FOOD, MECHANIC AND SEPTIC COMPLICATIONS IN PATIENTS ENTERALLY NUTRITIONED IN HOME CONDITIONS

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Home enteral nutrition (HEN for short) allows practically normal living for patients who cannot be fed orally but at the same time do not have to stay in hospitals, which is often found to decrease their mental condition, increase of probability of complications and costs of medical treatment.

The aim of the study was to analyze the frequency of nutritional, mechanical and septic complications in patients fed enterally in home conditions.

Material and methods. The study performed using retrospective analysis of study results and reports from control visits for patients in the period between 2012-2013. 147 patients fed enterally using HEN method participated in the study, including 70 men and 77 women aged 19 to 99 years (average 65 years). The following type of gastrointestinal tract access was used for patients: PEG in 113 (76.5%), feeding jejunostomy – 21 (1.4%), PEG-PEJ – 5 (3.5%), in case of the remaining 8 patients the nasogastric gavage (5.5%) was used.

Results. The most common complication were infections (of gastric tract, skin soft tissue in the region of nutritional fistula entry, in three cases the aspiration pneumonia was diagnosed) found in 55 (49.1%) of cases. Mechanical complications were found out in 29 (25.9% of all complications), nutritional complications were present 28 times, which constituted 25% of all complications.

Conclusions. In the studied group of patients with an implemented HEN procedure, septic complications were the most common problem. The longest average nutrition time with PEG-PEJ probably results from the effective protection of the patient against aspiration pneumonia.

Key words: HEN, PEG, PEG-PEJ
– perioperative period,
– swallowing disorders after radiotherapy procedures.

Possible types of access to gastrointestinal tract used in home enteral nutrition are:
– nasogastric or nasoenteral gavage,
– percutaneous endoscopic gastrostomy (PEG),
– percutaneous endoscopic gastrostomy extended with an jejunal gavage (PEG-PEJ),
– percutaneous endoscopic jejunostomy (PEJ),
– surgical gastrostomy or jejunostomy.

Enteral nutrition complications can be divided into:
– septic complications (infections) Septic complications include infections of gastrointestinal tract caused by bacterial colonization of gastrointestinal tract, infection of diet or equipment for preparation and feeding, insufficient storage of nutrition mixtures and not observing aseptic rules in caring about the access to the gastrointestinal tract. The most serious septic complication is aspiration pneumonia (1, 4);
– nutritional complications involving: diarrhea, colic, bloating, nausea, vomiting. These complications also include constipation most often caused by decreased peristalsis, insufficient water intake, no fiber in diet, using certain medicines and colon obstruction by fecal mass (4);
– mechanical complications: plugging, displacement, leaks, fractures, fastening damage or obstruction which may concern both the gavage, gastrostomy and nutritional jejunostomy. Change of location (gavage displacement) is particularly dangerous in case of nasogastric or nasoenteral gavage. Wrong location may lead to a puncture of windpipe, parenchymal tissue, esophagus and other parts of gastrointestinal tract and if it happens again, it may lead to choking with food. During enteral nutrition in home conditions, ends of gavages and nutritional stomas may break;
– metabolic complications: most often they include (4, 5): refeeding syndrome, hypo and hypernatremia, dehydration, hypo and hyperphosphemia, hypo and hyperkalemia, hypomagnesaemia, vitamin deficiency, metabolic acidosis, hyper and hypoglycemia.

The aim of the study was to analyze the frequency of nutritional, mechanical and septic complications in patients fed using HEN method.

MATERIAL AND METHODS

147 patients fed enterally using HEN method participated in the study, including 70 men and 77 women aged 19 to 99 years (65±19.4) fed enterally in home conditions in years 2012-2013. The following type of gastrointestinal tract access was used for patients: PEG in 113 (76.5%), feeding jejunostomy – 21 (1.4%), PEG-PEJ – 5 (3.5%), nasogastric gavage – 8 (5.5%) of patients.

Table 1 presents characteristics of the studied group, taking into account the illness cause. The study performed since November 2013 to March 2014 using retrospective analysis of study results and reports from control visits. The results were presented mostly in a form of average values frequency (M ± SD) The data was developed using statistical software SPSS 21 IBM.

RESULTS

Nutrition time and control visits

In years 2012-2013 average time of patient nutrition equaled about 276 days ± 269.8 and the medium number of control visits (outpatient) equaled 3 ± 2.7. The detailed results are

<table>
<thead>
<tr>
<th>Cause of change in nutrition</th>
<th>Total</th>
<th>PEG</th>
<th>jejunostomy</th>
<th>PEG/PEJ</th>
<th>gavage</th>
</tr>
</thead>
<tbody>
<tr>
<td>neoplasm</td>
<td>45</td>
<td>19</td>
<td>1</td>
<td>1</td>
<td>66</td>
</tr>
<tr>
<td>neurological</td>
<td>61</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>73</td>
</tr>
<tr>
<td>other</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>113</td>
<td>21</td>
<td>5</td>
<td>8</td>
<td>147</td>
</tr>
</tbody>
</table>
presented in tab. 2, divided in terms of access
to the gastrointestinal tract.

People who started enteral nutrition due to
neurological illnesses were fed about 367 days
and carried out 4 control visits at average. Patients who started nutrition due to a neo-
plasm were fed an average of about 156 days
and had about 2 control visits. Average time
of feeding for people who started enteral nutrition from other reasons was about 498 days
and the average number of control visits was
about 6. Detailed data are presented in
tab. 3.

The analysis shown differences in terms of
number of days of nutrition between people
who started enteral nutrition due to neoplastic
conditions and people who started nutrition
due to neurological conditions \( t (132.56) = 5.09; \)
\( p<0.001 \). Patients with neurological conditions
were, at average, fed longer \( (367.42\pm277.95) \)
than people with neoplastic conditions
\( (156.48\pm208.28) \). Significant statistical differ-
ence is also present between the same groups
in terms of number of control visits \( t (130.28) =
5.12; \) \( p<0.001 \). It turned out that people with
neoplastic conditions had less control visits
\( (2.21\pm1.99) \) than people with neurological con-
ditions \( (4.28\pm2.76) \).

An additional analysis shown that there is
a strong, positive relation between nutrition
time and a number of control visits \( r=0.961; \)
\( p<0.001 \). It seems that the longer the nutrition
time, the more control visits take place.

Home enteral nutrition complications

Nutritional complications (gastroenteral)

In the group of patients fed using PEG, 24
gastroenteral complications were observed.
Complications most often encountered in
this group were constipation – 8, then diarrhea
– 5, nausea and vomiting – 4, stomach pain
and bloating – 2, which in total constitute
82.6% of all nutritional complications. Among
the patients fed using nutritional jejunostomy
the only noted complications were diarrhea (2
times) and constipation (1 time). In the group
of patients fed using PEG-PEJ no nutritional
complications were noted and among the pa-
tients fed using a gavage, a diarrhea took place
only once (tab. 4).

The correlation analysis shown a significant
relation between the nutrition time and the num-
ber of nutritional complications \( r=0.556; \) \( p=0.02 \).

Table 2. Average time of nutrition and average number of control visits, divided in terms of gained access
to the gastrointestinal tract

<table>
<thead>
<tr>
<th>Type of access to gastrointestinal tract</th>
<th>Average nutrition time [M (SD)]</th>
<th>Average number of control visits [M (SD)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td>304.65 (272.71)</td>
<td>3.66 (2.69)</td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>129.57 (152.43)</td>
<td>2.14 (1.46)</td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td>534.80 (291.64)</td>
<td>6 (3.39)</td>
</tr>
<tr>
<td>Nasogastric gavage</td>
<td>110.13 (250.98)</td>
<td>2 (2.56)</td>
</tr>
</tbody>
</table>

Table 3. Average time of nutrition and average number of control visits, divided in terms of cause of starting
enteral nutrition

<table>
<thead>
<tr>
<th>Cause</th>
<th>Average nutrition time [M (SD)]</th>
<th>Average number of control visits [M (SD)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoplastic</td>
<td>156.48 (208.28)</td>
<td>2.22 (1.99)</td>
</tr>
<tr>
<td>Neurological</td>
<td>367.42 (277.95)</td>
<td>4.28 (2.76)</td>
</tr>
<tr>
<td>Other</td>
<td>497.71 (243.15)</td>
<td>6.14 (2.12)</td>
</tr>
</tbody>
</table>
Septic complications

In patients fed using HEN method, infections of gastrointestinal tract (in culture, bacterial colonization and/or fungal infection of gastrointestinal tract) took place in 20 people (29 times total). Detailed data is presented in tab. 5.

Skin inflammation (skin infection) around the gastrointestinal tract access

In patients fed enterally in home conditions the skin inflammations around the gastrointestinal tract access took place in 20 people (26 times total). These were mostly light inflammations, e.g. reddening and irritation of the skin around the fistula. Detailed results are presented in tab. 6.

On the level of tendency there is a weak, positive relation ($r=0.29; p=0.089$) between the number of inflammations around the gastrointestinal tract access and the nutrition time. The longer the nutrition time, the more complications of this type occur.

Table 4. The frequency of nutritional complications depending on the type of access to the gastrointestinal tract

<table>
<thead>
<tr>
<th>Access method to the gastrointestinal tract</th>
<th>Vomiting and nausea</th>
<th>Diarrhea</th>
<th>Stomach pain, bloating</th>
<th>Constipation</th>
<th>A sum of complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td>7</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Mechanical complication (obstruction of gastrointestinal access)

In patients fed enteraly in home conditions, the obstruction of access to the gastrointestinal tract occurred in 7 people (8 times total). An obstruction was noted only in the group of patients fed using a nutritional jejunostomy and PEG-PEJ. In the group of patients nutritioned using PEG-PEJ the obstruction took place once in 2 people, what constituted 40% of all people nutritioned using that method. Detailed results are presented in tab. 7.

Mechanical complications (leaks of gastrointestinal tract access)

General mechanical complications in form of leaks took place 21 times. The analyses shown that in people nutritioned using PEG method it took place a total of 19 times. In people nutritioned using PEJ method it happened only once, similarly in people nutritioned using PEG-PEJ. Table 8 presents the accurate results.

Table 5. The frequency of appearance of bacterial and fungal infections in relation to the type of access to the gastrointestinal tract

<table>
<thead>
<tr>
<th>Access type</th>
<th>Frequency of bacterial or fungal infection</th>
<th>Number of patients where an infection was found</th>
<th>The percentage of patients fed using the chosen method in which an infection occurred</th>
<th>A sum of occurrences of complications in form of bacterial and fungal infections</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td>1</td>
<td>11</td>
<td>11.5</td>
<td>22</td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>2</td>
<td>4</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td>1</td>
<td>1</td>
<td>4.8</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>complication did not occur</td>
<td>complication did not occur</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Table 6. Frequency of occurrence of skin inflammation around the gastrointestinal tract access in relation to the type of access

<table>
<thead>
<tr>
<th>Access type</th>
<th>Frequency of occurrence of skin inflammation</th>
<th>No. of patients who reported skin inflammation</th>
<th>A percentage of patients fed using the given method who developed a skin inflammation</th>
<th>Sum of occurrence of complications in form of an inflammation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td>1</td>
<td>13</td>
<td>11.5</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>1</td>
<td>2</td>
<td>9.5</td>
<td>2</td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td>powikłanie nie wystąpiło / complication did not occur</td>
<td></td>
<td></td>
<td>–</td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>powikłanie nie wystąpiło / complication did not occur</td>
<td></td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>

Table 7. The frequency of gastrointestinal access obstruction depending on the type of access

<table>
<thead>
<tr>
<th>Access type</th>
<th>Frequency of obstruction</th>
<th>Number of patients in whom obstruction occurred</th>
<th>A percentage of patients nutritioned using the given method in whom obstruction occurred</th>
<th>Total occurrence of complications in form of obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>1</td>
<td>4</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>compensation did not occur</td>
<td></td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>

Table 8. Frequency of leaks in gastrointestinal tract in relation to the type of access

<table>
<thead>
<tr>
<th>Access type</th>
<th>Leak frequency</th>
<th>Number of patients for which leaks took place</th>
<th>A percentage of people fed using the given method for which the leak took place</th>
<th>The total occurrence of complications in a form of a leak</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG</td>
<td>1</td>
<td>11</td>
<td>9.7</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Nutritional jejunostomy</td>
<td>1</td>
<td>1</td>
<td>4.8</td>
<td>1</td>
</tr>
<tr>
<td>PEG-PEJ</td>
<td>1</td>
<td>1</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Nasogastric tube</td>
<td>compensation did not occur</td>
<td></td>
<td></td>
<td>–</td>
</tr>
</tbody>
</table>

General frequency of complications

In 2012-2013 the home enteral nutrition complications in the tested group took place 112 times. Septic complications occurred most often (55 times, which constituted 49.1% of all complications, this group includes 3 people with aspiration pneumonia). The second in terms of frequency were the mechanical complications, took place 29 times, (25.9% of all complications). The nutritional complications took place only 28
Food, mechanic and septic complications in patients enterally nutritioned in home conditions

DISCUSSION

In the available publications the most often described causes of starting enteral nutrition in home conditions are of neurological and endoplastic grounds, which is also confirmed by our experiences (5, 6, 7). In a 12 year long observation of patients nutritioned using HEN method by De Luis et al. carried out from 1999 to 2012, 49.5% patients started nutrition due to neurological conditions and 30.2% due to head and neck neoplasm (3). Data from other centers dealing with the HEN nutrition procedure confirm our observations. Paccagnella A. et al, when examining patients in the period 2001-2005 found out that 40.9% of patients were qualified for enteral nutrition due to neurodegenerative conditions and 26.7% due to cerebrovascular incidents, 11.5% due to head and neck neoplasm and 9.8% due to abdominal neoplasms (8). In the analyses carried out by ESPEN, the most often used type of gastrointestinal track access in patients nutritioned using the HEN method was a PEG (58.2%), a nasogastric gavage (29.3%) and surgically created jejunostomy (5.4%), or a percutaneous endoscopic jejunostomy – PEG (3.4%) which also corresponds to our experiences (9). The analysis of HEN procedure performed by Jones B. and involving the period of 2000-2010 shows that the most often used way of feeding in patients is gastrostomy (75%), then gavages (21%), and nutritional jejunostomies are put on 4% of patients (10). According to experiments by Cabrit R. et al the most common method of feeding was gastrostomy (55.2%), gavages were used in 18.6% and jejunostomy in 7.2% of patients (11). Other analyses offer similar data, what is reflected in our study (9, 11, 12). The analyses of studies from Brazil, Italy and Spain show that the nasogastric and nasoenteral gavage were the most often chosen accesses to the gastrointestinal tract in patients fed enterally at home, while in our material they constituted only 5.4% of gastrointestinal tract access cases (5, 8, 13). In case of analyses of nutrition using HEN method there are significant discrepancies. According to Alivizatos et al. the most common complication related with gastrointestinal tract access among patients nutritioned using HEN method were obstruction and fracture (45.1%), leaks in the set (6.4%), skin inflammation around the gastrointestinal tract access (6.4%) and diarrhea (6.4%) (6). The reports above show that the most common complications of enteral nutrition were mechanical complications, which were not found out in such large quantities in our survey.

In our material the most often observed complications are septic complications (49.1%), and on the second place the mechanical complications (25.9%). The nutritional complications are observed the least often (25%). Such a large divergence of results may be caused by lack of correct diagnosis of septic complications in other centers which carry out HEN. The results of the cited tests and the obtained data in our analysis are similar only regarding presence of diarrheas. Difference in frequency of complications may be caused by the differences in the procedures and the methods of carrying out long-term enteral nutrition. In our study, three patients with a PEG set applied were diagnosed with aspiration pneumonia during control examinations. In these patients, PEG was replaced with PEG-PEJ and further nutrition was carried out enterally without the risk of aspiration pneumonia happening again. In our opinion further studies are needed which analyze all groups of complications in order to systematize knowledge and minimize the potential HEN complications.
CONCLUSIONS

Most complications related with the HEN procedure in our material are related to septic complications. Most complications can be avoided if the person who carries out the procedure is well trained and educated. Only serious septic complications require hospitalization (pneumonia, widespread infection of soft tissues in the PEG exit region).

It seems that the longest average time of feeding patients with PEG-PEJ set results from the patient’s protection against aspiration pneumonia, which is one of the most serious complications of enteral nutrition.

REFERENCES