2	1/20 (5)
Shortness of breath	3	1	1/3 (33)
Vomiting	18	2	2/18 (11)
Swollen lips	14	–	1/14 (7)
Ulceration of oral mucosa	20	–	1/20 (5)
Wheeze	1	–	1/1 (100)
Tachypnoea	2	1*	1/2 (50)
Supplemental oxygen requirement	2	1*	2/2 (100)

*One patient with asthma required intubation.

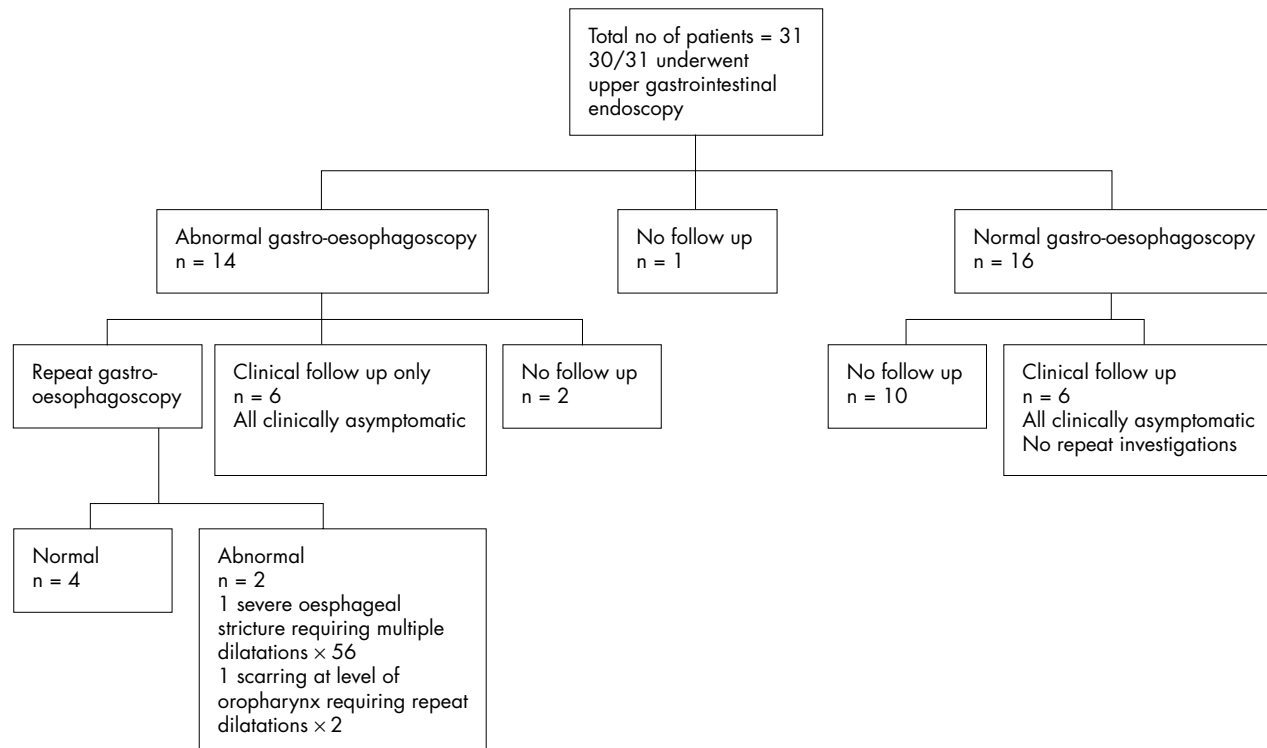


Figure 1 Follow up of patients seen in the emergency department following caustic ingestion.

in the current study. Only two of the children (6%) in our study required intubation for respiratory distress. The agents ingested varied. Both patients had prominent signs of respiratory involvement, including stridor and oxygen requirement, early in their presentation. This is in keeping with earlier studies.⁶ Both patients were admitted to intensive care on arrival at hospital. None of the patients was admitted to a general ward for observation and subsequently worsened requiring intensive care treatment. These findings suggest that any patient presenting with respiratory symptoms should be nursed in a high dependency setting with access to advanced airway support at least in the initial stage of their presentation.

That only a few cases of caustic ingestion required interventional respiratory support suggests that the protection afforded by the pharyngeal glottic mechanism to the lower airway is extremely efficient. Mucosal damage to the superior surface of the epiglottis from this study does not appear to produce severe respiratory compromise in the majority of cases. In both the patients requiring intubation the duration of mechanical ventilation was short (<48 hours) and chest x rays were normal, suggesting that either the agents are not overly toxic to the lower airway or, more likely, that the upper airway is effective in limiting the amount of caustic agent that reaches the lower airway.

In summary, ingestion of caustic substances by children occurs disproportionately in young boys and usually involve household cleaning substances. Gastrointestinal symptoms

are common but significant gastrointestinal injury is not. There is potential to refine the indications for endoscopy. Respiratory symptoms are uncommon, however, the presence of these symptoms may indicate the development of airway obstruction requiring intervention and should be taken seriously.

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