Paul Babyn, MD  Welcome everyone. This is Dr. Paul Babyn. I’m one of the guest editors for one of the upcoming *RadioGraphics* monograph on pediatric imaging and I’m very pleased today to be able to welcome to this podcast Dr. Sudha Anupindi who is Director of the Gastrointestinal and Hepatic Imaging from the Body Section at Children’s Hospital of Philadelphia, as well as Dr. Susan Back who is the Director of the section of the GU also in the Body Section at Children’s Hospital of Philadelphia. Welcome to you both.

Sudha A. Anupindi, MD  Thank you.

Susan J. Back, MD  Good Morning.

P. B.  So today we’re going to be providing an introduction to one of the papers in the monograph which is entitled “The Utility of Contrast Enhanced Ultrasound for Assessment of Focal Liver Lesions.” So I’d first like to start by asking how you both became interested in this topic and why you think it’s an important exhibit and article for the readership of *RadioGraphics*?

S. J. B.  Sure. I became interested in ultrasound contrast as a fellow. I was working at that time with one of the agents that was available here in the United States to optimize the dose for voiding urosonography and it was through the excitement and interest that developed during that project and mentorship that began with that work and really fueled my interest. From that point once we had the contrast agent on formulary we began to expand the applications and now we use it routinely throughout the department. Ultrasound is such an important imaging tool in pediatrics and contrast just adds so much to what we can answer with ultrasound, so it’s a really important thing for radiologists to understand not only for adults but all of the applications in pediatrics.

S. A. A.  I began to work with Sue because of my interest in liver imaging and through that I started collaborating with her and kind of developing contrast enhanced ultrasound for liver lesions and helping to roll this out in our department and to educate others as well as educating ourselves because as you can imagine it’s a work in progress as you’re trying to bring in a new modality into your department.

P. B.  So this is a very exciting new area within pediatric imaging. What do you see as the benefits of ultrasound contrast for evaluation of focal hepatic lesions in children?

S. A. A.  Well I think the most important benefits of contrast enhanced ultrasound for focal liver lesions is its high safety profile based on the extensive literature and also because it is slightly lower in cost relatively speaking in comparison to our conventional imaging studies such as contrast enhanced CT and MRI especially for evaluation of liver lesions in children. We don’t have to use any ionizing radiation, you can perform these studies without sedation, and it’s very ideal for patients who have any type of renal impairment because it’s not nephrotoxic and I think some added benefits which we found in our department were that you can add these studies to your regular routine practice on same day if you have a patient you feel you need to do some problem solving to evaluate a lesion, you can just add it on that same day, do the study very easily and that also enables us to give very timely feedback to patients, families and clinicians that you may not be able to afford with some of the other more conventional imaging studies.

P. B.  Could you describe for us a little bit about the technique and how frequently are you using an ultrasound contrast now?

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approximately 120 examinations and it has become part of our working ultrasound department. It’s become one of the routine offerings.

P.B.  How do you decide when to offer an ultrasound versus a follow-up CT or MR?

S.A.A.  Well the main indications that we’re using contrast enhanced ultrasound for evaluation of focal liver lesions are primarily we’re using it as a problem solving tool. If there is an indeterminate lesion seen say on a CT or an MRI that was done we usually opt to further evaluate those lesions with contrast and for any indeterminate incidental liver lesions, let me give you an example, we often see incidental liver lesions when we’re doing ultrasounds for other indications and we get some of these cases that come from the outside; a child comes in for assessment of the kidneys and bladder and suddenly you might see something in the liver. That’s a common scenario. And for those we would use contrast enhanced ultrasound now as opposed to having to put that child through an MRI. We use it as a problem solving tool. There are sometimes the contrast enhanced MRs are not let’s say a slam dunk case where it’s so easily readily determined what it is. We would use contrast enhanced ultrasound perhaps to help characterize the lesions better. So right now those are the primary main indications and we are also starting to use it more and more for blunt abdominal trauma. These would be children who sustained low impact injuries to the abdomen who are hemodynamically stable. They would be ideal candidates for us to evaluate using contrast.

P.B.  So it sounds like ultrasound is becoming, with contrast, is becoming a very integral part of your departmental activities. Perhaps we can now review a little bit about which hepatic lesions you have evaluated with ultrasound contrast and describe some of the sonographic contrast appearance for these lesions. I would like to show the Figure 1 from your paper and ask if you could take the audience through this figure fairly briefly.

S.A.A.  Our goal for that figure was that for each phase of the contrast each of the images are labeled first arterial then portal venous and then delayed venous. So those would be the three phases that we would observe the lesion in real time imaging after the contrast was injected. So what we decided to do was the background contrast that you see in the liver in each of those phases as it is in the diagram is what you would see in real time ultrasound and that’s what we try to mirror. And each of these circles represents a lesion. So for example let’s take a hemangioma that would be the easiest one to start with. In the hemangioma labeled as hemangioma we presented more than one potential appearance of the hemangioma. The classical enhancement pattern you would expect to see would be in the early arterial phase would see some rim enhancement and slowly the enhancement over time through the portal venous and delayed venous you would see peripher-

eral to central filling and it looks kind of nodular so that’s why we made it a little bit I think undulating around the periphery the edges as the color fills in. So we try to really reflect different appearances that one could see during each phase of the contrast. A similar type of pattern we showed what are the possibilities of focal nodular hyperplasia. We showed that you could have the spoke wheel pattern of enhancement and then we also demonstrated in delayed phases sometimes the contrast is routine within the lesion over time or it may become more isoechoic or iso-enhancing to the surrounding normal liver parenchyma. We felt that doing the diagram this way would really help serve as a great guide for those who are trying to interpret these studies. One of the things we found in our practice was once we had the procedure down and that seemed to flow very nicely and was well organized and our technologist and our physicians and nursing staff all knew what to do, the next step was now how do we interpret these studies. So that was really our goal in putting together this particular figure with each phase of the enhancement patterns.

P.B.  So thank you very much for doing this. I found it a very useful figure and also I very much appreciated having the video links. In the article the readers can access two videos; one is relating to demonstration of hemangioma within the liver and shows the normal hepatic parenchyma and the changes from hemangioma; and the second relates to a metastatic lesion. Can you describe the difference between the primary hepatic lesions that are benign versus what you may expect to see with a malignancy?

S.A.A.  Sure. So the main hallmark of malignant lesion on contrast enhanced ultrasound is to see an early washout. Video 2 is a six-month-old who was diagnosed to have hepatoblastoma and this was an incidental liver lesion that was actually seen on an abdominal MRI, abdominal and pelvic MRI that was done for precocious puberty. And so that’s how we found that lesion and it was actually the MRI which shows the lesion but really was not well characterized because it was at the dome of the liver, there was a lot of breathing and motion artifact so we went right to contrast enhanced ultrasound. And it wasn’t clear from the MRI that this could be a potential malignant lesion. It was actually the ultrasound that helped prove that. And you will see in the video that initially you see early arterial enhancement and then right away during the portal venous phase you’ll start seeing the contrast washout pretty quickly. And by the end of the delayed venous phase there’s no contrast at all in the lesion. And that really is a hallmark of malignancy and when you see that that should raise some red flags. And in fact what happened with this child was because we saw this on ultrasound, we discussed it with the clinicians and said we’re very concerned this could be a malignant lesion and it so happens that they did do some alpha-fetoprotein levels which were markedly elevated, the child went on to have biopsy, and it was proven to be a hepatoblastoma.
P.B. So a pretty dramatic use of ultrasound contrast in that case. Perhaps you both could describe a little bit about how you’ve integrated ultrasound contrast into your overall departmental practice beyond just focal lesions of the liver?

S.J.B. Sure so we use it for other solid organs within the abdomen. We also use it for voiding urosonography and characterization of complex anatomy of the GU system. We’ve looked at GU sinus. Our interventional radiology colleagues in our division have also been instilling it in lesions like kidney lesions to see if they are communicating with the celiac system before they sclerose them. They’ve done biliary imaging through direct installation of contrast into the biliary tree during procedures. Each of these ways we’ve tried to replace the use of fluoroscopy and we’ve been able to answer questions and guide imaging and give diagnosis to the clinicians and I think in a setting that’s more comfortable for the patient especially when we’re doing voiding urosonography the family is right next to the patient and so we don’t have the fluoroscopic tower hovering over them and it makes it a little bit more patient friendly despite the fact we can’t avoid catherization. So I think the families have been really appreciative of our ways to cut down on radiation as Sudha has mentioned it avoids sedation sometimes in these younger children would otherwise need MRI. And so we’ve had some positive feedback both from families and the clinicians who’ve referred for these exams.

P.B. Okay well I’d like to thank you both for your time today and for your excellent article which is going to be a major contribution to the *RadioGraphics* literature and to pediatric imaging. And I’d like to thank you for your time today. I greatly appreciate both of you coming and sharing some of your experience with us and showing how to get started with ultrasound contrasts in the department and appreciate the excellent examples you’ve described this morning for us.

S.J.B. Thank you.

S.A.A. Thank you very much.