Esophageal replacements in children

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Replacement of the esophagus in children can be used in case of malformations, injuries or acquired conditions. The new esophagus should allow normal oral feeding, with little or no gastroesophageal reflux, and be able to function for the lifetime of the patient. Since a century, many substitutes have been used such as segments of colon, the entire stomach, gastric tubes or parts of the small bowel, but no one is perfect and operates as a normal esophagus. Esophageal replacements are demanding challenges for the pediatric surgeons. We shall review the different techniques and the pitfalls related to these procedures based on our experience of more than 300 esophageal replacements in children performed since 1989.

A. Introduction
In 1907, Cesar ROUX performed in Lausanne, Switzerland, the first total Esophageal Replacement (ER) on a 12-year-old child suffering from caustic stenosis. It was a preternal jejuno-plasty, so called «esophago-jejuno-gastro-stomorie, a new procedure for untreatable esophageal stenosis»1. In 1911, his successor Henri Vulliet, was the first to use the colon. Since then many surgical procedures were used to replace an injured or abnormal esophagus. From 1966 to 1989, Noël Genton did 46 ERs in children and that was the largest series at that time1 8.

B. Indications for Esophageal Replacements
From 1989 to 2014, we have performed 285 ERs in children aged 9 months – 18 years (mean 5.9), mostly for caustic burns (95%). Both in low or high-income countries ingestion of corrosive substances, alkalis (90%) or acids (10%), is the most common cause of esophageal replacement. The majority of ingestions occurs in children younger than 5 years and could be prevented3 4. Ingestions in adolescents, mainly in girls, are usually intentional with larger volumes swallowed. In addition, there might be an unknown number of cases of child abuse. The true prevalence of these injuries is unknown. According to the report on pediatric trauma done by the WHO and the UNICEF more than 120 000 children under 6 years of age suffered caustic injuries in the USA in 20046. Other indications are less common and summarized in Table 1. We never performed an ER for a peptic stricture or for an Esophageal Atresia (EA) in children born in our institution. Peptic strictures are released with dilations following antireflux procedures. The definition of «long gap esophageal atresia» (LGEA) as the «inability to achieve primary end-to-end anastomosis», is surgeon dependant. Most anastomosis of LGEA can be done as delayed procedures, waiting for several months with a gastrostomy, as long as no cervicostomy has been done impeding from spontaneous lengthening. The management of LGEA continues to be debated but the delayed anastomosis is possible with equivalent significant morbidity and the long-term outcomes are more favorable compared to replacements.

C. Pathogenesis
Most acids produce a coagulation necrosis by denaturing proteins, inducing a coating coagulum that protects the underlayers from deeper penetration. Bases induce more severe injuries known as liquefaction necrosis, i.e. the detachment of proteins together with a saponification of fats, which penetrate deep through the esophageal wall and can perforate. The severity of the damages is related to several factors, including the physical form, the pH, the concentration and the volume of the agent. The physical form of the agent plays a significant role: the ingestion of solid pellets which adhere to the mucosa results in prolonged local contact time with the esophagus, thus deeper localized burns, while liquids generate superficial but more extensive lesions. The contact time is of little interest as a lesion occurs within a few seconds.

Due to stagnation, lesions are more frequent and more serious at the level of anatomic narrowings of the esophagus (superior esophageal sphincter, aortic arch and left main bronchus, cardia). The long-term effect of caustic burn is a hypertrophic scarring process, which can result in stricture formation. In addition, with the disappearance of the mucosa, the facing surfaces adhere to each other, worsening the stenosis or occluding the lumen. Mucosal reepithelialization is a slow process, usually not complete before 4 to 6 weeks. Not until a complete reepithelialization, the inflammation continues and granulation tissue comes to maturity. Thus a stricture formation is detectable after 2 weeks, and is definite by the 4th week. This is the best time to start dilatations.

If the muscular layers of the esophagus have been destroyed they will not regenerate and be replaced by fibrous tissue. Even if the lumen has been kept open, the contraction waves will never overpass that point. The caustic burn induces a shortening of esophagus and a motility disorder resulting in reflux and poor esophageal clearance, which adds a peptic stenosis to a caustic one evidenced by histology. For this reason, all our patients under treatment with dilatations receive Proton Pump Inhibitors (PPI) as early as possible6 8.

D. Initial Treatment and Preoperative Preparation
The rate of stricture formation after caustic ingestion reported in literature varies from to 2% to 63%. About a month after ingestion, the diagnosis of
stenosis can be assessed by an esophagogram and an endoscopy, once the edema has gone.

Isolated short stenosis, i.e. 1 to 2 cm, can be treated by dilatations with good results. Long ones (more than 3 cm), multiple stenosis (more than 2), or those with a tracheo-esophageal fistula cannot be solved by dilatations and require ER[10]. However, the decision should not be precipitated as spontaneous improvement can occur within a few months until the lesions are stabilized. We have seen children with long narrow stenosis at 6 months eligible for ER, who have been «forgotten» in their native countries. When they «reappeared» a year later, they only required dilatations of short narrow strictures. A strong predictor of poor outcome is the delay from ingestion to beginning of dilatations[8]. Without improvement after 12 months of repeated dilatations, we consider performing an ER[10].

It is tempting to consider resection and primary anastomosis for short stenosis. Many authors have tried — including ourselves — with poor results. A caustic lesion is not limited to the stenosis and is surrounded above and below by poorly vascularized injured tissues. Performing an anastomosis bears a high risk of recurrence of the stenosis even done without tension for two reasons: i) the suture is performed on a poorly vascularized esophagus; ii) there are no tensionless anastomosis in these cases. Due to the peri-esophagitis, the mobilization of the esophagus impairs the poor remaining vascularization. Should the resection aimed to be radical, the extent of the defect would lead to a replacement. ERs are major surgeries that require the child to be in a good nutritional condition. Dysphagia leads to slow and insidious progression of weight loss and malnutrition. If dysphagia lasts for more than a month, a gastrostomy should be done. Most patients referred to us were in poor nutritional conditions even with a previously done gastrostomy and must be placed under refeeding program before surgery. The way the gastrostomy has been done on the anterior stomach-wall is a major concern for the surgeon. When intending to replace an esophagus, the surgeon never knows which transplant he can use: if the gastrostomy has been placed too close from the greater curvature, he may face an interruption of the gastropliopic artery and the vascularization of the stomach can be compromised. When performing a gastrostomy for caustic stenosis, it is wise to place it far away from the great curvature. In some cases, we used an interesting artifice suggested in 1974 by Papahagi: when performing the gastrostomy we ligated the middle colonic artery and sometimes the right one to stimulate the development of the left one, anticipating a possible transverse isoperistaltic colonic replacement.

A preoperative evaluation of oropharynx and larynx has to be done preoperatively as associated lesions are not unusual: 15% in our experience[8]. It should include vocal cord movements before surgery in the neck as paralysis can occur at the time of the injury. We recommend the use of the consensual classification of benign laryngotracheal stenosis done by the European Laryngological Society[16]. The length of the intact proximal esophagus above the first stenosis should be carefully measured as an indicator of swallowing problems. We have abandoned preoperative mechanical preparation (enemas)[15]. The day before surgery, a preparation of polyethylene glycol is given orally or through the gastrostomy, independently of the planned procedure, as we never know which transplant will be used.

E. Surgical Procedures

1. Where should the esophageal substitute be placed?

The historic route was preternal as the thorax could not be open at that time (Figure 1a). Then the transplants were placed in the retrosternal position and the native esophagus was removed during a second procedure (Figure 1b). We introduced the one-stage procedure in 1989, placing the transplant in the orthotopic position i.e. in the posterior mediastinum (Figure 1c)[10]. This position is straighter and shorter than in the retrosternal route, but requires removal of the native esophagus. It avoids the two kinks at the upper thoracic inlet and at the re-entry into the abdomen[7, 13, 14]. However, in some circumstances the retrosternal route had to be used when it appears impossible to dissect safely the esophagus or a previous transplant from the mediastinum. It is easy to pass behind the sternum in a space with few adhesions. But with time, any transplant placed in this space will widen, especially if there is a narrowing at the distal end where it reintegration the abdomen. Colonic transplants placed retrosternally have a strong tendency to become redundant and we have had to tailor some of them. This is more frequent in colonic transplants than in gastric tubes.

2. Should we remove the native esophagus and how?

There are two reasons to remove the native esophagus before an ER: (i) to place the transplant in the orthotopic position; (ii) because of the oncologic risk induced by the burned esophagus. The prevalence of malignancies, mostly carcinoma, is unknown but has been shown in several reports to range from 1.8% to 16%. They were believed related to the abrasion by food on the burned esophagus. Subsequently it was said that a disconnected burn esophagus did not bear that risk. However, cases have been reported of carcinoma appearing on disconnected unused native esophagus after replacements[10]. For this reason we remove if possible a burned esophagus before replacement. However, a demucosed short segment of an abandoned disconnected esophagus is an acceptable risk.

In 1978, Oringer described a blind esophagectomy without thoracotomy. Since 1989 we introduced the one-stage orthotopic ER following a closed-chest esophagectomy[3, 11]. The esophagus was removed through a left cervical incision after transthiatal dissection by laparotomy. A blind dissection by digiota- lsy was performed in the middle part of the esophagus where adhesions are the most severe and can lead to serious life threatening injuries[11]. The greater danger is at the level of the aortic arch and left bronchus which is the farthest point from incisions. Even after the experience in more than 200 cases we considered this step as the most dangerous part of the procedure, showing 18% of various complications. It allowed the esophagus to be totally removed in 45% of cases and partially in 40%[10, 16]. For this reason we tried to achieve esophagectomy under visual control without opening the thorax. Some cases of esophageal dissection using thoracoscopy or a combination of thoracoscopy and laparoscopy have been reported. The problem is that thoracoscopy gives a lateral view of the esophagus that is hidden in the scarring process. It is safer to start the dissection from below by a transthiatal approach and to follow the intact esophagus up into the adhe- sions. Since 2006, we use a standardized procedure through a laparoscopic transthiatal approach[17, 18]. Through this approach, the anatomical structures that run the greatest danger of being damaged during dissection are freed from the esophagus under view control. The dissection can be pursued as far as possible, usually just below the clavicle. Using this technique in more than 40 cases, no vascular or bronchial wound occurred and the rate of total removal of the esophagus raised up to 83% without complication (Table 2)[18]. Moreover, it appeared that the delay to extubation and the length of stay in the PICU was shorter after laparoscopic transthiatal esophagectomy[17, 18]. A pre-existent or per-operative tracheoesophageal fistula must be identified and occluded. The healing of such a suture requires coverage with a well-vascularized tissue. For this purpose several flaps are used, such as pericar- dial flap, muscular flap taken from the intercostal muscles or a flap from the latissimus dorsi in the most severe cases. In some cases we left a part of the native esophagus after the removal of its mucosa and used it as a tracheal or bronchial coverage with success.

3. Which transplant?

The esophagus can be replaced by a segment of colon, the stomach, a gast- rictube or a part of the small bowel. However none is perfect and can operate as a normal esophagus.

A meta-analysis on 15 studies has compared 3 techniques of replacements for LGEA: jejunal or colon interposition and gastric pull-up[10]. Gastric pull-ups and colons appeared comparable regarding postoperative mortality, anasto- motic complications, and graft loss. On long-term follow-up, gastric pull-ups seems to be associated with a higher respiratory morbidity but fewer gastroin- testinal complications than colons. They were only 2 studies with jejunum and none with gastric tubes[10]. Another extensive comparison of recent literature on the four main types of ER is available[20].

We are frequently asked which is our favorite transplant. We cannot answer this question as we must adapt the technique to the patient’s condition and so, be aware of different techniques (Table 3).
a. Colonic transplants

The colon is the most frequently used for ER. It offers the advantage of a segment of bowel with several possible vascular supplies that is long enough to be mobilized. The length can be adjusted to the requirement and the diameter is appropriate.

The best transplant is taken on the transverse colon, vascularized by the left colonic artery and placed isoperistaltically (Figure 2). An efficient left colonic artery is missing in about 10% patients and the transverse arcade can be absent. Before ligating the vessels we check the quality of the chosen arterial supply by clamping the unused arteries withatraumatic vascular clamps. The superficial arteries must remain pulsating, especially at the farthest end from vascular supply. We use conventional ligatures and never coagulate to prevent from vascular spasms. Once freed, the transplant is cleaned and preserved in warm cloths avoiding any tension on the vessels.

The colonic transplant has no efficient propulsive contraction and empties by gravity. However, in 1971, Jones first demonstrated on animals27 and since then in humans28, that an acid reflux in the transplant induces a contraction that protects the colonic mucosa against acid aggression. For this reason we believe that colonic transplants should be placed in an isoperistaltic position to benefit from this self-protection.

If the right colon is used, it can be placed isoperistaltically using a vascular supply from the middle colonic artery or antiperistaltically on the ileocolic artery. As the right colon is shorter than the transverse, the distal ileum is used with sacrifice of the valve to gain extra length.

To bring the transplant to the neck, we place the proximal end of the transplant inside a large (40mm) Penrose drain and sutured to it. This avoids friction to its proximal edge when pulling it up. We handle the colon to find the best position for an optimal arterial pulse and venous return. Should compression or kinking occur on the drainage vein, the transplant could have a venous engorgement that may induce an ischemia with subsequent leak or stenosis.

Proximally, we always perform end to end anastomosis, using a single layer full thickness interrupted resorbable sutures, with a V-shape incision of the proximal esophagus to make the colon width fit to its diameter if needed.

The colocolonic anastomosis is performed on the anterior wall of the stomach by the upper third of the small curvature using two layers of resorbable sutures. A decompression tube is placed into the transplant though the gastrostomy, to close the esogastric junction and a pyloroplasty. The esophagus is sutured to the fundus using a single layer of full thickness interrupted resorbable sutures. This gives the longest possible «conduit»25. The vagus nerves are divided bilaterally during the gastric pull-up, so most authors recommend a Mikulicz pyloroplasty. A feeding jejunostomy should be done for the postoperative period29.

Hirschi found no deaths in 41 patients operated upon between 1985 and 2002, but a high incidence of leaks (36%) and strictures (49%) was noted26. In his series of 192 gastric pull-ups over a 25 years period, Spitz reported no transplant failure but 5.2% deaths. Mortality is not unusual and includes cervical fistula (12%), anastomotic strictures (19.6%), swallowing dysfunctions (30.6%), delayed gastric emptying (8.7%)27. In his most recent review Spitz reported on 236 gastric transpositions with a mortality rate of 2.5%, leak rate of 12%, and stricture of 20%/29.

For the sake of comparison, from 1989 to 2014 we performed >280 ER using either colons or gastric tubes but no gastric pull-up: no deaths were observed and no transplant lost. The complications are reported in Table 4.

Acid and/or biliary reflux is a problem encountered by ~30% of patients with gastric transplants even without pyloroplasty. The prevalence of reflux esophagitis in the upper native esophagus when the stomach is used as a substitute ranges from 30% to 78%. It should be pointed out that the gastric conduit is aperistaltic and surgically denervated even if studies have shown mass contractions of the body of the stomach without any obvious rhythmic peristaltic contraction26.

Another major problem is related to the volume of the stomach in the chest of small children that compromises the lung function and the heart venous return. We were involved in undoing 12 gastric pull-ups for life threatening events and possibly some of the reported deaths were related to that. Newman reports that several patients undergoing gastric pull-up in the 1960s, required colon transposition in the 1980s because of lung problems associated with chronic acid reflux, aspiration pneumonia and compression by the dilated intrathoracic stomach29,30.

Parrel described a modification of the gastric pull-up (TEGPUL), performed by transhiatal laparoscopy, without pyloroplasty or pyloromyotomy, bringing the transplant through the distal esophagus. It has been successfully done on 10 children for esophageal atresia and seems promising, but studies with a larger number of patients and longer follow-up are needed27.

b. Gastric tubes

The concept of gastric tubes comes from the experiments on gastrosomisties undertaken during the second half of the XXth century. The first description of a gastric tube was by Dan Gavriliu from Romania in 1952. Gavriliu built two different tubes one being reversed and the other was isoperistaltic. Both required a splenectomy at that time. Today most gastric tubes are reversed, built out of the greater curvature with blood supply from the left gastroepiploic artery without splenectomy (Figure 4). The free edge of the tube should be taken at about 3 cm from the pylorus. The gastric curvature is molded around a 24-Fr tube, using 2 to 3 shots of a 75 mm-long GIA stapler. It is brought to the neck in the same manner as for a colonic transplant. Care must be taken to the hinge between the tube and the stomach and some reinforcement stitches can be useful. The upper anastomosis is done the same way as for the colon. A gastrostomy is performed on the anterior wall of the stomach with a decompression tube into the transplant, a gastrostomy tube and a jejunal feeding tube through it.

The gastric tube is an excellent substitute to the esophagus with a reliable blood supply. We never encounter a leak along the suture line as described. A major problem is related to the position of a previously done gastrostomy along the great curvature, interrupting the gastroepiploic artery. We had to perform several redo ERs for severe stenosis of the upper part of gastric tubes because the surgeons had closed such gastrostomies along the curvature to build their tubes.

Because a part of the stomach is used, an anti-reflux wrap is not possible. Thus the gastric tube has the disadvantage of an associated gastrosophageal reflux. The long suture carries the risk of progressive dysfunctional propulsion. It appears to act purely as a passive conduit. The volume of the stomach, reduced at the beginning, grows with time. The gastric tube keeps its tubular shape without developing dilatation as the colon does.

c. Gastric pull-ups

The gastric pull-up became predominant after the works of Sweet (1948) in adults patients with esophageal cancer and Spitz in children for EA (1984)24. The gastric pull-up involves mobilization of the entire stomach, creating a space in the mediastinum and achieving one anastomosis in the neck with the cervical esophagus. However, they are three additional sutures to close the gastrostomy, to close the esogastroic junction and a pyloroplasty. The esophagus is sutured to the fundus using a single layer of full thickness interrupted sutures. This gives the longest possible «conduit»25. The vagus nerves are divided bilaterally during the gastric pull-up, so most authors recommend a Mikulicz pyloroplasty. A feeding jejunostomy should be done for the postoperative period29.

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e. Small bowel interpositions

Several techniques use either jejunum or ileum. The vessels of the jejunum are in short arcades with no long unique artery. To lengthen the pedicle, a segment of jejunum distal to the transplant is withdrawn. Then the transplant is brought to the upper esophagus and sutured. In most studies jejunal transplants are anastomosed directly to the stomach.

According to its vascular disposition the jejunal transplant requires the withdrawal of a greater length than needed, to divide the vascular arcades and to allow curves in the jejunum to be straightened (Figure 5). Furthermore, the jejunum is fragile to the erosion of acid, so the jejunum should not be the first choice. However, we have used the jejunum as a rescue transplant for referred patients after failure of colonic or gastric transplant.

f. Free Grafts and Patches

In some circumstances it can be interesting not to replace the whole esophagus and to widen a stenotic segment for instance after ischemia of a segment of transplant. A free graft of jejunum (or of ileum or colon) can be used in the neck or the upper thorax with micro vascular anastomosis on the facial or thyroid arteries. It can be used as a circular interposed graft or as a diamond shape patch after longitudinal opening of the stricture. We used successfully 4 free jejunal grafts with micro-anastomosis, measuring from 2 to 4 cm, for short stenosis of the cervical esophagus or after recurrent stricture of the proximal anastomosis of transplants.

5. Pharyngeal associated burns

Burns from ingestion of caustic agents may include the oral, pharynx and larynx as well. Combined lesions of the esophagus and the pharynx represent a challenging problem. In our series, 25 children had associated pharyngeal burns with partial or total destruction of the epiglottis, pharyngolaryngeal stenosis and/or obstruction of piriform sinuses with variable severity including total closure of the airways in 4 cases. However, they all had intact vocal cords. The closure reflex of laryngeal vestibule during caustic ingestion protects the larynx. For those unusual very difficult cases we proceed in a one-stage reconstruction of the larynx and of the esophagus. At the beginning of the procedure, the ENT surgeons (Prof Ph. Monnier, Prof Ph. Pasche) ressect totally the pharyngo epiglottic stenosis and the scarring bands with CO2 laser under suspension micropharyngoscopy. This allows the resection of the two pyriform sinuses with excellent hemostasis and locates exactly the place where the transplant should be brought.

Then a one-stage esophagoplasty is done using isoperistaltic colonic interposition or gastric tube. After an endoscopic pharyngoplasty, the proximal anastomosis is done at the level of the arytenoid cartilages on the larynx and somewhat higher in the oro-pharynx posteriorly. Thus, the proximal end of the transplant is 3-5 mm from the vocal cords. A long stay in the Pediatric Intensive Care Unit (PICU) is needed after surgery because of possible pharyngeal and pulmonary complications, in spite of tracheostomies. All but one child were able to recover normal swallowing within 2 to 6 months. Then they did not present with aspiration during daytime once the tracheostomy was closed. It took 3-12 months until they stopped coughing at night. During this period pulmonary aspirations were frequent with several pneumonias (1 to 5 per child). With a follow-up ranging from 1 to 10.6 years all children are healthy, eating and breathing normally.

We believe that very proximal pharyngeal anastomosis of ERs can be attempted as long as children have no impairment of vocal cord mobility by glottic scars or lesion to the laryngeal recurrent nerve. However, the rehabilitation is very long until they learn how to occlude their larynx and swallow with their vocal cords. Regardless to the used transplant there is an important difference in all aspects of the postoperative courses in those where the proximal anastomosis is done a few centimeters below the upper esophageal sphincter or if it has been destroyed.

F. Postoperative period, Complications and Follow-up

1. Postoperative period

We place two low-pressure suction tubes into the transplants to avoid their postoperative distension as deflating the transplants improves venous return. The children cannot eat postoperatively, sometimes for an extended period. To avoid parenteral nutrition, a trans-pyloric jejunal tube is placed through the gastrostomy to feed the child promptly. The stomach is deflated using the gastrostomy to avoid anastomosis leakage et reflux along the tubes into the transplant. To maintain a mean arterial pressure as high as possible, thereby avoiding a poor perfusion in the transplant, we ask the intensivists to administer adequate fluids and sometimes amines during the first 24 h.

An esophagogram is performed per os between D7 and D14 related to the difficulty of the procedure. Without leak, the child is allowed to eat soft food. Should a leak occur, the tube is left in place under soft suction for another week. All cervical leaks closed spontaneously without reoperation, but sometimes with secondary stenosis.

2. Complications

The most frequent short and long-term complications are stenosis and leaks of the proximal anastomosis (Table 4). We believe leaks of the farthest end of the transplant seem to be related to venous stasis rather than poor arterial supply, as evidenced by the fact that a straighter transplant would give better results with less leak and stenosis than a tortuous one. The same explanation can be ascribed to stenosis of the proximal anastomosis. We noticed that all patients with a leak of the proximal anastomosis required dilatations. Four children developed cervical delayed stenosis (3 months, 3 and 5 years after surgery) even though the radiological, endoscopic and surgical aspects were normal and they were already eating. This raises the question how long these children should be kept under observation. Other complications are summarized in Table 4.

3. Long-term Follow-up

We have a long-term follow-up for 69% patients (mean 8.6 years). All patients are eating normally, with no failure to thrive and no growth retardation. Most children or parents have no complaint. Those who are now adult lead a normal life. Nevertheless, many children experience noisy breathing, coughing reflexes and have acquired strange eating habits as for instance drinking between each bite.

With the improvement of life expectancy after replacements cancer may occur in the transplants. Primary cancer has been described from colonic transplants, and from gastric pull-ups at a mean age of 69 years. To date, very few cases have been reported. But the question raised is whether we should perform endoscopies in esophageal substitutes and since what age.

G. Conclusions

The «ideal» ER conduit for children should (a) be long-lasting, (b) be associated with minimal reflux, (c) be technically feasible, (d) not affect cardiac or pulmonary function, and (e) allow oral consumption of nutrition. With a personal experience of more than 285 ERs during 24 years I still don’t know which is the best procedure. We believe that a successfully replaced esophagus does not behave as a normal one. The best esophagus for a child is his own one. Everything has to be done to preserve it and ER should be last resort.
The SALTC organizes a unique 3-week course in laparoscopic colorectal surgery. The selected fellow rotates in 3 Swiss hospitals, where he shadows a specialist colorectal surgeon. The SALTC and the participating centers guarantee that the fellow will scrub in 2-3 colectomies per center: he assists the first one, and operates under assistance the next 2.

This year, the SALTC will offer 2 Masterclasses, which will take place at the following hospitals during October-December 2018:

- Baden  Dr. med. A. Keerl
- Frauenfeld  Prof. Dr. med. M. Müller
- Genève - HUG  PD Dr. med. F. Ris
- Lausanne - CHUV  Prof. Dr. med. D. Hahnloser
- Lugano  Prof. Dr. med. D. Christoforidis
- Zürich - Triemli  Dr. med. J. Wydler

Travel and housing expenses are reimbursed by the SALTC for up to CHF 1’500/ fellow. The ideal fellow is in a training program with good perspectives for a career in a Swiss hospital, has a main interest in colorectal surgery, and has already acquired a good level in laparoscopy (assisted at least 10, performed under assistance at least 5 laparoscopic colectomies).

Applications should be submitted to Prof. Dr. D. Christoforidis, Viceprimario Chirurgia, Ospedale Regionale di Lugano, 6900 Lugano, before June 30th, 2018.

For details on how to apply and for any further information, visit www.saltc.ch or contact Prof. Dr. D. Christoforidis, Ospedale Regionale di Lugano, 091 811 69 56, dimitri.christoforidis@eoc.ch.
Table 1: Indications for esophageal replacements (n=285)

<table>
<thead>
<tr>
<th>Acquired</th>
<th>Congenital</th>
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<tbody>
<tr>
<td>273 Caustic stenosis</td>
<td>4 malformations</td>
</tr>
<tr>
<td></td>
<td>2 long congenital stenosis</td>
</tr>
<tr>
<td></td>
<td>1 long esophageal duplication</td>
</tr>
<tr>
<td></td>
<td>1 achalasia</td>
</tr>
<tr>
<td>2 stenosis post radiotherapy</td>
<td>1 giant esophageal leiomyoma</td>
</tr>
<tr>
<td>2 stenosis post viral infection (Herpes)</td>
<td>2 sequellea of epidermolysis bulbosa</td>
</tr>
<tr>
<td>1 stenosis post fungal infection (Candida)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Esophagectomies: Comparison according to the techniques used

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>N</td>
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</tr>
<tr>
<td>Mean Ages</td>
<td>5.9</td>
<td>6.0</td>
</tr>
<tr>
<td>Total esophagectomies</td>
<td>111 45%</td>
<td>34 83%</td>
</tr>
<tr>
<td>Partial esophagectomies</td>
<td>97 40%</td>
<td>5 12%</td>
</tr>
<tr>
<td>Failure</td>
<td>36 15%</td>
<td>2 5%</td>
</tr>
<tr>
<td>Major accidents</td>
<td>44 18%</td>
<td>0 0%</td>
</tr>
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</table>

Table 3: Choice and place of 285 transplants.

<table>
<thead>
<tr>
<th>Transplant</th>
<th>n</th>
<th>Direction</th>
<th>n</th>
<th>Position</th>
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<tr>
<td>Transverse Colon</td>
<td>234</td>
<td>Isoperistaltic</td>
<td>224</td>
<td>Posterior Mediastinum</td>
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<td>Gastric Tube</td>
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<td>Cervico-mediastinal</td>
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Table 4: Complications

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<tr>
<td>Stenosis (upper anastomosis)</td>
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<td>Stasis in transplant</td>
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<td>GER</td>
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<td>Leak-fistula</td>
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<td>Pyloric spasm-delayed gastric emptying</td>
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<td>Occlusion</td>
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<td>Redundant transplant</td>
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<tr>
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<tr>
<td>Severe bronchospasms</td>
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<td>Transplant too long - kinking</td>
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<td>Tracheomalacia</td>
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<td>Death</td>
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</table>
References

3. Danielou T (2012) Histoire de l’oesophagoplastie chez l’enfant, Master under supervision of O. Reinberg, Faculty of Biology and medicine, University of Lausanne, Switzerland, pp 47