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Neurogenic dysphagia: Nutrition therapy improves rehabilitation

Augmented clinical nutrition optimizes the general rehabilitation outcome in patients with neurogenic dysphagia. A study involving 127 stroke patients undergoing postacute multidisciplinary rehabilitation.

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\textbf{ABSTRACTS}

\textbf{Objectives:} To examine whether augmented nutrition therapy (Volkert et al. 2006, Williams 2006) improves the general rehabilitation outcome of patients with neurogenic dysphagia compared to neurologic patients without dysphagia.

\textbf{Subjects / methods:} 127 stroke patients undergoing postacute multidisciplinary neurorehabilitation approach were routinely screened for neurogenic dysphagia and undernutrition. An aspiration free daily input of 1300 to 2500 kcal was assured by means of augmented clinical nutrition including changes of food/fluid consistency, feeding assistance, mealtime supervision, therapeutic swallowing manoeuvres, endoscopic evaluation, tube feeding, and parenteral nutrition (Volkert et al. 2006, Williams 2006, ECRI 1999, Bath et al. 2002). Outcome was defined as difference of neurofunctional scores at admission and discharge. Nutritional status was assessed with Innsbruck Nutrition Scale (Hackl 2004) and Nutritional Risk Screening (NRS 2002; Kondrup et al. 2003).

\textbf{Results:} 50\% (n = 64) of all patients of the whole sample needed nutritional support. A high amount of cognitive impairment in these swallowing compromised patients (56 out of 64) indicates that most of these patients suffered from neurogenic dysphagia affecting the preoral swallowing phase. Only 31 out of 63 of normal swallowing patients were cognitively normal. Swallowing disordered patients exhibited a highly significant better outcome in rehabilitation compared to not swallowing disturbed patients.

\textbf{Conclusions:} Multiple approaches for screening and assessment of dysphagia and undernutrition after stroke and enforced nutrition scenario unmask the underestimated rehabilitation potential of swallowing compromised patients after stroke.

\textbf{Keywords:} Neurogenic dysphagia, clinical nutrition, rehabilitation

\textbf{Zielsetzung:} Verbessert forcierte Ernährungstherapie (Volkert et al. 2006, Williams 2006) den Rehabilitationserfolg bei Patienten mit neurogenen Schluckstörungen im Vergleich zu neurologischen Patienten ohne Dysphagie?


\textbf{Schlussfolgerungen:} Der Einsatz verschiedener Methoden für Screening und Klassifizierung von Schluckstörungen und Unterernährung bei Patienten nach akutem Schlaganfall belegt ebenso wie die Ergebnisse unterstützender Maßnahmen bei der Nahrungsaufnahme, dass das Rehabilitationspotenzial von Schlaganfallpatienten mit Schluckstörungen unterschätzt wird.

\textbf{Schlüsselwörter:} Neurogene Schluckstörungen, Dys phagie, klinische Ernährung, Rehabilitation
The incidence of neurogenic dysphagia in patients with acute stroke ranges from 35 to 40 % respectively 50 %, half of them not recovering in the first week living with dysphagia for months after stroke. Not only swallowing difficulties but also altered consciousness and or sensory/perceptual deficits may lead to dysphagia. Up to 20 % of stroke survivors die during the first year from aspiration if stroke related dysphagia is present, 37 % will develop pneumonia (Adams et al. 2005, National guideline clearinghouse of the Heart and Stroke Foundation of Ontario (HSFO) 2005).

Also for 60 % of patients with traumatic brain injury dysphagia is reported in the (post)acute phase (Mackay et al. 1999). Dysphagia increases the risk of developing poor nutritional status, the risk of infections, impaired functional outcome, slower rate of recovery, poorer rehabilitation potential and higher mortality (Williams 2006, Perry et al. 2003, Kondrup et al. 2003). Fewer data are available for patients with complicated course after surgery or sepsis and complex critical illness. Mertl-Rötzer (2004) reports the high incidence of dysphagia in 80 % of postacute patients after longterm ventilation, exact percentages in former research are not available (Jarrett et al. 1995, Isherwood et al. 2007).

30 % of all geriatric patients in hospital are undernourished (Volkert et al. 2006), a large part of them even at admission, for the majority of them undernutrition develops further while in hospital (Davalos et al. 1996). We suppose that this could be prevented if special attention would be paid to nutritional care.

This clinical study was conducted because in our rehabilitation setting patients with neurogenic dysphagia seem to exhibit quite remarkable improvement during neurorehabilitation. Thus we investigated the hypothesis that augmented nutritional strategy improves outcome and uncovers the underestimated rehabilitation potential of stroke patients with neurogenic dysphagia.

Methods/Subjects

128 consecutive inpatients undergoing postacute neurorehabilitation were enrolled, one patient dropped because of second stroke event during rehabilitation. Inclusion criteria were ischemic or hemorrhagic stroke (n = 89), traumatic brain injury (TBI), severe polyneuropore- and myopathy after complex critical illness (CID) as disabling disease (n = 38), minimal duration of stay three weeks and no further stroke during rehabilitation.

92 men and 35 women with median age of 65 years (SD 13.6) were included and followed up. Median time since onset of signs and symptoms until start of neurorehabilitation was 7.4 weeks, median length of stay was 29 days. 70 patients were obese (according to body mass index (BMI) > 25 kg/m²). Cognitive deficits (perceptual problems, hemispatial neglect, attention-, memory-deficits or problems in information processing/cognitive deceleration) were detected in 81 out of 127 patients.

Further patient characteristics for the whole sample are shown in table 1. Table 2 shows the characteristics of patients with (n = 64) versus without (n = 63) nutritional support. This research was completed in accordance with the guidelines of the Helsinki Declaration (2004).

Rehabilitation setting

In our specialized department for inpatient neurorehabilitation therapy was individually adapted according to the principles of Bobath (1993), Affolter (1997), proprioceptive neuromuscular facilitation (Wang 1994), cognitive therapeutic exercises (Perfetti 1986), lactate adjusted treadmill training, with/without partial body weight support (Hesse et al. 1995, Husemann et al. 2007), 24 hours rehabilitation nursing, speech and swallowing diagnosis and therapy including fiberoptic endoscopic examination of swallowing (FEES) and functional dysphagia therapy (FDT; ECRI 1999, Bartholome 1993, Bath et al. 2002), neuropsychological and psychological assessment, training and support (Prigatano et al. 1986, Finestone et al. 1995), caregiver involvement and training, social support, and recreational therapy. Individual rehabilitation plans were established.

Nutritional management

Screening for impaired nutritional and swallowing status was performed within three hours after admission before administering drugs, food or fluid (Kondrup et al. 2003, National guideline clearinghouse of HSFO 2005). For screening for dysphagia a simple bedside observation was conducted by trained nursing stuff and/or physician during initial examination including anamnestic data as recent pneumonia, observation of consciousness, severe cognitive deficits concerning attention, perception, quality of voice, coughing, slow and effortful eating, globus syndrome, reduced deglutition rate. In case of any abnormalities bedside swallowing assessment was conducted by speech and swallowing therapists (SLP) within three hours after admission including: anamnestic data as recent pneumonia, severe cognitive deficits see above, preoral swallowing phase, orofacial motor and sensory abilities, pocketing, swallowing water, voice quality before/after water according to National Guideline Clearinghouse HSFO 2005 (Williams 2006).

Bedside FEES was conducted, radiologic videofluoroscopic examination of swallowing was conducted if swallowing assessment remained unclear after FEES (ECRI 1999). Energy and fluid intake was registered daily.

Instrumental examination

Fiberendoscopic evaluation of swallowing transnasal: inspection of mucosa, saliva, sialophagia, if possible one teaspoon water in different consistencies (food colouring), compensatory manoeuvres are tested in compliant patients. A speech and swallowing therapist was always present, to administer bolus and test compensatory manoeuvres in compliant patients (ECRI 1999).
Augmented nutritional strategies including the complete spectrum of therapeutic approaches:
  - Patients seated with an upright torso position whenever fed oral.
  - Slow feeding rate.
  - It was ensured that swallowing had taken place before any additional food or liquid was offered.
  - Changes of food or fluid consistency.
  - Oral nutrition supplements if indicated.
  - Mealtime supervision by nursing stuff, feeding assistance.
  - Mealtime supervision by speech and speech-language pathologist (SLP).
  - Tube feeding (nasogastric or PEG), low threshold for introduction of transitory nasogastric tube.
  - Parenteral nutrition, as soon as possible combination with enteral feeding.
  - In patients with frequent gastroesophageal reflux gastric tube position was adjusted forwards jejunal.
  - Adequate and safe (aspiration and reflux free) daily energy and fluid intake were ensured, approximately 1200 to 2500 kcal per day depending on metabolic demand (Volkert et al. 2006, Williams 2006, ECRI 1999, National guideline clearinghouse HSFO 2005, Kondrup et al. 2003).

**Assessment Instruments**

For assessment of nutritional status the following parameters included in Innsbruck Nutrition Score (INS; Hackl 2004) were assessed:
- Body mass index
- Loss of weight
- Creatinin quotient (catabolic index)
- Length (days) of oral food intake below 500 kcal/die

Clinical nutrition is not indicated if score < 2, recommended if score 3–4, indispensable if score > 5. INS is used mostly in Austria and well established in large cohorts. Retrospectively we calculated Nutritional risk screening (NRS 2002; Kondrup et al. 2003) using the data available in patients’ medical history (post hoc data acquisition from nurses admission survey protocol) consisting of the following items: actual BMI kg/m², unintentional loss of weight in last three months, decrease of food intake over last month, severity of illness. Monitoring and re-evaluation is indicated if score is 3–4 implying the threshold for risk of undernourishment. If scoring exceeds the critical value of NRS 2002 > /= 5 nutritional intervention is clearly indicated.

In our sample we found 47 patients with NRS 2002 score > 5, 80 patients scored 3–4 in NRS 2002.
Sequelae known to be associated with neurogenic dysphagia and nutritional strategies were registered: sepsis, pneumonia, malnutrition, dehydration, tube feeding, vomiting, gastroesophageal reflux, osmotic diarrhoea (Volkert et al. 2006, Williams 2006, Finestone et al. 1995, Axelsson et al. 1988).

Improvement in neurorehabilitation was calculated as the difference of rehabilitation assessment scores at admission and discharge (Δ-value).

- Barthel Index (BI), early rehabilitation version, was chosen to avoid floor effects: substraction of 50 points each for tracheotomy with frequent need for suctioning, need for intensive care and or mechanical ventilation, severe dysphagia, severe disorientation, aphasia from standard (range –375 to +100 points; Mahoney et al. 1965, Schönle 1995). For establishing the validity of neurorehabilitative improvement we additionally calculated a Barthel Index without swallowing associated items (BI-WS).
- Nottingham Basic activities of daily living (BADL, range 0 to 13 points; Whiting et al. 1980) and instrumental respectively extended activities of daily living (EADL, range 0 to 17 points; Lawton et al. 1969) covering basic personal (such as grooming) and instrumental ADL such as using the telephone, managing money, and leisure activities.
- Rivermead motor assessment (RMA) measures motor function after stroke, with three sections, gross function, leg function, and trunk, arm (range 0 to 38 points; Collin et al. 1990).

**Statistical Analysis**

The statistical package for the social sciences (SPSS for Windows, 13.0, 2004) was utilized for comparing means between groups (chi-square test, t-test, Mann-Whitney-U-test).

64 of 127 consecutive patients routinely admitted for inpatient neurorehabilitation needed nutritional support such as mealtime supervision, feeding assistance, tube feeding or intravenous/central venous nutrition to reach safely and aspiration free obligatory daily energy input of approximately 1200 to 2500 kcal per day depending on metabolic rate (body surface area, primary illness).

Estimating undernutrition using the three variables BMI, percentage of recent weight loss and recent change in food intake included in NRS 2002 in our sample we found 47 patients exceeding the critical value of NRS 2002 score > /= 5, clearly indicating nutritional intervention, and 80 patients exhibiting NRS 2002 threshold score 3–4 for risk of undernourishment. The latter with 17 patients out of this risk group with

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequencies (n = 127)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity (BMI &gt; 25 kg/m²) at admission</td>
<td>70</td>
</tr>
<tr>
<td>INS</td>
<td></td>
</tr>
<tr>
<td>Loss of weight &gt; 3 kg</td>
<td>44</td>
</tr>
<tr>
<td>Creatinin quotient &gt; 25</td>
<td>21</td>
</tr>
<tr>
<td>Oral energy intake &lt; 500 kcal/day</td>
<td>47</td>
</tr>
<tr>
<td>Oral abstinence &gt; 2 days</td>
<td>45</td>
</tr>
<tr>
<td>NRS 2002</td>
<td></td>
</tr>
<tr>
<td>NRS &gt; /= 3</td>
<td>80</td>
</tr>
<tr>
<td>NRS &gt; /= 5</td>
<td>47</td>
</tr>
<tr>
<td>Nutritional support</td>
<td>64</td>
</tr>
<tr>
<td>Changes in food/fluid consistency</td>
<td>46</td>
</tr>
<tr>
<td>Meal time supervision</td>
<td>45</td>
</tr>
<tr>
<td>Tube feeding</td>
<td>29</td>
</tr>
<tr>
<td>Cognitive deficits</td>
<td>88</td>
</tr>
</tbody>
</table>

Table 1: Patient characteristics for the whole sample
Neurogenic dysphagia was caused by problems in all phases of swallowing: preoral, oral, intradeglutitive, postdeglutitive phase. A relatively high percentage (69 %) showed clinical relevant cognitive deficits such as perceptual problems, hemispatial neglect, attention and/or memory deficits or problems in information processing / cognitive deceleration mostly affecting preoral and oral phase. For these patients meal time supervision and/or feeding assistance was essential. For the group with (n = 64) and the group without (n = 63) nutritional support we found the same bimodal distribution for presence (2 / 3) or absence (1 / 3) of cognitive deficits.

Using the INS item “daily oral energy intake < 500 kcal” as nutritional screening score (n = 47), blinded NRS 2002 analysis posthoc found the same group of patients with NRS 2002 scoring > 5 (n = 47). All these patients received nutritional support including the complete spectrum of therapeautic approaches. Characteristics and differences of the two subgroups see table 2. Outcome of nutritional supported patients measured by BI, BI-WS and BADL showed highly significant differences in improvement compared to patients without need for nutritional support.

**Table 2: Characteristics of study sample splitted for nutritional support**

<table>
<thead>
<tr>
<th>Variable</th>
<th>With nutritional support (N=64)</th>
<th>Without nutritional support (N=63)</th>
<th>P value (test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean years ± SD)</td>
<td>64.6 ± 12.9</td>
<td>60 ± 14.3</td>
<td>n.s.</td>
</tr>
<tr>
<td>Men / women</td>
<td>45/19</td>
<td>47 / 16</td>
<td>n.s.</td>
</tr>
<tr>
<td>Cognitively impaired (yes/no)</td>
<td>56/8</td>
<td>32/31</td>
<td>&lt;0.001 (chi square)</td>
</tr>
<tr>
<td>Weeks since onset, median (min.-max.)</td>
<td>6.3 (1.75–51.9)</td>
<td>8 (1.5–46)</td>
<td>n.s.</td>
</tr>
<tr>
<td>NRS 2002, median (min.-max.)</td>
<td>6 (1–8)</td>
<td>2 (1–6)</td>
<td>&lt;0.001 (U-test)</td>
</tr>
<tr>
<td>△BADL, median (min.-max.)</td>
<td>3 (0–12)</td>
<td>0 (0–13)</td>
<td>0.009 (U-test)</td>
</tr>
<tr>
<td>△EADL, median (min.-max.)</td>
<td>1 (0–16)</td>
<td>2 (0–14)</td>
<td>n.s.</td>
</tr>
<tr>
<td>BI-Admission, median (min.-max.)</td>
<td>–40 (–250–55)</td>
<td>40 (–135–100)</td>
<td>&lt;0.001 (U-test)</td>
</tr>
<tr>
<td>BI-Discharge, median (min.-max.)</td>
<td>25 (–150–100)</td>
<td>80 (0–100)</td>
<td>&lt;0.001 (U-test)</td>
</tr>
<tr>
<td>△BI, median (min.-max.)</td>
<td>70 (0–250)</td>
<td>30 (0–165)</td>
<td>&lt;0.001 (U-test)</td>
</tr>
<tr>
<td>△BI-WS, median (min-max.)</td>
<td>50 (0–240)</td>
<td>25 (0–155)</td>
<td>0.011 (U-test)</td>
</tr>
<tr>
<td>△RMA, median (min.-max.)</td>
<td>3 (0–32)</td>
<td>2 (0–22)</td>
<td>n.s.</td>
</tr>
<tr>
<td>BMI-Admission, median (min.-max.)</td>
<td>24.8 (15.8–35.8)</td>
<td>25.5 (17–39)</td>
<td>n.s.</td>
</tr>
<tr>
<td>BMI-Discharge, median (min.-max.)</td>
<td>26.1 (19.1–33.8)</td>
<td>26.3 (20.9–30.6)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Discrepancies between our data and the FOOD results (FOOD Trial Collaboration 2003a, 2003b, 2005) could be caused by the following different characteristics of samples: Most of our patients needed “conservative” feeding assistance, compared to FOOD trial a relatively small percentage (29/127, 23 %) of patients needed tube feeding (either nasogastric or PEG), a higher percentage of patients (46/127, 36 %) needing consistency adaptation or mealtime supervision. The patients enrolled in FOOD trial were recruited within the first two to three weeks after stroke for inpatient rehabilitation, for our cohort the median time since onset of signs and symptoms until admission for neurorehabilitation was seven weeks.

In our study we used more sensitive and specific parameters to assess outcome in neurorehabilitation: highly significant improvement could be documented for the ADL scales Basic Activities of Daily Living and the Barthel Index, even when corrected for swallowing specific items. All swallowing compromised patients as compared to not swallowing disturbed patients exhibited under augmented nutritional strategies a highly significant better outcome in rehabilitation also when swallowing specific parameters were not considered in the calculation of rehabilitation improvement.

In accordance with FOOD trial three patients with tube feeding could not benefit in the same amount from augmented nutrition as oral fed patients from mealtime supervision and consistency adaptation. This confirms our clinical observation that the rehabilitation potential of these patients is strongly underestimated. There is also an analogy between the cohort of FOOD trial 1 and our sample: a very low percentage was remarkably undernourished. Nevertheless patients are able to swallow, mealtime supervision also for oral nutritional supplements in this patient cohort with cognitive deficits is essential. Not only dysphagia related problems showed significant improvement but also mobility, ambulation, gross motor function, cognitive deficits as indicated by the increment of the outcome scales.
Although there was a high prevalence of obesity with a mean BMI at admission of 24.3 kg/m² in patients receiving nutritional support respectively 26 kg/m² for the whole sample every patient at risk was treated with enhanced clinical nutritional strategies. Concerning our sample the concurrent validity of both short and sensitive measurements of nutritional status INS and NRS 2002 is exceptionally high, showing a perfect concordance of the INS item "daily oral energy intake <500 kcal" and the critical NRS 2002 cut off value (x > / = 5).

To reduce expenditure of time screening possibly could be reduced to the following three questions: Is the daily oral energy intake below 500 kcal? Does the patient exhibit clinical relevant cognitive deficits? Does the patient score >5 in NRS 2002?

In conclusion, enhanced nutritional strategies including changes of food or fluid consistency, oral nutrition supplements, mealtime supervision, feeding assistance, tube feeding, low threshold for introduction of transitory nasogastric tube, parenteral nutrition, facilitate better outcome in NR also in patients only at risk for undernutrition without apparent signs of mal-/undernutrition. Combination of multiple approaches for screening and assessment of nutrition and swallowing as well as multiple therapeutic manoeuvres seems to be effective for early rehabilitation.

For exact screening and assessment procedures repetitive training of the multidisciplinary rehabilitation team is necessary. A crucial role can be pointed out for nursing stuff, physicians and SLP.

Under these conditions swallowing compromised patients showed an accelerated recovery of severity of disability despite results established by former work (Williams 2006, FOOD Trial Collaboration 2003a, 2003b, 2005).

**REFERENCES**


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