Dr. Travis Dekker:

Welcome all to the Arthroscopy Association's Arthroscopy Journal podcast. One, I'm Dr. Travis Dekker coming from the United States Air Force Academy and today I'm talking to a friend, colleague, and mentor of mine, Dr. Adam Anz. Adam is a bright and talented surgeon coming from the Gulf Breeze Andrews clinic. He serves as a team physician for Navarre High School and Pensacola Christian College and is part of the team of physicians for the Pensacola Wahoos and Auburn University. In addition, he helps in the coverage for the US Ski Team specializing in women's downhill.

He's also one of the more thoughtful surgeons I've met and has a brilliant mind for everything from innovative surgical interventions and techniques to basic science applications. His out of the box thinking as it comes to biologic interventions has really given him a name. He's an honest researcher that is critical of his results and findings to ensure that anything his research team produces well safely and effectively impact our future patients. I've enjoyed collaborating with him over these past few years and I've learned more about the practical application of biologic interventions by simply listening to his thoughtful approach. Adam, I'm very excited to welcome you to the podcast and greatly appreciate you taking the time to be with us this evening.

Dr. Adam Anz:

Travis, thank you for the invitation and thank you for the great introduction. I'm humbled and appreciate your warm thoughts.

Dr. Travis Dekker:

Well, today I'll be focusing on an article within *Arthroscopy* published in April ‘22 entitled, “Concentrated Bone Marrow Aspirate Is More Cellular and Proliferative When Harvested From the Posterior Superior Iliac Spine Than the Proximal Humerus.” Adam, I really enjoyed diving into this article and can you give us a bit of your own personal history on your journey with biologics and specifically bone marrow concentrate?

Dr. Adam Anz:

Happy to and it's quite a rabbit hole that I was pushed by Gary Poehling down in 2009. I was at that time a resident at Wake Forest and Gary was a wonderful mentor to me. He was the Editor of *Arthroscopy* for decades, a thoughtful clinician, an excited clinician too. He was always kind of pushing the envelope.

And in 2009 we had a visitor come give us a grand round at Wake who was utilizing bone marrow aspirate the way that the HemeOnc doctors do. And what I mean by that is he was taking cells with apheresis in Neupogen, which is the same process that the HemeOnc doctors converted from bone marrow aspirate to apheresis harvest for bone marrow transplant. And that physician was using that to augment microfracture to improve cartilage repair. And that's a long haul rabbit hole that we could go down. But I'll say that that got me first introduced and interested in biologics.

I went and visited with that individual in 2009 and our collaboration since 2009 through 2020 sped into a randomized controlled trial in the United States on that technology utilizing that cell source and that cell source is what the FDA would deem a high risk biologic. So it's a drug. And so that cell source kind of spun me in all different directions of biologics, learning about some cell sources are drugs and biologics and are going to take us still some time to get to, but what is available right now in that space and what is exciting about that space.

And so through travels related to that technology to Malaysia to collaborate, also went and spent some time in Germany with Peter Wehling seeing what he was doing with Regenokine and then also traveled with some other individuals and just saw of what all people were doing out there in this space.

So that kind of led to studies on our campus like what we're going to discuss today where we're just trying to think about the best cell source and which soil source is the best to get these cells from our patient. We did some studies thinking about the ACL and ACL byproduct tissue and we published some of those in arthroscopy and then we started focusing on rotator cuff as Hernigo's study thinking about augmenting cuff became mainstream and then also the Chicago Group, looking at their study at augmenting cuff as well. That made us start thinking about what's the best place to get these cells in the setting of rotator cuff surgery. And you'll have different opinions from different people about that subject, but we wanted to test it and this is what led to this study we're going to discuss today.

Dr. Travis Dekker:

Adam, really interesting to hear about your journey. It was great to see the pictures and even the slides that you showed me along your journey with the use of that technology. And it is interesting to even go to the Biologics Association meetings now to hear about the progression that we continue to make on a yearly basis as well as what is available and still what is considered a drug that we still have to critically evaluate our results for. And so you gave us a little bit of a background of specifically this project, but can you tell us what your indication specifically for the use of concentrated bone marrow for augmentation of rotator cuff repair has been in your practice now?

Dr. Adam Anz:

Currently it is part of my clinical trials in this space and so it's not a big part of what I do outside of some of our clinical trials. We've been blessed to have some opportunities with the state of Florida with funding for these studies and biologics. And so that study was funded by a grant from the state of Florida and we still have that grant ongoing. So part of the quid pro quo from the state if they're going to give us some research funds is that we have to utilize them to investigate these technologies in our patients. And so for instance, this study has been followed up by a second study where we're thinking about different types of humeral harvest. And for that reason there isn't anything clinically that I'm utilizing concentrated bone marrow aspirate for. And the reason is kind of back to your introduction is just the thoughtful use of biologics.

Hernigo's study got us all excited and we've been eagerly waiting for someone to repeat that study and confirm that this is something we should take the time and the expense to put into our standard of care. And so regarding my standard of care, I'm still deliberately watching the literature and at this point I'm not really using it for any of my clinical cases outside of our clinical studies. And that's because I'm still kind of waiting for the penny to drop and for there to be a clearer picture of when we should tell our patients that they should take on the added expense because to do a bone marrow aspirate in the OR is added time and added expense and we need to ensure that we have that clear direction to go. And so for that reason, I'm mainly keeping it in these studies and that's been a good kind of transition for the practice. And so at this point I'm not really using it outside of these trials that we're studying.

Dr. Travis Dekker:

Well, Adam, you're right. I think that with your discussion right there, it does point to the true reflection that you have of not only your practice but also the extent of not only the effectiveness of the intervention but also wanting to validate it. And you've been very thoughtful in your research as you've approached that and there's no one, at least that I've been exposed to, those more well versed in the

utilization of biologics across all the spectrums of it, specifically with that of bone marrow. And I think that with the listeners, we have a general idea and sense of what bone marrow can be used for and why it's effective. And you mentioned that cellularity specifically is a key factor in how effective concentrated bone marrow can be and why you studied the difference between the two sites. And you mentioned a few factors that affect cellularity and essentially the effectiveness of the bone marrow. And so can you discuss these along with others?

Dr. Adam Anz:

Yes. There's a lot of predicate literature out there from the trauma world thinking about different harvest sites for bone marrow aspirate, and it seems like site is probably the biggest effect or the biggest variable upon cellularity.

The other thing is, of course the human that you're getting the bone marrow aspirate from. It seems that younger individuals have more cells in their bone marrow, individuals who are more active and exercise more often have more cells in their bone marrow. And then there's some other environmental factors that just should be considered when you're thinking about the individual that you're harvesting from. I'm just thinking comorbidities and who's going to have the best milieu.

In terms of sites of harvest, we kind of went back and read through all the trauma literature or just didn't read through it all, but got some glimpses from it. And it seems like the central locations of the pelvis have more cells than the peripheral locations, such as your distal femur or your proximal tibia or your proximal humerus.

With that being said, sometimes you still got to choose the specific scenario to test, and that was kind of what we were after with this study was we wanted to compare directly the pelvis to the humerus.

And there was one other study out there that was there for comparison looking at arthroscopic harvest from the humerus compared to arthroscopic harvest during labral repair in the hip. And that, to us, was kind of an apple and an orange because they're different individuals. And so they were comparing the cellularity of harvests during preparing for a suture anchor in the labrum and then comparing that to harvest for suture anchor preparing in the humerus. And that was kind of different than what we were thinking clinicians were going to be thinking through, but they were choosing their sites. It seems that clinicians are going to think, "Okay, I either want to go from the pelvis or I want to go from the humerus." And so that's kind of where we designed the study.

And there is some clear study from the trauma literature, again comparing anterior crest to posterior crest and posterior crest has outperformed the anterior crest. So those were all the things that we consider when we designed this study.

And we also just considered practicality. We predominantly do our rotator cuff repairs in the lateral cubist position and we have found that you can go ahead and put them in that lateral cubist position and we use a bean bag and you can just kind of push the bean bag down so that you can harvest while the bean bag's up. And we found that harvest to be quite quick.

That was one of the outcomes that we looked at was the time of the harvest compared between the two sites. And we found it to be about five to seven minutes in terms of just palpating out the posterior crust, marking it out, prepping it with a ChloraPrep, draping it with just some disposable towels, the ones that kind of have a sticky on them. And then just using the Jamshidi and getting the bone marrow aspirate. And Tom's found that actually a little bit quicker than getting it from the humerus.

Dr. Travis Dekker:

Well, Adam, that you kind of catapulted into the next question. I know there's a million different ways to harvest bone marrow. I know we've discussed this and for some folks I polled the audience at a couple of these smaller meetings that I've been to and for some of some folks retrieval out of the posterior iliac crest is more of an unknown in terms of not knowing what to do and how to do it. You discussed how you did it with the propping them up with the bean bag. Can you give us any other tips and tricks on how you do this routinely when you do aspirate bone marrow and any other tips and tricks for those large patients or really muscular patients where landmarks might be harder to palpate?

Dr. Adam Anz:

Sure. An ultrasound is a tool that can really help you when you're getting started with this. You can reliably palpate the crest more laterally, and that's kind of where I start. And then just march posteriorly with that crest and then you'll be able to fill the PSIS. Many times you can put your thumb kind of the very most distal coddle portion of it, and then I kind of mark it out, I put my thumb on it, mark it out with a marker. And then early on, and I still do this in some of the larger individuals, I use an ultrasound machine. And in our surgery center, all of our blocks are put in by our anesthesiologists and they all have ultrasound machines down there, so there's always one readily available. And then I can do two things. I can confirm my placement of where I feel like the PSIS is, but then I also can obtain the vector for the trajectory of the needle.

And if you're kind of in your mind's eye looking at someone in the low cubist position, you would be surprised, but the needle's going to go in an uphill vector in terms of getting adequately into the PSIS. And so you can find that vector with an ultrasound machine by just visualizing what kind of looks like a mountaintop and then angling the probe to see how you're looking straight down that mountaintop. And then once you get that angle, I just kind of turn my head behind me and I pick a mark or I pick something in the room to kind of think about that vector and connecting two dots so that I know where that needle's going to go.

After that, then I will use a spinal needle. Now with the, we typically also put some numbing medicine just for the postoperative period, so it's not as painful, but that spinal needle is then your second time to sound the crest in the PSIS. And so with that needle, you can again see exactly where you are in space and get your vector a second time. Then I use just an 11 blade to make a small incision with my right hand, my left hand always has a sponge in it because for some reason that skin back there wants to bleed a little bit.

And then I get the Jamshidi needle. And then I've, in my mind's eye and in my thoughts, collected how my vector's going to be and use the sharp trocar to get into the crest. And then once I'm in, I go ahead and switch it for the blunt trocar and I advance it about three to four centimeters and then aspirate with 30CC syringes while withdrawing and rotating the needle all the way to the cortex for the first 30. And I put the blunt back in and then I go for a different divergent vector again, same distance, and then rotate and withdraw for my second 30. And then I go in a third vector a third time for a third 30CC aspirate.

And that's been what I've evolved to over the years. And there's a couple different considerations. One, you want to just maximize the location that you're harvesting from in terms of changing the position of that needle and rotating. The other thing is the larger volume syringes are not the best to harvest from, and you should theoretically use like 5CC syringes and pop those syringes and get 1 to 2cc aliquots. However, that's pretty time intensive and without a clear evidence that it's going to be a better harvest, I've been doing the harvest that I described because we have to always balance time in the OR and practicality.

Dr. Travis Dekker:

Well, Adam, it's super insightful and helpful. Probably will change how I've been getting my own bone marrow. But I know you've taught courses and people ask you at meetings all the time, different questions about specifically concentrated bone marrow. What have been the concerns or hesitancy for people to adopt utilization of concentrated bone marrow as an adjunct for some of the surgeons that you've spoken to that have been asking for your advice like myself?

Dr. Adam Anz:

I think it's mainly time and expense. And I think that the thought is that the harvesting of bone marrow from is going to take a lot more time than it actually does. And so that's one hurdle. The second is just expense because the kits are roughly, I would say $500 to $850. And so you just have to consider that expense for either your hospital or your surgery center. Another hurdle, sometimes the hospitals want to have a perfusionist there to actually run a concentrating system for you, which is just a little bit of a hurdle. And many times your surgery center will kind of look at you and say, "Okay, well who's going to pay for this, bub?" And that can be a hurdle as well.

The patients at times request it, and I think when they request it then that's the times that has been an indication outside of my clinical trials. But those are the main hurdles that I see.

Once people get just used to the harvest and the time is less of a hurdle. And there are many different courses and I would definitely encourage listeners interested in getting into space to go to one of those courses, practice some of these harvest techniques, and then once everybody's kind of stuck the needle in the bone a few times, just take a tin blade and dissect it all out, make it a big incision and see where your needle was and think through if that's the best location to get the harvest from. And so those are all kind of some tricks that I feel like have helped me. And these courses, just being there with the cadavers and getting a good feel for where you really want to stick the needle is a game changer or very helpful.

Dr. Travis Dekker:

Adam, super insightful. And of course I know through AANA and Arthroscopy that been offering lots of courses and hopefully will continue to take advantage of those in-person sessions. And getting back to your paper. I was read through the highlights of your results, and there's clearly large differences in the makeup between the two sites. Do you mind highlighting the most results from your findings for the listeners?

Dr. Adam Anz:

I think at this point the posterior crest has outperformed the humerus in terms of this specific study. One of the critiques of this study is that we advanced the Jamshidi needles into the humorous about 2.5 centimeters, which is kind of standard when we're utilizing our suture anchors. It's typically around two centimeters. And so for this critique, we have another study that we're in the middle of where what we're doing is we're going to again get PSIS bone marrow to compare it to humeral bone marrow, but we're going to stick that Jamshidi needle with the arm abducted and send that trocar all the way down the humerus for what people call a deep humeral harvest. Because there are some animal studies to suggest that the endosteal areas around the diaphysis may have a little bit of a better harvest. And this is not my brain child, this is really Rafi Mirzayan's brain child.

He's been harvesting kind of with the arm abducted that same kind of starting point when you think about your most anterior medial suture anchor for a cuff repair kind of adjacent to your biceps, instead of just sending that down in your standard position, kind of making sure that you can send that trocar or

all the way down the humerus. And so right now, if you're just sticking that Jamshidi needle say two centimeters into the humerus, you're not going to get as cellular of a harvest as the PSIS. But stay tuned or keep your eyes out because we're going to have a similar article probably in about a year that will answer the question of PSIS versus what we call a deep humeral harvest.

Dr. Travis Dekker:

Something definitely to look forward to. Adam, that's been great and kind of you to take your time with us this evening. As it pertains to biologics and specifically concentrated bone marrow, do you mind reviewing with our listeners your main indications overall in practice for its use of this time? The subsequent question that I've heard some people looking at diving into is, are you doing any of these aspirations now in clinic? And do you feel that that's a safe bedside procedure to do?

Dr. Adam Anz:

It is safe to do in the clinic and can be done in the clinic, but can doesn't necessarily mean should. And so I've done many in the clinic and I've transitioned them to the OR setting, and here's why. You can get a harvest in the clinic, it's not a problem. However, you can really only numb up the skin and the periosteum, but you really can't numb up the inside of the bone.

And so one thing that kind of pushed me this direction, I had to have a jaw surgery and they did a biopsy of my mandible while I was awake. And he numbed up the periosteum and he numbed up the skin, the soft tissues. But I learned real quick that you really can't numb up the inside of a bone.

And so that experience made me realize that with bone marrow aspirate, can doesn't necessarily mean should because I feel like I can get a better harvest in the OR. And so my indications currently predominantly involve these early arthritic pictures and athletes who there is an unmet medical need and they need to keep performing at their level. And I do think that in these individuals, concentrated bone marrow aspirate is better than PRP. And at this point I haven't seen any movement in the FDA to ever go after anybody treating osteoarthritis with concentrated bone marrow aspirate.

However, in the elderly population, we did a study comparing bone marrow aspirate to PRP and the elderly population saw no difference. And so in the elderly population for osteoarthritis, I typically utilize PRP just from the practicality. I would say that for revision or rotator cuff repairs, I utilize a bone marrow aspirate. I'm blessed in the sense that we live around a whole bunch of military installations, Travis, you know this best. And that has translated into a very healthy patient population that actually takes care of themselves very well. And knock on wood, very few revisions come across my doorstep.

And so with that being said, I think that is a clear indication for concentrated bone marrow aspirate to augment your rotator cuff repairs. But outside of that and outside of my clinical trials, I'm not utilizing it for rotator cuff repairs.

And then I think another indication for concentrated bone marrow aspirate is IntraOsseous BioPlasty. That is something that we're very interested in studying on our campus as part of a multi-center study. And so that's another time that I'm doing concentrated bone marrow aspirate.

The last indication is one that is anecdotal but seems to be successful is utilizing it in high level throwers with flap accumulations throughout their career that at the end of the season need a good anti-inflammatory load inside their shoulder. That's an indication that I've anecdotally had some success with and feel like has a place. So I hope that kind of answers the question.

Dr. Travis Dekker:

That's great. Very comprehensive. I'm glad you've been able to help take care of our military folks down there. I know my prior place down at Eglin is greatly appreciative of all the work that you've helped with take care of those folks. And Adam, lastly, before we go, I've always been intrigued by your forward thinking and out of the box and very honest approach as it pertains to biologics. You've been very judicious and how you use them. Then also how you evaluate them. You've mentioned some of the studies that you're getting involved with in your institution and personally, where do you specifically see progress being made with concentrated bone marrow over the next three to five years?

Dr. Adam Anz:

I think concentrated bone marrow is going to be a little bit tricky. I think biologics is going to be a portfolio or like a golf bag. There's not just going to be one club in the golf bag. There's going to be a whole different portfolio of clubs for different indications.

I think concentrated bone marrow aspirate is still going to be utilized for some of these point of care surgical adjuncts because it's readily available. I think that for osteoarthritis, my prediction is that a cultured cell product is not far away with an FDA approval. That's a little bit of an insider statement. We're working with one specific company and their request for me has been to help with the developmental process through the FDA. And they are kind of going down that pathway. And the FDA is really looking for a success story that plays by the rules and that just develops safety and efficacy and just says, hey, here's safety and efficacy, and that's all they're really looking for.

So I do think that a cultured product is probably about five years away. I think that the technology with Neupogen apheresis is moving as well. We studied that on our campus in a phase two level and it's moving towards phase three. I think that product will make its way through the FDA for cartilage repair, but I think bone marrow will predominantly stay in these surgical adjuncts where we just need a little bit of a push with some bone marrow with our biology.

Dr. Travis Dekker:

Well, Adam, it was a pleasure to have you tonight in your *Arthroscopy* article published in April of 2022 entitled, Concentrated Bone Marrow Aspirate Is More Cellular and Proliferative When Harvested From the Posterior Superior Iliac Spine Than the Proximal Humerus can currently be accessed at www.arthroscopyjournal.org. And thanks once again, Adam, for joining us.

Dr. Adam Anz:

Hey, my pleasure. Thanks for having me, Travis.

Speaker 3:

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