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Videofluoroscopic assessment in children with severe cerebral palsy presenting with dysphagia

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Abstract In this study 16 patients with severe spastic cerebral palsy with an age range between 6 months and 16 years were examined using videofluoroscopy and a modified barium meal. All patients were slow, inefficient eaters. Silent aspiration was demonstrated in five cases. The latter five patients demonstrated a

delayed swallow reflex but there was little correlation between aspiration and the oral phase of deglutition. Our data confirms the impression that early diagnostic workup including videofluoroscopy is helpful in managing the feeding difficulties in these children, and may prevent chronic aspiration and malnutrition.

Introduction

Only a limited amount of data is available concerning the characteristic sequelae of dysphagia in children with severe cerebral palsy. Swallowing difficulties that occur are potentially life threatening. Unfortunately, it is not unusual for evaluation and management of such problems to be deferred until the children are medically or nutritionally compromised. Reports of the videofluoroscopic swallow studies of such children are rare, although recently a comprehensive survey of 22 patients assessed in this manner has been published [1].

Materials and methods

Subjects

The data reported here was extracted from a standard database on 16 consecutive cases of severe cerebral palsy (10 boys, 6 girls) at the Ulster Hospital Swallow Assessment Clinic. The subjects at the time of study ranged from 6 months to 16 years of age. All patients demonstrated severe motor involvement with tetraplegia. Two patients had mixed spastic/athetoid cerebral palsy.

Videofluoroscopic procedure

All studies were completed in the radiology department of the Ulster Hospital by one or other of the two first named authors. A speech/language therapist assessed the patients prior to, and after the radiological examination. The initial referral was always however from a medical practitioner, either the patient's paediatrician or, in some cases, their community-based general practitioner. The technique used has previously been described in some detail [2]. Videofluoroscopic evaluation was done on a remote control machine (Siemens Siregraph 2) utilizing a VHS video-recorder (Panasonic NV – SD4413) interfaced directly with the X-ray screening footswitch. This system permitted repeat immediate viewing of an examination at variable speed, as well as still-frame evaluation.

Infants and children were fed in a similar position and if possible in the same chair that would normally be used at home or in the community. A mobile ramp allowed the smaller chairs to reach the field of view of the imaging system. Older children were occasionally seated on the footplate of the screening table.

The texture and type of barium utilized was prepared by our clinic dietician to simulate the usually tolerated foodstuffs for each child. Barium used was E-Z-HD, (E-Z-EM Co. Westbury, N. Y.). Infants were given liquids but older children were assessed with barium impregnated paste, puree, biscuits, jelly or mince. All materials were at room temperature apart from the mince which was heated according to patients' preference. Most studies were carried out using a lateral projection only, although occasional anterior-posterior images were also obtained. This proved useful in assessing symmetry or lateralization of bolus passage and retention in the pharyngeal recesses.

Multiple abnormalities were identified including:

- A. Extensor spasm of the arms and neck as food approaches the mouth
- B. Poor lip closure
- C. Abnormal tongue movements, such as "tongue pump" movement (a poorly coordinated up and down movement pattern)
- D. Jaw spasticity
- E. Nasal aspiration
- F. Delayed swallow reflex
- G. Laryngeal dipping (transient dipping of contrast medium into the upper larynx above vocal cord level)
- H. Cricopharyngeal dysmotility
- I. Silent aspiration (no cough reflex)

Gastro-oesophageal reflux was not assessed, as in our experience this is better demonstrated as part of a conventional barium meal study or by pH monitoring.

Results

The prevalence of each type of individual abnormality in the study is demonstrated in Table 1. These can be broadly grouped into pre-oral, oral and pharyngeal. The pre-oral phase is represented by extensor spasm. The oral phase includes lip closure and tongue and jaw movements. The pharyngeal phase abnormalities include abnormalities of pharyngeal motility such as a delayed swallow reflex, laryngeal dipping, cricopharyngeal dysmotility and aspiration. The oral phase was abnormal in 11 cases (68.75%). In the pharyngeal phase, triggering of the swallow reflex was delayed in 12 cases (75%). Aspiration was observed in five patients (31.25%), none of whom demonstrated an adequate cough reflex. The number of swallowing abnormalities per patient are tabulated (Table 2).

Only one patient had a single abnormality but nine (56.25) had three or more abnormalities. All patients who displayed silent aspiration also showed a delay in the swallow reflex. Conversely four of the nine patients who demonstrated delayed swallowing did not aspirate. The aspiration pattern varied between food consistencies. Of the five patients who aspirated:

- A. Two (40%) aspirated with liquid consistency alone
- B. One (20%) aspirated with both liquid and puree
- C. One (20%) aspirated with puree alone
- D. One (20%) aspirated with shortbread alone

Discussion

The frequent occurrence of dysphagia with severe spastic cerebral palsy has been widely reported [3-5]. On occasions gastrostomy feeding has been advocated to ensure adequate nutrition. We advocate a tailor-made feeding programme for each child optimising their family's strengths and minimising weaknesses.

Table 1 Characteristics of swallowing abnormalities in 16 patients with spastic cerebral palsy

Abnormality	Number	Percentage
Extensor spasm	3	18.75
Poor lip closure	5	31.25
Tongue pump action	9	56.25
Jaw tightness	1	6.25
Nasal aspiration	2	12.5
Cricopharyngeal dysmotility	2	12.5
Delayed swallow reflex	8	50
Laryngeal dipping	1	6.26
Silent aspiration	5	31.25

Table 2 Number (%) of patients demonstrating one or more swallowing abnormalities

Number of swallowing abnormalities	Number of patients (%)
1	1 (6.25)
2	6 (37.5)
3	7 (43.75)
4	2 (12.5)

Recently, dynamic recording capability has become much more widely available with the use of inexpensive videotape-recorders, easily connected to existing videofluoroscopy systems. Despite some loss of image quality, videotape-recorded fluoroscopy has many advantages over conventional cinefluorography systems in that it does not require specially designed radiographic equipment. Videofluoroscopy does involve radiation exposure of the patient, which must be minimized because of the known potential harmful effects. Patient doses in diagnostic radiographic procedures are highly operator dependent. Although doses can be crudely estimated from known parameters [6], good technique can minimize unnecessary exposure. This includes well-established methods such as intermittent screening, good collimation, the use of timing devices and so on. Ongoing studies at this institution will soon determine exact figures. In principal, examinations are only carried out where the information gained is likely to outweigh any radiation risk. The rapid increase in recent years of the use of feeding gastrostomy tubes in such patients will further increase pressure to perform videofluoroscopic studies earlier, in order to plan the optimum time for tube insertion. It is not yet clear whether this test is advisable as a baseline standard, and it should be stressed that all patients in this study were already significantly nutritionally compromised.

The videofluoroscopic swallow study provides a clear picture of the dynamics of the entire swallowing process. Clinical assessment by the speech therapist is an accu-

rate means of assessing the oral phase of swallowing but unreliably detects difficulties with the pharyngeal and oesophageal phases of swallowing. As no obvious correlation exists between oral phase problems and silent aspiration, videofluoroscopic assessment proves invaluable in predicting the most serious abnormality, namely silent aspiration. In our study no patient who aspirated demonstrated a cough reflex revealing that "no cough" while eating is not necessarily a good sign.

Our study confirms the impression that videofluoroscopic assessment of dysphagia is a useful tool in the individualisation of a feeding programme. A statistically significant correlation between pharyngeal abnormalities and aspiration has been noted [1]. Videofluoroscopy allows parents and caretakers the opportunity to observe the therapeutic impact of positional/postural changes and alteration in texture and/or bolus size of the material swallowed to eliminate aspiration.

The use of varying textures of food laced with barium is a technique widely recognised by radiologists specialising in the field of dysphagia in adults [7]. It is not always the case that thin liquids are necessarily the most dangerous to swallow in terms of likely aspiration. In this study 40% of those who aspirated did so with consistencies other than thin liquid. If a liquid only barium

study had been performed, 40% of those who aspirated would not have been detected. In our opinion this justifies the increased radiation dose to the patient although we accept this view is controversial.

Our sample of 16 patients revealed 5 with silent aspiration (31.25%). This is significantly less than the 70% reported by Griggs et al. [3] or the 68.2% reported by Mirrett et al. [1]. This may reflect our policy of early assessment and the relatively high awareness of the role of videofluoroscopy amongst paediatricians and speech therapists working in our catchment area. Clinical assessment of similar patients in our institution revealed that the pattern of feeding problems observed could change with the age of the patient. Repeat clinical and videofluoroscopic assessment may prove helpful but must be weighed against harmful radiation effects. Further studies in this area are required.

Early documentation of each child's swallowing profile with the radiologist involved as part of a multidisciplinary team allows appropriate feeding regimens to be introduced on the basis of knowledge rather than trial and error. Further studies need to clarify whether this approach lessens or indeed increases the likelihood of feeding gastrostomy. This work is currently in progress at our institution.

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