

Myocardial infarction on snow days: Incidence, procedure use and outcomes

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BACKGROUND: Snowfall can cause chaos in urban centres and put considerable stress on health care systems. Given that myocardial infarction (MI) is a condition that may be triggered or aggravated by stress, and that health system stress could influence the typical care provided to patients with MI, a study was conducted comparing 'snow days' with 'nonsnow days', specifically assessing the incidence of MI, the use of acute procedures and in-hospital mortality.

METHODS: Hospital discharge data were used on all patients discharged after MI. These data were merged with data from Environment Canada to determine the amount of snowfall that occurred on any given day. The use of acute procedures was determined by linking to data from the Alberta Provincial Project for Outcomes Assessment in Coronary Heart disease (APPROACH). Snow days were defined as days when at least 5 cm of snow fell, and the two subsequent days were included because of the lingering effect of 'urban chaos' that can ensue after significant snowfall. The average incidence of MIs on snow days versus nonsnow days was then determined. Risk-adjusted odds ratios for the use of direct percutaneous coronary intervention and in-hospital mortality were also determined.

RESULTS: There were 61 snow days and 575 nonsnow days. The incidence of MI (incidence density ratio of 1.08, 95% CI 0.82 to 3.10) and the use of direct percutaneous coronary intervention (adjusted OR=1.07, 95% CI 0.74 to 1.54) were slightly higher on snow days. In-hospital mortality trended toward being lower (adjusted OR=0.54, 95% CI 0.28 to 1.04) for patients admitted on snow days, although none of these differences were statistically significant.

CONCLUSION: Despite the potential for the significant adverse effects of snow days on the incidence of MI, the use of acute procedures and outcomes, these findings suggest only minor effects, if any.

Key Words: Myocardial infarction; Snowfall; Weather

Snowfall can cause chaos in urban centres and has the potential to place considerable stress on individuals and health care systems (especially systems that involve the transfer of patients in ambulances). Myocardial infarction (MI) is a condition that may be triggered or aggravated by stress, and the level of health system stress could influence the typical care provided to patients with MI. Several studies have looked at stressful events such as earthquakes and other natural disasters (1-3) and have found an increase in MI when these events occur. Temperature is another researched area, with several

Infarctus du myocarde et chutes de neige : incidence, interventions et issue

CONTEXTE : Les chutes de neige peuvent être cause de désordre dans les centres urbains et exercer une pression considérable sur le système de soins de santé. Comme l'infarctus du myocarde (IM) peut être déclenché ou aggravé par le stress et que la pression exercée sur le système de santé peut se répercuter sur les soins habituellement fournis aux patients victimes d'un IM, nous avons mené une étude visant à comparer l'incidence des IM, le recours aux interventions d'urgence et la mortalité intrahospitalière pendant les jours de neige avec les jours sans neige.

MÉTHODE : Nous avons utilisé les registres de sorties d'hôpitaux concernant tous les patients ayant subi un IM, puis fusionné les données recueillies avec celles d'Environnement Canada pour connaître la quantité de neige tombée pendant l'un ou l'autre des jours de la période d'étude. Quant aux interventions d'urgence, elles ont été déterminées à partir des données de l'Alberta Provincial Project for Outcomes Assessment in Coronary Heart Disease (APPROACH). Les jours de neige ont été définis comme ceux où il était tombé au moins 5 cm de neige, auxquels nous avons ajouté les deux jours suivants en raison de l'influence persistante du « désordre urbain » causé par une chute de neige importante. Nous avons ensuite déterminé l'incidence moyenne des IM survenus pendant les jours de neige et les jours sans neige, ainsi que le risque relatif indirect (RRI) rajusté en ce qui concerne les interventions coronariennes percutanées directes (ICPD) et la mortalité intrahospitalière.

RÉSULTATS : Nous avons dénombré 61 jours de neige et 575 jours sans neige. L'incidence des IM (rapport de densités d'incidence : 1,08; intervalle de confiance [IC] à 95 % : 0,82 – 3,10) et le recours aux ICPD (RRI rajusté : 1,07; IC à 95 % : 0,74 – 1,54) se sont révélés légèrement plus élevés pendant les jours de neige que pendant les autres jours. Quant à la mortalité intrahospitalière, elle a montré une tendance à la baisse (RRI rajusté : 0,54; IC à 95 % : 0,28 – 1,04) chez les patients hospitalisés pendant les jours de neige, mais aucun des écarts n'était statistiquement significatif.

CONCLUSION : Malgré l'influence sensiblement défavorable que pourraient avoir les chutes de neige sur l'incidence des IM, les interventions d'urgence et l'issue après un cathétérisme cardiaque, les résultats portent à croire que les précipitations neigeuses n'ont que peu d'effet, sinon pas du tout, sur les éléments étudiés.

studies showing an association between large temperature changes and an increase in MI incidence (4-6).

Our study compared 'snow days' with 'nonsnow days', specifically assessing the incidence of MI, the use of acute procedures and in-hospital mortality.

METHODS

Hospital discharge data from the Calgary Health Region on all patients with MI discharged between April 1, 1996, and December 31, 1998, were used. June, July, August and September

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TABLE 1
Characteristics of patients admitted to hospital on snow days versus nonsnow days

Characteristic	Nonsnow day, n (%)	Snow day, n (%)	P
Age over 65 years	1027 (50.2)	110 (47.0)	0.356
Female sex	600 (29.3)	70 (29.9)	0.855
Acute renal failure	59 (2.9)	10 (4.3)	0.240
Cancer	54 (2.6)	6 (2.6)	0.946
Cerebrovascular disease	62 (3.0)	7 (3.0)	0.974
Congestive heart failure	487 (23.8)	51 (21.8)	0.493
Chronic renal failure	72 (3.5)	5 (2.2)	0.268
Diabetes	86 (4.2)	7 (3.0)	0.375
Cardiac dysrhythmias	406 (19.8)	59 (25.2)	0.053
Pulmonary edema	16 (0.8)	5 (2.1)	0.040
Shock	87 (4.3)	13 (5.6)	0.356

were excluded due to the general lack of snowfall in these months. The use of acute procedures within the first day of hospital care was determined by linking hospital discharge data to cardiac catheterization registry data from the Alberta Provincial Project for Outcomes Assessment in Coronary Heart disease (APPROACH). These data were merged with weather data from Environment Canada, which included temperature, precipitation and snowfall. The amount of snowfall that occurred on any given day was determined, and snow days were defined as days when at least 5 cm fell (plus the two subsequent days because of a potential lingering effect of 'urban chaos').

The average incidence of MIs on snow days and nonsnow days were determined. Risk-adjusted odds ratios were calculated for the use of direct catheterization (ie, catheterization on the first day of hospitalization) or direct percutaneous coronary intervention (PCI) (ie, on the first day of hospitalization) and in-hospital mortality, adjusting for age, sex, acute renal failure, cancer, cerebral vascular disease, congestive heart failure, chronic renal failure, diabetes, pulmonary edema, cardiac dysrhythmias and cardiogenic shock.

RESULTS

There were 2280 MI admissions between April 1, 1996, and December 31, 1998 (excluding June through September). Weather information was available for 636 days, of which 618 had one or more MIs. There were 61 snow days and 575 nonsnow days for the above time period. The median snowfall on the snow days was 8 cm (range 5 cm to 28 cm). Two hundred thirty-four MIs occurred on the 61 snow days (3.84 MIs/day) and 2045 MIs occurred on the 575 nonsnow days (3.56 MIs/day). The incidence of MI was slightly higher on snow days, with a statistically insignificant incidence density ratio of 1.08 (95% CI 0.82 to 3.10).

Table 1 presents the clinical profile of patients admitted to hospital on snow days versus nonsnow days. The prevalence of clinical risk factors in the two patient groups was generally similar, although there was a higher proportion of patients with pulmonary edema and dysrhythmias on snow days.

There were no statistically significant differences in the use of direct catheterization (27.8% on snow days versus 24.5% on nonsnow days [P=0.28]) or PCI (16.7% on snow days versus 15.8% on nonsnow days [P=0.74]). Meanwhile, there was a statistically insignificant trend toward lower mortality on snow days (6.4% for snow days versus 8.2% for nonsnow days [P=0.37]).

TABLE 2
Odds ratios for the association between snow days and the three study end points

Study end point	Crude OR (95% CI)	Adjusted* OR (95% CI)
Direct catheterization	1.20 (0.89 to 1.63)	1.18 (0.87 to 1.60)
Direct PCI	1.09 (0.76 to 1.57)	1.07 (0.74 to 1.54)
In-hospital mortality	0.77 (0.44 to 1.32)	0.54 (0.28 to 1.04)

*Adjusted for age, sex, acute renal failure, cancer, cerebral vascular disease, congestive heart failure, chronic renal failure, diabetes, pulmonary edema, cardiac dysrhythmias and cardiogenic shock. PCI Percutaneous coronary intervention

The corresponding crude and adjusted odds ratios for these endpoints are presented in Table 2. There was no statistically significant difference in the use of direct catheterization, the use of PCI or in the occurrence of in-hospital death for snow days versus nonsnow days. The latter endpoint, however, trended toward significance (upper 95% CI 1.04).

DISCUSSION

Despite the potential for significant adverse effects of snow days on the incidence of MI, procedure use and outcomes, our findings suggest only minor effects, if any. There was, in fact, even a trend toward lower mortality on snow days. We were unable to determine whether this reflected the occurrence of death before MI patients even reached the hospital; however, prehospital deaths would likely not explain away the observed 1.8% absolute difference in death rates.

Others have explored the association between snowfall and cardiac events in emergency departments. Spitalnic et al (7) found a 27% increase in the frequency of cardiac arrest presentations to the emergency department on days with snowfall (P=0.0004). Blindauer et al (8) studied the famous 1996 New York blizzard and found a 25% increase in the diagnosis of angina, MI or suspected MI in the emergency department for the blizzard period relative to other times. However, Persinger et al (9) found no significant correlations between the amount of snowfall and admission for major categories of cardiac emergency. Potential mechanisms underlying these findings include the stress and anxiety associated with snow days, the physical exertion associated with snow shovelling and the possible direct effects of cold (7-9).

Our study findings agree with those of Persinger et al (9), but it should be noted that we focused on relatively modest snow days that reflected the tendency toward modest, single-day snowfall in the Calgary region. Accordingly, our findings certainly do not preclude an effect from more major snowfalls, as would be seen in blizzards. However, for the typical day-to-day snowfall levels expected in this region, snow days do not appear to have notable effect (if any) on MI incidence or care.

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