Patient Safety Tip of the Week

July 18, 2017

Another Hazard from Alcohol-Based Hand Gels

Along with soap and water, alcohol-based hand gels are a key component of our hand hygiene programs. But occasionally we have seen unexpected consequences from these.

In our April 2013 What's New in the Patient Safety World column "Reminder: Hand Sanitizers Are Flammable" we noted a very unusual hospital fire injuring a young girl in Oregon (Budnick 2013). It was suspected that an alcohol-based hand sanitizer from a wall-mounted dispenser was the key fuel in this fire. The fire began on the shirt of an 11 y.o. girl, who suffered third degree burns over multiple parts of her body. The report of the fire marshal who investigated the fire determined through discovery and analysis of circumstantial evidence and elimination of other ignition sources that static electricity had likely been the ignition source. The girl had apparently been scuffing her feet and rubbing her bed linens in attempt to create sparks on her sheets. The fuel source was determined to be an alcohol-based hand sanitizer, which the girl had apparently spread on her bedside table and shirt. The alcohol content of the hand sanitizer was 50-70%. In addition, there was olive oil on the girl's shirt and hair. This apparently had been used to remove glue from EEG electrodes that had been used for monitoring. It was noted that some olive oil dripped on her shirt while it was combed through her hair and that the girl also wiped her hands on her shirt after touching her hair. The fire marshal tested the hypothesis regarding the oil and hand sanitizer on her shirt and the ignition source and confirmed burn patterns that matched those in the actual case. Notably, he determined that ignition source would not have been adequate to ignite just the olive oil without the presence of the hand sanitizer.

Those who are familiar with surgical fires know that the alcohol-based skin preps used in the OR are commonly identified as the fuel in surgical fires. But that was the first time we'd heard of the hand sanitizers found in most hospital rooms as a potential fuel. But they certainly have the same types of volatile alcohols in high concentrations that we see in the surgical skin preps that have been associated with surgical fires. This fire did not even require an oxygen-rich environment. But static electricity is ubiquitous and the fumes from the alcohol-based hand sanitizer obviously were enough to generate this fire.

But, beside fires, there are other potential unexpected consequences from hand sanitizers. Now a report from the UK describes another unintended consequence of alcohol-based hand sanitizers: a patient death from drinking substantial amounts of an alcohol-based hand gel (75% ethyl alcohol concentration). Though the case apparently occurred in

2015, it just began to receive attention this year. The 76 y.o. patient apparently had dementia and was confused and drank large amounts of the sanitizer, which was at the end of his bed (Burke 2017). The amount of alcohol in his blood was six times the legal limit (Wooler 2017).

In response to the UK incident, some hospitals have introduced lockable wall mounted dispensers and issued staff with personal mini bottles of hand wash (Coggan 2017).

This is not the first time ingestion of hand gel for its alcohol content has been problematic in the UK. Previously there were reports of patients and visitors drinking hand gel from public areas of hospitals. A number of hospitals in the north of England have removed hand gel from public areas because some patients and visitors were drinking it for its alcoholic content (Barbour 2012).

Gormley and colleagues described a case of coma due to ingestion of an ethanol-based hand sanitizer in a medical inpatient in the US (Gormley 2012). The teenage patient complained of dizziness and then became comatose on the sixth day of a hospitalization. After the patient was admitted to the ICU, a nurse from the patient's floor found an empty 500 mL bottle of hand sanitizer in the patient's wastebasket, covered with a towel. Another clue to the underlying etiology was in serum osmolarity (alcohol is highly osmotic and is included in most formulas for calculating osmolarity but is usually assumed to be zero). In this case, the calculated osmolarity was 304 mOsm/kg and measured osmolarity was 388 mOsm/kg. That led to measurement of serum ethanol level, which returned as 720 mg/dL when drawn more than 6 hours after onset of symptoms. He was treated with hemodialysis and, after regaining consciousness, admitted to infusing the hand sanitizer into his gastrostomy tube because he wanted to "get a buzz" though he denied any suicidal intent. He also admitted to several ingestions during the past year of other ethanol-based hand sanitizers, mouthwash and alcoholic beverages through his gastrostomy tube.

And after we began writing this column, an AHRQ WebM&M presented yet another case of a patient becoming unconscious from alcohol intoxication related to drinking hand sanitizer (Stewart 2017). The patient had a history of alcohol abuse and severe depression and had been hospitalized with pneumonia. When found unconscious, her blood alcohol level was 530 mg/dL. Several empty containers of alcoholic foam hand sanitizer were found and the patient later admitted drinking the sanitizer.

Poisoning from hand sanitizing solutions has been increasing recently. In Canada there have been deaths reported due to ingestion of such agents, which may also contain methanol which is even more toxic (CBC 2013). CDC recently reported on exposure of children aged ≤12 years in the US to hand sanitizers (Santos 2017), using data from the National Poison Data System (NPDS). From 2011 to 2014, a total of 70,669 hand sanitizer exposures in children aged ≤12 years were reported to NPDS, 92% of which were exposures to alcohol-based hand sanitizers. Exposures were somewhat less common during summer months and it was speculated that there might be greater access to hand sanitizers during the school year. The major route of exposure was ingestion and the

majority of intentional exposures to alcohol hand sanitizers occurred in children aged 6–12 years. Alcohol hand sanitizer exposures were associated with worse outcomes than were nonalcohol hand sanitizer exposures. The CDC article points out that younger children have decreased liver glycogen stores, which increases their risk of developing hypoglycemia, and have various pharmacokinetic factors which make them more susceptible to developing toxicity from alcohol. The report concludes that caregivers and health care providers should be aware of the potential dangers associated with hand sanitizer ingestion and that children using alcohol hand sanitizers should be supervised and these products should be kept out of reach from children when not in use.

The fact that older children are more likely to be exposed suggests to the CDC authors that many such exposures are intentional. The above-mentioned Canadian report noted there are many online videos featuring teenagers ingesting hand sanitizers to get intoxicated (CBC 2013).

So what, if anything, should hospitals and other healthcare facilities do regarding this risk? First of all, remember that the overall risk:benefit ratio for alcholol-based sanitizers is overwhelmingly in favor of a net benefit. In so many of our columns on hand hygiene we've stressed the importance of ready availability of dispensers to promote compliance with hand hygiene. So no one would advocate widespread removal of these products from hospitals and clinics.

But there probably are a few things that might be done. First is a **risk assessment** for the patient. Patients who have a history of alcohol abuse or are at risk for alcohol withdrawal or are confused, delirious or demented might be considered at-risk for ingestion of the products. In such cases, it might be possible to utilize methods of dispensing only small amounts of alcohol-containing sanitizer.

The AHRQ article (Stewart 2017) cites as potential solutions dispensers that yield a small dose with a refractory period between doses or dispensers that alarm when used multiple times in a short period. But Stewart notes that these machines are likely to be expensive and thus impractical. As noted above, some UK hospitals have begun use of lockable wall mounted dispensers and issued staff with personal mini bottles of hand wash. Some hospitals are already using hand sanitizing systems that electronically capture the amounts dispensed in order to assess staff compliance with recommended hand hygiene practices. Most of those measure volumes dispensed over 24 hours or longer periods but theoretically they could be programmed to alarm if a certain amount is exceeded within a specified timeframe (keeping in mind that the same amount that would be appropriately dispensed for a healthcare rounding team in a patient room could be enough to seriously harm a patient who ingested that amount).

What about psychiatric patients? A review of intentional ingestions of ethanol-containing hand sanitizers (Gormley 2012) noted that many published case reports describe intentional ingestions that frequently occurred in the emergency department or psychiatric wards, with goals of intoxication or suicide.

What about those psychiatric patients admitted to medical or surgical services? We've done numerous columns on the risk of suicide on med/surg units and other non-behavioral health units. When you have to house a potentially suicidal patient or patient with significant psychiatric conditions on a medical or surgical unit, you need to perform a thorough environmental risk assessment. While hanging or jumping out of windows are probably the most common ways such patients may attempt suicide on those units, exposure to chemicals or other hazardous materials is another risk. And what hazard could be closer than the hand sanitizer dispenser in the patient's room? Since the availability of such dispensers on such units is important for infection control purposes, this might be one situation where the type of "alarming" dispenser mentioned by Stewart might be appropriate.

What about pediatric patients? From the recent CDC report it is clear that children are at highest risk for exposure to hand sanitizers and we'd expect hospitalized children are also likely at high risk.

What about using non-alcohol-based sanitizers? These are less potentially risky than alcohol-based ones but they are also less effective from an infection control standpoint. So don't expect any significant move away from the alcohol-based hand sanitizers. However, if you have a unit that has a historically low prevalence of infections (eg. a behavioral health unit), these might be an option.

We admit that none of these proposed solutions is ideal. The response in the UK to the case noted above indicates that product redesign may be necessary but is also looking for expert input into potential solutions.

While efforts to prevent ingestion of hand-sanitizers may be suboptimal currently, it is equally important to have early recognition of the resultant intoxication so that adequate support can be provided. Management includes the usual supportive care we'd provide any obtunded or comatose patient. But some patients may require dialysis to avoid end organ damage. Therefore, a high level of suspicion is needed if you find a patient obtunded or comatose. As noted above, serum osmolarity may be a clue. If there is a disparity between the calculated osmolarity and the measured one, get a serum ethanol level. Obviously, when we are confronted with a patient with altered level of consciousness and a picture compatible with a "metabolic encephalopathy" we consider intoxications as potential etiologies. But we often forget about that possibility in patients who develop this clinical picture after admission to the hospital. So when there is no obvious other "metabolic" derangement as a likely explanation for the patient's clinical status, get a toxicology screen. But while you are waiting for that tox screen to come back from the lab, don't forget a simple inexpensive step: "**Search the trash!**". Look in the trash receptacles in the patient's room or any other locations he/she may have recently been.

Lastly, don't forget that the dangers to the "at-risk" patient extend beyond the patient's room. They can easily find hand sanitizer dispensers when you send them to the

radiology suite or multiple other areas of the hospital. You might, therefore, even consider adding a warning on your “Ticket to Ride” for intra-hospital transports.

Spreading awareness of the risks associated with alcohol-based hand sanitizers, regardless of how infrequent, is an important first step. However, we need evidence for strategies that mitigate the risks yet help maintain the critical role in infection control that these sanitizers provide. Please send us your comments about any steps you’ve taken at your facilities or other logical interventions that might be undertaken.

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