The Liquid Bandage Research Project
at the University of Nebraska

Mark A. Carlson, MD
University of Nebraska Medical Center
Veterans Administration Health Center
Omaha, Nebraska, USA
Problem: bleeding from a blood vessel
Problem: bleeding from an internal organ

CT scan of abdomen in a patient after an automobile accident
How does the body stop bleeding?
How does the body stop bleeding?
How does the body stop bleeding?
What is the “Liquid Bandage?”
What is the “Liquid Bandage?”

- A liquid or semi-liquid material that is applied to a bleeding injury.
Liquid Bandage: ingredients
Liquid Bandage: ingredients

- Natural clotting proteins
Liquid Bandage: ingredients

- Natural clotting proteins
- Absorbable synthetic mesh
Why is the Liquid Bandage important?
Why is the Liquid Bandage important?

Because it is extremely effective at stopping blood loss.
Why is the Liquid Bandage important?

Because it is extremely effective at stopping blood loss.
Why is the Liquid Bandage important?

Because it is extremely effective at stopping blood loss.
Why is the Liquid Bandage important?

Because it is extremely effective at stopping blood loss.
Aerosol Delivery
Major hepatic injury
Liver resection treated with PLA + recombinant clotting factors
Hemostasis of major hepatic resections with recombinant clotting factors
Treatment of central liver injury with soluble recombinant factors (fibrinogen, thrombin, XIIIa)
Bleeding from femoral artery
Control of femoral artery injury
Other advantages of the liquid bandage

- No risk of transfusion-related infection
- Absorbable
- Safe
- Large scale production
- Cost-effective
Who will benefit from the liquid bandage?
Who will benefit from the liquid bandage?

Anyone with severe, life-threatening bleeding, including:

• Naval personnel injured in a missile strike
Who will benefit from the liquid bandage?

Anyone with severe, life-threatening bleeding, including:

- Naval personnel injured in a missile strike
- Base personnel injured in a terrorist bombing
Who will benefit from the liquid bandage?

Anyone with severe, life-threatening bleeding, including:

- Naval personnel injured in a missile strike
- Base personnel injured in a terrorist bombing
- Security personnel shot at a checkpoint
Who will benefit from the liquid bandage?

Anyone with severe, life-threatening bleeding, including:

• Naval personnel injured in a missile strike
• Base personnel injured in a terrorist bombing
• Security personnel shot at a checkpoint
• Also useful for Army, Marines, & other warfighters
Who will benefit from the liquid bandage?

Anyone with severe, life-threatening bleeding, including:

- Naval personnel injured in a missile strike
- Base personnel injured in a terrorist bombing
- Security personnel shot at a checkpoint
- Also useful for Army, Marines, & other warfighters
- Also useful for multiple civilian applications
Proposed studies: timeline & budget

Months 1-12 (efficacy studies):

• Nonsurvival studies in swine (N = 64)
• Optimize bandage properties
• Compare to best available treatments

Costs

$125,000

Months 13-18 (toxicity studies)

• Survival studies in swine (N = 24)
• Determine 30 day effects of bandage implantation
• Final step prior to human use

$160,000

Total cost = $285,000
Time = 18 months
Liquid bandage research consortium

UNMC/Omaha VAMC

- Mark A. Carlson, MD
- Iraklis I. Pipinos, MD
- Jason M. Johanning, MD
- Crystal Krause, PhD
- Tiffany Peña, MS

UNL

- William H. Velander, PhD
- Jennifer Calcaterra, PhD

LNKChemSolutions, Lincoln NE

- Gustavo Larsen, PhD
- Sandra Noriega, PhD
- Ruben Spretz, PhD
- Wilson H. Burgess, PhD