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# Cineradiography in 45 Patients with Acute Dysphagia

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**Abstract.** The function of the pharyngoesophageal stage of deglutition was studied by cineradiography in 45 patients with an acute onset of dysphagia. None of the patients had any radiographically detectable foreign body in the pharynx or esophagus. In 34 of the patients (76%) a functional or morphodynamic abnormality was disclosed; a defective closure of the laryngeal vestibule (26 patients), defective movements of the epiglottis (18 patients), uncoordinated relaxation of the cricopharyngeal muscle (14 patients), paresis of pharyngeal constrictor muscles (9 patients), and cervical webs (9 patients). In 21 of the patients more than 1 type of dysfunction was present. The results of this study suggest that cineradiography of the pharyngoesophageal stage of deglutition is useful in patients with acute dysphagia, without a foreign body, as functional abnormalities often can explain the patients' complaints.

**Key words:** Pharynx, abnormalities – Dysphagia, radiographic evaluation.

Patients with a sudden onset of dysphagia (a more or less complete inability to swallow a solid bolus or liquids) are usually subjected to a radiographic examination to confirm or exclude the presence of a foreign body which could explain the acute complaints. The radiographic examination is routinely performed with a single-film technique and focuses on the detection of a foreign body and its potential sequelae. The examination is often negative: no foreign body is found and no morphological lesions can be disclosed. In spite of this, however, the patient's dysphagia persists and another explanation should be suspected. A potential explanation for the complaints of these patients is the presence of some functional or morphodynamic abnormality.

The aim of this study was to evaluate cineradiography as a modality for monitoring pharyngeal function in patients with an acute onset of dysphagia.

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## Materials and Methods

Included in this series were 45 patients who had been referred to the radiology department because of acute dysphagia. The single films of the pharynx and esophagus had not disclosed any foreign body. There were 26 women and 19 men, aged 20–93 years, median 70. Twenty-four patients had a history suggesting a foreign body impaction in the throat. A bolus of an inappropriate size or consistency had gotten stuck in their throat after which they were more or less unable to swallow. The remaining patients had developed their dysphagia during a period of less than 2 weeks. Four of these patients could only swallow liquids.

All patients were examined with single-film technique of the pharynx and esophagus using survey films, films during and after swallowing of barium, as well as films with double-contrast technique. The patients were then subjected to a cineradiographic examination of the pharynx during swallowing of barium. Films were obtained using a cine pulse unit and a 16-mm camera. The film speed was 50 or 100 frames per second. The patients were examined in frontal and lateral positions. The cinefilms were analyzed according to a previously described method [1]. In this way each specific detail in the act of pharyngeal swallowing was registered.

This gives a complex description of the pharyngeal function and comparison between patients is difficult. To give a comprehensive characterization of each patient's total pharyngeal function a scoring system was developed and used in the evaluation

**Table 1.** Scoring index of pharyngeal dysfunction (maximum score: 10)

| Area | Dysfunction | Score |
|---|---|---|
| Epiglottis | Defective second movement | 1 |
| | Immobility | 2 |
| Laryngeal vestibule | Defective closure of subepiglottic segment | 1 |
| | Defective closure of supraglottic segment | 2 |
| | Defective closure of supraglottic segment and entrance of contrast medium into trachea | 3 |
| Pharyngeal constrictor musculature | One paretic segment | 1 |
| | Two paretic segments | 2 |
| | Three paretic segments | 3 |
| Cricopharyngeal muscle | Delayed but complete relaxation | 1 |
| | Incomplete relaxation | 2 |

of this material. The types of lesions registered and the scoring system used are shown in Table 1.

## Results

The results of the cineradiographic analysis are summarized in Table 2. Pharyngeal dysfunction and webs were registered in 34 of the patients (76%). In 21 cases 2 or more types of dysfunctions were revealed. Patients with a history suggesting a foreign body and those without had the same dysfunction pattern. However, the patient with a history compatible with a foreign body had more serious dysfunctions (Table 3).

A delayed closure of the subepiglottic segment of the vestibule was seen in 11 patients (Fig. 1). Delayed or nonclosure of the supraglottic portion of the vestibule was seen in 15 patients and in 11

**Table 2.** Cineradiographic findings in 45 patients with acute onset of dysphagia

| | Normal function | Epiglottis | | Laryngeal vestibule | | | Pharyngeal constrictor musculature | | | Cricopharyngeal muscle | | Cervical esophageal web |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Absence of 2nd movement | Immobility | Defective closure of subepiglottic segment | Defective closure of supraglottic segment | Contrast medium passing to trachea | Paresis of one segment | Paresis of 2 segments | Paresis of 3 segments | Delayed but complete relaxation | Incomplete relaxation | |
| Patients with a history suggesting a foreign body $n=24$ | 7 (29) | 5 (21) | 0 | 4 (17) | 3 (13) | 4 (17) | 1 (4) | 0 | 0 | 2 (8) | 4 (17) | 6 (25) |
| Patients without a history suggesting a foreign body ($n=21$) | 4 (19) | 7 (33) | 6 (29) | 7 (33) | 1 (5) | 7 (33) | 4 (19) | 1 (5) | 3 (14) | 2 (10) | 6 (29) | 3 (14) |

Figures in parentheses are percentages

**Table 3.** Scoring of pharyngeal function according to history

| | Epiglottic dysfunction | Defective closure of laryngeal vestibule | Paresis of pharyngeal constrictors | Uncoordinated relaxation of cricopharyngeal muscle | Score[a] | | |
|---|---|---|---|---|---|---|---|
| | | | | | Range | Mean | Median |
| Patients with a history suggesting a foreign body ($n=24$) | 5 | 22 | 1 | 10 | 0–6 | 1.5 | 1 |
| Patients without a history suggesting a foreign body ($n=21$) | 19 | 22 | 15 | 14 | 0–10 | 3.7 | 4 |
| $p$ values[b] | 0.01 | NS | 0.02 | NS | 0.05 | | |

[a] Score is the sum of score for all patients in that particular group

[b] $p$ values for the differences between scores have been calculated according to Wilcoxon two-sided rank sum test ($p \leqq 0.05$ considered significant)

of these barium passed into the trachea (Fig. 2). The defect in tilting down of the epiglottis was mostly of the more circumscript type with the epiglottis remaining in the transversal position (Figs. 1 and 2). This was seen in 12 patients. In 6 patients the epiglottis was immobile and remained in its upright resting position. Patients with immobile epiglottis also had passage of contrast medium into the vestibule and/or trachea due to a delayed closure of the vestibule. Four of these patients also exhibited a pharyngeal constrictor paresis. Paresis of the pharyngeal constrictor in 5 patients was confined to 1 segment (Fig. 1), in 8 patients to 2 segments, whereas 3 patients exhib-

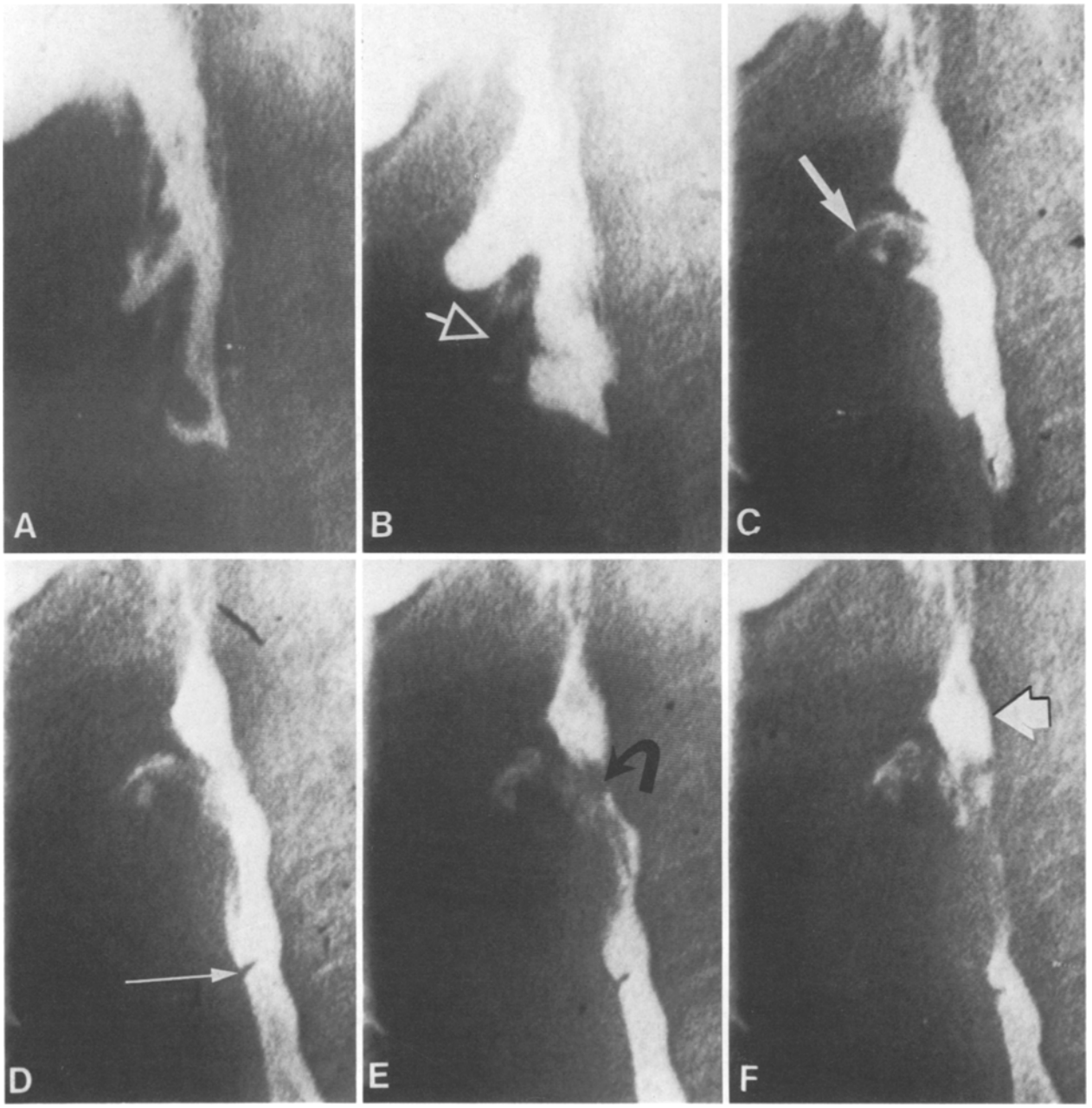



**Fig. 1.** Findings in an 84-year-old woman with acute dysphagia, suspected to be due to a lodged foreign body. **A–F** Lateral projection sequence from a cineradiographic examination. The subepiglottic portion of the laryngeal vestibule closes too late and air can be seen to remain in **B** (*open arrow*). In **C**, small amounts of contrast medium can be seen on the walls of the vestibule (*arrow*). The epiglottis tilts down to the transverse position but not further (*curved arrow*). **D** There is a web formation in the cervical esophagus (*thin arrow*). The peristalsis in the middle pharyngeal constrictor is weak and there is retention of contrast medium in the corresponding segment of the pharynx (*large white arrow*)

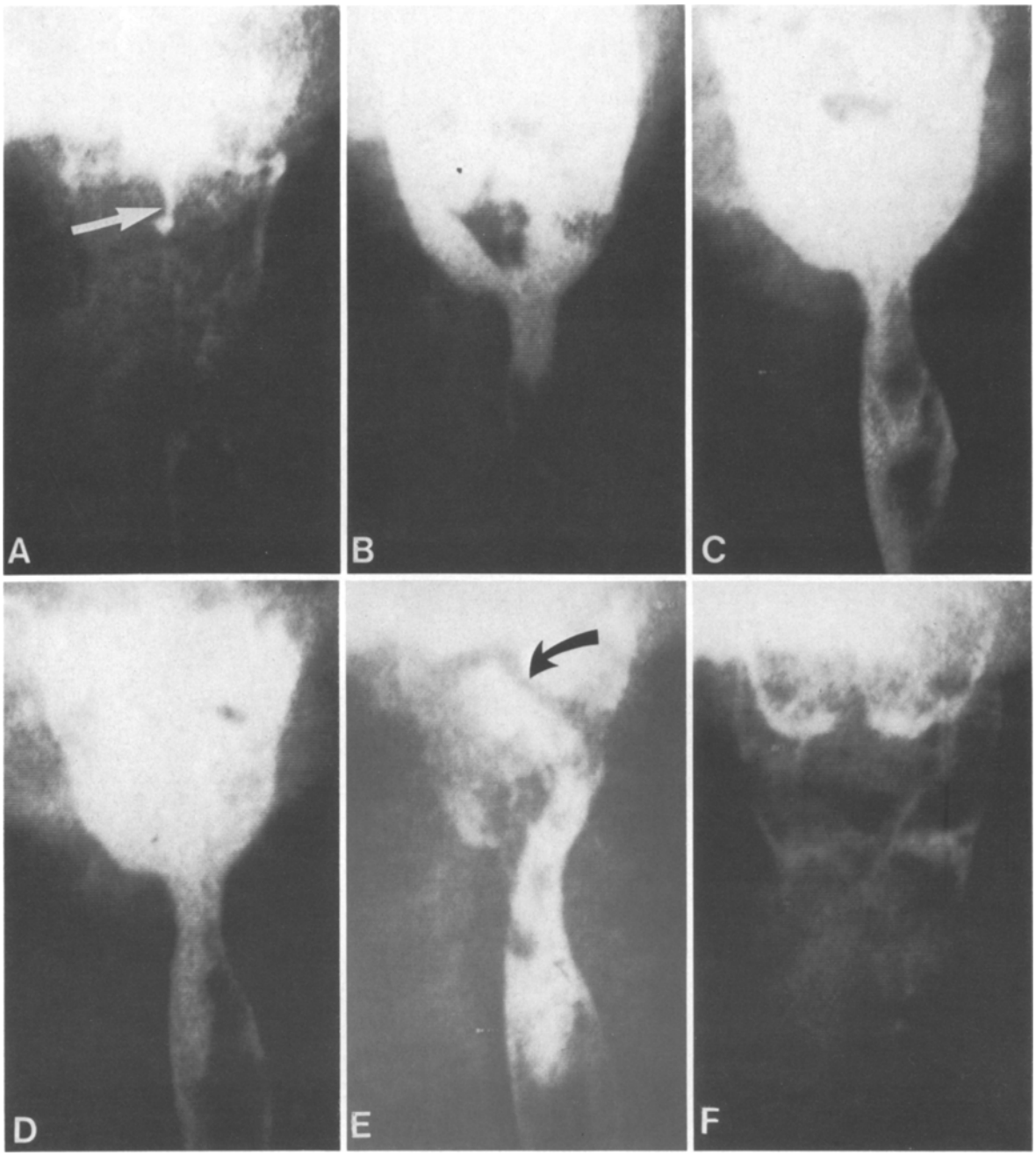
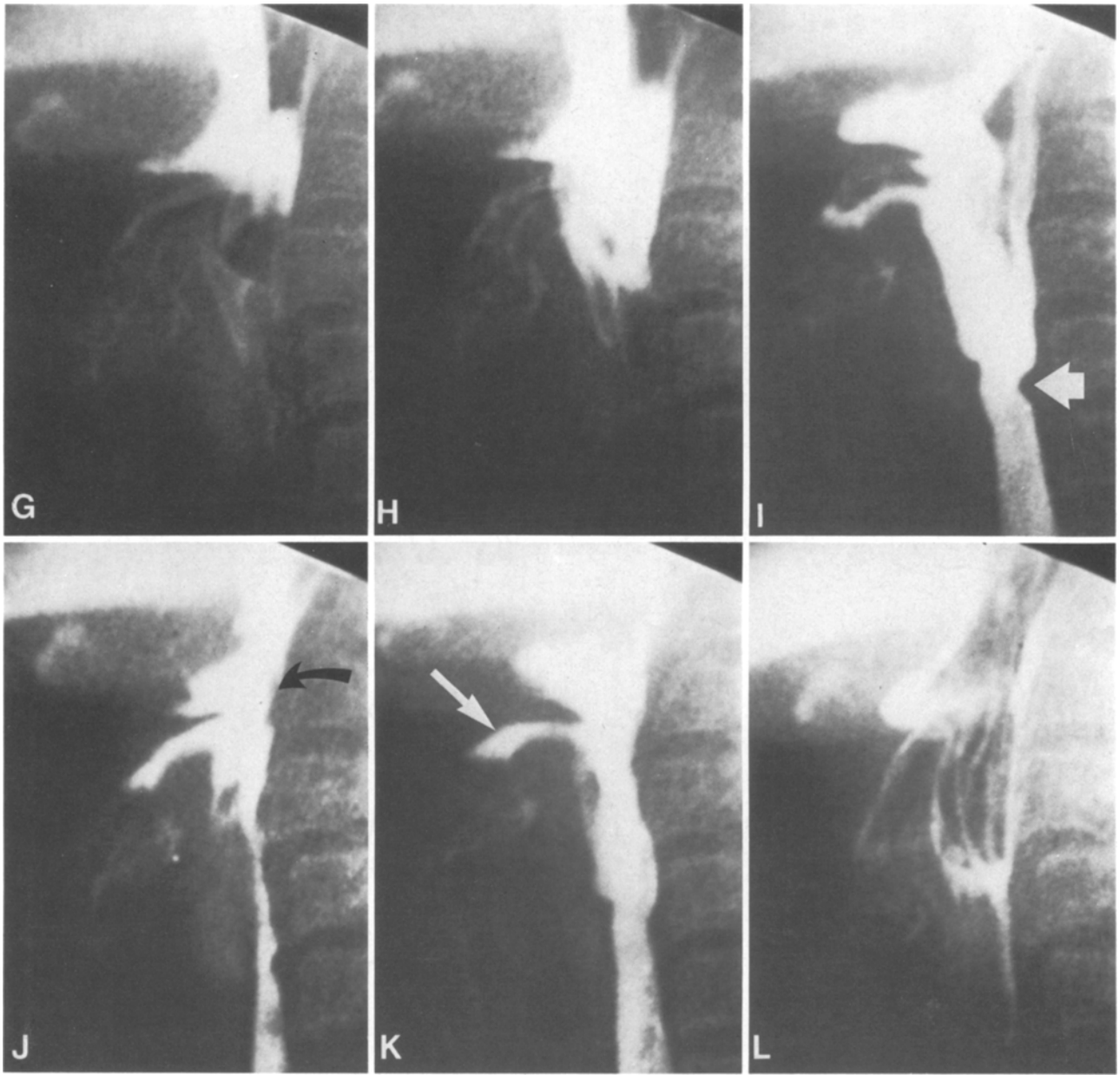



**Fig. 2.** Results from a 60-year-old man with acute dysphagia without suggestion of a foreign body. **A–F** AP projection, **G–L** (*facing page*) Lateral projection sequence from a cineradiographic examination. There is no peristalsis in the pharyngeal constrictor, resulting in some retention of contrast medium after passage of the bolus (**E, J**). Before opening the vestibule the patient manages to clear some of the retained contrast medium (**F, L**) by expiratory efforts. During the early stage of swallowing contrast medium passes into the vestibule (*white arrow*) down to the rima glottidis. The epiglottis does tilt to the transverse position but not further (*curves black arrow*). The cricopharyngeal muscle relaxes too late (*thick white arrow*)

ited a total palsy of all 3 segments of the pharyngeal constrictor (Fig. 2). Cricopharyngeal dysfunction was registered in 16 patients with delayed or incomplete relaxation of the sphincter (Figs. 2 and 3). Cervical esophageal webs were found in 9 patients (Figs. 1 and 3).

One man with a history suggesting a foreign body had a diverticulum in the left Killian–Jamieson's area below the transverse portion of the cricopharyngeal muscle. This diverticulum emerged in anterior direction.

Two patients with acute onset of dysphagia




which suggested a lodged bolus had esophageal abnormalities: 1 had moniliasis, the other had achalasia of the cardia.

## Discussion

Some patients with an acute onset of dysphagia may present with a history of food or foreign body ingestion. Other patients may have a definite and recurrent sensation of being unable to swallow even their own saliva, without giving a history of something specific getting stuck in the throat. These patients' complaints may have developed during a few days.

At least those patients who present with a definite history of swallowing complaints due to a lodged bolus are usually subjected to a radiographic examination to confirm or exclude the presence of a foreign body. The radiographic examination is routinely performed using a single-film technique and is focused on the detection of a foreign body and its potential sequel. Concomitant morphological lesions such as tumors and diverticula as well as cervical esophageal webs are also sought. The examination is often negative: no foreign body is found and no morphological lesions can be disclosed.

In a patient with a history compatible with an

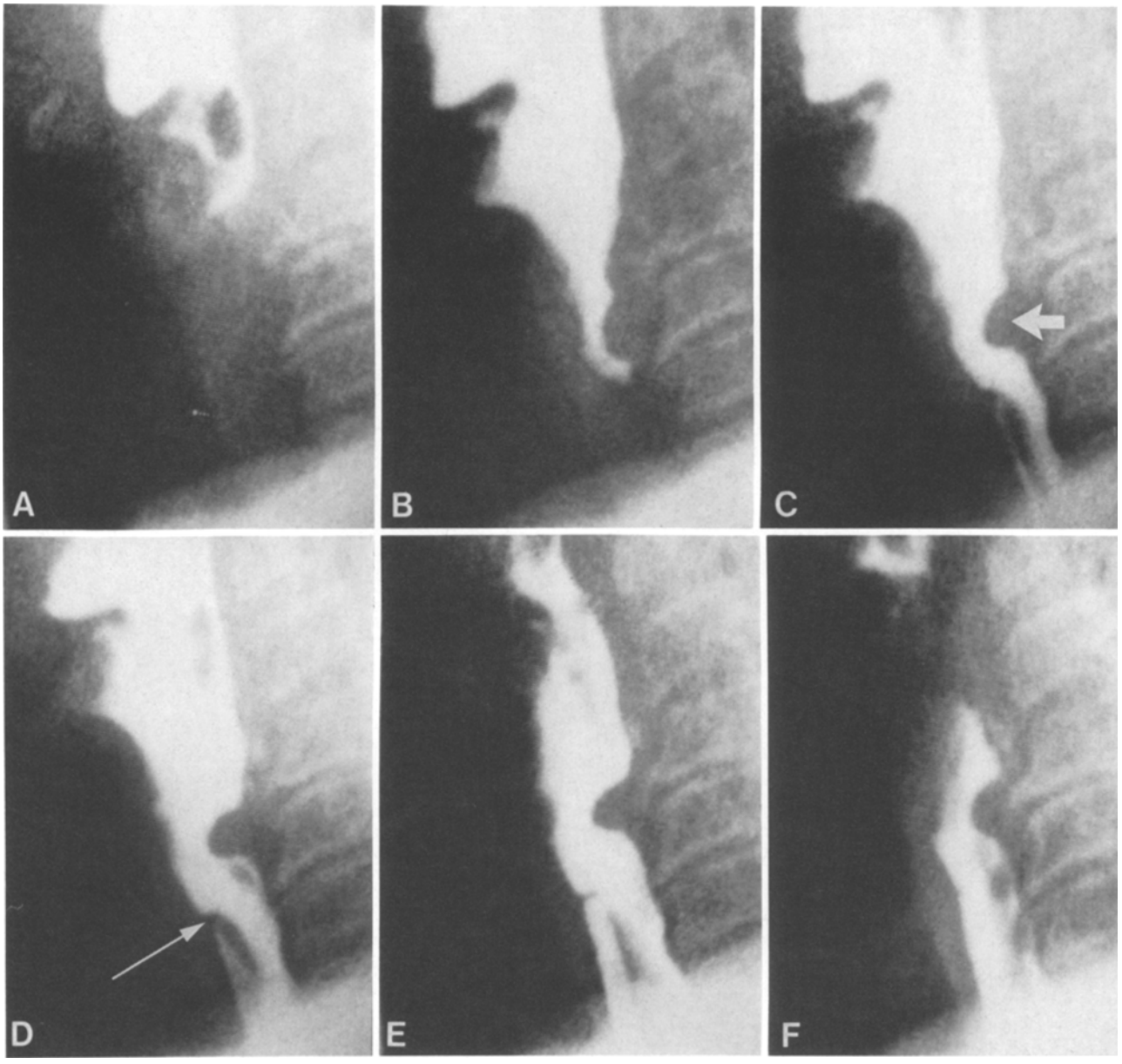



**Fig. 3.** Findings in an 80-year-old woman with dysphagia of two weeks' duration. **A–F** Sequence from a cineradiographic examination in lateral projection. There is an incomplete relaxation of the cricopharyngeal muscle (*arrow*) and a web in the cervical esophagus (*thin arrow*)

ingested foreign body, the examiner is often perplexed by the fact that no lodged bolus can be verified on barium swallow testing. This is more astonishing when patients claim that they cannot even swallow saliva, which is dribbling out of their mouths. This often impairs the patients' speech which becomes slurred. In these cases there may actually have been a lodged bolus which subsequently slipped down during the patient's transportation to the radiology department. The patient's persistent dysphagia could be due to mucosal lesions, which are difficult to detect on standard radiography due to the mucosal folds and plicae in the pharynx.

It has previously been shown that patients with dysphagia frequently experience functional abnormalities in the pharynx [1]. The spectrum of abnormalities may vary from circumscribed and minor lesions in a localized segment of the pharynx, to profound deterioration in the function of the epiglottis, laryngeal vestibule, and pharyngeal constrictors during deglutition [2, 3].

The present study was therefore undertaken to evaluate cineradiography as a modality to monitor pharyngeal function in patients with acute onset of dysphagia. We did not calculate the overall incidence of single-film examination disclosing a foreign body.

The most frequent dysfunction registered was defective closure of the laryngeal vestibule and defective motility of the epiglottis. This is in accordance with earlier studies [1, 4]. This indicates that these 2 functions, which deal with sealing off the airways during the passage of the bolus, are especially susceptible to dysfunction. This is in contrast to the closure of the rima glottidis which seems to be a most invulnerable function dealing with the closure of the airways during deglutition.

One-fourth of the patients with a history compatible with foreign-body ingestion presented with cervical webs. In 6 of these patients the web was either the only abnormality or it was associated with other circumscript dysfunctions such as restricted epiglottic motility or a minor and delayed closure of the laryngeal vestibule. This fact again indicates that cervical esophageal webs are symptomatic and should be considered seriously. In an earlier study the connection between webs and malignancies in the gastrointestinal tract was pointed out [5]. The present study adds to that observation the impact of cervical webs as potential reasons for acute dysphagia.

It is reasonable to assume that the web has been present for some time before the acute episode of dysphagia. However, it became symptomatic when a foreign body became lodged and caused possible trauma to the web. Mucosal rifts and subsequent inflammation may then perpetuate the dysphagia. However recurrent episodes of impacted boluses may have induced a submucosal fibrosis and this may have caused the webs. This has been pointed out in a study where an uncoordinated relaxation of the cricopharyngeal muscle was found regularly in conjunction with cervical esophageal webs [6]. Three of the patients in the present report had both webs and a defective relaxation of the cricopharyngeal muscle. No conclusion about the etiology of webs can be drawn from this series, but our observations indicate that the presence of a web should always be taken seriously. If the web does not respond to conservative treatment an endoscopic excision should be considered.

The pathogenesis of dysphagia and its relation to the dysfunction revealed by cineradiography is unclear. It is, however, tempting to assume that the webs give rise to a mere mechanical obstacle, which also could be true for an uncoordinated cricopharyngeal relaxation. It is also possible that the horizontally positioned epiglottis may give the patient a feeling of fullness in the throat as if the bolus or part of it had become impacted. The epiglottis, while swallowing a small bolus, is usually kept in an upright position even in normal individuals. This may explain why these patients try to overcome their swallowing inconvenience by habitual intake of small boluses.

The importance of a defective closure of the vestibule in the generation of dysphagia experienced as a feeling of something stuck in the throat is not obviously explained. It may be that sensory impulses from the vestibule and the adjacent gullet are mediated via the same fibers in the Xth cranial nerve and that the cortical/central nervous representation is not able to distinguish these impulses anatomically.

The etiology of the different functional abnormalities registered among the patients in this series remains unclear. In a few patients with concomitant cerebrovascular diseases, however, it is reasonable to ascribe the defective function to a lesion within the brain. Since some of the patients were old it is possible that the impaired pharyngeal function represented early cerebrovascular disease. Furthermore, the known decrease in impulse velocity in nerves in the aged hampers the intricate coordination of the synchronized muscular activity during swallowing. In patients with alcoholism and diabetes, peripheral neuritis may occur and could explain the pharyngeal dysfunction. In the same way a local muscular or fibrous tissue lesion could hamper the normal function, especially of such delicate actions as the tilting down of the epiglottis and closure of the laryngeal vestibule.

In the present series some patients presented with multiple lesions. They may have developed some of these earlier, but were able to compensate for the defect. A sudden and new circumscribed defect in the function may, even if minor, disturb the mechanism of compensation even to the degree of overt dysphagia.

Our study has shown that it is possible to demonstrate pharyngeal dysfunction, including webs, in 76% of patients referred for radiography of the pharynx due to a sudden onset of dysphagia. These patients should be examined with respect to pharyngeal function and not only for the presence of a foreign body or its sequelae. Even if fluoroscopy can provide functional information it is difficult to perform and assess in a patient with impaired swallowing. Therefore, we have introduced cineradiography in our routine examination of patients

with acute dysphagia. In our experience it is possible to define the functional status of the pharynx with this technique and in a majority of dysphagial patients find a reasonable explanation for their complaints.

## References

1. Ekberg O, Nylander G: Cineradiography of the pharyngeal stage of deglutition in 250 patients with dysphagia. *Br J Radiol 55:*258–262, 1982
2. Bosma JF: Studies of disability of the pharynx resultant from poliomyelitis. *Ann Otol Rhinol Laryngol 64:*529–547, 1953
3. Donner MW, Siegel CI: The evaluation of pharyngeal neuromuscular disorders by cineradiography. *AJR 94:*299–307, 1965
4. Ekberg O: Defective closure of the laryngeal vestibule during deglutition. *Acta Otolaryngol 93:*309–317, 1982
5. Ekberg O: Cervical oseophageal webs in patients with dysphagia. *Clin Radiol 32:*633–641, 1981
6. Kretzschmar K von R: Beitrag zur Röntgenologie der zervicalen Dysphagie. *Fortschr Röntgenstr 129:*158–163, 1978

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