Aspiration in the context of upper gastrointestinal endoscopy

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BACKGROUND: Pulmonary aspiration is a life-threatening complication of upper gastrointestinal endoscopy, the incidence of which has not been determined. Endoscopy-related aspiration has not been studied in procedures in which patients swallow a radiolabelled potential aspirate immediately before endoscopy and undergo nuclear scanning postprocedure.

METHODS: A pilot study was conducted in which 200 MBq of non-absorbable technetium-99m phytate in 10 mL of water was administered orally to 50 patients who were about to undergo endoscopy. Gamma camera images were obtained to ensure that there had been no aspiration before endoscopy. After endoscopy, a repeat scan was performed. Fluid aspirated through the endoscope was also collected and analyzed for radioactivity using a hand-held radiation monitor.

RESULTS: No evidence of pulmonary aspiration was found in any of the patients studied. The mean estimated percentage of the initially administered radioactivity aspirated through the endoscope was 2.66% (range 0% to 10.3%).

CONCLUSION: The present pilot study confirms earlier observations that clinically significant aspiration in the context of upper gastrointestinal endoscopy is uncommon. The incidence of aspiration may, however, be different in acutely bleeding patients undergoing endoscopy. For logistic reasons, this group could not be studied.

Key Words: Aspiration; Endoscopy; Gastroscopy

The risk of aspiration following upper gastrointestinal (GI) endoscopy has received scant attention. The abolition or impairment of the gag reflex with local pharyngeal anesthesia, use of intravenous sedation and the splinting of the upper esophageal sphincter by the endoscope, however, all predispose to aspiration of gastric contents. In addition, endoscopies are sometimes performed with the stomach full of blood or the small bowel full of bowel preparation fluid, further adding to the risk of this life-threatening complication. Easy access to endoscopy (partly due to its perceived lack of complications) means that a considerable number of patients at risk for aspiration pneumonia, such as those who are elderly, immunosuppressed, and victims of cerebrovascular disease and other neurological diseases are able to undergo endoscopy.

In the evaluation of endoscopy-induced aspiration, some studies (1,2) have relied on the performance of chest x-rays (CXRs) before and after endoscopy, with the presence of new pulmonary infiltrate(s) thought to indicate aspiration. However, to depend on CXR evidence alone is unreliable, because new CXR infiltrates may not be related to aspiration but may be related to coexistent pneumonia processes. If general anesthesia and intubation are performed before endoscopy, patients may aspirate during induction or extubation rather than during the endoscopy itself. Moreover, aspiration may occur during endoscopy but may not lead to any radiological changes evident immediately after endoscopy, either because insufficient fluid was aspirated or because new opacities may be hidden by other soft tissue opacities, such as the cardiac shadow or shadows related to pre-existing pulmonary disease. The clinical significance and prevalence of episodes of subclinical 'microaspiration' is unknown but may be useful as markers of overt aspiration. Characterization of patients sustaining aspiration during endoscopy may better identify the risk factors associated with aspiration and enable appropriate preventive strategies to be devised. To determine whether there was any unequivocal evidence of aspiration occurring during endoscopy, an open study was conducted in which endoscopy-related aspiration could be determined.

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Pulse oximetry levels of less than 90% were recorded. All sedation as determined by the endoscopist. Periods of apnea and desaturations (less than 90%) during the procedure(s) were noted. None of our patients were ‘urgent’ as defined by the need to perform endoscopy within the first 6 h. There were six semiurgent cases of our patients were ‘urgent’ as defined by the need to perform endoscopy within the first 6 h. There were six semiurgent cases. Nine patients had significant comorbidities – four had noninsulin-dependent diabetes, three had hepatic cirrhosis, one had chronic obstructive airways disease and one had lymphoma. It had been our intention to include as many urgent endoscopies as possible, but the delays inherent in performing the scans and the absence of facilities open after working hours for such a scan precluded this. On careful review of the scans, no evidence of aspiration was found in any of the patients. A representative study is shown in Figure 1. Even when the sensitivity of the imaging was reduced to 1%, significant

directly. Patients drank a small amount of radiolabelled fluid before endoscopy and then had nuclear scans taken after endoscopy to see whether any fluid had been aspirated from their stomachs into their lungs. A scan was also performed immediately after drinking the radiolabelled fluid to ensure that none of the fluid had been aspirated during swallowing.

METHODS

Written consent was obtained from all patients. The present study was approved by the Australian Capital Territory Health and Safety Ethics Committee. Clearance by the Australian Capital Territory Radiation Council was also granted. Overall, 50 patients were recruited to the study; the demographic profile of the group is shown in Table 1. Exclusion criteria included women of child-bearing age and individuals younger than 18 years of age. Immediately before endoscopy, with the patient sitting upright and before the administration of either lignocaine spray to the pharynx or intravenous sedation, 200 MBq of technetium-99m phytate in 10 mL of water was taken orally. There is evidence that this practice was subsequently discontinued because there was no radiation detected.

RESULTS

The indications for endoscopy, the endoscopic findings, the volume of fluid aspirated through the endoscope, the duration of endoscopy and the time between the initial scan and the endoscopy are outlined in Table 1. No patient experienced desaturations (less than 90%) during the procedure(s). None of our patients were ‘urgent’ as defined by the need to perform endoscopy within the first 6 h. There were six semiurgent cases (endoscopy required within 24 h), and the remainder were nonurgent cases. Nine patients had significant comorbidities – four had noninsulin-dependent diabetes, three had hepatic cirrhosis, one had chronic obstructive airways disease and one had lymphoma. It had been our intention to include as many urgent endoscopies as possible, but the delays inherent in performing the scans and the absence of facilities open after working hours for such a scan precluded this. On careful review of the scans, no evidence of aspiration was found in any of the patients. A representative study is shown in Figure 1. Even when the sensitivity of the imaging was reduced to 1%, significant

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Results</th>
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<tbody>
<tr>
<td>Number of patients</td>
<td>50</td>
</tr>
<tr>
<td>Mean age, years</td>
<td>55</td>
</tr>
<tr>
<td>Male-female, n</td>
<td>25:25</td>
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<tr>
<td>Duration of endoscopy</td>
<td>8 min (range 2 min to 20 min)</td>
</tr>
<tr>
<td>Time between first scan and endoscopy</td>
<td>38 min (range 4 min to 90 min)</td>
</tr>
<tr>
<td>Mean volume of fluid aspirated through the endoscope</td>
<td>41 mL (range 0 mL to 150 mL)</td>
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</tbody>
</table>

*Several patients had more than one positive finding

Figure 1) Nuclear scans performed immediately before endoscopy and after endoscopy demonstrating radioactive material in the stomach (left) and subsequently in the small intestine (right). There is an absence of radioactivity in the lung fields in both images.
amounts of the tracer were visible in the GI tract. This suggests that any aspiration approaching 1% of the administered dose would have been detected in the lung fields. The mean volume of fluid aspirated during endoscopy was 41 mL (range 0 mL to 150 mL) and the mean calculated radioactivity of this fluid was 5.32 MBq (range 0 MBq to 20.6 MBq), 2.66% of the administered dose. No significant thyroid activity was visible on the images, confirming that none of the tracer was absorbed.

**DISCUSSION**

Prout and Metreweli (4) first drew attention to the possibility of aspiration occurring during endoscopy in 1972, when they showed that 25% of patients developed CXR changes consistent with aspiration following administration of oral lipiodol in patients undergoing endoscopy. The implications of the study, in terms of aspiration of gastric contents into the lungs, are limited, given the fact that the x-ray contrast medium was given orally and not placed into the stomach. In addition, the endoscopes used were semirigid, the procedures were much longer and the doses of sedative medications correspondingly were much higher. A number of retrospective surveys (5-9) have reported aspiration to be a rare and sometimes fatal complication of endoscopy. Estimates of incidence have varied between one of 9875 procedures (Texas, USA) (7) and one of 184 emergency endoscopies (Paris) (8). All these surveys reported at least one death attributed to aspiration, except the one from Texas (7). It is possible that these surveys underestimated the true incidence of aspiration, because they relied solely on the recall of the participating endoscopists; although equally, some of the episodes attributed to aspiration may have stemmed from other causes of sudden cardiorespiratory deterioration, such as pulmonary emboli or myocardial infarction, particularly because no diagnostic criteria for aspiration were given in any of the studies.

It was not until 1991 that studies using pre- and postendoscopy CXRs were published. Lipper et al (1) reported that six of 30 intensive care patients with active, severe GI postendoscopy CXRs were published. Lipper et al (1) reported that six of 30 intensive care patients with active, severe GI bleeding developed new CXR shadowing in their left lung field within 4 h of endoscopy when compared with a CXR taken in the 12 h before endoscopy. Five of these six patients subsequently developed leukocytosis and fever, and five of the six also developed significant desaturation (less than 90%) during endoscopy. The longer term outcomes of the patients were not reported. In another pre- and postendoscopy CXR study involving a total of 220 GI bleeders in an intensive care unit, Rudolph et al (2) reported a 14% incidence of new CXR changes following endoscopy for GI bleeding in an intensive care unit. Interestingly, there was no evidence that securing the airway by intubation led to a decrease in the rate of aspiration, other than possibly reducing the rate of fatal, massive aspiration.

The present pilot study, using a very sensitive technique, failed to show any evidence of aspiration in the cohort of 50 patients. This may have been related to the fact that none of our procedures were particularly prolonged (maximum gastroscopy time was 20 min) and that none of the patients had had major upper GI bleeding. It had been our intention to study such cases during working hours but the logistic delays inherent in this approach made this impossible; as well, the nuclear medicine department was geographically remote from the endoscopy area in our hospital (The Canberra Hospital, Australia), and was relatively free of resuscitation personnel and equipment. Therefore, it was decided that the transfer of acutely bleeding patients would have entailed an unacceptable risk. In addition, the preparation of the radiolabelled colloid required advanced notice and would not have normally been performed outside of working hours. The fact that small quantities of radiation (as much as 10% of the administered dose) were detected in the fluid aspirated at endoscopy suggests that the method used has the potential to demonstrate aspirated material, particularly if the process could be streamlined and patients with acute upper GI bleeding could be studied.

**SUMMARY**

The present study confirms the safety of sedation practices in endoscopy, even in patients at moderate risk who undergo routine or semiurgent procedures. It is also in accordance with earlier observations that clinically significant aspiration is probably much more common in patients who have had very recent major upper GI bleeding. It would be interesting to perform a similar study in patients undergoing longer procedures, such as endoscopic retrograde cholangiopancreatography, or in those undergoing endoscopic ultrasound examinations, in which a good deal of fluid is often injected into the gastric lumen to aid in visualization.

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