Search History:
1. EMBASE; celox.ti,ab; 45 results.
2. EMBASE; *CHITOSAN/; 11515 results.
3. EMBASE; (chitosan adj2 gauze).ti,ab; 14 results.
4. EMBASE; (chitosan adj2 dressing*).ti,ab; 64 results.
5. EMBASE; 1 OR 2 OR 3 OR 4; 11564 results.
6. EMBASE; (haemorrhag* OR hemorrhag* OR bleed* OR "massive bleed*" OR "blood loss").ti,ab; 497998 results.
7. EMBASE; exp BLEEDING/; 676934 results.
8. EMBASE; exp POSTOPERATIVE HEMORRHAGE/; 25519 results.
9. EMBASE; 6 OR 7 OR 8; 822866 results.
10. EMBASE; 5 AND 9; 177 results.
11. EMBASE; 10 [Limit to: English Language]; 165 results.
12. Medline; celox.ti,ab; 38 results.
13. Medline; (chitosan adj2 gauze).ti,ab; 13 results.
14. Medline; (chitosan adj2 dressing*).ti,ab; 82 results.
15. Medline; *CHITOSAN/; 8575 results.
16. Medline; 12 OR 13 OR 14 OR 15; 8641 results.
17. Medline; (haemorrhag* OR hemorrhag* OR bleed* OR "massive bleed*" OR "blood loss").ti,ab; 363092 results.
18. Medline; exp HEMORRHAGE/ OR exp POSTOPERATIVE HEMORRHAGE/; 286902 results.
19. Medline; 17 OR 18; 494167 results.
20. Medline; 16 AND 19; 127 results.
21. Medline; 20 [Limit to: (Language English)]; 119 results.

Title: PolySTAT-modified chitosan gauzes for improved hemostasis in external hemorrhage

Citation: Acta Biomaterialia, February 2016, vol./is. 31/(178-185), 1742-7061;1878-7568 (01 Feb 2016)

Author(s): Chan L.W., Kim C.H., Wang X., Pun S.H., White N.J., Kim T.H.

Language: English

Abstract: Positively-charged chitosan gauzes stop bleeding from wounds by electrostatically interacting with negatively-charged cell membranes of erythrocytes to cause erythrocyte agglutination and by sealing wounds through tissue adhesion. In the following work, nonwoven chitosan gauze was impregnated with PolySTAT, a synthetic polymer that enhances coagulation by cross-linking fibrin, to generate PolySTAT/chitosan gauzes with improved hemostatic efficacy. When comparing nonwoven chitosan and PolySTAT/chitosan to a commercially-available chitosan-containing gauze (Celox Rapid), no appreciable differences were observed in fiber size, morphology, and pore size. However, PolySTAT/chitosan demonstrated more rapid blood absorption compared to Celox Rapid. In a rat model of femoral artery injury, PolySTAT/chitosan gauzes reduced blood loss and improved survival rate compared to non-hemostatic controls and Celox Rapid. While Celox Rapid had stronger adherence to tissues compared to PolySTAT/chitosan gauzes, blood loss was greater due to hematoma formation under the Celox dressing. Animals treated with

PolySTAT/chitosan gauzes required less saline infusion to restore and maintain blood pressure above the target blood pressure (60 mmHg) while other treatment groups required more saline due to continued bleeding from the wound. These results suggest that PolySTAT/chitosan gauzes are able to improve blood clotting and withstand increasing arterial pressure with the addition of a fibrin cross-linking hemostatic mechanism. Statement of significance Blood loss remains one of the leading causes of death after traumatic injury in civilian populations and on the battlefield. Advanced biomaterials that interact with blood components and/or accelerate the clotting process to form a hemostatic plug are necessary to staunch bleeding after injury. Chitosan-based gauzes, which stop bleeding by causing red blood cell aggregation, are currently used on the battlefield and have shown variable performance under high pressure arterial blood flow in animal studies, suggesting that red blood cell aggregates require further mechanical stabilization for more reliable performance. In this work, we investigate the binding and cross-linking of fibrin, a major component in blood clots, on chitosan gauze fiber surfaces to structurally reinforce red blood cell aggregates.

Publication Type: Journal: Article

Source: EMBASE

Title: Control of Junctional Hemorrhage in a Consensus Swine Model With Hemostatic Gauze Products Following Minimal Training

Citation: Military medicine, November 2015, vol./is. 180/11(1189-1195), 1930-613X (01 Nov 2015)

Author(s): Conley S.P., Littlejohn L.F., Henao J., DeVito S.S., Zarow G.J.

Language: English

Abstract: OBJECTIVE: Uncontrolled hemorrhage from junctional wounds that cannot be controlled by traditional tourniquets accounts for one in five preventable battlefield exsanguination deaths. Products for treating these wounds are costly and require special training. However, chemically treated gauze products are inexpensive, potentially effective, and require only minimal training. This study was designed to assess the efficacy of three hemostatic gauze products following brief training, using a consensus swine groin injury model.METHODS: After viewing a 15-minute PowerPoint presentation, without demonstration or practice, 24 U.S. Navy Corpsmen, most with little to no live tissue or hemostatic agent experience, applied one of three hemostatic agents: QuikClot Combat Gauze, Celox Trauma Gauze, or Hemcon ChitoGauze. Animals were resuscitated and monitored for 150 minutes to assess initial hemostasis, blood loss, rebleeding, and survival. Participants completed a survey before training and following testing.RESULTS: Products were similar in initial hemostasis, blood loss, and rebleeding. Twenty-three swine survived (96%). Ease of use and perceived efficacy of training ratings were high. Comfort level with application improved following training.CONCLUSIONS: Hemostatic gauze can potentially be effective for treating junctional wounds following minimal training, which has important

implications for corpsmen, self-aid/buddy-aid, civilian providers, and Tactical Combat Casualty Care guidelines.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *ProQuest* in Military Medicine

Title: Celox-coated gauze for the treatment of civilian penetrating trauma: a randomized clinical trial.

Citation: Trauma monthly, Feb 2015, vol. 20, no. 1, p. e23862., 2251-7464 (February 2015)

Author(s): Hatamabadi, Hamid Reza, Asayesh Zarchi, Fatemeh, Kariman, Hamid, Arhami Dolatabadi, Ali, Tabatabaey, Ali, Amini, Afshin

Abstract: Uncontrolled hemorrhage is a well-recognized cause of mortality in trauma victims and the control of active hemorrhage is among the initial steps in resuscitation. The purpose of this study was to assess the role of a hemostatic agent "celox" in the management of civilian stab-wound trauma. In this clinical trial study, 160 patients with penetrating limb trauma were randomly allocated to either the control or intervention group (n = 80, each group). Controls were treated with the simple pressure dressing, while the celox-coated gauze was used in the intervention group. The time for achievement of hemostasis and the amount of bleeding were recorded. Data were analyzed using SPSS Version 21 and Stata 13. A P value of less than 0.05 was considered statistically significant. The mean age of participants was 30.5 and the majority of patients were male (90.6%). The forearm and distal leg were the most sites of injury. Hemostasis was achieved within 5 minutes in 32.5% of the control group and 51.3% of the intervention group. Using the celox-coated gauze significantly reduced the time to hemostasis (P = 0.01). Moreover, the blood loss was significantly lower in the celox group compared to the controls (P < 0.05). Using the celox-coated gauze is able to achieve hemostasis in penetrating limb trauma faster than the conventional pressure bandage. Further research is required to clarify the subset of patients who will benefit the most from this effect in the emergency department.

Source: Medline

Full Text:
Available from *National Library of Medicine* in Trauma Monthly

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Title: Topical and effective hemostatic medicines in the battlefield

Citation: International Journal of Clinical and Experimental Medicine, January 2015, vol./is. 8/1(10-19), 1940-5901 (30 Jan 2015)

Author(s): Zhang Y.-J., Gao B., Liu X.-W.

Language: English

Abstract: Uncontrolled hemorrhage has been considered as one of the most important factors for causing death on the battlefront. If given timely and efficient hemostatic medicines in pre-hospital setting, patients will obtain more time and chance to wait for medical treatment so as to save their lives. However, there is not a certain answer about which kind of hemostatic drugs can achieve efficacious effect to hemostasis in the battle. This review aims to summarize effective hemostatic medicines applied in battlefield from 41 articles. After analyzing and comparing the efficacy and complications of those products, we conclude that Fibrin Sealant Dressing, Celox and Woundstat are prior to other materials to stanch life-threatening extremity hemorrhage on the battlefield based on present research in the related area. Therefore, in the prevalence of some inevitable battlefield throughout the world, especially in the Middle Eastern countries, our findings suggest for the first time that the effective hemostatic device is not only a key point to link pre-hospital and hospital care but also an essential way to increase the survival rate of battlefront in the foreseeable future.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *National Library of Medicine* in International Journal of Clinical and Experimental Medicine
Available from *National Library of Medicine* in International Journal of Clinical and Experimental Medicine

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Title: A review on biomedical applications of chitosan-based biomaterials

Citation: International Journal of Pharma and Bio Sciences, 2015, vol./is. 6/3(P162-P178), 0975-6299 (2015)

Author(s): Ishihara M., Hattori H., Nakamura S.

Language: English

Abstract: Chitin/chitosan and their derivatives have attracted considerable interest as a potential source for biomaterials such as hydrogels due to their safety and biological activities, such as, antimicrobial, antitumor and stimulation of wound healing, etc. In particular, some kinds of covalently cross-linked (chemical) chitosan hydrogel such as chemically cross-linked chitosan hydrogel, photocrosslinked chitosan hydrogel (PCH) and ionic crosslinked (physical) chitosan hydrogels such as ionic/temperature sensitive chitosan hydrogel and polyelectrolyte complexes (PECs) composing positive or negative charge have been developed. These have been used in several applications including drug delivery carriers, hemostats, wound dressings, submucosal fluid cushion, tissue adhesive and scaffolds of tissue engineering which we originally evaluated. In this review, we described

on chitosan hydrogels with particular attention on medical applications of PCH, hydrocolloids and PECs in fields of Biomedical Research.

Publication Type: Journal: Review

Source: EMBASE

Title: Review of new topical hemostatic dressings for combat casualty care.

Citation: Military medicine, May 2014, vol. 179, no. 5, p. 497-514, 1930-613X (May 2014)

Author(s): Bennett, Brad L, Littlejohn, Lanny

Abstract: This review analyzes the new (2008-2013) hemostatic agents and dressings for enhanced efficacy in preclinical studies, and investigates supportive findings among case reports of effectiveness and safety in hospital and prehospital literature. A literature search was conducted using PubMed, National Library of Medicine using key words and phrases. The search revealed a total of 16 articles that fit the criteria established for third-generation hemostatic dressings. There were a total of 9 preclinical, 5 clinical, and 2 prehospital studies evaluated. Evaluation of these third-generation studies reveals that mucoadhesive (chitosan) dressings, particularly Celox Gauze and ChitoGauze, clearly show equal efficacy to Combat Gauze across many dependent variables. Chitosan-based products are ideal prehospital dressings because they are shown to work independently from the physiological clotting mechanisms. Many first-, second-, and third-generation chitosan-based dressings have been in use for years by the United States and other NATO militaries at the point of injury, and during tactical evacuation, in Operation Enduring Freedom and Operation Iraqi Freedom without reported complications or side effects. Based on the reported efficacy and long-term safety of chitosan-based products, increased use of Celox Gauze and ChitoGauze within the Department of Defense and civilian venues merits further consideration and open debate.

Source: Medline

Full Text:
Available from *ProQuest* in Military Medicine

Title: Chitosan-based dressing for the treatment of external/accessible bleedings in children with bleeding tendency

Citation: Journal of Pediatric Hematology/Oncology, March 2014, vol./is. 36/2(140-142), 1077-4114;1536-3678 (March 2014)

Author(s): Misgav M., Kenet G., Martinowitz U.

Language: English

Abstract: INTRODUCTION: Bleeding episodes in patients with congenital or acquired bleeding disorders are usually managed with factor concentrates or blood products. However, external and accessible bleeds may effectively be managed with topical hemostasis. MATERIALS AND METHODS: After the application of the Hemcon, a Food and Drug Administration-approved chitosan-based hemostatic dressing was used as the "last resort" to successfully control external bleeds in 2 patients with severe bleeding disorders. We describe a single-center experience with this dressing, including its use in pediatric patients as the first mode of therapy. RESULTS: A total of 5 patients (median age 2 y) with severe bleeding disorders were treated with topical chitosan-based dressing for a total of 6 bleeding episodes. The dressing was used either after the failure of extensive systemic therapy or as the first choice of treatment. In 4 of the 6 episodes, bleeding ceased immediately alleviating the need for systemic therapy. There was no rebleeding after the removal of the dressing and no adverse events or local skin reactions were recorded. CONCLUSION: Hemostatic dressings, such as the chitosan, should be encouraged for the treatment of external/accessible bleeds, especially among the pediatric patients with bleeding tendency. Copyright © 2013 by Lippincott Williams & Wilkins.

Publication Type: Journal: Article

Source: EMBASE

Title: Response of the coagulation system after application of hemostatic dressings in an animal model

Citation: Polish journal of veterinary sciences, 2014, vol./is. 17/4(725-727), 1505-1773 (2014)

Author(s): Jastrzebski P., Adamiak Z., Pomianowski A., Krystkiewicz W., Holak P., Sawicki S., Przyborowska P., Zhalniarovich Y., Gudzbeler G.

Language: English

Abstract: The objective of this study was to determine the response of hemostatic dressings. Coagulation and fibrinolytic systems, red blood cell parameters, platelet and leukocyte counts were evaluated after the application of hemostatic dressings: QuikClot, Chitoauze and Celox gauze. The experiment was performed on ten pigs.

Publication Type: Journal: Article

Source: EMBASE

Title: Effects of ankaferd blood stopper and celox on the tissue factor activities of warfarin-treated rats

Citation: Clinical and Applied Thrombosis/Hemostasis, January 2014, vol./is. 20/1(16-21), 1076-0296;1938-2723 (January 2014)

Author(s): Aktop S., Emekli-Alturfan E., Ozer C., Gonul O., Garip H., Yarat A., Goker K.

Language: English

Abstract: The aim of this study is to evaluate the effect of these new generation hemostatic agents on early-stage soft tissue healing of warfarin-treated rats by measuring the tissue factor (TF) activities. Rats in the warfarin group were treated intraperitonally with 0.1 mg/kg warfarin, and rats in the control group were treated with 1 mL/kg saline. All rats had 3 incisions on dorsal dermal tissue applied Celox, Ankaferd Blood Stopper (ABS), or no hemostatic agent. Six rats from each group were killed on day 4, and the other 6 were killed on day 8. Prothrombin time (PT) and TF activities were evaluated, respectively. Both the hemostatic agents positively affected the hemostasis. Warfarin treatment increased the PT levels as expected. Celox-treated dermal tissues had higher TF activity when compared to ABS-treated ones. The ABS affected the early-stage healing positively in clinical aspect, whereas Celox was more effective on hemostasis by means of increasing TF activities. © The Author(s) 2013.

Publication Type: Journal: Article

Source: EMBASE

Title: Management of External Hemorrhage in Tactical Combat Casualty Care: Chitosan-Based Hemostatic Gauze Dressings--TCCC Guidelines-Change 13-05.

Citation: Journal of special operations medicine : a peer reviewed journal for SOF medical professionals, Jan 2014, vol. 14, no. 3, p. 40-57, 1553-9768 (2014)

Author(s): Bennett, Brad L, Littlejohn, Lanny F, Kheirabadi, Bijan S, Butler, Frank K, Kotwal, Russ S, Dubick, Michael A, Bailey, Jeffrey A

Abstract: Hemorrhage remains the leading cause of combat death and a major cause of death from potentially survivable injuries. Great strides have been made in controlling extremity hemorrhage with tourniquets, but not all injuries are amenable to tourniquet application. Topical hemostatic agents and dressings have also contributed to success in controlling extremity and compressible junctional hemorrhage, and their efficacy continues to increase as enhanced products are developed. Since the addition of Combat GauzeTM (Z-Medica Corporation, Wallingford, CT, USA; http://www.z-medica.com/) in April 2008 to the Tactical Combat Casualty Care (TCCC) Guidelines, there are consistent data from animal studies of severe hemorrhage that chitosan-based hemostatic gauze dressings developed for battlefield application are, at least, equally efficacious as Combat Gauze. Successful

outcomes are also reported using newer chitosan-based dressings in civilian hospital-based surgical case reports and prehospital (battlefield) case reports and series. Additionally, there have been no noted complications or safety concerns in these cases or across many years of chitosan-based hemostatic dressing use in both the military and civilian prehospital sectors. Consequently, after a decade of clinical use, there is added benefit and a good safety record for using chitosan-based gauze dressings. For these reasons, many specific US military Special Operations Forces, NATO militaries, and emergency medical services (EMS) and law enforcement agencies have already implemented the widespread use of these new recommended chitosan-based hemostatic dressings. Based on the past battlefield success, this report proposes to keep Combat Gauze as the hemostatic dressing of choice along with the new addition of CeloxTM Gauze (Medtrade Products Ltd., Crewe, UK; http://www.celoxmedical.com/usa/products /celox-gauze/) and ChitoGauze® (HemCon Medical Technologies, Portland, OR, USA; http://www.hemcon.com/) to the TCCC Guidelines. 2014.

Source: Medline

Title: Effect of 24 hour application of three hemostatic dressings to porcine thigh muscles.

Citation: Polish journal of veterinary sciences, Jan 2014, vol. 17, no. 3, p. 519-521, 1505-1773 (2014)

Author(s): Adamiak, Z, Jastrzebski, P, Pomianowski, A, Otrocka-Domagała, I, Holak, P, Zhalniarovich, Y, Przyborowska, P, Głodek, J

Abstract: The effectiveness of three types of hemostatic dressings, QuikClot Gauze, ChitoGauze PRO and Celox Gauze, was evaluated in nine pigs. The results indicated a strong influence of all examined dressings on porcine femoral muscle tissue evaluated 24 hours after direct contact. A histopathological analysis revealed pathological changes in muscle tissue specimens collected from all the animals.

Source: Medline

Full Text:
Available from *ProQuest* in Polish Journal of Veterinary Sciences

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Title: Successful use of a military-grade haemostatic agent for a major head and neck bleed.

Citation: The Journal of laryngology and otology, Oct 2013, vol. 127, no. 10, p. 1031-1033, 1748-5460 (October 2013)

Author(s): Crunkhorn, R, Burnham, R, Walton, G

Abstract: Major haemorrhage is a catastrophic complication occurring in 3-4 per cent of head and neck cancer patients. Massive haemorrhage also causes 50 per cent of preventable deaths in combat situations. There has been a surge of interest in the

development of effective haemostatic products in the military, with chitosan being one such product. A 48-year-old lady presented with a life-threatening head and neck bleed. She was known to have a malignant peripheral nerve sheath sarcoma originating from the left parapharyngeal space. Bleeding was successfully controlled with the application of CeloxTM granules, a chitosan-based product currently used in the military. This paper describes the first known use of a military haemostatic agent to control a malignant head and neck bleed. Celox granules can be poured directly onto a wound to enhance haemorrhage control. The suggested mechanism of action and reports of current uses of haemostatic agents are described.

Source: Medline

Full Text:
Available from *ProQuest* in Journal of Laryngology and Otology, The

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Title: Haemostatic dressings in prehospital care

Citation: Emergency medicine journal : EMJ, October 2013, vol./is. 30/10(784-789), 1472-0213 (01 Oct 2013)

Author(s): Smith A.H., Laird C., Porter K., Bloch M.

Language: English

Abstract: Massive haemorrhage still accounts for up to 40% of mortality after traumatic injury. The importance of limiting blood loss after injury in order to prevent its associated complications has led to rapid advances in the development of dressings for haemostatic control. Driven by recent military conflicts, there is increasing evidence to support their role in the civilian prehospital care environment. This review aims to summarise the key characteristics of the haemostatic dressings currently available on the market and provide an educational review of the published literature that supports their use. Medline and Embase were searched from start to January 2012. Other sources included both manufacturer and military publications. Agents not designed for use in prehospital care or that have been removed from the market due to significant safety concerns were excluded. The dressings reviewed have differing mechanisms of action. Mineral based dressings are potent activators of the intrinsic clotting cascade resulting in clot formation. Chitosan based dressings achieve haemostasis by adhering to damaged tissues and creating a physical barrier to further bleeding. Acetylated glucosamine dressings work via a combination of platelet and clotting cascade activation, agglutination of red blood cells and local vasoconstriction. Anecdotal reports strongly support the use of haemostatic dressings when bleeding cannot be controlled using pressure dressings alone; however, current research focuses on studies conducted using animal models. There is a paucity of published clinical literature that provides an evidence base for the use of one type of haemostatic dressing over another in humans.

Publication Type: Journal: Review

Source: EMBASE

Full Text:
Available from *Highwire Press* in Emergency Medicine Journal

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Title: Comparison of novel hemostatic dressings with QuikClot combat gauze in a standardized swine model of uncontrolled hemorrhage

Citation: Journal of Trauma and Acute Care Surgery, August 2013, vol./is. 75/2 SUPPL. 2(S150-S156), 2163-0755;2163-0763 (August 2013)

Author(s): Rall J.M., Cox J.M., Songer A.G., Cestero R.F., Ross J.D.

Language: English

Abstract: BACKGROUND: Uncontrolled hemorrhage is the leading cause of preventable death on the battlefield. The development, testing, and application of novel hemostatic dressings may lead to a reduction of prehospital mortality through enhanced point-of-injury hemostatic control. This study aimed to determine the efficacy of currently available hemostatic dressings as compared with the current Committee for Tactical Combat Casualty Care Guidelines standard of treatment for hemorrhage control (QuikClot Combat Gauze [QCG]). METHODS: The femoral artery of anesthetized Yorkshire pigs was isolated and punctured. Free bleeding was allowed to proceed for 45 seconds before packing of QCG, QuikClot Combat Gauze XL (QCX), Celox Trauma Gauze (CTG), Celox Gauze (CEL), or HemCon ChitoGauze (HCG), into the wound. After 3 minutes of applied, direct pressure, fluid resuscitation was administered to elevate and maintain a mean arterial pressure of 60 mm Hg or greater during the 150-minute observation time. Animal survival, hemostasis, and blood loss were measured as primary end points. Hemodynamic and physiologic parameters, along with markers of coagulation, were recorded and analyzed. RESULTS: Sixty percent of QCG-treated animals (controls) survived through the 150-minute observation period. QCX, CEL, and HCG were observed to have higher rates of survival in comparison to QCG (70%, 90%, and 70% respectively), although these results were not found to be of statistical significance in pairwise comparison to QCG. Immediate hemostasis was achieved in 30% of QCG applications, 80% of QCX, 70% of CEL, 60% of HCG, and 30% of CTG-treated animals. Posttreatment blood loss varied from an average of 64 mL/kg with CTG to 29 mL/kg with CEL, but no significant difference among groups was observed. CONCLUSION: These results suggest that the novel hemostatic devices perform at least as well as the current Committee on Tactical Combat Casualty Care standard for point-of-injury hemorrhage control. Despite their different compositions and sizes, the lack of clear superiority of any agent suggests that contemporary hemostatic dressing technology has potentially reached a plateau for efficacy. Copyright © 2013 Lippincott Williams & Wilkins.

Publication Type: Journal: Article

Source: EMBASE

Full Text:

Title: Chitosan based advanced hemostatic dressing is associated with decreased blood loss in a swine uncontrolled hemorrhage model.

Citation: American journal of surgery, May 2013, vol. 205, no. 5, p. 505-510, 1879-1883 (May 2013)

Author(s): Kunio, Nicholas R, Riha, Gordon M, Watson, Katherine M, Differding, Jerome A, Schreiber, Martin A, Watters, Jennifer M

Abstract: The purpose of this study was to compare standard gauze (SG) and advanced hemostatic dressings in use by military personnel in a no-hold model. A randomized, controlled trial was conducted using 36 swine. Animals underwent femoral arteriotomy, followed by 60 seconds of uncontrolled hemorrhage. After hemorrhage, packing with 1 of 3 dressings-SG, Combat Gauze (CG), or Celox Rapid gauze (XG)-and a 500-mL bolus of Hextend were initiated. Pressure was not held after packing, and animals were followed for 120 minutes. Physiologic parameters were monitored continuously, and electrolyte and hematologic laboratory assessments were performed before injury and 30 and 120 minutes after injury. Dressing failure was determined if bleeding occurred outside the wound. All animals survived to study end. Baseline characteristics were similar between groups. No statistical difference was seen in initial blood loss or dressing success rate (SG, 10 of 12; CG, 10 of 12; and XG, 12 of 12). Secondary blood loss was significantly less with XG (median, 12.8 mL; interquartile range, 8.8 to 39.7 mL) compared with SG (median, 44.7 mL; interquartile range, 17.8 to 85.3 mL; P = .02) and CG (median, 31.9 mL; interquartile range, 18.6 to 69.1 mL; P = .05). Packing time was significantly shorter with XG (mean, 37.1 ± 6.2 seconds) compared with SG (mean, 45.2 ± 6.0 seconds; P < .01) and CG (mean, 43.5 ± 5.6 seconds; P = .01). XG demonstrated shorter application time and decreased secondary blood loss in comparison with both SG and CG. These differences may be of potential benefit in a care-under-fire scenario.

Source: Medline

Title: Hemostasis in a noncompressible hemorrhage model: An end-user evaluation of hemostatic agents in a proximal arterial injury

Citation: Journal of Surgical Education, March 2013, vol./is. 70/2(206-211), 1931-7204;1878-7452 (March-April 2013)

Author(s): Satterly S., Nelson D., Zwintscher N., Oguntoye M., Causey W., Theis B., Huang R., Haque M., Martin M., Bickett G., Rush Jr. R.M.

Language: English

Abstract: Objective: 1. Evaluate hemostatic bandages by the end user using subjective and objective criteria. 2. Determine if user training and education level impact overall hemostatic outcomes. 3. Our hypothesis was that prior medical training would be directly linked to improved hemostatic outcomes in noncompressible hemorrhage independent of dressing used. Design: Military personnel were given standardized instruction on hemostatic dressings as part of a tactical combat casualty care course (TC3). Soldiers were randomized to a hemostatic dressing. Proximal arterial (femoral and axillary) injuries were created in extremities of live tissue models (goat or pig). Participants attempted hemostasis through standardized dressing application. Evaluation of hemostasis was performed at 2- and 4-minute intervals by physicians blinded to participants' training level. Setting: Military personnel that are due to deploy are given refresher instruction by their units as well as participating in the TC3 to further hone their medical skills prior to deployment. The TC3 is simulation training designed to simulate combat environments and real-life trauma scenarios. Participants: Military personnel due to deploy, physicians (residents and board certified surgeons), animal care technicians, and veterinarian support. Results: Celox 42 (33%), ChitoGauze 11 (9%), Combat Gauze 45 (35%), and HemCon wafer 28 (22%) bandages were applied in 126 arterial injuries created in 45 animals in a standardized model of hemorrhage. Overall, no significant difference in hemostasis and volume of blood loss was seen between the 4 dressings at 2 or 4 minutes. Combat gauze was the most effective at controlling hemorrhage, achieving 83% hemostasis by 4 minutes. Combat gauze was also rated as the easiest dressing to use by the soldiers ($p<0.05$). When compared to nonmedical personnel, active duty soldiers with prior medical training improved hemostasis at 4 minutes by 20% ($p = 0.05$). Conclusions: There is no significant difference in hemostasis between hemostatic bandages for proximal arterial hemorrhage. Hemostasis significantly improves between 2 and 4 minutes using direct pressure and hemostatic agents. Prior medical training leads to 20% greater efficacy when using hemostatic dressings. © 2013 Association of Program Directors in Surgery.

Publication Type: Journal: Article

Source: EMBASE

Title: Evaluation of hemostatic field dressing for bacteria, mycobacteria, or fungus contamination

Citation: Military medicine, March 2013, vol./is. 178/3(e394-e397), 1930-613X (01 Mar 2013)

Author(s): Murray C.K., Brunstetter T., Beckius M., Dunne J.R., Mende K.

Language: English

Abstract: Infectious complications have a major impact on wounded warriors. Pathogens causing infections include multidrug-resistant bacteria, fungi, and mycobacteria. The potential sources for these pathogens include nosocomial transmission, the environment

(e.g., dirt), or the patients (skin flora) themselves. The purpose of this pilot study was to explore the possibility that hemostatic field dressings might act as an inoculation source of pathogens into wounds. To accomplish this, hemostatic field dressings were assessed for the presence of bacterial, fungal, or mycobacterial contamination. We evaluated two samples of QuikClot Combat Gauze and two samples of CELOX Gauze subjected to normal stresses associated with storage after receipt from the manufacturer. We then evaluated 16 samples of QuikClot Combat Gauze that were collected from personnel deployed in Afghanistan and had undergone routine mechanical stress. Samples underwent screening with Trypticase Soy Broth, blood agar plates, MacConkey agar plates, CHROMagar Staphylococcus aureus plates, chocolate agar plates, Potato Flake agar, Lowenstein-Jensen media, and Middlebrook 7H11 media. No bacteria, fungi, or mycobacteria were recovered from the dressings. It does not appear that hemostatic field dressings are contaminated, even after subjected to field conditions. Further research is needed to identify inoculation sources of fungi and mycobacteria, which cause infections.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *ProQuest* in Military Medicine

Title: Long-term preclinical evaluation of the intracorporeal use of advanced local hemostatics in a damage-control swine model of grade IV liver injury.

Citation: The journal of trauma and acute care surgery, Feb 2013, vol. 74, no. 2, p. 538-545, 2163-0763 (February 2013)

Author(s): Inaba, Kenji, Branco, Bernardino C, Rhee, Peter, Putty, Bradley, Okoye, Obi, Barmparas, Galinos, Talving, Peep, Demetriades, Demetrios

Abstract: The purpose of this study was to evaluate the long-term efficacy and safety of kaolin- and chitosan-based hemostatic agents for hemorrhage control in a 14-day survival, damage-control swine model of Grade IV liver injury. A total of 48 anesthetized pigs (40 kg) underwent a 35% total blood volume bleed, cooling to 34°C and a standardized liver injury. The animals were randomized to standard gauze control (SG, n = 12), QuikClot Combat Gauze (QCCG, n = 12), Celox (CX, n = 12), or Celox Gauze (CXG, n = 12) packing. At 15 minutes, shed blood was calculated, followed by damage-control closure. At 48 hours, pack removal and definitive closure was performed. At 14-day sacrifice, the liver, kidney, heart, lung, and small bowel standard intra-abdominal organs were sampled for histopathological examination. Uncontrolled blood loss at 2 minutes demonstrated internal consistency of the injury. Blood loss at 15 minutes was significantly lower in the CX and QCCG arms (SG, 11.1 ± 1.1 mL/kg; QCCG, 5.3 ± 1.2 mL/kg; CX, 5.7 ± 1.2 mL/kg; and CXG, 10.1 ± 1.3 mL/kg; p = 0.002). Forty-eight-hour survival was 50.0% for SG, 58.3% for QCCG, 83.3% for CX, and 41.7% for CXG (p = 0.161). Fourteen-day survival was 41.7% (5) for SG, 50.0% (6) for QCCG, 58.3% (7) for CX, and 41.7% (5) for CXG (p = 0.821). Four CX and two QCCG deaths were caused by bowel obstruction; one SG death was caused by sepsis; the remainder was caused

by blood loss.Histopathology in one CX animal demonstrated eosinophilic material within a coronary vessel consistent with granule embolization. Celox and QuikClot Combat Gauze were effective hemostatic adjuncts to standard intracavitary damage-control packing. The hemostasis was durable, facilitating pack removal, and definitive closure at reoperation. There was however an increase in the development of intra-abdominal adhesions resulting in small bowel obstruction. The potential for distant embolization of granular agents warrants further investigation.

Source: Medline

Full Text:
Available from *Ovid* in The journal of trauma and acute care surgery.
Available from *Ovid* in Journal of Trauma and Acute Care Surgery

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Title: The use of Celox gauze as an adjunct to pelvic Packing in otherwise uncontrollable pelvic haemorrhage secondary to penetrating trauma

Citation: Journal of the Royal Army Medical Corps, December 2012, vol./is. 158/4(331-333; discussion 333-334), 0035-8665 (Dec 2012)

Author(s): Arul G.S., Bowley D.M., DiRusso S.

Language: English

Abstract: Haemorrhage from severe pelvic fractures can be associated with significant mortality. Modern civilian trauma centres may manage these injuries with a combination of external pelvic fixation, extra-peritoneal packing and/or selective angiography; however, military patterns of wounding are different and deployed medical facilities may be resource constrained. We report two successful instances of pelvic packing using chitosan impregnated gauze (Celox) when conventional surgical attempts at vascular control had failed. We conclude that pelvic packing should be considered early in patients with military pelvic trauma and major haemorrhage, as part of damage control surgery and that Celox gauze may be a useful adjunct. In our cases, the Celox gauze was easily removed after 24-48 hours without significant bowel adhesions and did not leave a residual phelgmon (of exudate or gel) that may predispose to infection.

Publication Type: Journal: Article

Source: EMBASE

Title: Chitosan based hemostatic dressing is associated with decreased blood loss in a swine uncontrolled hemorrhage model

Citation: Journal of the American College of Surgeons, September 2012, vol./is. 215/3 SUPPL. 1(S54-S55), 1072-7515 (September 2012)

Author(s): Kunio N.R., Riha G.M., Watson K.M., Kremenevskiy I.V., Differding J.A., Schreiber M.A., Watters J.M.

Language: English

Abstract: INTRODUCTION: Comparison of advanced hemostatic dressings utilized by US and British military personnel with standard gauze (SG). METHODS: Randomized, controlled, blinded trial utilizing thirtysix swine. Animals underwent a femoral arteriotomy followed by 60 seconds of uncontrolled hemorrhage. Packing with one of the three dressings; SG, Combat Gauze (CG), or Celox Gauze (XG) and a 500 mL bolus of Hextend over a 12 minute period were initiated post hemorrhage. No pressure was held post packing and animals were followed for 120 minutes. Physiologic parameters were monitored continuously while electrolyte and hematologic labs were performed prior to injury, thirty minutes post injury, and 120 minutes post injury. Dressing failure was determined if bleeding occurred outside of the wound. RESULTS: All animals survived to study end. Baseline characteristics were similar between groups. No statistical difference was seen in dressing success rate (SG: 10/12, CG: 10/12, XG: 12/12) or initial blood loss. Secondary blood loss was significantly less with XG (12.8 mL [8.8, 39.7]) compared to SG (44.7 mL [17.8, 85.3]) (p=0.02) and CG (31.9 mL [18.6, 69.1]) (p=0.05). Packing time was significantly shorter with XG (37.1+/-6.2 seconds) compared to SG (45.2+/-6.0) (p=0.01) and CG (43.5 +/- 5.6) (p=0.01). CONCLUSIONS: Celox gauze demonstrated shorter application time and decreased secondary blood loss in comparison to both standard gauze and Combat Gauze. In a care under fire scenario these advantages may offer significant differences in outcomes for the patient and reduce exposure time of medics. This in turn may allow for changes in current tactical combat casualty care policy.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Successful use of a military haemostatic agent in patients undergoing extracorporeal circulatory assistance and delayed sternal closure.

Citation: Interactive cardiovascular and thoracic surgery, Jun 2012, vol. 14, no. 6, p. 695-698, 1569-9285 (June 2012)

Author(s): Muzzi, Luigi, Tommasino, Giulio, Tucci, Enrico, Neri, Eugenio

Abstract: We report the successful control of bleeding in two patients who underwent post-cardiotomy extracorporeal circulatory support (ECMO) and then developed life-threatening bleeding due to severe coagulopathy. After the failure of conventional techniques, bleeding control was achieved using Celox Gauze (MedTrade Products Ltd, Cheshire, UK) packed on the sternal edges and pericardial cavity.

Source: Medline

Full Text:
Available from *Highwire Press* in Interactive CardioVascular and Thoracic Surgery
Available from *Free Access Content* in Interactive Cardiovascular and Thoracic Surgery

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Title: The effects of arterial blood pressure on rebleeding when BleedArrest, Celox and TraumaDex are used in a porcine model of lethal femoral injury.

Citation: Military medicine, Mar 2012, vol. 177, no. 3, p. 340-344, 0026-4075 (March 2012)

Author(s): Burgert, James, Gegel, Brian, Neal, Ann R, Kammer, Karl E, Paul, Martha E, Schwartz, Daniel J, Loughren, Michael, Johnson, Arthur

Abstract: Uncontrolled bleeding remains the leading cause of preventable death in trauma. Hemostatic agents are effective in hemorrhage control but often fail following high-volume crystalloid resuscitation. Aggressive fluid resuscitation increases the blood pressure which may dislodge the newly formed clot causing rebleeding. The purpose of this study was to determine the systolic blood pressure (SBP) and the mean arterial pressure (MAP) at which rebleeding occurs when a clot is formed by one of these hemostatic agents (BleedArrest, TraumaDex, or Celox) compared to a control group. This was a prospective, experimental study using male 5 Yorkshire swine per group (BleedArrest, TraumaDex, Celox, or control). The femoral artery and vein were transected to simulate a traumatic injury. Subjects were allowed to bleed for 60 seconds then one of the agents was poured into the wound. The control group underwent the same procedures but without the hemostatic agent. After 30 minutes, dressings were removed and the SBP was increased incrementally using intravenous phenylephrine until rebleeding occurred or until the arterial blood pressure reached 210 mm/Hg. The SBP and MAP were significantly higher in the BleedArrest, TraumaDex, and Celox groups compared to a control group ($p < 0.05$).

Source: Medline

Full Text:
Available from *ProQuest* in Military Medicine

Title: Effects of ankaferd blood stopper and Celox on short term soft tissue healing in warfarin treated rats

Citation: Turkish Journal of Biochemistry, 2012, vol./is. 37/(no pagination), 1303-829X (2012)

Author(s): Aktop S., Emekll Alturfan E., Ozer C., Caliskan Ak E., Gonul O., PIsIrIcIler R., Ercan F., Yarat A., Goker K.

Language: Turkish, English

Abstract: Ankaferd Blood Stopper (ABS) is a standardized medicinal plant extract, approved in the management of postsurgery dental bleeding and external hemorrhage in Turkey. Celox a complex carbohydrate derivative of chitin is also used to stop bleeding. Aim of this

study was to evaluate the effects of these agents on the tissue collagen content in short term soft tissue healing. Rats were divided as the warfarin treated group (n=12) and the control group (n=12). Rats in the control and study groups were injected 1ml/kg i.p. saline and 0,1 mg/kg i.p. warfarin respectively for 3 days before surgery, stopped on the day of surgery and continued from postoperatively first day until the day of sacrification. 3 incisions were made on all 24 rats, 40 mg of chitosan has been applied to the first wound and 25 mu l of ABS has been applied to the last wound. The wound in the middle has been sutured without haemostatic agent. Six rats in the control and study group have been sacrified 4 days after surgery and the remaining 6 have been sacrified 8 days after surgery. Protrombin time in blood and the collagen content of tissues were evaluated by commercial assay kit and by Lopez-De and Rojkind method. The tissue samples were also evaluated histologically. Both haemostatic agents have shown satisfactory results on haemostasis. Warfarin treatment increased PT level as expected. ABS has shown better soft tissue healing in short term than Celox clinically, biochemically and histologically. ABS clinically affected early stage healing positively. Celox was ineffective to achieve epithelialization.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Intracorporeal use of advanced local hemostatics in a damage control swine model of grade IV liver injury

Citation: Journal of Trauma - Injury, Infection and Critical Care, November 2011, vol./is. 71/5(1312-1318), 0022-5282;1529-8809 (November 2011)

Author(s): Inaba K., Rhee P., Teixeira P.G., Barmparas G., Putty B., Branco B.C., Cohn S., Demetriades D.

Language: English

Abstract: Background: The purpose of this study was to evaluate the efficacy of zeolite- and chitosan-based local hemostatic agents for the control of intracorporeal bleeding in a damage control swine model of grade IV liver injury. Methods: Anesthetized pigs (weight, 40 kg) had a controlled 35% total blood volume bleed from the right jugular vein. A laparotomy was performed and the animals were cooled to 35degreeC. Ringer's lactate was titrated to achieve a three to one blood withdrawal resuscitation. The liver was injured with a standardized 10 cm x 3 cm avulsion. After 2 minutes of uncontrolled hemorrhage, the animals were randomized to application of gauze control (GC, n = 11), Celox (CX, n = 11) (5AM Medical, Newport, OR), or QuikClot ACS (QC, n = 11) (7-Medica, Wallington, CT) and packed in a standardized manner. At 10 minutes, the packs were removed to calculate amount of shed blood. The animals then underwent damage control closure with packing in place. Forty-eight hours after initial damage control packing, the animals were returned to the operating room for pack removal and killing. The need for repacking of the liver was assessed and tissue samples were collected from the liver edge and adjacent small bowel for histopathology. Results: There was no difference in the amount of uncontrolled bleeding

at 2 minutes (GC: 4.0 mL/kg +/- 0.4 mL/kg, CX: 3.5 mL/kg +/- 0.5 mL/kg, QC: 4.0 mL/kg +/- 0.6 mL/kg; one-way analysis of variance: p = 0.715). Compared with GCs, the blood loss at 10 minutes was significantly lower in the CX and QC arms (GC: 8.3 mL/kg +/- 0.9 mL/kg, CX: 3.7 mL/kg +/- 0.7 mL/kg, QC: 4.6 mL/kg +/- 0.8 mL/kg; one-way analysis of variance: p = 0.001). A total of 27.3% of control animals died compared with 18.2% of CX and 0.0% of QC. All GC and QC animals required repacking, compared with one (9.1%) of those in the CX arm. There was no difference between groups in the extent of necrosis. Conclusion: Celox and QuikClot ACS are effective adjuncts to standard intracavitary damage control packing for the control of bleeding. Celox provided durable control allowing packing removal at the time of take-back laparotomy. Further evaluation of their long-term effects is warranted.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Ovid* in Journal of Trauma-Injury Infection & Critical Care
Available from *Ovid* in Journal of Trauma-Injury Infection and Critical Care

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Title: Advanced hemostatic dressings are not superior to gauze for care under fire scenarios

Citation: Journal of Trauma - Injury, Infection and Critical Care, June 2011, vol./is. 70/6(1413-1418), 0022-5282;1529-8809 (June 2011)

Author(s): Watters J.M., Van P.Y., Hamilton G.J., Sambasivan C., Differding J.A., Schreiber M.A.

Language: English

Abstract: BACKGROUND: Advanced hemostatic dressings perform superior to standard gauze (SG) in animal hemorrhage models but require 2 minutes to 5 minutes application time, which is not feasible on the battlefield. METHODS: Twenty-four swine received a femoral artery injury, 30 seconds uncontrolled hemorrhage and randomization to packing with SG, Combat Gauze (CG), or Celox Gauze (XG) without external pressure. Animals were resuscitated to baseline mean arterial pressures with lactated Ringers and monitored for 120 minutes. Physiologic and coagulation parameters were collected throughout. Dressing failure was defined as overt bleeding outside the wound cavity. Tissues were collected for histologic and ultrastructural studies. RESULTS: All animals survived to study end. There were no differences in baseline physiologic or coagulation parameters or in dressing success rate (SG: 8/8, CG: 4/8, XG: 6/8) or blood loss between groups (SG: 260 mL, CG: 374 mL, XG: 204 mL; p > 0.3). SG (40 seconds +/- 0.9 seconds) packed significantly faster than either the CG (52 +/- 2.0) or XG (59 +/- 1.9). At 120 minutes, all groups had a significantly shorter time to clot formation compared with baseline (p < 0.01). At 30 minutes, the XG animals had shorter time to clot compared with SG and CG animals (p < 0.05). All histology sections had mild intimal and medial edema. No inflammation, necrosis, or deposition of dressing particles in vessel walls was observed. No histologic or ultrastructural differences were

found between the study dressings. CONCLUSIONS: Advanced hemostatic dressings do not perform better than conventional gauze in an injury and application model similar to a care under fire scenario. © 2011 Lippincott Williams & Wilkins, Inc.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Ovid* in Journal of Trauma-Injury Infection & Critical Care
Available from *Ovid* in Journal of Trauma-Injury Infection and Critical Care

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Title: Pre-hospital haemostatic dressings: A systematic review

Citation: Injury, May 2011, vol./is. 42/5(447-459), 0020-1383 (May 2011)

Author(s): Granville-Chapman J., Jacobs N., Midwinter M.J.

Language: English

Abstract: Background: Uncontrolled haemorrhage is a leading cause of prehospital death after military and civilian trauma. Exsanguination from extremity wounds causes over half of preven military combat deaths and wounds to the anatomical junctional zones provide a particular challenge for first responders. Commercial products have been developed, which claim to outperform standard gauze bandages in establishing and maintaining non-surgical haemostasis. Since 2004, two advanced haemostatic dressing products, HemCon and QuikClot have been widely deployed in military operations. Newer products have since become available which aim to provide more efficient haemostasis than and thus supersede HemCon and QuikClot. Aim: To conduct a systematic review of clinical and preclinical evidence to compare the relative efficacy and safety of available haemostatic products, which are of relevance to pre-hospital military and civilian emergency medical providers. Method: An English language literature search was performed, using PubMed and Web of Knowledge Databases, with cross-referencing, focussed product searches and communication with product manufacturers. For studies employing animal models, the injury model was required to produce fatal haemorrhage. Products were categorised by primary mode of action as either factor concentrators, mucoadhesive agents or procoagulant supplementors. Results: From 60 articles collated, 6 clinical papers and 37 preclinical animal trials were eligible for inclusion in this review. Products have been tested in three different types of haemorrhage model: low pressure, high volume venous bleeding, high pressure arterial bleeding and mixed arterial-venous bleeding. The efficacy of products varies with the model adopted. Criteria for the 'ideal battlefield haemostatic dressing' have previously been defined by Pusateri, but no product has yet attained such status. Since 2004, HemCon (a mucoadhesive agent) and QuikClot (a factor concentrator) have been widely deployed by United States and United Kingdom Armed Forces; retrospective clinical data supports their efficacy. However, in some recent animal models of lethal haemorrhage, WoundStat (mucoadhesive), Celox (mucoadhesive) and CombatGauze (procoagulant supplementor) have all outperformed both HemCon and QuikClot products. Conclusion:

HemCon and QuikClot have augmented the haemostatic capabilities of the military first aid responder, but newer products demonstrate potential to be more effective and should be considered as replacements for current in service systems. These products could have utility for civilian pre-hospital care. © 2010 Elsevier Ltd. All rights reserved.

Publication Type: Journal: Review

Source: EMBASE

Full Text:
Available from *Injury* in Patricia Bowen Library and Knowledge Service West Middlesex university Hospital

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Title: Hemostatic effect of a chitosan linear polymer (Celox®) in a severe femoral artery bleeding rat model under hypothermia or warfarin therapy.

Citation: Ulusal travma ve acil cerrahi dergisi = Turkish journal of trauma & emergency surgery : TJTES, May 2011, vol. 17, no. 3, p. 199-204, 1306-696X (May 2011)

Author(s): Köksal, Ozlem, Ozdemir, Fatma, Cam Etöz, Betül, Işbil Büyükcoşkun, Naciye, Sığırlı, Deniz

Abstract: In this study, the hemostatic efficacy of Celox® in rats under hypothermia or warfarin treatment was investigated. A total of forty-eight Sprague-Dawley female rats weighing 200-350 g were used in the study. Six experimental study groups were designed, as follows: Group 1: Normothermia + compression; Group 2: normothermia + Celox®; Group 3: hypothermia + compression; Group 4: hypothermia + Celox®; Group 5: normothermia + warfarin + compression; and Group 6: normothermia + warfarin + Celox®. Celox® provided effective hemorrhage control in all three tested groups. There was a statistically significant difference between compression and Celox® implementation in all groups in terms of hemostasis (p-values for the normothermia, hypothermia and warfarin groups were $p<0.05$, $p<0.01$ and $p<0.01$, respectively). Furthermore, the compression numbers were significantly lower in all of the groups that received Celox ® than in those in which compression alone was applied (p-values for the normothermia, hypothermia and warfarin groups were $p<0.01$, $p<0.01$ and $p<0.001$, respectively). Celox® provides effective hemorrhage control under conditions of normothermia, hypothermia and use of the oral anticoagulant agent warfarin.

Source: Medline

Title: Comparison of Celox-A, ChitoFlex, WoundStat, and combat gauze hemostatic agents versus standard gauze dressing in control of hemorrhage in a swine model of penetrating trauma.

Citation: Academic emergency medicine : official journal of the Society for Academic Emergency Medicine, Apr 2011, vol. 18, no. 4, p. 340-350, 1553-2712 (April 2011)

Author(s): Littlejohn, Lanny F, Devlin, John J, Kircher, Sara S, Lueken, Robert, Melia, Michael R, Johnson, Andrew S

Abstract: Uncontrolled hemorrhage remains one of the leading causes of trauma deaths and one of the most challenging problems facing emergency medical professionals. Several hemostatic agents have emerged as effective adjuncts in controlling extremity hemorrhage. However, a review of the current literature indicates that none of these agents have proven superior under all conditions and in all wound types. This study compared several hemostatic agents in a lethal penetrating groin wound model where the bleeding site could not be visualized. A complex groin injury with a small penetrating wound, followed by transection of the femoral vessels and 45 seconds of uncontrolled hemorrhage, was created in 80 swine. The animals were then randomized to five treatment groups (16 animals each). Group 1 was Celox-A (CA), group 2 was combat gauze (CG), group 3 was Chitoflex (CF), group 4 was WoundStat (WS), and group 5 was standard gauze (SG) dressing. Each agent was applied with 5 minutes of manual pressure. Hetastarch (500 mL) was infused over 30 minutes. Hemodynamic parameters were recorded over 180 minutes. Primary endpoints were attainment of initial hemostasis and incidence of rebleeding. Overall, no difference was found among the agents with respect to initial hemostasis, rebleeding, and survival. Localizing effects among the granular agents, with and without delivery mechanisms, revealed that WS performed more poorly in initial hemostasis and survival when compared to CA. In this swine model of uncontrolled penetrating hemorrhage, SG dressing performed similarly to the hemostatic agents tested. This supports the concept that proper wound packing and pressure may be more important than the use of a hemostatic agent in small penetrating wounds with severe vascular trauma.

Source: Medline

Full Text:
Available from *John Wiley and Sons* in Academic Emergency Medicine
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Available from *John Wiley and Sons* in Academic Emergency Medicine
Available from *Wiley-Blackwell Free Backfiles NHS* in Academic Emergency Medicine

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Title: Celox (chitosan) for haemostasis in massive traumatic bleeding: Experience in Afghanistan

Citation: European Journal of Emergency Medicine, February 2011, vol./is. 18/1(31-33), 0969-9546 (February 2011)

Author(s): Pozza M., Millner R.W.J.

Language: English

Abstract: The use of Celox, a chitosan-based haemostatic agent, for the control of massive traumatic bleeding in patients arriving at a ROLE 2 (Enhanced Care) Facility in southwestern

Afghanistan is described. Twenty-one soldiers with gunshot wounds were treated with successful haemostasis in 18 at the first application and in three after further applications. Celox is an effective haemostatic agent and a useful adjunct for the treatment of massive traumatic bleeding. European Journal of Emergency Medicine 18:31-33 © 2011 Wolters Kluwer Health Lippincott Williams & Wilkins.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Ovid* in European Journal of Emergency Medicine

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Title: Hemostatic dressings reduce tourniquet time while maintaining hemorrhage control.

Citation: The American surgeon, Feb 2011, vol. 77, no. 2, p. 162-165, 0003-1348 (February 2011)

Author(s): MacIntyre, Allan D, Quick, Jacob A, Barnes, Stephen L

Abstract: Tourniquet application has become first-line treatment for extremity hemorrhage on the battlefield and has seen increased use in the civilian arena. We hypothesized that an effective windlass tourniquet could be removed after application of a hemostatic dressing in a swine model of peripheral vascular injury. A tourniquet was placed proximally in 50 forelimb-injured swine after 30 seconds of hemorrhage with cessation of hemorrhage in all cases. Hemcon, ActCel, Quikclot, Celox, or standard gauze was then placed over the wound with direct pressure for three minutes. The tourniquet was then removed. Success was determined if no bleeding was identified. Standard gauze resulted in a 100 per cent failure rate with active bleeding present after each application. Celox was successful in maintaining hemostasis in 6 of 10 (60%) subjects. Quikclot succeeded in 80 per cent of subjects. ActCel maintained hemostasis in nine (90%) subjects, whereas HemCon was successful in all instances (100%). All four hemostatic dressings were superior to gauze in maintaining hemostasis after removal of an effective tourniquet. Use of hemostatic dressings in conjunction with a tourniquet may reduce tourniquet times and improve outcomes in peripheral vascular injury and warrants further study.

Source: Medline

Full Text:
Available from *ProQuest* in American Surgeon, The

Title: Hemostatic effect of a chitosan linear polymer (celox) in a severe femoral artery bleeding rat model under hypothermia or warfarin therapy [English;Turkish] Hipotermi ve varfarin uygulanan siddetli femoral arter kanamali{dotless} si{dotless}can modelinde kitosan lineer polimer'in (celox) hemostatik etkinligi

Citation: Ulusal Travma ve Acil Cerrahi Dergisi, 2011, vol./is. 17/3(199-204), 1306-696X (2011)

Author(s): Koksal O., Ozdemir F., Cametoz B., Isbil Buyukcoskun N., Sigirli D.

Language: English, Turkish

Abstract: Background In this study, the hemostatic efficacy of Celox in rats under hypothermia or warfarin treatment was investigated. METHODS A total of forty-eight Sprague-Dawley female rats weighing 200-350 g were used in the study. Six experimental study groups were designed, as follows: Group 1: Normothermia + compression; Group 2: normothermia + Celox; Group 3: hypothermia + compression; Group 4: hypothermia + Celox; Group 5: normothermia + warfarin + compression; and Group 6: normothermia + warfarin + Celox. RESULTS Celox provided effective hemorrhage control in all three tested groups. There was a statistically significant difference between compression and Celox implementation in all groups in terms of hemostasis (p-values for the normothermia, hypothermia and warfarin groups were $p<0.05$, $p<0.01$ and $p<0.01$, respectively). Furthermore, the compression numbers were significantly lower in all of the groups that received Celox than in those in which compression alone was applied (p-values for the normothermia, hypothermia and warfarin groups were $p<0.01$, $p<0.01$ and $p<0.001$, respectively). CONCLUSION Celox provides effective hemorrhage control under conditions of normothermia, hypothermia and use of the oral anticoagulant agent warfarin.

Publication Type: Journal: Article

Source: EMBASE

Title: The effects of BleedArrest, celox, and TraumaDex on hemorrhage control in a porcine model

Citation: Journal of Surgical Research, November 2010, vol./is. 164/1(e125-e129), 0022-4804;1095-8673 (November 2010)

Author(s): Gegel B., Burgert J., Cooley B., MacGregor J., Myers J., Calder S., Luellen R., Loughren M., Johnson D.

Language: English

Abstract: Background: Hemorrhage is the second leading cause of death in civilian trauma and the leading cause of preventable death in military trauma. The purpose of this study was to examine the effectiveness of three hemostatic agents: BleedArrest, TraumaDex, and Celox. Materials and Methods: This was a prospective, experimental study using male Yorkshire swine. The pigs (n = 5 per group) were randomly assigned to one of the following: BleedArrest, TraumaDex, Celox, or control. To simulate a trauma injury, the investigators generated a complex groin injury with transection of the femoral artery and vein in all pigs. After 1 min of uncontrolled hemorrhage, one of the hemostatic agents was poured into the

wound, followed by standard wound packing. The control group underwent the same procedures with the exception of the hemostatic agents. In all groups, 5 min of direct manual pressure was applied to the wound followed by a standard pressure dressing. After 30 min, dressings were removed, and the amount of bleeding was determined. Results: There were significant differences between the BleedArrest (mean = 21.2, SD +/- 36.6 mL) TraumaDex (mean = 68, SD +/- 103.5 mL) and Celox (mean = 18.l6, SD +/- 41.6 mL) groups compared with Control group (mean = 230, SD +/- 154 mL) (P < 0.05). However, there were no statistically significant difference between BleedArrest, TraumaDex, and Celox groups (P = 0.478). Conclusions: BleedArrest, Celox, and TraumaDex were statistically and clinically superior at controlling hemorrhage compared with the standard pressure dressing in the control group. © 2010 Elsevier Inc. All rights reserved.

Publication Type: Journal: Article

Source: EMBASE

Title: Chitosan arrests bleeding in major hepatic injuries with clotting dysfunction: an in vivo experimental study in a model of hepatic injury in the presence of moderate systemic heparinisation.

Citation: Annals of the Royal College of Surgeons of England, Oct 2010, vol. 92, no. 7, p. 559-561, 1478-7083 (October 2010)

Author(s): Millner, Russell, Lockhart, Alan S, Marr, Rebecca

Abstract: The purpose of this study was to explore the effectiveness of two chitosan formulations, Omni-Stat® granules and Celox Gauze®, in a model of major hepatic injury in the presence of clotting dysfunction. Major hepatic injuries in moderately heparinised swine were treated with either Omni-Stat® granules or Celox Gauze® as compared to control plain gauze. Plain gauze control failed to stop the bleeding in 13 of 14 attempts. Omni-Stat® arrested the bleeding in 18 of 18 attempts, providing it was in contact with the bleeding surface. Celox Gauze® arrested bleeding in 5 out of 6 attempts initially, and with further pressure in the sixth. The results support the evidence that chitosan-derived products act independently of classical clotting pathways and should be effective in patients who suffer major liver injury even in the presence of clotting dysfunctions.

Source: Medline

Full Text:
Available from *National Library of Medicine* in Annals of The Royal College of Surgeons of England
Available from *Annals of the Royal College of Surgeons* in Patricia Bowen Library and Knowledge Service West Middlesex university Hospital

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Title: Effects of arterial blood pressure on rebleeding using Celox and traumaDEX in a porcine model of lethal femoral injury

Citation: AANA Journal, June 2010, vol./is. 78/3(230-236), 0094-6354 (June 2010)

Author(s): Burgert J.M., Gegel B.T., Austin III R., Davila A., Deeds J., Hodges L., Hover A., Lockhart C., Roy J., Simpson G., Weaver S., Wolfe W., Johnson D.

Language: English

Abstract: This study was designed to identify the systolic blood pressure (SBP) and mean arterial pressure (MAP) at which rebleeding occurs when a clot is formed by a hemostatic agent, Celox or TraumaDEX, compared with a standard dressing. Fifteen pigs (5 each) were assigned randomly to 1 of 3 groups: Celox, TraumaDEX, or standard pressure dressing as a control. In all animals, the femoral artery and vein were transected to simulate traumatic injury. Subjects were allowed to hemorrhage 1 minute before treatment. Direct pressure was held 5 minutes followed by application of elastic dressings for 30 minutes. Dressings were removed after 30 minutes, and the wound was observed for rebleeding. Animals demonstrating hemostasis received phenylephrine infusion to increase SBP in 10-mm Hg increments until SBP reached 210 mm Hg or hemorrhage recurred. There were statistically significant differences between Celox (mean SBP, 166.4 mm Hg; mean MAP, 137.6 mm Hg) and the control (mean SBP, 88.25 mm Hg; mean MAP, 59.7 mm Hg), and between TraumaDEX (mean SBP, 152.2 mm Hg; mean MAP, 113.2 mm Hg) and the control ($P < .05$). However, no statistically significant difference existed between Celox and TraumaDEX. Celox and TraumaDEX effectively prevent rebleeding compared with standard dressing.

Publication Type: Journal: Article

Source: EMBASE

Title: Effects of Celox and TraumaDEX on hemorrhage control in a porcine model.

Citation: AANA journal, Apr 2010, vol. 78, no. 2, p. 115-120, 0094-6354 (April 2010)

Author(s): Gegel, Brian T, Burgert, James M, Lockhart, Cheryl, Austin, Robert, Davila, Alejandro, Deeds, Jacob, Hodges, Lonnie, Hover, Andrew, Roy, John, Simpson, Glenn, Weaver, Stephen, Wolfe, William, Johnson, Don

Abstract: The purpose of this study was to compare the effectiveness of 2 hemostatic agents, chitosan-based Celox and the biopolymeric, microporous particles TraumaDEX, with a control group in a porcine model of hemorrhage. The animals were randomly assigned to 1 of 3 groups: Celox (n = 5), TraumaDEX (n = 5), or a standard pressure dressing alone (n = 5). To simulate a battlefield injury, the investigators generated a compound groin injury with transection of the femoral artery and vein in 15 pigs. After 1 minute of uncontrolled hemorrhage, Celox or TraumaDEX was poured into the wound, followed by standard wound

packing. The control group underwent the same procedures with the exception of the hemostatic agents. In all groups, 5 minutes of direct manual pressure was applied to the wound, followed by a standard pressure dressing (3M Coban). After 30 minutes, dressings were removed, and the amount of bleeding was measured. There were statistically significant differences in bleeding between Celox and control (P = .01) and between TraumaDEX and control (P = .038), but no statistically significant difference in bleeding between Celox and TraumaDEX (P = .478). Celox and TraumaDEX may be effective hemostatic agents for use in civilian and military trauma.

Source: Medline

Full Text:
Available from *EBSCOhost* in AANA Journal
Available from *ProQuest* in AANA Journal

Title: Comparative testing of new hemostatic agents in a swine model of extremity arterial and venous hemorrhage.

Citation: Military medicine, Apr 2010, vol. 175, no. 4, p. 280-284, 0026-4075 (April 2010)

Author(s): Clay, Jared G, Grayson, J Kevin, Zierold, Dustin

Abstract: To compare advanced hemostatic dressings: HemCon (HC), QuikClot ACS+ (advanced clotting sponge, and two granular agents: Celox (CX) and WoundStat (WS), with a standard field dressing in a swine model of extremity hemorrhage. We randomized 30 animals to treatment with a standard dressing or a hemostatic agent applied to a 2 x 6-mm injury in the femoral artery and vein after 45 s of free bleeding. Animals received 500 mL Hextend 15 min after the bleeding commenced without further resuscitation. End point was survival to 120 min or non-survivable blood pressure. Survival to 120 min among treatment groups was 100% (WS), 83% (CX), 67% (HC), and 50% (ACS+). No control animals survived. Postinjury blood loss (mL/kg) was 4.6 (WS), 12.9 (CX), 10.0 (HC), and 15.8 (ACS+) compared to 27.0 for controls. All hemostatic dressings result in significantly less blood loss and improved survival over standard gauze dressing.

Source: Medline

Full Text:
Available from *ProQuest* in Military Medicine

Title: Penetrating pelvic battlefield trauma: Internal use of chitosan-based haemostatic dressings

Citation: Injury, February 2010, vol./is. 41/2(239-241), 0020-1383 (February 2010)

Author(s): Morrison J.J., Mountain A.J.C., Galbraith K.A., Clasper J.C.

Language: English

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Injury* in Patricia Bowen Library and Knowledge Service West Middlesex university Hospital

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Title: Comparison of 10 hemostatic dressings in a groin transection model in swine

Citation: Journal of Trauma - Injury, Infection and Critical Care, October 2009, vol./is. 67/4(848-855), 0022-5282;1529-8809 (October 2009)

Author(s): Arnaud F., Parreno-Sadalan D., Tomori T., Delima M.G., Teranishi K., Carr W., McNamee G., McKeague A., Govindaraj K., Beadling C., Lutz C., Sharp T., Mog S., Burris D., McCarron R.

Language: English

Abstract: Background: Major improvements have been made in the development of novel dressings with hemostatic properties to control heavy bleeding in noncompressible areas. To test the relative efficacy of different formulations in bleeding control, recently manufactured products need to be compared using a severe injury model. Methods: Ten hemostatic dressings and the standard gauze bandage were tested in anesthetized Yorkshire pigs hemorrhaged by full transection of the femoral vasculature at the level of the groin. Application of these dressings with a 5-minute compression period (at ~200 mm Hg) was followed with a subsequent infusion of colloid for a period of 30 minutes. Primary outcomes were survival and amount and incidence of bleeding after dressing application. Vital signs and wound temperature were continuously recorded throughout the 3-hour experimental observation. Results: These findings indicated that four dressings were effective in improving bleeding control and superior to the standard gauze bandage. This also correlated with increased survival rates. Absorbent property, flexibility, and the hemostatic agent itself were identified as the critical factors in controlling bleeding on a noncompressible transected vascular and tissue injury. Conclusions: Celox, QuikClot ACS⁺, WoundStat, and X-Sponge ranked superior in terms of low incidence of rebleeding, volume of blood loss, maintenance of mean arterial pressure >40 mm Hg, and survival. Copyright © 2009 by Lippincott Williams & Wilkins.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Ovid* in Journal of Trauma-Injury Infection & Critical Care
Available from *Ovid* in Journal of Trauma-Injury Infection and Critical Care
Available from *Ovid* in The journal of trauma.

Title: The second step in vitro trial of ankaferd bloodstopper: Comparison with the other hemostatic agents, Glubran 2, Floseal and Celox

Citation: Journal of Endourology, October 2009, vol./is. 23/(A189) (October 2009)

Author(s): Huri E., Akgul T., Yucel O., Astarci M., Ustun H., Germiyanoglu C.

Language: English

Abstract: Background: We investigated the efficacy of Ankaferd compared with the other hemostatic agents (Glubran 2, Floseal and Celox). Methods: Fourty Wistar rats; divided into five groups. Group T (traditional), partial nephrectomy (PN) with hilar control, Group G (Glubran 2), conventional PN followed application of Glubran 2, Group F (FloSeal), FloSeal application to excised area of kidney, Group C (Celox), Celox was applied, Group A (Ankaferd-ABS), Ankaferd, a novel hemostatic agent, was used. Warm ischemia time (WIT), hemostasis time (HT), were recorded. Histopathologic features were compared among the groups. Kruskal-Wallis and Mann-Whitney U tests were used for statistical analysis. Results: WIT (sec) for GT, 150.4 (SD:10.2), GG, 43.3 (SD:1.7), GF, 52.1 (SD:1.7), GC, 66.6 (SD:2.2) and GA, 81.5 (SD:6.5), there were significant differences ($p < 0.001$). In GA, significant less WIT was detected while the difference compared with the other groups was also significant ($p < 0.001$). HT, in GT, 140.1 (SD:10.2), GG, 32.9 (SD:1.2), GF, 40.9 (SD:1.1), GC, 55.8 (SD:1.8) and GA, 70.1 (SD:6.6) were detected with significant differences (95% CI) ($p< 0.001$). In GA, decreased HT was confirmed, compared with GT while increased HT detected compared with the other groups (GG, GC, GF) ($p<0.001$). Fibrosis, adhesion and calcification were not demonstrated in GA compared with the other groups significantly ($p < 0.001$). Increased fibrosis and adhesion was shown in GF. Erythrocyte aggregation and microvascular proliferation were observed in GG, GF, GA significantly higher ($p < 0.001$). Conclusion: A novel hemostatic agent, ABS, as effective as the other licenced hemostatic agents with comparable WIT and HT and better results of histopathologic findings.

Publication Type: Journal: Conference Abstract

Source: EMBASE

Title: Comparison of 10 hemostatic dressings in a groin puncture model in swine.

Citation: Journal of vascular surgery, Sep 2009, vol. 50, no. 3, p. 632, 1097-6809 (September 2009)

Author(s): Arnaud, Françoise, Teranishi, Kohsuke, Tomori, Toshiki, Carr, Walter, McCarron, Richard

Abstract: The use of mineral (clay) or biologic (chitosan) materials has improved the efficacy of dressings used in the bleeding control of noncompressible areas. A series of novel manufactured products already evaluated in a vascular transection model was further

compared in a severe vascular puncture injury model. Ten hemostatic dressings were tested in anesthetized Yorkshire swine hemorrhaged for 45 seconds in a femoral arterial puncture model. Application of these dressings was followed by 5 minutes of compression (about 175 mm Hg), and at 15 minutes, 500 mL resuscitation fluid (Hextand) was infused during a 30-minute period. The animals were monitored for a 3-hour experimental observation period. Primary outcomes were incidence of bleeding after dressing application and animal survival. Blood loss was 18.8% +/- 5.2% estimated blood volume (EBV) after 45 seconds of free bleeding. Relative performance of dressings is characterized as groups of dressings that performed similarly. Recurrence of bleeding after application was observed with most dressings and was lower with Woundstat, Celox, X-Sponge, and ACS+ (35% +/- 49%) compared with FP-21, Hemcon, Chitoflex, and Bloodstop (79% +/- 43%; P < .01). Blood loss after treatment was 25.3% +/- 18.4% EBV for the top four dressings and 53.0% +/- 18.4% EBV for the bottom four (P < .05). Survival was higher for top four vs bottom four dressings (78% +/- 12% vs 25% +/- 0%, respectively; P < .01). Overall performance of these dressings according to survival, incidence of bleeding, and post-treatment blood loss, yielded similar ranking as with a previously tested transection injury model. The findings indicated that the efficacy of Woundstat, Celox, X-Sponge, and ACS+ were similar and superior in improving survival, hemostasis, and maintenance of mean arterial pressure in an actively bleeding wound caused in this severe vascular injury model.

Source: Medline

Full Text:
Available from *Free Access Content* in Journal of Vascular Surgery

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Title: Determination of efficacy of new hemostatic dressings in a model of extremity arterial hemorrhage in swine.

Citation: The Journal of trauma, Sep 2009, vol. 67, no. 3, p. 450, 1529-8809 (September 2009)

Author(s): Kheirabadi, Bijan S, Scherer, Michael R, Estep, J Scot, Dubick, Michael A, Holcomb, John B

Abstract: The HemCon (HC) bandage and QuickClot have been used over the past 6 years for treating external compressible hemorrhage in combat casualties. Previously, we tested three new hemostatic agents in granular/powder forms that were superior to these products. In this study, four new dressings (preselected) that are more suitable for battlefield application were evaluated. The efficacy and acute safety of the dressings were tested in our standard arterial hemorrhage model. Anesthetized pigs (n = 38, 37 kg) were instrumented, and arterial blood was collected for hematological and coagulation assays. After splenectomy, the right femoral artery was isolated, injured (6 mm arteriotomy), and unrestricted bleeding allowed for 45 seconds. A hemostatic dressing (HC RTS [n = 6], Celox-D [CXb, n = 6], TraumaStat [TS, n = 10], Combat Gauze [CG, n = 10], or placebo gauze [PG, n = 6]) was then applied over the wound randomly and compressed for 2 minutes. Fluid resuscitation was administered and titrated to maintain a mean arterial pressure of 65 mm Hg. Animals were observed for 180 minutes or until death. Computed tomography

angiography was performed on survivors and tissues were collected for histology. No differences were found in baseline blood measures, pretreatment blood loss or fluid infusion among groups. HCs and CXb testing discontinued after six unsuccessful tests, and the data were excluded. Stable hemostasis was achieved in two PG, two TS, and eight CG pigs in remaining groups resulting in stabilized mean arterial pressure and significantly different survival rates (20-80%, p = 0.03). CG secured hemostasis for 134.6 minutes +/- 22.2 minutes, which was significantly longer than TS (35.7 +/- 22.0 minutes, p < 0.05) but not different from PG (57.9 +/- 36.2 minutes). The average survival time of CG-treated animals (167.3 +/- 5.9 minutes) was also significantly longer (p < 0.05) than that of TS- (90.0 +/- 15.3 minutes) or PG-treated (121 +/- 19.3 minutes) pigs. Posttreatment blood loss was less in CG (37.4 +/- 17.3 mL/kg) than that of the two other groups (TS = 79.8 +/- 13.8 mL/kg and PG = 75.5 +/- 23.8 mL/kg), but this difference was not significant. No significant rise in wound temperature (>1 degrees C) was recorded after treatment with dressings and computed tomography images showed no flow through the vessels. Histologic observations showed mild to moderate changes in treated vessels with no difference between CG and PG. In vitro analysis of blood treated with CG or PG (lesser extent) showed increased clotting rate and clot strength. TS treatment had no effect on blood clotting activity. CG was the most effective dressing tested in this arterial hemorrhage model. The hemostatic property of CG is attributed to its raw material (nonwoven Rayon and polyester blend), kaolin coating, and the large surface area (3 inch x 4 yd) of this absorbent sponge. CG is now recommended as the first line of treatment for life-threatening hemorrhage on the battlefield, replacing HC.

Source: Medline

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Available from *Ovid* in Journal of Trauma-Injury Infection and Critical Care
Available from *Ovid* in The journal of trauma.

Title: Comparison of new hemostatic granules/powders with currently deployed hemostatic products in a lethal model of extremity arterial hemorrhage in swine

Citation: Journal of Trauma - Injury, Infection and Critical Care, February 2009, vol./is. 66/2(316-326), 0022-5282;1529-8809 (February 2009)

Author(s): Kheirabadi B.S., Edens J.W., Terrazas I.B., Estep J.S., Klemcke H.G., Dubick M.A., Holcomb J.B.

Language: English

Abstract: BACKGROUND: HemCon bandage (HC) and QuikClot granules (QC) have been deployed for the past 5 years for treating external hemorrhage in combat casualties. We examined efficacy and initial safety of three new hemostatic granules/powders in a swine extremity arterial hemorrhage model that was 100% fatal with army standard gauze treatment. The new products were compared with the most advanced forms of HC and QC products. METHODS: Anesthetized pigs (37 kg, n = 46) were instrumented, splenectomized, and their femoral arteries were isolated and injured (6 mm arteriotomy). After 45 seconds

free bleeding, a test agent [WoundStat (WS), super quick relief (SQR), Celox (CX)] or a control product [HC or QC bead bags (advanced clotting sponge plus)] was applied to the wounds and compressed with a large gauze for 2 minutes. Fluid resuscitation (colloid and crystalloid) was given and titrated to a mean arterial pressure of 65 mm Hg. Animals were observed for 180 minutes or until death. Computed tomography angiography was performed on survivors and tissue samples were collected form wounds for histologic examination. RESULTS: No differences were found in baseline measurements and pretreatment blood loss (17.4 mL/kg +/- 0.5 mL/kg, mean +/- SEM) among groups. Advanced clotting sponge plus testing was halted after six unsuccessful attempts (no hemostasis observed) whereas other agents were tested each in 10 animals. Stable hemostasis was achieved in 10 (WS), 7 (SQR), 6 (CX), and 1 (HC) subjects in each group, resulting in the recovery of mean arterial pressure and survival of the animals for 3 hours ($p < 0.05$, SQR or WS vs. HC). Posttreatment blood loss was significantly reduced with the use of the new agents (CX = 40 +/- 16.6, SQR = 34.5 +/- 16.3, WS = 9.5 mL/kg +/- 5.2 mL/kg) as compared with HC (85.6 mL/kg +/- 10 mL/kg, $p < 0.05$). The granular treated animals lived for 180 (WS), 164 +/- 8.2 (SQR) and 138 +/- 17.7 (CX) minutes, significantly ($p < 0.05$) longer than the HC (83.3 +/- 12 minutes) group. A significant ($p < 0.05$) rise in temperature (53.5degreeC +/- 1.8degreeC) over baseline (36.5degreeC +/- 0.3degreeC) was measured only in the wounds treated with SQR. Computed tomography images showed no blood flow through treated vessels. Histologic evidence indicated the least tissue damage with HC, moderate damage with WS and CX, and most damage including axonal necrosis with SQR. CONCLUSION: The new hemostatic agents are significantly more effective in treating arterial hemorrhage than currently deployed products. Among them, WS granules appear to be most efficacious, followed by SQR and CX powders. The clinical significance of tissue damage caused by these agents and any potential risk of embolism with procoagulant granular/powder products are unknown and warrant survival studies. © 2009 Lippincott Williams & Wilkins, Inc.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Ovid* in Journal of Trauma-Injury Infection & Critical Care
Available from *Ovid* in Journal of Trauma-Injury Infection and Critical Care
Available from *Ovid* in The journal of trauma.

Title: A New Hemostatic Agent: Initial Life-Saving Experience With Celox (Chitosan) in Cardiothoracic Surgery

Citation: Annals of Thoracic Surgery, February 2009, vol./is. 87/2(e13-e14), 0003-4975 (February 2009)

Author(s): Millner R.W.J., Lockhart A.S., Bird H., Alexiou C.

Language: English

Abstract: Celox (MedTrade Products Ltd, Cheshire, UK) is a proprietary preparation of chitosan, indicated for moderate to severe hemorrhage and currently used for hemostasis in the emergency and military settings. We describe its lifesaving use in 2 patients undergoing cardiothoracic surgery in which conventional techniques had failed. © 2009 The Society of Thoracic Surgeons.

Publication Type: Journal: Article

Source: EMBASE

Full Text:
Available from *Free Access Content* in Annals of Thoracic Surgery

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Title: An alternative hemostatic dressing: comparison of CELOX, HemCon, and QuikClot.

Citation: Academic emergency medicine : official journal of the Society for Academic Emergency Medicine, Jan 2008, vol. 15, no. 1, p. 74-81, 1553-2712 (January 2008)

Author(s): Kozen, Buddy G, Kircher, Sara J, Henao, Jose, Godinez, Fermin S, Johnson, Andrew S

Abstract: Uncontrolled hemorrhage remains a leading cause of traumatic death. Several topical adjunct agents have been shown to be effective in controlling hemorrhage, and two, chitosan wafer dressing (HemCon [HC]) and zeolite powder dressing (QuikClot [QC]), are being utilized regularly on the battlefield. However, recent literature reviews have concluded that no ideal topical agent exists. The authors compared a new chitosan granule dressing (CELOX [CX]) to HC, QC and standard dressing in a lethal hemorrhagic groin injury. A complex groin injury with transection of the femoral vessels and 3 minutes of uncontrolled hemorrhage was created in 48 swine. The animals were then randomized to four treatment groups (12 animals each). Group 1 included standard gauze dressing (SD); Group 2, CX; Group 3, HC; and Group 4, QC. Each agent was applied with 5 minutes of manual pressure followed by a standard field compression dressing. Hetastarch (500 mL) was infused over 30 minutes. Hemodynamic parameters were recorded over 180 minutes. Primary endpoints included rebleed and death. CX reduced rebleeding to 0% ($p < 0.001$), HC to 33% (95% CI = 19.7% to 46.3%, $p = 0.038$), and QC to 8% (95% CI = 3.3% to 15.7%, $p = 0.001$), compared to 83% (95% CI = 72.4% to 93.6%) for SD. CX improved survival to 100% compared to SD at 50% (95% CI = 35.9% to 64.2%, $p = 0.018$). Survival for HC (67%) (95% CI = 53.7% to 80.3%) and QC (92%; 95% CI = 84.3% to 99.7%) did not differ from SD. In this porcine model of uncontrolled hemorrhage, CX improved hemorrhage control and survival. CELOX is a viable alternative for the treatment of severe hemorrhage.

Source: Medline

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