BBGuy Essentials 048:
Bloodless Medicine? with Steve Frank
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Joe Chaffin: This is the Blood Bank Guy Essentials Podcast, episode 048!

[INTRO MUSIC]

Joe: Hi, everyone! Welcome back to the podcast dedicated to helping *you* understand the essentials of blood banking and transfusion medicine! I'm Joe Chaffin, your host.

A patient who chooses not to receive donated blood can really make us all very nervous, and I really do mean ALL of us in the healthcare setting, from blood bankers to nurses to clinicians. It can be difficult to know what to do or where to start. So, I'm very excited to bring you an interview with someone who has enormous experience with just this kind of situation, Dr. Steve Frank, who directs the bloodless medicine program at Johns Hopkins University in Baltimore, MD.

Before we get to that interview, you should know this is NOT a continuing education episode. You can find other episodes that do provide credit at BBGuy.org/podcast, as well as at wileyhealthlearning.com/TransfusionNews. Continuing education episodes are provided by Transfusion News (TransfusionNews.com), with generous sponsorship from Bio-Rad (who has no editorial input).

A few months ago, I was approached by a board member of the Society for the Advancement of Blood Management ("SABM") about doing a couple of episodes centered around patient blood management ("PBM" for short). I readily agreed, because PBM is something we are all figuring out in transfusion medicine today, and we all need to have a great handle on it. I thought it would be a good opportunity to collaborate and get information to you. Today's interview is the first of two in my "friendly collaboration" with SABM. You should really check out SABM, by the way! You can find them at SABM.org, where they have lots of great information.

As I said, my guest today is Dr. Steve Frank, who is Professor of Anesthesiology and Critical Care Medicine at Johns Hopkins. I wanted to talk to Steve in order to delve into the details of his truly excellent "Bloodless Medicine" program. Now, you're not going to believe this, but his program sees over 2000 patients per year who come in not wanting to

receive blood donated by someone else! Obviously, we are talking about more people than just Jehovah's Witnesses! Is it *really* possible to do surgery and medicine without blood? Steve seems to think so, and I want him to tell you why! Here's my conversation with Dr. Steve Frank about patient blood management and bloodless medicine!

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Joe: Well hi, Steve! Welcome to the Blood Bank Guy Essentials Podcast!

Steve: Thanks for having me. I'm privileged to be here.

Joe: It's such an honor to have you here. I've heard you speak on numerous occasions at AABB Annual Meetings, but this is the first time we're meeting, kind of virtually. And I have to tell you, just from the beginning, I've been doing blood banking for a long time, and I've been involved in lots of discussions with lots of different clinicians, and for you as an anesthesiologist (and maybe in your world, this is a little different), in my world, my experience with anesthesiologists has not always been that they have even CLOSE to the level of passion that you have about transfusion medicine and about people being transfused appropriately. And I'm just wondering, where does that come from? What's the origin of that for you? How did you get interested?

Steve: Well I did a fellowship in vascular and transplant anesthesia, and I was focused on liver transplants. So, I was giving a lot of blood, because this was back in the 80s and 90s when liver transplants were still a huge deal. And while I was in my training, I personally had a lifesaving transfusion. I'm a cyclist, and it turns out, in 1988, I had a head-on collision with a Mercedes-Benz.

Joe: Oh no!

Steve: Not my fault. But I was helicoptered to Maryland Institute of Shock Trauma, and I had an emergency splenectomy. And if it weren't for six units of blood, I wouldn't be here today, because I left the hospital with hemoglobin of 7. So, I calculate that I lost about an entire blood volume! So, I'm lucky to be here. And so, there's no doubt that blood saves lives. However, we all know that in the last decade, we've now seen 10 large clinical trials showing that lower hemoglobin triggers are either as good or better than "liberal" transfusion. And so, we've incorporated the new evidence into our blood management program. And I like to say that "Blood saves lives when you need it, but only increases risk and cost when you don't."

Joe: That sounds like a bumper sticker slogan right there, my friend!

Steve: It could be.

Joe: I'm excited to hear that. You have published so much, you have spoken so much, and it's obvious from the times that I've heard you speak, that you are VERY passionate about this. And I think that's incredibly cool to see. Before we get started on this I want to mention that this interview is part of a joint effort to promote discussions about patient blood management through my website and in my affiliation with TransfusionNews.com, and also the "Society for the Advancement of Blood Management," which you can find at SABM.org. So, Steve, I wonder, I mean there's no financial thing with SABM or anything, but I'm interested in them, I know you're interested in them, could you tell us just a little bit about your interactions with that organization, what they've meant to you in terms of your practice and your experience in blood management?

Steve: Sure, Joe. I've been going to SABM meetings since 2011, the Society for Advancement of Blood Management. I've been lucky to be chair of their research committee, and also for two years, I was on their board of directors. So, the society has annual meetings. We attract patients, nurses, doctors. We have a following in the bloodless field, patients who want to avoid transfusion for personal or religious reasons. And so, we cover everything from patients who won't accept transfusions to massive transfusion protocols. So, it's really a blood management society that's advancing the practice in the field.

Joe: Yeah, lots of resources that they have, and it's obvious they are very passionate about blood management and what they're doing. So, I salute them and I thank them for helping me get this two-episode series on discussions and patient blood management going. Steve, you mentioned "bloodless" just a second ago, and that's something that you are, not only a extremely well-published individual in terms of bloodless medicine, but you have "boots on the ground." You have established this program, obviously, not by yourself, but you and an impressive team there at Johns Hopkins. And I want to spend some time talking about your bloodless medicine program. But before we do that, I wonder if we could just step back for just a second, and just talk about an overall philosophy of patient blood management with some practical tips that you've learned. You were heavily involved in starting the patient blood management program, the overall patient blood management program at Johns Hopkins in 2012, and you also from the work that you've published, you were also heavily involved in spreading that

program out to the entire Hopkins Health System. So again, you've got a ton of practical experience on this, way more than most people do. So, I think you're the perfect person to talk about this. Let's start by emphasizing your program there at Johns Hopkins. What was the driving force to have you guys start a patient blood management program?

Steve: The timing was perfect, because in 2012, the Joint Commission held their "overuse summit," and they identified not only that blood transfusion was the top most common procedure performed in U.S. hospitals, but also one of the top five overused procedures in 2012, right up there with antibiotics for the common cold as other overused procedure. And this is based on evidence. At the time we had five landmark randomized trials in the New England Journal or JAMA showing that a "restrictive" transfusion strategy was as good or better than a "liberal" strategy. So the timing was perfect back in 2012. And, of course, if you can reduce risk and cost at the same time by reducing unnecessary procedures, then everybody comes out ahead.

Then in 2013, along came the "Choosing Wisely" campaign. And that's when the AABB released their Choosing Wisely aims (that was 2014), including their guidelines for hemoglobin triggers and to advocate single unit transfusions for red cells followed by reassessment. So that led to what I call the "lowest-hanging fruit" in a blood management program, which is what we call the "Why give two when one will do?" campaign for single unit red cell transfusions. And at first I didn't quite like it because I thought it was "too cute," like a slogan, you know, "Why give two when one will do?" I thought it was just too cute. And it turns out it had more impact on overall blood utilization than any other measure that we tried. And it turns out, we were all taught that the "dose" of blood was two units ever since the 1970's or 80's, I guess. And until 2014, when AABB released the Choosing Wisely aim for single unit transfusions, we never really questioned the double unit dose. And so, whether you give your blood at a hemoglobin of 7 or 8, or even higher than 8, I think it makes less difference in overall blood use than whether you're always giving two units versus one. So, that was probably our most successful campaign, but we have about eight or nine other measures in our PBM program that I could quickly summarize if you like.

Joe: I'd love for you to just kind of give us that quick overview, Steve, but I don't want to leave the "Why give two?" thing quite yet, if you don't mind, simply because a lot of people listening to this episode are in places where PBM, believe it or not, is still just kind of getting going. I mean, I know there was a study or a survey a few years ago showing about 38-40% or so of hospitals had patient blood management programs, and I think most of the

big academic places clearly do. But for people that are listening in smaller places that are just getting started with this, tell us how you just, practically, "rubber meets the road," how do you convince clinicians of this? How do you have this discussion about the "Why give two?", just from a really very practical perspective?

Steve: Well, we created an image with the Choosing Wisely logo and a big red font that said, "Why give two when one will do?", and then we put that on screen savers throughout our institution, across the health care system. So you'd watch these "hand washing awards," you know, that the nurses get? They put them on the screen saver, and they're holding their hands up and getting their award. And then you'd see about 10 of those go by, and then you'd see, on the screen saver, the "Why give two when one will do?" message would pop up. I have nothing against hand washing! We all know infection is the number one killer in the hospital (when I look at morbidity at least). But we were happy that they put our campaign on the screen savers, and that made a big difference, because nurses would see the message, doctors, PA's (that's physician's assistants), and nurse practitioners (which happen to give a lot of blood in most hospitals). And also *patients* would see these messages on their screen savers and might even wonder, "Do I need two units?" So that, along with letters in our hospital newspapers, that made a big impact.

Joe: I'd love for you to just kind of take us through some of those practical steps that you have learned are effective in establishing a program.

Steve: Sure thing, Joe. So, everything that administrators and physicians are talking about now is based on "value." And we say that "value equals quality over cost," right? So, the good thing about blood management is you can achieve both at the same time, quality AND cost move in the right direction. With now 10 randomized trials showing what I call, "Less is more" for transfusion, and 4 of those 10 studies show you could actually cause HARM by giving extra blood to certain subsets of patients. So the patients are doing as well or better, while getting less blood. So you're increasing value, not just decreasing cost. So that's my answer to the cost question, because of course the administrators are counting dollars. We have a saying at Johns Hopkins, "You need to cut STUFF or STAFF!" We're trying to cut "stuff" first and save our own jobs and blood fits into that equation.

Now the other methods that we use, I won't go into details but for example **tranexamic acid**, which is an anti-fibrinolytic, is being called a "game changer" now at the national orthopedic meetings. They recently took a

survey at one of these national meetings, and 90% of programs were using tranexamic acid now for their total joint replacements. So, it seems to reduce bleeding and transfusion by about 30% for total joints. So that's a game changer.

We're using "**cell-savers**" or autologous blood salvage for cases in the OR where you can get back at least one unit of the patient's own blood. That seems to be the cut point where it pays for itself. It's an older technique, but we can't forget that it's helpful, and who wouldn't rather have back their own red cells instead of someone else's from the blood bank?

We are **dealing with preoperative anemia** before elective surgeries. Sometimes I like to say, "$4 worth of iron pills can avoid $400 worth of blood." So the experts in the field are saying that "Oral iron doesn't work," but if someone's iron deficient and they have time to absorb iron, it DOES work, and you might not have to go with intravenous iron or erythropoietin, which are the two other methods we use.

Other things, we do, simple things: I'm an anesthesiologist, so during surgery, if we can **maintain normothermia and avoid hypothermia**, then patients will bleed less. That's easily achieved, and we can even use **moderate or controlled hypotension** during spine surgery or orthopedic cases to reduce bleeding. **Newer surgical cautery methods**, **topical hemostatics** like thrombin and some of the other sealants can reduce bleeding. We're using **smaller phlebotomy tubes** in the ORs and in the ICUs. We've shown that patients in our adult ICUs can lose an average of 60 mL a day of blood just due the lab testing. So that's just over 1% of your blood volume in a normal-sized adult. So with smaller phlebotomy tubes and trying to eliminate unnecessary lab tests, we can reduce blood loss that way as well.

And last, but not least, we're doing more **point-of-care testing** in operating rooms to get faster turnaround time. For example, thromboelastography to decide whether patients need what I call "yellow products:" plasma, platelets, or cryoprecipitate. We can get good information from thromboelastography.

Joe: Steve, when we talk about your bloodless program, I know we'll get a little more detail on some of those, and that's great. Before we leave your overall view of patient blood management, I wonder if we could circle back? You mentioned the 10 studies that support the use of a more "restrictive" trigger in terms of transfusing red cells. One thing that I often hear from folks at smaller hospitals that I work with that are trying to get PBM started, is that, "Yeah, okay, that's nice for RED CELLS, but where's the data on that for

platelets and plasma? We have a harder time trying to help our clinicians know what appropriate places to transfuse or appropriate triggers to transfuse for platelets or plasma?" How do you respond to that?

Steve: Oh, that's a good question, because if you look at the guidelines that we have for plasma and platelets that are published, they're all based on either "weak" or "very weak" evidence outside of maybe oncology, where we do have a good randomized trial for platelet triggers and platelet dose. So, we tend to use guidelines from consensus panels based on INR triggers for plasma, or platelet count triggers from the AABB platelet guideline document. And I like to say we use three kinds of information to decide on these "yellow products:" The lab, the TEG, and the clinical picture. So if I'm doing a liver transplant, for example, and I'm on that team, I don't just treat the TEG, I don't just treat the platelet count, I also look at the clinical picture, as well. And if two out of the three say that "you need platelets," then we give the platelets. And I think clinical experience comes into play as well, since we treat patients, not numbers!

Joe: Music to my ears! Before we leave this, what you just said leads to I think a really important question, and I've covered this on previous podcasts, but I really want to get your feeling on it. I fear that as a result of everything that we're hearing over the last few years about the 10 randomized trials you mentioned, the evidence-based transfusion triggers that people are implementing really all over the United States and all around the world, sometimes I fear that just like in the "old days" that you and I both remember, when people had the mistaken belief that you automatically had to get the hemoglobin to 10, for example, and we had to meet that number, I fear that as the pendulum has swung the other way, in some cases, we have scenarios where people are believing that any transfusion of red cells over a hemoglobin of 7 is automatically bad. And I wondered if I could just get your take on that. And you know these are numbers, obviously, but how do we use them? Are they absolute hard and fast, 100% percent rules? Where do we go with this?

Steve: Sure. I'm glad you like the fact that we treat patients not numbers. because...

Joe: That got me started! Did you notice that? [laughs]

Steve: ...well, numbers are obviously easy to audit. But if you look at the 10 randomized trials, every one of them allowed a transfusion based on SYMPTOMS. So, for example, the "FOCUS Trial," the orthopedic study with

hip fracture patients, something like 15% of the patients who got blood in the "restrictive" transfusion limb were not transfused because their hemoglobin was less than 8, but that was based on symptoms. And so then you might ask, "Well, what symptoms count?" Well, in the FOCUS trial they used tachycardia, or hypotension not responsive to fluids, or cardiac chest pain, is what they said. Now I've also heard people use "fatigue" as a symptom. Well, if the nurse keeps you up all night measuring your blood pressure and wakes you up for a Tylenol at 3:00 in the morning, you might have fatigue, and that's probably not going to respond to a transfusion [laughs]. So even symptoms can be subjective, of course. So for example, Jeff Carson, when he designed the FOCUS trial, his primary outcome was ability to ambulate, because he knows that after a hip fracture one of the most important things is to get out of bed and walk. And so, he found, in 2000 randomized patients, that the ability to ambulate was no greater or better with a higher hemoglobin trigger of 10 than it was with a trigger of 8. So I think symptoms and functional outcomes are just as important.

Joe: Everyone listening, as I mentioned, there's going to be a whole lot of different references on the show page for this episode. One that I would highly recommend to you is one that was e-published in "JAMA Internal Medicine" in November of 2017. And again, this will be on the website. [Divyajot] Sadana is the primary author, Steve is the senior author on that paper. Really just an excellent overall view with tons of practical steps. So Steve, a) nice job on that, and b) I think you've put out a lot of really great resources for people, so I really appreciate your approach.

Steve: Thank you, Joe. That was an outgrowth of an organization called the "High Value Practice Academic Alliance," which is a new society that promotes high value care. And so we worked with people at the Cleveland Clinic and New York University (NYU) to put that review article together.

Joe: It's excellent, so I highly recommend that, everyone. So Steve, I've teased this long enough. We've got to get to your bloodless medicine program. So, there's a lot of directions we could go with this, but let's just start from the beginning. Who comes to you guys and is interested in bloodless medicine? I mean is that even possible? Can we actually do medicine and surgery without blood, Steve?

Steve: [Laughs] Well, we all know, historically, it was the patients who came for religious reasons who asked to avoid transfusion (some people would use the word "refuse" transfusion, which has more negative connotations, refusing something), but for years, especially when surgery was more

"invasive" back in the 80s and 90s, these Jehovah's Witness patients would present a major challenge. And now that we've learned all these measures of blood conservation, and now that surgery itself has become more minimally invasive, we're able to do more with less, and we have more tools. Through our blood management programs, we've learned how to provide care to Jehovah's Witness patients, and from the Jehovah's Witness patients, we've learned methods of blood management. So it's a two-way street. And I like to say that for blood management and bloodless programs, you use the same exact methods only one you try to reduce transfusion, and the other you try to avoid it.

Joe: I see, so a bloodless program is really patient blood management to the extreme, right?

Steve: That's exactly what I say in my lectures about bloodless medicine is you're taking blood management to its extreme. So, for example with pre-op anemia management, you're not going to let the patient into an elective hip replacement with a hemoglobin of 11, even though they might be OK; they might not with tranexamic acid. You're going to try to get the hemoglobin above 13. And so this is just good medicine, right? If you're walking around with a hemoglobin of 11, you probably should have an anemia workup, right? Including rule-out, for example, a G.I. malignancy if you're iron deficient. And so, it's really better medicine. We use the cell-savers, we maintain normal body temperature during surgery. We use topical hemostatics. And interestingly, if you worked in the operating room and watch enough surgery, you'll notice that when you bring a Jehovah's Witness patient in for a given procedure, somehow the surgeons lose less blood!

Joe: Coincidentally I'm sure! [laughs]

Steve: I'm not exactly sure what they do, but they do things different. Maybe they're tying off the small bleeders, or maybe the intern doesn't sew the critical anastomosis, but they can lose less blood if they want to, and that's what happens.

Joe: Wow. OK. So, you mentioned obviously the "Witnesses" that are interested in this for obvious religious reasons, and I want to get to some of the specifics about Witnesses and what they will or won't accept. And I know that's individualized, and I want to get to that in a few minutes. But before we do that, I'm wondering, as you guys have established your program there at Johns Hopkins, and you've gotten, deservedly so, good publicity about that, and from everything I've read that you've published, you've had some great

results. Are you seeing more patients that are NOT Witnesses say, "Look, I don't want to get blood donated by another person, either!" Are you seeing more of that as time goes on?

Steve: Oh, that's a great question! So, it depends if you ask the question. If you just put a consent in front of them and say, "Sign here in case you need blood," they're going to sign it. But if you ask them prospectively during their preoperative visit, if you would agree or not agree to blood transfusion, and you tell them the risk and the benefits, then you'll get more and more patients that would rather avoid the transfusion. And they're not Jehovah's Witness patients. And so often they'll say, "Provisionally, I'd like to avoid transfusion, unless my life depends on it." And so we've heard that answer, too. If it's life threatening, then they'll take it.

Joe: OK Steve, again you've published on this, there's a lot of details that people can find actually on the Hopkins Bloodless Medicine website which again I will link from the show page. If you are even remotely interested in bloodless medicine, folks, you should go to this website, because they've done a great job with a ton of resources. Steve, I want to take us through just some practical steps, some of which we've already mentioned, but let's kind of roll through this and talk about the things that you do for these folks prior to surgery, during surgery, and after surgery. So, let's start with pre-op intervention. Someone, practically speaking, makes an appointment to come into your bloodless program, and sits down and talks to your team. Where do they go? What kind of things do you guys do to get them started before surgery?

Steve: Right. Assuming most of our surgery is elective, the most important thing preoperatively is to identify these patients ahead of time, and not the day before the case, or the morning of the surgery, when, if they DO have preoperative anemia, it's a little too little, too late to deal with, and you might end up postponing cases. So the sooner you can find out about patients...that's why we have a website and we have a toll-free phone number, so we can find out about patients from their doctors, or their family members, or the patients themselves ahead of time. We **get their hemoglobin measured often a month before elective surgeries**, so we have time to deal with iron deficiency, or time to stop their anticoagulants, if we can. So, preoperatively, we often get **iron studies**, of course, because we want to know if we're dealing with simple iron deficiency, which responds really well, or what we call now "anemia of inflammation," which we used to call "anemia of chronic disease." So sometimes those patients need aggressive treatment, not just with iron, but also erythropoietin.

But most importantly, we have **graded the surgeries** on a scale for bleeding, from, I like to think of, "low, medium, and high blood loss," because if you're coming for a thyroidectomy, for example, which is definitely in the low blood loss category, and your hemoglobin's 11, you can be fine. You can deal with that diagnosis and treatment of anemia later after the surgery because you're going to lose about a tablespoon of blood during a thyroidectomy. And so, we've ranked the surgeries, we actually use our MSBOS list as a ranking of "degree of difficulty," if you will, for surgeries. So if you're coming in for open heart surgery, like a CABG valve replacement, that's in a high blood loss category, right? So we're going to be much more aggressive in treating anemia, getting your hemoglobin up to a higher target before the procedure.

Joe: Steve, just to interrupt you, the principle just being, the higher you are when you go in, the less likely you'll need to get blood during or after, right?

Steve: Exactly. And we also take into account your body mass. For example, if you have a 40 Kg patient coming for aortic valve, their blood volume is going to be not even 3 L. If you have an 80 Kg patient, their blood volume is going to be almost 6 L. So the allowable blood loss that you'll tolerate to get down to a critical hemoglobin level is directly proportional to your body mass and your preoperative hemoglobin.

Joe: So Steve, you talk in some of the things that you've published about using things like intravenous iron and erythropoietin, which I think you mentioned a moment ago. I think sometimes people get a little nervous and say, "Wow that's kind of aggressive!" How do you respond to that?

Steve: Sure. Well, iron deficiency anemia, some people say, is the most common disease on the planet. Even in this country, we see it quite a bit. And the IV iron proponents will tell you that oral iron is poorly absorbed and poorly tolerated, with constipation and abdominal distress. Every time I donate blood, I take oral iron, and I don't have any side effects at all! So, I think the side effects are sometimes overemphasized with oral iron. But what we do, we started giving the low molecular weight iron dextran called "InFed." And so the beauty of that is you can give a whole gram of IV iron in one visit. So we don't have to bring the patient back three or five times to the infusion center, which adds time, and cost, and inconvenience. So, it turns out that the old, high molecular weight iron dextrans were the ones causing the anaphylaxis, and those are now off the market in America, but the new low molecular weight iron dextran has very, very low incidence of side effects.

Joe: I interrupted you there Steve were you going to say something more about EPO? I don't want to stop you if you were going to say something more about EPO...

Steve: I can just say that it's often poorly reimbursed and it sometimes comes right out of our hospitals budget. So we tried it. It also has a black box warning on the FDA for thrombotic risk and perhaps tumor promotion. So we use it judiciously, and less than 5% of our Jehovah's Witness patients will end up getting preoperative EPO (only when we aim for a high hemoglobin target for a high blood loss surgery and iron doesn't do the job by itself).

Joe: Got it. OK, one more thing on your pre-op: Are you able to, when someone comes into your program, are you able to work with the surgeons on, say for example, choosing one type of procedure versus another that would help your bloodless patients?

Steve: Right. That's a great question. Well, an extreme example would be a coronary artery stent compared to a five-vessel CABG. So, the amount of blood that you're going to lose or require is dramatically less with that less invasive approach. So another example would be prostatectomy. So now the robotic prostatectomies that we do, turns out we transfused 1 patient in the last 800. And when I did open prostatectomies as a resident in anesthesia, they used to all give pre-op autologous donations because they were losing 2 and 3 L of blood with that open surgery. So at first I thought robotic surgery was just a marketing gimmick, you know, because I saw it on a billboard one day, and then I realized that they hardly ever got transfused, and it is really a more precise less invasive approach. And the same is true for hysterectomies now. They're doing those robotically with exceedingly low transfusion rates compared to open hysterectomies. So one of the reasons blood use is down across the United States by 25% in the last decade is less invasive surgery approaches.

Joe: That makes total sense. Ok so what about *during* surgery? What are the kind of things that surgeons CAN do intraoperatively to reduce blood loss?

Steve: Well, the two simplest methods involving anesthesia care are **maintaining normal body temperature**. We've shown that patients, if you don't warm them during surgery, their body temperature will often be under 35.0^{o} C, which happens to be 95.0^{o} F (if you're still on the Fahrenheit system). And below 35 is where patients definitely have more coagulation problems and more bleeding. So just maintaining normal temperature can reduce bleeding. And we have these forced air warming blankets that are

now routine. They cost like $9 apiece, and we use them routinely to maintain body temperature. **Controlled hypotension**, we call it, especially for any surgery involving bone, like spine, or hip, or knee surgery. If you can reduce arterial blood pressure safely to, I call it mild or moderate hypotensive levels, you can reduce bleeding.

Otherwise, during surgery, we have the **cell-saver**, which was invented in the late 1970s. It was super-hot popular during the HIV era in the 80s when the blood was pretty darn high-risk. Everybody wanted cell-saver blood. And it's still a great way to do blood conservation. We tend to shy away from it for any cancer cases, because we're concerned that maybe some cancer cells will be redistributed into the bloodstream, but for orthopedics and cardiac and vascular surgery we still use the cell-saver quite often. Plus, you're giving patients back their own blood that hasn't been stored. We won't go into the storage lesion, but this blood is "fresh," and it's only been outside your body for maybe an hour. So you're getting red cells and saline back when you give them back cell-saver blood. So if you give too much of it, you're going to get a dilutional coagulopathy. There's no clotting factors or platelets in cell-saver blood.

Then the surgeons, they have these newer cautery methods. They call it the **"harmonic scalpel"** that burns while it cuts. It's like a "hot scalpel!" And then they have this new **"saline-irrigated bipolar cautery"** that you can cut right through the liver, believe it or not, and it seals off the blood vessels. I even have videos of this new saline-irrigated bipolar cautery doing incision right through the liver without bleeding. And **topical hemostatics** have been around forever. Now the companies actually market them pre-packaged: Thrombin, and gelatin, and fibrin glue and other sealants, that if you have raw surface bleeding during surgery, the topical hemostatics are definitely effective.

Joe: Steve, those are terrific and there's one other thing that I wonder if you just thumbnail for us? I remember back, 10-15 years ago or even longer, I remember hearing people talking about **"acute normovolemic hemodilution,"** and it seemed like it kind of went out of vogue for a while. But I know that's an important part of what you guys do. It kind of bridges the "pre-op" and "during surgery" time frames. For those that aren't familiar with it, could you just thumbnail acute normovolemic hemodilution for us?

Steve: Sure, what it is, it's really a pre-op autologous donation, if you will, but you're doing it in the operating room prior to incision. So we put in a big line in

an IV or even an arterial line, and we pull off between 1 and 4 units of autologous blood into citrated anti-coagulant bags, CPDA...

Joe: Just standard blood bags, Steve? Just standard blood donor bags?

Steve: The same blood bag that the Red Cross uses when you donate. It even has a needle on the end that they stick into your arm! [laughs] It's the same bag. And so, the beauty of the ANH technique is you're actually pulling off whole blood. So this has red cells, plasma, AND platelets, and it's citrate anticoagulant, so you can store this blood right in the room for up to six hours at room temperature. So that when they bleed, before the bleeding starts, we give crystalloid and or colloid. So we've hemodiluted the patient, so if you come in with a hemoglobin of 14, and we take off, say 3 units, and then dilute you down to a hemoglobin of 9, then you're going to bleed "more water than cells," I like to say, because you're conserving red cells in that pre-donated blood. And then when the bleeding stops, when the surgeons start to close, you can give back these units of whole blood, not only the red cells but also the fresh clotting factors and platelets, that, by the way, you would have lost if you just used the cell-saver. So it has that advantage over cell-saver blood, that you're getting whole blood. So we've been doing this a lot now with cardiac surgery if they come in with a nice healthy hemoglobin to start, because the clotting factors in the platelets make a big difference after you had a run on the cardiopulmonary bypass.

Joe: And in your experience Steve, is that something that Jehovah's Witnesses will accept?

Steve: So, about 95% of our Jehovah's Witnesses will accept all these alternative techniques, like cell saver, or ANH, or even albumin. About 95% of them will accept these blood conservation techniques. It's a personal decision for them. They say in their literature that "you have to make your own conscious decision on what's acceptable." But the only thing the Watchtower Society tells them that's not acceptable is red cells, plasma, and platelets (and also white blood cells, but we hardly give any of those).

Joe: OK, so potentially, you've seen some that will even accept things like cryoprecipitate, for example?

Steve: [Laughs] Funny you should mention cryo, because none of my clinician friends can figure out why, but the Jehovah's Witness patients and their literature from the Watchtower Society considers cryoprecipitate to be a "minor fraction" of blood, kind of like albumin. In other words, they're derived

FROM blood, and they're a personal decision, but they're not "off-limits" like red cells, plasma, and platelets. So it's funny, they will, like 95% of them will accept the albumin and the cryoprecipitate and individual clotting factors, even PCCs.

Joe: Oh wow!

Steve: We haven't had to give much PCC, but they consider that a minor fraction that's derived from blood, and a personal decision.

Joe: Interesting. That's actually very interesting. I think a lot of people will find that surprising. So Steve, you had mentioned...I don't want to forget to do the post-surgery stuff. Those are some awesome, awesome tips for intraoperative things. One of the things that I know you've experienced, I've certainly seen it in my role as a transfusion medicine doc, is that the patient gets out of the OR and they're doing okay, their hemoglobin is stable, and wow, just "magically" over the first couple of days (and I say that in quotes), "magically" over the first couple days after they are post-op, their hemoglobin drifts down, and suddenly they're needing a little transfusion to top them up. So obviously, that's a setup, that's a "softball on a tee" for you there, Steve! So what kind of things can you do post-op?

Steve: Well I like to say that, "Hemoglobin almost always goes DOWN while you're in the hospital." It's very unusual to see it *increase*. And one of the reasons is **blood loss due to phlebotomy**. So especially in the ICUs, we send so many lab tests, that...We took a survey in our adult ICUs at Johns Hopkins and we found that the average adult was losing 60 mL a day of blood due to lab testing. And some of that blood was being thrown in the trash to clear the saline out of the lines, you know, from a central line or an arterial line, to get an undiluted sample. And then the rest of the blood is being sent to the lab in phlebotomy tubes. So we started using smaller phlebotomy tubes in all of our ORs and ICUs. It turns out phlebotomy tubes come in three sizes: I call them "adult, pediatric, and neonatal." So, the lab doesn't exactly like the neonatal tubes, because they're so small and they don't have a rubber port on top. You have to unscrew the cap. They have to be run by hand, manually, so we only use the neonatal tubes for true neonates and some Jehovah's Witness patients who are in ICU for a while. But we pretty much switched to the medium-size, the pediatric tubes that hold between 2 and 4 mL, whereas the adult tubes, depending on the color of the top, hold between 5 and 10 mL. So the smaller tubes have made a big difference.

Joe: And most labs are ok with getting those pediatric-sized tubes?

Steve: [Laughs]

Joe: [Laughs] Or is "OK" too strong a phrase?

Steve: The only drawback is some of the tubes, depending on the color...we have blue tops that are 1.8 [mL], and gold tops that are 4 [mL], but some of the really smaller volumes don't have enough leftover sample for add-on tests. So if your lab has a lot of add-on tests, where you call down to the lab and want to add something on, you might need a bigger tube, but that doesn't happen too frequently.

Joe: So Steve, I want to bottom line this before we go, because as I mentioned, you've published a lot about this. So I want to talk a little bit about how this is working. And I guess my first question is just from the perspective of...your intent is to be a "bloodless program," so do you have statistics on what proportion of the patients that come through your bloodless program actually do not get someone else's blood?

Steve: Well, we honor their wishes when they come in, and we tell them risk and benefits, and they sign a consent asking to avoid transfusion. As long as they're 18 years of age or older, we honor those wishes. So the only patients in a bloodless program are at risk for allogeneic transfusion are the minors under 18 years of age. And so, legally, we're not allowed by the court of law to deny a lifesaving transfusion to a minor in a Jehovah's Witness family. And we tell the parents that we can't withhold blood in a life-saving situation. And nine times out of ten, the parents are relieved. We'll tell them that we're going to do everything possible to avoid the transfusion. We'll tell them all these great conservation techniques we're going to use. And then they're relieved that we don't have to go to court to get a court order that we're legally obligated to save the child's life if it comes to that situation.

Joe: Is there any surgery that people come to you and say, "I want to do bloodless," that you say, "Oh man, THAT'S too much!" I mean, like for example, if someone was to get a liver transplant, can you even SAY that you could do that in someone with a surgery like that?

Steve: So good question. So most of our liver transplants are too sick to start with. Many of them have severe pre-op anemia and thrombocytopenia. And so, there are some programs in the country that will entertain Jehovah's Witness patients for liver transplant, in the perfect scenario. We have not done a liver transplant. We haven't done a thoraco-abdominal aortic

aneurysm. But short of those two cases, we've done every other kind of surgery that you can name. So you happened to pick the one that we're still working on how to get that done.

Joe: [Laughs] Well still, it's amazing what you HAVE done, and that wasn't meant to be judgmental. I actually didn't know the answer to that question! That was just me being curious. So I guess the two other super-important questions before we go: First, do you have data on clinical outcomes for your patients that are enrolled in your program? And second, do you have data, because as you said before, we're living in a world where everyone's looking at cost and value, do you have data on costs for your program?

Steve: Oh, so yeah, good question, Joe. So we did a propensity-matched case control study in 2014 in the journal "Transfusion." We took the first 300 patients when we started our bloodless program and matched them to a comparable control group. And we looked at morbidity, mortality, and cost. So these are patients that get what I call, "extreme blood management." We do everything we can to optimize blood loss and avoid transfusion. And we found that when you look at heart attack, stroke, renal and respiratory and thrombotic events, there's no difference in those outcomes between bloodless patients and the control group. When we looked at infection, that's hospital acquired infection, they had about half the incidence of infections, but the P-value was 0.08 (probably because it was a small sample size) and mortality was lower in the bloodless group, but the p-value was just under 0.05, and we were under- powered to look at mortality anyway. So, bottom line is the patients do as well or better for outcomes, and the cost difference was about 12 to 15% lower cost in providing bloodless care compared to conventional care. And we've seen other studies like this, but many of them are focused on cardiac surgery, and there's not a whole lot of those either. So most of the results show that you can achieve outcomes as well or better.

Joe: Steve, this has been a terrific look at your program, at patient blood management in general, bloodless medicine specifically. I think you've given us a ton of things to think about and a ton of great tips, so I'm going to throw it to you to just close this out. Is there anything you'd like to leave us with as we as we move forward with this?

Steve: I just want to thank you, Joe, for featuring not only blood management but also our bloodless program. And, I just want to thank you for being so passionate yourself in this field.

Joe: It is my pleasure. I'm happy to do that. I'm going to actually roll you back around to your "buzz phrase!" Can you give that to us one more time? Your bumper sticker, the way that you look at patient blood management?

Steve: Sure. I like to say that "Blood saves lives when you need it, but only increases risk and costs when you don't."

Joe: Well, such an honor to have you, Steve! Thank you so very much for being here!

Steve: Thank you, Joe! Hope to talk to you soon.

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Joe: I hope you enjoyed that discussion! I'm pretty sure you came away from it with some ideas for improving your own blood management program, even if you aren't ready for bloodless medicine just yet! I will tell you, however, that I agree with Dr. Frank when he says that bloodless medicine is not just being discussed by Jehovah's Witnesses anymore!

You'll find a ton of references on the show page for this episode at BBGuy.org/048, so be sure to check it out. You can also give your feedback and comments at the very same page! I read every single comment and respond to most of them. Do me a favor and give an iTunes review when you have a chance, as well. You can email me directly through the BBGuy.org site, as well as the direct email comment@bbguy.org.

I hope you'll join me again in a couple of weeks, when Dr. Jeff Winters from Mayo Clinic returns to discuss emergency removal of white blood cells and platelets. As always, my goal is always to bring you discussions to help you understand the essentials of blood banking and transfusion medicine!

So, until we meet again, my hope is that you'll smile, and have fun, and above all, never EVER stop learning! Catch you next time on the podcast!