

Use of a Pig Model to Demonstrate Vulnerability of Major Neck Vessels to Inflicted Trauma From Common Household Items

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Abstract: Commonly available items including a ball point pen, a plastic knife, a broken wine bottle, and a broken wine glass were used to inflict stab and incised wounds to the necks of 3 previously euthanized Large White pigs. With relative ease, these items could be inserted into the necks of the pigs next to the jugular veins and carotid arteries. Despite precautions against the carrying of metal objects such as knives and nail files on board domestic and international flights, objects are still available within aircraft cabins that could be used to inflict serious and potentially life-threatening injuries. If airport and aircraft security measures are to be consistently applied, then consideration should be given to removing items such as glass bottles and glass drinking vessels. However, given the results of a relatively uncomplicated modification of a plastic knife, it may not be possible to remove all dangerous objects from aircraft. Security systems may therefore need to focus on measures such as increased surveillance of passenger behavior, rather than on attempting to eliminate every object that may serve as a potential weapon.

Key Words: neck trauma, stabbing, plastic knife, pen, bottle, glass, aircraft security

(*Am J Forensic Med Pathol* 2007;28: 31–34)

The types of instruments causing lethal incised or stab wounds of the neck and its major vessels are usually knives, although wounds due to broken glasses or bottles are occasionally encountered in victims of assaults, often occurring in hotels or at social functions where alcohol is being served. The amount of force required to create a stab wound is determined by both the speed of approach of the blade and the sharpness of the tip, with skin providing the most resistance to penetration. Thus, once a forceful thrust with a relatively sharp object has penetrated the skin, passage through soft tissue and muscle is relatively easy.¹ In the following study, a series of sharp objects, including a ballpoint pen, a plastic knife, a broken

drinking glass, and a broken bottle, were used to stab pig carcasses to determine whether such weapons could reach major vessels and inflict lethal wounds.

MATERIALS AND METHODS

Three Large White pig carcasses were obtained from the Institute of Medical and Veterinary Science (IMVS) Veterinary Services Surgical Research Facility, Adelaide, South Australia. The animals had been used in unrelated projects that had been approved by the institutional animal ethics committee. Approval had also been granted by the committee for the subsequent use of the carcasses in this study. The animals had been euthanized with intravenous injections of 20 mL of Lethabarb (pentobarbitone 325 mg/mL). The age, sex, and weight of each animal were recorded.

Immediately following cessation of cardiorespiratory function, demonstrated by electronic monitoring and confirmed on physical examination, the animals necks were shaved and a variety of wounds were inflicted by stabbing the animals with a range of objects. These included a standard office ballpoint pen, a plastic knife obtained from an in-flight meal tray, a standard wine bottle, and a wine glass. The pen was not modified. The plastic knife was broken to provide a sharp tip. The wine bottle was broken against a second bottle, and the neck of the bottle was retained. The wine glass was also broken against another glass, and the portion attached to the base was retained.

The wounds were inflicted at a point midway between the angle of the mandible and the point of the shoulder on each side of the neck of each animal. The wounds were photographed and underlying tissues dissected to demonstrate the proximity of the weapon to major vessels.

For ethical reasons, no human cadavers were included in the study.

RESULTS

The animals were all female Large White pigs, aged between 3.0 and 4.0 months and weighing approximately 30 kg.

Wounds

A standard plastic ballpoint pen was thrust forcefully into the side of a pig neck. Once through the skin, the pen was easily pushed into the deeper soft tissues. Dissection revealed that the pen had passed above the external jugular vein to a point immediately adjacent and beneath the internal carotid artery, 70 mm from the skin surface (Fig. 1).

Manuscript received August 23, 2005; accepted November 14, 2005.

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ISSN: 0195-7910/07/2801-0031

DOI: 10.1097/01.paf.0000233530.18744.07



FIGURE 1. A standard ballpoint pen used to stab a pig neck (A). The pen in situ having been thrust into the side of a pig neck (B). Dissection of the pig neck shown in (B) demonstrated that the pen had passed above the external jugular vein and deep to the internal carotid artery (C).

A broken plastic knife was also stabbed into the side of a pig neck. Once through the skin, it easily penetrated deeper soft tissues. Dissection revealed that the knife had also penetrated to the level of the internal carotid artery (Fig. 2).

The edge of a broken wine glass was drawn across the side of a pig neck, easily cutting through skin and soft tissues.

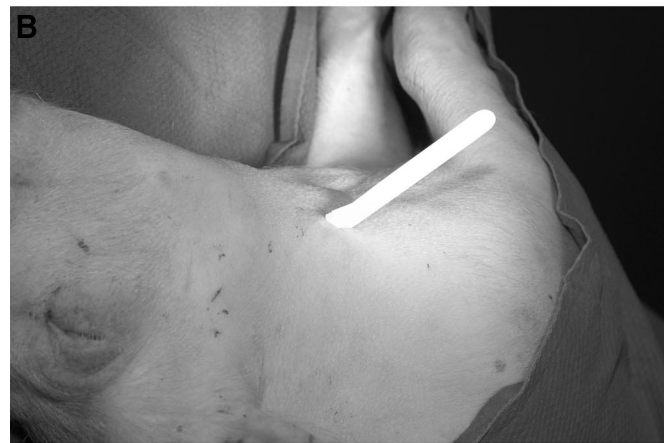
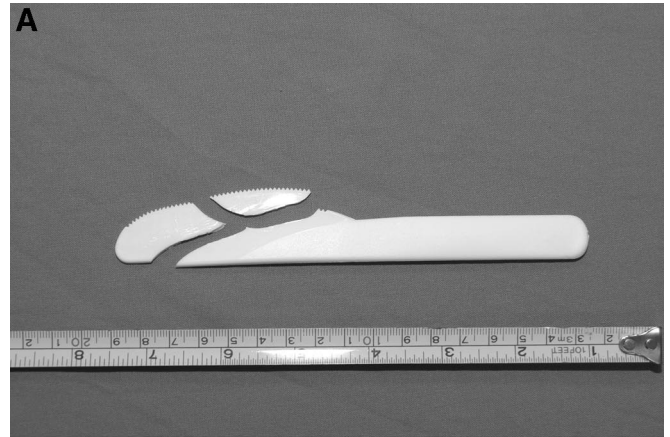


FIGURE 2. A broken plastic knife used to stab a pig neck (A). The knife in situ having been thrust into the side of a pig neck (B). Dissection of the pig neck shown in (B) demonstrated that the knife had penetrated soft tissue deep to the internal carotid artery (C).

Several more passes resulted in severing of the jugular veins and carotid artery (Fig. 3).

The neck of a broken wine bottle was pushed into the side of a pig neck, resulting in a deep incised wound, with severing of the jugular veins and carotid artery (Fig. 4).

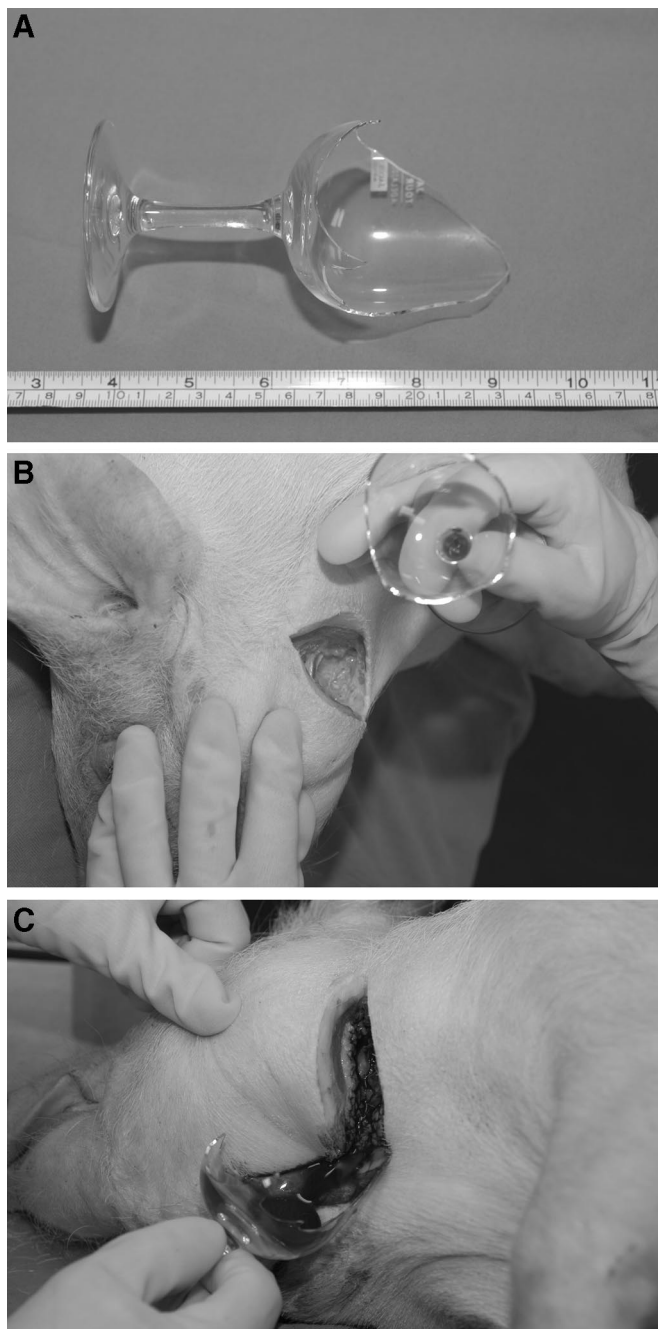


FIGURE 3. A broken wine glass used to incise a pig neck (A). An incision made by the broken glass on the side of a pig neck (B). An even deeper incision of the pig neck shown in (B) demonstrating that the glass had penetrated soft tissues around the jugular veins and internal carotid artery (C).

DISCUSSION

Major vessels of the neck include the carotid arteries and their branches and the jugular veins and their tributaries. While the external jugular veins are superficially placed in subcutaneous tissues, the common and internal carotid arter-

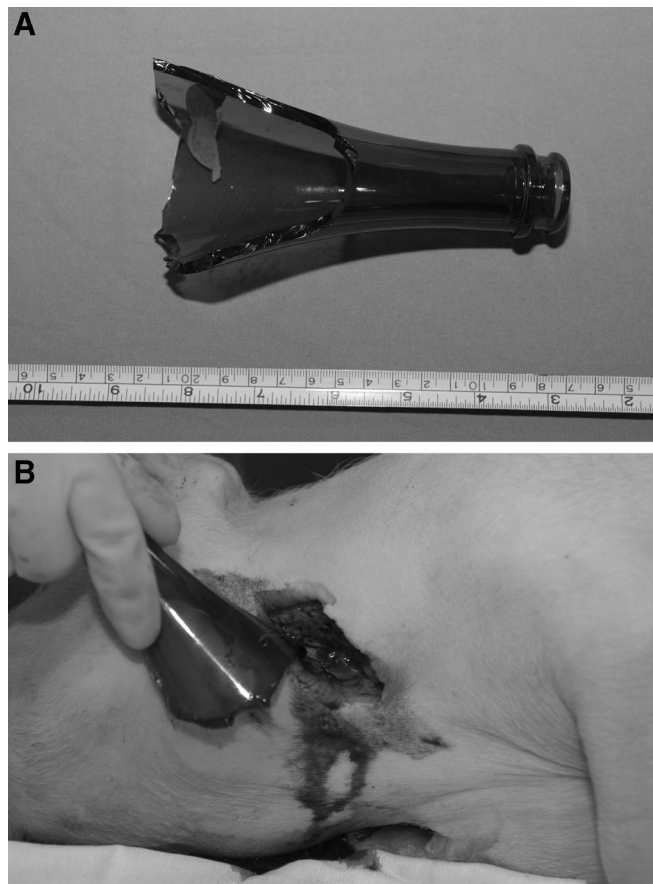


FIGURE 4. A broken wine bottle neck used to incise a pig neck (A). A deep incised wound of the pig neck, with transection of the jugular veins and internal carotid artery (B).

ies and internal jugular veins are deeply placed within the carotid sheath on the sides of the neck, beneath the bodies of the sternocleidomastoid muscles. When these vessels are injured by sharp objects, death may be due to exsanguination from blood loss from incised veins or arteries, from air embolism due to air uptake into incised veins, or from compression of vessels with critical narrowing of luminal diameter due to external pressure from hemorrhage into perivascular soft tissues. Death may occur very rapidly from a combination of all of these factors.

Given the significant concerns that have been raised in recent years regarding aircraft hijacking and international terrorist activities, a large amount of effort has been expended in attempting to make aircraft safer places. This has resulted in markedly increased airport security with routine X-raying of baggage and use of metal detectors on passengers. Confiscation of sharp items such as knives, screwdrivers, corkscrews, and nail files and replacement of metal knives on board with plastic cutlery has also become routine in an attempt to prevent the use of such objects in hijacking.

Unfortunately, however, the current study using an animal model has clearly demonstrated that significant injuries can still be inflicted by items that are carried on board by many passengers or are made available on board. Most travelers carry pens,

and most domestic and international aircraft flights serve meals with plastic knives. Airport duty-free shops the world over sell alcoholic beverages in glass bottles. Many international and domestic carriers still routinely use wine glasses. All of these items were demonstrated in the study to be capable of causing deep injuries, with potential compromise of major vessels.

The pig model was chosen as the animals were readily available to us for study and the cervical anatomy was comparable to that of humans. However, it should be noted that porcine necks are more muscular and stocky, with placement of the carotid sheath vessels at a deeper level than in humans, ie, it is in all likelihood more difficult to inflict the injuries that were created in this study in pigs than in humans, although the injuries were created without particular effort in the animals.

This study has shown that items commonly carried or found on board airplanes are capable of being used to inflict serious and life-threatening injuries. This information is likely to be known to organizations and individuals who are planning to undertake such activities as the use of alternative nonconventional weapons in self-defense training is well recognized.

The purpose of this report is to suggest that if airport and aircraft security measures were consistently applied, then items such as glass bottles and glass drinking vessels would also be prohibited from flights. However, given the results of a relatively uncomplicated modification of a plastic knife, it may not be possible to remove all dangerous objects from aircraft. Security systems may therefore need to be focused on other measures, such as increased surveillance of passenger behavior, rather than on attempting to eliminate all objects that may serve as potential weapons.

ACKNOWLEDGMENTS

The authors would like to sincerely thank the staff of the Institute of Medical and Veterinary Science (IMVS) Veterinary Services Surgical Research Facility, Adelaide, South Australia, in particular Dr Tim Kuchel (head) and Jodie Dier (supervisor) for the provision of pigs and for the use of their facility for the dissection and evaluation of wounds.

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