Aspiration pneumonitis in an overdose population: Frequency, predictors, and outcomes

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Objective: **To characterize the frequency of aspiration pneumonitis in an unselected population of overdose patients and, further, to identify factors that predispose to aspiration pneumonitis and the outcomes of patients with aspiration pneumonitis compared with those without.**

Design: **Retrospective cohort study.**

Setting: **Toxicology unit of a tertiary referral hospital.**

Patients: **All poisoning admissions.**

Measurements and Main Results: **A total of 71 of 4,562 poisoning admissions to the Hunter Area Toxicology Service between January 1997 and October 2002 had definite aspiration pneumonitis (1.6%; 95% confidence interval, 1.2–2.0). Older age, Glasgow Coma Score of <15, spontaneous emesis, seizures, delayed presentation to hospital, and ingestion of tricyclic antidepressants were associated with an increased risk of aspiration pneumonitis. Paracetamol poisoning and female sex were associated with a decreased risk of aspiration pneumonitis with univariate analysis. Ingestion of alcohol, benzodiazepines, antipsychotics, and administration of activated charcoal were not associated with aspiration pneumonitis. A logistic regression model for predicting aspiration pneumonitis contained seven predictors: age, sex, Glasgow Coma Score of <15 (odds ratio, 3.14; 95% confidence interval, 1.87–5.27), emesis (odds ratio, 4.17; 95% confidence interval, 2.44–7.13), seizure, tricyclic antidepressant ingestion, and time from ingestion to presentation (delay of >24 hrs [odds ratio, 4.42; 95% confidence interval, 2.42–8.10]). The mortality for patients with aspiration pneumonitis was 8.5% compared with 0.4% for those without (odds ratio, 23; 95% confidence interval, 9–60; $p < .0001$), and they had a significantly higher intensive care unit admission rate. The median length of stay of patients with aspiration pneumonitis was 126 hrs (interquartile range, 62–210 hrs) compared with 14.7 hrs (interquartile range, 7–23 hrs) in patients without ($p < .0001$).**

Conclusions: **Our study has shown a number of risk factors in overdose patients that are associated with aspiration pneumonitis that may allow the early identification of these patients for appropriate observation and management. Patients with aspiration pneumonitis have a significantly increased mortality and length of stay in the hospital. (Crit Care Med 2004; 32:88–93)**

KEY WORDS: aspiration; intensive care; critical care; overdose; poisoning; antibiotic; aspiration pneumonia; Glasgow Coma Score; unconsciousness

Aspiration pneumonitis and aspiration pneumonia are associated with significant morbidity and mortality, but despite this, they are poorly characterized in most at-risk populations (1–3). Aspiration pneumonitis is a chemical injury to the lung parenchyma by the acid contents of the stomach (4). Bacterial colonization and sepsis are uncommon sequelae, although in severe cases they may occur. Aspiration pneumonitis most commonly occurs in patients with a decreased level of consciousness (1, 4). In contrast, aspiration pneumonia differs in being a bacterial infection of the lung resulting from oral flora being aspirated. It occurs in a different patient group of mainly elderly patients with dysphagia or gastric dysmotility (4). Although the distinction is somewhat arbitrary, there are clearly different population groups at risk of the two potential aspiration-induced lung diseases (4). It is important to examine these two conditions separately so that the prognosis and treatment of at-risk populations are better defined. Leroy et al. (1) previously looked at predictors of illness and outcome in patients with community-acquired aspiration pneumonia. Because of the small numbers in the study, they were unable to do this for separate populations.

Previously, it has been shown that drug overdose is a common cause of aspiration, ranging from 29% to 50% of patients in three studies conducted in intensive care units (ICUs) (1–3). These studies included all patients with aspiration and did not distinguish between pneumonitis and pneumonia. They do not provide information on risk factors or prognosis of aspiration pneumonitis for overdose patients. Other risk factors for aspiration pneumonitis include acute cerebrovascular accident, seizure disorder, coma secondary to trauma, and general anesthesia, in which the major predisposing factor is a decreased level of consciousness (4, 5).

There are few studies of aspiration in overdose patients (6), and most focus on the risk of aspiration with decontamination (7–11) and did not investigate other risk factors. One study of 224 patients admitted to a toxicological ICU showed a relationship between decreasing Glasgow Coma Score (GCS) and risk of aspiration (6) and that not only was there an increased frequency of aspiration with a GCS of ≤8 but also with a GCS of <15 (6). Case reports of significant aspiration after decontamination with activated

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charcoal indicate the significant morbidity and mortality that occurs (12–15).

The objective of this study was to characterize the frequency of aspiration pneumonitis in an unselected population of overdose patients presenting to a single toxicology unit and, further, to identify factors that predispose to aspiration pneumonitis and the outcomes associated with aspiration pneumonitis. In line with previous definitions, we will refer throughout to the condition as aspiration pneumonitis based on it being a chemically mediated lung injury (4).

METHODS

The Hunter Area Toxicology Service (HATS) is a regional toxicology unit situated at the Newcastle Mater Misericordiae Hospital that services a population of about 350,000 people and is a tertiary referral center for a further 150,000 (16). All presentations to emergency departments in the region are either admitted to the unit or notified to HATS and entered prospectively into a clinical database. A preformatted admission sheet is used by medical staff to collect data at admission (17), and this and additional information from the medical record is entered into the database by two trained personnel blinded to any study hypotheses. Detailed demographic and clinical information is recorded (18). The study included cases between January 1997 and October 2002.

Identification as a case required that the patient had aspiration pneumonitis. This was defined as a patient with significant respiratory difficulty, dysfunction, or failure (aspiration) and localized infiltrates on a chest radiograph consistent with aspiration pneumonitis. Patients were included if they were diagnosed by the attending clinical toxicologist as having aspiration and had positive chest radiograph findings. The use of this definition was likely to underestimate the cases and we are likely to have included only clinically apparent aspiration pneumonitis. Witnessed aspiration or the presence of putative risk factors was not required for inclusion. This definition is consistent with previously used criteria in a study of aspiration pneumonitis in consecutive drug-poisoned patients (6).

Cases of aspiration pneumonitis were identified by searching four fields of the HATS database for the terms "aspiration" and "pneumo*." These fields included comments about complications, other major illness and investigations done: investigation comments, general comments/notes, other major illness, intensive care comments. An overdose admission was included as a potential case if these terms were found. These admissions were then further reviewed by one of the investigators (F. Downes), and all fields were reviewed to determine whether the patient had evidence of aspiration pneumonitis. This required that the diagnosis of aspiration pneumonitis was made and a chest radiograph was consistent with aspiration pneumonitis (localized infiltrates). The reviewing investigator was blinded at the time to any other characteristics of the patients or their admission, including GCS, spontaneous emesis, and age.

A large cohort of poisoned patients for the same time period was derived from all admissions to investigate the frequency of aspiration pneumonitis in a cohort of all overdose patients and to define risk factors. The cohort consisted of all poisoning admissions to HATS, including deliberate self-poisoning, recreational poisoning, and accidental poisoning. No admissions were excluded.

The data retrieved for each patient in the full cohort included patient demography (sex, age), details of drug ingestion (time between ingestion and admission to hospital, type of drug ingested [tricyclic antidepressant, benzodiazepine, antipsychotic agent, or paracetamol], alcohol co-ingestion), clinical features (spontaneous emesis, GCS at admission of <15, seizure), treatment (administration of activated charcoal, use of antibiotics), major outcomes (length of stay [LOS], ICU, and death), and presence of aspiration pneumonitis (as above). The outcome of patients with and without aspiration pneumonitis was compared, using the following: LOS, ICU admission, mechanical ventilation and death.

Univariate analysis of the cohort of poisoned patients was undertaken to identify what factors were predictive of aspiration pneumonitis. A logistic regression model was then developed with an outcome variable of aspiration pneumonitis and the following predictor variables: age (in years), sex, LOS (in hours), GCS (15 or <15), spontaneous emesis, treatment with activated charcoal, alcohol (co)ingestion, TCA ingestion, antipsychotic agent ingestion, benzodiazepine ingestion, paracetamol ingestion, seizure, and time between ingestion and admission to hospital. The final variable of time from ingestion was categorized into the following groups: <4 hrs, 4–24 hrs, and >24 hrs. A subgroup analysis was done including only patients admitted to the ICU. Univariate analysis of the ICU cohort was done using the same predictors, except GCS (≥ 8 or <8) was used. A second logistic regression model was then developed with the same predictors and outcome variable of aspiration pneumonitis.

Statistical Analysis. For descriptive statistics, mean and standard deviation (SD) values are quoted for normally distributed data, and median values and interquartile range are used for nonparametric data. Univariate analyses were conducted using two-sample Student's *t*-tests (or Wilcoxon's rank-sum test for nonnormal data) and χ^2 tests. Univariate and multivariate analyses were conducted using logistic regression. All analyses were performed using Stata 7.0 (Stata Corporation, College Station, TX,) or GraphPad InStat (Version 3.02 for Windows 95, GraphPad Software, San Diego, CA), except for the calculation of 95% confidence intervals (95% CI) with StatMate (Version 1.01, July 1, 1996, GraphPad Software).

RESULTS

There were 4,562 poisoning admissions to HATS between January 1997 and October 2002.

Patients with Aspiration Pneumonitis. The initial search of the database found 110 cases in which the word "aspiration" or the prefix "pneumo" occurred in any of the comment fields. These records were further searched, and 83 cases consistent with aspiration pneumonitis were identified (diagnosed by a clinical toxicologist). The remaining 27 had other pulmonary conditions that were not aspiration pneumonitis (e.g., pulmonary embolism). Twelve of the 83 potential cases were excluded because a chest radiograph was not done or it had been reported as normal. There were thus 71 of 4,562 cases with aspiration pneumonitis or 1.6% (95% CI, 1.2–2.0).

Comparison of Patients with and Without Aspiration Pneumonitis. The average age of patients who had aspiration pneumonitis was 44 yrs (SD = 18.5) compared with 33 yrs (SD = 13.4) in patients without ($t = 6.6$, $p < .001$). Sixty-one percent of patients with aspiration pneumonitis were men, compared with 39% of patients without aspiration pneumonitis being men (χ^2 [2] = 15.7, $p < .001$).

The median time from ingestion to hospital admission was 4.67 hrs for patients with aspiration pneumonitis and 2.27 for patients without ($Z = 2.71$, $p = .007$). For patients whose time from ingestion to hospital admission was <4 hrs, 1.0% had aspiration pneumonitis. This increased to 1.9% for patients who were admitted to the hospital between 4 and 24 hrs of ingestion, and to 4.4% in those admitted >24 hrs after the overdose (χ^2 [2] = 52.24, $p < .001$).

Of 3,487 patients with a GCS of 15 at admission, 27 developed aspiration pneumonitis (0.8%; 95% CI, 0.5–1.1) compared with 44 of 1075 patients with a GCS of <15 (4.1%; 95% CI, 3.0–5.5). Therefore 62% of patients with aspiration pneumonitis had a GCS of <15, com-

pared with 23% without (χ^2 [1] = 59.1, $p < .001$).

Spontaneous emesis occurred in 34% of patients with aspiration pneumonitis compared with 11% of patients without (χ^2 [1] = 35.2, $p < .001$). Sixteen percent of patients with aspiration pneumonitis had a seizure, compared with only 2% of patients without (χ^2 [1] = 52.5, $p < .001$).

Ingestion or co-ingestion of common and important drugs including alcohol was analyzed. Nineteen percent of patients with aspiration pneumonitis ingested a TCA and but only 7% without (χ^2 [1] = 14.5, $p < .001$). There was no significant difference between the proportion of patients with aspiration pneumonitis who ingested antipsychotics, benzodiazepines, and alcohol and the proportion of patients without aspiration pneumonitis who ingested those agents. Paracetamol was ingested by 9% of patients with aspiration pneumonitis, compared with 23% who did not have aspiration pneumonitis (χ^2 [1] = 8.3, $p = .004$).

Thirty-three percent of both the aspiration and nonaspiration groups received charcoal, which was not significantly different. Of patients with a GCS of 15, 35% were decontaminated with charcoal, whereas only 25% with a GCS of <15 received charcoal ($p < .0001$). The odds ratios (ORs) and corresponding 95% CIs for each predictor, obtained from univariate logistic regression, are shown in Table 1.

Predictors of Aspiration Pneumonitis: Multivariate Analysis. Logistic regression was used to construct a model for predicting aspiration pneumonitis. Both forward and backward stepwise methods were used, with the likelihood ratio test, resulting in the same model. The final model, shown in Table 2, contains seven predictors: age, sex, GCS, emesis, seizure, TCA ingestion, and time from ingestion to presentation. The only predictor that was not significant compared with univariate analysis was paracetamol.

Outcomes in Patients with Aspiration Pneumonitis vs. Those Without Aspiration Pneumonitis. The median LOS of patients with aspiration pneumonitis was 126 hrs (interquartile range, 62–210 hrs) compared with 14.7 hrs (interquartile range, 7–23 hrs) in patients without ($p < .0001$). Ninety percent of patients with aspiration pneumonitis were admitted to the ICU, which was significantly more than the 11% for patients without aspiration pneumonitis (OR, 70; 95% CI, 32–153; $p < .0001$). A total of 52 of 71 patients (73%) with aspiration pneumonitis received mechanical ventilation, which was significantly more than the 273 of the 4,491 patients (6%) without aspiration pneumonitis (OR, 42; 95% CI, 25–73; $p < .0001$). The mortality in patients with aspiration pneumonitis was 8.5% compared with 0.4% in patients without (OR, 23; 95% CI, 9–60; $p < .0001$). The mortality in patients who did and did not receive charcoal was not significantly different ($p = .656$).

Subgroup Analysis of Patients Admitted to the ICU: Univariate and Multivariate Analysis. There were 64 cases of aspiration pneumonitis in the 585 patients admitted to the ICU, or 11% (95% CI, 9–14). The ORs and corresponding 95% CIs for each predictor, obtained from univariate logistic regression, are shown in Table 3. Of 441 patients with a GCS of ≥8, forty developed aspiration pneumonitis (9%; 95% CI, 7–12) compared with 24 of 144 patients with a GCS of <8 (17%; 95% CI, 11–24).

A logistic regression model was constructed to predict aspiration pneumonitis in ICU patients with overdose. The final model, shown in Table 4, contains three predictors: age, emesis, and time from ingestion to presentation, and GCS of <8 was no longer a significant predictor after multivariate analysis.

DISCUSSION

Aspiration pneumonitis is an uncommon occurrence in patients presenting with overdose, but our study clearly demonstrates that it is associated with significantly worse morbidity and mortality in these patients. A number of independent risk factors were identified for aspiration pneumonitis in all poisoned patients (Table 2), but only three of these were significant for the subgroup of patients admitted to the ICU: age, emesis, and time from ingestion to admission (Table 4).

Table 1. Univariate analysis of aspiration pneumonitis against each predictor

Predictor	Odds Ratio	95% Confidence Interval
Age		
10-yr increase	1.54	1.35 – 1.75
Sex		
Male (reference)	—	—
Female	0.40	0.25 – 0.65
Transgender	1.75	0.23 – 13.29
Decreased Glasgow Coma Score		
No (reference)	—	—
Yes	5.47	3.37 – 8.88
Emesis		
No (reference)	—	—
Yes	4.07	2.47 – 6.71
Charcoal		
No (reference)	—	—
Yes	1.03	0.63 – 1.70
Alcohol co-ingestion		
No (reference)	—	—
Yes	0.72	0.41 – 1.27
Tricyclic antidepressant co-ingestion		
No (reference)	—	—
Yes	3.07	1.66 – 5.66
Antipsychotic co-ingestion		
No (reference)	—	—
Yes	1.38	0.75 – 2.53
Benzodiazepine co-ingestion		
No (reference)	—	—
Yes	1.38	0.86 – 2.23
Paracetamol co-ingestion		
No (reference)	—	—
Yes	0.36	0.17 – 0.80
Seizure		
No (reference)	—	—
Yes	8.05	4.11 – 15.77
Ingestion to hospital presentation time		
<4 hrs (reference)	—	—
4–24 hrs	2.88	1.54 – 5.37
>24 hrs	6.70	3.76 – 11.93

Table 2. Logistic regression of aspiration pneumonitis against each predictor for all overdose patients

Predictor	Adjusted Odds Ratio	95% Confidence Interval
Age		
10-yr increase	1.41	1.23 – 1.63
Sex		
Male (reference)	—	—
Female	0.49	0.29 – 0.82
Transgender	2.70	0.33 – 21.87
Glasgow Coma Score		
No (reference)	—	—
Yes	3.14	1.87 – 5.27
Emesis		
No (reference)	—	—
Yes	4.17	2.44 – 7.13
Seizure		
No (reference)	—	—
Yes	5.02	2.40 – 10.47
Tricyclic antidepressant co-ingestion		
No (reference)		
Yes	2.24	1.16 – 4.34
Ingestion to hospital presentation time		
<4 hrs (reference)	—	—
4–24 hrs	2.35	1.23 – 4.49
>24 hrs	4.42	2.42 – 8.10

Although many of these are consistent with the clinical experience of toxicologists and critical care specialists, our study confirms the significance of them.

The rate of aspiration pneumonitis has varied between studies, and few have investigated all overdose patients, irrespective of treatment. In a study by Adnet and Baud (6) of overdose patients admitted to an ICU, the frequency of aspiration pneumonitis in consecutive patients was 65 of 224 or 29%. The reason for the high rate was that 190 patients (85%) had a GCS of <15. The study also suggested that aspiration pneumonitis did not occur in patients with a GCS of 15, with no patients in 34 developing aspiration pneumonitis, but the upper 95% CI for this is 10%, which includes 0.8%, the proportion of patients in our study with a GCS of 15 who developed aspiration pneumonitis. In our study, there were 1,075 patients (24%) with a GCS of <15. Thus, the frequency of aspiration pneumonitis overall in our study of 1.6% was lower than that of Adnet and Baud (6), but the frequency in patients with a GCS of <15 was 4.1%. The frequency of aspiration pneumonitis in our ICU patients was 11%, which was closer to the results in the study by Adnet and Baud (6). However, a direct comparison between the two studies is not possible because the previous study included only patients admitted to an ICU, and admission polices between ICUs may differ. In contrast, our study includes all overdose patients presenting to an emergency department, which makes the results more generalizable. There are a number of studies of decontamination that report rates of aspiration pneumonitis from 0% to 5%, which are consistent with our study (19).

No ingested medication type was independently associated with aspiration except for TCAs. Decreased level of consciousness, emesis, and seizures did not account for the increased aspiration risk in TCA overdose, suggesting that other factors are involved, possibly the intrinsic toxicity of the drugs. A number of studies have described the pulmonary complications of TCA overdose, which include pulmonary edema, with or without adult respiratory distress syndrome, in addition to aspiration pneumonitis (20–23). It is possible that in our study some of the patients had other pulmonary complications of TCA poisoning rather than aspiration pneumonitis (20). Our inclusion criteria for aspiration pneumonitis may not have excluded patients with pulmonary edema because of the retrospective nature of the analysis. Two previous studies were unable to find any significant association between demographic features and initial clinical variables, and the occurrence of aspiration pneumonia (pneumonitis) (20, 21). However, both these studies included smaller numbers of patients, and not all risk factors for aspiration pneumonitis were included in the logistic regression: level of consciousness was only included in one, and emesis and time of presentation were not included in either (20, 21).

This study did not demonstrate that the administration of charcoal was an independent risk factor for aspiration pneumonitis, with a third of patients with and without aspiration pneumonitis receiving charcoal. This is consistent with previous studies investigating the safety and efficacy of charcoal that demonstrated that charcoal did not increase the risk of aspiration pneumonitis (7–11, 19). Our results suggest that the occurrence of aspiration pneumonitis in patients receiving charcoal is a result of other risk factors, such as a decreased level of consciousness and spontaneous vomiting. In addition, there was no difference in the mortality of patients with aspiration who did and did not receive charcoal.

The study confirms the established impression of clinicians that the development of aspiration pneumonitis is associated with significant morbidity and mortality in overdose patients. This is clearly demonstrated in this study of consecutive admissions to a toxicology unit, with a significantly increased number of deaths in the group with aspiration pneumonitis. There is also a significantly longer LOS, increased ICU admission rate, and increased rate of mechanical ventilation. It could be argued that these are surrogate measures of severity in these patients and that in itself, aspiration pneumonitis dictates admission to ICU. However, LOS and requirement for mechanical ventilation are less likely to be affected by any ICU admission policy because need for ventilation is more easily standardized, and for LOS, HATS has a standard admission and discharge policy. This is further supported by the increased mortality in patients with aspiration pneumonitis.

There continues to be controversy regarding the use of antibiotics in aspiration pneumonitis (24). There are no controlled trials comparing antibiotics vs. placebo in aspiration pneumonitis (4). Antibiotic use in our patient group was haphazard, with variation in initiation, duration, and antibiotic agent used. This is consistent with a recent survey of critical care physicians in the United States that demonstrated a divergent approach to antibiotic use in aspiration pneumonitis (24). The mainstay of treatment for aspiration pneumonitis is respiratory support (ventilation or noninvasive respiratory support), oxygen therapy, aggres-

Table 3. Univariate analysis of aspiration pneumonitis against each predictor in patients admitted to the intensive care unit

Predictor	Odds Ratio	95% Confidence Interval
Age		
10-yr increase	1.25	1.07 – 1.47
Sex		
Male (reference)	—	—
Female	0.52	0.30 – 0.88
Transgender	1.19	0.14 – 10.51
Glasgow Coma Score of <15		
No (reference)	—	—
Yes	1.24	0.73 – 2.10
Glasgow Coma Score of <8		
No (reference)	—	—
Yes	2.01	1.16 – 3.46
Emesis		
No (reference)	—	—
Yes	2.67	1.52 – 4.66
Charcoal		
No (reference)	—	—
Yes	0.51	0.30 – 0.87
Alcohol co-ingestion		
No (reference)	—	—
Yes	0.67	0.37 – 1.28
Tricyclic antidepressant co-ingestion		
No (reference)	—	—
Yes	0.80	0.42 – 1.52
Antipsychotic co-ingestion		
No (reference)	—	—
Yes	1.31	0.68 – 2.51
Benzodiazepine co-ingestion		
No (reference)	—	—
Yes	1.37	0.80 – 2.34
Paracetamol co-ingestion		
No (reference)	—	—
Yes	0.89	0.39 – 2.04
Seizure		
No (reference)	—	—
Yes	1.91	0.94 – 3.89
Ingestion to hospital presentation time		
<4 hrs (reference)	—	—
4–24 hrs	3.59	1.78 – 7.26
>24 hrs	4.88	2.61 – 9.13

Table 4. Logistic regression of aspiration pneumonitis against each predictor for patients admitted to the intensive care unit

Predictor	Odds Ratio	95% Confidence Interval
Age		
10-yr increase	1.18	1.01 – 1.38
Emesis		
No (reference)	—	—
Yes	2.41	1.34 – 4.34
Ingestion to hospital presentation time		
<4 hrs (reference)	—	—
4–24 hrs	2.89	1.41 – 5.96
>24 hrs	4.64	2.45 – 8.79

sive chest physiotherapy, and management of secondary complications.

The subgroup analysis of patients admitted to the ICU differed from the analysis of all patients, but this is likely because of a much smaller sample size. The only significant predictors from multivariate analysis in ICU patients were age, emesis, and time from ingestion to admission (Table 4). Because a significant number of patients admitted to the ICU have a GCS of <15, a cutoff GCS of <8 was also tested. Although a GCS of <8 was significantly associated with aspiration in the univariate analysis (Table 3), it did not remain significant after multivariate analysis (Table 4). Similarly, TCA ingestion and seizures were also not significantly associated with aspiration pneumonitis in ICU patients, whereas they had been significant for all overdose patients. This may be because most TCA overdoses and patients who have seizures after overdose are admitted to the ICU, whereas emesis and ingestion time are less likely to influence admission to the ICU, so they are more discriminating.

A limitation of this study was the definition of aspiration pneumonitis used. Previously defined criteria for aspiration pneumonitis included infiltrates on chest radiograph and either witnessed aspiration or risk factors for aspiration pneumonitis (25, 26). However, these criteria are less applicable to studies of overdose patients, and different criteria have been adopted (6, 11) that rely mainly on radiographic changes. In our study, the definition included patients with positive chest radiograph findings and significant respiratory dysfunction or failure resulting in the attending clinical toxicologist diagnosing aspiration pneumonitis. Aspiration is often not witnessed in overdose patients, particularly if they present to the hospital late. Using purported risk factors in the case definition would have been problematic and would not have allowed for independent analysis of those risk factors. A decreased level of consciousness is common in overdose and, as in the study by Adnet and Baud (6), is insufficient evidence by itself to make the diagnosis of aspiration pneumonitis. Other risk factors such as dysphagia and intestinal obstruction are less relevant to overdose patients, and they relate to aspiration pneumonia rather than pneumonitis.

It is likely that our study underestimated the frequency of aspiration pneumonitis because it only included cases of clinically apparent aspiration pneumonitis and so required that patients had significant respiratory impairment from the aspiration. It is more difficult to define patients who aspirate without obvious respiratory dysfunction, and it is unclear whether this is important. Our inclusion of only aspiration pneumonitis is clinically relevant because these are the patients who have more severe outcomes and need to be identified early.

The significant association between decreased level of consciousness (GCS < 15) and aspiration may be coincidental if

Our study has shown a number of risk factors in overdose patients that are associated with aspiration pneumonitis that may allow the early identification of these patients for appropriate observation and management.

the diagnosis of aspiration pneumonitis was based on this, at the time, by the attending clinical toxicologist. However, in all our cases, there was evidence of significant respiratory impairment or failure such that other elements were included in the diagnosis of aspiration pneumonitis. The associations demonstrated with other risk factors for aspiration pneumonitis in overdose patients, such as spontaneous vomiting, drug type, and seizures, are far less likely to be biased and therefore represent true risk factors. We do not have an explanation for male sex being an independent risk factor, and this requires further investigation.

We have demonstrated a number of risk factors to be important in the development of aspiration pneumonitis in overdose patients, although this requires validation in a prospective study. It is important that this is not generalized to other nonpoisoned patient groups because the pathophysiology and etiology are different. This is particularly true for aspiration pneumonia, which occurs in an older patient group, often with dysphagia or gastric dysmotility (4). However, this study provides good data to help identify overdose patients who may be at risk of aspiration pneumonitis and who should be observed appropriately and in whom consideration should be given to a chest radiograph being done within the first 24 hrs. It would be appropriate to perform chest radiographs in any patient who presents with two or more of the six risk factors in Table 2. Ideally this should be done as a prospective study to determine whether this improves the diagnosis and management of these patients. Given the limitations of gastrointestinal decontamination, specifically activated charcoal, it is our belief that when patients have defined risk factors for aspiration pneumonitis and unprotected airways, decontamination should be limited to those cases in which there is greatest likelihood of benefit, and airway protection should be considered mandatory.

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