

**LAPAROSCOPIC PERCUTANEOUS ENDOSCOPIC GASTROSTOMY (LAPEG)
TUFTS MEDICAL CENTER FLOATING HOSPITAL FOR CHILDREN
BOSTON, MASSACHUSETTS
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PETER NGO, MD: Welcome to the Floating Hospital for Children. My name is Dr. Peter Ngo. I'm a pediatric gastroenterologist and the director of pediatric endoscopy at the Floating Hospital for Children. Today we are going to be performing a laparoscopic percutaneous endoscopic gastrostomy tube in a 19-month-old boy. Today I am joined by Dr. Brian Gilchrist, our chief of pediatric surgery, and Dr. Alex Flores, our chief of pediatric gastroenterology, who will be performing the procedure.

00:01:19

BRIAN GILCHRIST, MD: We are presently finding the umbilical defect, which is something you find in most of these children, so that we have a port of entry into the abdomen. This is a minimally invasive procedure. We're dissecting out the umbilical hernia, which you can see very clearly here, and we are going to be -- let me have that. Snap there. Okay. You can see this hernia. Let me have a snap, please. As you can see, there's a hernia sac here emanating through the abdominal cavity up to the umbilicus. And now we're going to open this up and use it as a port to put our scopes through. Go ahead. Snap, please. Come right through there. Stay away from the skin. That's it. Take your time. There's the hernia. Good. I'll just snap right there.

00:02:13

PETER NGO, MD: So this procedure that we're performing, a laparoscopic percutaneous endoscopic gastrostomy tube, it's an improvement over the more traditional blind percutaneous endoscopic gastrostomy tube. In the past, this surgery was only performed as an open surgical procedure which required a fairly large decision in the abdomen to place a feeding tube. In 1980, we began performing these procedures as an endoscopic technique, which decreased recovery time. However, there's been a risk of complications that's been accepted with the blind procedure that has been anywhere between 2 and 5 percent, and these are major surgical complications. So we've aimed to limit that and significantly reduce those major complications by using direct visualization with a laparoscope at the time of percutaneous gastrostomy.

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BRIAN GILCHRIST, MD: Just watch yourself. That's it. Okay. So now let me have a center retractor. So we're in the abdomen. You can see the bowel, you can see the omentum. It's in our direct vision. All right, let's have the port, please. Do you see that? You can see the bowel? Okay, now, place the port in. Heading away. That's it. You've got plenty of room.

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PETER NGO, MD: So right now, the laparoscope port is being inserted into the abdomen, and this will allow us to put a laparoscope in to view the stomach at the time that the gastrostomy tube is inserted into the stomach. And this allows us to directly visualize the insertion of the needle through the abdominal wall into the stomach. And this allows us to be certain that there is no colon in the way, no liver in the way or other abdominal organs which are at risk for perforation when the procedure is done blind.

00:04:34

BRIAN GILCHRIST, MD: Camera's white-balanced.

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PETER NGO, MD: You can also see Dr. Gilchrist prior to the surgery took the time to mark with an X an appropriate spot for the gastrostomy tube on the anterior abdominal wall. This is our initial laparoscopic view through the port.

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BRIAN GILCHRIST, MD: Can I have a little more insufflation, guys?

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PETER NGO, MD: There's also a line drawn on the abdomen to show the costal margin, or the lower part of the ribs, and this is done prior to insufflating the abdomen in order for us to know, even after the abdomen is insufflated, where the best location for the gastrostomy tube is.

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BRIAN GILCHRIST, MD: Okay. Peter, I would know here. I mean, this is colon that you're looking at directly. This is the thing that Dr. Flores, when he sort of began this whole procedure indicated was the great danger. If you try to stick a kid's abdominal wall and the colon is sitting here, and Dr. Flores and Dr. [Lessen] in 2002 came up with this operation to avoid injury to the liver and to the colon. We don't even see the stomach here. All you're seeing is dilated colon. We don't see the stomach at all. Now, this may be the stomach, but you can't discern that yet because the colon is all stuck up here. So he's going to now -- that may be the stomach. Oh, looks like it is the stomach. He's going to blow this up.

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PETER NGO, MD: So right now, the stomach is going to be insufflated with an endoscope, and that's going to allow us to clearly see where the stomach is with the laparoscope in relation to the abdominal wall. This is an endoscopic view right now. I do have a question that's come in asking what the indications are for percutaneous endoscopic gastrostomy. So a PEG procedure, or percutaneous endoscopic gastrostomy, is the placement of a feeding tube through the abdominal wall into the stomach, and this is done to supplement nutrition. So patients that have either an inability or difficult with taking adequate amounts of nutrition by mouth may need a supplemental form of nutrition, and usually this can be done by placement of a feeding tube and supplemental nutrition via that route. In this patient, this is a 19-month-old boy with a syndrome called Cornelia de Lange syndrome that is known to have poor growth. However, in this patient, who I've been following closely with the pediatrician and the dieticians, we have seen that over the last six to nine months, weight has even fallen further on Cornelia de Lange-specific growth charts. So that's been the indication for a gastrostomy tube placement in this patient.

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Right now you're still looking at an endoscopic view of the stomach. Here is the laparoscopic view. And you can see this is either a colon or stomach. And it's difficult to tell until you pan out

and really take a look at the whole region. But once the stomach is fully insufflated, you can see a light from the endoscope, which also helps guide the position.

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BRIAN GILCHRIST, MD: This is a perfect example of why blind percutaneous endoscopic gastrostomy should be an operation of [historical role] only. This is the stomach air now.

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PETER NGO, MD: So you can see off to the left is the liver in that image. And what has been known with blind PEG -- and it's called blind because the needle that is introduced into the stomach is inserted without any visual guidance from the intraabdominal cavity, and so that needle needs to be inserted through the skin directly into the stomach. And you can't know for certain, even with experience and good technique, if you are going directly into the stomach or if the colon or the liver or other intraabdominal organs are in the way. And although you can make efforts to minimize that risk, that risk is always present. And even at large centers, there are clear reports of complication rates, major surgical complication rates between 2 and 7 percent, depending on the center. And this is only what's reported. And so by using laparoscopic assistance to directly view that insertion into the stomach, we're able to know for certain that we're missing those intraabdominal organs. One of the scary things about a blind procedure as well is that you may go through an organ such as the colon and successfully still insert the tube into the stomach. And the complication may not be realized until even years later or at least months later when the tube is changed and the colon then separates away from the abdominal wall and a new tube that is placed may not be placed in the stomach any longer. And that can be a catastrophic event. I have another question from Tarek. Can the percutaneous gastrostomy replace the open surgery?

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BRIAN GILCHRIST, MD: Absolutely.

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PETER NGO, MD: So in most cases, percutaneous endoscopic gastrostomy is the preferred route of the procedure. There are some cases when an open surgical procedure is still necessary, and these are often cases where patients have had prior intraabdominal surgeries that would make laparoscopies exceedingly difficult or times when another intraabdominal surgery is needed at the same time, such as a Nissen fundoplication or an anti-reflux procedure. So those are often cases when an open gastrostomy is placed. However, in most cases, and especially in children, a percutaneous gastrostomy can be placed. And we feel that, in particular, laparoscopic use in addition to the percutaneous gastrostomy is extremely helpful in cases where there's high risk for perforating another organ. So, for example, in cases of hepatomegaly, or a large liver, or in cases of significant scoliosis, as is frequently seen in children with cerebral palsy who need gastrostomy tubes, or in cases of very large colons, such as in colonic dysmotility, these are cases that increase your risk for perforation. And therefore, by using laparoscopic guidance, we're able to be certain that the placement of the tube is directly through the abdominal wall and directly into the stomach, missing those other organs.

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The light that is seen just above Dr. Gilchrist's finger there is actually light from inside the stomach from the endoscope that is transilluminating the abdominal cavity. That is one of the means by which we guide placement of the gastrostomy tube.

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BRIAN GILCHRIST, MD: Just hang on there a second. Okay, blow it up, Alex.

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PETER NGO, MD: Right now this is an endoscopic view. With Dr. Gilchrist pushing with his finger on the abdominal wall, we're able to see an indentation on the inside of the stomach that will help Dr. Flores use a snare to catch a guide wire that's passed from the skin into the stomach. It is this guide wire, then, that is used to secure the pull-tight gastrostomy tube which is pulled down the mouth and out through the abdominal wall. This is Dr. Gilchrist with the trocar now and needle, which is ready to be inserted through the skin, and using laparoscopic visualization, inserted into the stomach. Dr. Flores is ready with the endoscope inside the stomach. And they're now just confirming appropriate placement of this gastrostomy tube. The needle guide is inserted through the abdominal wall, and on laparoscopic view. This is the endoscopic view with the snare out. And this is the laparoscopic view. Now, there is the snare, which is now being placed over the catheter.

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BRIAN GILCHRIST, MD: Don't move that camera. Leave the camera where it is right now. It won't pass. Hang on a second.

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PETER NGO, MD: I have another question about whether or not a laparoscopic percutaneous endoscopic gastrostomy tube can be placed in adults. And this procedure can definitely be placed in adults. We have been using it in children at a pediatric institution; however, it is definitely applicable to adult patients as well. And it will also decrease complication rates as far as perforating other intraabdominal organs when it is used in adults.

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I have another question from Thomas asking, "When should you perform a LAPEG instead of a PEG, or the LAPEG, meaning laparoscopic guidance of a percutaneous endoscopic gastrostomy tube. And this is particularly useful in cases where there's a higher risk of perforating an intraabdominal organ such as the colon or the liver. But the LAPEG can decrease this complication rate, which is a known complication rate, in any patient undergoing standard PEG procedure. The laparoscopic guidance simply allows direct visualization as the gastrostomy tube guide wire is placed through the skin, into the stomach.

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Okay. Now, here you see the laparoscopic guidance, which allows us to visualize placement of the insertion needle through the abdominal wall and into the stomach. Now that we know that that insertion catheter has been directly placed through the stomach, missing any intraabdominal organs, we're able to then confidently place a guide wire through that sheath, which then is grasped by a snare from the endoscope and pulled out the patient's mouth.

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BRIAN GILCHRIST, MD: Okay, you see that? Like Tom Brady throwing a pass, man, threading the needle.

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PETER NGO, MD: You can see how close the liver is and the colon on either side. And so by performing this procedure blind, there is significant risk of hitting those organs.

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BRIAN GILCHRIST, MD: Yeah. Marcaine, please. We always use marcaine.

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PETER NGO, MD: Marcaine is used to anesthetize locally the skin around the gastrostomy site. One of the nice aspects of this procedure over the traditional open gastrostomy tube is the

cosmetic result. There is only one incision through the umbilicus, and the gastrostomy tube is pulled out through the single introduction hole in the abdomen. That's the guide wire that you can see, and the gastrostomy tube was attached to the guide wire and placed through the stomach and adhered to the abdominal wall. And this shows that there's been no injury to other adjacent intraabdominal organs. On the overhead view of the surgery, you'll be able to see that the gastrostomy tube now is outside of the patient. So that is the gastrostomy tube, which is placed through the stomach now directly to the skin wall. This is a longer initial gastrostomy tube than can be later placed, which would be a short, low-profile device. But this is the safest way to place the initial.

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ALEX FLORES, MD: You can see in the [scope area] right now that they bolstered the hole, the gastrostomy is in place, and it is correctly visualized: no bleeding, good in those spaces. And you can see in the laparoscopic view the seal of the gastric wall with the abdominal wall. We're going to retrieve the scope now.

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PETER NGO, MD: This is the scope being pulled out the esophagus. And having the endoscope allows us to confirm appropriate placement inside the stomach. Having the laparoscope allows us to confirm appropriate apposition of the stomach wall and the abdominal wall. And outside of the patient we're able to see the PEG tube in place. There is a bolster around the top of the PEG tube which is secured with a silk tie, which is being tied on right now. This simply allows the bolster to remain in appropriate position so that it does not slide back and cause laxity in that junction between the stomach and the abdominal wall. The laparoscopic instrument now will be removed and there will simply be a very small incision which is hidden within the umbilicus that is closed surgically.

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BRIAN GILCHRIST, MD: This is Dr. Gilchrist speaking. The operation being closed completed, the factors now that are most important are things that have been well illustrated and talked about by Dr. Flores around the country. You've got to secure these tubes properly, and we do that by bolstering and also by using 4-0 monocryl sutures on these diaphragms. But most importantly, at the chest tube placement -- scissors, please -- you must use a very good taping regimen so that these do not get pulled out, because these are immature tracts for six weeks, and you don't want to lose the site. And I think wherever Dr. Flores has discussed this, I think, seminal operation across the country, he's emphasized the fact that you've got to secure this well so that we don't lose the tract. I think that's a key element to doing these operations, and I don't think they should be forgotten. Even though the operation is completed, you don't want to lose the game in the eighth or ninth inning here.

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ALEX FLORES, MD: One other thing -- this is Dr. Flores -- we give antibiotics over 24 hours and you can start [feeding] after 24 hours. We are worried that early feeding has been advocated with the placement of PEGs, but I think we're pretty safe with 24 hours closure here. And depending on the diagnosis of the patient, the patient has dysmotility syndrome is different than if the patient has just nutrition [supporous], an indication for the gastrostomy. This eliminates that risk of an [anxiety] that endoscopies have regarding placement of these tubes that you don't know if it pierces a vital organ, as Dr. Ngo has mentioned. And this is really one of the advantages of this technique. Granted that you can do what we call a lap G, a laparoscopic one-step, but I think this is important because it allows us to identify the gastric vessels, that they are

posterior when we place the gastrostomy. And it's something that's pretty safe, so there is no evidence of [bobulization] of the intestine or the stomach around the area.

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BRIAN GILCHRIST, MD: Now we're doing a standard umbilical hernia defect operation just to close the defect through which we went through to do the port placement. Make sure you look inside, get your pickups. Look inside. You could lose the game in the eighth inning, Doc.

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PETER NGO, MD: So now, the decision to place a gastrostomy tube is one that is done in conjunction with the patient and the patient's family as well as the primary care physician, the surgeons, and the gastroenterologist. And for example, in this case here, I've had long discussions with the patient's family about the procedure. We are able to show the patient prior to the procedure several examples of gastrostomy tubes, both the initial PEG tube as well as what we can later change to, or the low-profile buttons. I've had discussions with the pediatrician, who plays a vital role in the care of the patient, and discussions with the patient about the procedure and what they can expect as well following the procedure. In addition, our nutrition staff and our nurse practitioners have been excellent with regard to obtaining all the appropriate equipment for use of the tube at home and for arranging for those services. The patient will remain in the hospital after this procedure, and we will likely start feeds within 48 hours, usually after a 24-hour period. And we have found that feeding with a LAPEG is very similar to feeding after placement of a blind PEG. There is very little recovery time, and patients are often home and back on their feet within a matter of days.

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ALEX FLORES, MD: I think one of the important points to remember also is -- a lot of parents ask about scarring and the [infections] when we place these tubes. When you place it laparoscopic-assisted, the [stomach formation] is much better than if you do it in an open fashion or if you do it laparoscopic-guided. And this is certainly beneficial because the granuloma formation decreases tremendously with the use of this technique.

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PETER NGO, MD: What's also nice is that with this procedure, which is performed with a pediatric surgeon and a pediatric gastroenterologist, we have all of the skills necessary for any circumstance. And so in certain cases, there's always a possibility that a laparoscopic procedure could need to be converted to an open, more traditional gastrostomy for a number of reasons, and we have that capability, although it's very uncommon that it's necessary. But in particular, one of the important aspects of making this procedure work well and smoothly is coordination and good communication between the pediatric surgeon and pediatric gastroenterologist. And that's what, here at the Floating Hospital, we really prided ourselves in as far as having excellent communication between the two divisions and good coordination, both in patient care, as far as accommodating patients and getting patients to the operating room, and also in the operative and postoperative care of these same patients.

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So you can see the umbilicus here after that defect is closed. It's a very small incision that leads to a very excellent cosmetic result. And the gastrostomy tube has no open surgical manipulation around it.

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BRIAN GILCHRIST, MD: You won't even see any incision in this kid because this incision will fall down into the depth of the umbilicus, which we're closing now with sutures that will dissolve

and not have to be taken out. Keep your short end short, keep your hands up high. Change posts. Come on, that's too long. Snap, please. Four knots. Snap, please. Another pair of pickups. Come on, keep the stitches coming.

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PETER NGO, MD: I have a question about what is the percentage of penetrating other organs than the stomach with the blind laparoscopic tube. This has been reported in a number of large centers with large numbers of patients. Whenever you have a large center performing the blind percutaneous endoscopic gastrostomy tube over a period of time, they're bound to have complications and even mortalities related to that. And this ranges from 2 to 7 percent or so of major surgical complications. And even in a recent report in our pediatric gastroenterology journal in 2001 from France, looking just at long-term postoperative complications as far as two years out following the procedure, there were 2 percent of the time perforation through the colon that was not noted at the time or immediately after the procedure. And this is what Dr. Flores was referring to about the anxiety of the gastroenterologist and surgeon performing a blind PEG, because despite good techniques and experience, there's still that complication risk. And that is something that we just found unacceptable. And so with the minimally invasive techniques that are available today with very small laparoscopic instruments, we're able in small children to confirm this appropriate placement before we send the patient out to start feeding. And that way we have more confidence in the procedure, we know that we are not going to have one of these unanticipated major complications down the road.

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BRIAN GILCHRIST, MD: let me show you the final product here once it's all cleaned up. Looks beautiful. Put a 2x2 on the umbilicus, guys. Lengthwise. You won't even see that incision afterwards. This'll be changed in six weeks when this tract is mature. The gastrostomy tubes are a little more unsightly than the buttons, but the buttons are like Ferraris and the gastrostomy tubes are like Chevrolets. The Ferraris are cute, but they break a lot, they're fragile. So we use the gastrostomy tube, the Chevrolet, for the first six weeks because they don't break and they have a long tube. We get magnificent results with them, absolutely remarkable.

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ALEX FLORES, MD: The other thing that is important if you have an overshoot here is to leave the tube to drainage. When we do that to decompress the stomach so you don't have acute gastric dilatation. And because anesthesia sometimes leaves the stomach gastroparetic after that and the manipulation, so I think keep in mind that, to keep it to drain with gravity.

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BRIAN GILCHRIST, MD: This is Dr. Gilchrist again. The key element now -- this is something that Dr. Flores taught all of us -- is you've got to secure these tubes properly with a tape job, like you do on a chest tube, when you're transporting a patient. If you lose this tube, it's a disaster. So what we do on all these cases is we create a mesentery and we tape like to like. We put tape on the child and then we actually take a mesentery to the tube itself and we kiss it so that the vector of force is dissipated, so if these kids get pulled on, it doesn't pull out. And Alex Flores has told people throughout the country where he's lectured on this that this is probably the key element to keeping these kids safe postoperatively. I would emphasize to you that you cannot forget to do this. It's the ninth inning and you don't want to lose the game after having done a perfect operation, and this is a key element to that entire endeavor.

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PETER NGO, MD: Yeah. And this is something that is such a simple thing to do, and it really improves patients' safety. And you could see with that overhead shot of the abdomen that the mesentery -- there's a mesentery on the tube that's attached to the abdominal wall with tape. And therefore, if the child is moved or picked up and the tube is still connected, the force is not transmitted to the fresh gastrostomy site, but instead to the tape which is adhered to the abdominal wall, therefore protecting the site. Because the time that is most critical in preventing postoperative complications is immediately post-op and while that tract is healing and maturing before the patient goes home.

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BRIAN GILCHRIST, MD: Okay, guys. Is that a wrap?

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PETER NGO, MD: All right. So you've just been able to watch here at the Floating Hospital a laparoscopic percutaneous endoscopic gastrostomy tube. This is a novel change in the way blind percutaneous gastrostomy tubes have been placed in order to improve patient safety and patient outcome. Dr. Flores and Dr. Gilchrist were joining us today, and thank you for joining us today.

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