Jeffrey Klein, MD  Hi this is Jeff Klein, editor of RadioGraphics and today I’m pleased to have with us Dr. Dean Huang and Professor Paul Sidhu from King’s College Hospital in London who are here with us to discuss their featured paper in the current issue of RadioGraphics which is entitled “Contrast-enhanced US-guided Interventions: Improving Success Rate and Avoiding Complications Using US Contrast Agents.” Professor Sidhu and Dr. Huang welcome.

Thank you.

J.K. We’re going to begin with Professor Sidhu, can you briefly describe for our audience the nature of the contrast agents that are used for contrast enhanced ultrasound imaging in the interventional setting and what is the current status of the approval of these agents for their use?

Paul S. Sidhu  Ultrasound contrast agents are quite unique in that they’re very different from contrast agents used in other areas of radiology. They are in fact microbubbles. So they are about five to ten microns in size and when you inject them intravenously they go through the biliary system and so recirculate through the lungs and they last for about five to six minutes in each patient. What you are using is you’re using the ultrasound beam to resonate these microbubbles and increase the return of the ultrasound beam up to maybe 300 times more than you would normally appreciate. The most important aspect of these contrast agents is they are truly intravascular. So wherever you see this contrast agent in the body when you’re imaging and you need specific ultrasound modality to image this, a low mechanical index so you’re not bursting the bubble and allowing them to resonate. Being truly intravascular, wherever you see them in the body they’re going to intravascular. So if there’s no vascularity to the area you’re looking at, there are no blood vessels going there. And then you can use this in interventional procedures particularly the non-vascularized areas to pick out different areas where you can target for your interventional procedures bearing in mind you’ve got four or five minutes to do this. You can actually repeat the injections several times because of the safe nature of the contrast agents and you’re only injecting a small volume each time, one, two, maybe three or four mL of the agent to inject. Currently, the approval for these contrast agents in Europe is for vascular, liver, heart, and breast. It’s used quite widely by the cardiologists and very recently in the United States, the FDA has given approval for radiology use of these drugs, this agent, one particular agent, in liver practice. The most important thing about the approval for the FDA was not just liver in adults but liver in the pediatric patients as well. And this I think we’ll look back on it and see as a game changer for ultrasound. So briefly that’s the use of the contrast agent and how it works and how useful it is in a real time ultrasound setting.

J.K. Terrific, thank you. Professor let’s just briefly discuss the indications for the use of these agents in the ultrasound guided interventional radiology setting. It’s clear from the paper that the use of these agents is particularly useful for liver lesion characterization specifically when you suspect a liver abscess and certainly seems to help direct the appropriate placement of catheters for drainage and to assess the adequacy of drainage. Let’s take a look at Figure 5 from the paper and Movie 1 which I think nicely demonstrate nicely the use of these ultrasound contrast agents for access and drainage of these particular liver collections.

P.S.S. The figure illustrates an air containing abscess within the liver reasonably well demarcated on the basic ultrasound image. But you want to be absolutely sure that you’re targeting an area of liquid or necrosis within that abscess to safely base your catheter drainage in the least possible (inaudible). By giving the intravenous injection of contrast in this particular image, you can visualize exactly where that non-vascularized area is and you can then use your guidance and your catheter precisely placed catheter right in the center of the lesion and you can see it clearly. So it’s very, very useful in this sort of, with this technique, particularly for the people who are less confident in looking and finding where this is on ultrasound, it just adds another dimension to the whole procedure.

J.K. Thank you. Professor Sidhu in your paper you describe the use of intracavitary contrast in the drainage of infected pleural collections specifically empyemas. Figure 8 shows us the use of interpleural contrast to assess the presence of loculations. Can you take us through these images and show us how use of these agents might help in guiding interpleural treatment of these parapneumonic collections?

P.S.S. It’s very important to appreciate that when you’re using this contract agent in an interpleural cavity in the body, you’re using much less of the volume that you would intravascular. When you inject 2 mL in the vascular space it’s diluting to 8 liters and that’s why 2 mL is a small amount but it
does the whole vascular system. When you’re injecting it into a cavity that perhaps has only 50 mL in there you don’t need very much at all. If you use too much, you’ll get shadowing and artifact. So when you inject it into a cavity space you’re using as little as a drop in 50 mL of saline. You can use this when you’ve got an indwelling catheter maybe to the pleural space, it’s not draining, you want to know if it’s loculated. By just instilling this agent into that space you can watch it move through the pleural cavity and you can see whether it’s loculated or not and if it is loculated you can confirm that it needs to do something and maybe you can introduce a thrombolytic into the thing and release the receptor. You can then use your contrast agent again to inject again and see now that it’s going through the entire cavity. You can also combine it or perceive this intracavity use within intravascular use and look at the vascularization of the lump and clearly demarcate where the pleural fluid is. This will increase your confidence and if you would like to put a drain in you’re putting it in exactly the right place where there is no fluid. So it really is a useful tool in this situation. The problem solved to help and of course to manage that patient adequately.

J.K. Terrific. Thank you very much. Let’s turn if we can to Dr. Huang. It’s seems like intravascular contrast agents can be particularly useful in targeting viable regions and particularly for large tumors that have areas of necrosis. You showed several examples of the use of ultrasound contrast for accessing large renal lesions. Let’s look at Figure 10 which I think illustrates its use in this particular setting.

Dean Y. Huang: Thank you Jeff. As Professor Sidhu mentioned earlier when the ultrasound contrast agents is (inaudible) these microbubbles are purely intravascular making them ideal for the assessment of the vasculature within the (inaudible) and it is the vascular characteristics of any of (inaudible) that shows whether the lesion is viable or not. Conversely, if we have a large tumor as we can see here in Figure 10 where it demonstrates a large renal tumor, the tumor often outgrows the vascular supply in the central portion of lesion causing central necrosis to have a possibly biopsy or we need to do it to target our needle so that we can avoid necrotic tissue by doing our subcutaneous biopsy procedures and with help of contrast enhanced ultrasound we can demonstrate clearly the viable portion of this large tumor and help us improve the (inaudible) of our biopsy procedure and thus improve our capacity to make accurate diagnosis and help us to targeting the correct portion during the procedure.

J.K. Great, thank you Dean. Let’s move if we can to Figure 12 which shows us the use of contrast enhanced ultrasound in the evaluation of successful thermal ablation of tumors. Can you take us through this case and explain how you use contrast enhanced ultrasound in this particular setting?

D.Y.H. Thank you Jeff. Thermal ablation such as a radiofrequency ablation, microwave ablation, or cryoablation is now widely accepted in our practice as an alternative to surgery for solid tumors; and imaging is of paramount importance to determine the success of our ablation treatment. And in the case of a hypervascular tumor as we demonstrate in Figure 12 here where there’s a hypervascular renal tumor, the contrast enhanced ultrasound allow us to detect any enhancing lesions which may represent a residual viable tissue following ablation treatment. In this case, with improved resolution on ultrasound of the for the microvasculature, contrast enhanced ultrasound allowed us to improve our identification of any residual tumor following ablation and in this particular case we saw some residual tumor at the edge of the ablation treatment which allow us to repeat procedure and perform a further targeted ablation just to make sure we have clearance of the tumor residual during this kind of procedure. And also I think I just want to emphasize that contrast enhanced ultrasound can also be used during the post-ablation therapy surveillance and this has been shown to be effective and usually post-ablation the volume of disease can be similar in texture on standard ultrasound with the enhancement information demonstrated on contrast enhanced ultrasound. This will help us to achieve clarity in determining whether there is any residual or recurrent tumor in the surveillance period.

J.K. Terrific, thank you. Dr. Huang an interesting use of ultrasound contrast that you illustrate in your paper is its use in detecting and treating endoleaks in patients who have undergone endovascular aortic aneurysm repair. Can we review Figure 16 which I think illustrates beautifully the use of contrast ultrasound in this particular situation?

D.Y.H. Thank you Jeff. So an endoleak represents blood flow outside the stent-graft placement following intravascular repair of an aneurysm. In this case, demonstrated in Figure 16, we have a large, a previously treated internal iliac aneurysm which was treated previously with stent-graft and multiple metallic embolization coils. On the CT scan due to previous embolization coil there are multiple artifacts which prevent clear visualization of the area of endoleak. With the ability of enhanced contrast ultrasound demonstrating the enhancement and vascularity within an aneurysm, we are able to perform a targeted treatment of injection or embolic agent percutaneously in real time and the advantage of using contrast enhanced ultrasound in this scenario is that in a patient who is quick to heal this allow us to reduce the complexity of logistics of managing the treatment so instead of conventionally managing these patients the fluoroscopy or under CT guidance, we can perform these procedures with real time ultrasound guidance percutaneously. This is another example where contrast enhanced ultrasound provide a (inaudible) solution for potentially complex clinical scenario that we face each day.

J.K. Terrific. Well Dr. Dean Huang, Professor Paul Sidhu, I want to thank you for taking the time today to discuss with us your paper on contrast enhanced ultrasound guided interventions which again appears in the current March-April 2017 issue of RadioGraphics. Thank you very much.

P.S.S. Thank you Jeff.

D.Y.H. Thank you.