Operative Dictations in Pediatric Surgery

Dominic J. Papandria
Gail E. Besner
R. Lawrence Moss
Karen A. Diefenbach
Editors

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ISBN 978-3-030-24211-4 ISBN 978-3-030-24212-1 (eBook)
https://doi.org/10.1007/978-3-030-24212-1

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To Smedley, Kinch, and Chumley – my one love and my two epic sidekicks – you followed where the path led and offered up the best parts of yourselves to add delight to the journey. I am a better man every day despite myself and because of you all.

Dominic J. Papandria

To my mother who instilled in me the desire to become a surgeon-scientist before the term was even invented; to my son, Matthew, and daughter, Nicole, who never fail to amaze me; to my husband, David, who has always supported me; and to the many patients who have entrusted their care to me.

Gail E. Besner

To my greatest teachers: the many children and families for whom I have had the great privilege to care. To the many students and residents who have left me confident that surgery has an exciting future and is in the best of hands. To my wife Kris and my three children Jackson, Krissy, and Ruby who mean more than the world to me.

R. Lawrence Moss

To my parents who gave me the courage to pursue my dream; to my sister, my biggest cheerleader; and to my husband for his love and unfailing support, I would not be here without you.

Karen A. Diefenbach

Preface

In the tradition of the adult text, *Operative Dictations in Pediatric Surgery*, this new volume is designed as a concise guide to the pediatric surgical trainee and practicing surgeon alike. The surgical care of children is inherently multidisciplinary, and we are excited to share this work with our community of surgeons, urologists, gynecologists, head and neck surgeons, and allied health providers. We greatly appreciate the support and enthusiasm on the part of Springer Publishing in coordinating the efforts of our fantastic team of authors to produce this inaugural edition. The book provides summary information across a great variety of surgical and endoscopic procedures, together with template operative dictations to orient learners to the pertinent details and technical variations of the operation. Each chapter also includes procedure-specific indications and risks that are relevant to the consent process.

Our collaborating authors – 81 in all – represent 8 distinct surgical subspecialties and are drawn from 18 institutions throughout North America. We are delighted to offer their collective expertise and perspective to our colleagues and trainees who care for children across the surgical spectrum. In preparing this volume, we have attempted to provide appropriate emphasis on minimally invasive approaches and to portray contemporary practice whenever possible. The result reflects the authors' experiences while still addressing common technical variations to ensure that each chapter is broadly reflective of clinical practice. We do recognize that individual practice is informed by surgeon experience, resource constraints, and other factors, and thus adaptation of the materials included is expected to suit each clinical situation.

As the pediatric surgical community continues to advance the science and technical sophistication of the care of this fragile population, we embrace new challenges and strive to invest in the future of this most rewarding discipline. If we can help to perpetuate the continued success of our peers and the understanding of those who will someday follow in the footsteps, that will be our ultimate satisfaction in this endeavor.

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Rigid and Flexible Esophagoscopy for Foreign Body Removal

1

William B. Rothstein and Laura A. Boomer

Indications and Benefits

- Metallic or radiopaque foreign body confirmed radiographically
- Suspected foreign body by history, or impacted organic material
- Benefits: Direct visualization of the foreign material, confirmation of removal, evaluation of the esophageal mucosa

Risks and Alternatives

- Standard risks (bleeding, infection, need for additional procedures, risks of anesthesia)
- Injury to adjacent structures (teeth, pharynx, esophagus)
- Aspiration
- Perforation or laceration of the pharynx or esophagus
- Alternatives: Long laryngoscope with Magill forceps, fluoroscopically guided balloon, or catheter removal

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Essential Steps

Rigid Esophagoscopy with Foreign Body Removal

1. Place the patient supine with a shoulder roll to facilitate neck extension similar to endotracheal intubation – the "sniffing position." A tooth guard is recommended to avoid dental injury.
2. Select the largest suitable rigid endoscope.
3. Ensure the camera and light source are appropriately set up prior to beginning the procedure, and that all equipment is the appropriate length for the endoscope.
4. Sit or stand at the patient's head.
5. Retract the tongue and protect the teeth with the non-dominant hand, and carefully guard the endotracheal tube, so as to avoid dislodging the tube during the procedure.
6. Insert scope into oral cavity with the lip of the bevel up. Balance it using the thumb and index finger of non-dominant hand as a fulcrum.
7. Under direct visualization, advance scope along posterior pharyngeal wall.
8. Elevate the cricoid with the tip of the scope and advance into the cervical esophagus.
9. Only advance scope when lumen is visualized.
10. Clear secretions with suction while inspecting for foreign body. Inspect for

D. J. Papandria et al. (eds.), *Operative Dictations in Pediatric Surgery*,
https://doi.org/10.1007/978-3-030-24212-1_1

pathology that may be associated with a retained foreign body (esophageal webs, strictures).
11. Use long grasping forceps to remove foreign body. This can be done piecemeal through the lumen of the scope with soft objects. Large solid objects may be grasped tightly to the end of the scope and removed by retracting the scope and grasper together.
12. After removal, reinsert the endoscope to complete the exam by inspecting the lumen at the site of the foreign body to evaluate for damage, and distal to the foreign body to ensure no further obstruction.

Flexible Esophagoscopy with Foreign Body Removal

1. Place patient in the supine position with the neck extended. (Alternatively, the patient may be placed in lateral decubitus position.)
2. Stand at the head of on the right side of the Table.
3. A bite block facilitates easy passage of the scope.
4. Insert an 8–9-mm flexible endoscope over the tongue and advance along the posterior pharynx under direct visualization. In smaller children, a 6-mm pediatric endoscope may be required; however, the working channels of smaller endoscopes will accommodate a smaller range of instruments.
5. Apply gentle insufflation and pressure against the upper esophageal sphincter to advance into cervical esophagus.
6. Clear secretions with suction to adequately visualize the foreign body.
7. Foreign bodies can be grasped with various snares and graspers through the working port of the scope and removed piecemeal or retracted along with the scope.
8. After removal, reinsert the endoscope to complete the exam by inspecting the lumen at the site of the foreign body to evaluate for damage, and distal to the foreign body to ensure no further obstruction.

Table 1.1 Recommended endoscopy sizes

Age	Rigid	Flexible
Premature infant	4	≤6 mm (pediatric gastroscope)
Term infant (0–3 months)	4–5	≤6 mm (pediatric gastroscope)
3–12 months	5–6	≤6 mm (pediatric gastroscope)
1–2 years	6	6–8 mm
2–5 years	6–7	8 mm (adult gastroscope)
5–10 years	7	8 mm (adult gastroscope)
>10 years	8	8 mm (adult gastroscope)

Note These Variations

- The oral cavity can also be navigated by passing the scope along the floor of the mouth, to the right of the tongue, and following the right pyriformis fossa.
- Recommended endoscopy sizes based on patient size listed in Table 1.1.

Template Operative Dictation (Rigid)

Preoperative Diagnosis Esophageal foreign body

Postoperative Diagnosis Esophageal foreign body

Findings
1. Esophageal foreign body at the level of *cricopharyngeus/mid-esophagus/gastroesophageal junction*
2. No evidence of intraluminal injury
3. Normal cervical esophageal anatomy

Procedure(s) Performed Rigid esophagoscopy with foreign body removal

Anesthesia *General endotracheal anesthesia/ Procedural sedation*

Specimen *Coin/foreign object/none*

Estimated Blood Loss None

Indications This is a/an ___*-day/week/month/year*-old *male/female* with a/an ___*-day/hour/week* history of drooling and dysphagia after a choking event. A suspected esophageal foreign body was confirmed radiographically. *He/she* was deemed to be a suitable candidate for rigid esophagoscopy with removal of foreign body.

Procedure in Detail The patient was placed in supine position and appropriately padded after a smooth induction of general anesthesia. A shoulder roll was placed and the neck gently extended. Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. A size ___ rigid endoscope was introduced to the oral cavity and advanced through the upper esophageal sphincter under direct visualization. The foreign body was visualized at the level of the ___. At this point, an optical long grasping forceps was introduced through the lumen of the endoscope and the foreign body was grasped. The foreign body was retracted against the orifice of the endoscope and the endoscope and foreign body were retracted out through the oral cavity. The endoscope was then reinserted past the level of the previous foreign body and slowly withdrawn. The esophageal mucosa appeared intact and undamaged, with no anatomical abnormalities noted. The endoscope was then removed and the procedure terminated.

Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well, was extubated in the operating room, and was transported to the post-anesthesia care unit in stable condition.

Template Operative Dictation (Flexible)

Preoperative Diagnosis Esophageal foreign body

Postoperative Diagnosis Esophageal foreign body

Findings

1. Esophageal foreign body at the level of *cricopharyngeus/mid-esophagus/gastroesophageal junction*
2. No evidence of intraluminal injury
3. Normal cervical esophageal anatomy

Procedure(s) Performed Flexible esophagoscopy with foreign body removal

Anesthesia *General endotracheal anesthesia/Procedural sedation*

Specimen *Coin/foreign object/none*

Estimated Blood Loss None

Indications This is a/an ___*-day/week/month/year*-old *male/female* with a/an ___*-day/hour/week* history of drooling and dysphagia after a choking event. A suspected esophageal foreign body was confirmed radiographically. *He/she* was deemed to be a suitable candidate for flexible esophagoscopy with removal of foreign body.

Procedure in Detail The patient was placed in *supine position/lateral decubitus position* and appropriately padded after a smooth induction of general anesthesia. Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. A bite block was placed in the mouth. A size ___ flexible endoscope was introduced to the oral cavity and advanced through the

upper esophagus, maintaining direct vision of the lumen throughout. The foreign body was visualized at the level of the ___. At this point, a grasping forceps was introduced through the working channel of the endoscope and advanced through until the tip could be visualized. The foreign body was grasped and pulled up against the endoscopy channel. The endoscope and foreign body were retracted out through the oral cavity. The endoscope was then reinserted past the level of the previous foreign body and slowly withdrawn. The esophageal mucosa appeared intact and undamaged, with no anatomical abnormalities noted. The endoscope was then removed and the procedure terminated.

Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well, was extubated in the operating room, and was transported to the post-anesthesia care unit in stable condition.

2 Flexible Esophagoscopy and Fluoroscopically Guided Dilation

William B. Rothstein and Laura A. Boomer

Indications and Benefits

- Symptomatic strictures related to anastomotic strictures (after esophageal atresia repair), caustic ingestion, or other cause
- Benefits: Direct visualization of stricture, confirmation of dilation, evaluation of the esophageal mucosa

Risks and Alternatives

- Standard risks (bleeding, infection, need for additional procedures, risks of anesthesia)
- Injury to adjacent structures (teeth, pharynx, esophagus)
- Aspiration
- Perforation of the pharynx or esophagus
- Alternatives: Enteric feeding tube placement, fluoroscopically guided balloon dilation, esophageal resection

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Essential Steps

Flexible Esophagoscopy with Balloon Dilation of Stricture

1. Place patient in left lateral decubitus or supine position with neck extended.
2. A bite block facilitates easy passage of the scope.
3. Insert a flexible endoscope over the tongue and advance along the posterior pharynx under direct visualization. For sufficiently tight strictures, a bronchoscope may be necessary.
4. Apply gentle insufflation and pressure against the upper esophageal sphincter to advance into cervical esophagus.
5. Advance to the point of stricture. Carefully inspect the mucosa for signs of perforation. If visual findings are inconsistent with pre-procedure diagnosis, consider tissue sample.
6. A wire can be passed through the stricture under fluoroscopic guidance.
7. Pass the balloon dilator through the scope and over the wire.
8. Real-time fluoroscopy may be used to confirm placement of the balloon across the stricture. Balloon should sit with equal portions above and below the point of stricture.
9. Dilation diameter should be selected based on pre-procedure radiographic findings.

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https://doi.org/10.1007/978-3-030-24212-1_2

10. Fill the balloon dilator with water or contrast and maintain for 30 seconds to 1 minute at each chosen dilator diameter.
11. Watch the balloon fill under fluoroscopy to ensure balloon does not slip above or below stricture, as well as directly with the endoscope.
12. Repeat or serial dilations may be necessary depending on the etiology of the stricture.
13. Remove the balloon dilator and again inspect mucosa for bleeding or perforation.
14. It may be possible to traverse the stricture with the flexible endoscope following dilation.

Note These Variations

- Push dilators or bougies may be used in place of a balloon dilator. After passage of a guidewire through the stricture, the bougie is passed over the wire and guided into the stomach by fluoroscopy. Additionally, some bougies do not have the ability to be passed over a wire. These may be inserted directly into the esophagus, but passage should be visualized with fluoroscopy. This method is associated with a greater risk of bleeding and perforation due to the shear stress of the dilator.

Template Operative Dictation

Preoperative Diagnosis Esophageal stricture

Postoperative Diagnosis Esophageal stricture

Findings
1. ___-cm long, circumferential radial stricture in *cervical esophagus/mid-esophagus/distal esophagus*
2. No evidence of esophageal perforation pre- or post-procedure

Procedure(s) Performed
1. Flexible endoscopy with balloon dilation of esophageal stricture
2. Intraoperative fluoroscopy with surgeon interpretation

Anesthesia *General/procedural sedation*

Specimen {Specimen}

Estimated Blood Loss ___ ml

Indications This is a/an ___ *day/week/month/year*-old *male/female* with a history of *esophageal atresia with tracheoesophageal fistula/caustic ingestion/{other primary cause}*. Patient symptoms were concerning for stricture, which was confirmed by *upper GI study/endoscopy. He/she* was deemed to be a suitable candidate for flexible endoscopy with balloon dilation of esophageal stricture.

Procedure in Detail After a smooth induction of anesthesia, the patient was placed in *left lateral decubitus position/supine position* and appropriately padded. Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. A flexible endoscope was introduced to the oral cavity and advanced through the upper esophageal sphincter under direct visualization. A symmetrical, circumferential stricture was visualized in the ___. At this point, a guidewire was inserted through the accessory port of the endoscope and across the stricture under direct fluoroscopy. A ___-mm balloon dilator was introduced through the accessory port of the endoscope over the wire. A small amount of contrast was introduced into the balloon and placement confirmed by fluoroscopy. Once the

balloon dilator was able to be passed through the stricture, and its position confirmed on fluoroscopy, the wire was removed. The balloon was then inflated with contrast for 60 seconds to the designated pressure. The balloon was then completely deflated. A second dilation was performed in a similar fashion with a ___-mm balloon. The balloon was again deflated and then withdrawn. After the procedure, the mucosa was inspected carefully with the endoscope. There was a small amount of bleeding, but no other sign of mucosal damage. Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well, was extubated in the operating room, and was transported to the post-anesthesia care unit in stable condition. A post-procedure chest radiograph was obtained in the recovery room.

3 Repair of Esophageal Atresia with Tracheoesophageal Fistula (Open and MIS Approaches)

Dominic J. Papandria and Karen A. Diefenbach

Indications and Benefits

- Esophageal atresia, with or without tracheoesophageal fistula
- Benefits: Restoration of esophageal continuity, protection of the airway from aspiration when fistula present

Risks and Alternatives

- Standard risks (bleeding, infection, need for additional procedures, risks of anesthesia)
- Injury to adjacent structures (trachea, esophagus, azygous vein, lung, vagus nerve, recurrent laryngeal nerves)
- Chest wall deformity, scoliosis (associated with open approach)
- Anastomotic leak, anastomotic stricture, or recurrence of fistula
- Alternatives: Temporary occlusion/ligation of fistula

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Essential Steps

Thoracoscopic Repair

1. Rigid bronchoscopy with patient in supine position and occlusion of the fistula with Fogarty catheter
2. Position patient in left lateral decubitus position (left side down) and pad and secure patient to operative table
3. Prep and drape
4. Port placement
5. Identification, isolation, and ligation of the tracheoesophageal fistula
6. Identification and mobilization of the upper esophageal pouch
7. Division of the fistula and resection of the tip of the proximal segment of the esophagus
8. Anastomosis of the proximal and distal esophageal segments
9. Injection of local anesthetic to perform intercostal rib blocks for regional anesthetic effect
10. Placement of thoracic drain near the anastomosis
11. Closure of the remaining incisions

Repair by Thoracotomy

1. Rigid bronchoscopy and placement of Fogarty catheter to occlude the fistula

D. J. Papandria et al. (eds.), *Operative Dictations in Pediatric Surgery*,
https://doi.org/10.1007/978-3-030-24212-1_3

2. Position patient in left lateral decubitus position (left side down) and pad and secure patient to operative table
3. Prep and drape
4. Muscle-sparing thoracotomy incision and placement of retractors
5. Identification, isolation, and ligation of the tracheoesophageal fistula
6. Identification and mobilization of the upper esophageal pouch
7. Division of the fistula and resection of the tip of the proximal segment of the esophagus
8. Anastomosis of the proximal and distal esophageal segments
9. Placement of thoracic drain near the anastomosis
10. Closure of the thoracotomy

Note These Variations

- Bronchoscopy is not performed by all surgeons; it is included as many surgeons do it routinely to evaluate tracheal anatomy, identify the location of the distal fistula, rule out a proximal fistula, evaluate for significant tracheomalacia, and optimally place the endotracheal tube.
- At the time of the bronchoscopy, a Fogarty catheter may be used to occlude the fistula to facilitate ventilation and allow general anesthesia including paralytics to be given prior to entrance into the chest and ligation of the fistula.
- Preoperative echocardiogram is performed on all of these patients to evaluate for congenital cardiac anomalies which are frequently associated with TEF/EA and to evaluate the location of the aortic arch. Some surgeons will change their approach from the right to the left if there is a right-sided aortic arch.

Template Operative Dictation (Thoracoscopic)

Preoperative Diagnosis *Esophageal atresia/esophageal atresia with tracheoesophageal fistula*

Postoperative Diagnosis Same as preoperative diagnosis

Findings Same as postoperative diagnosis

Procedure(s) Performed Thoracoscopic repair of esophageal atresia *with tracheoesophageal fistula*

Anesthesia General

Specimen None

Drains *None/___FR chest tube/___FR drain*

Implants None

Estimated Blood Loss ___mL

Indications This is a/an ___*-day/week/month/year*-old *male/female* with esophageal atresia *and tracheoesophageal fistula*. *He/she* was deemed to be a suitable candidate for thoracoscopic repair of the same.

Procedure in Detail Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. General anesthesia was induced and patient remained spontaneously breathing. *A rigid bronchoscopy was performed which noted normal tracheal anatomy, mild/moderate/severe tracheomalacia, and a tracheoesophageal fistula at approximately ___cm proximal to the carina. A 3/4/5 FR Fogarty catheter was passed through the fistula and the balloon inflated to occlude the fistula. The endotracheal tube was then placed in a midtrachea position.* The patient was placed in left lateral decubitus position and appropriately padded and secured. The right chest and axilla were then prepped and draped in the usual sterile fashion. A ___-mm port was placed in the anterior axillary line at the level of the ___ intercostal space. After verifying the position of the port in the chest, the chest was insufflated to a pressure of *4/6* mmHg. Two additional ports were placed under direct

vision, one in the anterior axillary line at the ___ intercostal space under direct vision and one in the posterior axillary line in the ___ intercostal space.

[Choose One:]

If tracheoesophageal fistula: Inspection of the chest revealed the azygous vein and blunt dissection revealed the distal esophagus below the vein. Following the distal esophagus superiorly, the fistula was identified where it inserted on the posterior wall of the membranous trachea. *To facilitate safe ligation of the fistula, the azygous vein was ligated and divided using electrocautery/a bipolar sealing device/endoclips.* The fistula was then ligated using *a ___-0 Vicryl suture ligature/ an endoclip*. The fistula was divided and the distal portion of the esophagus was mobilized to minimize tension on the anastomosis.

If pure atresia: {Continue dictation}

Inspection of the chest near the esophageal hiatus revealed a short distal segment of distal esophagus. This was mobilized circumferentially using blunt dissection being careful to avoid injury to any vagal fibers. A bipolar sealing device was used for hemostasis.

{Continue dictation}

Dissection was then performed to expose and mobilize the proximal esophageal pouch using blunt dissection and bipolar sealing device for hemostasis. Gentle pressure on the orogastric tube facilitated this process. Care was taken to dissect closely along the esophagus to avoid injury to the membranous trachea and the recurrent laryngeal nerves. Any vagal fibers were preserved when possible.

Once both the proximal and distal segments of the esophagus were mobilized, the end of the proximal esophageal segment was *excised/ incised* to expose the mucosa. The anastomosis was then performed using interrupted ___-0 Vicryl/PDS suture starting at the far corner of the posterior wall of the anastomosis and completing the back wall. The OG tube was then passed under direct vision into the distal esophagus and the anterior wall of the anastomosis was then completed starting from the farthest corner. A total of ___ sutures were placed. The transanastomotic tube was *removed/passed into the stomach and secured by anesthesia*.

Intercostal rib blocks were performed under direct visualization using ___% Marcaine with epinephrine. A ___FR chest tube/ ___ drain was placed adjacent to the anastomosis and secured as it exited the chest at the inferior, anterior incision using ___-0 Silk/Neurolon/Nylon suture.

The remaining ports were removed and the incisions closed at the level of the fascia using a ___-0 Vicryl suture and a ___-0 Monocryl suture. Dressings were applied to the incisions *and the drain site*.

Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well. *He/she remained intubated and was transported to the NICU* unit in stable condition thereafter.

Template Operative Dictation (Open)

Preoperative Diagnosis *Esophageal atresia/ Esophageal atresia with tracheoesophageal fistula*.

Postoperative Diagnosis Same as preoperative diagnosis

Findings Same as postoperative diagnosis

Procedure(s) Performed Repair of esophageal atresia *with tracheoesophageal fistula*

Anesthesia General

Specimen None

Drains *None/___FR chest tube/___FR drain*

Implants None

Estimated Blood Loss ___ mL

Indications This is a/an ___*-day/week/month/ year*-old *male/female* with esophageal atresia *and tracheoesophageal fistula*. He/she was deemed to be a suitable candidate for repair of the same by thoracotomy.

Procedure: in Detail Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. General anesthesia was induced and patient remained spontaneously breathing. *A rigid bronchoscopy was performed which noted normal tracheal anatomy, mild/moderate/severe tracheomalacia, and a tracheoesophageal fistula at approximately ___cm proximal to the carina. A 3/4/5 FR Fogarty catheter was passed through the fistula and the balloon inflated to occlude the fistula. The endotracheal tube was then placed in a mid-trachea position.* The patient was placed in left lateral decubitus position and appropriately padded and secured. The right chest and axilla were then prepped and draped in the usual sterile fashion. A muscle-sparing incision was made at the level of the fourth intercostal space extending from the anterior axillary line posteriorly for a length of ___ cm. The latissimus dorsi muscle was mobilized and retracted without dividing and the serratus anterior muscle was mobilized from its posterior insertion to expose the ribs and intercostal muscles. The chest was entered at the fourth intercostal space just superior to the fifth rib. *Care was taken to preserve the parietal pleura.* The Finochietto retractor was used to spread the ribs. Blunt dissection was used to separate the parietal pleura from the chest wall posteriorly until the distal esophagus was identified.

[Choose One:]

If tracheoesophageal fistula: Following the distal esophagus superiorly, the fistula was identified where it inserted on the posterior wall of the membranous trachea. *To facilitate safe ligation of the fistula, the azygous vein was ligated and divided using electrocautery/suture ligation.* The fistula was then ligated and divided using *a ___-0 Vicryl suture ligature/interrupted ___-0 ___ sutures*. The distal portion of the esophagus was mobilized to minimize tension on the anastomosis.

If pure atresia: The distal esophagus was mobilized circumferentially to minimize tension on the anastomosis using blunt dissection being careful to avoid injury to any vagal fibers. A bipolar sealing device was used for hemostasis.

{Continue dictation}

Dissection was then performed to expose and mobilize the proximal esophageal pouch using blunt dissection and bipolar sealing device for hemostasis. Gentle pressure on the orogastric tube facilitated this process. Care was taken to dissect closely along the esophagus to avoid injury to the membranous trachea and the recurrent laryngeal nerves. Any vagal fibers were preserved when possible.

Once both the proximal and distal segments of the esophagus were mobilized, the end of the proximal esophageal segment was *excised/incised* to expose the mucosa. The anastomosis was then performed using interrupted ___-0 Vicryl/PDS suture starting at the far corner of the posterior wall of the anastomosis and completing the back wall. The OG tube was then passed under direct vision into the distal esophagus and the anterior wall of the anastomosis was then completed starting from the farthest corner. A total of ___ sutures were placed. The transanastomotic tube was *removed/passed into the stomach and secured by anesthesia*.

A ___FR chest tube/ ___ drain was placed adjacent to the anastomosis and secured as it exited the chest at the anterior and inferior to the incision using ___-0 Silk/Neurolon/Nylon suture.

The incision was closed in layers. Interrupted ___-0 Vicryl sutures were used to approximate the ribs being careful to not obliterate the intercostal space. The serratus anterior muscle was reapproximated to its posterior insertion using interrupted ___-0 Vicryl sutures. The subcutaneous tissue was closed using a running ___-0 Vicryl suture and the skin was closed using a running ___-0 Monocryl suture. Dressings were applied to the incisions *and the drain site*.

Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well. *He/she remained intubated and was transported to the NICU* unit in stable condition thereafter.

Esophageal Replacement

4

Michaela Kollisch-Singule and Jennifer Stanger

Indications and Benefits

- Esophageal stricture (from caustic injury, reflux esophagitis, anastomotic scarring after esophageal atresia repair, achalasia)
- Congenital esophageal stenosis (if not amenable to resection with end-to-end anastomosis)
- Long-gap esophageal atresia
- Benefits: Continuity of gastrointestinal tract to optimize enteral nutrition

Risks and Alternatives

- Standard risks (bleeding, infection, need for additional procedures, risks of anesthesia)
- Injury to adjacent structures (azygous vein, vagus nerve, posterior membranous trachea)
- Vascular insufficiency with necrosis
- Anastomotic stricture/leak/ulcer
- Delayed gastric emptying, disordered peristalsis, ulcers
- Long term: Dilation and dysmotility of the conduit
- Alternatives: Serial dilations of strictures, delayed repair of atresia/stenosis, gastric/jejunal feeding tubes for enteral nutrition

Essential Steps

1. Abdominal incision
2. Mobilization of esophagus
3. Mediastinal dissection of esophagus
4. Neck dissection of esophagus
5. ***If {Colon interposition}***
   (a) Division of gastrocolic ligament
   (b) Mobilization of ascending and descending colon
   (c) Conduit assessment for perfusion
   (d) Ligation of left branch of the middle colic artery and the marginal artery (with preservation of the ascending branch of the left colic artery)
   (e) Transection of transverse colon
   (f) Mobilization of colon up mediastinum
   (g) Division of descending colon
   (h) Transection of stomach distal to gastroesophageal junction
   (i) Withdrawal of esophagogastric specimen from mediastinum through neck
   (j) Creation of colono-gastric anastomosis
   (k) Creation of colo-colonic anastomosis

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D. J. Papandria et al. (eds.), *Operative Dictations in Pediatric Surgery*,
https://doi.org/10.1007/978-3-030-24212-1_4

6. ***If {Gastric tube}***
   (a) Gastrohepatic ligament divided down to pylorus
   (b) Mobilization of greater curvature of stomach
   (c) Ligation of left gastric artery
   (d) {Pyloroplasty}
   (e) Creation of gastric tube with sequential staple loads
   (f) Withdrawal of esophagogastric specimen from mediastinum through neck
7. Transection of cervical esophagus
8. Anastomosis between cervical esophagus and colon/gastric conduit
9. Penrose drain into neck
10. {Jejunostomy feeding tube}
11. Closure

Note These Variations

- Open, laparoscopic, robotic approach
- Conduit choice: Colonic interposition, gastric tube, gastric transposition, jejunal substitution
- Stapled/handsewn anastomoses
- Suture choices
- Placement of jejunostomy feeding tube

Template Operative Dictation (Open)

Preoperative Diagnosis Esophageal *stricture/stenosis/atresia*

Postoperative Diagnosis Same as preoperative diagnosis

Findings Same as postoperative diagnosis

Procedure(s) Performed Esophageal replacement

Anesthesia *General*

Specimen *Esophagus/esophagogastrectomy*

Drains Penrose in neck

Implants None

Estimated Blood Loss ___ mL

Indications This is a/an ___*-day/week/month/year*-old *male/female* with esophageal *stricture/stenosis/atresia*, which was causing *dysphagia/odynophagia/inability to maintain oral nutrition. He/she* was deemed to be a suitable candidate for esophageal replacement with a *colon transposition/gastric tube.*

Procedure in Detail Following satisfactory induction of anesthesia, the patient was placed in a supine position and appropriately padded. {A Foley catheter and nasogastric tube were placed.} Timeouts were performed using both pre-induction and pre-incision safety checklists with participation of all present in the operative suite. These confirmed the correct patient, procedure, operative site, and additional critical information prior to the start of the procedure. The abdomen and left neck were then prepped and draped in the usual sterile fashion. Prophylactic antibiotics were given.

An *upper midline/transverse/subcostal* incision was made into the abdomen and the peritoneal cavity entered. The pars flaccida was incised and dissected to the right crus of the diaphragm. The crural dissection was continued by coming across the anterior arch of the diaphragm. The left crus was similarly dissected as much as possible, which required ligation of the short gastric arteries, until the anterior aspect of the gastroesophageal junction was visualized. The esophagus was retracted laterally to expose the decussation of the crural fibers, and a retroesophageal window was developed until the esophagus was circumferentially mobilized. The esophageal hiatus was widened by incising it anteriorly. The phrenic vein was ligated in order to adequately expose the mediastinum.

The mediastinum was entered and the loose areolar tissue was bluntly dissected around the distal esophagus separating it from the surrounding mediastinal attachments and mobilization carried proximally toward the neck.

Attention was turned to the left neck. Just anterior to the sternocleidomastoid muscle and extending to just above the sternum, a small neck

incision was made and carried down along the medial aspect of the sternocleidomastoid muscle. The omohyoid and sternohyoid muscles were divided. The dissection was carried deeper until the vertebral bodies were palpable posteriorly. The esophagus was bluntly dissected free of the posterior membranous trachea anteriorly, and from the vertebral bodies posteriorly. The cervical esophagus was encircled with a/an __-inch Penrose drain and retracted gently caudally allowing for blunt dissection inferiorly toward the previous mediastinal dissection from the transhiatal approach.

[Choose one:]

If {colon interposition}: {The patient preoperatively received a colonic *mechanical/antibiotic* prep.} The gastrocolic ligament was incised, separating the transverse colon from the greater curvature of the stomach. The splenic and hepatic flexures were taken down. In a lateral-to-medial approach, the mobilization of the left colon was continued from the splenic flexure down the white line of Toldt, mobilizing the descending colon off the retroperitoneum to the level of the sigmoid colon. In a similar fashion, the ascending colon was mobilized to the level of the cecum dissecting down from the hepatic flexure sweeping the colon off the hepatorenal fossa and retroperitoneum, while protecting the ureter, duodenum, and kidney. The colon was grasped and elevated to identify the tenting of the mesentery to indicate the regions of the middle and left colic vascular pedicles. {Transillumination was used to identify the arteries.} The peritoneum was incised on either side of these vessels in order to isolate them. {The length of colon required for the conduit was estimated by measuring the distance from the angle of the mandible to the xiphoid process.} The conduit was assessed for adequate perfusion and viability by placing small bulldog clamps on the arteries to be ligated and reassessing for graft viability. After several minutes, the bowel appeared *healthy/dusky* {and flow was confirmed with fluorescein dye injection/mesenteric Doppler flow/inspected for venous congestion}. After demonstrating adequate perfusion, the left branch of the middle colic artery was ligated at its origin and the marginal artery was ligated. The remaining mesentery between the right colic artery and the right branch of the middle colic artery was divided, being cautious to leave the ascending branch of the left colic artery and arcades intact. Using the previously noted required length for guidance, the transverse colon was divided and brought up through the mediastinum and through the cervical neck incision in an isoperistaltic fashion, verifying that there were no twists in the mesentery. The distal colon was divided, verifying adequate conduit length to reach the stomach. An anastomosis was fashioned with a *handsewn/stapled* anastomosis to re-establish continuity of the colon. The stomach was stapled just distal to the gastroesophageal junction. A colono-gastric anastomosis was created with a *handsewn anastomosis/linear cutting staples* verifying no redundancy of the colon within the mediastinum.

If {gastric tube}: The division of the gastrohepatic ligament was continued along the lesser curvature of the stomach to the duodenum, exposing the lesser sac. {No accessory/replaced left hepatic artery was noted.} Attention was then directed to mobilizing the greater curvature of the stomach. The gastrocolic ligament was divided while the right gastroepiploic artery and arcade were carefully preserved. Retrogastric adhesions to the retroperitoneum and pancreas were taken down. Once the lesser sac was completely mobilized, the left gastric pedicle was ligated with a _____ before completely freeing the stomach. {A pyloroplasty was performed.} The nasogastric tube was withdrawn. The gastric conduit was created in an *isoperistaltic/retroperistaltic fashion* over a _____ French chest tube, using a stapler along the greater curvature of the stomach. The left gastroepiploic arcade was identified and preserved throughout this process. Sequential staple loads were used until adequate length of the tube was obtained to reach the cervical incision. {The suture line was oversewn with ___ suture.} The gastric conduit was withdrawn into the cervical neck wound and visualized directly from the abdomen to verify that the staple line remained lateral and the specimen did not twist.

The cervical esophagus was transected sharply and the esophagus and *colon/gastric*

conduit were lifted out of the mediastinum via the neck incision. The *colon/gastric* conduit was opened and a heel stitch secured between the cervical esophagus and *gastric/colonic* conduit. A *cutting stapler/handsewn anastomosis* was used to create a *side-to-side/end-to-end* anastomosis between the cervical esophagus and the conduit. The remaining defect was then closed with *interrupted __ sutures/TA stapler* and a nasogastric tube was then passed distally into the neo-esophagus. After completing the anastomosis, the conduit was grasped and pulled down into the abdomen until the cervical anastomosis seated down into the neck, ensuring a straight conduit. Hemostasis was verified. The nasogastric tube was secured at __cm at the level of the nares. {A jejunostomy feeding tube was placed.}

The abdomen was irrigated and hemostasis verified. The abdominal fascia was closed with __ suture. The wound was irrigated and closed with ___. A Penrose drain was placed in the cervical neck incision and secured. The neck incision was closed with interrupted _ suture and the skin was reapproximated with __ and dressed.

Upon completion of the procedure, a debriefing checklist was completed to share information critical to the postoperative care of the patient. The patient tolerated the procedure well, *was extubated in the operating room*, and was transported to the post-anesthesia care unit in stable condition thereafter.