

**ARAVIND**

So I'm charged with talking about general abdominal surgery in pregnancy. And that basically boils down, to us, to be appendicitis and cholecystitis or biliary disease. It's an interesting topic, since from when I started my practice to what we do now is almost 180 degrees different. 14 years ago, we did every operation open.

**SANKAR:**

And now we hardly do an open operation. I think I maybe the only one who remembers how to do an open appendectomy. And we rarely operated for biliary disease.

And what we found is that we're doing more and more laparoscopic surgery. Our negative appendectomy rate has dropped considerably. It used to be about three times the rate of our non-gravid women.

We've got them back in line. And we're operating more and more for biliary disease. And we're doing everything laparoscopically.

So it's been a whole sea change over the last 14 years. And we'll go through some of the evidence behind that and why we do that, although most of it, I think, is self evident to all of you.

So what is the problem? What is the rate of a non-obstetrical surgery, abdominal surgery in pregnancy? It's about one in 500 births.

And you can see the indications there. It basically breaks down to 40%, 20%, 20% and other, 20%. Most of that is trauma. A small portion of that is bowel obstruction and hernia. So the vast majority, as I said before, is appendicitis and biliary disease.

And these are the risks that you're all familiar with, fetal loss in the first trimester, premature labor in the third trimester. And there is evidence of low birth weights when operating any time during the pregnancy. That's statistically about the only piece of data that's held up since the '60s. And obviously, whenever possible, we try to defer surgery until after delivery.

The risk-- and this is basically the whole take-home message here. The morbidity and mortality for the mother and baby are secondary to the underlying disease process, and not to the diagnostic or therapeutic maneuvers performed. And that's been the real take-home message here.

We had a lot of negative appies because we were reluctant to do CT scanning or any type of other diagnostic modalities. We were afraid to operate on biliary disease because unsure of doing laparoscopic gallbladder surgery or open gallbladder surgery in these women. And we found that we could do both well and really help mother and baby.

Acute appendicitis-- one in 2,000 pregnancies. It has the same frequency whether the woman's pregnant or not. Of course, suspicion of appendicitis warrants operative exploration. So if you have a clinical suspicion of appendicitis I think you can just go straight to the operating room. And that's typically what we do.

Usually, though, when we get called, they have had a whole slew of laboratory exams as well as radiologic exams done. They usually start off with an ultrasound. And an ultrasound is helpful if it is positive for appendicitis.

I have never seen an ultrasound positive for appendicitis that I couldn't diagnose with my fingers. So a negative ultrasound is not helpful. And we are going more and more to helical CT scans. The risk to the baby is always thought to be the radiation.

And the international college for radiation protection has put that limit at between 5 and 10 rads. The helical CT scan gives between 0.25 0.33 rads. It's not a lot. And it's thought to be safe from the second trimester on. The first trimester, we tend to go more towards MRI if the diagnosis is in question.

Acute cholecystitis-- cholecystitis, or biliary disease if we're talking just symptomatic stones as well, we have effective nonsurgical treatments oftentimes. That's just fine. Diagnosing gall stones in the patient and letting them know this is what it is. And that's enough, usually, to get them through their pregnancy, as long as they know what is happening to them.

Cholecystectomy, depending on what studies you see, is one to six out of every 10,000 pregnancies. Which I kind of don't believe. Because I think all six of those people see me. So I think that the rate is much higher, actually.

Pregnant patients with symptomatic stones have a high rate of recurring symptoms. 50% of women who get diagnosed with symptomatic stones come back to the emergency room, come back to the office. And these are people that we will now move more aggressively to doing surgery.

So there are symptomatic stones. They know that it's stones. They come back with biliary symptoms, nausea, vomiting, upper abdominal pain, postprandial abdominal pain. We try to nurse them through to the second trimester, take them to surgery.

And then I'll tell you a little bit why we do that later on. And the big killer here is the gallstone pancreatitis. 70% of gallstone pancreatitis requires hospitalization, a long-term hospitalization, typically two to four weeks hospitalization, being treated for that.

It's usually [INAUDIBLE] NPO. They've been put on TPN. All those babies end up having low birth weight.

And it's very significant. And fetal loss in gallstone pancreatitis is 10% to 20%, depending on the series that you look at. So that's a very significant problem.

Which is why, over the course of the last 14 years, we've become a lot more aggressive in taking out symptomatic stones in the second trimester. So we're seeing a lot lower rate of gall stone pancreatitis in our population. We used to have one or two patients parked in the labor and delivery suite on TPN, just kind of waiting this out. We rarely have that problem anymore.

Laparoscopy versus laparotomy-- I put this slide up. Almost nobody does any open procedures anymore for these problems. I joked earlier, I don't think, especially the newer grads even remember how to do an open [INAUDIBLE], certainly not an open cholecystectomy.

There was always concern about that. But laparoscopy obviously has the obvious advantages, decreased fetal depression due to less narcotics, less wound complications, more rapid recovery. They're up and back at their normal life a lot quicker.

Why did we worry about this? There was unknown effects of pneumoperitoneum. There was one study done by John Hunter at Organ Health Sciences.

It's a really wonderfully designed study where he took a pregnant sheep and performed cholecystectomies on them and then was able to monitor the fetus. And they had a significant respiratory acidosis. And it was thought to be with CO<sub>2</sub>. He repeated the same study using nitrogen gas. And found that he was able to reverse that.

We also have experience from donor nephrectomies. When we first started doing laparoscopic donor nephrectomies for transplant there was a rash of primary non-function of the kidney. So we took the kidney out.

We hooked it up. It didn't work. We biopsied them.

And we found that they were having a cortical necrosis. So the nephrons on the outer surface of the kidney-- which could be up to 50%-- were dead. And we found that was because of the pneumoperitoneum.

So we try to run the pneumoperitoneum low. We're also very aggressive about fluid resuscitating those patients throughout surgery when they're going through their donor nephrectomy experience.

And I think that that's the same thing that happens to the uterus as one of the issues in Hunter's Model. So if you can account for that, a laparoscopy can be done quite safely. These are the published guidelines from SAGES, which is one of the surgical organizations.

OB consultation, of course. I'm usually the second person there after the OB. So that's good. I definitely would call them anyway.

I deferred surgery till the second trimester, use of pneumatic compression devices to prevent DVTs. Obviously these patients are at high risk for DVT. Fetal and uterine status should be monitored through surgery in conjunction with our anesthesiologist.

We have a great group of anesthesiologists here. Typically, what we do is prior to nine weeks we don't do anything. 9 to 24 weeks we do pre and post heart [INAUDIBLE]. And after 24 weeks we do fetal monitoring, in general. And that's, obviously, in conjunction with the OB hospitalist or the obstetrician that's in charge.

Protect the uterus with a lead shield if we're going to do cholangiography. Most of the time, we haven't had to do that. When we have people or women who have had a common duct stones or evidence of common duct stones or obstruction, we have a very talented endoscopist here who is able to do ERCP without fluoroscopy.

So he's able to just cannulate the duct and remove the stones without using any type of fluoroscopy, which has been very, very helpful. Access to the abdomen with an open technique. And that's a recommendation.

However, I don't do that. Because I actually think there's safer ways to enter the abdomen. And I'll talk about that here in a second.

Again, a dependent position for the vena cava, position the patient on the left side. And then minimize pneumoperitoneum to 8 to 12 millimeters of mercury. Again, you should try to get that. You can maybe even get pneumoperitoneum even less than that. There's such a laxity in the abdominal wall, even though you have this gravid uterus, that you could maybe even run five, six sometimes, and still see what you need to see.

What we do-- plus, minus ultrasound. Ultrasound seems to be the first thing that everybody goes to. It's never been helpful for me. But it's always done. It's easy.

And like I said, if it's positive for appendicitis, you could have probably figured it out with your fingers. If it's negative, it doesn't help. So we'd move on to the next thing, which is either observation, you can observe them.

It's perfectly fine. And typically, if the diagnosis is in question, a period of observation overnight for 24 hours. And that's true observation.

So that doesn't mean put them in the hospital and then 24 hours later, come back and see what happened. Really, try to observe the patient. And do repeated exams. And see if there's a change in the patient.

And then the big sea change here is liberal use of CT. And I'm very quick to go to CT scan. The risk of radiation after the second trimester is minimal. And it has nearly 100% sensitivity and specificity these days for appendicitis.

There's use of MRI in the first trimester. The studies on that are, there just really isn't anything. They're just sort of case reports and case series.

And again, if you've ever looked at an MRI, especially in a gravid patient, it's a fuzzogram, at best, to me. So I really depend on the radiologist to help with that as, certainly, an option.

Biliary disease, we obviously delay surgery to the second trimester if possible. And here's the big thing here, is once a woman has had a second visit to the emergency room or a second episode of hospitalization, we move to laparoscopic cholecystectomy. We don't even think twice about it anymore.

They do much, much better. They have a decreased rate of preterm labor, decreased rate of induction, decreased hospital stay, decreased cost overall.

HIDA scan used to be contraindicated for pregnancy. The exposure to radiation for a HIDA scan is 0.15 rad. So it's even less than a CT scan. So we're not afraid to use it if we have to.

Again, ERCP can be done without fluoroscopy. Even if you use a fluoroscopy, it's rarely more than 0.5 rad. And then open cholecystectomy, with common bile duct.

If it's needed, it's needed. There are times when, thankfully rare, when there's a common stone. You can't get it out, you can do an open cholecystectomy with common bile duct.

There are other ways of temporizing these diseases too. If you have a patient who's very, very sick or has some other medical issue that precludes doing safe surgery, biliary disease can be temporized by other adjuncts like cholecystostomy tubes. So that's always an option as well.

You can actually put a tube, drain the gallbladder. And that will tide them over until their other issues are solved. Yeah?

**AUDIENCE:** [INAUDIBLE] ultrasound guiding them?

**ARAVIND** No, they just go in blindly with a scope. I say blindly, but they're able to see the ampulla and then just feel their way through that. So Dr. [INAUDIBLE] is extremely good at that.

**SANKAR:**

And here, the SAGES guideline is for open exposure or open access to the abdomen. I actually think that's not a safe way of doing it. I prefer to use a five-millimeter Visiport. And that's actually putting a camera through a five-millimeter port.

I go subxiphoid through the right rectus muscle. And you have a much better control of getting into the abdomen that way. Once you're in, you can insufflate.

And then you can look with the five-millimeter camera. And under direct vision, put the rest of your trocars in. And you can also look at the anatomy. So you can have optimal placement of your trocars.

We use humidified heated gas. And that's just something we do. I think it's just a little gentler. There's no date up on that at all.

I put robotics on there. We're at the Institute here, in north Austin, for robotics. I am doing robotics now. But that's already high stress.

We have two patients there. In my experience, being in the console for the robot, you're so focused on what's in front of you on that screen. You actually forget about what's 10 feet away on the table. And so I prefer to do these laparoscopically. I can't see going to robot right now for that reason.

Recommendations-- there are, obviously, no Level I recommendations, no prospect of randomized trials. There are some good Level II data, OB consultation, laparoscopy is safe. Ultrasound is safe.

And then Level Three recommendations, helical CT is safe. And endoscopy is safe. Most of this is done in the setting of upper GI, lower GI bleeding. But it translates very nicely to ERCP. All right, are there any questions?

**AUDIENCE:** If we order a CT scan here, for example, do we know it's a helical CT scan? And what, really, does that mean in the first place?

**ARAVIND** Yeah, it's a spiral CT scan. So what it is, in the old days, a CT scan would take 16 pictures and then move a few

**SANKAR:** millimeters, take 16 pictures, move a few millimeters. This one, a helical CT scan, literally takes it like a corkscrew.

And a computer basically fills in the gaps. They're very accurate. And they use a lot less radiation.

All of our CT scans are helical. And I think most places are too. I mean, even in Guatemala, we have helical CT scan. Yes?

**AUDIENCE:** We've been trying to take out the gallbladder in the third trimester. She had someone come in at 32, 34 weeks and has acute cholecystitis. Have you done something to drain the gallbladder?

**ARAVIND** Yeah, that's a great way to go. Yeah, you can put a cholecystostomy tube in. And you can temporize that until

**SANKAR:** after delivery. The likelihood of preterm labor in that patient is probably a lot higher. But you just have to be aware of that.

**AUDIENCE:** How long can the drains stay in?

**ARAVIND** It can stay in forever, really. But typically, we keep it in for six weeks. And then you can pull it out.

**SANKAR:**

We used to mandate a cholecystectomy. A cholecystostomy tube would later mandate a cholecystectomy. But there are lots of reports now, people pulling those tubes out and not taking the gallbladder out. And the patients seem to do fine. Yes?

**AUDIENCE:** Any comments or experience with laparoscopic [INAUDIBLE]?

**ARAVIND**  
**SANKAR:** There are. There's lots of case reports of that. And all of those are with people who are going super umbilical, like around the umbilicus.

And that's why I really recommend going through the rectus. It's very controlled. You have anterior fascia muscle, posterior fascia. So you can really control that with a 5-millimeter trocar.

Most of these women, their livers are slightly enlarged. So at worst you go through the liver. It's not a problem really.

You can just pull it out, yeah. It's much preferable than going through the uterus. Are there any other questions? Yes?

**AUDIENCE:** Are there any studies to show a benefit of robotics versus laparoscopic?

**ARAVIND**  
**SANKAR:** In just all comers?

**SANKAR:**

**AUDIENCE:** [INAUDIBLE] with the gallbladder.

**ARAVIND**  
**SANKAR:** There are no studies that show robotic cholecystectomy is better than laparoscopic cholecystectomy. And for single-site robot cholecystectomy, there's some evidence that there's a higher incidence of common duct injury and higher incidence of postoperative hernia.

I have not seen a single study on using robots in da Vinci's robotic surgery in pregnant patients. But I'm sure it'll come. Any other questions? Anybody have any questions about operative approach in the gravid patient? No?

**AUDIENCE:** [INAUDIBLE] Is there literature that says it's safer?

**ARAVIND**  
**SANKAR:** There really isn't. And the studies that were done before were related to Veress needle verses open technique.

**SANKAR:** But the irony is, in the general surgical literature, there's just as many bowel injuries and intra-abdominal injuries related to open as there are to Veress needle.

And you know what? It's hard to ferret that out. It was a really operator problem, you know?

We all have experience with the one guy that seems to have all the problems. So it seems like they study that guy. I don't know. I just think that in my hands, I think that having that direct vision is very helpful.

**AUDIENCE:** So you don't use a Veress needle.

**ARAVIND**  
**SANKAR:** I do use a Veress needle. I mean, I use whatever they give me. But in this particular situation, I would demand the Visiport. Yeah.

**AUDIENCE:** Can you say where you go again? I'm a little confused.

**ARAVIND** I go just at the xiphoid just to the right, so right below the costal margin. Go right through the rectus, yeah. Yes?  
**SANKAR:**

**AUDIENCE:** Why do you go through the right side? Because nobody [INAUDIBLE].

**ARAVIND** The reason is, typically, I'm dealing with right side of pathology. I'm either doing an appendix or gallbladder. The  
**SANKAR:** falciform sort of runs from the umbilicus over towards the right. So everything's going to be on that side.

And if I go on the left-- you can do that. And sometimes I have to. Because I can't see what I need to-- you run into the falciform.

So oftentimes I put a port in. I get insufflation. Then I can move over to the right if I have to.

But it just saves one extra port placement. But that's the reason. Yes?

**AUDIENCE:** Are you experienced with incarcerated umbilical hernias in pregnancy?

**ARAVIND** I've not had that personally. But hernia and trauma are that other 20%. And that's the majority of those, yeah.  
**SANKAR:**

But it happens. And if it's incarcerated, I mean, you have to do what you have to do. In most of those you just make an incision right there. Yes?

**AUDIENCE:** For the CAT scan, you do no contrast?

**ARAVIND** No, we give contrast, oral contrast especially. Mhm. What we do do, is we don't give gadolinium in the first  
**SANKAR:** trimester for an MRI. So we do non-contrast MRI in the first trimester. Yeah?

**AUDIENCE:** [INAUDIBLE] Do you have [INAUDIBLE] with you?

**ARAVIND** I just wave the flag for Dr. Destefano, yeah.  
**SANKAR:**

**AUDIENCE:** Nice. Would you prefer one to be in there with you?

**ARAVIND** Whatever makes her happy, that makes me happy.  
**SANKAR:**

**KIM** It makes me happy that you're not scared to operate on my patients.  
**DESTEFANO:**

**ARAVIND** Yeah. Well, I think we can do these things safely. And I think that it's a real benefit for patients who are suffering  
**SANKAR:** from biliary disease to get that gallbladder out in the second trimester if they're having recurrent symptoms. It certainly saves them down the line.

And we can more accurately diagnose appendicitis by doing a helical CT scan. So you can really reduce your negative appy rate. The negative appy rates that are reported in the last 10 years, 5 years, because of the advent of helical CT is the same as with non-gravid patients. Whereas before it was between 30% and 50%.

When you can diagnose something with almost 100% accuracy and with very little risk, there's no reason not to do it. So those are the two big things. Yes?

**AUDIENCE:** So the idea that somehow, intraoperative monitoring, we can tell you when the next to the last heartbeat is going to [INAUDIBLE]. Have you ever had to intervene, do a delivery, during an operation?

**ARAVIND** No. No. That's really too much for me to take.

**SANKAR:**

[LAUGHTER]

**AUDIENCE:** [INAUDIBLE] monitoring the ICU or in the operating room that we can actually tell you something. It's probably not true.

**ARAVIND** Go ahead, yeah?

**SANKAR:**

**KIM** [INAUDIBLE] that we actually are trying to optimize [INAUDIBLE] more than we are necessarily going to do a  
**DESTEFANO:** [INAUDIBLE].

**ARAVIND** There you go. Are there any other questions? Yeah?

**SANKAR:**

**AUDIENCE:** [INAUDIBLE]

**ARAVIND** They are, yeah. Yeah. All right, that's it. All right. Well, thank you so much, appreciate it. Enjoy your stay.

**SANKAR:**

[APPLAUSE]