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Review

Epidemiology of penetrating injuries in the United Kingdom: A systematic review

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HIGHLIGHTS

- 11 articles reviewed.
- Highest incidence in London.
- Highest mortality in Midlands.

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ABSTRACT

Introduction: Penetrating injuries account for a significant number of deaths in the United Kingdom (UK) annually. Numerous articles have examined the epidemiology of penetrating trauma in various areas of the UK. This article aimed to systematically review the current literature and evaluate the incidence and mortality of penetrating injury according to region in the UK.

Methods: A systematic literature search was performed using MEDLINE® (1946 to June 2016), EMBASE® (1974 to June 2016), and PsycINFO® (1806 to June 2016) databases. The following keywords were used in combination with Boolean operators: "epidemiology", "incidence", "frequency", "pattern", "distribution"; "penetrating"; "injuries", "injury", "trauma"; "United Kingdom", "UK", "England", "Scotland", "Wales", "London".

Results: Eleven relevant studies were identified across five regions of the UK. Study periods ranged from 3 months to 16 years and encompassed between 343 and 127,191 patients. Relative incidence within individual studies ranged from 0.3% (Midlands) to 21.0% (London) and mortality ranged from 0.5% (London) to 15.4% (Midlands). The majority of patients were young males.

Discussion: An extensive range of incidence and mortality rates were observed between studies in all regions. This was largely dependent on the study population under review. London was found to have the highest incidence of penetrating injuries, however these studies tended to focus on populations of trauma patients. The high proportion of male victims may reflect the risk of becoming involved in gangs and violence.

Conclusions: Our ambiguous results indicate the need for further work directed towards the epidemiology of penetrating injuries within regional trauma networks.

1. Introduction

Penetrating injuries (PI), defined as any injury that occurs when an object pierces the skin and enters a tissue of the body, constitute an estimated 3.1% of adult [1] and 10% of paediatric [2] trauma in the United Kingdom (UK). Penetrating trauma is a major contributing factor to premature mortality and permanent disability; it can have dramatic physical and psychological consequences for the individual, particularly when the injury is sustained via assault [3]. There are significant economic and political implications; the average treatment cost per patient amounts to nearly £8000 [4], which places emphasis on the need for primary prevention through

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legislation and other interventions. Indeed, penetrating trauma tends to be a consequence of interpersonal violence [5–9].

Several epidemiological studies have examined incidence and mortality rates of penetrating trauma in various areas of the UK [9–13]. The extant literature is limited, however, because frequently it is localised and utilises specific study populations that differ in nature of injury. To date, no comparison has been made between studies to draw general conclusions. The current study aimed to systematically review the published literature and evaluate the incidence and mortality rates of adult penetrating trauma in relation to geographical region within the UK.

2. Patients and methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method directed this systematic review. Comprehensive searches of the MEDLINE® (1946 to June 2016), EMBASE® (1974 to June 2016), and PsycINFO® (1806 to June 2016) databases were performed to identify studies of potential relevance. Keywords were combined using "OR"/"AND" operators and included the following: "epidemiology", "incidence", "frequency", "pattern", "distribution"; "penetrating"; "injuries", "injury", "trauma"; "United Kingdom", "UK", "England", "Scotland", "Wales", "London". Results were screened for applicability, with further scrutiny of the abstract if uncertain, prior to removal of duplicates. The remaining articles were subject to exclusion criteria and only those that met all conditions were included in this review.

Studies from various areas of the UK were included. National epidemiological studies were used to evaluate the overall incidence of adult penetrating trauma in the UK. Research conducted locally at NHS Foundation Trusts was also incorporated to provide an insight into the patterns and disparities between regions. This included articles which specifically reviewed the incidence of penetrating trauma. The criteria permitted inclusion of complete articles and conference abstracts concerning adult populations.

Publications that reviewed populations from outside the UK were excluded from this review, including those concerning the military and Republic of Ireland. Studies which lacked adequate supporting data or evaluated only the incidence of non-penetrating trauma were also excluded. Furthermore, studies that examined the incidence of uncommon traumatic injuries (i.e. splenic trauma) or paediatric populations were excluded.

3. Results

The literature search generated 118 potentially relevant publications for appraisal. Of these studies, 84 were deemed irrelevant and subsequently excluded as they related to diagnosis or management of PI. Eight were rejected from this review as they evaluated populations from outside the UK and a further 15 were excluded as they studied paediatric populations or the incidence of specific visceral injuries. This rendered a total of 11 papers for final inclusion after reference checking [Fig. 1].

A summary of the epidemiological evidence is presented in [Table 1]. Evidence was gathered from four modalities of data source across five geographical regions of the UK: England, Wales & Northern Ireland (EWNI), Scotland, Midlands, South West, and London. The mean study period was 46 months (range: three months to 16 years). The number of included patients ranged from 343 to 127,191, though one article did not disclose study population figures. High heterogeneity was also observed between studies regarding the frequency of penetrating trauma cases; incidence ranged from 0.3% to 21.0%. However, the latter figure arose from an article which specifically evaluated trauma patients. Mortality rates were reported to lie between 0.5% and 15.4% for the five

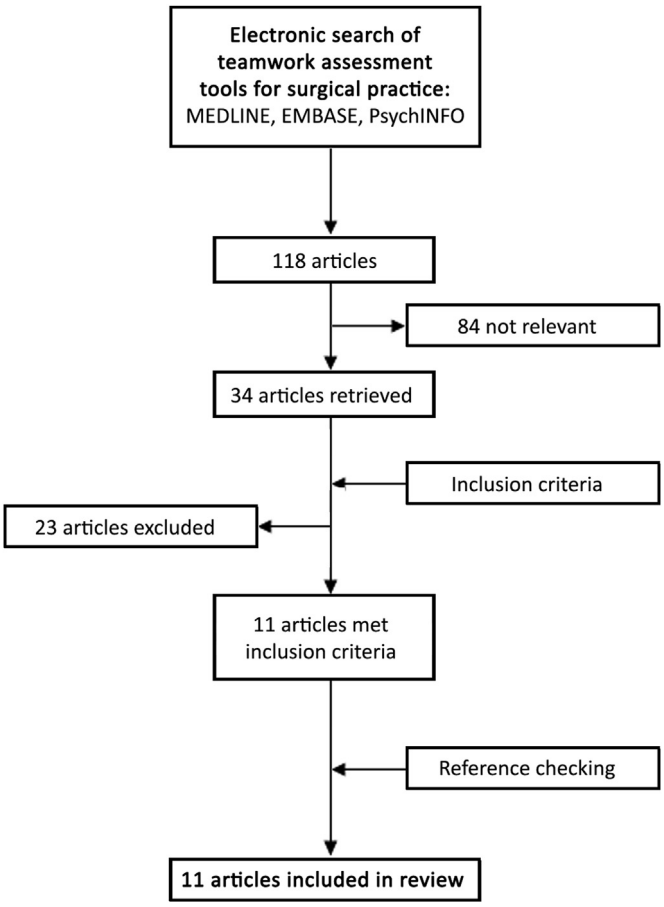

Fig. 1. Flowchart depicting search strategy and results.

publications which examined deaths from PI.

In all regions, the vast majority of cases were male with the highest proportion in the South-West (91.9%) and the lowest in the Midlands (84.7%). Patient ethnicity was reported in only one article where 50% were assigned to the category Black or Black British.

The highest reported incidence of penetrating trauma in each region is as follows: London (21.0%), Scotland (8.7%), South West (7.3%), EWNI (7.1%), and Midlands (3.6%). A study conducted in the Midlands was also found to have the lowest incidence rate of 0.3%. The mortality rates followed a different pattern: Midlands (15.4%), London (13.2%), EWNI (8.9%), and Scotland (8.2%). Mortality in the South West was not reported.

4. Discussion

Several surprising results were discovered upon statistical analysis of the included studies. Significant variation was observed between studies regarding the relative incidence (0.3–21.0%) and mortality rate (0.5–15.4%) of PI. One explanation for this heterogeneity would be the inclusion of articles which specifically reviewed major trauma patient populations, which have a higher incidence and mortality rates in comparison to those that investigated the general population.

The overall proportion of males that comprised the PI population was found to be similar for each region (84.7%–91.9%) reflecting the high proportion caused by violent assault [5–9].

It is interesting to note that 10/11 publications did not disclose the ethnicity of PI patients despite revealing that this information was collected in the methodology. The reasons for this are not clear,