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Review

Systematic review of complications and outcomes of diabetic patients with burn trauma

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ARTICLE INFO

Article history:
Accepted 15 June 2016

Keywords:
Burns
Trauma
Diabetes
Complications
Outcomes
Review

ABSTRACT

Objectives: We aimed to understand the effect diabetes plays on the extent of complications and patient outcomes in burn trauma.
Methodology: We searched MEDLINE, Science Direct and the Cochrane Review Database for 571 articles. Through our selection criteria, 12 articles were selected for systematic review and meta-analysis. Data was analysed via Review Manager 5.3, using Mantel–Haenszel statistics and random effect models.
Results: The odds of a diabetic patient sustaining a wound or local infection was 2.55 times higher (95%CI: 1.21–5.36, $Z = 2.47$; $p = 0.01$), with a low heterogeneity ($Tau^2 = 0.00$; $I^2 = 0\%$). Diabetics also had a higher odds of urinary tract infections (OR = 3.32 (95% CI: 1.92–5.73; $Z = 4.31$, $p < 0.001$), low heterogeneity ($Tau^2 = 0.00$; $I^2 = 0\%$)). In terms of length of hospital stay, the mean difference between diabetic and non-diabetic patients was 3.94 (95% CI: -2.69 to 10.6; $I^2 = 98\%$; $p = 0.24$). For mortality rates, the odds ratio between diabetic and non-diabetic patients was 2.22 (95% CI: 0.45–10.9; $I^2 = 93\%$; $p = 0.32$). Through our systematic review, we also found that diabetic patients are also more prone to nosocomial wound infections (OR = 2.26; 95% CI = 1.10–4.64), cellulitis (OR = 2.69; 95% CI = 1.85–3.91), bacteraemia (OR = 2.91; 95% CI = 1.48–5.73), sepsis (OR = 4.36; 95% CI = 2.20–8.64), a higher number of burn related operations (OR = 3.94; 95% CI = 1.94–7.90), longer period of wound closure (MD = 26.8; 95% CI = 8.52–45.1), respiratory complications (OR = 2.91; 95% CI = 1.35–6.28) and a higher number of days on ventilator (MD = 8.70; 95% CI = 3.51–13.89).
Conclusions: Diabetic patients have a higher odds of sustaining wound infections, local infections and urinary tract infection. However, diabetic patients did not have a higher odds of longer hospital stay or mortality.

Contents

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http://dx.doi.org/10.1016/j.burns.2016.06.023
0305-4179/

Please cite this article in press as: Sayampanathan AA. Systematic review of complications and outcomes of diabetic patients with burn trauma. Burns (2016), http://dx.doi.org/10.1016/j.burns.2016.06.023

1. Introduction

Diabetes mellitus is part of a group of chronic diseases characterised by hyperglycemia. According to the 2014 update of the International Diabetes Federation[1], the global prevalence of diabetes is 8.3%, of which 46.3% of individuals remain undiagnosed. By 2035, 205 million additional people will have diabetes, on top of the 387 million people who already have diabetes [1]. The disease itself destroys the body in various ways and results in multisystemic complications [2,3]. These complications can be classified as microvascular complications (e.g. neuropathies, retinopathies, nephropathies) and macrovascular complications (e.g. acute myocardial infarctions, cerebrovascular accidents, and peripheral vascular diseases) [4]. Diabetes causes an immunological impairment due to derangements in polymorphonuclear leukocytes, macrophages and lymphocyte function whilst the hyperglycemia itself results in increased blood viscosity hence hampering blood flow to the peripheries [5–9]. Consequently, this places diabetic patients at higher risk of other problems, such as infections, poor wound healing, and eventual amputations.

Within the context of burn trauma, patients are generally induced into a state of severe stress resulting in both hypermetabolism [10] and hyperglycemia [11], so as to support bodily functions within such conditions. In diabetic patients, such bodily response system is more pronounced. With the breach of the skin barrier, patients are more prone to infections [12]. Furthermore, massive fluid shifts potentially cause cardiovascular instability and further metabolic abnormalities [13,14]. Numerous papers have revealed that as a consequence, diabetic patients are at higher risk of poorer outcomes and complications [15,16]. In this systematic review and meta-analysis, we aim to synthesise the information from these papers to obtain a big picture regarding the exact ways diabetes mellitus affects individuals who sustain burn trauma.

2. Methodology

We searched MEDLINE, Science Direct and the Cochrane Database (2000 to March 2015) for publications in any language that described relationships between diabetes and the prevalence of complications and outcome data regarding patients with burn trauma. Our search terms were as follows: ‘‘(burn*[MeSH Terms]) AND (diabetes[MeSH Terms] OR diabetic[MeSH Terms])’’ for MEDLINE, ‘‘TITLE-ABSTR-KEY(burn*) and TITLE-ABSTR-KEY(diabetes OR diabetic) AND LIMIT-TO(content type, ‘‘1,2’’,‘‘Journal’’)’’ for Science Direct and ‘‘’burns’ in Title, Abstract, Keywords and ‘diabetes’ OR ‘diabetic’ in Title, Abstract, Keywords in Cochrane Reviews’’’ for the Cochrane Review database.

Out of 571 articles identified from these three databases, we selected articles which were relevant to outcomes and complications in diabetic patients who sustained burn trauma. Only papers involving to human studies were included. Reviews and articles not written in the English language were excluded from the analysis.

Data was analysed using Review Manager 5.3 [17]. When papers contained raw data, we calculated the unadjusted odds ratios with 95% confidence intervals via Mantel–Haenszel statistics. We took into account random effects within our analysis model. For combined studies, we calculated the I^2 statistic for combined studies [18] which accounts for the proportion of total variation in study estimates as a result of heterogeneity of studies included. For certain studies, we were unable to combine data due to insufficient raw data necessary for analysis. For such studies, we described their findings along with their published odds ratios or relative risks (adjusted or crude). For factors in which data was combined from studies, Forest Plots are displayed.

3. Results

We identified 571 studies. After the removal of duplicates and non-English articles, we had 475 studies remaining. After reading titles and abstracts, we excluded 463 further studies as they did not study complications and outcomes of burns in diabetic patients, involved cadaveric studies or were review articles. 12 articles were eventually available for our analysis. Fig. 1 summarises the flow of selection of our 12 articles, with the reasons for exclusion. Table 1 summarises the characteristics of the studies within our systematic review.

Table 2 Table Summarising Various Outcomes and Complications Affected by Diabetes in Patients with Burn trauma. Where only 1 study was analysed for the factor, I^2 was not applicable (NA) due to the inability to study heterogeneity. From our systematic review, we noted that certain articles revealed complications which diabetic patients were at higher odds of experiencing if they sustained burn trauma. These complications included local infections and wound infections, nosocomial wound infections, cellulitis, urinary tract infections, bacteraemia, sepsis, prolonged duration of wound closure, respiratory complications, prolonged length of hospital stay amongst both grafted and non-grafted patients and prolonged duration spent on ventilators. Diabetic patients who sustained burn trauma also had a higher odds of having more burn related operations. When further comparing diabetic patients with and without sensory deficits, we noted that patients with sensory deficits were at higher odds of having more total body surface area burnt. When comparing patients with controlled and uncontrolled diabetes mellitus, patients with uncontrolled diabetes were at higher odds of undergoing more burn related operations. Further details on these findings together can be found in Table 2. We performed a meta-analysis based on 4 main outcome factors- prevalence of wound and local infections, prevalence of urinary tract

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