

**Re: With finger amputations, be aware of excessive tourniquet pressure**

Dear Editor,

I read with interest the article “The Nuts and Bolts of Finger Amputation” in the October issue of EPM. I found the article to be very informative, and it was a great review of a fairly common injury. Among the treatment goals mentioned were the achievement of “near normal sensibility”, and “early functional recovery”; however, using a surgical glove as tourniquet may not only reduce the chance of achieving these goals, it may increase the risk of a tourniquet related injury.

While tourniquets are necessary for the evaluation and management of many digit injuries, there are significant complications associated with their use. These include neurovascular injury resulting from excessive tourniquet pressure, and tissue necrosis that occurs when a tourniquet is left on a digit. The common technique of cutting a finger off of a glove and rolling it onto a digit was banned in the UK in 2010 due to 31 cases of digital ischemia and necrosis that occurred between 2004 and 2009 after the tourniquet was inadvertently left on the digit. While the technique described in the article of placing the entire glove on the patient’s hand effectively eliminates the chance that the tourniquet will be forgotten, studies show that rolling the finger of the glove onto the digit can apply excessive pressure.

The current pressure recommendation for an upper extremity pneumatic tourniquet is 200 mmHg, the “not to exceed” pressure is 300 mm Hg, and nerve injury has been demonstrated at 500 mm Hg. In a 2008 study, the rolled glove method was shown to apply an average pressure to the digit of 561mm Hg. The other methods tested applied even greater pressures, which included the elastic catheter (834mmHg), and the commercial silicon band (636 mmHg). Pressure related injuries occur more quickly than ischemic injuries, with case reports noting neurovascular injuries occurring after only 15-20 minutes of tourniquet application. Two studies performed in the 1980s, using elastic bands, rolls and straps similar to current digital tourniquets, reported tourniquet-induced nerve injury in 71% and 77% of patients. While these injuries are common, they are usually transient. However, even transient nerve injury was noted to result in impaired postoperative function and delayed recovery; outcomes contrary to the treatment goals described in the article.

Several years ago, I learned of the risks associated with digital tourniquet use after reviewing three cases involving tourniquet complications that had occurred in our department. After several literature searches, I realized that each available tourniquet method had significant risks, including the inability to reliably apply a safe and effective pressure. Ultimately, this realization led me to develop the T-Ring, a one size fits all tourniquet that automatically adjusts to the size of any digit and eliminates the risk of excessive pressure. A recent study (Lahham, WJEM 2010) showed the T-Ring consistently applied the lowest and least variable pressure of all methods on all digit sizes, while consistently preventing blood flow.

While injuries related to tourniquets do not occur commonly, they do occur; and we are not always aware which of our patients have conditions that will make them more susceptible to pressure related injury. To minimize these risks, it is currently recommended to always use the least amount of pressure necessary to achieve hemostasis. Using the entire glove does provide an answer to the forgotten tourniquet; it unfortunately does not solve the problem of excessive tourniquet pressure.

- William Green, MD

