Aspiration in Children and Adolescents with Neurogenic Dysphagia: Comparison of Clinical Judgment and Fiberoptic Endoscopic Evaluation of Swallowing

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Abstract

A total of 30 children and adolescents with dysphagia due to various chronic neurological disorders were assessed for their risk of aspiration. This assessment was performed clinically by experienced speech and swallowing therapists, and verified thereafter by fiberoptic endoscopy. We found the clinical judgment to be correct in only 70% (for aspiration of saliva), 55% (of puree), and 67% (of thin liquids). We conclude that, because of this unacceptably high error rate of clinical assessment, a fiberoptic evaluation of swallowing is a necessary diagnostic step both for the planning of therapy and for the development of feeding strategies in children and adolescents with neurogenic dysphagia.

Keywords
- dysphagia
- aspiration
- fiberoptic endoscopic evaluation of swallowing

Introduction

Dysphagia is a frequent problem in children and adolescents with chronic neurological disorders.[1,2] In these patients, a clinical evaluation by speech and swallowing therapists allows an assessment of the motor and sensory functions involved in the swallowing process. Thereby, the risk for aspiration can be estimated for various types of food, and important recommendations for feeding and for ongoing swallowing therapies can be given.[3–5] This clinical evaluation can, however, assess only indirect signs for aspirations.

Direct evidence for aspirations can be provided by fiberoptic endoscopic evaluation of swallowing (FEES).[1,6] This low-cost, well-tolerated, and repeatable diagnostic procedure[7] therefore plays an important role in the treatment of patients with dysphagia. Although no visualization of the swallowing process itself is possible, the direct endoscopic visualization of the anatomical structures involved in the swallowing process immediately before and after swallowing is essential both in the primary diagnostic work-up and for follow-up studies of therapy in dysphagic patients.[4,8]

Investigation including FEES is a standard procedure to evaluate the aspiration risk in patients with swallowing disorders. Nevertheless, many of these patients, and especially children, do not undergo such an investigation, especially when they are treated as outpatients. In addition, some patients cannot be investigated at all due to noncompliance or due to contraindications for endoscopy such as thrombopenia. In all these situations, the therapists have to rely on their clinical judgment alone.

In this study, we systematically compared the results of clinical assessment of swallowing with FEES with respect to the estimated risk of aspirations. Thus, we were able to test the validity of the clinical assessments by comparing the results with FEES.

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Patients and Methods

Patients

This analysis included all children and adolescents ($n = 30$; 14 girls; age range, 10 months–17 years; median, 5 years) with neurogenic dysphagia who had received FEES in the Clinic for Neuropediatrics and Neurorehabilitation, Epilepsy Center for Children and Adolescents, Vogtareuth between May 2011 and June 2012. Patient characteristics are displayed in ►**Table 1**.

Clinical Assessment

Before FEES, all these patients had received swallowing therapy as inpatients including a clinical assessment by specialized hospital staff (German board-certified speech and swallowing therapists, all with at least 3 years of professional experience in pediatric neurorehabilitation).

The clinical judgment whether aspiration events occurred was based on anamnestic information (concerning the type of food and way of feeding in the past, the occurrence of respiratory tract infections/aspiration pneumonias and of unclear fever), a detailed physical examination (with special respect to vigilance, tone, head control, mobility, respiration, and voice), the observation of spontaneous tongue and lip movements, drooling, throat clearing, coughing, tongue protrusions, rooting, and, if possible, the observation of the swallowing of puree, thin liquids, and solid food. This assessment resulted in a judgment whether aspiration events occurred (yes/no) for saliva and for the food consistencies thin liquid/puree/solid.

Fiberoptic Endoscopic Evaluation of Swallowing

FEES was performed in an interdisciplinary team comprising a pediatric neurologist (performing the FEES), a nurse (for patient monitoring and safety), and two speech and swallowing therapists (for positioning, motivation, feeding, instruction of phonation, and documentation). We used a pediatric fiberoptic bronchoscope (Olympus BF-3C160, external diameter 3.8 mm, 120 degrees angle of vision; Olympus Medical Systems, Tokyo, Japan) and the rpSzene 6.1 software (Rehder u. Partner Medizintechnik, Hamburg, Germany) for video documentation and archiving. FEES was performed without sedation. All patients received decongestive nasal drops before the examination, positioning was decided individually (buggy/wheelchair/nurse's lap/bed). Heart rate and oxygenation were monitored continually via transcutaneous pulse oxymetry.

After introducing the endoscope nasally, the pharynx and larynx were examined visually looking at the relevant anatomical structures and any saliva residues. Then, when the patient's management of saliva allowed this, food types of different consistencies were given (fruit puree, water, and bread), all colored in blue to make them distinguishable from the red mucosa. Not all consistencies were given to all patients, depending on the individual assessment of the aspiration risk during the FEES.

Both during and after the FEES, the physician and the speech therapists evaluated the findings. For all the tested consistencies, it was decided in a consensus whether evidence for "penetration" (defined as entry of food or saliva in the laryngeal inlet, but not below the vocal folds) or "aspiration" (defined as entry of food or saliva below the vocal folds) was seen.

Finally, silent aspirations (i.e., aspiration of material below the vocal folds without any clearance reaction such as coughing or clearing the throat) were assessed separately, as this is the most dangerous dysfunction in dysphagic patients.[9]

As our intention was to compare clinical practice with FEES, we included clinical judgments from all eight speech pathologists in our team, and FEES was performed by three different pediatric neurologists working together with the respective speech pathologist and the nurse taking care of the child at the time of FEES.

Results

FEES could be completed in all 30 patients, and no serious adverse events occurred. Two patients experienced short dips in oxygenation (below 85%), with spontaneous recovery. Furthermore, two patients required suctioning of saliva or food, but only to increase the visibility during FEES, not for respiratory problems.

The aspiration risk was assessed both clinically and during FEES for saliva in all 30 patients, for puree in 22 patients, for thin liquids in 21 patients, and for solid food only in 3 patients. Therefore, the results for solid food were not analyzed further.

FEES detected aspirations or penetrations for saliva in 15 of 30 patients (50%), for puree in 14 of 22 patients (64%), and for thin liquids in 12 of 21 patients (57%). Silent aspirations were observed for saliva in 9 of 30 patients (30%), for puree in 3 of 22 patients (14%), and for thin liquids in 1 of 21 patients (5%).

We then compared whether clinical judgment and FEES agreed or disagreed on the assessment of the risk for aspiration for the three consistencies (►**Table 1**). When FEES detected only a penetration, we still classified a clinical judgment of aspiration as "true positive," since penetrations imply a high risk for aspirations (even if not all penetrations necessarily lead to aspirations[5]). For the aspiration of saliva, the clinical assessment was correct in 21 of 30 patients (70%; 11 true positive, 10 true negative), but incorrect in 9 of 30 patients (30%; four false negative, five false positive). For the aspiration of puree, clinical assessment was correct in 12 of 22 patients (55%; seven true positive, five true negative), but incorrect for 10 of 22 patients (45%; six false negative, four false positive). For the aspiration of thin liquids, clinical assessment was correct in 14 of 21 patients (67%; 12 true positive, 2 true negative), but incorrect for 7 of 21 patients (33%; all false positive) (►**Fig. 1**).

Discussion

The major finding of this study is that the validity of clinical assessments concerning the aspiration risk in children and adolescents with neurogenic dysphagia is not high. Of 73 assessments overall, only 47 were correct (65%)—in other words, approximately one-third of the assessments were incorrect.

Mistakes were made in both the directions. For 10 of 73 assessments (14%), the speech therapist saw no evidence for aspirations, although they could be documented by FEES

Table 1 Patient characteristics and results for FEES and clinical judgment

Pt no	Sex	Principal diagnosis (age at injury)	Tracheostomy	Age at FEES (mo)	FEES			Clinical		
					Saliva	Puree	Liquids	Saliva	Puree	Liquids
1	M	Traumatic brain injury (7 mo)	N	10	N	N	N	A	A	A
2	F	Multiple congenital anomaly syndrome	Y	10	N	N	N	N	A	A
3	F	Multiple congenital anomaly syndrome	N	15	A	N/A	N/A	A	N/A	N/A
4	F	Complex cerebellar malformation	N	16	N	N	A	N	N	A
5	M	Encephalitis (2.8 y)	N	32	A	P	A	N	N	A
6	M	Hypoxic-ischemic encephalopathy (10 mo)	N	34	P	A	A	A	N	A
7	M	Hypoxic-ischemic encephalopathy (2.7 y)	N	37	P	A	N	N	N	A
8	M	Enzephalitis (10 mo)	N	41	N	N	A	N	N	A
9	M	Cerebral palsy	N	41	A	N/A	N/A	A	N/A	N/A
10	M	Hypoxic-ischemic encephalopathy (3.10 y)	Y	48	A	A	A	A	N	A
11	M	Leukodystrophy	N	51	N	P	N	A	A	A
12	M	Joubert syndrome	N	51	N	N	P	A	A	A
13	F	Cerebral palsy	N	54	A	A	N/A	A	N/A	A
14	F	Arnold–Chiari malformation	Y	55	A	N/A	N/A	A	A	A
15	M	Cerebral palsy	N	75	N	N	P	N	N/A	A
16	M	Cerebral palsy	N	86	A	N	P	N	N	A
17	F	Cerebral palsy	N	90	N	A	P	A	A	A
18	F	Pierre Robin sequence	N	95	N	P	A	N	N	A
19	F	Hypoxic-ischemic encephalopathy (12.7 y)	Y	108	P	P	N/A	A	A	A
20	F	Encephalitis (10 y)	N	123	N	A	A	N	A	A
21	M	Cerebral palsy	N	133	P	N	N	A	N	A
22	F	Refractory epilepsy, tetraparesis, unclear etiology	N	143	A	P	N/A	A	A	A
23	M	Traumatic brain injury (12.8 y)	Y	159	N	N	N	N	N	A
24	M	Niemann–Pick C	N	161	P	N/A	N	N	N/A	A
25	F	FIRES (13.6 y)	Y	171	A	P	N/A	A	A	A
26	M	Traumatic brain injury (7.6 y)	N	179	N	N/A	P	N	N/A	A
27	F	Traumatic brain injury (14.8 y)	N	179	N	N/A	N	N	N	N
28	F	Multiple congenital anomaly syndrome	Y	183	A	A	N/A	A	N	A
29	M	Progressive dystonia	N	195	N	P	N	N	A	N
30	F	Hypoxic-ischemic encephalopathy (17.8 y)	Y	216	N	N	N/A	A	A	A

Abbreviations: A, aspiration; F, female; FEES, fiberoptic endoscopic evaluation of swallowing; FIRES, febrile infection-related epilepsy syndrome; M, male; mo, months; N, no; N/A, not available; P, penetration; Y, yes; y, years.

Note: Demographic and clinical data as well as results for FEES and clinical judgments for the three consistencies saliva, puree, and thin liquids are displayed for all participants, sorted by age at FEES.

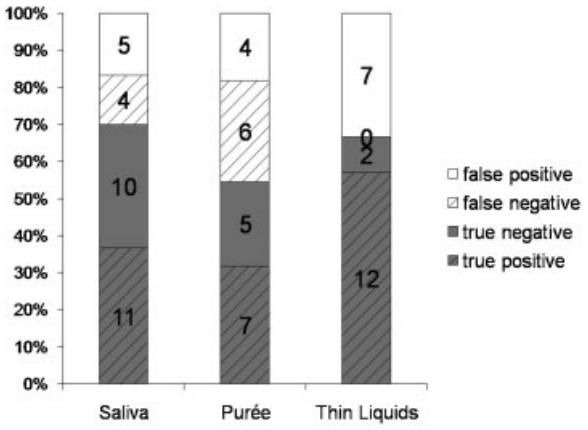

Fig. 1 Validity of the clinical assessments concerning aspirations of saliva, puree, and thin liquids.

(false negative). And for 16 of 73 assessments (22%), the speech therapist assumed that aspirations took place, although they were not observed during FEES (false positive). Especially when these incorrect assessments concern puree and thin liquids, they can have a dramatic impact on the clinical management.

False negative. Of the 13 patients in our cohort who aspirated puree during FEES, the therapists would have given clearance for puree feeding in 6 (46%) patients. This means that, in these patients, to rely on the clinical assessment alone would clearly have increased the risk for complications of aspiration, such as aspiration pneumonia.

False positive. Of the nine patients who did not aspirate puree during FEES, the therapists would have—unnecessarily—prohibited puree feeding in four patients (44%). Similarly, no clearance for the feeding of thin liquids would have been given for 7 of the 18 patients (39%) not showing aspirations of water during FEES. The clinical impact of this type of misjudgment is not as dramatic, but can still imply an unnecessary slowing of the therapeutic process, or even an unnecessary prolongation of the period of tube feeding.

Admittedly, this study has several limitations. First, clinical judgment is always subjective, and different speech pathologists may judge the same patient quite differently. Second, FEES may influence or disturb swallowing and may therefore have an impact on aspiration, so that, in this artificial situation, aspiration events are observed which would, under normal circumstances, not occur. Third, our sample might seem small, especially as a wide age range is covered. On the contrary, we are aware of only one similar study[3] with a larger neuropediatric cohort ($n = 75$) than in our study.

FEES is a safe and reliable procedure for the individual assessment of the aspiration risk for various types of food. This has been shown in previous studies[1,2,6,7] and was again confirmed here. Therefore, we can conclude from the results of our study that, in children and adolescents with neurogenic dysphagia, FEES should be performed as soon as possible in the therapeutic process.

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