The British Student Doctor, 2020;4(3):49-51
doi: 10.18573/bsdj.201
C4ME Supplement

The morphology of musket wounds

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No conflicts of interest to declare

Accepted for publication: 31.10.20

Link to YouTube Video:
https://youtu.be/wq-RF-3ZJTA

Background

The study of historical surgery allows for greater understanding of historical medicine and how such techniques differ to modern equivalents. As such, recent academic interest has focused upon the biomedical validity of the surgical techniques used to treat patients in the medieval and early modern periods. (1) The early modern time period is classically defined to encompass 1500-1800 AD. For the purposes of this article, 'modern' refers to the late 19th century onwards. Early modern military surgeons would have had to treat gunshot wounds caused by lead musket balls fired from black powder charged firearms. Substantial advances have been made in ballistics technology since the 16th and 17th centuries, fundamental adaptations to the technology have led to differing ballistics behaviour between modern and historical ammunition. Previous attempts to describe musket wound morphology have used modern projectiles as analogues. (1) Extrapolating data derived from modern projectiles to apply to historical examples is inherently flawed due to such design differences. As such, debate still exists regarding the morphology of musket ball inflicted wounds, and therefore whether the methods adopted by early modern surgeons to treat them would have been effective.

Aims

- Can current data regarding gunshot wounding from modern weapons accurately predict the behaviour of pre-industrial weapons?
- Can data available at the present regarding pre-industrial firearms allow for the accurate prediction of gunshot wound morphology in human beings?
- Can accounts from historical sources describe gunshot wound morphology in enough detail to corroborate our modern understanding?

Methods

A literature search of the medical and non-medical journals available on Scopus, Web of Science and PubMed was conducted to assess the validity of ballistics data at predicting the wound morphology of modern projectiles as well as historical weapons. Facsimiles of published surgical treatises of Ambroise Paré (1510-1590) and Richard Wiseman (1621-1676) were searched for recorded incidences of gunshot wounds and descriptions of their morphology. This project did not require ethical approval.

Results

A total of 234 papers were obtained using a range of keywords, filtered to 131 papers of potential relevance, 30 of which were analysed in detail. These papers used a variety of modalities to assess gunshot wound (GSW) morphology, mainly ballistics gelatine but also animal models as well as post-mortem data were used. Modern ballistics reveals that a model to assess the morphology of gunshot wounding can be divided into 4 categories: permanent wound tract (the path of the bullet), temporary cavitation (damage from the displacement of tissue parallel to the bullet), penetration (the depth of entry of the bullet), and projectile fragmentation (the shattering of the bullet within the body). (2) A review of the modern literature also revealed an over emphasis the role of temporary cavitation (3) in wounding as well as the significance of projectile fragmentation in causing more substantial injuries. (4)

Modern ballistics data for 17th century projectiles suggest that maximal temporary cavitation may occur far more proximal in wound tract compared to modern weapons with a reduced fragmentation rate when fired into soft tissue analogues such as ballistics gelatine. (5) The permanent wound tract may be impacted by projectile deformation, prominent in soft lead musket balls. This is not seen in modern projectiles.

The literature revealed 11 modern autopsy cases where a musket ball had been used in a homicide or suicide as well as 8 ballistics reports involving muskets. In addition, 34 descriptions of bullet wounds were obtained from the historical sources.

Modern forensic cases regarding musket wounds were collated to reveal that 27% of wounds produced an exit wound and 18% resulted in projectile fragmentation in primarily wounds to the head and neck. Due to the limited modern data available for musket wounds outside the head and neck, historical accounts were also scrutinised. These accounts reveal that exit wounds were formed between 26.5%-51% of the time with only 6% of cases resulting in projectile fragmentation in a variety of anatomical locations including the limbs and trunk. This is significant as it reveals that musket balls were unlikely to fragment when fired in soft tissue and more likely to be retained within tissue compared to a modern round. This appears to be congruent with the results of the few ballistics papers available in this field. (4, 5, 6)

Discussion

These results suggest that muskets balls do not necessarily conform to Fackler's classical model of ballistics. Musket balls did not appear to fragment unless striking bone and had a reduced capacity to penetrate through human tissue. Ballistics tests using both soft tissue simulant and anatomically correct models are required to confirm these observations from the literature.

These results are applicable to several fields. Although rare, GSW with black powder weapons do occur in the forensic literature. These data may be used to help the pathologist to characterise such injuries. It also assists medical historians in understanding the effectiveness of 17th century surgery. The low rate of projectile fragmentation would suggest that the doctrine of rapid removal of the embedded ball from the patient was a logical approach to treatment of this type of wound.

Lessons Learnt

Due to the historical nature of this dissertation, the conventional techniques used to gather data for a literature project had to be modified. The search for modern, peer-reviewed journals regarding black powder gunshot wounds was frustrating due to the dearth of such material. However, this in combination with the novel approach to reviewing period appropriate documentation made discoveries particularly satisfying. The primary skill I gained from this project was that of critical analysis. This is only achieved by reading a large volume of scientific literature from various periods. This enables one to identify fallacious arguments that have penetrated the literature without proper merit. This is a vital skill required for any scientist. Secondary skills such as manipulating databases, data processing and scientific writing were also achieved.

It is commonly stated that a good doctor is a good scientist. This project enabled me to apply the scientific method to answer a historical problem thus enabling me to develop this important skill. It must also be considered that playing the historian is critical to the role of a physician when ascertaining information from a patient. Combining these two disciplines, I hope, will improve my capacity to practice medicine in the coming years.

References

1. Rutherford S. A new kind of surgery for a new kind of war: gunshot wounds and their treatment in the British Civil Wars. Oxford: University Press Scholarship Online; 2018. p. 57-77.

2. Fackler ML, Malinowski JA. The wound profile: a visual method for quantifying gunshot wound components. The Journal of Trauma. 1985;25(6):522-9.

3. Fackler ML. Wound ballistics: a review of common misconceptions. The Journal of the American Medical Association. 1988;259(18):2730-6.

4. Fackler ML, Surinchak JS, Malinowski JA, Bowen RE. Bullet fragmentation: a major cause of tissue disruption. The Journal of Trauma. 1984;24(1):35-9.

5. Krenn P, Kalaus P, Hall B. Material culture and military history: Test-firing early modern small arms. Material Culture Review. 1995;42:101-108

6. Dougherty PJ, Eidt HC. Wound ballistics: Minie ball vs. full metal jacketed bullets--a comparison of Civil War and Spanish-American War firearms. Military Medicine. 2009;174(4):403 7.

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Journal DOI
10.18573/issn.2514-3174

Issue DOI
10.18573/bsdj.v4i3

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Cardiff University Press
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