EXCERPT: BRENNEN MEDICAL LUNCHEON SYMPOSIUM
“Contemporary Applications for Porcine Xenograft” Surgeons’ Panel

Paul Silverstein, M.D., F.A.C.S. (Moderator)
Introduction: “Historical Overview of Porcine Xenograft”

Sidney F. Miller, M.D., F.A.C.S.
“Porcine Xenograft (Mediskin™) used as Temporary Coverage for Partial Thickness Burns with Ancillary Debriding”

Herbert L. Meites, M.D., F.A.C.S.
“Wound Management with Porcine Xenograft”

Kevin M. Sittig, M.D., F.A.C.S.
“Successful Utilization of Porcine Xenografts (E•Z Derm™) and Silver in the Surgical Management of Full Thickness Burns”

David J. Smith, M.D., F.A.C.S.
“The use of Porcine Xenograft (E•Z Derm™) in the Treatment of Partial Thickness Burns”

David M. Heimbach, M.D., F.A.C.S.
“Porcine Xenograft (Mediskin™) in the Treatment of TENS”

James M. Cross, M.D., F.A.C.S.
“Temporary Coverage of Full Thickness Burn Injuries with Porcine Xenograft (E•Z Derm™)”

Paul Silverstein, M.D., F.A.C.S. (Moderator)
Conclusion
INTRODUCTION
Thank you attendees and thank you Dan, Phil and Brennen Medical for sponsoring this luncheon and panel discussion. Over the 40 years that pigskin has been around it has been used for many applications. Biologic dressings are dressings that come from animal or human sources. Physiologic dressings are made in the laboratory. Biologic dressings have been known since 1867 when Dr. Reverdin at Bellevue Hospital New York first applied cadaver skin, (it happened to be full thickness cadaver skin) to the burns of a major electrical injury in a man who survived.

But it really wasn’t developed until the Vietnam conflict when Brooke Army Medical Center pioneered the use of cadaver skin and the harvesting of cadaver skin to facilitate burn healing to eliminate evaporative water losses, infection, and pain. The results were wonderful but no one had that kind of supply of cadaver allograft available. Other hospitals, and civilian burn centers, were also looking for dressings that would work like cadaver. We tried dogskin, calfskin, goatskin, chicken skin and others that we could harvest. Pigskin ultimately became the stand-in because it was physiologically similar and affordable. But I would be remiss if I didn’t give credit to the original user, the first person to ever publish the use of porcine xenograft on burns, in the New York State Medical Journal, was Dr. In Chul Song, a plastic surgeon in Brooklyn, New York. Dr. Song was the first person to do this procedure in a civilian hospital using pigs, of which they harvested the split-thickness skin grafts in the basement of the hospital.

We then started experimenting with this at Brooke to see how it worked. Questions we asked included: did it become vascularized, incorporated, white graft rejection or would you develop allergies, etc? We have shown fairly conclusively that pigskin is not a white graft reaction and it never becomes engrafted. You do get a biological anchor into the dermis which holds it down, but you never get vascularization or antibody formation. So in reality it performs like a dressing. The use of porcine xenograft in burns, for split-thickness skin graft coverage, for partial thickness burns, full thickness burns, and wounds have been explored now for 40 years. And we have as our panel a well known group of very experienced doctors.
WOUND MANAGEMENT WITH PORCINE XENOGRAFT

Historically we’ve learned a lot about taking care of burns and now we are applying it to the care of non-burn wounds. In addition to burns, xenograft is used for temporary wound coverage, skin ulcerations, skin tears, open surgical wounds we want to help facilitate to close and abrasions. All of these wounds appear small compared to our burn population but we can take what we have learned from the burn world and extrapolate the technique successfully to these patients. The nice part is xenograft helps keep these wounds moist which stops the wounds from drying out and becoming deeper and more difficult to heal.

The xenograft will adhere to the wound, which helps minimize pain, has a long shelf life, and we can get the product delivered tomorrow if needed. Finally, the cost is exceedingly low compared to other products out on the market. Reimbursement requires specific codes for using xenograft on wounds and because of the 90 day global it is necessary to use the Modifier 58. For clinical experience let’s start with this venous ulcer. When the patient came to us it had been present for several months and the patient refused any surgery. This was a significant wound yet it is not all full thickness. We added a compression dressing and xenograft to the wound. Three weeks later we had a wound that was closed, all of which was performed on an outpatient basis and without the need for surgical intervention. We have a very busy liver transplant service at our hospital and the transplant people who are immune suppressed typically do not heal well. Their wounds are sent to us and we will typically clean or debride these in the outpatient area, put on the xenograft and get them to close. Again, these are very sick people and you want their wounds to heal without doing anything more dramatic. Another liver transplant patient came in with a very wide granulated wound. We went ahead and put pieces of xenograft on top of it, two weeks later it closed without any further intervention.

Finally, as we are seeing more and more radiation for breast cancer and other cancers, the area radiated with subsequent surgery, does not heal well. For example, an ulcerated left chest wound from breast cancer radiation came to us. This wound is exquisitely painful and very hard to heal. We used xenograft to cover the wound. This required a couple of different applications of xenograft for the wound to reepithelialize but we achieved a significant reduction in pain and 6 weeks later we have the wound closed.
THE USE OF PORCINE XENOGRIFT (E•Z DERM™) IN THE TREATMENT OF PARTIAL THICKNESS BURNS

I felt very comfortable with the use of the xenograft on partial thickness injuries. The most important to me was the ease of use. I thought it was reproducible. Many of the burns we see are transfers and they already have some kind of topical treatment over which we have no control. I wanted something I was comfortable with that would close the wound, allow it to heal, get the patient out of the hospital rapidly, and that the staff would feel comfortable using.

That is why we’ve relied on xenograft for partial thickness. A particularly good application is a 25 percent partial thickness burn on an 11-month old. These are nightmares, as you know, to take care of the kids. The larger sheets make it very easy to get this entire area closed. Just one strip of the xenograft is needed for coverage. Trim off the dry edges the next day, wrap again with Kerlix and send them home. We usually let these dry out for about 7-10 days. It is okay if they start to come off on their own. If not, we put a moisturizer on (we use a lot of beta-glucan) to break the adherence and allow the xenograft to lift off a little sooner.

Overall, we have found the porcine xenograft clearly minimizes pain, gives you an occlusive barrier, is easy, reproducible, and in our hands works extremely well. Thank you very much.
TEMPORARY COVERAGE OF FULL THICKNESS BURN INJURIES WITH PORCINE XENOGRRAFT (E•Z DERM™)

When I use E•Z Derm on excised full thickness burns it is on a very select group of patients, a small segment of my patient population. I completely excise the burn, achieve homeostasis and then apply the E•Z Derm, or the porcine xenograft. The one thing I found out from my billers is that you must signify, in your op note, how you hold the porcine in place. Whether you use staples, fibrin glue, sutures, or whatever, you must elucidate that in your op-note. If you do not, you will get reimbursed as if you are just putting down a dressing rather than a xenograft.

The other caveat is I dress the xenograft as if it is a skin graft. I do not use wet bulky dressings over the graft. In about 5-7 days I’ll take the patient back to the operating room, remove the E•Z Derm, and then apply a routine split-thickness skin graft. Here is an example; a young man with a 70 percent burn and a bad inhalation injury went very quickly into septic shock. In the operating room I did a combination of fascial and tangential excision, and achieved homeostasis quickly. I use fibrin glue on almost all my skin grafts, so I used that, put down the E•Z Derm, and this entire procedure took about 45 minutes. The entire burn was almost completely excised in that time frame.

So clearly the benefit of using xenograft is the ability to rapidly excise large full thickness burns, using very little O.R. time, and allowing the E•Z Derm to temporarily close the burn. Looking at the cost differential, E•Z Derm is a lot cheaper than using cadavaric skin, and my hospital likes that cost savings.
PORCINE XENOGRAFT (Mediskin™) USED AS TEMPORARY COVERAGE FOR PARTIAL THICKNESS BURNS WITH ANCILLARY DEBRIDING

Debriding wounds is not the only use in our burn center for pigskin, but this is one where I found it to be, in my experience, valuable to actually clean up dirty wounds. We get a number of patients who come to the burn clinic with burns that are 5 to 14 days old or older. They wait weeks to come in and be seen, usually because it doesn’t smell or look good or somebody told them they should see a doctor.

At this point it’s not really a burn that can get grafted, but it needs to be cleaned up. In my experience when we excise such burns we are left with what I refer to as a “dermal moss”. It’s a deep dermis that’s somewhat sticky and is hard to get off and not a good bed for grafts.

I have had very good results using xenograft to clean this type of wound, further debride it and prepare the granulation tissue for skin grafting. Here is an example of a typical patient: a 23-year old female came in 10 days after sticking her knee against a car muffler. Part of the eschar had fallen off and some was still stuck. It was not a nice, well-defined circumferential area; instead it was ragged and outlined. We brought her in, put on some soaks and took her to the operating room. There we cleaned her up and started her on changes of pigskin until it was fully debrided and ready for grafting. We had nice healthy granulation tissue about 15 days later when she was skin grafted.

Another patient, referred in from an outlying hospital, was a 42-year old male who presented in the outpatient clinic after being excised for necrotizing fasciitis. To prepare this wound for skin grafting, we used porcine xenograft on an outpatient basis and had the patient change the porcine at home until he developed a nice granulating base for skin grafting. In conclusion, I believe porcine xenograft is effective in debriding remaining non-viable dermal elements and promoting granulation to prepare some of these wounds for skin grafting. Thank you.
SUCCESSFUL UTILIZATION OF PORCINE XENOGRAFTS (E•Z DERM™) AND SILVER IN THE SURGICAL MANAGEMENT OF FULL THICKNESS BURNS

Dr. Silverstein and I were reminiscing about the fact that nothing seems to go out of style. It goes out of style but it comes back in, and when I first got into the burn world and was trying to learn what to do, pigskin was there. We tried it in Shreveport, Louisiana with a heat index of 114 with humidity, so when you put it down one day you could smell it outside in the hall the next day and you could follow that fluorescent green trail to the patient’s room.

So we had a problem. We switched to cadaver, needless to say, and I put silver in our algorithm of taking care of our grafted patients as well as our full thickness injuries. When cost became the big driver in every facility as well as the inability to routinely get homograft, we were forced to go back to using xenografts. The shelf storage makes it very convenient to use. It is right there in your unit, no refrigeration, and I don’t have to carry a pager in case the -70 freezer goes off in the middle of the night because the temperature dropped. We started using it on early excision, putting the xenograft down, coming back and re-excising, and then putting the autografts down. After the autografts went down, we started using porcine as opposed to homografts to cover the top of the autografts in order to allow the epithelial interstices to completely close in. For example, take a major burn with a 3:1 widely meshed autograft. We use fibrin glue, then porcine over the top and then cover the porcine with silver dressing materials.

For a week these dressings are not touched. We don’t rewet it, we don’t do anything. In a week’s time, you will have a very dry, protective porcine derivative there and the interstices begin to close underneath. Usually by the second or third week, it’s beginning to lift off and you can take them to the hydro area to shower. Our successful use of porcine has reduced the cost of our homograft. Basically it’s one-tenth the cost of homograft. And, I don’t have to carry a pager. I don’t worry about the freezer going out and more importantly, when the joint commission comes around I don’t have to worry about the log books for tissue tracking. Porcine is our preference for a temporary cover. Thank you.
Porcine Xenograft (Mediskin™) in the Treatment of TENS

T.E.N. is an awful disease way down on the list of diseases you want to get. You get it because you have taken some sort of a drug that you never want to take again. But the important issue is that it’s an epidermal disease; you lose your epidermis. The dermis is absolutely normal, it just doesn’t have any epidermis on it anymore. So the philosophy of care is that the dermis is intact and it has to be protected. If you let it dry out, if you put a bunch of goo on it, you will end up with a little crust on top which becomes a pseudo eschar and starts to damage the dermis.

We all know that the scarring from any kind of burn or donor site or T.E.N. is related to the thickness of the dermis that’s left. If you have all your dermis left you get no scarring because epidermis doesn’t scar. If you have no dermis left you get a lot of scarring. In fact, you get 100 percent scarring as that wound contracts. So our philosophy is that if you can protect the dermis, the wounds will heal without scarring in 14 days or less.

We have a protocol to take care of our T.E.N.s patients. As soon as they arrive in the ER they go to the operating room and are placed prone on the operating room table. We wash the T.E.N. with a wet washcloth, no soap, no detergents, no Betadine, nothing that is caustic or harmful to the dermis. We want to protect the dermis. So you get rid of the epidermis, put xenograft on and cover them with Conformant. Starting out prone on the operating table, they get turned onto a Clinitron bed to get their anterior surface grafted with pigskin. The patient can get hypothermic, so you have to be very quick at what you do and have the room very warm. Once this pigskin is on you let it dry out; no soaps, no anything.

Example: gentleman with about a 90 percent T.E.N. loss. He is on the operating table with big sheets of pigskin, not the little scrawny ones. The big sheets of pigskin get stapled in place and put in Conformant. Then you turn the patient over. You want to have a high airflow because you want this to dry out. Patients will leak many liters of fluids so you have to replace the fluid but you also need air going through the bed and drying out the pigskin. Inspect the pigskin everyday to see that it is adherent, clean, and looking nice. At the same time the patient continues receiving meticulous critical care.
As the wound starts to heal, the pigskin starts to turn into a potato chip, (or perhaps more appropriately, a pork rind) and it begins to come off as the patient's own skin heals underneath. Our average ICU stay for people with T.E.N. is 11 days. Our average total hospital stay is 14 days. Once they have skin coverage they’re virtually well enough to leave the hospital completely healed. So what are our results? We’ve taken care of 149 patients as of the first of January this year with 19 deaths; a mortality rate of 13 percent. That’s the best mortality rate reported anywhere, ever. So in summary I think our hypothesis is correct- protect the dermis. We protect the dermis with pigskin. So we’ve proved our hypothesis in terms of having a really good survival rate. Thank you.
CONCLUSION

You have now seen examples of how pigskin has most often been used. One is a temporary wound cover on second-degree burns, partial thickness injuries and ulcers. Second, to prevent evaporative water loss in a fully excised wound, pending skin grafting or applying of CEAs. Pain reduction has been brought up many times. As a matter of fact, David really didn’t mention it very much but TENS patients have horrible pain.

And this eliminates most of their pain; it cuts narcotics utilization down to nothing. In addition, we can protect the wound from bacterial invasion. Porcine biologic dressings over the years have been proven stable and standard, and we have thousands of patients around the world who can testify to that.