Gadobenate Dimeglumine Administration and Nephrogenic Systemic Fibrosis: Is There a Real Risk in Patients with Impaired Renal Function?

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Hi. This is Herb Kressel and welcome to the September Radiology podcast. This month we have discussions with authors of three provocative papers. First, I'll be speaking with Dr. Sadhna Nandwana of Emory University who with her colleagues wrote a very interesting study on the use of gadobenate dimeglumine in patients with impaired renal function looking at the subsequent incidents or potential incidents of nephrogenic systemic fibrosis. Then my colleague Dr. Deborah Levine will be speaking with Sangeet Ghai who with colleagues from the University of Toronto published a study looking at the quality improvement effects of thyroid biopsy specialists in terms of wait time reduction and biopsy accuracy rates. And finally, my colleague Dr. David Kallmes will be speaking with Dr. Chi-Jen Chen of Taipei Medical University in Taipei, Taiwan who wrote a very stimulating article exploring the sex differences in working memory after mild traumatic brain injury. We hope you enjoy this month's podcast. And a special note, this month we have available transcripts of the podcast discussions. We've learned that many of our listeners and viewers may not be that familiar with English as a language and we feel that the transcripts will be helpful in furthering their understanding of medical English. We hope you enjoy the podcast and we hope you enjoy the transcripts. Please contact us with any suggestion for further improvement.

Herbert Y. Kressel, MD

Hi. This is Herb Kressel and welcome to this month's edition of the Radiology podcast. Today I am joined by Dr. Sadhna Nandwana, Assistant Professor of Radiology at Emory University who with her colleagues authored a really fascinating paper on the use of gadobenate dimeglumine in patients with impaired renal function. As there's a lot of interest in NSF and the gadobenate based contrast, I think this is a very, very timely article. Welcome Dr. Nandwana.

Sadhna B. Nandwana, MD

Thank you for having me.

H.Y.K.

And in full disclosure Dr. Nandwana trained with us in Boston and I want to welcome her to the podcast. We're very proud of you.

S.B.N.

Thank you so much for having me again.

H.Y.K.

Sure. Okay so gadobenate is in a class of gadolinium-based contrast agents that have been associated with few or any NSF cases and what’s the explanation for this? Why do people feel that these are...some gumption to decide to use a gadolinium-based agent in patients. I gather these were part of a transplant work-up. So could you tell us the thinking of why you decided to do that as opposed to some of the alternatives, you know non-contrast enhanced MRI or other modalities?

S.B.N.

Sure. We have a very strong MR program here at Emory and it's part of our practice pattern to image in conjunction with a nephrologist all of our pre-transplant recipient patients with MRI and MRA with contract. We actually started with gadodiamide prior to 2007 and had seen some cases of NSF and that’s why we switched over to gadobenate dimeglumine. We found that these patients that are getting screened prior to transplant with contrast were able to pick up unknown malignancies, some background abnormalities that would otherwise have been missed, and so we have a very strong relationship with our nephrologists and our transplant surgeons to go ahead and use the contrast and image these patients.

H.Y.K.

Now some people sort of looking at sort of the same issues would try to use some of the non-contrast MRA techniques or people are also advocating diffusion weighted imaging to look for these neoplasms, how did you kind of weigh the two different approaches?

S.B.N.

We basically set out to say we want a diagnostic study. We don’t want to have to hedge and say well there may be a neoplasm there and especially given that we have a lot of dialysis patients that are at risk for RCCs, we want to know about this pre-operatively. So we said well if we have a strong relationship with our nephrolo-
hists and our transplant surgeons and we're giving them contrast, we can screen them effectively for NSF. We knew that we were able to detect it prior to with gadodiamide as we were able to identify those patients. We felt pretty confident that we could control the narrative basically.

**H.Y.K.** And I think you're also are you dialyzing them soon after the contrast administration?

**S.B.N.** Correct so if the patient’s already on dialysis, they have to get dialyzed within 36 hours, however we do recommend with 24 hours. And so this is practiced as soon as the patient checks in, we confirm with the patient, with their nephrologist that they are on the dialysis schedule prior to receiving the contrast.

**H.Y.K.** What did you actually do in your study? What was the study design?

**S.B.N.** So our study design was a retrospective review of patients that had renal failure and were presenting for an MRI or an MRA for the evaluation of a pre-transplant workup. We were looking at this patient population specifically because they had known renal disease and we wanted to see the effects of them having received the gadobenate dimeglumine. Once we identified those patients as patients who had received a study during 2010, we conducted a thorough chart review and we looked at all the clinical notes that were available in the electronic medical record for both the presence of NSF or NSF-like symptoms in their skin exams. We recorded two, the latest follow-up for two types, basically one type where it included a dedicated skin evaluation by a clinician, and the then the latest communication which may or not have included a skin evaluation.

**H.Y.K.** What was the overall length of follow-up?

**S.B.N.** The length of follow-up for a patient that had a dedicated skin exam by a clinician was about 2.35 years. That's the average, and for the follow-up with any communication, was about 3.1 years.

**H.Y.K.** And you also in the patients examined during the target year which was 2010, you looked at all gadolinium-based contrast administrations from 2007 through 2014. What was the logic for looking at that?

**S.B.N.** Right so what we wanted to know was you know these patients received, we know they received gadobenate dimeglumine on that index scan. What we wanted to know was were there other times that they had received a gadolinium-based contrast agent and if so could that have contributed to whether or not they developed NSF.

**H.Y.K.** If they had developed NSF you'd be able to see if there's a confounding factor as opposed to just pure gadobenate.

**S.B.N.** Correct. And so unfortunately we didn't have anything prior to 2007, that's when we went electronic, so we were able to look from 2007 onwards. The other thing that it allowed us to do was to see what the effective multiple doses had on patients. Out of the 400 patients we did find that about 66 had received additional contrast for other unrelated studies.

**H.Y.K.** Okay. What did you find with your review?

**S.B.N.** We found a zero percent incidence of NSF in our patient population of renal failure. And interestingly we had patients that were on dialysis whether it be peritoneal dialysis or hemodialysis as well as patients that were not on dialysis but had a very low GFR and there was no difference in the incidence of NSF in those patient populations.

**H.Y.K.** That’s sort of impressive. Now you studied 400 patients but do you think that sample size is large enough for this to be a meaningful result?

**S.B.N.** So it’s an interesting question. You know the incidence of NSF with gadobenate dimeglumine is really it’s unknown. I mean we have no unconfounded cases reported. So we’re unable to really do a power calculation to see what should the sample size be. That being said, agents that have been associated with NSF, so agents such as gadodiamide, in a similar patient population which is renal disease patients, we do know the rates of NSF in those patient populations. Those range anywhere from one to about eighteen percent depending on the type of study that was performed.

**H.Y.K.** As an incidence?

**S.B.N.** As an incidence, correct. And so what we assume is that if we kind of extrapolate that data out to gadobenate dimeglumine which is they should have a similar incidence of NSF in the renal failure population, our study of 400 patients would be powered enough to detect at least a one percent incidence.

**H.Y.K.** Okay, that’s impressive. As I’m sure you know there have been several recent reports about increased signal intensity in the dentate nucleus and other nuclei in the brains in patients who have received gadolinium-based contrast agents and it’s been shown that this is due to gadolinium deposition in the brain. Have you had the opportunity to go back and look at the head scans of your patients in this study if they were obtained to see if there was any increased signal?

**S.B.N.** Not yet and it’s a great idea and I think we definitely will be doing that in the future.

**H.Y.K.** Okay well good. Now here we are, I guess the study year was 2010, so what’s your current policy regarding MRI in this patient group? Did you just sort of continue what you were doing? Is there any further modifications?
A Quality Initiative to Reduce Wait Times and Improve Adequacy Rates

S.B.N.  Yes so we are continuing what we were doing and basically what the study showed for us was support and that we could continue to do what we’re doing. So we’re going ahead and proceeding with our policy of imaging all of these patients with gadobenate dimeglumine.

H.Y.K.  Now in the article, you suggest that you allow a three lifetime doses of 0.15 mmol/kg of gadobenate and then how was that actually arrived at and how do you manage it?

S.B.N.  Right, it’s a good question. It’s basically trial and error and what we feel comfortable with. We can say that we’ve imaged literally thousands of patients that have renal disease with gadobenate dimeglumine with no problem. Now we have data that’s been published to show that. We’re not as cavalier to say we’re just going to do it forever and ever, so we came up with a number of three. It’s been our policy for years. And so what that really means is that when a patient comes in with renal failure and for the first three scans the technologist does not even call us up for approval. After the third scan, when they’re coming in for the fourth or fifth or sixth exam, the technologist will call us up and say hey doc this patient is coming back for X number of scans, do you still want to give contrast. At that point we don’t have a policy. It’s kind of whatever the person feels comfortable doing.

H.Y.K.  Someone makes a judgment at the time but a threshold to revisit and reconsider?

S.B.N.  Right, which is basically what the ACR recommends for any group 2 agent. What we do is we just push that threshold up higher after the third scan.

H.Y.K.  Very good. Well Dr. Nandwana I really enjoyed chatting with you. I thought your article will be of interest to lots of folks who are trying to figure out how to examine patients with severe renal disease and thanks for taking the time to join the podcast.

S.B.N.  Great. Thank you for having me again.

H.Y.K.  Bye-bye.

S.B.N.  Bye-bye.

Thyroid Biopsy Specialists: A Quality Initiative to Reduce Wait Times and Improve Adequacy Rates
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Deborah Levine  Hi. I'm Debbie Levine. I'm the Senior Deputy Editor for Radiology and I'm here today talking with Dr. Sangeet Ghai who is an Associate Professor of Medical Imaging at the University of Toronto. He and his group in Toronto devised a study to look at mid-care providers to ease the radiologists’ workload and provide a better patient experience for thyroid biopsies. We live in a healthcare environment where we are continually being asked to do more with less time, and in addition thyroid biopsy rates have just exploded so I found this paper to be very interesting and very timely as well. So welcome Dr. Ghai.

Sangeet Ghai, MD  Hi, thank you for having me. It’s a pleasure to be here.

D.L.  So I kind of mentioned what I thought some of the drivers were for doing this study and I’m wondering if you can mention as well what was the impetus for having these mid-care providers? Was it financial, efficiency turf issues? What drove you to do this?

S.G.  So really to go back and this is I think we’re talking about 2009 and 2010 when we started thinking of this program. The primary reason was we were receiving a lot of complaints from our clinical colleagues. The wait times were going up. How we function was you know we have a biopsy, dedicated biopsy center, and we used to do deep abdominal biopsies in the morning and do the superficial biopsies in the afternoon so that we didn’t have any recovery time and then they could go home immediately after that. And there are only so many we could do. Plus, if I can say it, there really wasn’t a consistency in the program. So you know you would have a first year resident someday who would be doing the biopsy. The second day it might be a fellow, some are more experienced than others, and there was kind of a bit of a disinterest in a program I would say. How we were doing it, we were really not following up getting enough follow-up as to you know when you do a biopsy was it an adequate specimen or not and then you have inadequate specimens and the patient comes back for a repeat biopsy that adds to their wait time. So we were going back, we were calling up the wait times of about three months for a thyroid biopsy even longer. So a lot of complaints coming from our physicians, surgeons, endocrinologists, and that’s when we started thinking as to what we can do to provide better service to our physicians and more so for our patients actually.

D.L.  So can you tell us a bit about what exactly you did in this study and what you found?

S.G.  Absolutely. I would love to. So when this first came up this was something as the director of the biopsy center in the hospital the chief actually and I had a chat. And he really wanted to set this program up. The first thing we did was bring this up in our divisional meeting to all
the radiologists in the group to see if this is something they would be interested in and surprisingly there was an overwhelming support that yes we should do that, this would be better for us. It would in fact free us also to do the other radiology reading scans and stuff and free up daytime as well. So the first step was getting approval from the radiologists, but we knew that they are going to be many, many obstacles in the path. Then I spoke with the CMPA in Canada which is the Canadian Medical Protective Association if there would be liability coverage for the physicians. And then if I can actually quote here from the paper, it said “It is a delegation of a medical act could be considered part of the professional work of medicine, but you would need to get approval from your regular party after province” which in our case was in our case CPS, so the College of Physicians and Surgeons in Ontario and also get consent from the sonographers or the MRTs that you would train which in this case would be the hospital. So we knew that we had to go back CMPA would be fine if we could go back to CPS and the hospital MAC. So the first step was to go to the College and there again have a very clearly defined policy for delegation of controlled acts on the website which again said that you could do it provided you include proper identification, evaluation of the individuals, how you train them, that should be there, there should have been an established process for the delegation. Then they should maintain competence and train them for informed consent as well. So when we read the policy online we thought yes we could easily go through that, it’s going to take a while, but there’s no reason why this is not possible. And the third step was again for the medical liability of the sonographers, we had to back to the hospital. So when we looked at all this we knew that we really needed the approval of the hospital and the CE for them to approve for this entire process. So we put forward a plan of how we would train the sonographers in a stepwise manner and we put this to the hospital MAC. It did come up in the meeting. The first time actually it did not pass through and that was because some of the pathology colleagues have concerns about if our adequacy rates were not pretty good and is this actually going to even further make it worse or we going to open the flood gates and start doing thyroid biopsies on each and every patient just because we’re opening having new sonographers perform the biopsy. So it didn’t pass through the first time. We took it again, we did have discussions with the pathology division, how to work closely with them for on-site side of pathology and when to ask for on-site side of pathology. I think the second time it just whizzed through. It wasn’t a problem. The hospital approved it. So when the hospital approved it we were I think on board the whole process could get now started to train the sonographers.

D.L. So you trained your sonographers and tell us about your study and what you found in your study.

S.G. Sure. So initially when we initially thought should we train MRTs, radiation technologists or our sonographers, but the fact that sonographers already have some hand-eye coordination and the fact that their licensed to practice sonography, to do ultrasounds and (inaudible), we thought it would be better to train them. It would be easier actually. It could be a one step just to train them for the biopsy. So we had our one day training program which included directive talks from the morning to the evening actually. We showed them some, there were some video demonstrations as well. The second step in the training was phantom training. There was a one day full of phantom training or half a day of phantom training. The third step was having them come to the biopsy center, observe us, how we do the procedures and the fourth step was a one-to-one training for them. So they would all come into the biopsy center just for the afternoon and we did superficial biopsies over a period of about three weeks and we did about 45 to 50 and then they would be signed off by the radiologist who would have supervised them. So we did that. It took us again a few months to train four sonographers and then we started them to do the thyroid biopsies independently, under supervision, in a room which was made available right next to the deep abdominal biopsy room. There’s a control room on the left hand side, we had the deep abdominal biopsy, on the right hand side we had the ultrasound room. And so initially we started slowly. We would only book about three patients in the morning. They would do a full ultrasound. They would document the ultrasound. They would call us to the room to show us the images and think what they thought which nodule should be sampled and what should not be, and once we agreed on which nodule should be sampled, they would go ahead and do the biopsies and only if they had an issue they would call us. We were always there available in the very next room, you know if you’re doing an abdominal biopsy sometimes it takes about ten, fifteen minutes, so if worse to worse you just wait for ten minutes and then we would come across and help them if help was needed. So it’s been running well. It’s been about three years, more than that now. What was published in the paper was our adequacy rates just for the first year when they started. I think it went from 74 to 78 percent in the very first year, but I do have some data now from 2014 which actually says that the adequacy rates have going up to about 90 percent. So I think this has been a very successful program for us. Our clinicians, we keep meeting them, we keep discussing all these in the rounds as well in (inaudible). There’s been a very good approval from them so there’s really no complaints coming in. I must say that this has been a success for us.

D.L. So you talk about your wait times going down in the paper which makes sense because you’ve got people dedicated to doing these and your adequacy rates went up and I think wait time finding, as I said, makes a lot of sense. Why do you think your adequacy rates went up with these mid-level care providers?

S.G. I think it’s the consistency. It’s the same people who have been doing it. We have the four sonographers who were trained to do this and they kind of rotate
one in four weeks, so for one full week they would do the target biopsies and for three weeks they’ll be doing ultrasounds in the ultrasound department, come back to do biopsies again, and you know they cover for their vacations as well. Sometimes they will be there a little bit more than a week in a month. And I think that consistency is what has led to this benefit. I must say it’s pretty similar to sonographers now do the ultrasounds and they are very good at it having done it over the years. Initially we would have some days it’s a first year resident who might be in the rotation. You know there might be a fellow, some are trained better than the others, so I think that’s the predominate reason, the consistency. They take pride as well that they’re doing this and they’re doing it very well. I truly believe that this really has been one of the biggest benefits of having them in this program.

D.L. Now when you get informed consent from the patients and when these sonographers get the informed consent, are the patients told that it’s a non-physician who is going to be doing their biopsy?

S.G. Yes, absolutely. In fact the sonographers have been, they are able to take the informed consent and they will do it and our name, the staff who is there, and in their names as well. Most of the patients are absolutely fine, they are told that I’m a biopsy specialist, a thyroid biopsy specialist, and I work with so and so, Dr. Ghai is with me today. He is in the other room and some patient’s yes they do ask I would have thought this was going to be done by a physician and they ask for it. And frankly speaking, if now I’m asked to come into the room at the time of the consent, I actually tell them, I’ve done five thyroid biopsies in the year, the person here has done over a thousand. You really want me to do the thyroid biopsy and most of the time, in fact always, they’ve said no I’m fine with it. I just wanted to make sure of that. And then we have to convince them that this is a program which has been approved by the hospital. There’s been a training program and there’s an evaluation which happens every year as well. There’s a fixed number that they have to do to maintain their competency. It’s just that you need to go in and speak to them for a minute and everything is fine after that.

D.L. Given your success with this program with your mid-level care providers, are you using this in other areas either in ultrasound or elsewhere in your imaging department?

S.G. So in the past, you know been using them for PIC lines as in many hospitals they provide some fluoroscopy assistance for things like (inaudible) and (inaudible) in the past, it just frees up the radiologist, so there’s been a precedence in the past. Have we increased it’s since (inaudible) the scope of their practice, we really haven’t as yet, but we’re talking about things like could we add paracenteses? Sometimes it just occupies the room for a long period of time. Is that something chronic patients, liver patients, where you’re doing four liters, five liters, is that something they can do? It’s just that you have to go through the whole process because again you go back to the CMPA, the CPSO, we haven’t started it, but yes we’ve been talking about some simple procedures such as that.

D.L. You mentioned early on that you got the radiologist acceptance very easily, pathology took just a little bit of work, what about your referring clinicians? Were there any issues with them?

S.G. Surprisingly there really wasn’t. All the endocrinologists were on board. We kind of cater to a group the university hospitals, it’s not just the one hospital, so we have (inaudible), we have Mount Sinai Hospital, Women’s College, where we have the endocrinologists apart from Princess Margaret Hospital here. All across the board, now we have not had, in fact once or twice I’ve had a positive feedback from the clinicians saying that they were very happy with it, so surprisingly nothing really from the other departments. Everything has been well received.

D.L. Wonderful. And what are your wait times now for these thyroid biopsies?

S.G. Less than three weeks I would say. It’s less than three weeks to the extent that we’re thinking we might start doing them four days in a week instead of providing the service days if the wait times keep coming down. So it’s been less than three weeks. I think today it might be about three weeks.

D.L. Wonderful. Well thank you so much for your time and this discussion. I really appreciate it. Of course we’re talking about your study in Canada. Do you have any ideas how this might work in the United States, do you know if we could do it?

S.G. I don’t know. I would think it’s a little different in the U.S. Having not worked in the U.S. I don’t want to be commenting too much. I believe a lot of physicians, not only radiologists, also do these procedures in the US in the clinics. I don’t know if they would be willing to have their assistants do this or not. But I think here it’s been, in our experience, in our hospital, it’s really been very good.

D.L. Okay. Well again, thank you so much. I really appreciate your time.

S.G. Thank you for having me. It’s been a pleasure.
Sex Differences in Working Memory after Mild Traumatic Brain Injury: A Functional MR Imaging Study
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David Kallmes Hello, my name is David Kallmes, I am Deputy Editor for neuroradiology. I'm joined today on this podcast by Professor Chi-Jen Chen of the Department of Radiology at Taipei Medical University. Dr. Chen welcome to the podcast.

Chi-Jen Chen, MD Thank you.

D.K. We are here today to talk about your publication entitled Gender Difference in Mild Traumatic Brain Injury, Functional MRI Study. Congratulations on your paper.

C.J.C. Thank you.

D.K. So can you briefly tell us at the beginning what you did in this experiment and your major findings?

C.J.C. Okay actually in our prep clinical presence we found more females seek medical attention after mild traumatic brain injury. However, according to our past experience and the epidemiologist study we found that actually male MTBI patient outnumbered female. So we wondered if there might be some sex factor difference in the MTBI outcome. When we reviewed our literature we found the result is actually mixed. Experimental studies show that a female animal actually have better outcome than male, however in the human study, males actually had a better outcome than female. So we tried to understand that, so therefore we conduct a study, we studied 30 patients with MTBI and 30 normal control. Both groups contain equal number of the men and the women and patients under functional MRI we see in one month after injury and we follow-up function in our study the sixth week after the first scan. All the patients also underwent new psychological tests including digital span and continued performance tests. The initial results shows that MTBI patients show increased activation in working memory circuit in men, but the decreased activation in women compared to the control. As a follow-up, men with MTBI returned to a normal activation pattern similar to the control; whereas the women show persistent hypo-activation suggesting on-going working memory problem. Also, the neuropsychological results shows that among the women and the total digital span scores were lower in the MTBI group compared to the control group. This finding provides evidence that female gender may be a risk factor for working memory impairment after MTBI.

D.K. So it seems somewhat surprising that there are differences both at baseline and at follow-up, that the activation is opposite in men and women at baseline. Was this an unexpected finding?

C.J.C. Pardon?

D.K. Was this finding of different activation, of hyper-activation in men and hypo-activation in women at baseline or early after injury, was this find a surprise to you?

C.J.C. It does not surprise me, it's only, because it's compatible with our clinical finding, because actually more women seeks for medical attention after MTBI so it means usually it may seem it's because women are more likely to admit they have a symptom, but actually it's not. Actually they have real problem than men after MTBI.

D.K. Is there any obvious explanation for this?

C.J.C. Until now we still don't know what, but there are some assumption – one possible explanation may be biomechanical, that women may have because their head are smaller and because their neck muscle are weaker than men, so that when it comes to MTBI their ability to absorb any shock of the impact is weaker. That's one explanation. And the other explanation is that maybe men and women use different brain region in working memory tests and the brain region women use during working memory may be more susceptible to injury, but this is only a hypothesis. It needs to be tested in the future.

D.K. And can FMRI be used for prognosis based on your findings? That is to say can you predict what will happen to an MTBI patient early after injury based on patterns of activation?

C.J.C. Yes I believe that it seems that MRI is very sensitive to the MTBI injury, but unfortunately at the present we are only doing a group study. We cannot apply it to the individual label so maybe more work need to be done in the future to extend the usage of the function of the MRI to the individual label.

D.K. And in a related note, can you envision that any type of specific therapy, either medication or other cognitive type therapy might be individualized to men or women based on your findings?

C.J.C. Unfortunately, at present the treatment for men and women after MTBI are the same because actually no chronological or rehabilitation treatment can benefit from this. Actually 85% of patients will recover spontaneously within three months. Only 15% have persistent symptoms. This group of patients we need to pay more attention, but actually we don’t know which ones to pay more attention in the beginning, but right now we know maybe female we need to put more attention and maybe
I know have some trouble in the clinical trial, but still not have a very obvious result right now.

D.K. Could it be that the mechanism of injury was different between the men in your study and the women in your study that might have affected the outcome or were the mechanisms of injury similar between groups?

C.J.C. Actually they both have the same, no difference between the mechanism of injury. Most of them suffer from the motor vehicle injury and a few are a sport injury and maybe less in an assault. So the mechanism seems no different between men and women in our study.

D.K. And can you share with us studies that are on-going at your center or studies that you would like to do in the future to elucidate the mechanism or offer prognostic indicators?

C.J.C. Okay actually the results are only preliminary. A question remains including just as I mentioned the possible physiologic basis of working memory and the role of the sex hormone at the time of the follow-up injury. So we plan to combine functional MRI and the reliable neuropsychological test and the direct measurement of the hormone label both at the injury time and the follow up stage and we also try to combine other imaging modality such as diffusion tensor imaging tool for the structure integrity and resting state functional MRI for the functional connectivity susceptible with the imaging for micro-trauma and profusion study for the hemodynamic evaluation. Also the MR special scope for the metabolism. We hope using this modality can further help us to explore the underlying possible physiology and cause of the sex difference in the MTBI.

D.K. It sounds like a very comprehensive study. Is that ongoing now or are you planning it in the future?

C.J.C. Actually we have finished a little about (inaudible) for the micro-trauma. We didn’t find a difference. The number of micro-trauma between these two groups actually is the same, so now we try to use functional connectively to detect any difference between these two groups.

D.K. Sure. Okay. I want to thank you sincerely for supporting our journal. A prospective study MTBI is a welcome study and it was very well done. We look forward to receiving future papers from your excellent group. Thank you Dr. Chen.

C.J.C. Okay. Thank you. I hope our future work we can submit to Radiology very soon.

D.K. We look forward to it.

C.J.C. Thank you.