

A study on police bean bag injuries in a pork model

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Introduction: Currently law enforcement agencies in 10 countries have been granted approval for the use of police bean bag. The need for "less lethal" weapon to control violent suspects is under hot discussion. The manufacturer acknowledges that this weapon will only cause bruises, skin abrasions and minor injuries so as to incapacitate the violent suspect. The objective of this study was to see the degree of trauma produced by shooting police bean bag at different firing ranges. **Materials and methods:** Fresh pork was chosen for this test. The pork was subjected to police bean bag challenge at two different firing ranges. A standard shotgun (Model Remington 870P) was used. In order to test the degree of trauma to different parts of the body, regions with small amount of soft tissue (pig rib) and large amount of soft tissue (pig thigh) were selected. Each region would receive challenge of police bean bag at three and five meters range shot. The above test was repeated with heavy clothing covering the pork. **Results:** It was shown that all shots of police bean bag could produce injuries, ranging from minor indentation to laceration of soft tissues. The degree of trauma was greatly diminished if the target had been protected by heavy clothing. Moreover, the trauma produced on rib region was more severe than that of the thigh region. The larger volume of soft tissue, the better absorption of kinetic energy was expected and resulted in lesser degree of injuries. **Conclusion:** Although police bean bag can still produce injuries, there is great potential for bean bag technology as this is an alternative to deadly force. Both suspects and law enforcement agencies can benefit from this less lethal technology as police bean bag clearly causes fewer fatal injuries and death than traditional bullets. (*Hong Kong j.emerg.med.* 2003;10:124-129)

Keywords: Bean bag, gunshot, law enforcement, wounds

Introduction

This new weapon was first developed in early 1970s and has been used in the United States since 1994. Currently law enforcement agencies in 10 countries have been granted approval for the use of police bean bag.¹ The need for "less lethal" weapon to control violent suspects is under hot discussion.² Police bean bag clearly causes fewer injuries and death than

traditional bullets. The police bean bag is a synthetic bag filled with lead pellets and is fired from a shotgun. The bag is designed to exit the shell, separate from the wadding, and unfold so that the largest area of the bag will hit and transmit all the kinetic energy to the target. The manufacturer claims that this weapon will only cause bruises, skin abrasions and minor injuries so as to incapacitate the violent suspect. The objective of this study was to see the degree of trauma produced by shooting police bean bag at different firing ranges on a pork model.

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Materials and methods

Fresh pork was chosen for this test. The pork was subjected to police bean bag challenge at two different firing ranges. A standard shotgun (Model Remington

870P) was used. (Figure 1) There were several companies manufacturing police bean bag. Super-Sock CTS Model 2581 was chosen for this experiment. (Figure 2) Standard eye and ear protection devices were used when discharging the firearms during the test. In order to test the degree of trauma to different parts of the body, regions with small amount of soft tissue (pig rib) and large amount of soft tissue (pig thigh) were selected. Each region would receive challenge of police bean bag at three and five meters range shot. As lesser degree of injury was expected with heavy clothing, the above test was repeated with heavy clothing covering the pork. After shooting, the pork would be examined for the degree of injuries. Injury was defined as indentation or laceration. If laceration occurred, the pork would be cut open to see the penetration level of injuries.

Results

1. Injury produced on bare pork rib at **five** meters range (Figure 3):

As seen from the serial pictures in Figure 3, the police bean bag produced a deep indentation with

charcoal marks on the skin surface. There was no breach of the skin layer. After cutting open the pork rib, it was shown that the degree of trauma extended from skin up to the muscle layer.

2. Injury produced on bare pork rib at **three** meters range (Figure 4):

As seen from the serial pictures in Figure 4, the indentation on the skin surface was deeper than at five meters range. Moreover, the wadding of the bullet was not separated from the bean bag during firing. It was stuck on the skin surface and was surrounded by charcoal marks. There was no breach of the skin layer. After cutting open the pork rib, it was shown that the degree of trauma was also up to the muscle layer.

3. Injury produced on pork rib with heavy clothing at **five** meters range (Figure 5):

As seen from the serial pictures in Figure 5, charcoal marks were seen on the clothing. However, there was minimal indentation produced on the skin surface. There was no breach of the skin layer. After cutting open the pork rib, only minimal injury was seen on the underlying soft tissues.

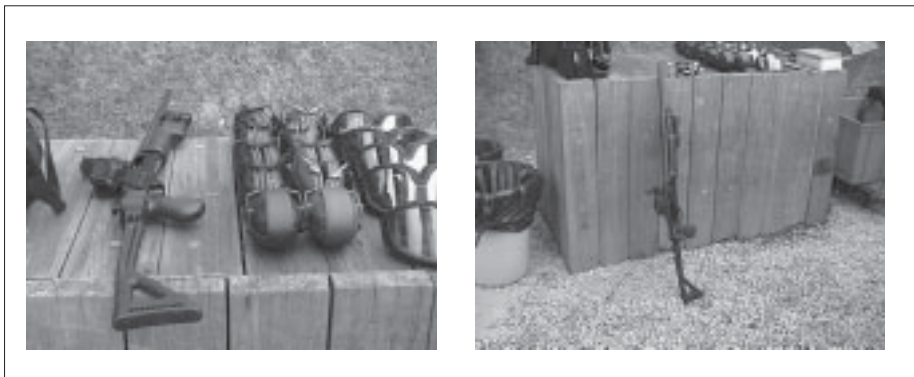


Figure 1. Shotgun Model Remington 870P.



Figure 2. Super-Sock CTS Model 2581 Bean Bag.



Figure 3. Results of 5 meters range shot on bare pork rib.

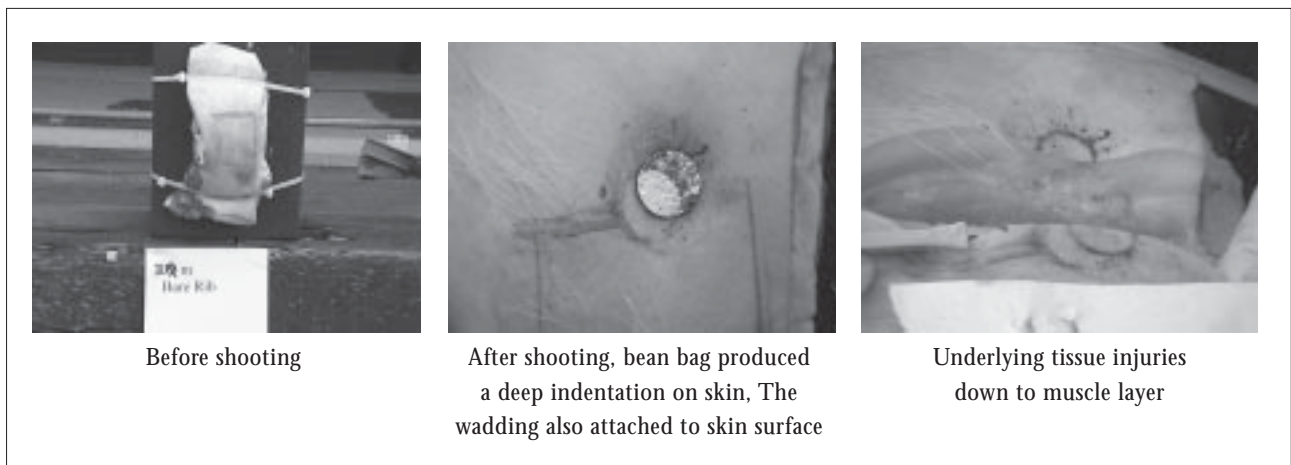


Figure 4. Results of 3 meters range shot on bare pork rib.



Figure 5. Results of 5 meters range shot on pork rib with heavy clothing.

4. Injury produced on pork rib with heavy clothing at **three** meters range (Figure 6):

As seen from the serial pictures in Figure 6, only minimal indentation with minimal underlying soft tissue injury was noted. There was no breach of the skin surface layer.

5. Injury produced on bare pork thigh at **five** meters range (Figure 7):

As seen from the serial pictures in Figure 7, the police bean bag produced a moderate indentation on the skin surface and was surrounded by charcoal marks. There was no breach of the skin layer. After cutting open the pork thigh, only minimal injury was seen in the muscle layer.

6. Injury produced on bare pork thigh at **three** meters range (Figure 8):

As seen from the serial pictures in Figure 8, the police bean bag also produced a moderate

indentation on the skin surface and was surrounded by charcoal marks. The skin surface was intact and similar to five meters range shot; only minimal injury was detected in the muscle layer.

7. Injury produced on pork thigh with heavy clothing at **five** meters range (Figure 9):

As seen from the serial pictures in Figure 9, the police bean bag produced minimal indentation on the skin surface. The skin surface was intact. After cutting open the pork thigh, the injury was only up to the fat layer.

8. Injury produced on pork thigh with heavy clothing at **three** meters range (Figure 10):

As seen from the serial pictures in Figure 10, charcoal marks and probably the wadding marks were seen on the clothing. There was minimal indentation on the skin surface. The skin surface was intact and the injury was up to the fat layer only.

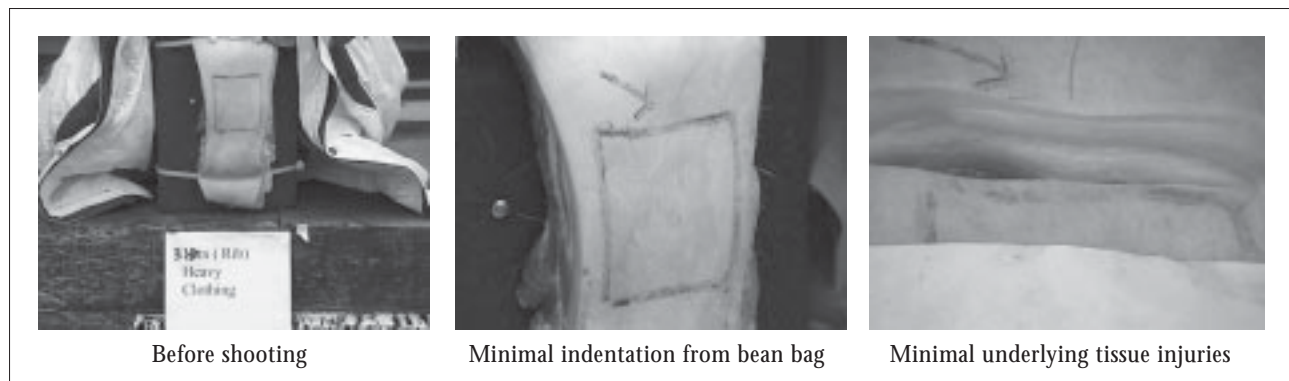


Figure 6. Results of 3 meters range shot on pork rib with heavy clothing.



Figure 7. Results of 5 meters range shot on bare pork thigh.



Figure 8. Results of 3 meters range shot on bare pork thigh.



Figure 9. Results of 5 meters range shot on pork thigh with heavy clothing.



Figure 10. Results of 3 meters range shot on pork thigh with heavy clothing.

Discussion

Police bean bag ammunition is developed for use by law enforcement personnel in situation where armed force is acceptable but lethality is unwarranted. Police bean bag delivers its kinetic energy over an area of approximately 40 mm in diameter to impart a less-lethal impact to the target. It may cause bruises, skin

abrasions and other injuries associated with blunt trauma.³ The optimal firing ranges are between 3 to 15 meters for close-range round with a projectile velocity of 70 meters per second.⁴ However, it is stressed that shot placement rather than deploying range is the critical factor in determining the extent of injuries. Shot to head, neck, thorax, heart or spine can result in fatal or serious injuries.

The standard for demonstration of bullet effectiveness is to analyse the impact of bullet on 10% ordnance gelatin at 4°C.⁵ However, the trauma produced by police bean bag are usually non-penetrating injuries. Therefore, the use of animal tissue is a good simulation to study the effect of police bean bag on different parts of the body. In the above experiment, it was shown that all shots of police bean bag could produce injuries, ranging from minor indentation to laceration of soft tissues. The degree of trauma was greatly diminished if the target had been protected with heavy clothing. Moreover, the trauma produced on rib region was more severe than that of the thigh region. The larger volume of soft tissue, the better absorption of kinetic energy was expected and resulted in lesser degree of injuries. As seen from three meters range shots, the wadding might not separate from the police bean bag and struck the target as well. As a result, it would produce a more severe localized injury. Finally in all shots during experiment, no breach of skin layer was detected. However, human skin might not behave similarly to pig skin and further studies using different types of skin would be required.

According to the experience of Los Angeles County and University of Southern California (LAC + USC) in United States, the trauma produced by police bean bag might range from minor injuries to fatality. Serious injuries like penetrating wounds, massive haemothorax, pneumothorax, pulmonary contusion, ruptured eyeball, splenic rupture, subcapsular hepatic haematoma, pneumopericardium and compartmental syndrome were recorded. The manufacturer advised that the shots should avoid the regions including head, neck, thorax, heart or spine. However, according to the record from LAC+USC, 44%, 17% and 5% of the police bean bag were shot on trunk, abdomen and head respectively.⁶

The police bean bag did not perform as the design intended. As shown in this experiment, the wadding might not be separated from the police bean bag. The kinetic energy was dissipated in a localized region of the skin and more injuries were expected. Moreover, there was the possibility that rupture of the bag might release the pellets and result in penetrating injuries. The degree of incapacitation was unpredictable if the target was covered with heavy clothing. According to

the experience of LAC+USC, the average number of shots required to incapacitate a violent subject was 2.48 (range 1 to 12). Therefore, in critical situation, law enforcement personnel might not have enough time to master the situation and produce the optimal result as mentioned by the manufacturer. Therefore, the Asia Pacific Police Conference in 1996 concluded that bean bag technology was an "unacceptable" method of non-lethal incapacitation.⁷

Conclusions

Despite the above drawbacks, there is still great potential for bean bag technology as this is an alternative to deadly force. Both suspects and law enforcement agencies can benefit from this less lethal technology as police bean bag clearly cause fewer fatal injuries and death than traditional bullets. It is hoped that more investigations using mathematic models, animal testing and anthropomorphic dummy testing can be done to predict the morbidity and mortality of this bean bag technology. As bean bag technology will be expected to become more popular in the future, emergency physicians should be aware of the possible pattern of injuries produced by this technology.

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