

PhD. dissertation

**The influence of the anastomosis performing technique
and the extension of oesophageal resections and
total gastrectomies
to the postoperative recovery.
Experimental examination of the healing process of
telescopic anastomoses.**

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The oesophageal resection and the gastrectomy are the most straining and the most threatened with complications interventions in the surgery of the gastrointestinal tract.

Usually the indication of operation is malignant tumour.

Nowadays the incidence of malignant oesophageal tumours increased. The frequency of gastric cancer decreased however this tendency is observable together with the increasing rate of proximal third malignancy of the stomach.

In case of oesophageal cancer the resection can be avoided only if the tumour is early diagnosed and superficial. This is the same in case of gastric cancer but even more gastrectomies must be performed because of the oral moving tendency of tumours.

It is a big challenge for surgeons to perform these usually heroic operations with low postoperative complication and mortality rate.

An anastomosis with the oesophagus is a considerable reason for complication in itself. Nowadays we have the possibility to analyse the results about the telescopic anastomosis modified by us based on our more than 10 year clinical experience.

In the clinical chapter of the dissertation (chapter 2) the experiences about the oesophageal resections and gastrectomies performed in our surgical unit for malignant tumours are analysed in special consideration of the connection of extended resection with the postoperative complications and with the telescopic anastomosis technique.

In the experimental chapter (chapter 3) the examination of healing process of telescopic anastomoses is reviewed.

We divided into two parts this dissertation only with didactical purpose. We have begun our work near the sick-bed and the operating-table and we are going to use our experiences there, as well.

Objectives:

To study retrospectively the case histories of those patients of our surgical unit who underwent oesophageal resection or gastrectomy for malignant tumour.

1. To estimate the prevalence of postoperative general and surgical complications and the mortality of oesophageal resections and gastrectomies for cancer.
2. To analyse whether the extension of resection influences or not the rate of complications and the mortality.
3. To compare the leakage rate of telescopic anastomosis modified by us with some other kind ones.
4. To examine whether the cervical or thoracic position (in case of oesophageal resection) and thoracic or abdominal position (in case of gastrectomy) of anastomoses have any influence to the frequency of insufficiency.
5. To examine whether the above circumscribed positions of anastomoses influence or not the postoperative complication rate and the mortality.
6. To study in experiments the healing process of telescopic anastomoses.
7. To make clear what the invaginated part in the other organ's lumen happens with.
8. To examine those preconditions of healing process which follow from the structure of the telescopic anastomosis.
9. To examine whether the length of the invaginated part affects or not to the healing process.
10. To clarify those fine technical failure possibilities that can endanger the undisturbed healing of telescopic anastomosis.

2.THE ANASTOMOSIS PREPARING TECHNIQUE, THE INFLUENCE OF THE EXTENSION OF OESOPHAGEAL RESECTIONS AND TOTAL GASTRECTOMIES TO THE POSTOPERATIVE RECOVERY

2.1. LITERATURE REVIEW

2.1.1. Literature review of the oesophageal tumour surgery

Recently the surgical resection is still the most effective treatment for oesophageal cancer. The modern oesophageal surgery has developed since the second part of the 20th century.

The reconstruction of the alimentary tract after oesophageal resection was the most difficult problem. Only 256 reconstruction trial had been mentioned in the literature until 1934. Most of them were performed using skin tube. Reconstruction was not so far done definitely after resection due to oesophageal cancer. Based on the increasing experimental results and clinical experiences the methods of reconstruction techniques developed in the next decades. The first one table resections with reconstruction were performed in cases of cardiac or lower third oesophageal tumours.

Due to accumulated experiences and the developing conditions of the partner professions the operation technique of the middle and lower third cancer of the oesophagus could be standardised and it became increasingly safe.

Even cervical oesophageal resections, hypopharyngeal tumour resections and the first laryngo-pharyngo-oesophagectomies were performed successfully in the 1960's. However these heroic interventions poorly improved the prognosis of the disease. This disappointment divided the surgeons into groups on the basis of their opinions. One of these groups accepted that oesophageal resection can be only palliative treatment in each case. Those surgeons whose conviction was that early stage oesophageal cancer can be curable would have liked to improve the radicalism with the extension of resection.

The morbidity and mortality rate of oesophageal resections are the highest of all operations on the gastrointestinal tract. The most frequent complication after oesophageal resection is the anastomosis leakage. This is why it is still a problem of the oesophageal surgery.

Nowadays it is still necessary to work out new methods to perform proper replacement with appropriate length and with good blood supply. On the other hand the improvement of anastomosis performing techniques would be necessary. Promising results can be found about both topics in the literature.

2.1.2. Literature review of surgery of gastric tumours

The first trials of surgical treatment for gastric cancer had been mentioned at the beginning of the 19th century. The first successful gastric resection was performed by Billroth in 29th January 1881. Schlatter was who removed the entire stomach first time (16 years after the first distal gastric resection by Billroth) in 6th September 1897 at Zürich. The mortality rate of gastric operations was 25-30 per cent at the turn of the 19th-20th century. But the new surgical method the gastrectomy had been born!

Both the first gastric resection and the total gastrectomy were performed by Herczel in Hungary. The activity of Polya and Verebély was remarkable on this field in the first decades of the 20th century. The mortality rate of resections was 29,2 per cent and that of gastrectomies was 76 per cent in those days. These rates decreased significantly until the early 50's. The mortality rate of distal resections was between 5 and 18 per cent and that of gastrectomies between 17 and 37 per cent.

Some surgeons underlined at the turn of the 19th-20th century that gastrectomy should be performed more often while others called an attention to the significance of radical lymphadenectomy.

More and more surgeons began to perform total gastrectomy and tried to remove the regional lymph nodes thank for the mending circumstances of anaesthesiology. This tendency seemed to be accelerated between the 1940's and 50's. Both clinical and pathological evaluations could find pro and contra arguments and evidences about gastrectomy.

Based on the conception developed in the 1960's and 70's the removal of the entire stomach is reasonable only if there is no other possibility. The lymphadenectomy was effaced in the western countries but not in the Far-East.

The survival time was constant in Europe and in the USA while it increased significantly in Japan. This is why a revision of opinion began in the 1980's. In cases of Lauren's diffuse type of gastric tumours the so called theoretical total gastrectomy was suggested, however there was increasing number of sceptic opinions, as well. At that time the problem of the regional extension of resection was also a case at issue. Extended lymphadenectomy was begun to perform in numerous surgical centres. The necessary and possible extension was still the manner in dispute.

The good effect of extended lymphadenectomy to the survival was verified by the German Gastric Cancer Study but it could not be proved by numerous prospective randomised multicentre trials. At the same time increasing rate of general and surgical postoperative complications and mortality was detected. As it turned out the reason of it was the splenectomy and pancreatic resection performed towards radical lymphadenectomy.

Nowadays the evolving standpoint is that the so called theoretical total gastrectomy is not advisable and the extension is needed only to the regional lymph nodes. The extension of resection to the adjoining organs is the question of the potential risk and the expected benefit.

2.2. Materials and methods

2.2.1. Collection and processing of data, statistical analysis

Based on our documentations those patients' case histories were elaborated who underwent oesophageal resection or gastrectomy for malignant tumour between 1st June 1990 and 31st May 2001.

The essences of each documentations were written down to a form complied by us. Only those data were used which seemed to be unambiguous and exact.

Those data which we had in each case were typed into a Microsoft Office Excell schedule. The risk factors of extension of resection, the radicalism, the position and technique of anastomosis and their influence to the postoperative general and surgical complication and to the mortality rate were examined by comparing statistical analysis.

The statistical analysis was made by computer using the "statistica" software. We applied the χ^2 analysis (if necessary with Yates-correction). The difference was accepted as significant if the "P" was less than 0.05.

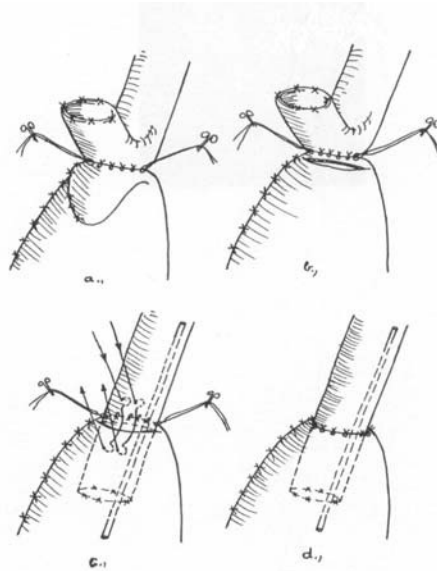


Figure 1.

2.2.2.2. The indication of oesophageal resection, operative technique

In case of malignant oesophageal tumour the indication of resection is the possibility of R0 resection in that patient whose general condition is suitable for this straining operation.

The standard operation is the transthoracic subtotal oesophageal resection with retrosternal gastric tube reposition by Akiyama and with collar oesophago-gastrostomy.

Systematic two-field lymphadenectomy is performed only in the past 5 years. Three field lymphadenectomy (with cervical block-dissection) is still not performed in our surgical unit. Transmediastinal resection was performed only in selected suitable cases. The anastomoses were made with double layer interrupted, sometimes single layer continuous technique and with telescopic method modified by us. We did not use stapler for performing anastomosis.

We would like to present only the telescopic technique entering into details. Recently end-to-end telescopic anastomoses are performed as seen in figure 1.

The substance of telescopic anastomosis is that the free end of the proximal anastomosing tubular organ lays freely in the lumen of the other (distal) anastomosing tubular organ. The posterior suture line is on the posterior wall of the gastric tube (fig. 2/a). The gastric tip which has critical blood supply is resected 3-4 millimetre far from the ready posterior suture line. The next two steps are invaginating the free end of the oesophagus into the lumen of the gastric tube and then performing the anterior suture line. The result is an end-to-end telescopic anastomosis. The recommended suture material is an absorbable 3/0 atraumatic one (p.e. Vicryl, PDS).

The structure of telescopic oesophago-gastrostoma is different than other generally applied ones. A 10-15 millimetre long section of the oesophagus lays freely in the lumen of the gastric tube.

The inverting gastric wall wound lips with its serosal layer encircles the oesophagus like a 3-4 millimetre wide belt. The knots of the posterior suture line invert into the lumen, the anterior ones are out of it. The stitches do not drain the lumens directly. The relieving nasogastric pipe is not in contact with the suture line. Telescopic anastomosis can be performed with any part of the oesophagus and not only with the stomach but also with small or large bowel.

2.2.2.4. Demographic data and adjoining diseases of our oesophagus resected patients.

There were 346 oesophageal operations for cancer in our surgical unit in the examined period. Resection could be performed in 168 cases. The resectability rate was 48,5 per cent.

The female-male proportion was 1:16, the mean age was 54 years.

Only 20 patients had no any significant adjoining disease. The most frequent adjoining disease were the pulmonary abnormalities as chronic bronchitis, pulmonary emphysema. The other frequent diseases were the cardiovascular, hepatic and pancreatic disorders.

2.2.2.5. The mean data of operated oesophageal tumours.

The indication of resection was upper third tumour in 8 cases, middle third oesophageal cancer in 99 and lower third in 61 cases. The histological type of tumour was squamous cell carcinoma in 155 cases, carcinosarcoma in 2 cases and adenocarcinoma in 11 cases. Only 11 patients had stage I. tumour. In 61 cases the operations were performed for stage II. and in 73 patients for stage III. cancer. In 23 cases it turned out during the operation or based on the postoperative histology that the tumour is in stage IV.

2.2.2.6. The method of performing oesophageal resection.

Right side standard thoracotomy through the fifth intercostal space was performed for the resection of oesophagus. The gastric tube was usually performed from upper median laparotomy and the anastomosis was performed from left side collar incision. The 20 transhiatal resections were performed with similar laparotomy and collar incision.

Because of the locoregional spread of the tumour in 18 patients 29 and as synchron resection in 41 patients 43 additional organ resection was made.

Splenectomy was needed in 34 cases because of intraoperative injury.

The reconstruction of the continuity of the alimentary tract was made with gastric tube in 160 patients, with ileo-colic segment in 3 patients and with jejunal Roux-en-Y loop in 3 patients. In one patient the jejunal replacement was thru presternal subcutaneous tunnel and also a skin tube was formed as reconstruction.

Reoperation was performed in one patient for duodenal perforation on the 14th postoperative day and in an other patient for pyloric spasm caused by vagotomy on the 17th postoperative day. Both of them recovered. Two more of our patients had postoperative pancreatitis.

The most severe complication after oesophageal resection is the necrosis of the interposed organ. This occurred in 7 of our patients (4,2 per cent) (see table I.). Gastric tube necrosis occurred in 6 cases and ileocolic segment necrosis in one patient. In two patients the diagnosis of interpositum necrosis was clarified only by necropsy. Mediastinitis developed in 5 cases, each of them was operated on but only 2 of them survived.

Anastomosis leakage occurred in 21 patients, each of them in cervical position. This is 12,5 per cent of all anastomoses. All anastomoses in thoracic position healed without disturbance. Reoperation was done due to 4 cases of anastomosis leakage, all of them recovered.

Table I. *Anastomosis leakage and interposition necrosis after oesophageal resections*

The type, position and variant of anastomosis	Total	Leakage		Interposition necrosis	
	numb.				
	n	n	%	n	%
Oesophago-gastrostoma - cervicalis	135	20	14,8	6	4,4
end to end telescopic	62	5	8,1	1	1,6
end to side telescopic	44	7	15,9	3	6,8
Total telescopic:	106	12	11,3	10	9,4
end to side double layer interrupted	22	7	31,8	1	4,6
end to end single layer continuous	7	1	14,4	1	14,4
Total non-telescopic:	29	8	27,6	2	6,9
Oesophago-ileo-colostoma - cervicalis	3	1	33,3	1	33,3
end to side double layer interrupted	3	1	33,3	1	33,3
Oesophago-gastrostoma intrathoracalis	24				
end to end telescopic	16				
end to side telescopic	5				
end to side double layer interrupted	3				
Oesophago-jejunostoma - intrathoracalis	3				
end to side double layer interrupted	3				
Oesophago-colostoma - intrathoracalis	1				
end to side double layer interrupted	1				

The table contains only the primary performed 166 anastomoses.

The cardiorespiratoric problems were the most frequent postoperative general complications.

Surgical complication caused the death of 7 patients (4,2 per cent). and we lost 16 patients for general complications (9,5 per cent). The total mortality rate was 13,7 per cent.

2.2.3. Gastrectomies

2.2.3.1. The indications of gastrectomy, surgical and anastomosis performing technique.

Total gastrectomy for malignant neoplasm was performed when the tumour located in the upper or middle third or when the antral tumour spread to middle third or in case of entire gastric tumour. Gastrectomy for the lower third cancer was performed only when the preoperative examination verified Lauren's diffuse type tumour. Additional term was the patient's relatively good general condition and the expectation of R0 status.

The most of gastrectomies were performed from upper median laparotomy. Thoracotomy was done only when the tumour spread to the cardia. The major and the minor omentums were removed with the stomach in each case. Splenectomy was always made in the first part of the examined interval but only the metastasis suspicious lymph nodes were removed from the second field. Extended lymphadenectomy has been performed for 5 years in our surgical unit. Pancreatic resection or resection of any other adjacent organs was done only when this could result radical (R0) resection.

The continuity of the gastrointestinal tract was reconstructed with Roux-en-Y loop. Pouch reservoir was never performed. End to side oesophago-jejunostoma is usually done. Double layer interrupted, stapled (EEA[®]) and telescopic technique was applied. The steps how to perform telescopic anastomosis has been previously reviewed.

2.2.3.2. The way how to perform gastrectomies.

Altogether 416 patients had been operated on for ten years for gastric cancer. Gastrectomy was made in 161 patients. This was 52,8 per cent of resections. The female-male rate was 1:2, the mean age was 61 years. Laparotomy was enough to perform in 128 cases. 33 thoracotomy was needed. The direction of the extension of resection can be seen in table II. Gastrectomy with only omentectomy happened in 44 patients. Extended, two field lymphadenectomy was done in 68 cases. 66 double layer interrupted, 18 stapled and 77 telescopic anastomoses were performed. 128 of all anastomoses were in abdominal and 33 of them in thoracic position.

Table II. *The directions of extension of resection in case of 161 gastrectomies**

Extension	n
Minor and maior omentum	44
Spleen	66
Spleen and oesophagus	24
Spleen and other organs	6
+left side diaphragma	2
+colon transversum	1
+jejunum	1
+oesophagus, liver, diaphragma	1
+oesophagus, colon transversum	1
Pancreas+spleen	12
Pancreas+spleen+other organ	7
+oesophagus	5
+liver, diaphragma	1
+colon transversum	1
Oesophagus	2
Total:	161

*Omentectomy was performed in each case

2.2.3.3. Postoperative complications, their treatment and mortality after gastrectomies.

Wound suppuration occurred in 6 patients. Intraabdominal abscess could be observed in 4 patients. Gastrointestinal bleeding occurred in 3 patients in the postoperative period. In two cases intraabdominal bleeding were diagnosed. Severe pancreatitis was in 3 patients and postoperative ileus in 2 patients. The most frequent complication was the anastomosis leakage which could be observed in 8 cases (5 per cent). These are detailed in table III.

Table III. *Anastomosis leakage after gastrectomies*

Anastomosis performing technique	n	Leakage	
		n	%
Double layer interrupted	66	6	9,1
Stapled	18	1	5,5
Telescopic	77	1	1,3
The type position and performing technique of anastomoses	n	Leakage	
		n	%
Oesophago-jejunostoma intrathoracalis	33	3	9,1
Double layer interrupted	15	2	13,3
Stapled	-	-	-
Telescopic	18	1	5,5
Oesophago-jejunostoma intraabdominalis	128	5	3,9
Double layer interrupted	51	4	7,8
Stapled	18	1	5,5
Telescopic	59	-	-

Only one of the 77 telescopic anastomoses was insufficient (1,3 per cent).

Nine of all patients had to be re-operated because of any complication and 3 of them died despite of the re-operation.

As the most of the joint-diseases was of the cardiorespiratory system, the most of the surgical complications occurred in it, as well.

3 patients (1,9 per cent) died due to surgical complication and 5 patients (3,1 per cent) because of general complication. Altogether we lost 8 patients, this means 5 per cent postoperative mortality rate.

2.3. Results

2.3.1. Results analysed the case histories of our oesophagus resected patients

Based on the opinion of the given surgeon and the data of histopathological examinations R0 resection could be presumed in 117 cases (69,6 per cent).

Undisturbed healing could be observed after 83 operations (49,4 per cent) however in 85 patients more or less complications occurred in the postoperative period. We lost 23 patients, this means 13,7 per cent postoperative mortality rate.

Based on the data of the statistical analysis the extension of resection had no influence to the occurrence of postoperative complications (table IV.).

Only the gastrectomy or gastric stump resection with splenectomy resulted significantly increased number of surgical complications, however this had no influence to the total number of complications, to the number of general complications and to the mortality rate.

Table IV.		Complications and mortality in case of oesophageal resection. These comparision based on the extension								
Group	Direction of extension	n	Complication case		Complications				Mortality	
					surgical		general			
			n	P	n	P	n	P	n	P
1.	Non-extended	109	59	•	31	•	37	•	14	•
2.	Extension to lung or pericardium	18	12	ns	7	ns	7	ns	0	ns
3.	to stomach and spleen	7	6	ns	5	<0,05	2	ns	2	ns
4.	to spleen	34	21	ns	12	ns	13	ns	6	ns
5.	2-4. groups altogether	59	39	ns	24	ns	22	ns	8	ns
• The group of the base of comparison										

The anastomosis leakage rate was 12,5 per cent of all 168 anastomoses, 15,2 per cent of all 138 cervical anastomoses, 14,8 per cent of all 135 cervical oesophago-gastrostomas and only 8,1 per cent of all 62 cervical telescopic end to end oesophago-gastrostomas.

The leakage rate of oesophago-gastric anastomoses depends on two things which can be proved by statistical analysis. One of them is the position of the anastomosis and the other is the anastomosis preparing technique (table V.).

Table V.	The comparison of the leakage rate of different type of oesophago-gastrostomas						
The position, type and variant of anastomosis	n	Leakage	P value				
		n	P1	P2	P3	P4	P5
Oesophago-gastrostoma cervicalis	135	20	•				
end to end telescopic	62	5		•	•	•	
end to side telescopic	44	7		•	ns	•	
total, telescopic	106	12					•
end to side double layer interrupted	22	7		•		<0,05	
end to end single layer continuous	7	1					
total, non-telescopic	29	8					<0,05
Oesophago-gastrostoma intrathoracalis	24	0	<0,05				
end to end telescopic	16	0		ns			
end to side telescopic	5	0		ns			
end to side double layer interrupted	3	0		ns			
• The group of the base of comparison							

The insufficiency rate of cervical oesophago-gastrostomas was significantly increased compared with that of in thoracic position independently from their preparing technique ($P1 < 0,05$). This difference was not significant when comparing the identical pairs of anastomosis types in cervical and thoracic position (all $P2 > 0,05$). There is not significant difference of the leakage rate between the telescopic end to end and end to side cervical anastomoses ($P3 = ns$). The leakage rate of the two types of telescopic anastomoses was significantly lower compared with the double layer anastomoses or with the two types of non-telescopic ones ($P4 < 0,05$, $P5 < 0,05$). Significantly increased number of all complications and surgical complications could be observed in cases of cervical anastomoses however this difference was not significant when comparing with the general complications. Interposition

necrosis occurred only in cervical anastomosis position cases but the connection between the interposition necrosis and the anastomosis position could not be proved.

2.3.2. Results based on the case histories of our patients who underwent gastrectomy.

124 of our 161 gastrectomy patients (77 per cent) had R0 resection. The postoperative healing was undisturbed in 102 patients after gastrectomy (63 per cent) but in 59 cases complication occurred (37 per cent). Surgical complication could be observed in 30 patients (18,6 per cent) and general complication in 36 patients (22,4 per cent). Both surgical and general complications occurred in 14 patients (8,7 per cent). 8 of our patients died, this means 5 per cent clinical mortality.

In table VI. can be seen the data of the effect of extension of resection to the complications and to the mortality.

Table VI. *The comparison of complications and mortality in case of gastrectomies based on the extension*

Group	Extension	Operations n	Complications									Mortality		
			total			surgical			general					
			n	P ₁	P ₂	n	P ₁	P ₂	n	P ₁	P ₂	n	P ₁	P ₂
1.	Minor and maior omentum	44	9	•		3	•		6	•		2	•	
2.	Spleen	66	28	<0,05	•	15	<0,05	•	17	ns	•	2	ns	•
3.	Spleen + oesophagus	24	10	<0,05	ns	6	<0,05	ns	5	ns	ns	1	ns	ns
4.	Spleen + other organ	6	1	ns	ns	1	ns	ns	0	ns	ns	0	ns	ns
5.	Spleen + pancreas	12	9	<0,05	<0,05	4	<0,05	ns	5	<0,05	ns	2	ns	<0,05
6.	Spleen + pancreas + other organ	7	4	<0,05	ns	1	ns	ns	3	ns	ns	1	ns	ns
7.	Oesophagus	2	0	ns		0	ns		0	ns		0	ns	
8.	2 – 7 groups altogether	117	52	<0,05		27	<0,05		30	ns		6	ns	

• The group of the base of comparison

Compared the only omentectomy group with other extended resection group can be appointed that the extended resection raised the possibility of surgical complications. This also occurred in the splenectomy group (group 2). The splenectomy with other organ resection led to increased number of complication only in case of pancreatic resection (group 5.). The total number of complications was significantly higher in this group. The mortality rate was

significantly higher, as well, than in the only splenectomy group ($P < 0,05$). Altogether the extension of resection had no effect on the mortality rate (group 8).

The abdominal or thoracic position of the anastomosis was irrelevant only the type of the anastomosis affected the frequency of insufficiency (table VII.).

Table VII. *The comparison of the leakage rate of different anastomosis variants*

Anastomosis variant	n	leakage		P
		n	%	
Telescopic	77	1	1,3	•
Double layer interrupted	66	6	9,1	$<0,05$
Stapled	18	1	5,5	ns
Double layer interrupted+ stapled	84	7	5,2	$<0,05$

• The group of the base of comparison

Comparing the telescopic anastomoses with the double layer ones the difference is significant. This is even demonstrable if comparing it with the double layer together with stapled ones ($P < 0,05$).

2.4. Discussion

2.4.1. Discussion of oesophageal resection data

The prognosis of the oesophageal cancer is bad, only the surgical treatment can improve this hard chance. The chance for healing is given only in case of R0 resection. This can account for the effort to raise the surgical radicality. 117 of our operations could be labelled R0 resection (69,6 per cent). This rate is between 35 and 100 per cent in the literature.

Surgical complication occurred in the postoperative period in 28,6 per cent of our patients and general complications in 32,7 per cent. The complication rate is between 26 and 70 per cent in the literature.

Siewert's opinion is that the reconstruction and not the resection is responsible for the surgical complications and the mortality. Our results confirm this opinion.

Usually we do not speak about extended or combined resection in case of oesophageal operations. The oesophageal tumour is irresectable when it spreads to the airways, to the big vessels, to the lung or to the pericardium. Mostly it is really right but as Müller opined even the R0 resection is possible in case of the infiltration of the adventitial layer of the aorta. Our opinion is that R0 resection is not impossible when it spreads to a little area of the lung or the pericardium. In our patients the extension of resection to the lung or to the pericardium or the splenectomy for intraoperative injury had no influence on the complications and the postoperative mortality rate. The extension to the stomach or to the gastric stump caused significantly increased number of surgical complications.

The most serious complication is the vascular catastrophe of the supplementary organ: the interpositum necrosis. Its frequency is between 0,5 and 4 per cent. We realised it in 4,2 per cent after our operations. The reason of it was that 75 per cent of our anastomoses were in cervical position and except for 7 cases the interpositum was retrosternally led to the neck.

The other but less severe complication of oesophageal surgery is the anastomosis leakage. The leakage rate of oesophageal anastomoses decreases in the past decades but it is actually still high, as well.

The insufficiency of the collar anastomoses rarely causes life threatening complication. On the other hand the insufficiency is much frequent in collar anastomoses than in other position. based on the data of HIETE's Surgical Clinic 85 per cent of oesophageal anastomosis leakages are in collar position.

Based on the data of Müller and associates the insufficiency rate of intrathoracic anastomoses was 9 per cent while that of in collar position was 22 per cent. Faller reported a multicentre cumulative study of 817 Hungarian oesophageal resection cases between 1988 and 1992 with 24,7 per cent leakage rate. Taking into consideration of the above mentioned data our 12,5 per cent leakage rate is acceptable especially because the most of anastomoses were in collar position. Anastomosis leakage was not observed in thoracic position. The difference between the leakage rates of collar and thoracic anastomoses is statistically significant according to the international literature.

The leakage rate of collar telescopic anastomoses was significantly lower than that of other type anastomoses in collar position. The best in this point of view was the end to end telescopic one. Death in connection with anastomosis leakage did not occur. Based on our results we think the telescopic technique to have reason for existence in the oesophageal surgery.

23 of our patients died in the postoperative period, this means 13,7 per cent mortality rate. The reason of the death was surgical complication in 4,2 per cent and general complication in 9,5 per cent.

Based on the cumulative statistics of Earlam and associates the postoperative clinical mortality rate was 31 per cent between 1950 and 1979 in Europe. Based on the review of Müller and associates who worked up 116 articles from different European surgical centres found the average mortality rate 16 per cent after oesophageal resection and the clinical mortality rate was estimated 11 per cent by them. More distinct improvement is not detectable in the past decade. Faller and associates reported 13,7 per cent mortality rate in 1992. The mortality rate in our department is fully the same. The result of Japanese authors were previously and also recently better than ours.

2.4.2. The discussion of our results after gastrectomies

Nowadays the prognosis of gastric cancer is still poor despite all therapeutic efforts. The survival depends on the surgical intervention. Today the "theoretical total gastrectomy" seems to be provenly unreasonable but considering the localisation and biological behaviour of tumours the proportion of gastrectomy must be more than 60 per cent.

There is remarkable difference between the complication rate of gastrectomies and subtotal resections but not so big that it could justify any decision against the radicality.

We always try to decide according to the oncological principles. This is why in our ten year material there was 52,8 per cent total gastrectomy rate from the 305 gastric resection. This is the highest published rate in Hungary.

Complications occurred in 37 per cent of patients after gastrectomy. 1,9 per cent of patients died of surgical complication and 3,1 per cent of general complication. It is very important to decrease the mortality rate because the chance for convalescence is given only if the resection was adequate and radical and if surviving the postoperative period. During the 161 gastrectomies performed by us in 44 patients (27,3 per cent) only omentectomy happened with the gastrectomy.

More extension happened in 117 patients (72,7 per cent) that means except for 2 cases splenectomy, as well. The necessity of it was questionable.

Splenectomy and omentectomy with gastrectomy happened in 66 patients. This was the most frequent extension and not accidentally. This was the routine operation for decades however without lymphadenectomy. Extended lymphadenectomy is routinely performed in our surgical unit only in the past years, at the same time with numerous splenectomy, as well.

Comparing the extended operations with the only omentectomy with gastrectomy group significantly increasing rate of complications can be observed in the extended lymphadenectomy with gastrectomy group. However there is not difference in the number of general complications and the mortality rate. This can be detected if comparing it with the only splenectomy with gastrectomy group that is consonant with the data of the literature.

The question of lymphadenectomy came up again in the 1980's in Europe based on the Japanese and some European experiences. The growth of general and surgical complication rate after extended lymphadenectomy is published in the European prospective randomised studies. In retrospective (German) gastric cancer study this was not demonstrable. Based on these studies it turned out that the splenectomy and pancreatic resection and not the lymphadenectomy is the factor which is responsible for the increased number of complications. This is the reason why advisable to consider carefully the indication of splenectomy.

The resection of the left part of the pancreas can be necessary due to the facilitation of complete lymphadenectomy and the removal of the retropancreatic lymph-nodes. According to our knowledge this is not in routine use in Hungary. We perform left pancreatic resection only when the tumour spread to the pancreas. All the same after splenectomy the pancreatic resection is the second frequent extension in our practice. We can confirm that the pancreatic resection increased more the postoperative morbidity (even compared it with the splenectomy group). The surgical and general complication became more frequent even the mortality rate was higher in this group.

Anastomosis leakage occurred in 8 patients of 161 total gastrectomies that means 5 per cent rate. Our results are acceptable according to the international data of the literature. Only the anastomosis performing technique influenced the leakage rate. The 1,3 per cent insufficiency rate of telescopic anastomoses was significantly lower than that of the double layer ones and lower but not significantly than that of the stapled oesophago-jejunostomies.

We can not present comparison of these data from the literature because there is no other publication about the telescopic anastomoses except for ours. The mortality rate of anastomosis insufficiency after gastrectomies is between 30 and 40 per cent in the literature. We lost only 1 patient provenly due to leakage.

2.4.3. Conclusion

1. The complication rate of both oesophageal resections and gastrectomies is still high. In both kind of operation the general complication rate is high which can be explained partly with the patient's polymorbidity. The big surgical strain upsets the unstable balance of these patients's organism. Especially in case of oesophageal resection this is the reason of the still high postoperative mortality rate.
2. The frequency of surgical complications can be reduced if rationally extended resection is performed. On the other hand the oncologically reasonable extension must be taken in behalf of the better long-term results. Our opinion can be confirmed with the fact that the extension of operations did not increase the mortality rate. The tumorous infiltration of the neighbouring structures does not mean automatically inoperability in case of oesophageal tumour.

3. The telescopic anastomosis technique is well useable in the everyday practice. The leakage rate could be decreased with the help of its adaptation both in case of oesophageal resection and gastrectomy.
4. In case of oesophageal resection complication is more frequent in cervical anastomoses than in thoracic one although the consequences of the insufficiency do not endanger directly the patient's life. In case of gastrectomy the thoracic or abdominal position of the anastomosis has no influence to the frequency of insufficiency.
5. In case of oesophageal resection if the anastomosis is in collar position the complications and mainly the surgical complications become more frequent but the mortality rate is not higher than in case of thoracic anastomosis. In case of gastrectomy the position of the anastomosis does not affect to the postoperative healing.

3 THE EXPERIMENTAL EXAMINATION OF THE HEALING PROCESS OF TELESCOPIC ANASTOMOSES

The structure of a telescopic anastomosis is notably different than a conventional one. We have no information about its healing process since the publications about the telescopic anastomoses detail only the operative technique, their clinical application and results.

3.1. Literature review

The telescopic anastomosis technique was worked out by Sonnenburg and Maylard independently from each other at the turn of the 19th-20th century. They invaginated a 15-20 cm long section of the ileum with its mesentery into the ascendant colon. The joining point of the mesentery and the colonic incision was the critical area of these kinds of anastomoses. Leakage occurred frequently in this area.

According to Guleke, Grekow was the first who applied the telescopic technique in the colonic surgery. D'Alaines mentioned the colo-rectal invagination as Mummery's method. This method is also detailed by Littmann as Lockhardt-Mummery anastomosis.

Telescopic technique was first time mentioned in the oesophageal and gastric surgery in the 1920-30's years. According to Fischer the first successful gastro-oesophageal anastomosis was performed with this method by Sauerbruch. During proximal gastric resection the oesophagus was deeply inserted into the lumen of the gastric stump and fixed there with multiple layer of purse-string sutures.

The first author who reported his experiences about the telescopic anastomosis in the Hungarian literature was Kopasz in 1964. Ileo-colostomas were performed by him with this method. Later Mihályi, Kun and associates, Mencser and associates and Krasznay and associates reported the use of this method in the bowel surgery and me and my associates about the oesophageal and gastric surgery application of the telescopic anastomosis. We can conclude that the method is old, only the surgical technique of its performing changed and developed.

3.2. Materials and methods

First of all we would have liked to get informations about the biomechanical properties of oesophageal telescopic anastomosis before the beginning of the healing process. This is why we observed the internal pressure tolerance of oesophago-gastrostomas and oesophago-jejunosomas in model experiment by measuring bursting pressure.

It can be assumed on the basis of the structure of telescopic anastomosis that the increasing inner pressure does not affect to the suture line disruptingly. We have tried to find the answer to this presumption with the help of computer model. Than we would have liked to

come to know the healing process of these anastomoses in animal experiments. As the bowel surgery was the place of birth of the telescopic technique, ileo-colostomas were examined, as well.

3.2.1. Model experiments

For measuring the bursting pressure altogether 135 anastomoses were performed as detailed in table VIII.

Table VIII. *The examined anastomosis model types and variants*

The anastomosis		
type	variant according to its suturing technique	n
Oesophago-gastrostoma	telescopic	9
	single layer interrupted, with mucosa	9
	single layer interrupted, without mucosa	9
	single layer continuous, with mucosa	9
	single layer continuous, without mucosa	9
	double layer interrupted	9
	double layer, internal continuous – external interrupted	9
Oesophago-jejunostoma	telescopic	9
	single layer interrupted, with mucosa	9
	single layer interrupted, without mucosa	9
	single layer continuous, with mucosa	9
	single layer continuous, without mucosa	9
	double layer interrupted	9
	double layer, internal continuous – external interrupted	9
	stapled (EEA)	9
Altogether:		135

The organs of hybrid pigs weighting 90 to 100 kgs were used. All anastomoses were performed by the same hands. The bursting pressure measurement was done on these models. The anastomoses were immersed into physiologic saline solution. The pressure when the first gas bubble appeared during the measurement was considered as bursting pressure.

3.2.2. Computer model

The distribution of wall-tension around the suture line of the anastomosis was examined with the help of computer model in case of conventional end to end anastomosis and in case of telescopic one. We applied the “Pro Engineer 2000 i 2” software for engineering hydraulic systems and the “Pro Mechanica 2000 i 2” software for mathematic calculations.

3.2.3. Animal experiments

Mongrel dogs were used with the licence of the Animal Experiment and Scientific Ethics Committee of the University of Debrecen (licence number: ATEB 66/99 MÁB).

Telescopic oesophago-gastrostomas and telescopic ileo-colostomas were performed in the animals. Bursting pressure measurements were done on the 7th and 21st postoperative days and the so called 0 day bursting pressure was measured, as well. The macromorphologic observations and histological examinations were made to get picture about the changes during the healing process. Altogether 12 oesophago-gastrostomas and 9 ileo-colostomas were made.

Oesophago-gastrostomas:

Group A (n=3): The length of the invaginated part: 20 mm, survival time: 7 days.

Group B (n=3): The length of the invaginated part: 10 mm, survival time: 21 days.

Group C (n=3): The length of the invaginated part: 20 mm, survival time: 21 days.

Group D (n=3): The length of the invaginated part: 30 mm, survival time: 21 days.

The fixing of the oesophageal mucosa to its muscular wall was done 2, 4 and circularly inserted stitches in each group.

Ileo-colostomas:

Group I. (n=3): The length of the invaginated part: 20 mm, survival time: 7 days.

Group II. (n=3): The length of the invaginated part: 10 mm, survival time: 21 days.

Group III. (n=3): The length of the invaginated part: 20 mm, survival time: 21 days.

In case of ileo-colostoma the mucosa of the invaginated ileum was not fixed to the muscular layer because mucosal retraction is not expected to be in small bowel.

At the end of the planned survival time the animals were sacrificed. the whole stomach with the oesophagus and the colon with 30 cm long ileal segment was removed. The fundal part of the stomach with the anastomosis was excised after excluding it with an UKL-60 linear stapler forming an equiangular triangle. The procedure was the same in case of ileo-colostomas. The 0 day look-alikes of anastomoses were performed using the sacrificed animal's remnant stomach with the greater curvature area, the remnant oesophagus, the spared ileum and the colon. Bursting pressure measurements were done on the 0 day anastomoses and the 7th and 21st day preparations, as well. Macroscopic observations were made after cutting up the anastomosis area then the preparations were put in 10 per cent formaldehyde solution to fix them. After paraffine embedding longitudinal section slides were made from the anastomosis area for histological examinations. Near the ordinary haematoxylin-eosin staining Van Gieson elastica (Hart) staining was done for detecting the elastic fibres, Masson's trichrom staining for demonstrating the collagen fibres and silver impregnation to examine the reticular fibres.

Variance analysis and "t" test were made for statistical evaluation. Those differences were accepted as statistically significant when the "P" value was less than 0,05.

3.3. RESULTS

3.3.1. Results of model experiments

3.3.1.1. Results of bursting pressure measurements in anastomosis models

The average bursting pressure data of the different kind of oesophago-gastrostomas are shown in table IX.

The average bursting pressure of telescopic anastomoses is significantly higher than in case of any other type of single layer ones. Compared it with the double layer anastomoses the result is inversed. The double layer anastomoses can tolerate higher bursting pressure. All P1 are less than 0,05 according to the above mentioned facts. Considering the bursting pressure it is irrelevant that the single layer anastomosis was made with interrupted or continuous suture. It is also irrelevant that the stitches contain the mucosa or not. The average bursting pressure data are not significantly differ, both P2 and P3 data are higher than 0,05.

Table IX. *The comparison of bursting pressure data of different variants of oesophago-gastrostoma*

The anastomosis variant according to its suture	n	Average bursting pressure		P value		
		mmHg	SD	P1	P2	P3
Telescopic	9	127	18	•		
Single layer interrupted with mucosa	9	52	8	<0,05	•	•
Single layer interrupted without mucosa	9	57	8	<0,05	•	ns
Single layer continuous with mucosa	9	65	25	<0,05	ns	•
Single layer continuous without mucosa	9	55	4	<0,05	ns	ns
Double layer interrupted	9	188	31	<0,05		
Double layer, internal continuous, external interrupted	9	163	26	<0,05		

• The group of the base of comparison

Table X. *The comparison of bursting pressure data of different variants of oesophago-gastrostoma*

The anastomosis variant according to its suture	n	Average bursting pressure		P value		
		mmHg	SD	P1	P2	P3
Telescopic	9	44	10	•		
Single layer interrupted with mucosa	9	30	11	<0,05	•	•
Single layer interrupted without mucosa	9	32	7	<0,05	•	ns
Single layer continuous with mucosa	9	37	17	ns	ns	•
Single layer continuous without mucosa	9	40	5	ns	<0,05	ns
Double layer interrupted	9	47	9	ns		
Double layer, internal continuous, external interrupted	9	72	20	<0,05		
Stapled (EEA)	9	44	9	ns		

• The group of the base of comparison

The average bursting pressure of telescopic oesophago-jejunosomas was 44 mmHg. This is significantly higher than that of mucosa involving or not involving interruptedly sutured anastomoses's 30 mmHg and 32 mmHg data. Both P1 data are less than 0,05.

Compared with the single layer continuously sutured anastomoses's 37 mmHg and 40 mmHg bursting pressure data this difference is not significant. Both P1 data are higher than 0,05.

Among the double layer anastomoses the mean bursting pressure was higher than that of the telescopic one only in those double layer anastomoses (72 mmHg) which contained external interrupted and internal continuous suture ($P1 < 0,05$).

Compared the single layer interrupted anastomosis with continuously sutured ones in which the stitches did not contain the mucosa the bursting pressure was significantly higher in the continuously sutured ones ($P2 < 0,05$).

Those factor that the stitches contain or not the mucosa of the anastomosing organs did not influence the bursting pressure. Both P3 data was higher than 0,05.

3.3.1.2. Observations in model experiments

During the measurements could be experienced that the first gas bubble usually appeared from one of the piercing channel of stitches and not from interstitch area.

In case of continuous suture frequently occurred that the first bubbles appeared at that area where the stitches were irregularly far from each other. the tension of the suture line incised the organ's wall this way widening the piercing channel while it engaged the regular spiral shape.

In case of telescopic anastomosis the gas exit appeared between the stitches. Only that technical failure could cause gas secession from a piercing channel when the stitch accidentally contained the mucosa.

3.3.2. Results of computer model

The computer model certified that the suture line of the telescopic anastomosis is in low tension region even if it was under high internal pressure. In case of regular end to end anastomosis the highest wall tension could be observed just in the sutured region.

3.3.3. Results of animal experiments

3.3.3.1. Bursting pressure data of oesophago-gastrostomas

The data of oesophago-gastrostomas are detailed in table XI. The analogous 0 day look-alikes of the certain surviving groups are signed with identical small letters.

The bursting pressure of 0 day anastomoses (groups a, b, c, d) altered between 41 and 63 mmHg. On the 7th day the mean bursting pressure was 115 mmHg (group A). Compared it with any 0 day group the increase is significant ($P < 0,05$, table XI. line 2.). By the 21st day more increase could be measured ($P < 0,05$, table XI. line 2.). Compared the 0 day groups with each other in all possible variations difference could not be detected ($P > 0,05$, table XI. line 3.). This was the same when comparing the 21st day groups with each other ($P > 0,05$, table XI. line 4.). As the difference between the 0 day groups was only in the length of the invaginated part and this was the same between the 21st day groups we could conclude that the length of the invaginated part did not influence to the bursting pressure neither on the 0 day (groups a, b, c, d) nor after the healing process (groups B, C, D).

Table XI.. *The average bursting pressure data of different variants of oesophago-gastrostomas and their comparision*

Group	n	Length of invagination (mm)	Survival time (day)	Average bursting pressure	
				mmHg	SD
A	3	20	7	115	5
a	3	20	0	48	4
B	3	10	21	184	2
b	3	10	0	63	15
C	3	20	21	201	16
c	3	20	0	41	10
D	3	30	21	188	10
d	3	30	0	45	17

Line	Compared groups	P value
1.	A; a; b; c; d;	<0,05
2.	A; B; C; D;	<0,05
3.	A; c; d; e;	ns
4.	B; C; D;	ns

3.3.3.2. Macroscopic observations in case of oesophago-gastrostoma

The muscular wall of the oesophagus was not free by the 7th day (group A). In case of 20 mm invagination length it was covered by the gastric mucosa.

We examined 9 anastomoses on the 21st day (groups B, C, D). The invaginated part was covered by the gastric mucosa in each case independently from the length of invagination and the fixing way of the oesophageal mucosa. The joining of the gastric and oesophageal mucosa was complete on the whole circumference of the free oesophageal end. Those three anastomoses seemed to be the most regular in which the oesophageal mucosa was fixed to its muscular wall at the free end with circularly inserted stitches.

3.3.3.3. Histological observations in case of oesophago-gastrostomas

The serosal layer of the belt-like inverting gastric wall which encircles the oesophagus at the anastomosis line disappeared by the 7th day. Granulation tissue appeared between the muscular layer of the stomach and the oesophagus. Collagen fibres prevailed in the granulation tissue on the 7th day. The reticular and elastic fibres piled up by the 21st day. Neither necrosis nor micro abscesses were observable in the oesophageal wall. The external surface of the muscular layer was covered by the gastric mucosa. The mucosa slid forward with its submucosa on the muscular wall of the oesophagus. In ideal cases this mucosa joined with the oesophageal one. This process was partial on the 7th day. If the joining of the two mucosas was not complete on a small part of the circumference mucosal regeneration filled the lack. The healing process of ileo-colostomas was the very same than that of the oesophago-gastrostomas.

3.4. DISCUSSION

As we had considerable clinical experiences about the oesophageal telescopic anastomoses we tried to focus to the examination of these anastomoses in our experiments.

The technically well performed tension free anastomosis is stressed by the intraluminal pressure of the anastomised organs. We can get picture about it by measuring the bursting pressure. The bursting pressure is that pressure which can burst the suture line or the tissue. The unit of it is mmHg or in SI kPa. The evaluation of this data is similar to the evaluation of a car crash test. Rarely occurs such a high pressure in the gastrointestinal tract in the early postoperative period that we use for the measurement (i.e. vomiting, ileus). If the intraluminal content can get out from the lumen across the suture line undisturbed healing can not be presumed on.

According to our results of model experiments the pressure tolerance of telescopic anastomoses are better than any other single layer anastomosis types. It seems to be irrelevant from this point of view that preparing it with interrupted or continuous suture or the stitches contain or not the mucosa.

In case of oesophago-jejunosoma the bursting pressure is higher in telescopic anastomoses than in single layer interrupted anastomosis however this difference is not demonstrable comparing with single layer continuous anastomosis.

The pressure tolerance of telescopic anastomoses and stapled (EEA) anastomoses was the same.

The better pressure tolerance of double layer anastomoses can be explained with the additional safety of the external suture line. These stiches do not pierce into the lumen and can tolerate the increasing internal pressure after that the internal suture line has lost its integrity. This fact probably suggests favouring double layer anastomosis. Contrarily recently the clinical experiences and the different experiments clarified the safety of single layer anastomoses is proper. In case of double layer anastomosis the effort to increase the safety results unfavourable wound circumstances in the suture line (i.e. beta, gamma type) and it can worsen the microcirculation of the anastomosis area. Remarkable property of the telescopic anastomosis is that the stitches do not pierce through all layers of the organs' wall therefore those do not drain the lumens directly.

Based on theoretical considerations favourable property of telescopic anastomosis is that the increasing inner pressure presses the walls of the anastomosing organs to each other and not tear them open. This phenomenon seems to be logical but it has not been proved or denied with measurements yet. Based on the results of the computer model we can conclude that the hypothesis is true in case of certain substance quality and in the examined pressure range.

In case of telescopic anastomoses the wound lips of the anastomosing organs are as far from each other as long section is invaginated into the lumen. The invaginated oesophageal or jejunal segment is in direct contact with the content of the lumen. However this factor does not cause undisturbed healing according to the clinical experiences. The most problematic question is what the invaginated oesophageal or ileal segment happens with among such aggressive foreign environment. According to our animal experiments mucosa covers the invaginated part. The gastric mucosa with its submucosal layer slides forward onto the external muscular wall of the oesophagus and joins with the oesophageal mucosa.

Well known thing that primary wound healing is not possible in the gastrointestinal tract. Inflammation is always observable in the anastomosing line mainly in the submucosal layer. The advantage of single layer anastomoses is that the wound circumstances are simple; the exsudate can leave easily the wound sides. These circumstances are given in case of telescopic anastomosis, as well. We think the mucosal forward sliding to be very important

and advantageous condition of the healing process of telescopic anastomoses. This is why the suture line becomes excluded hermetically from the lumen resulted favourable circumstances for the healing process. Even the 30 mm long invaginates are covered with mucosa by the 21st day.

According to our macroscopic observations it is advisable to fix the oesophageal mucosa to its muscular layer with circularly inserted stitches at the free end of the oesophagus.

The length of the invaginated section itself does not influence the healing process. The fact that the bursting pressure data increases during the healing process both in oesophago-gastrostomas and ileo-colostomas is independent from the length of the invagination.

Based on our model- and animal experiments the followings can be concluded:

1. The invaginated oesophageal section does not suffer from neither ischaemic nor any other laesion. The mucosa sliding forward onto the wall of the invaginated section, protects it and the suture line from the potentially damaging effect of the intraluminal content. In case of telescopic anastomosis the always observable inflammation is not preceded in the suture line area thanks for the sliding submucosal-mucosal layer of the distal anastomosing organ.
2. The pressure tolerance of telescopic anastomosis promptly after its preparing is better than any other type of single layer one. The distance between the wound lips of the anastomosing organs does not set back the healing process.
3. The inner pressure tolerance of the anastomoses increases well and significantly during the healing process and it is independent from the length of the invaginated section. The length of the invaginated section (up to 30 mm) does not influence the healing process.
4. That technical failure when the stitches pierce into the lumen decreases the pressure tolerance. The regular joining of the gastric and oesophageal mucosa is complete at the end of healing process if the mucosa was fixed to the muscular wall with circularly inserted stitches.

The healing process of the ileo-colostomas is the very same (except for the mucosa fixing stitches).

These observations can explain the good results we experienced in the clinical practice.

4. SUMMARY

Analysing the case histories of our operated patients the followings can be concluded:

- Complications occurred in the postoperative period in the case of more than half of those patients who underwent oesophageal resection and more than one third of those who were after gastrectomy. General complications were more frequent in both groups and those were responsible for the most of the mortality.
- In cases of oesophageal resections the removal of the stomach or the gastric stump increased the number of surgical complications significantly. The extension of resection to the lung or to the pericardium or carrying out splenectomy for accidental intraoperative injury had no effect to complications or to the mortality rate. The extension of the resection to the spleen during gastrectomies led to a significant growth in the number of all complications and mainly surgical ones. The extension of resections to other organs with splenectomy had further unfavourable consequence only in the case of pancreatic resection. Increased mortality rate could be observed in this group. However the extension of resection did not influence the mortality rate.
- In cases of oesophageal resections the leakage rate of telescopic anastomoses in cervical position were significantly lower than that of any other type of anastomosis. In cases of

gastrectomies the leakage rate of telescopic anastomoses were the lowest but compared it with the double layer interrupted anastomoses the difference was statistically significant.

- The occurrence of insufficiency was higher in cases of cervical oesophago-gastrostomy compared it with thoracic ones. There was no difference between the leakage rate of thoracic anastomoses and that of intraabdominal ones in cases of gastrectomies.

- In cases of oesophageal resections significantly more problems and surgical complications were experienced when the anastomosis was in cervical position than in thoracic ones. When performing gastrectomies the position of anastomosis was irrelevant from this point of view.

About our experimental results:

- The short invaginated oesophageal or bowel segment of telescopic anastomoses was not injured. Its external surface became covered with the mucosa of the recipient organ. Owing to their structure the anastomoses were able to endure well the internal pressure of the lumen from the first moment they had been prepared. The lack of lumen draining stitches is an important factor. The distance between the wound lips of anastomised organs did not hamper the healing process.

- The length of the invaginated section had no influence to the healing process.

- When performing such an anastomosis it is very important that the stitches should not penetrate into the lumen of the organs. It is advisable to fix the mucosa to the muscular wall at the free end of the oesophagus by inserting interrupted stitches 3-4 mm far from each other.

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