Achieving Hemostasis in the Operating Room and Critical Care Setting: What the Pharmacist Needs to Know

Presented as a Live Webinar

Wednesday, April 10, 2013
and
Thursday, May 2, 2013

Planned and conducted by ASHP Advantage and supported by an educational grant from ZymoGenetics, a Bristol-Myers Squibb Company.
WEBINAR INFORMATION

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Go to www.ashpadvantage.com/hemostasis/webinar.html and click on the Register Now button. After you submit your information, you will be e-mailed computer and audio information.

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A live webinar brings the presentation to you — at your workplace, in your home, through a staff in-service program. You listen to the speaker presentation in “real time” as you watch the slides on the screen. You will have the opportunity to ask the speaker questions at the end of the program. Please join the conference at least 5 minutes before the scheduled start time for important announcements.

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One person serving as the group coordinator should register for the webinar. That group coordinator will receive an e-mail confirmation with instructions for joining the webinar. A few minutes before the webinar begins, the group coordinator should launch the webinar link. Once the webinar has been activated, the coordinator will have the option to open the audio via VoIP (Voice Over IP) on the webinar toolbar or use a touch tone phone with the provided dial-in information. At the conclusion of the activity, the group coordinator will complete a brief online evaluation and report the number of participants at that site. Each participant will process his or her individual continuing education statement online.

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1. Computer with internet access and basic system requirements. When you register, the webinar system will assess your system to ensure compatibility.
2. Telephone to dial the toll-free number and listen to the presentation (if you choose not to use Voice Over IP [VoIP] via your computer).

Webinar System Requirements
Be sure to view the webinar system requirements for Windows, Mac, iOS, and Android prior to the activity.
Achieving Hemostasis in the Operating Room and Critical Care Setting: What the Pharmacist Needs to Know

ACTIVITY FACULTY

William D. Spotnitz, M.D., M.B.A.
Professor of Surgery
Director, Surgical Therapeutic Advancement Center
Department of Surgery
University of Virginia Health System
Charlottesville, Virginia

William D. Spotnitz, M.D., M.B.A., is Professor of Surgery and Director of the Surgical Therapeutic Advancement Center at University of Virginia Health System in Charlottesville.

With an academic surgical career spanning more than 20 years as a cardiovascular and thoracic surgeon, Dr. Spotnitz has been active in tissue adhesive translational research, device development, and patenting and has participated in the training of more than 30 thoracic and cardiovascular surgical fellows. He founded the Tissue Adhesive Center (TAC) at the University of Virginia in 1997 and then expanded its activities as founder and director of the University’s Surgical Therapeutic Advancement Center (STAC). With six employees and a self-generated budget of over $500,000 per year, the center facilitates multidisciplinary clinical research in surgery and related fields.

After graduating magna cum laude with an undergraduate degree in chemistry from Harvard College in Cambridge, Massachusetts, Dr. Spotnitz received his M.D. degree from Columbia University College of Physicians and Surgeons in New York City. He completed residencies in general surgery and thoracic surgery at Columbia Presbyterian Medical Center, also in New York City. Prior to his current position, he held cardiac and thoracic surgical division chief positions at Temple University in Philadelphia and the University of Florida in Gainesville. In addition, Dr. Spotnitz received his M.B.A. degree from the University of Florida, Warrington College of Business in 2007 being elected class graduation spokesperson and a member of Beta Gamma Sigma, the international honor society for collegiate schools of business (top 20% of students).

As an internationally recognized clinical expert and pioneer in the research and development of fibrin sealant in the United States, Dr. Spotnitz is the author or co-author of more than 160 publications, 70 of which are in the field of tissue hemostats, sealants, and adhesives. He is a nationally recognized expert in myocardial contrast echocardiography as a method of evaluating cardiac perfusion, and he has received grants from both the National Institutes of Health (NIH) and the American Heart Association (AHA) to study this area.

Dr. Spotnitz has served actively as an AHA volunteer and was President of the Virginia Affiliate of the AHA. Dr. Spotnitz has also served as chair of an NIH Small Business Investigational Research funding study section.
Achieving Hemostasis in the Operating Room and Critical Care Setting: What the Pharmacist Needs to Know

Bradley A. Boucher, Pharm.D., FCCP, FCCM, BCPS
Professor of Clinical Pharmacy and Associate Professor of Neurosurgery
University of Tennessee Health Science Center
Memphis, Tennessee

Bradley A. Boucher, Pharm.D., FCCP, FCCM, is Professor of Clinical Pharmacy and Associate Professor of Neurosurgery at the University of Tennessee Health Science Center in Memphis. He also practices as a clinical pharmacist in the area of critical care at Regional Medical Center at Memphis.

Dr. Boucher received his Bachelor of Science and Doctor of Pharmacy degrees from the University of Minnesota and completed a critical care fellowship at the University of Kentucky. In addition, he is a board-certified pharmacotherapy specialist and a fellow of the American College of Clinical Pharmacy (ACCP) and American College of Critical Care Medicine. Dr. Boucher has received several professional honors, including being elected as a pharmacy member of the National Academy of Practitioners and receiving the 2011 ACCP Clinical Practice Award.

Dr. Boucher’s current research interests include pharmacokinetic and therapeutic issues in the critically ill surgical patient and medical management of the neurotrauma patient. He has published over 75 peer reviewed articles and 15 book chapters during his career. He has also served as an editorial board member for several medical journals, including Critical Care Medicine and American Journal of Pharmaceutical Education, and he is currently serving on the editorial board of Critical Care Research and Practice. Dr. Boucher has served as President of ACCP and maintains active membership in numerous professional scientific and professional organizations, including ACCP, American Society of Health-System Pharmacists, and Society of Critical Care Medicine.
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Dr. Spotnitz declares that he has served as a consultant for Baxter, Bayer, BioLineRx, Biom’Up, Covidien, Cubist, Ethicon/J&J, Grifols, Lifebond, Luna Innovations, Medafor, The Medicines Company, Neomend, Profibrix, Sealantis, and ZymoGenetics-BMS.

Bradley A. Boucher, Pharm.D., FCCP, FCCM, BCPS
Dr. Boucher declares that he has served on the speakers bureau and as a consultant for The Medicines Company and ZymoGenetics-BMS.

Kristi Hofer, Pharm.D.
Dr. Hofer declares that she has no relationships pertinent to this activity.

Carla Brink, M.S., B.S.Pharm.
Ms. Brink declares that she has no relationships pertinent to this activity.

Susan R. Dombrowski, M.S., B.S.Pharm.
Ms. Dombrowski declares that she has no relationships pertinent to this activity.

ASHP staff has no relevant financial relationships to disclose.
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ACTIVITY OVERVIEW

Bleeding is a major complication of surgery and is associated with poor clinical outcomes. A number of techniques and products for achieving surgical hemostasis are available. Although pharmacists may not be present in the surgical suite, they need to be aware of surgery-related processes that decrease the need for blood transfusions and improve patient safety in the operating room and critical care practice areas. This educational activity will review key clinical, safety, economic, and regulatory factors that pharmacists need to consider when evaluating local and systemic hemostatic agents for use in the institutional setting.

Time for questions and answers from the webinar audience will be provided at the end of the presentation.

LEARNING OBJECTIVES

At the conclusion of this knowledge-based educational activity, participants should be able to

- Discuss the clinical and economic impact of surgical complications that result in bleeding and transfusion.
- Demonstrate knowledge of local and systemic hemostatic agents, including clinical, safety, economic, and regulatory factors.
- Describe the role of the health-system pharmacist in the use of hemostatic agents to manage surgical bleeding.

CONTINUING EDUCATION ACCREDITATION

The American Society of Health-System Pharmacists is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education. This activity provides 1 hour (0.1 CEU) of continuing pharmacy education credit (ACPE activity # 0204-0000-13-416-L01-P).

Attendees must complete a Continuing Pharmacy Education Request online and may print their official ASHP statements of continuing pharmacy education credit at the ASHP eLearning site (elearning.ashp.org) immediately following this activity.

Complete instructions for processing CE can be found on the last page of this handout.

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Associate Professor Neurosurgery
University of Tennessee Health Science Center
Memphis, Tennessee

Disclosures for Faculty and Planners
- William D. Spotnitz, M.D., M.B.A (faculty)
- Bradley A. Boucher, Pharm.D., FCCP, FCCM, BCPS (faculty)
  - Speakers bureau and consultant for ZymoGenetics-BMS
- Following individuals have no pertinent relationships to report (planners)
  - Kristi Hofer, Pharm.D.
  - Carla Brink, M.S., B.S.Pharm.
  - Susan R. Dombrowski, M.S., B.S.Pharm.

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William D. Spotnitz, M.D., M.B.A.
- Strategies for Minimizing Risk and Optimizing Management of Bleeding
- Local Hemostatic Agents

Bradley A. Boucher, Pharm.D., FCCP, FCCM, BCPS
- Systemic Pharmacologic Hemostatic Agents
- Pharmacist Roles in Surgical Hemostasis

CLINICAL CHALLENGES
1. Bleeding
   - Non-sutureable
   - Non cauterizable
2. Minimally Invasive Procedures:
   - Newer approaches tend to increase the amount of non-sutureble bleeding;
3. Surgical Coagulopathy

Surgical Hemostasis
Advantages
- Better vision
- Stable hemodynamics
- Fewer transfusions
  - Bloodless surgery
- Reduced operative, ventilator, ICU, & hospital times

Fewer infections
- Decreased costs
- Reduced morbidity and mortality

Kessler CM et al, Chapter 71 & Edmunds LH, Chapter 74, Kessler CM et al, Chapter 71 & Edmunds LH, Fibrinolysis
Acidosis
Hypothermia
Anticoagulation & Thrombosis

Operating the reproducd, Coleman RW et al.

Vitamin K Deficiency
HIT
Mechanical approaches
Factor Dilution
Dilution
DIC
Fibrinogenolysis
Liver Dysfunction
Hypothermia
Acidosis
Fibrinolysis
Vitamin K Deficiency
Factor Inhibition

HEMOSTASIS: CELLULAR MODEL

Initiation

\[
\begin{align*}
\text{Injury} & \rightarrow \text{Tissue} \\
\text{Factor Cells} & \rightarrow \text{Plasma} \\
& \rightarrow \text{Platelets}
\end{align*}
\]

\[
\begin{align*}
\{ & \hspace{1cm} \text{TF} \rightarrow \text{VIIa} \\
& \hspace{1cm} \downarrow \\
V & \rightarrow \text{Xa} \\
& \rightarrow \text{Thrombin} \\
& \hspace{1cm} \uparrow \\
& \hspace{1cm} \text{Thrombin} \\
& \hspace{1cm} \rightarrow \text{Fibrin}
\end{align*}
\]

Proming

Propagation

\[
\begin{align*}
\text{Injury} & \rightarrow \text{Tissue} \\
\text{Factor Cells} & \rightarrow \text{Plasma} \\
& \rightarrow \text{Platelets}
\end{align*}
\]

Zimmerman LH. Pharmacotherapy. 2007; 27(9 Pt 2):45S-56S.

SURGICAL GROUPS

1. Hemostats
2. Sealants
3. Adhesives

Spotnitz WD, Burks S. Transfusion 2008; 48: 1502-16.

HEMOSTATS

- Porcine gelatin
- Bovine collagen
- Oxidized regenerated cellulose
- Polysaccharide spheres

1. Mechanical
- Bovine thrombin
- Human pooled plasma thrombin
- Recombinant human thrombin

2. Active
- Bovine gelatin & human pooled plasma thrombin
- Porcine gelatin thrombin

3. Flowable
- Human pooled plasma
- Bovine thrombin/collagen & autologous plasma
- Human pooled plasma & equine collagen or oxidized regenerated cellulose

4. Fibrin
- Human pooled plasma
- Bovine thrombin/collagen & autologous plasma
- Human pooled plasma & equine collagen or oxidized regenerated cellulose

LOCAL AGENT CRITERIA

- Safety
- Efficacy
- Usability
- Cost

ROLE OF THROMBIN IN LOCAL HEMOSTATS

Mechanical
Porcine Gelatin Sponge
Active
Bovine
Human Pooled
Recombinant
Human
Flowable
Bovine or Porcine Gelatin Matrix
Fibrin Sealant
Human Pooled
Liquid & Patches
HEMOSTATIC AGENT FORMULATIONS

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponges</td>
<td>Moist sponges</td>
</tr>
<tr>
<td>Powders</td>
<td>Putties</td>
</tr>
<tr>
<td>Sheets</td>
<td>Matrix</td>
</tr>
<tr>
<td>Fibrillar</td>
<td>Fibrin sealant</td>
</tr>
<tr>
<td>Liquids</td>
<td>Patches</td>
</tr>
</tbody>
</table>

TOPICAL HEMOSTATS

- **Low Product Cost Continuum**
  - Mechanicals
    - Porcine Gelatin
    - Recombinant Human Thrombin
    - Pooled Plasma
  - Actives
    - Bovine Gelatin
    - HPP Fibrin Sealant
  - Flowables
    - Bovine Collagen Sealant
  - Fibrin Sealants
    - HPP Fibrin Sealant

- **High Product Cost Continuum**
  - Mechanicals
    - Oxidized Human Plasma
  - Actives
    - Bovine Gelatin
    - Thrombin
  - Flowables
    - Bovine Collagen Sealant
  - Fibrin Sealants
    - HPP Fibrin Sealant

Enlarged slide on page 12

LOCAL HEMOSTATS 2013

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponges &amp; Patches</td>
<td>Ethicon/J&amp;J, Cryolife, Plainsboro, NJ</td>
</tr>
<tr>
<td>Patches</td>
<td>Tissucol, Bard, Westlake Village, CA</td>
</tr>
<tr>
<td>Putties</td>
<td>Hematek, Davol/Bard, Warwick, RI</td>
</tr>
<tr>
<td>Gelatin Sponges &amp; Powders</td>
<td>Gelfoam, Pharmacia, MI</td>
</tr>
</tbody>
</table>

Which of the following is NOT a criterion for evaluating local hemostats?

- a. Safety
- b. Efficacy
- c. Usability
- d. Cost
- e. Approvability

Enlarged slide on page 13

**Sponges & Patches Characteristics**

<table>
<thead>
<tr>
<th>Category</th>
<th>Safety</th>
<th>Efficacy</th>
<th>Usability</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>Relatively Safe</td>
<td>Effective for Minimal Bleeding</td>
<td>Easy to Prepare &amp; Use</td>
<td>Relatively Inexpensive</td>
</tr>
<tr>
<td>Active</td>
<td>Disease Transmission: Viral, Prion</td>
<td>Most Effective for Localized Bleeding</td>
<td>Moderate Strength</td>
<td>More Complex to Prepare &amp; Use</td>
</tr>
<tr>
<td>Flowable</td>
<td>Disease Transmission: Viral, Prion</td>
<td>More Effective for Localized Bleeding</td>
<td>More Complex to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
<tr>
<td>Fibrin Sealants</td>
<td>Disease Transmission: Viral, Prion</td>
<td>More Effective for Localized Bleeding</td>
<td>More Complex to Prepare &amp; Use, New Patches Easier</td>
<td>More Expensive</td>
</tr>
</tbody>
</table>

Enlarged slide on page 13

**Sealant & Adhesive Characteristics**

<table>
<thead>
<tr>
<th>Category</th>
<th>Safety</th>
<th>Efficacy</th>
<th>Usability</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrin Sealant</td>
<td>Disease Transmission: Viral, Prion</td>
<td>Enhanced Strength</td>
<td>More Complex to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
<tr>
<td>Cyanoacrylate</td>
<td>Relatively Safe</td>
<td>Enhanced Strength</td>
<td>Easy to Prepare &amp; Use</td>
<td>Inexpensive</td>
</tr>
<tr>
<td>PEI Polymeric</td>
<td>Relatively Safe</td>
<td>Enhanced Strength</td>
<td>Moderately Easy to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
<tr>
<td>Alumen &amp; Metacrylate</td>
<td>Tissue Injury: Nerve, Muscle</td>
<td>Enhanced Strength</td>
<td>Moderately Easy to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
</tbody>
</table>
Which of the following is a hemostat?

- a. Dual polyethylene glycol (PEG) polymer
- b. Albumin and glutaraldehyde
- c. Cyanoacrylate
- d. Thrombin
- e. PEG polymer and human serum albumin

**SUMMARY**

- A wide variety of hemostats, sealants, and adhesives are available.
- Knowledge of these agents can facilitate improved quality of care.

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**Systemic Pharmacologic Hemostatic Agents**

**Anticoagulant Reversal Agents**

- Vitamin K
  - Reversal of warfarin
- Protamine
  - Reversal of unfractionated heparin (not low molecular weight heparin products)
  - Potential for adverse reactions, including anaphylaxis, acute pulmonary vasoconstriction, hypotension

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**Desmopressin**

- Analog of vasopressin
- Stimulates release of vWF multimers from endothelial cells
- Prevent or control bleeding in patients with von Willebrand syndrome
- Cochrane Library review of surgical patients: no benefit from administration of desmopressin to cardiac surgery patients

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**Antifibrinolytic Agents: The Lysine Analogs**

- Indications: hemorrhaging in hemophilia
- Mechanism of action: competitively inhibit activation of plasminogen to plasmin
- Epsilon aminocaproic acid
- Tranexamic acid

---

vWF = von Willebrand factor


CRASH-2 Study

- Prospective, randomized, controlled trial of tranexamic acid or placebo in adult trauma patients with, or at risk of, significant bleeding within 8 hours of injury
- All-cause mortality: 14.5% tranexamic acid group, 16.0% placebo group (P=0.0035); no significant differences in vascular occlusive events except MI favoring tranexamic acid
- Conclusion: should be considered for use in bleeding, trauma patients


Which is the most significant adverse event associated with the use of recombinant factor VIIa for off-label indications?

- a. Anemia
- b. Thromboembolic events
- c. Fluid overload
- d. Thrombocytopenia
- e. I do not know

Recombinant Factor VIIa (rFVIIa)

- Indication: treatment of bleeding episodes in hemophilia A or B with inhibitors to factor VIII or IX
- Off-label uses: uncontrolled, life-threatening bleeding
- Dosing: wide range for off-label uses (15 to 400 mcg/kg)
- Safety: risk of thromboembolic events
- Pharmacoeconomics: some evidence that high acquisition cost offset by reduced blood product use, decreased morbidity, mortality


Recombinant Factor VIIa (cont.)

- Cochrane Database meta-analysis: uncertain hemostatic effectiveness either prophylactically (6 RCTs) or therapeutically (7 RCTs) in patients without hemophilia
- Meta-analysis of 10 case series in major abdominal surgery patients: reduction or cessation of bleeding in 73.2% patients; survival in 66% responders (19 of 29) vs. 10% nonresponders (1 of 10)


CONTROL Trial

- Phase III randomized clinical trial of rFVIIa vs. placebo in trauma patients with refractory hemorrhage
  - rFVIIa group (n=273) dose: 200 mcg/kg, then 100 mcg/kg at 1 and 3 hours, or placebo (n=300)
  - Results: no differences in mortality for blunt or penetrating trauma patients (P=0.05), significant reduction in RBC transfusions in rFVIIa group (P=0.04), no difference in thrombotic adverse events
  - Overall equivocal risk/benefit ratio for off-label indications


Pharmacist Roles in Surgical Hemostasis
Which of the following roles is the most important for hospital pharmacists related to hemostatic agents?

a. Conduct P&T evaluation of hemostatic agents within class
b. Ensure appropriate clinical use of hemostatic agents
c. Affix safety labels to local hemostats before dispensing
d. Provide education related to hemostatic agents
e. I am unsure

Pharmacy and Therapeutics Committee

- Evaluative
  - Appraisal of published efficacy, safety data relative to hemostatic products undergoing formulary review
  - Hemostatic agent class reviews
  - Preparation of drug monographs including storage requirements, pharmacoeconomic evaluations
- Advisory
  - Provision of general safety information (e.g., ISMP, FDA newsletter)
  - Hospital wide alerts, sentinel events

Distribution, Monitoring

- Create safe use/handling protocols
  - Labeling, addition of auxiliary warning labels e.g., “do not inject” for local hemostatic agents
  - Storage, preparation
- Surveillance
  - Hemostatic medication-use evaluation
  - Adverse event reporting
- Monitoring of hemostatic agents entering institution via central supply versus pharmacy department

Patient Care

- Knowledge of bleeding causes, consequences and hemostasis
- Familiarity with characteristics, clinical use of hemostatic agents
  - Blood products
  - Local agents
  - Systemic agents
- Development of therapeutic guidelines, pathways
- Education: inservices, newsletters, institutional websites

Overcoming Barriers to Pharmacist Involvement in Surgical Hemostasis

- Bridge existing knowledge gap relative to bleeding, hemostatic agents
- Engage with other healthcare professionals in other departments
  - Physicians, nurses, laboratory personnel, and others interested in patient safety, clinical outcomes, quality of care, and cost
- Direct patient care settings
- Committees: P&T, Blood Conservation, Quality Council/Patient Safety, Medication Safety

Conclusion

- Perioperative bleeding is a significant cause of increased morbidity and mortality in surgery patients
- Local and systemic hemostatic agents are important adjunctive therapy for reestablishing hemostasis in surgical patients, although have associated risks
- Pharmacists can play an important role relative to minimizing blood product use and maximizing benefits of local and systemic hemostatic agents
Surgical Toolbox

Spotnitz WD, Burks S. Transfusion 2012; 52: 2243-55.

Local Hemostats 2013

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
<th>Class</th>
<th>Brand</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemostats</td>
<td>Mechanical</td>
<td>Porcine Gelatin</td>
<td>Gelfoam Sponge &amp; Powder</td>
<td>Pharmacia, Kalamazoo, MI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bovine Collagen</td>
<td>Artene Sheet, Flour</td>
<td>Davol/Bard, Warwick, RI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human Pooled Plasma Thrombin</td>
<td>hauling</td>
<td>Integra, Plainsboro, NJ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recombinant Human Thrombin</td>
<td></td>
<td>Ethicon/J&amp;J, Somerville, NJ</td>
</tr>
<tr>
<td></td>
<td>Flowable</td>
<td>Human Pooled Plasma &amp; Oxidized Regenerated Cellulose</td>
<td>Tachosil</td>
<td>Baxter, Westlake Village, CA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual Human Plasma</td>
<td>Evershield</td>
<td>Orthovita/Stryker, Malvern, PA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bovine Collagen, &amp; Bovine Thrombin</td>
<td></td>
<td>Ethicon J&amp;J, Somerville, NJ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Human Pooled Plasma &amp; Equine Collagen</td>
<td>Tachosil</td>
<td>Baxter, Westlake Village, CA</td>
</tr>
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<td></td>
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<td>Ethicon J&amp;J, Somerville, NJ</td>
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## Hemostat Characteristics

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<th>Cost</th>
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<tbody>
<tr>
<td>Mechanical</td>
<td>Relatively Safe Swelling, Infection</td>
<td>Effective for Minimal Bleeding</td>
<td>Easy to Prepare &amp; Use</td>
<td><em>Relatively Inexpensive</em></td>
</tr>
<tr>
<td>Active</td>
<td><em>Antibody Formation Disease Transmission: Viral, Prion Recombinant</em></td>
<td>Effective for Localized &amp; Diffuse Bleeding</td>
<td>Relatively Easy to Prepare &amp; Use</td>
<td>Moderately Expensive</td>
</tr>
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<td>Flowable</td>
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## Sealant & Adhesive Characteristics

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<td>Disease Transmission: Viral, Prion</td>
<td>Moderate Strength</td>
<td><em>More Complex to Prepare and Use</em></td>
<td>More Expensive</td>
</tr>
<tr>
<td>Cyanoacrylate</td>
<td><em>Relatively Safe for External Use, Vascular Approved</em></td>
<td>Enhanced Strength Moderate in skin closure</td>
<td>Easy to Prepare &amp; Use</td>
<td>Inexpensive</td>
</tr>
<tr>
<td>PEG Polymer</td>
<td><em>Relatively Safe Swelling</em></td>
<td>Moderate Strength</td>
<td>Moderately Easy to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
<tr>
<td>Albumin &amp; Glutaraldehyde</td>
<td><em>Tissue Injury: Nerve, Muscle Emboli Pseudoaneurysms</em></td>
<td>Enhanced Strength</td>
<td>Moderately Easy to Prepare &amp; Use</td>
<td>More Expensive</td>
</tr>
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SELECTED REFERENCES


SELF-ASSESSMENT QUESTIONS

1. Which of the following is the primary clinical challenge related to bleeding from minimally invasive procedures?
   a. Newer approaches tend to increase the amount of non-suturable bleeding.
   b. Newer approaches tend to decrease the amount of non-suturable bleeding.
   c. Newer approaches tend to increase the amount of suturable bleeding.
   d. Newer approaches tend to decrease the amount of non-cauterizable bleeding.

2. Which of the following local hemostats is least likely to be associated with infectious disease transmission and immunogenicity?
   a. Bovine thrombin.
   b. Human pooled plasma thrombin.
   c. Recombinant human thrombin.
   d. Human pooled fibrinogen and thrombin.

3. Which of the following is the most worrisome adverse event associated with the use of recombinant factor VIIa for uncontrolled, life-threatening bleeding?
   a. Anemia.
   b. Thromboembolic events.
   c. Fluid overload.
   d. Thrombocytopenia.

4. As described by Dr. Boucher, which of the following is the most important role for pharmacists within pharmacy and therapeutic committees relative to systemic and local hemostatic agents?
   a. Affixing safety labels before dispensing these agents.
   b. Monitoring physician prescribing patterns for these agents.
   c. Evaluating the cause of bleeding within a particular intensive care unit.
   d. Evaluating the efficacy and safety data within hemostatic agent class.

Answers
1. a
2. c
3. b
4. d
Instructions for Processing CE Credit with Enrollment Code

**Pharmacists and Technicians:** All ACPE accredited activities which are processed on the eLearning site will be reported directly to CPE Monitor. To claim pharmacy credit, you must have your NABP e-Profile ID, birth month, and birth day. If you do not have an NABP e-Profile ID, go to www.MyCPEMonitor.net for information and application. Please follow the instructions below to process your CPE credit for this activity.

1. The **ASHP eLearning** site allows participants to obtain statements of continuing education credit conveniently and immediately using any computer with an internet connection. Type the following link into your web browser to access the e-Learning site: [http://elearning.ashp.org/my-activities](http://elearning.ashp.org/my-activities)

2. If you already have an account registered with ASHP, log in using your username and password. **If you have not logged in to any of the ASHP sites before and/or are not a member of ASHP**, you will need to set up an account. Click on the **Register** link and follow the registration instructions.

3. Once logged in to the site, enter the enrollment code for this activity in the field provided and click **Redeem**.

   **Note:** The Enrollment Code was announced at the end of the live activity. Please record the Enrollment Code in the grid below for your records.

4. The title of this activity should now appear in a pop-up box on your screen. Click on the **Go** button or the **activity title**.

5. Complete all required elements. A green ✔ should appear as each required element is completed. You can now claim your credit.

6. Look for your profession on the right side of the screen (under **Achievements**) and click the appropriate **Claim** button.

   **CPE Credit for Pharmacists and Technicians:** To claim continuing pharmacy education (CPE) credit, you will need to enter your NABP e-Profile ID, birth month, and birth day. Once you have entered this information the first time, it will auto fill in the future. Please note: All CPE credit processed on the eLearning site will be reported directly to CPE Monitor.

7. Review the information for the credit you are claiming. If all information appears to be correct, check the box at the bottom and click **Claim**. You will see a message if there are any problems claiming your credit.

8. After successfully claiming credit, you may print your statement of credit by clicking on **Print**. If you require a reprint of a statement of credit, you can return here at any time to print a duplicate. Please note that for CPE credit, printed statements may not be necessary because your credit will be reported directly to CPE Monitor.

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<th>Activity Title</th>
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<td>Achieving Hemostasis in the Operating Room and Critical Care Setting:</td>
<td>___ ___ ___</td>
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<td></td>
<td>What the Pharmacist Needs to Know</td>
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