

QuikClot Combat Gauze performance under hemodilution/hypothermia/coagulopathy conditions –

The lethal triad of hypothermia, acidosis and coagulopathy has been recognized as a significant cause of death in patients with traumatic injuries. In 1982, a study described a “bloody vicious cycle” in which hemorrhage and tissue injury cause this predictable triad of complicating factors. Normal human body temperature is 35.6–37.8 degrees Celsius with hypothermia being defined as a core temperature < 35 degrees Celsius. The coagulation system is a temperature- and pH-dependent series of complex enzymatic reactions that result in the formation of blood clots to stop both internal and external hemorrhage.

When evaluating the efficacy of a hemostatic dressing to be effective during extreme physiological conditions it is important to review independent peer-reviewed data. There have been a number of papers that have been published which studied hemorrhage control and clot stability under various extreme physiological conditions. QuikClot Combat Gauze has the largest amount of independent data.

Gegel et al. (2014)¹ investigated the efficacy of QuikClot Combat Gauze, fluid resuscitation, and movement on hemorrhage control in a porcine model of hypothermia. This study used the same injury model and methodology as Johnson et al. (2012)², with the additional steps of hypothermia induction before the complex groin injury was performed. As noted in the investigations performed by Johnson et al. (2012)², QuikClot Combat Gauze was again statistically superior in comparison to standard gauze. There was a greater degree of this statistical significance in favor of QuikClot Combat Gauze in this induced hypothermic model, in the groups relative to blood loss, fluid tolerance before rebleeding, and number of movements before rebleeding. Johnson et al. (2012)³ conducted another investigation of hemorrhage control in the presence of hemodilution comparing QuikClot Combat Gauze to standard gauze, in which 30% of the swine’s blood volume was removed and replaced with lactated ringer’s solution. The results of this study showed that QuikClot Combat Gauze had significantly less blood loss and produced a much more robust clot compared to standard gauze. Garcia-Blanco et al. (2015)⁴ investigated the effects of volume resuscitation on rebleeding and movement in a hypothermic hemorrhage model, again comparing QuikClot Combat Gauze to standard gauze. QuikClot Combat Gauze allows for significantly more fluid resuscitation and tolerates significantly more movements than standard gauze. Another study by Sena et al. (2013)⁵ examined the use of kaolin-impregnated gauze (Combat Gauze) for packing high-grade hepatic injuries in a hypothermic coagulopathic swine model.

The results of this study showed that survival in the Combat Gauze group was higher than in the plain gauze group. Animals in the Combat Gauze group lost considerably less blood than those in the plain gauze group.

As noted above traumatic injury patients are subject to the effects of hypothermia, acidosis and coagulopathy. Peer-reviewed human clinical data is another measure of the efficacy of Combat Gauze to control traumatic bleeding. There have been a number of publications of human uses of Combat Gauze in both military and civilian settings. The Israeli Defense Forces (IDF) published a retrospective study on the use of QuikClot Combat Gauze to control hemorrhage in military trauma. The second report was 133 uses of QuikClot Combat Gauze, with an 88.6% success rate in junctional wounds, and a 91.9% success rate in extremity wounds (Shina et al., 2015)⁶. Zietlow et al. (2015)⁷ reported on the translation from military experience to the civilian pre-hospital setting. The study was a retrospective review of tourniquet and hemostatic applications in a rural ambulance and rotor-wing transport rural setting. QuikClot Combat Gauze had a 95% success rate in this study. Schauer et al. (2017)⁸ describe the use of QuikClot Combat Gauze by ground forces in Afghanistan, as documented in the Prehospital Trauma Registry. Patients who received QuikClot Combat Gauze were compared with those who did not receive it. Patients receiving QuikClot Combat Gauze had higher rates of gunshot wounds and were generally sicker. Hemorrhage control success was similar to reported in other studies (~88%). Cripps et al. (2018)⁹ conducted an in vitro analysis of the effects of a kaolin coated hemostatic Dressing on anticoagulated blood. Human blood samples of patients on various anticoagulants were tested with kaolin coated material (KCM). In comparing clinical samples - the addition of KCM significantly improved the initiation of clot formation in both normal and anticoagulated subjects, regardless of the type of anticoagulant.

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