The Roux-en-Y syndrome
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Summary and conclusions

The Roux-en-Y gastrojejunostomy is a frequently used type of reconstruction after partial gastrectomy, since it is effective in preventing alkaline reflux into the gastric remnant. Recent studies indicate that a substantial number of patients with a Roux-en-Y diversion complain of abdominal pain, epigastric fullness, nausea and vomiting, worsened by eating. This symptom complex is called the Roux-en-Y syndrome. The aims of this thesis were to determine the prevalence of the Roux-en-Y syndrome, to further elucidate the pathogenesis and to evaluate the therapeutic effect of cisapride.

Chapter 2

A survey of the literature with respect to the incidence, pathogenesis and treatment of the syndrome is presented. The frequency of occurrence of the syndrome after partial gastrectomy with Roux-en-Y reconstruction varies between nil and 50% according to previous studies. The pathogenesis of the syndrome has not been clarified. In most studies, mechanical obstruction was excluded. Slow gastric emptying, motility and transit disorders in the Roux-limb, and vagotomy have all been mentioned as possible causes. However, results of studies concerning the role of each possible cause are conflicting. This may be explained by several factors, such as the small numbers of patients in most studies, the fact that transit studies, particularly of the Roux-limb, have often been inadequately performed, and the fact that objective assessment of the vagal status is usually lacking. Treatment of patients with the Roux-en-Y syndrome is cumbersome, medical treatment is unsuccessful in most, and major surgery such as subtotal gastrectomy relieves complaints in only part of the patients.

Chapter 3

An unselected group of 66 patients subjected to partial gastrectomy and Roux-en-Y gastrojejunostomy for benign disorders was interviewed using a standard questionnaire. The Roux-en-Y syndrome was found in 35 of these 66 patients. No relation was found between the occurrence of the Roux-en-Y syndrome and operative details such as: the indication for operation, the number of previous gastric surgical procedures, the length of the Roux-limb, and the presence or absence of a status after vagotomy. The prevalence of other abdominal symptoms was quite low, although diarrhea was seen in 20 patients. Our study confirmed the effectiveness of the Roux-en-Y gastrojejunostomy in preventing entero gastric reflux, since only three patients complained of bilious vomiting and heartburn after the procedure. This study shows that the prevalence of the Roux-en-Y syndrome after partial gastrectomy in combination with a Roux-en-Y gastrojejunostomy is high (53%). Therefore, we recommend that the Roux-en-Y gastrojejunostomy after partial gastrectomy has to be reserved for the treatment of proven and severe alkaline reflux gastritis.
Chapter 4

Radionuclide transit studies of both the gastric remnant and the Roux-limb were performed and the findings were related to the questionnaire in order to clarify the role of slow gastric emptying and stasis in the Roux-limb in the pathogenesis of the Roux-en-Y syndrome. In addition, the relation between transit disorders and the vagal status was studied. Gastrojejunal transit was studied in 61 patients, 34 of whom were symptomatic. The median (interquartile range) gastric half-emptying time was longer in the symptomatic than in asymptomatic patients, i.e., 79 (43-146) versus 56 (27-79) min (p<0.05). Stasis in the Roux-limb was observed in 18 of 28 symptomatic patients and in only three of the 27 asymptomatic patients (p<0.01). The median (interquartile range) fraction of activity emptied from the stomach and remaining in the Roux-limb at 60 min was 54 (39-69) percent in symptomatic patients and 33 (21-40) percent in those without symptoms (p<0.01). No relationship was found between slow gastric emptying and stasis in the Roux-limb. Slow gastric emptying, Roux-limb stasis or a combination of both was found in 30 of 34 symptomatic and in only nine of 27 asymptomatic patients (p<0.01).

Gastric emptying was significantly slower in patients with a bilateral vagotomy (94 min, 43-225) than in those without a vagotomy (59 min, 31-77) (p<0.05). Stasis in the Roux-limb was not related to the vagal status.

This study shows that both slow gastric emptying and Roux-limb stasis can be interpreted to cause the Roux-en-Y syndrome. Vagotomy seems to be the major cause of slow gastric emptying, but it is not related with stasis in the Roux-limb. In order to prevent incapacitating gastroparesis, we recommend not to add a vagotomy to the procedure, and to accept the risk for the development of (recurrent) ulcers since, in contrast to gastroparesis, they can be treated adequately medically.

Chapter 5

Manometric studies of the Roux-limb were performed and related to the results of the radionuclide transit studies in order to investigate if slow gastric emptying and Roux-limb stasis can be attributed to motility disturbances in the Roux-limb. Thirty-seven patients were studied, 26 patients with the Roux-en-Y syndrome and 11 without. Thirteen patients had slow gastric emptying and 14 had stasis in the Roux-limb. The basic motor patterns, the migrating motor cycle (M.M.C.) and the fed state motility pattern were present in most patients. However, motility disturbances were present in 34 of the 37 patients. Motility disturbances were observed significantly more frequently both in patients with symptoms than in those without, as well as in patients with Roux-limb stasis than in those without. No relation was found between motility disorders and slow gastric emptying. Aberrant propagation of the M.M.C. and absence of the fed state were the only motility disorders which were not observed in patients with normal Roux-limb transit. They probably represent the more serious motility disturbances.

The results of this study indicate that Roux-limb stasis is caused by motility disorders in the Roux-limb. They also indicate that Roux-limb stasis cannot be held responsible for slow gastric emptying, since there is no correlation between motility disorders in the Roux-limb and slow gastric emptying. Slow gastric emptying and Roux-limb...
Summary and conclusions

Stasis should therefore be interpreted as independent causes of the Roux-en-Y syndrome.

Chapter 6

The aim of this study was to determine the role of vagal denervation in the development of motility and transit disorders in the Roux-limb. For this purpose, the innervation of the Roux-limb was tested by measuring the rise of plasma pancreatic polypeptide (P.P.) after an insulin induced hypoglycaemia, the so called P.P. test. The results of these tests were related to manometric and radionuclide studies of the Roux-limb.

Forty-seven patients with a Roux-en-Y gastrojejunostomy after partial gastrectomy were studied. A truncal vagotomy had been performed in 26 of these 47 patients. The P.P. test showed that two of the 26 patients subjected to vagotomy had a moderately impaired vagal function, and that the other 24 all had a severely impaired vagal function. In the patients not subjected to a vagotomy vagal function was disturbed in 11 of the 21 patients. Motility disturbances were not observed more frequently in patients with either moderately or severely impaired vagal function than in patients with normal vagal function. Stasis in the Roux-limb was seen even more frequently in patients with a normal vagal function than in patients with a severely impaired vagal function.

The results of this study indicate that vagal denervation is not the cause of motility and transit disorders in the Roux-limb. Our manometric findings that motility disorders were present in the majority of patients suggest that the construction of the Roux-limb in itself is responsible for the disordered motility. Consequently, deleting a vagotomy when a Roux-en-Y gastrojejunostomy is constructed may reduce the chance for postoperative complaints associated with slow gastric emptying (Chapter 3), but this is no guarantee for the prevention of the Roux-en-Y syndrome, since Roux-limb stasis can still occur.

Chapter 7

The effect of cisapride on complaints and on transit through the gastric remnant and the Roux-limb was determined in 24 patients with the Roux-en-Y syndrome. Thirteen of them had slow gastric emptying and 13 had stasis in the Roux-limb (2 patients had both). Symptoms and transit times were evaluated before and after treatment during three weeks using a questionnaire and scintigraphy. Subjects with a symptomatic response at three weeks continued therapy with cisapride, and they were interviewed again after six months. Seven patients with slow gastric emptying and three patients with Roux-limb stasis had enduring symptomatic relief, and all ten exhibited accelerated transit during therapy. In these seven patients with slow gastric emptying, the mean (± SD) half gastric emptying time was 204 ± 89 min before and 111 ± 59 min during cisapride treatment (p < 0.05). In the three responding patients with Roux-limb stasis, the mean (± SD) percentage of radioactivity, emptied from the gastric remnant and remaining in the Roux-limb after 60 min was 74 ± 4 % before and 25 ± 10 % during cisapride treatment (p < 0.05). In patients without symptomatic response, transit did not improve.

This study shows that cisapride gives long lasting symptomatic relief and improved transit times. It also indicates that cisapride is effective in the treatment of the Roux-en-Y syndrome.
transit in about 40% of patients with the Roux-en-Y syndrome. Despite this low success rate we recommend to consider treatment with cisapride in all Roux-en-Y patients, because a more effective drug is not available and since revisional surgery is no guarantee for success.