Is tube feeding associated with altered arterial oxygen saturation in stroke patients?

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Abstract

Background: Reduced arterial oxygen saturation (SaO2) during swallowing, oral feeding and feeding tube placement has been demonstrated in stroke patients. It is not known if tube feeding causes similar episodes of arterial desaturation and whether there is a case for routine pulse oximetry during tube feeding.

Objective: To determine if tube feeding in stroke patients is associated with hypoxia.

Methods: We compared ischaemic or haemorrhagic stroke patients who were NG or PEG fed with a control group of age matched non-dysphagic stroke patients who were orally fed. We excluded people already on supplemental oxygen. Pulse oximetry was performed before, during a meal (for 20 min) and for 10 min after and changes from baseline readings determined.

Results: Data were collected for 20 controls and 18 tube-fed patients. Mean age was 75 years and median time to assessment 14.5 days. The two groups were reasonably matched for age, sex, type of stroke and time to assessment, but differed significantly in the Oxfordshire Community Stroke Project (OCSP) classification and Rankin score. The mean baseline SaO2 of controls was 96.5% (SD 1.47) and that of the tube-fed group 96.0% (SD 1.46). Reduction in SaO2 from baseline during and after feeding ranged from 0.35% to 0.78% with no statistically or clinically significant differences between the two groups.

Conclusions: No clinically significant reduction in SaO2 was found in our tube-fed patients as compared to controls. Our study suggests that routine pulse oximetry during tube feeding is not necessary.

Keywords: tube feeding, oximetry, oxygen, stroke, elderly

Introduction

Nasogastric (NG) or percutaneous endoscopic gastrostomy (PEG) tubes are commonly used to feed dysphagic stroke patients. Pulse oximetry has previously been used in stroke patients to study changes in arterial oxygen saturation (SaO2) in a variety of situations; a close correlation has been found, in some studies, between aspiration as diagnosed clinically or by videofluoroscopy and a drop in SaO2 measured by pulse oximetry [1–3]. Eating a meal in stroke patients assessed as safe to swallow has been associated with a small fall in SaO2 [4]. The insertion of a NG or PEG tube in stroke patients has recently been associated with a modest drop in SaO2 [5]. In NG-fed patients with chronic obstructive pulmonary disease (COPD), there was a minor drop in SaO2 associated with feeding [6]. It is also well known that tube feeding can lead to aspiration pneumonia [7]. However, it is not known if tube feeding in stroke patients leads to episodes of arterial desaturation and whether there is a case for routine pulse oximetry during tube feeding.

The detection of hypoxia following a stroke is extremely important as a reduced SaO2 may be associated with an unfavourable outcome [8, 9]. Stroke patients have been shown to have lower baseline O2 saturations as compared to controls and are at risk of further hypoxia [1, 4, 10]. This exploratory study was set up to look for changes in SaO2 during tube feeding in stroke patients who were not hypoxic at baseline.

Methods

Study design

Prospective, controlled study of consecutive patients with ischaemic or haemorrhagic stroke admitted to a stroke unit between May and November 2003.

Patients and controls

Stroke was defined according to WHO criteria [11]. Most patients had their swallowing assessed by speech and
language therapists. The tube-fed group comprised patients considered unsafe for swallowing, who were either NG tube or PEG fed. The control group consisted of age-matched stroke patients who were assessed as safe to swallow and allowed to feed orally. The stroke was classified according to the Oxfordshire Community Stroke Project (OCSP) clinical classification system [12]. The modified Rankin scale was used as a measure of disability [13, 14]. Consent was obtained from the patients or permission sought from the next of kin of patients with communication difficulties. The study had local Ethics Committee approval. We excluded terminally ill people and patients already on supplementary oxygen either for post stroke hypoxia or for other pre-existing medical conditions causing significant hypoxia.

**Equipment and research procedure**

Oxygen saturations were measured by a Ohmeda 3700 pulse oximeter (Datex-Ohmeda, Hatfield, Hertfordshire, UK) in the sitting or propped up position with a shielded finger probe on clean, warm hands. The sensor was usually placed on the paretic side or randomly on the right or left side. No difference has been found in oximetry readings between the hemiparetic or non-paretic side in patients with stroke [15]. Baseline readings were made continually for at least 5 minutes before the meal. Recordings were then taken during the meal for 20 minutes (or less if the meal was completed sooner), and for 10 minutes after the meal. For tube-fed patients, baseline recordings were made for 5 minutes before and the feed then started at a rate of 75–100 mls/hour with continuous recordings for 20 minutes during the feed. The feed was then interrupted as we wished to monitor the two groups for approximately the same period of time and oximetry continued for 10 minutes afterwards. The mean SaO₂ before, during and after the meal was recorded. Changes from the baseline were calculated as the difference between the baseline level and mean level during feeding and the mean level for the 10 minute post-feed period. Clinically significant desaturation was defined as a fall in SaO₂ of >3% and hypoxia defined as a SaO₂ of <90% [1, 4].

**Sample size calculation and statistical analysis**

The sample size was calculated from previous study data [1] as 18 in each group to detect a change in the SaO₂ of 3% at a significance level of 5% and a power of 90%. The baseline characteristics of the two groups were compared using the chi squared test for dichotomous variables and either the independent sample t test or non parametric methods for continuous or ordinal variables. The SaO₂ readings in the two groups were compared using the independent sample t test. Within subject comparisons were made by the paired sample t test.

**Results**

Twenty orally fed and 18 (12 NG and 6 PEG) tube-fed patients were studied. Mean age was 75 years (SD 10.8). Sixteen were male (42.1%) and 22 female (57.9%). Median time from stroke onset to assessment of SaO₂ was 14.5 days. The two groups were reasonably matched for age, sex, type of stroke and median time to assessment but differed significantly in the OCSP classification and Rankin score (Table 1).

The mean baseline SaO₂ of controls was 96.6% (SD 1.43) (Table 2). The mean drop in SaO₂ while eating a meal was 0.65% (SD 1.31). This was statistically but not clinically significant. Only 1 patient in the control group had a short-lived clinically significant drop in SaO₂ of 5% from a baseline of 96%. When SaO₂ measurements were continued after the meal, the mean difference from baseline was 0.35% (SD 0.99). Two orally fed patients had an increased SaO₂ of 1% after their meals. The mean baseline SaO₂ in the tube-fed group was 96.0% (SD 1.46) with a mean drop of 0.61% (SD 1.61) from baseline during feeding (non-significant) and a mean drop of 0.78% (SD 1.22) for the 10 minute period after the feed (statistically but not clinically significant). Only 2 patients had brief but clinically significant drops of 4% in SaO₂ during tube feeding. Both were smokers and one had recently been treated for a chest infection. One tube-fed patient demonstrated a 2% elevation in SaO₂ while being fed. There were no statistically or clinically significant differences in baseline SaO₂ and changes from baseline between the two groups (Table 2).

**Discussion**

It is considered important to identify situations which lead to hypoxia in stroke patients, particularly in the acute phase. The value of pulse oximetry in identifying aspiration has been investigated in several studies. Zaidi found a close correlation between aspiration diagnosed clinically and a drop in SaO₂ in stroke patients during swallowing [1]. Collins and Bakheit showed a drop of up to 2% in SaO₂ on simultaneous pulse oximetry with videofluoroscopy in dysphagic stroke patients 2 minutes after swallowing [2]. In contrast, other studies have concluded that pulse oximetry is not helpful in assessing aspiration [16–18]. It has also been suggested that drops in SaO₂ may be related to in-coordination of
breathing rather than aspiration [16, 18, 19]. Eating a meal in stroke patients considered safe to swallow was associated with a small fall in median SaO₂ which persisted for at least 10 minutes after eating and in some, the SaO₂ fell to ≤90% during or after eating [4].

It has recently been shown that the placement of feeding tubes in stroke patients may cause reduced SaO₂ levels particularly if the placement is prolonged or difficult, and if sedation is used [5]. In patients with COPD, a small study of 11 subjects demonstrated a statistically significant (though not clinically significant) drop in arterial oxygen saturation measured by blood gas analysis on NG feeding [6]. Tube feeding theoretically cannot be expected to prevent the aspiration of oral secretions and regurgitated gastric contents. Aspiration of gastric contents in tube-fed patients has, in fact, been demonstrated in scintigraphic studies [20]. There is also no evidence to suggest that tube feeding reduces the risk of aspiration pneumonia [7].

Though hypoxia during tube feeding seems possible on theoretical grounds, we found no statistically or clinically significant change in SaO₂ in our tube-fed patients as compared to non-dysphagic stroke controls (Table 2). Within-subject comparisons, however, showed a statistically significant drop of SaO₂ in orally fed subjects on eating and in tube-fed subjects at the end of the feed (Table 2). However, these changes were in the order of 0.65–0.78% and cannot be considered clinically significant. No patient had significant hypoxia at baseline because patients who were already hypoxic and on supplementary oxygen were excluded. We were unable to study tube-fed patients sooner because of practical considerations including the current timing of NG and PEG tube placement. However, we theorised that the presence of tube feeding associated drops in SaO₂ would probably be independent of the age of the stroke. We also considered the possibility that the presence of a NG tube may influence SaO₂ readings. However, in a previous investigation, the presence of a NG tube (not actively used for feeding during assessment) was not a confounding factor and did not influence SaO₂ [18].

Our study suggests that routine pulse oximetry during tube feeding is not necessary. It is possible, however, that more prolonged monitoring will be needed to completely exclude tube feeding-related hypoxia.

### Table 2. Comparison of baseline, during feeding and post feed SaO₂ in orally fed stroke patients (controls) and tube-fed stroke patients

<table>
<thead>
<tr>
<th>SaO₂</th>
<th>Orally fed stroke patients (controls) (n = 20); % (SD)</th>
<th>Tube-fed stroke patients (n = 18); % (SD)</th>
<th>P values*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline SaO₂</td>
<td>96.6 (1.43)</td>
<td>96.0 (1.46)</td>
<td>0.208</td>
</tr>
<tr>
<td>Feeding SaO₂</td>
<td>96.0 (2.11)</td>
<td>95.4 (2.52)</td>
<td>0.461</td>
</tr>
<tr>
<td>Post feed SaO₂</td>
<td>96.3 (1.52)</td>
<td>95.2 (2.24)</td>
<td>0.122</td>
</tr>
<tr>
<td>Baseline-feeding SaO₂</td>
<td>0.65 (1.31)b</td>
<td>0.61 (1.61)a</td>
<td>0.935</td>
</tr>
<tr>
<td>Baseline-post feed SaO₂</td>
<td>0.35 (0.99)c</td>
<td>0.78 (1.22)b</td>
<td>0.240</td>
</tr>
</tbody>
</table>

*Independent sample / test.  
*P < 0.05–paired sample / test.  
*Non significant–paired sample / test.

### Key points

- It is important to identify situations which may lead to hypoxia in stroke patients.
- Reduced arterial oxygen saturation (SaO₂) during swallowing, oral feeding and feeding tube placement has been demonstrated in stroke patients.
- It was previously not known if tube feeding in stroke patients caused episodes of hypoxia and whether there was a case for routine pulse oximetry during tube feeding.
- No clinically significant reduction in SaO₂ was found in tube-fed patients in this study as compared to controls.

### References

Effects of dementia on perceived daily pain in home-dwelling elderly people: a population-based study

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Abstract

Background: pain is a significant problem in the elderly, but the impact of dementia on perceived pain has not been studied in population-based study settings.

Objectives: to analyse the prevalence of daily pain and analgesic use among home-dwelling older people with and without dementia.

Design: a cross-sectional population-based survey.

Setting: population of Kuopio city, Finland.

Subjects: 523 home-dwelling subjects aged 75 years and older.

Methods: structured clinical examination and interview.

Results: prevalence rates for any pain, any daily pain, pain every day interfering with routine activities, and daily pain at rest were significantly lower in those subjects with dementia (43%, 23%, 19% and 4%, respectively) compared to those subjects without dementia (69%, 40%, 36% and 13%, respectively). The subjects with dementia were less likely to use analgesics (33%) than the non-demented (47%).

Conclusion: dementia was related to a lower prevalence of reported pain and analgesic use among home-dwelling elderly people.

Keywords: pain, dementia, cognitive impairment, elderly

Introduction

In Western societies, individuals aged 75 years and older represent the fastest growing section of the population. In them, morbidity and social problems are on the increase, posing challenges to the health care system. Most of these elderly people wish to remain at home as long as possible. Thus, it is important to investigate the presence of major symptoms like pain, which can affect functional status and the quality of life in elderly people. Persistent pain is very common among elderly people. A study from Scotland has shown that the prevalence of chronic pain can be as high as 62% in the general population of people aged 75 years and older [1]. A population-based French study indicated that the prevalence of daily chronic pain was 33% [2]. In an epidemiological study from the United States the presence of pain on a daily basis had a great impact on perceived health status among home-dwelling elderly people [3]. Based on the