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Swallowing Therapy of Neurologic Patients: Correlation of Outcome with Pretreatment Variables and Therapeutic Methods

Stefanie Neumann, MA(phil),[1] Gudrun Bartolome, SLP,[1] David Buchholz, MD,[2] and Mario Prosiegel, MD[1]

[1]Neurologisches Krankenhaus München, Munich, Germany; and [2]The Johns Hopkins Swallowing Center and Department of Neurology, The Johns Hopkins Medical Institutions, Baltimore, Maryland, USA

Abstract. The results of swallowing therapy in 58 patients with neurologic disorders are presented. All patients received tube feeding, either partially or exclusively, at admission, and successful outcomes, defined as exclusively oral feeding, were achieved in 67% of patients over a median treatment interval of 15 weeks. A subset of 11 patients who had experienced disease onset 25 weeks or more prior to admission nonetheless had a similar success rate of 64%. No other pretreatment variable, including age, localization of lesion, type or degree of aspiration, or cognitive status, correlated with successful outcome. Indirect therapy methods such as stimulation techniques and exercises to enhance the swallowing reflex, alter muscle tone, and improve voluntary function of the orofacial, lingual, and laryngeal musculature were utilized in all but 1 patient. Direct methods including compensatory strategies such as head and neck positioning, and techniques such as supraglottic swallowing and the Mendelsohn maneuver were additionally employed in nearly one-half of patients. Swallowing therapy is associated with successful outcome, as defined by exclusively oral feeding, among patients with neurogenic dysphagia, regardless of pretreatment variables including time since disease onset. Indirect treatment methods appear to be effective when used either alone or in combination with direct methods. Achievement of oral feeding is not associated with undue risk of pneumonia. Further rigorous scientific studies are needed.

Key words: Dysphagia — Swallowing therapy — Swallowing rehabilitation — Deglutition — Deglutition disorders.

Address offprint requests to: David Buchholz, M.D., 601 N. Caroline Street, Room 5072A, Baltimore, MD 21287-0876, USA

Swallowing therapy in patients with neurogenic dysphagia takes two basic forms: direct and indirect. Direct therapy emphasizes compensatory techniques to help cope with sensorimotor impairment of the oral cavity, pharynx, and/or larynx, resulting in swallowing dysfunction. Examples of these compensatory techniques include postural adjustment, double swallowing, supraglottic swallowing, and the Mendelsohn maneuver [1–4]. The potential applications and benefits of these approaches have been previously discussed [5–14].

Indirect swallowing therapy, on the other hand, attempts to overcome sensorimotor impairment through stimulation techniques and exercises to enhance the swallowing reflex, alter muscle tone, and improve the function of voluntary orofacial, lingual, and laryngeal muscles. It is based on the principle that, following neurologic injury, recovery of lost functions can be facilitated by specific stimulation and re-education of the neural pathways governing those functions [15,16]. This principle underlies many established neurologic rehabilitation strategies [17–23].

The study reported herein retrospectively reviews the outcomes of 58 patients with neurogenic dysphagia who were treated with either indirect therapy alone or indirect plus direct therapy. Additionally, patient outcomes were correlated with important pretreatment variables. The results are consistent with the position that swallowing therapy is safe and efficacious and should be considered for all patients with neurogenic dysphagia. Furthermore, indirect therapy alone appears to be an effective approach for selected patients.

Patients and Methods

The study group consisted of 32 males and 26 females aged 22–84 years (median 57 years) who were hospitalized at a neurologic rehabilitation

facility. They were seen consecutively over a period of 5 years and had been referred for swallowing therapy because of overt difficulty swallowing. Exclusion criteria were (1) nonneurologic underlying illness, (2) exclusively oral feeding at time of admission, and (3) prior surgery, such as cricopharyngeal myotomy or laryngeal suspension, to improve swallowing.

Underlying illnesses included ischemic infarction, hemorrhage, neoplasm, and traumatic brain injury. Additionally, 2 patients had brainstem encephalitis. Lesions were categorized as either cortical, basal ganglia, or brainstem and as either unilateral or bilateral. The median time since onset of disease (time since lesion) was 10 weeks with a range of 3–156 weeks.

Patients were studied by means of interview, clinical ("bedside") swallowing examination, cognitive testing, and cineradiographic evaluation of swallowing based on the method of Donner modified by Hannig [24]. Swallowing studies were performed before and after (and in some cases also during) swallowing therapy.

Pretreatment patient variables included (1) age, (2) localization of lesion, (3) time since lesion, (4) type of feeding (partially or exclusively tube feeding), (5) swallowing phase impairment (oral preparatory, oral, pharyngeal, and/or esophageal), (6) type of aspiration (none, pre-, intra-, or postdegluttitive), (7) degree of aspiration (none, penetration of laryngeal vestibule without subglottic contrast, <10% subglottic contrast with cough present, or >10% subglottic contrast and/or cough absent), and (8) cognitive status (presence or absence of attention, memory, or planning/problem solving deficits).

Swallowing therapy was of two types: direct and indirect. Direct methods involve compensatory strategies based on manipulation of the act of swallowing during food intake. These techniques have been previously described in detail [1–14] and include head and neck positioning, supraglottic swallowing, and the Mendelsohn maneuver.

Indirect therapy methods attempt to stimulate the swallowing reflex and to restore voluntary orofacial, lingual, and laryngeal motor activity; they can be divided into three categories: (1) stimulation, (2) assisted exercises, and (3) independent exercises.

Stimulation is conducted prior to exercising and utilizes sensory stimuli not only to promote reflex activity but also to encourage voluntary motor function or alter muscle tone. For example, as described by Logemann [5], an iced mirror applied to the faucial arches is intended to trigger the swallowing reflex. Passively stretching a patient's cheek laterally with a tongue blade placed into the corner of the mouth is utilized to increase facial muscle tone and enhance subsequent voluntary closure of the mouth. Stimulation of the tongue via stretching, brushing, or icing is performed to activate movements and, depending on the stimulus, increase or decrease muscle tone.

Assisted exercises can be isotonic (movement against resistance) or isometric (maintenance of position against resistance). For instance, an isotonic exercise would be pushing a tongue blade away from the mouth with the tip of the tongue, whereas an isometric exercise would be holding the tongue steady in the midline while the therapist applies lateral pressure.

Independent exercises include more complex, voluntary actions that are described and/or demonstrated by the therapist and then copied by the patient. For example, the patient may be taught to voluntarily prolong laryngeal elevation. By building on these learned skills, the patient may then be able to accomplish compensatory techniques such as supraglottic swallowing and the Mendelsohn maneuver, which are among the methods of direct therapy. Indirect therapy can thereby serve as a bridge to successful direct therapy.

The patients in this study received individualized therapy 5 days per week for approximately 45 min per session. Twenty-nine patients (50%) received indirect therapy alone, 28 were treated with both direct and indirect methods, and 1 patient had only direct therapy. The decision as to how each patient was treated was made at the discretion of the swallowing therapist, based on clinical and radiographic assessment. Regardless of the type of therapy chosen, all patients received appropriate modification of dietary consistencies. Treatment lasted a median of 15 weeks with a range of 2–52 weeks.

Outcome of therapy was judged on the following scale: (1) exclusively oral feeding without compensatory techniques, (2) exclusively oral feeding with compensatory techniques, (3) partially oral feeding without compensatory techniques, (4) partially oral feeding with compensatory techniques, and (5) exclusively tube feeding. For statistical analysis, a successful outcome was defined strictly as categories 1 and 2 (exclusively oral feeding without or with compensatory techniques). Successful outcomes were correlated with pretreatment patient variables and with the type of therapy (indirect alone vs. indirect plus direct). In addition, the type and duration of therapy were correlated with each other and with certain pretreatment variables.

Table 1. Swallowing phases showing impairment (>10% prevalence)

Pharyngeal	31%
Oral preparatory + oral + pharyngeal	26%
Oral preparatory + oral	17%
Oral + pharyngeal	12%

Table 2. Type of aspiration

21%		None	
14%		Predegluttitive aspiration	15%
7%	9%	Intradegluttitive aspiration	10%
24%		Postdegluttitive aspiration	

The converging lines indicate percentages of coexisting types of aspiration.

Table 3. Degree of aspiration

None	21%
Penetration of laryngeal vestibule	21%
<10% with cough present	23%
>10% and/or cough absent	35%

Results

Prior to treatment, 50 patients (86%) had exclusively tube feeding and 8 (14%) had combined oral and tube feeding. The frequencies of swallowing phase impairments with prevalence greater than 10%, alone or in combination, are presented in Table 1. The frequencies of the types and degrees of aspiration are shown in Tables 2 and 3, respectively. Table 4 lists the prevalence of cognitive deficits.

A successful outcome (exclusively oral feeding) was achieved in 39 patients (67%). Statistical correlation of each pretreatment variable with regard to successful

Table 4. Cognitive deficits

Attention deficits	52%
Memory deficits	36%
Planning/problem solving deficits	36%

Table 5. Attention deficits correlated with median duration of therapy

Attention deficits present (n = 30; 52%)	20 weeks
Attention deficits absent (n = 28; 48%)	10 weeks

$p = 0.00136$; Mann-Whitney U-test, two-tailed probability.

Table 6. Time since lesion and successful outcome

Time since lesion	Successful outcome (%)
<25 weeks (n = 47; 81%)	68
≥25 weeks (n = 11; 19%)	64

Not significant; Chi-square test, two-tailed probability.

outcome revealed no significant relationship of any of the variables, although patients with attention deficits required longer duration of therapy (Table 5). This study failed to confirm the results of a previous study indicating that attention deficits were associated with poorer outcome of swallowing therapy [26], perhaps because of the relatively small number of patients studied. Of special note is the fact that "time since lesion" did *not* correlate with outcome when patients were segregated into two categories; less than 25 weeks and 25 weeks or more (Table 6). Those in the latter category tended to require longer duration of therapy (20 weeks vs. 12 weeks), although the difference was not statistically significant.

Correlation of swallowing phase impairment with the type of therapy chosen (indirect vs. indirect plus direct) revealed that indirect therapy alone was the preferred method in 80% of patients with oral preparatory and oral phase impairment, as compared with 50% of patients overall and only 23% of patients with pharyngeal phase impairment alone (Table 7). With regard to time since lesion, indirect therapy alone was somewhat more likely to be chosen in the group of patients who were less than 25 weeks (Table 8).

Indirect plus direct therapy tended to last longer than indirect therapy alone (18 weeks vs. 12 weeks), but the difference was not statistically significant. Successful outcomes tended to be associated with indirect therapy alone, but not to a significant degree (Table 9).

The overall outcome of swallowing therapy, according to type of feeding before and after treatment, is indicated in Table 10. Table 11 indicates that achievement of oral feeding was not associated with increased risk of pneumonia during or after therapy; to the contrary, patients who remained tube-feeders were much more likely to incur pneumonia.

Table 7. Swallowing phase impairment correlated with type of therapy chosen

Swallowing phase impairment	Indirect therapy (%)	Indirect + direct therapy (%)
Pharyngeal[a]	23	72
Oral preparatory + oral + pharyngeal	60	40
Oral preparatory + oral	80	20
Oral + pharyngeal	42	58

[a]One patient with pharyngeal phase impairment received direct therapy alone.

Table 8. Time since lesion correlated with type of therapy chosen

Time since lesion	Indirect therapy (%)	Indirect + direct therapy (%)
<25 weeks	55	45
≥25 weeks	27	73

Not significant; Chi-square test, two-tailed probability.

Table 9. Type of therapy correlated with successful outcome

Type of therapy	Successful outcome (%)
Indirect	76
Indirect + direct	57

Not significant; Chi-square test, two-tailed probability.

Table 10. Type of feeding before and after swallowing therapy

	Before (%)	After (%)
Exclusively tube feeding	86	14
Oral and tube feeding combined	14	19
Exclusively oral feeding	0	67

Discussion

The results of this study are consistent with previous reports indicating that swallowing therapy is associated with successful outcome, in this study defined by achievement of oral feeding, in patients with neurogenic dysphagia [8,11,25,26]. It is acknowledged that, following neurologic injury such as stroke or trauma, spontaneous recovery of impaired neurologic functions may contribute to improved outcome in the setting of rehabilitative management. In this study, however, the beneficial role of swallowing therapy, independent of natural neurologic recovery, is substantiated by the simi-

Table 11. Occurrence of pneumonia during and after therapy according to feeding status at discharge

	Pneumonia during therapy (%)	Pneumonia within 4–6 weeks after therapy (%)
Exclusively tube feeding	89	22
Oral and tube feeding combined	17	9
Exclusively oral feeding	9	2

larly high rates of successful outcomes (68% vs. 64%, respectively) in not only those patients with recent lesions (<25 weeks) but also those with remote lesions (≥25 weeks). The vast majority of spontaneous recovery takes place within the first 25 weeks after neurologic injury, and subsequent improvement, as in this study, implies the effect of some other factor, in this case swallowing therapy.

Moreover, the benefit of swallowing therapy demonstrated by this study cannot be attributed solely to improved compensation in the face of stable oropharyngeal dysfunction, as one-half of the patients received indirect therapy *alone* and therefore were not trained in compensatory techniques. The implication is that, as in other areas of rehabilitation, specific stimulation methods and exercises can facilitate the return of impaired voluntary motor functions.

The relative efficacy of indirect therapy vs. indirect plus direct therapy cannot be inferred from this study, because the patients selected for each type of therapy were not strictly comparable. Patients who received indirect therapy alone were more likely to have had recent neurologic injury (<25 weeks) and to have had oral preparatory and oral phase impairment. The tendency to choose indirect therapy alone for those patients with recent lesions may reflect greater optimism about the potential for functional recovery in those patients. The correlation between choice of indirect therapy alone and oral preparatory or oral phase impairment is understandable, corresponding to the focus of indirect therapy on voluntary motor functions such as those involved in these phases, as opposed to the involuntary nature of the pharyngeal phase.

It should be emphasized that indirect and direct therapy are compatible, as in nearly one-half of the study patients, and they can be productively integrated. For some dysphagic patients it may be mandatory to first attempt to reestablish orofacial, lingual, and laryngeal muscle performance using indirect therapy prior to instituting compensatory methods (direct therapy), because these patients may be unable to carry out compensatory techniques such as supraglottic swallowing or the Mendelsohn maneuver if the requisite voluntary musculature functions inadequately.

It is possible that the apparent benefit of swallowing therapy as demonstrated by this study is related not to specific therapeutic interventions but rather to nonspecific factors inherent in the therapeutic interaction, such as frequent human contact, mobilization, or increased attention to swallowing impairment and its potential complications. A randomized, prospective trial with three arms (specific treatment, nonspecific interaction, and no treatment) would be needed in order to investigate this possibility.

As no pretreatment variable correlated with successful outcome, this study provides no evidence to help predict which patients with neurogenic dysphagia are more or less likely to respond favorably to swallowing therapy. Even patients with cognitive deficits had no statistically significant tendency toward treatment failure. Accordingly, all patients with neurogenic dysphagia, regardless of factors such as age, localization of lesion, time since lesion, type and degree of aspiration, and cognitive status, should be considered for swallowing therapy.

Swallowing therapy appears to be relatively safe in that there was a low incidence of pneumonia during or within 4–6 weeks following therapy among those patients who achieved oral feeding. On the other hand, patients who had to continue tube feeding were much more likely to suffer pneumonia, presumably because their severely compromised swallowing function not only precluded oral feeding but also predisposed to aspiration of oropharyngeal secretions and/or refluxed tube feedings. The approximately fourfold higher occurrence of pneumonia during therapy as compared with the interval within 4–6 weeks after therapy probably reflects the several-fold longer duration of the therapy interval (i.e., the incidence was stable, but the periods of ascertainment varied in length). Alternative explanations include (1) pulmonary protective mechanisms may have been more impaired during the therapy interval because of the relative recency of the patients' acute illnesses during that time as compared with the post-therapy interval; (2) the therapy itself may have contributed to the occurrence of pneumonia during treatment, although this is unlikely given the very small amounts of material ingested under careful supervision; and (3) the lower occurrence of pneumonia after therapy may indicate a beneficial effect of therapy on airway protection, even among those patients who did not achieve oral feeding.

Despite the apparent benefit of swallowing therapy as evidenced by the two-thirds of patients in this study who achieved fully oral feeding, further and better studies are needed. Only prospective, randomized, controlled studies employing treatment and nontreatment

arms will finally resolve the issue of whether or not swallowing therapy is efficacious and cost effective, as well as the relative contributions of indirect and direct methods.

Conclusions

Swallowing therapy is safe and is associated with successful outcome, in this study defined by achievement of oral feeding, in patients with neurogenic dysphagia, regardless of pretreatment variables including time since disease onset. Indirect treatment methods such as stimulation techniques and exercises appear to be effective when used either alone or in combination with direct methods such as compensatory maneuvers. Truly rigorous, controlled, scientific studies are needed.

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