Episode Book

EPISODE #5943

Tourniquets From Belts and Socks: What Actually Works

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SYNOPSIS

When a group of students was caught in an explosion on the Ramim Ridge in the Upper Galilee, there were no commercial tourniquets on scene — so they improvised from belts and socks, in one case coached over a video call by a father simultaneously scrambling rescue services. This episode digs into what the major first aid and military organizations actually recommend about improvised tourniquets, whether there's a real hierarchy of materials, and what separates one that works from one that makes bleeding worse. The honest state of the evidence starts with a hole: there are no human studies comparing manufactured and improvised tourniquets for severe bleeding. What's left is manikin data, simulation, and retrospective accounts — and they tell a stranger story than the internet version, where the belt you're told to grab is on the military's do-not-use list and a single stick changes everything.

TRANSCRIPT



Corn

Most of what gets written about tourniquets starts from the assumption that when you need one, you'll have one. Daniel wants to know what happens on the ridge when that assumption is wrong.



Corn

Here's the scene he sent us. On the twelfth of October, a group of students from a yeshiva in Ma'alot were on a hike in the Upper Galilee, on the Ramim Ridge near Mitzpe Pe'er. An unexploded munition detonated. A fourteen-year-old named Elazar Yair Wilensky was killed, more than twenty kids were injured. Fourteen ambulances went out, three military rescue helicopters, and the Education Ministry shut down school trips along the Lebanese border and the northern Golan for forty-eight hours.



Corn

And here's the part Daniel wants us to sit with. There were no commercial tourniquets up there. So the students made them out of belts and socks, and in at least one case a boy video-called his father, Dvir Klein, while Klein was simultaneously scrambling the IDF and Magen David Ambulance, and the father talked him through how to build one.



Herman

Magen David Adom.



Corn

That's what I said.



Herman

Ramim Ridge, October. That's a hike that was supposed to be a hike.



Corn

Daniel's actual question is narrower than the headline. He wants to know what the major first aid organizations actually recommend about improvised tourniquets, whether there's a real hierarchy of materials, what separates one that works from one that makes things worse, how you'd build one from what's in your bag, and whether coaching an untrained kid through it over a phone is realistic. He also wants the honest state of the evidence.



Herman

And the honest state of the evidence starts with a hole. There are no human studies comparing manufactured tourniquets to improvised ones for severe bleeding. None. Everything we have is manikins and simulation, plus retrospective stuff from real events where the two got mixed together. ILCOR's first aid task force said that outright when they published their review at the end of 2019.



Corn

Which is why the recommendations come out so hedged.



Herman

They come out hedged because the evidence is thin and everybody in the room knows it. ILCOR's line is a weak recommendation, very low certainty evidence, that a first aid provider use a manufactured tourniquet rather than an improvised one. That's the headline. Now read the sentence after it, because that's the sentence this episode is about. If a manufactured tourniquet isn't available and direct pressure can't control the bleeding, providers could consider an improvised tourniquet, made to appropriate specifications. They even put the specification in the parenthesis. Wide and tight.



Corn

Two adjectives and a prayer.



Herman

That's a fair characterization of how much design guidance the civilian consensus gives you. The American College of Surgeons trauma committee says use an improvised one only if no commercial one is available, and then declines to say how to build it. The Stop the Bleed program, which is the ACS civilian arm, in the Cornelissen review, is reported as pushing direct pressure when there's no commercial tourniquet. JAMA has a paper from



Herman (continued)

2017, Galante, that says hold direct pressure for fifteen minutes, and if it's still bleeding, go to a band-and-windlass design.



Corn

Fifteen minutes of direct pressure with a bomb just having gone off.



Herman

With a bomb just having gone off, with twenty injured kids, with one pair of hands per casualty and no gauze worth the name. That's the situation where the theory and the ground don't meet. And then you get the military documents, which are a completely different register.



Corn

The military ones are the ones that actually specify how to do it.



Herman

Because the military has to. TCCC's skill card, published March 2021, states an improvised tourniquet should be used only as a last resort when a recommended tourniquet is not available. UK Defence Medical Command, last reviewed in January of this year, says improvised tourniquets are only to be used in extremis where an issued tourniquet is not available. Same posture. And then both of them, unlike the civilian bodies, hand you the measurements.



Corn

This is the part I want to dig into, because the word hierarchy implies somebody ranked things, and I want to know if they actually did.



Herman

They did, and the ranking is not intuitive. TCCC's spec for the strap: more than forty inches long, folded to at least two inches wide. Cravat, bandana, trouser leg, towel, necktie. For the windlass: a quarter inch to an inch in diameter, four to six inches long. A dowel, a broom handle, a cleaning rod, a freshly cut limb. A branch. They mean a branch. The list of inappropriate materials is the interesting half. Electric cords, belts, wire, or anything under two inches wide. Single pens or pencils. Ground clutter wood. Polished metal. Boot laces. Zip ties.



Corn

Belts.



Herman

Belts are on the list. Second entry.



Corn

So the exact improvisation the students reportedly reached for is the one the military puts in the do-not-use column, right next to extension cords.



Herman

UK Defence Medical goes further and gives you numbers. Band at least a hundred centimeters long and five centimeters wide. Windlass between half a centimeter and two and a half centimeters in diameter, ten to fifteen centimeters long. And the Röhrich review from 2019, the one in the Journal of Special Operations Medicine, recommends specifically against belts as a first choice. High failure rate, and hard to combine with a windlass. That second reason is the one that matters.



Corn

Because a belt doesn't take a windlass well.



Herman

A belt is stiff, it's wide, it has a buckle, it doesn't knot the way cloth knots, and the windlass needs a knot to sit on. You can get a windlass onto a cravat. Getting one onto a leather belt in a way that will hold tension is a different problem. And everything Röhrich tested says cravat-like fabric is the best available answer. Strap at least two centimeters wide, they found two to ten centimeters adequate, and a rod twenty to thirty centimeters long, hard, and non-bending.



Herman

Non-bending is the whole sentence. And that gets us to the windlass, and this is the single most important technical fact in the episode. Altamirano's group tested improvised tourniquets on a manikin thigh. Without a windlass, they failed to stop bleeding in seventy-nine of eighty tests. That's ninety-nine percent failure.



Corn

And with a windlass?



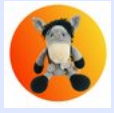
Herman

Thirty-two percent failed. Which is terrible, and it's also the difference between a tourniquet that essentially never works and one that works two thirds of the time. Pulse stoppage, same study: a hundred percent failure without a windlass, thirty-one percent with.



Corn

So you take a category of object that is basically useless and you add one stick, and it becomes marginally useful.



Herman

Marginal is the honest word and I want to keep it. There's a second study, Lyles, manikin model, same journal, same year. Commercial CAT tourniquet, a hundred percent effective. Improvised bandage, forty percent. Improvised bandana, ten percent. So it's not that improvisation is good. It's that improvisation is a spectrum from ten percent to something in the sixties, and the thing that moves you along that spectrum is the rod.



Corn

Herman, why does a stick change the number that much? I want the mechanism, not the statistic.



Herman

Because a tourniquet has to deliver pressure you cannot deliver with your hands. You can pull cloth tight with maybe forty, fifty pounds of force, and you can hold that for thirty seconds before your grip starts to go. A windlass is a lever and a ratchet. You twist it, and the twist converts a manageable rotational effort into tension in the band that is simply not achievable by pulling. And then the twist holds itself, because the rod is locked against the knot. That's the part people miss. The windlass isn't a tightening aid, it's the mechanism of the tourniquet. You're not making a tight bandage and adding a stick. The stick is what makes it a tourniquet.



Corn

And that's why the manikin failures without one were almost total. The band was there. The occlusion wasn't.



Herman

And here's the historical part of it, which I find grimly clarifying. Boston Marathon, 2013. Twenty-seven improvised tourniquets were applied to casualties. Twenty-seven. On arrival at hospital, all of them were ineffective. All twenty-seven.



Corn

That's the number the coverage from that day never carried.



Herman

It didn't, and neither did the follow-up. And the Röhrich review's hypothesis for why is one sentence, and I'll quote it because it's the best sentence in the literature: not using a rod is associated with nearly universal failure. Twenty-seven improvised tourniquets, none with a windlass, essentially none working. And Kragh's testing in Wilderness and Environmental Medicine in 2015 explains the second half of that. He tested windlasses themselves. Single windlasses broke constantly. Chopsticks snapped. Pencils snapped. Craft sticks snapped. At two windlasses, only the chopsticks survived without breaking.



Corn

Let me make sure I have the through-line. The single pen the internet tells you to use as a windlass is a pen that will snap, and the chopstick snaps once and survives twice.



Herman

That's the through-line.



Corn

So the popular version of this gets both ends wrong. Belts instead of cloth, one pencil instead of several chopsticks, and no windlass at all in most of what people picture.



Herman

And there's a fourth thing, which is worse than all three of those, and it's the venous tourniquet. This is the Cornelissen systematic review, European Journal of Trauma and Emergency Surgery, 2019. If the pressure in the band is high enough to occlude the veins but too low to occlude the arteries, you have created a tourniquet that stops blood leaving the limb while blood keeps arriving.



Corn

Which means it's filling.



Herman

It's filling. It's congesting, it is making the bleeding worse rather than better, and it can produce compartment syndrome on top of that. There's a specific reason a lay rescuer produces this state and it isn't stupidity. It's that the casualty is screaming. The band is tight, they're in agony, and the natural human response is to stop twisting because you're hurting the person you're trying to help. So you stop one turn of the windlass short of occluding the artery, and the thing you built is worse than the pressure you were applying with your hands before.



Corn

That reframes the whole problem. The failure mode isn't that the improvised tourniquet isn't tight enough to work. It's that there's a band of tightness where it works against you.



Herman

There is, and I'd guess it's wider than people imagine. And it's the reason Cornelissen's authors come to the conclusion they come to, which is a genuine provocation. Their conclusion: the use of and training in improvised tourniquets by civilian immediate responders is not recommended, because of limited efficacy and safety concerns. Direct pressure is a viable alternative.



Corn

Now hold on, because that conclusion sits strangely next to their own data. I want to put the contradiction on the table.



Herman

Good, because it's the most interesting thing in the literature. The Cornelissen review covered twenty studies, and in some of the simulated and real settings, improvised tourniquets outperformed commercial ones on success rate. Band-and-windlass designs performed the most consistently of the improvised group. So you have a review whose evidence base suggests the technique can work, whose conclusion says don't teach it.



Corn

That's not a contradiction in the science. That's a difference between efficacy and policy.



Herman

Say more.



Corn

Efficacy is what the device can do in the hands of someone who knows what they're doing. Policy is what you tell an untrained public to attempt when the alternative is direct pressure, which is hard to get catastrophically wrong. Cornelissen's authors are writing the second document. Their data is the first document. Both can be right.



Herman

That's the cleanest framing of it I've read, and it explains the whole shape of the recommendations. Look at which organizations give you specs and which give you a shrug. TCCC and UK Defence Medical give you millimeters, because they train the skill and they need the trainee to build the right object. The American College of Surgeons gives you nothing, because it doesn't train it, so it doesn't want a spec that implies endorsement. The specificity is a signal of institutional confidence. The vagueness is a signal too.



Corn

And ILCOR is the interesting one, because it gives you a weak recommendation and then two adjectives. Wide and tight. That's a spec written by a committee that has read the manikin studies and does not believe a phrase like two inches wide is going to mean anything to someone kneeling over a bleed.



Herman

Or, to be fair to them, they think telling someone to make it wide and tight is more useful under stress than a number they won't remember.



Corn

Then let's do the practical version, because Daniel asked for it and because I think a listener who takes one thing out of this should have the sequence, not the philosophy.



Herman

The sequence, per TCCC, is this. Find a strap or cloth more than forty inches long. Fold it to at least a couple of inches wide. Wrap it around the limb, at least a couple of inches above the wound, and not over a joint. Tie a half knot. Lay the windlass on top of that half knot. Tie a full knot over the windlass so the rod is captured. Twist the rod until the bleeding stops. Then secure the rod so it cannot unwind, because the rod is only holding that tension as long as it doesn't rotate back.



Corn

How do you know it worked?



Herman

Three checks. The bleeding stops. The pulse below the tourniquet disappears. And the band is visibly indented into the limb. If you have two of those three, you keep going. If you have none of them, you're probably in the venous-tourniquet band, and the correct move is to keep twisting, not to loosen.



Corn

Keep twisting through the screaming.



Herman

Keep twisting. That's the counterintuitive instruction and it's the one that gets people killed. The pain is the thing working.



Corn

Now the harder question, and the one that comes straight off the ridge. Can you talk someone through this on a phone?



Herman

Let's be honest about what we know. ILCOR notes that simulation studies show lay providers can apply a tourniquet with minimal training. There's also a study out there, it's on PubMed, number three one nine six one seven five six, of lay callers applying a tourniquet following protocol-based dispatcher instructions. I could not get the results.



Corn

Couldn't get them how?



Herman

The journal page was behind a challenge and I couldn't retrieve the full text. So I know the study exists, I know what it was asking, and I do not know its success rate. I am not going to guess at it.



Corn

Fine. What do we know about the people who did receive training?



Herman

This is the part that should worry anyone who thinks a phone call fixes this. The Goralnick PATTS trial data, quoted in Röhrich. Eighty-eight percent of trained participants applied a tourniquet correctly. Sixteen percent of untrained participants did. And roughly half of the trained group had lost the skill when they were retested three to nine months later.



Corn

Half.



Herman

Half. In under a year. These are people who sat through a course and practiced on a manikin. So the idea that a father on a video call, who is himself not a medic, is going to transmit a novel psychomotor skill to a fourteen-year-old in the middle of a mass casualty event, and that the fourteen-year-old will execute it correctly on the first attempt, on a friend, while other children are screaming... that's working against a very steep curve.



Corn

And yet the kids in that report did apply tourniquets, and the EMT who arrived, David Radko, said he gave them instructions and they listened and followed them. There's a line from the civil defense person, Tamir Duadi, about them sitting there holding their friends and making tourniquets. That happened. The curve being steep doesn't mean nobody climbs it.



Herman

No, and I want to be careful not to talk myself into saying the phone call was pointless. The phone call gave them a procedure when they had none, and the alternative was doing nothing. But the evidence says the version of the procedure that arrives over a phone call, from a non-medic, to a non-medic, in a hurry, is probably going to be the intuitive version. Belt, sock, no windlass.



Corn

So let's put the effectiveness numbers side by side, because I want the size of the gap to be concrete.



Herman

Salchner, Wilderness and Environmental Medicine, 2023. They built an improvised tourniquet out of a space blanket with a carabiner as the windlass. Complete occlusion of the radial artery in about fifty-two percent of applications. Traces of perfusion persisted in forty-eight percent. The CAT, in the same setup, got to a hundred percent, and it took twenty-seven seconds against ninety-four for the improvised version.



Corn

So half the time, and three and a half times the setup time, and even the good improvised build fails half the time.



Herman

And that's a space blanket and a carabiner, which is a better improvised kit than a belt. And then there's the AAST multicenter study, 2022, which is the closest thing we have to real-world data. Thirteen hundred and ninety-two injured limbs, prehospital. Tourniquets controlled bleeding in about eighty-eight percent. Improvised ones showed up in forty-two of those patients. And the patients who got a tourniquet were less likely to arrive in shock, thirteen percent versus seventeen point four.



Corn

Which is the actual endpoint. Not whether the bleeding stopped in the field in the abstract, but whether the patient arrived at the hospital with blood pressure.



Herman

That's what all of this is for.



Corn

Herman, let me push on the thing that's been bothering me since we started. The ICRC publishes a pre-hospital tourniquet guide, publication four seven four zero, dated October of 2023, written specifically for resource-scarce, long-transport settings. That's the document for the ridge. Not the field manual, not the hospital protocol. The document that assumes an ambulance is an hour away.



Herman

Yes, and that's the correct framing for the whole episode. Everything I've quoted is one of two documents. There's the document for when the ambulance is coming and there's the document for when it isn't. TCCC, UK Defence Medical, ICRC, those are the second kind. They train the skill and they write the spec because their people are going to be alone with the casualty. The ACS and ILCOR are the first kind. They assume a system is en route, and their advice reflects that.



Corn

And the Israeli students were the second kind, whether the guidance was written for them or not.



Herman

They were the second kind, with a belt, with a sock, with a father on a video call, and with no windlass mentioned anywhere in the reporting.



Corn

Not mentioned isn't the same as not used.



Herman

True. I don't know whether they used a rod. I only know that the reports describe belts and socks and instructions over a call. But the evidence is unambiguous about what happens to an improvised tourniquet without a rod, and it's unambiguous about what happens to a belt used as the band, so we can at least say what the odds were.



Hilbert

The word I'd push back on is improvised.



Hilbert

You keep saying improvised like it means made up on the spot. A windlass is not made up. It's a stick through a loop of cord and it has been the standard way to stop a limb bleeding since before either of us was anywhere, and every kit in every ambulance is a windlass in a plastic housing with a patent on it. What those kids did was not improvised. What they did was first aid. The thing that got improvised was the shopping.



Herman

That's a better distinction than the one I was using.



Hilbert

I've got four of them in the flat. Windlasses. Different sizes. I keep them in the drawer with the tape measure and the small screwdrivers, and one of them is aluminum and was sold to me as a tent pole repair kit, and it cost four pounds forty, and I have owned it since a man named Ronan in a camping shop told me a single piece of aluminum will slip under a knot because it's too smooth and you have to file a flat on it, which I did, with a nail file, on the balcony.



Corn

You filed a tent pole.



Hilbert

I filed one flat. And then I bought three more because they were four pounds forty. The one I use is the broom handle off a hand brush that lost its bristles in about twenty thirteen and which is sitting in the hall cupboard, cut down to eleven centimeters.



Herman

You cut down the broom handle.



Hilbert

It was a hand brush. There's no broom. The reason it's the one I use is that it has a shoulder on it where the handle met the brush head, and a shoulder catches the knot, so when you've got the tension on it, it isn't going anywhere until you let it. The aluminum one, even with the file, you have to hold it. The wood holds itself.



Corn

And this is a thing you've tested.



Hilbert

I've tested it on a rolled-up yoga mat and a table leg and I will not be doing it on anything that bleeds. But here's what I actually came out to say. My brother-in-law Dermot is a doorman in Dublin, and he was on a job at a hotel in the summer where a man came off a motorcycle and there was a leg and there was no kit, and a woman there took off her scarf, and Dermot's account of it is that the scarf was fine and the scarf was the problem, because it was silk.



Herman

Silk doesn't hold.



Hilbert

It's too slippery to knot against itself, so every time they got it tight, it gave. And what he ended up using was the leather belt off his own trousers, and he says he had to get two of the lads to hold the cinch down flat while he got the belt through, and that the belt worked, and that this is why he doesn't want to hear anyone say a belt is no good, because he has one, in a bag, in his hall, in a hotel in Dublin, that worked.



Corn

But he also needed two people holding it flat while he threaded it.



Hilbert

He did. And it took four of them and about nine minutes and a man nearly died anyway, and the ambulance arrived and took the belt off and put a proper one on. Which is the part I'd keep. The belt was a stopgap that a doorman and three strangers managed in nine minutes, and it worked because there were four of them. The reports from the ridge are one kid per casualty. The belt isn't the mistake. The belt on your own with one pair of hands is.



Herman

That's the argument for the windlass in one sentence. A windlass is what lets one person do what took four.



Hilbert

It is. And I'll say the other thing, which is that the tent pole has a W on it in marker and so does the four pound forty one, because the ones without a W are in the drawer with the wood screws and I don't want to be reaching for the wrong one at the wrong time.



Corn

You marked your windlasses.



Hilbert

I marked the ones that aren't windlasses. Same thing.



Corn

This is a medical question and Hilbert has just told us he has a labelled system in a drawer.



Hilbert

Everyone has a labelled system in a drawer, Corn. Mine is just labelled.



Corn

That's a very awkward note from a very calm man.



Herman

Let me use it, because I think it's the right place to land. Hilbert's doorman got occlusion with a belt, four people, and nine minutes, and a proper tourniquet arrived anyway. That's the best case for an improvised band, and it took a whole crowd. The wound on the ridge had the opposite resource ratio. One kid, one casualty, one phone call.



Corn

Which is the argument for the windlass, and for carrying one, and for the fact that the object most likely to save a life on a hike costs less than a coffee. Which is an uncomfortable sentence to end a segment on, but there it is. Let's pull back to what this leaves open.



Herman

The open question is embarrassing and it's the one I'd put to anyone who writes guidance for a living. There is still no human study comparing a manufactured tourniquet to an improvised one in severe bleeding. Not one. Twenty years of manikins and we're still arguing about a stick.



Corn

And no ideal improvised design has been established either. The Cornelissen review went looking for one and came back with grade C evidence and no single answer.



Herman

Which means the guidance you'd want most, the version for the kid on the ridge, is the one the evidence base is least able to give you. There's a dispatcher study out there that might speak to it and I couldn't read it, and until someone can, the honest answer to Daniel's last question is a shrug with a caveat on it.



Corn

Then here's what I'd leave a listener with. There's a ridge in the Galilee with students on it, belts and socks in their hands, a father on a video call improvising instructions in real time, and an EMT arriving to find that they'd listened and followed them. And the evidence says the version of that improvised tourniquet most likely to work is the one almost nobody reaches for, and the reason they don't reach for it is that it's the only part of the thing you can't improvise from what's already on you. You can lose the belt. You can lose the sock. You can't lose the stick if you never knew you needed one.



Herman

That's the show's producer, Hilbert Flumingtop, at the desk. If you enjoyed this one, try episode fourteen oh eight, Israel Wartime Readiness Field Guide; episode eighteen sixty-one, Emergency Prep You Can Sing To; and episode six twelve, The Three-Second Rule for First Aid Kits. This has been My Weird Prompts.



Corn

If you want to leave us a review, that helps more than you'd think. And if you've got a question like this one, send us your own prompt on Telegram at t dot me slash MWP listener bot.



Herman

We'll be back soon.

SOURCES

What the research for this episode read before the script was written. Primary sources first.

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