DOUBLE TRACT RECONSTRUCTION (DTR) – AN ALTERNATIVE TYPE OF DIGESTIVE TRACT RECONSTRUCTIVE PROCEDURE AFTER TOTAL GASTRECTOMY – OWN EXPERIENCE

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The only proven, effective therapy in case of the gastric cancers is surgery.

**The aim of the study.** The most common procedure which is made in such a situation is total resection of the stomach. In our publication we would like to present and to recommend a very rare made type of the reconstructive procedures after total gastrectomy, which is called “double tract reconstruction” (DTR). This type of reconstruction is occasionally made mainly in Japan.

**Material and methods.** Double tract reconstruction has been made in 2nd Department of General and Gastroenterological Surgery since 2000. Till today 75 patients were treated with this method.

**Results.** The frequency of complications after double tract reconstruction was occasional, and there were no differences between this procedure and Roux-en-Y method of the reconstruction. There were no differences in the time of the operation between this two methods. The most important advantage of this method is that duodenal passage is extant. Because of that the endoscopic examination of papilla Vateri can be made.

**Conclusions.** We would like to recommend this method as an alternative to Roux-en-Y procedure because of its simplicity and safeness.

**Key words:** gastric cancer, double tract reconstruction, Roux-en-Y procedure, gastrectomy

The only effective method of treating gastric cancer consists in the partial or complete excision of the stomach and local lymph nodes. In most cases gastrectomy is the method of choice. Since 1884, when Schlatter was the first to perform the above-mentioned procedure the continuous problem is connected with the reconstruction of the digestive tract. The excision of the stomach leads towards several digestive tract functioning disturbances. The following functions of the stomach are abolished: storage, mixture of food, initial digestion and absorption of many substances. The excision of natural sphincters (pylorus and cardia) leads towards fast passage of food to the small bowel, and reflux of the alkaline contents to the esophagus. Initial protein digestion and vitamin B₁₂ absorption is impaired. Due to the lack of gastric acid secretion one may observe increased bacterial colonization of the digestive tract. In case of duodenal closure the secretion of intestinal peptides is impaired, and absorption of fat, iron, calcium and other elements is reduced (1-6).

The digestive tract reconstruction method influences the amount and quality of absorbed food, and thus, the patients’ state of nutrition and quality of life after the operation. Depending on the type of anastomosis one may observe increased bacterial colonization of the digestive tract. In case of duodenal closure the secretion of intestinal peptides is impaired, and absorption of fat, iron, calcium and other elements is reduced (1-6).

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Double tract reconstruction (DTR) after total gastrectomy

standards considering the mentioned problem. Different modifications are introduced, improving the patients’ quality of life. Nowadays, the Roux-en-Y method is most often used, considering digestive tract reconstruction surgery after gastrectomy. In recent years the problem of gastric content passage through the duodenum has been brought up, as well as the need to perform intestinal pouches, which would functionally replace the excised stomach (2, 3, 7). In 1965, Kajitani and Sato were the first to describe the double tract reconstruction (DTR) method (8). Ever since, one may observe the development of the above-mentioned method in countries of the Far East (tab. 1).

MATERIAL AND METHODS

In case of patients after total gastrectomy two types of digestive tract reconstruction procedures are performed at the II Department of General and Gastroenterological Surgery, Medical University in Bialystok: the Roux-en-Y method and since January, 2000 the „Double Tract Reconstruction” (DTR) technique.

The initial part of the procedure is similar in case of both methods consisting in gastrectomy with regional lymph nodes.

The Roux-en-Y method consists in the anastomosis of the esophagus and Roux loop with concomitant duodenal closure. Food passes through the esophagus to the jejunal loop, and mixes with bile and pancreatic juice 45 cm below. The distance between the entero-enterostomy and esophagoduodenostomy (about 45 cm) minimizes biliary content and pancreatic juice reflux to the esophagus, and ensuing symptoms connected with alkaline reflux (1, 2, 7, 9).

The DTR method differs from the previously described technique by the fact that the duodenum is anastomosed to the jejunum 35 cm from the esophageal anastomosis. The second entero-enterostomy is performed 20-25 cm below (fig. 1 and 2). Therefore, due to the duodeno-intestinal anastomosis part of the nutritional content passes to the duodenum mixing with the biliary content and pancreatic juice. The digestive and absorption functions of the duodenum are maintained. The remaining nutritional passage is similar to that observed in case of the Roux-en-Y method. The above-mentioned method enables

![Fig. 1. Diagram of the digestive tract reconstructive procedures after total gastrectomy: A – Roux-en-Y, B – double tract reconstruction [Iwahashi et al. (11)]](image)

![Fig. 2. Intraoperation photo after regional lymphadenectomy during total gastrectomy procedure because of the gastric cancer](image)

Table 1. Stage of gastric cancer in case of patient’s subject to DTR surgery

<table>
<thead>
<tr>
<th>Stage of cancer</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>14</td>
</tr>
<tr>
<td>III</td>
<td>34</td>
</tr>
<tr>
<td>IV A</td>
<td>14</td>
</tr>
<tr>
<td>IV B</td>
<td>9</td>
</tr>
</tbody>
</table>

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food to pass through the duodenum, and by bypassing the organ to the small bowel. Thus, the terminology: “double tract reconstruction” (3, 6-8). The operation lasts between 260 and 300 minutes, depending on the stage of the tumor and possible additional surgical procedures (tab. 2). An additional entero-enterostomy slightly prolongs the operation (by about 15 minutes).

Table 2. Additional surgical procedures performed in patient’s subject to total gastrectomy, due to cancer by means of the DTR method

<table>
<thead>
<tr>
<th>Additional procedures performed during gastrectomy</th>
<th>Number of patient’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenectomy</td>
<td>42</td>
</tr>
<tr>
<td>Pancreatic tail resection</td>
<td>17</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>11</td>
</tr>
<tr>
<td>Small bowel diverticulectomy</td>
<td>3</td>
</tr>
<tr>
<td>Partial enterectomy</td>
<td>2</td>
</tr>
<tr>
<td>Liver cystectomy</td>
<td>2</td>
</tr>
<tr>
<td>Left lobectomy of the liver</td>
<td>1</td>
</tr>
<tr>
<td>Bilateral ovariectomy</td>
<td>1</td>
</tr>
</tbody>
</table>

All patients were additionally subject to regional lymph node excision (>D2) (fig. 3). Intraoperatively, an enteral nutrition tube was introduced below the entero-enterostomy, which was initiated on the first day after the procedure. On the fourth postoperative day an anastomotic leakage test was performed (oral administration of 100 ml of methylene blue), followed by the introduction of oral nutrition. The tube was removed on the seventh postoperative day.

It should be underlined that the II Department of General and Gastroenterological Surgery, Medical University in Białystok is one of the few centers in Europe performing digestive tract reconstruction procedures by means of the DTR method. So far, such operations were only performed in Japan (fig. 4).

RESULTS

During the period between 2000 and 2009, 274 patients with diagnosed gastric cancer were subject to surgical treatment at the II Department of General and Gastroenterological Surgery, Medical University in Białystok. Total gastrectomy was performed in 230 patients. Digestive tract reconstruction was performed by means of the DTR method in 75 (32.6%) patients, including 29 women and 46 men, aged between 27 and 84 years (mean age: 64.8 years). Most patients were diagnosed in the advanced stage of the disease. Stages III and IV were most often diagnosed (tab. 1).

Some of the above-mentioned patient’s were subject to additional surgical procedures. This was connected with the stage of the disease...
Double tract reconstruction (DTR) after total gastrectomy and infiltration of surrounding organs (tab. 2).

During the postoperative period we observed a small rate of complications. Two patients presented with esophago-intestinal anastomosis leakage, in case of one complicated by left subphrenic abscess development. Two other patients developed severe postoperative pancreatitis, which lead towards duodenenterostomy leakage in one case. One patient presented with entero-enterostomy leakage subject to conservative therapy. Two patients with postoperative intraperitoneal bleeding requiring reoperation. Two patients with numerous concomitant diseases died during the early postoperative period, due to cardiological reasons. Both patients were diagnosed with extensive myocardial infarction, which was not connected with the surgical intervention (tab. 3). The remaining patients treated by means of the above-mentioned method were discharged from the hospital in good general condition (an average of 9 days after surgery).

DISCUSSION

Digestive tract reconstruction after gastrectomy should ensure the patient’s fast return to normal everyday activities, maximally reducing symptoms resulting from the absence of the stomach. At the same time the method should be technically easy to perform, minimizing possible postoperative complications. In our opinion the DTR method fulfills the above-mentioned. The duration of the procedure and percentage of complications is similar to that observed in case of the Roux-Y method. The DTR method is potentially more risky, due to the possibility of an additional duodeno-enterostomy increasing the risk of postoperative leakage. Our own investigations did not confirm the above-mentioned. All Authors observed the insignificant number of anastomotic leakage cases. This phenomenon may be explained by the reduced pressure in the duodenum, due to the additional anastomosis (9, 10-14).

In case of intact duodenal passage there is no possibility of blind loop syndrome with ensuing diarrhea (3, 6).

Digestion and absorption of many substances, such as proteins, fats, fat-soluble vitamins, most water-soluble vitamins (except vitamin B\textsubscript{12}), and selected microelements (iron, potassium) takes place in the duodenum and initial part of the jejunum. The maintenance of partial duodenal passage should in theory improve absorption, even in other segments of the bowel (3, 6, 7).

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The above-mentioned theory was confirmed by most authors. An additional anastomosis results in postoperative improvement of digestion and absorption of food (especially fat), increased body mass and return to everyday activities (12, 15, 16). Similar results were obtained in case of other surgical methods (17). However, some authors found no advantage of DTR and other techniques where duodenal passage was maintained during the early postoperative period, as compared to the Roux-Y method (11, 14).

Ogoshi et al. (14) analysed 1061 patients with gastric cancer after gastrectomy demonstrating significantly longer survival in patients subject to DTR or other methods, where the duodenal passage was maintained (14).

In the few reports comparing the level of glucose, somatostatin, cholecystokinin and insulin, considering patients after DTR and Roux-Y surgery, the former technique showed values of the above-mentioned substances least different from physiological (18).

Another issue is the problem of the storage function that the stomach plays. The problem was solved by the creation of an additional intestinal pouch. Literature data described different jejunal pouches, created in the subphrenic and subcolonic part of the small bowel. The nature and validity of producing the intestinal pouch remains under discussion. Some authors demonstrated better absorption of food and improved quality of life in case of patients with an intestinal pouch, especially during the early postoperative pe-

Table 3. Surgical complications in patients after total gastrectomy by means of the DTR method

<table>
<thead>
<tr>
<th>Surgical complications after gastrectomy – DTR method</th>
<th>Number of patients</th>
</tr>
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<tbody>
<tr>
<td>Esophagoenterostomy leakage</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Left subphrenic abscess</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Acute pancreatitis</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Entero-enterostomy leakage</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td>Intraperitoneal hemorrhage</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>Myocardial infarction (death)</td>
<td>2 (2.6%)</td>
</tr>
</tbody>
</table>
period (19, 20). Others did not confirm the superiority of pouch versus no pouch presence after total gastrectomy (3, 6, 21). In case of DTR the duodenum serves as a food reservoir, at least partly compensating for the lack of the stomach.

An additional role of the above-mentioned pouch is to prevent possible biliary content reflux into the esophagus, and ensuing complications. The possibility of food passage through the duodenum in case of the DTR method prevents biliary content reflux to the esophagus. If the duodenal passage is present, regardless the anastomotic method used, one may observe fewer cases of biliary esophagitis and presence of an intestinal pouch (10, 17). However, some authors did not confirm the above-mentioned fact, in spite of long-term observations (3, 6, 21).

Double tract reconstruction procedures do not ensure an advantage of the nutritional content passage through the duodenum. Scintigraphic assessment of DTR after total gastrectomy performed by Fujiwara et al. (9) showed that the duodenal passage was present, although sometimes minimal. In none of the patients did the authors observe an increased amount of food in the duodenum, as compared to the small bowel. The above-mentioned may be dependent of the anatomical conditions and technical method of the performed anastomotic procedures (9).

An additional advantage of the DTR method, is the possible endoscopic approach to the duodenum, which in case of cholelithiasis, especially in patients after gastrectomy is particularly important (8, 13).

Investigations are under way determining the distant advantages connected with double tract reconstruction procedures after gastrectomy. Prospective investigations are under way comparing the Roux-en-Y and DTR methods, both clinical and functional, such as the evaluation of the esophageal biliary reflux by means of the Bilitec fibreoptic system, intravesophageal impedance, pH-metry, and patients’ quality of life. Initial results were presented during sessions at the 8-th International Gastric Cancer Congress, and will be the subject of future publications.

CONCLUSIONS

Our own experience and literature data permit to recommend the DTR method as safe and easy to perform, which might alleviate symptoms connected with the absence of a stomach, improving the patient’s quality of life.

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