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## Accelerant-related burns and drug abuse: Challenging combination

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### ABSTRACT

**Background:** Accelerants are flammable substances that may cause explosion when added to existing fires. The relationships between drug abuse and accelerant-related burns are not well elucidated in the literature. Of these burns, a portion is related to drug manufacturing, which have been shown to be associated with increased burn complications.

**Objectives:** 1) To evaluate the demographics and clinical outcomes of accelerant-related burns in a Provincial Burn Centre.

2) To compare the clinical outcomes with a control group of non-accelerant related burns.

3) To analyze a subgroup of patients with history of drug abuse and drug manufacturing.

**Methods:** Retrospective case control study. Patient data associated with accelerant-related burns from 2009 to 2014 were obtained from the British Columbia Burn Registry. These patients were compared with a control group of non-accelerant related burns. Clinical outcomes that were evaluated include inhalational injury, ICU length of stay, ventilator support, surgeries needed, and burn complications. Chi-square test was used to evaluate categorical data and Student's t-test was used to evaluate mean quantitative data with the p value set at 0.05. A logistic regression model was used to evaluate factors affecting burn complications.

**Results:** Accelerant-related burns represented 28.2% of all burn admissions (N=532) from 2009 to 2014. The accelerant group had higher percentage of patients with history of drug abuse and was associated with higher TBSA burns, ventilator support, ICU stay and pneumonia rates compared to the non-accelerant group. Within the accelerant group, there was no difference in clinical outcomes amongst people with or without history of drug abuse. Four cases were associated with methamphetamine manufacturing, all of which underwent ICU stay and ventilator support.

**Conclusions:** Accelerant-related burns cause significant burden to the burn center. A significant proportion of these patients have history of drug abuse.

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## 1. Introduction

Accelerants are flammable substances that may cause explosion when added to existing fires. These substances are dangerous because they tend to be colorless and highly volatile. Indeed, misuse of accelerants is directly related to higher severity of burns [1,2].

The relationships between higher risk behaviors such as drug abuse and accelerant related burns are not well elucidated in the literature. People with drug abuse have been associated with increased length of stay in hospital when corrected for demographics and burn variables [3]. Of these burns, a portion is related to drug manufacturing which typically involves accelerant use such as butane and propane. Methamphetamine is a highly addictive and easily manufactured substance of abuse. Its use has increased dramatically in North America in recent years [4]. Methamphetamine-associated burns have placed heavy burdens on both patients and burn centers. These patients have increased complications, higher incidence of inhalational injuries, and increased length of stay in hospital [5-8]. Another substance of concern in drug related burns is the manufacturing of cannabis [9]. The process of extracting cannabis oil, the higher concentrated form of delta-9-tetrahydrocannabinol (THC), requires ignition of volatile solvent, typically grain alcohol, putting users at risk for thermal burns or injuries from explosions [9].

The objectives of this study were to evaluate the demographics of accelerant-related burns in British Columbia, to compare the clinical outcomes with a control group of non-accelerant burns, and to analyze a special subgroup with history of drug abuse and drug manufacturing.

## 2. Methods

This was a retrospective case control study. Following ethics approval from the University of British Columbia Clinical Research Ethics Board, patient data associated with accelerant-related burns from 2009 to 2014 were obtained from the British Columbia Burn Registry. This registry contains prospectively collected data of patients admitted to the burn unit in Vancouver General Hospital. The keywords used to identify these patients included accelerant, propane, butane, and gasoline.

The demographics of these patients including age, sex, gender, co-morbidities, and ethnicity were collected. These patients were then compared with a control group of non-accelerant related burns. The control group consisted of all admitted patients from 2009 to 2014 with mechanisms of burns unrelated to accelerant use. These were identified from review of individual cases from the Burn Registry. Clinical outcomes that were evaluated included inhalational injury, ICU length of stay, ventilator support, surgeries needed, and burn complications.

At our institution, pneumonia is defined as either radiological evidence of pneumonia or positive sputum culture, plus at least two clinical signs of increased oxygen utilisation fever, or leukocytosis. In contrast, aspiration pneumonia is defined

by right lower lobe opacity on radiograph in addition to an inciting event of aspiration by history.

Graft failure is determined by the clinical assessment of our senior author during ward rounds. It refers to any graft loss with re-operation or extensive conservative management.

A subgroup analysis was performed on those with history of drug abuse and drug manufacturing. Drug abuse was defined as any regular use of illicit substance by history excluding alcohol and cigarette smoking. These substances included but were not limited to amphetamine-type stimulants, cannabis, cocaine, central nervous system depressants, hallucinogens, and opioids.

Chi-square test was used to analyze categorical variables and Student's t-test was used to evaluate mean quantitative data. Statistical significance was set with  $p$ -value=0.05. A logistic regression model was used to evaluate factors affecting burn complications.

## 3. Results

A total of 532 burn patients were admitted during the study period. Of these, accelerant-related burns represented 28.2% of all burn admissions ( $N=150$ ). The demographics of patients with accelerant versus non-accelerant burns are presented in Table 1. 107 out of 382 patients from the non-accelerant group were excluded from the analysis due to incomplete clinical data. Comparing to the non-accelerant group, the accelerant group had higher proportion of patients with drug of abuse (39.1% vs 17.5%,  $p<0.01$ ) and was associated with higher TBSA burns (15% vs 6.2%,  $p<0.01$ ). Despite having similar age, gender, and ethnicity, the non-accelerant group had more patients with diabetes (15.1% vs 7%,  $p=0.03$ ).

Regarding clinical details (Table 2), there was a higher proportion of patients in the accelerant group who received ventilator support (33.3% vs 17.8%,  $p<0.01$ ) and ICU stay (32% vs 17.8%,  $p=0.001$ ); however, there was no difference in the duration for ICU length of stay or the number of ventilator days. Higher proportion of the non-accelerant group underwent operative interventions (76% vs 61.3%,  $p=0.001$ ).

The accelerant and non-accelerant group had similar rates of inhalational injury but the accelerant group had more pneumonias (16.7% vs 5.1%,  $p<0.01$ ) and aspiration pneumonias (8% vs 1.8%,  $p<0.01$ ). There was no difference in surgical site infections, urinary tract infections, or graft failure between the two groups.

In the accelerant group, there were no differences in clinical outcomes and burn complications among people with or without history of drug abuse (Table 3). Of note, only 128 out of 150 patients had complete data regarding history of drug abuse to be included in data analysis.

From the study period 2009-2014, eight patients were involved in burns related to drug manufacturing; four were manufacturing methamphetamines whereas the others were involved in cooking hash oil (Table 4). All patients within the methamphetamine manufacturing group underwent ICU stay and ventilator support, and there was one mortality (25%). The number of patients within the subgroups was too small to generate meaningful statistical analysis.

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