

Aconcagua (6962 m) during January 2009 who signed written informed consent. *Exclusion criteria:* pregnant women, age <18 years. *Study protocol:* VS were measured before and after completion of a 6MWT using a standardized protocol on a 40-m course while acclimatizing at 4365 m. Subjects proceeded towards the summit at their own pace and returned a questionnaire with maximum altitude reached upon descent. *Statistical analysis:* means, 95% confidence intervals, and *t* tests were calculated using Stata.

**Results.**—Sixty-five subjects completed the 6MWT and returned their questionnaires. Thirty-six (55%) climbers reached the summit (6962 m). Mean maximum altitude reached was 6487 m. Among climbers who reached the summit, mean resting  $SaO_2$ : 86.3%, mean 6MWD: 482.9 m, mean postexercise  $SaO_2$ : 80.8%, and mean  $\Delta SaO_2$ : -5.5%. Among climbers who did not reach the summit, mean resting  $SaO_2$ : 83.9%, mean 6MWD: 451.8 m, mean postexercise  $SaO_2$ : 76.5%, and mean  $\Delta SaO_2$ : -7.4%. Between the 2 groups, the differences of the mean were as follows: resting  $SaO_2$ , -2.3% (95% CI: -4.4 to -0.3;  $P = .013$ ); 6MWD, 31.1m (95% CI: -9.4 to 71.5;  $P = .065$ ); postexercise  $SaO_2$ , -4.3% (95% CI: -6.6% to -1.9%;  $P = .0003$ ); and  $\Delta SaO_2$ , -1.9% (95% CI -4.2 to 0.4;  $P = .048$ ).

**Conclusions.**—Climbers who successfully reached the summit of Aconcagua were less hypoxic and performed better on 6MWT compared with those who did not. Future studies with larger sample sizes are needed to validate these results.

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### Intra-articular Sea Urchin Spine/Foreign Body Evaluation: Ultrasound Versus Fluoroscopy

In an out-of-hospital setting, evaluation for soft-tissue foreign bodies after impalement with a sea urchin spine can be challenging, with management options consisting of nonsurgical management or local surgical exploration. However, when an intra-articular foreign body is suspected, transfer to a hospital setting is often required for radiographic evaluation and surgical removal. Ultrasound (US) evaluation may allow for determining in the field if joint involvement is present, possibly eliminating patient transport to a health care facility. Our objective is to evaluate the effectiveness of bedside US in accurately determining the absence of an intra-articular foreign body in comparison to fluoroscopy and computed tomography (CT).

This was a prospective blinded study to determine the utility of US and fluoroscopy to detect an intra-articular foreign body. The largest joint in a skin-on chicken thigh was the target for the foreign body insertion. A single spine from a freshly harvested Uni sea urchin was introduced through the skin of the

chicken, directed towards the joint. The spines were very fragile, and introduction caused the spine to break leaving no evidence of the location of insertion. As a result, the investigator was unable to determine the final position of the spinous tip. Each chicken quarter was evaluated for the presence of an intra-articular foreign body by 3 methods: bedside US, fluoroscopy, and CT. A separate investigator performed each modality and was blinded to the other's results. US evaluation was performed by an emergency medicine physician (EMP) with hospital credentials for emergency US using a SonoSite MicroMaxx US machine with a linear probe. Fluoroscopy was performed by a second EMP using a GE series 9600 fluoroscopy system. There was no time limit for the evaluation of the quarter by either fluoroscopy or US. Using a GE Lightspeed VCT2 CT scanner, 0.625-mm slices (joint protocol) were acquired to evaluate the location of the foreign body. If the foreign body violated the joint capsule, then the interpreting radiologist classified the foreign body as intra-articular. Descriptive statistics were used to report the accuracy of each modality for the detection of intra-articular foreign bodies. All values are reported with a 95% confidence interval (CI).

Six of the 10 trials resulted in the spine penetrating the joint capsule. Ultrasound detected 9 of the 10 foreign bodies. There was one false positive result for joint penetration, yielding a sensitivity and specificity for detecting the intra-articular foreign body of 100% (95% CI: 46.3%–100%) and 75.0% (95% CI: 21.9%–98.7%), respectively. Fluoroscopy detected all 10 foreign bodies but had one false positive result for joint penetration, yielding a sensitivity of 100% (95% CI: 51.7%–100%) and specificity of 75.0% (95% CI: 21.9%–98.7%). The false positive result of both US and fluoroscopy occurred with the same foreign body.

CT remains the gold standard for detecting foreign body joint penetration. However, US may prove to be a valuable tool in identifying out-of-hospital joint penetration, thereby reducing unnecessary delay in treatment or hospital transfer.

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### Intranasal Fentanyl for Analgesia in Injured Patients at a Ski Resort

**Introduction.**—Intranasal fentanyl has been shown to be a safe, effective mode of analgesic administration in prehospital, emergency department, and postoperative patients. We evaluated the use of intranasal fentanyl for initial analgesia in injured patients at a ski resort.

**Methods.**—We retrospectively reviewed the charts of 46 injured adult and pediatric patients treated with intranasal fentanyl during the 2007–2008 winter ski season. Patients were treated with fentanyl according to online Medical Control Emergency Physician (MCEP)-approved doses (approximate dose 1.4  $\mu\text{g}/\text{kg}$ ), using 50  $\mu\text{g}/\text{mL}$  concentration fentanyl ad-

ministered with a MAD Nasal (Wolfe Tory Medical Inc, Salt Lake City, UT) mucosal atomizing device. Doses were administered in 1/6 dose increments in alternating nares. Pain scores were recorded at 0, 2, 5, and 10 minutes using a verbally administered numerical rating scale of 0 through 10.

**Results.**—Data analysis was performed using results from 42 of the 46 patients: 5 pediatric and 37 adult. Four patients were excluded due to incomplete data. Thirty-four patients were initially treated on-slope and 8 patients were initially treated in the clinic. Average weight-based dosage for intranasal fentanyl was 1.4  $\mu\text{g}/\text{kg}$  (95% confidence interval [CI]: 1.3–1.5  $\mu\text{g}/\text{kg}$ ;  $n = 42$ ). The mean baseline pain score for all patients was 8.2 (95% CI: 7.7–8.7;  $n = 42$ ). Pain scores were significantly reduced after treatment with fentanyl. Mean pain score reduction at 2 minutes was  $-1.4$  (95% CI:  $-2.0$  to  $-0.96$ ;  $n = 41$ ); at 5 minutes,  $-2.8$  (95% CI:  $-3.5$  to  $-2.1$ ;  $n=42$ ); at 10 minutes,  $-2.8$  (95% CI:  $-3.7$  to  $-1.9$ ;  $n = 29$ ). No significant complications were noted.

**Conclusion.**—Intranasal fentanyl provides effective analgesia in acutely injured patients and is a good option for patients in whom immediate intravenous access is complicated by environmental, anatomic, or resource limitations. The potential application for search-and-rescue and other austere medicine situations is widespread.

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#### Comparison of 4 Hemostatic Agents, CELOX-A, ChitoFlex, WoundStat, and Combat Gauze, Versus Standard Gauze Dressing in Control of Extremity Hemorrhage in a Limited Access Swine Model of Penetrating Combat Trauma

**Objectives.**—Exsanguination from extremity wounds remains the leading etiology of preventable combat death. We conducted a randomized, prospective, unblinded trial to investigate the efficacy of the most commonly used hemostatic agents in a model of severe vascular injury with mixed high-pressure arterial and venous bleeding in a small, linear tract wound that was designed to replicate a penetrating injury from a projectile where the bleeding site cannot be directly visualized.

**Methods.**—A complex groin injury with transection of the femoral vessels through a 3-cm entrance wound, followed by 45 seconds of uncontrolled hemorrhage, was created in 80 swine prior to randomization to 5 groups. Group 1 used standard gauze; group 2 CELOX; group 3 Chitoflex; group 4 Combat Gauze; and group 5 WoundStat. Each agent was applied with 5 minutes of manual pressure prior to resuscitation. Hemodynamic parameters were recorded over 180 minutes. Primary endpoints included initial hemostasis and incidence of rebleeding. Secondary endpoints included a composite index of adverse events (the 2 primary endpoints and mortality).

**Results.**—Composite adverse events consisting of mortality, posttreatment hemorrhage, and failure of initial hemostasis were compared between treatment groups using single degree of freedom  $\chi^2$  analysis. Chi-square values were Yates-corrected to obtain conservative tests of statistical significance. Four of 16 (25%) CELOX-A, 10 of 16 (62.5%) ChitoFlex, 6 of 16 (37.5%) Combat Gauze, 11 of 16 (68.8%) WoundStat, and 7 of 16 (43.8%) standard dressing subjects suffered from adverse events. A significant difference was found between the agents CELOX-A and WoundStat with respect to composite adverse events ( $P = .0335$ ).

**Conclusions.**—Our study demonstrated that CELOX-A was superior to WoundStat in controlling hemorrhage in smaller limited access wounds. There were no statistically significant differences in gauze products when compared to CELOX-A. Therefore, standard gauze and adequate wound packing were found to perform equally as well as advanced hemostatic agent products in controlling hemorrhage in smaller, linear tract wounds without direct visualization of the bleeding vessels.

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#### Internet Accuracy Regarding Snake Envenomation Prehospital Care

Snake envenomation is a cause of significant morbidity and mortality throughout the world. Historically, the threat posed from the bite of a venomous snake led to the use of numerous treatment modalities of variable efficacy, many based on traditional practice rather than sound scientific knowledge. Research has proven many of these unfounded practices to be ineffective and actually harmful.

With increasing use of the Internet for health information by both clinicians and patients, there is concern that improper treatment modalities regarding snake envenomation prehospital care are being perpetuated. To investigate this hypothesis, 2 major search engines were used to review 48 websites regarding 7 prehospital treatment options for snake envenomation (suction, immobilization, cryotherapy, heat, electric shock, incision, and removal of constrictive devices). Websites were evaluated for their quality using the Health on the Net (HON) seal and *Journal of American Medical Association* (JAMA) benchmarks.

Of the 48 websites reviewed, 26 contained inaccurate recommendations, and the remaining 22 websites were accurate regarding all topics addressed. Among the websites reviewed, improper treatment recommendations included: suction (14); ice/cryotherapy (6); incision (4); and electric shock (1). Five websites ([fda.gov](http://fda.gov), [MedlinePlus.gov](http://MedlinePlus.gov), [umm.edu](http://umm.edu)) that met all 4 JAMA benchmarks and the HON seal included 3 improper treatment recommendations. The 5 websites that met none of