Introduction

Over the past 10 years in Uzbekistan noted some decline in incidence of malignant tumors (from 74.1 to 68.2 per 100,000 population). In 2008 in Uzbekistan, identified 18,626 patients with malignant disease, which is 68.2 cases per 100,000 population. Standard incidence rates of pathologies (per 100,000 population) are: mammary (breast) cancer – 7.5; stomach cancer – 6.5; lung cancer – 4.6; cervical cancer – 4.2; malignant tumors of the skin – 4.02; esophageal cancer – 3.6; liver cancer – 3.4; malignant tumors of bones and joints – 3.15. In 2008 in the Republic of Uzbekistan mortality from malignant tumors has borrowed third place (after the injury-related deaths and cardiovascular disease).

Cancer of the esophagus detected in 991 patients (5% of all patients with malignant tumors), in the structure of all malignant diseases esophageal cancer hold the sixth place, and among tumors of the gastrointestinal tract – 2nd place (after stomach cancer).

The problem of esophageal anastomosis was and remains to be one of the leading challenges during all history of surgery. In spite of considerable positive changes being achieved over the last years the actuality of this question has not been decreased. The fate of anastomosis continues to be a factor defining not only the outcome of surgical intervention, but also a quality of life of the patient in the long-term period.

The formation of cervical esophaogastrianastomo-
mosis after esophagectomy may be manually sewn or mechanically stapled (lineal and circular staplers). The cervical EGA is made easier by manual manner almost in all cases than with use of staplers, because the length of the stomach transplant in esophago-gastroplasty is usually limited and proximal esophageal (or pharyngeal) segment is short. This situation limits maneuvers with stapler during formation of EGA. We think that the advantage of the manual method of formation of the cervical EGA in comparison with use of stapler is greater reliability, less degree of traumatism of tissues, possibility of formation of antireflux valvular mechanism, visual control of each suture. We have developed more reliable and functionally active, simple in formation cervical EGA allowing reduction of the number of failures and cicatrical stenosis, decrease in pathological expressions of the gastro-esophageal-pharyngeal reflux.

**Materials and Methods**

In the thoracic department of our center there were performed 212 esophagectomy with formation of cervical esophagogastric-anastomosis (EGA) because of cancer of the cervical part of esophagus during the period from June, 2000 to December, 2008. The distribution of the patients according to the sex was 98 (46.2%) males and 114 (53.8%) females. The age of patients fluctuated from 24 to 77 years (mean age 49 years). Distribution according to the age was as follows: from 18 to 44 years – 27 (12.7%) patients from 45 to 64 years – 134 (63.2%), from 65 to 77 years – 51 (24.1%) patients. Distribution in relation to stages of the disease are: stage II – 16 (7.5%), stage III – 196 (92.5%). The tumor localized in the upper part in 33 (15.5%), in the middle thoracic – in 101 (47.6%) and in the lower thoracic part of esophagus – in 78 (36.8%). The squamous cell cancer was diagnosed in 178 (83.9%) patients, adenocarcinoma – in 34 (16.1%).

The choice of operation type was made in dependence on localization of the tumor process in the esophagus. In cases of tumor localization in the upper thoracic part of esophagus there were performed transthoracic esophagectomy, abdominomediastinal lymph nodaldissection, formation of cervical EGA (approach: upper middle laparotomy, right side thoracotomy and cervicotony on the left side) – operation by McKeown. In cases of tumor localization in the middle thoracic and lower thoracic parts of esophagus there were performed transthiatal-esophagectomy (THe), abdominomediastinal lymphatic dissection, formation of cervical EGA (approach: upper medial laparotomy and cervicotony on the left side). The operation of McKeown was performed in 33 (15.6%) patients, transthiatal esophagectomy – in 179 (84.4%).

The detailed description of the technique (manually sutured anastomosis) of the formation of cervical esophagogastronanastomosis “end-to-side”. Our new technique of the formation of cervical esophagogastronanastomosis “end-to-side” in subtotal esophagus resection included preparation of the esophageal stump and transplant is differed by the following peculiarities: there are formed the stomachc stump of width 4.5 cm in the area of the application of esophagogastronanastomosis and 3.5 cm in the other parts (intrathoracic part); the stomach transplant is pulled out through the incision in the neck from the bed of the removed esophagus; the wide esophagogastronanastomosis “end-to-side” (the end of the esophagus into the side of the stomach transplant) between the end of esophagus and the hole along the marginal suture of the gastric transplant 3.0-3.5 cm lower from its end. Firstly, the posterior esophageal wall is sutured to the posterior stomach wall with two lateral interrupted sutures on the both sides in distance 0.75 and 1.5 cm from the suture of the transplant stump, and between them there was used one ‘P’-shaped suture. The wall of the gastrotransplantat is opened ovaly along the line of mechanical suture accordingly to the esophagus diameter.

The ring of the anastomosis is formed with single interrupted sutures through all the layers, the second row of 3-4 sutures is applied by type of “sliding” sutures beginning and ending on the stomach wall in distance 1.5 cm from the line of internal suture, and esophagus is intussuscepted into the stomach transplant. On the upper end of the left gastric tube there is placed purse-string serous-muscular suture in distance 0.2cm from the top, then in the center of purse-string suture the stomach wall is dissected and into the hole of transplant the two-lumen tube is introduced (for decompression of the transplant opening and early enteral nutrition), the purse-string suture is tightly tied and fixed to the tube. Then two semi-purse-string sutures in distance 1-1.5 cm from early applied purse-string suture are applied, the threads of semi-purse-string sutures are tied and at the same time the tube with the stomach wall are immersed deeply in order to form cylinder from serous-muscular and mucosal layer, directed to the opening of the stomach. Then the stomach wall is stitched to the subcutaneous fatty tissue with ends of the previously made semi-purse-string sutures.

In all the cases the esophageal plasty was performed by formation of isoperistaltic tube from the great curvature of the stomach by passing of the transplant through the bed of the esophagus removed to the neck (posterior mediastinal way). The cervical EGA was made manually. The patients were divided into 2 groups in relation to the type of cervical EGA formation. The groups were similar in relation to age, sex, preoperative status, localization and tumor stage.

Group 1 included 55 (25.9%) patients during the period from 2000 to 2003, who underwent formations of cervical EGA of type “end-to-end” after esophagectomy. During operation the 2-lumen nasogastronenteral probe
Antireflux operation for esophageal cancer was placed for decompression of the transplant lumen and artificial feeding.

Group II consisted of 157 (74.1%) patients who received developed cervical EGA “end-to-side” after esophagectomy since 2004. The purpose of the development of this anastomosis was to reduce the frequency of suture failures, gastro-esophageal-pharyngeal reflux in different time after operation, frequency of cicatricial stricture of esophageal-gastric anastomosis occurrence. The technique of its performance included the formation of EGA “end-to-side” along the stapled suture of the gastric tube 5 cm under oral end with plunging of the zone of esophagogastric suture into the lumen of the formed gastric tube and microgastrostomy in the oral end of transplant (Fig. 1). The two-lumen gastroenteral probe was placed through microgastrostomy hole for decompression of the transplant lumen and probe feeding.

All the patients received feeding through feeding canal of the probe on the second day after operation. The volume and quality of administered watery meal increased gradually in relation to restoration of the function of the gastrointestinal tract.

The functional state of the cervical EGA was studied with the use of roentgenological and endoscopic investigations.

The roentgenological investigations were performed...
in regimen of videoroentgenoscopy beginning 10 days after operation. After oral use of 10-20 ml of water-soluble contrast substance (thriombrast, verografin), in the vertical position there was assessed act of swallowing, anastomosis function, contrast agent evacuation through anastomosis and transplant, contrast agent passage on the upper part of intestinal tract. In case of absence of roentgenological features of anastomosis suture failures the peroral feeding began. The 2-lumen probe removed one day after control contrasting and absence of the signs of suture failures the oral feeding began (nasogastroenteral in patients from group 1, gastroenteral in patients from group II). In cases of presence of roentgenological signs of suture failures the probe feeding continued. Videoroentgenoscopy with EGA contrasting performed in vertical and horizontal position, evaluation of valvular function of anastomosis performed by retrograde moving of the contrast agent at the moment of cough reflex in 1, 3, 6, 12, and 24 months after operation.

Videendoscopic investigation of the cervical EGA performed in 1, 3, 6, 12, and 24 months after operation. The endoscopic bougienage was made in presence of the signs of stricture.

For the comparisons of the type of complications between Group I and II, the chi-squared test was performed. Statistical tests were two-sided and the level of significance was set at $P \leq 0.05$.

### Results

Out of the 212 operations performed in the early postoperative period the lethal outcome was in 14 (6.6%) patients (cardiac – 7, pulmonary – 5, septic – 2); of them after operation by McKeown – 2, after transhiatal esophagectomy – in 12. The cause of lethal outcome was not connected with technique and complications of EGA. The analysis of surgical treatment of 198 patients after esophagectomy revealed the following complications:

<table>
<thead>
<tr>
<th>N</th>
<th>Type of complications</th>
<th>EGA “end-to-end”</th>
<th>EGA “end-to-side”</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EGA suture failures</td>
<td>12 (23.5%)</td>
<td>9 (6.1%)</td>
<td>0.0005</td>
</tr>
<tr>
<td>2</td>
<td>EGA stricture</td>
<td>17 (33.3%)</td>
<td>7 (4.4%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>3</td>
<td>Reflux-esophagitis</td>
<td>37 (72.5%)</td>
<td>5 (3.4%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>4</td>
<td>Aspiration bronchitis</td>
<td>11 (21.6%)</td>
<td>1 (0.7%)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>5</td>
<td>Aspiration pneumonia</td>
<td>5 (9.8%)</td>
<td>1 (0.7%)</td>
<td>0.0011</td>
</tr>
</tbody>
</table>

The reflux-esophagitis of light degree occurred in the early postoperative period in 5 (3.4%) patients of group II. Short-term drug therapy and strong performance of the regime of feeding resulted in stopping of reflux symptoms because the made EGA valvular mechanism prevented leakage of acid contents into the pharynx.

The analysis of contrasting of the patients of groups I and II in the vertical and horizontal position showed that during artificial cough reflex in the patients of group I the contrast substance leak into pharynx without obstacles, and in the patients of group II the contrast substance leak into artificial small gas bubble of the transplant (Fig. 2), that provided closure of the valve interfering reflux. The scheme of the work of two different anastomoses is shown on the Fig. 3.
The surgical method at present time remains to be the main in the treatment of the esophageal cancer. The further improvement of the methods and techniques of the operative interventions is one of the major ways of increase in life time and improvement of life quality of the patients.

Today EGA after esophagectomy due to cancer of the thoracic part of the esophagus has been made as in pleural cavity (intrapleural EGA) and on the neck (cervical EGA).

Many authors believe that the advantages of the cervical EGA in the surgical treatment of the esophageal cancer included the possibility of control of the anastomosis state on the neck, absence of severe complications in anastomosis suture failures, possibility of surgery in localization of the process in the upper third of the thoracic part of esophagus (operation of McKeown).

The main disadvantages of the traditional cervical esophagogastric anastomosis “end-to-end” handsewn or stapled appeared to be the great percent of suture failure (by different data fluctuated from 6 to 41%, mean 15-20%)\(^3,12,13\). D.Singh and coauthors\(^11\) showed higher frequency of cervical anastomosis failure. According their data the frequency of failure in handsewn suture formation may achieve 58.0%.

According to the studies of the majority authors the stricture of the proximal anastomosis after esophageoplasty with gastric tube develop in 20.0-75.0% of patients\(^2,4,6,9\), and more seldom show stenosis frequency in limits 4.0-13.0%\(^1,7,8\). According to the data of S.Schettini and J.Pinus\(^10\) the frequency of stenosis of the cervical anastomosis after esophagectomy with gastric tube was, on the average, 33.0%. P.Hankoop and coauthors\(^5\) diagnosed stricture of the esophageal-gastric anastomosis after transhiatal esophagectomy in 114 (42.4%) out from 269 patients.
The leading functional complication of the cervical EGA at the long-term postoperative period (“end-to-end” or “end-to-side”) is gastric-esophageal-pharyngeal reflux, registered in 58.8% of patients and leading to inflammatory-atrophic changes in the esophageal and pharyngeal mucosa (38%), aspiration bronchitis (22.2%) and pneumonia (13.9%).

The use of our developed method of cervical EGA formation after esophagectomy due to thoracic part of esophagus cancer allowed reduction of the number of suture failures from 23.5% to 6.1%, EGA stricture from 33.3% to 4.4%, reflux-esophagitis from 72.5% to 3.4%, aspiration complications from 21.6% to 1%.

Thus, the complex analysis of the results of the use of our developed cervical EGA after esophagectomy due to cancer of the thoracic part of esophagus showed the following advantages:

- technique simplicity of the anastomosis formation;
- oblique crossing of the esophagus allows formation of rather wide anastomosis, that prevents stenosis formation;
- anastomosis formation along the line of handsewn suture of the gastric tube does not result in additional blood supplying disorders;
- plugging of the terminal part of the esophageal stump into the lumen of gastric tube strengthens zone of anastomosis, makes antireflux valve by type “ink-pot-unspilled”;
- fixation of the retained stump of the gastric stump above anastomosis at the expense of gas bubble makes additional antireflux mechanism;
- gastrostoma formation on the neck by type “ink-pot-unspilled” prevents leakage of the stomach contents outside, that allows to preserve gastrostoma for unlimited time. After removal of the probe the gastrostoma hole is closed quickly and independently;
- presence of gastrostoma with enteral 2-lumen probe round the anastomosis allows to be in test for a long time, to provide decompression of the stomach transplant that promotes prophylaxis of the incompetence;
- presence of gastroenteral 2-lumen probe allows beginning of the early enteral probe feeding and to perform it for a long time, that gives significant advantages related to functional and cost efficacy value;
- absence pf nasogastral probe in the postoperative period provides prevention of broncho-pulmonary complications;
- in occurrence of cicatrical sticture of the esophago-gastroanastomosis it easily eradicated by bougienage, and if necessary by endoscopic dissection.

Conclusions

The formation of the cervical EGA according to the developed technique allowed avoidance of the severe complications of the anastomosis suture incompetence, achieving to the minimum of the stenosis frequency, avoidance of the marked gastro-esophageal reflux at the long-term postoperative period. The placement of gastrostoma on the oral end of the transplant provided beginning early enteral feeding, avoidance oral feeding for long time; the method of stoma placement prevents leakage of the stomach contents outside the tube and skin maceration, need not stoma closure with special methods.

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References