

MALE 1: Next topic is Future of Stroke [00:00:05]
Thrombectomy Device. Welcome Dr. Dileep. [00:00:10]

DILEEP R. YAVAGAL: Thank you. [00:00:15]

Thank you, [PH 00:00:16]

Zifeng. Thanks to the meeting committee for inviting me. [00:00:20]

I'm going to address a [00:00:25]

technology that's really come up on the horizon recently [00:00:30]

of cyclical aspiration. But to just -- I'm sorry, the-- [00:00:35]

my Conflicts of Interest slide is missing. I consult for Medtronic, [00:00:40]

Cerenovus, and Rapid Medical. But I have no conflicts of [00:00:45]

interest with the topic of this presentation. So, [00:00:50]

we started with first-generation stent-retrievers. Many [00:00:55]

of you are very familiar. But for the trainees, we actually tried anything and everything.

[00:01:00]

And this was a small device, [00:01:05]

which is a snare that we tried to use. And MERCI certainly got us going. [00:01:10]

And then we had the big jump forward, second-generation devices. [00:01:15]

And although we are used to in the US, Medtronic and [00:01:20]

Solitaire and Trevo, there's other European devices that really [00:01:25]

added to this revolution, Preset, Catch and [00:01:30]

Aperio. And we are in the third generation. Really great [00:01:35]

progress. We have segmented retrievers. EmboTrap is now approved. [00:01:40]

And 3D is approved. And 3D is considered more of an [00:01:45]

assist-stent retriever, but it's very much there. It's approved to be [00:01:50]

used with the ACE catheters. And then MicroVention has the ERIC [00:01:55]

device that's, again, segmented. And we are up to the fourth-generation. We should [00:02:00]

really be pretty excited about this. We have the [00:02:05]

retrievers that have, like the Versi has [00:02:10]

this very cool design of segments that [00:02:15]

conform better to the vessel. I'm sorry. [00:02:20]

Yeah. And then NeVa is another device. And then Rapid Medical has [00:02:25]

the stent-retriever that can be inflated and deflated in the vessel [00:02:30]

with the interactive design. So, the [00:02:35]

US has these four approved retrievers [00:02:40]

and Phenox may be coming soon. But what we really are seeing [00:02:45]

in our practices and in the literature is that Aspiration has really come to the fore, [00:02:50]

either as first-line or in combination with stent-retrievers. [00:02:55]

And the survey published in SNIS, by JNIS [00:03:00]

I mean, showed that 40% of neuro-IRs, [00:03:05]

40% of neuro-interventionalists are using aspiration and at least one-third [00:03:10] in combination with the stent-retrievers. In my own practice, I [00:03:15] have a first-line stent-retriever policy, but I'm combining aspiration a fair bit. [00:03:20] The ease of use clearly has led to this being adopted globally. [00:03:25] But also, the data from the COMPASS trial [00:03:30] suggesting that there is 50% less cost [00:03:35] is driving this adoption. And [00:03:40] certainly, the equivalence of this technology with stent-retrievers from ASTER and COMPASS [00:03:45] gives a lot of confidence. And what Aspiration does is [00:03:50] intuitively straightforward, but if you break it down mathematically, [00:03:55] it's not that complicated. You have a suction force, the green arrow [00:04:00] that's pulling this clot down, and then the friction [00:04:05] that is maintaining the clot in the vessel [00:04:10] and sticking it to the vessel wall. There is some collateral [00:04:15] pressures that are actually helping the suction. And what we have had [00:04:20] is constant suction as our [00:04:25] technique. And we certainly understand [00:04:30] that the force is equal to pressure into area. So, if we [00:04:35] use the same force of suction and the maximum one can go is minus 29 millimeters, [00:04:40] if we want to increase our ability to suck this clot out, you need [00:04:45] to increase area. So that's what's happened. We have had [00:04:50] the luminal diameters that have increased of the catheters, and we've had [00:04:55] more and more success with it. They've become more navigable. But what we [00:05:00] have in unmet need is anything that we can modify with this pressure. [00:05:05] We are stuck with minus 29 as the maximum pressure that one can [00:05:10] physically grow on earth, and that can [00:05:15] be possibly changed by changing the way this pressure is applied. [00:05:20] And cyclical pressure or cyclical suction to remove the clot [00:05:25] is something that's quite interesting. But I'll come to that in a second. These were the initial [00:05:30] diameters, and it's just astounding to me that we are almost up to [00:05:35] 0.72 inches, which is the limit, I think. But you [00:05:40] never know. Our med device companies and startups are amazing, and I feel like [00:05:45] one day, we will just have catheters that are possibly [00:05:50] even bigger. But the idea of [00:05:55] the suction pumps has also evolved. We are [00:06:00] going to higher pressures, and then, we are also able to collect clots [00:06:05] with the newer generation pumps and have higher vacuums, and cyclical [00:06:10] suction is being developed as a new [00:06:15]

technology that's unmet. This group from Virginia, Commonwealth [00:06:20] University, Scott Simon and such, published a very interesting paper [00:06:25] that showed, and I have the reference here, but they showed [00:06:30] that cyclical aspiration when compared to just a uniform suction led [00:06:35] to a much higher speed of aspirating synthetic clots [00:06:40] in an in vitro model. And that is certainly [00:06:45] something that's fairly new, and their idea was, this is [00:06:50] not from their paper, this is from an abstract that's being presented tomorrow [00:06:55] at SVIN, but their idea is that with uniform suction, the [00:07:00] pressure that's applied to the face of the clot is constant, and the friction is [00:07:05] maintaining it here, whereas the cyclical aspiration could actually [00:07:10] tug it out of the vessel wall better, and that's what they [00:07:15] found in their in vitro model, and that's what other groups are also finding. [00:07:20] And here is a video of a cyclical aspiration of a slow [00:07:25] clot, and what you can see is that the [00:07:30] clot is pretty rapidly ingested as the [00:07:35] pressure is varied at the face of this clot, and you can see that [00:07:40] there is a moment of aspiration [00:07:45] where the pressure is low, and then, you suddenly tug the clot back [00:07:50] as the pressure increases. And so, the idea of [00:07:55] cyclical aspiration is to basically create [00:08:00] a negative force, and then [00:08:05] relax it for a brief second, and then again [00:08:10] reapply high pressure. [00:08:15] What you see with the regular aspiration is that you [00:08:20] have the uniform aspiration is you have a collar, [00:08:25] and the clot is stuck, and a lot of clot is hanging out. So here is a uniform suction [00:08:30] video in vitro, and you can see that beyond a certain point [00:08:35] with a bigger clot, you have to pull a large amount of clot [00:08:40] that may be outside. If you go to a [00:08:45] cyclical aspiration, the idea is that, and [PH 00:08:48] Matt Gounis has worked on this [00:08:50] a fair bit, and in personal communications and other conferences that he's presented this at, [00:08:55] the thought is that when you relax that brief second of pressure, [00:09:00] you accordion the vessel and possibly separate the clot out a little better [00:09:05] from the vessel wall, and you have a higher amount of clot. So here is a video of [00:09:10] cyclical aspiration, and you can see that the clot sort of [00:09:15] tugged free a little easier, the same clot that was similar in size to the previous [00:09:20] video. So, the data on this is [00:09:25]

coming out in a furious way, and we'll [00:09:30]
see more of this, but the intuitive mechanism of why this may work better [00:09:35]
is, again, that you have these clots that are pretty stuck, [00:09:40]
and cyclical aspiration may get them unstuck better. So fairly [00:09:45]
intuitive mechanism, and also the safety of this technique may be [00:09:50]
higher. Here is a [00:09:55]
large animal, a peripheral model where this clot was [00:10:00]
aspirated from an M2-sized [00:10:05]
vessel, and you have spasm from uniform aspiration, but with cyclical aspiration, [00:10:10]
the spasm is less. So, there may be safety aspects that may be better, including [00:10:15]
the fact that if you ingest the clot fully, you may have less [00:10:20]
ENT, less breakage of the clot and less embolization [00:10:25]
to non-territorial vessels. So, I think we are in an [00:10:30]
exciting era of growth in aspiration [00:10:35]
technologies. For thrombectomy, aspiration has been widely [00:10:40]
adopted with or without stent-retrievers, and the reasons are [00:10:45]
out there. There is ease of use. There is lower cost and [00:10:50]
scientific evidence that it's as good as stent-retrievers as there. There is [00:10:55]
certainly an amazing evolution in the navigability of larger catheters, but [00:11:00]
cyclical aspiration has a tremendous promise. We have something going [00:11:05]
beyond all the pumps that we have right now where we could really [00:11:10]
change our ability to aspirate large clots [00:11:15]
and do them better with a better first pass rate. So, I'd like to [00:11:20]
close with saying that this is something that [00:11:25]
we should watch, and possibly, could be the future of aspiration. [00:11:30]
Thank you so much. I really appreciate your attention. [00:11:35]