

# Postoperative Shivering Among Cannabis Users at a Public Hospital in Trinidad, West Indies

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**Purpose:** Postoperative shivering has been anecdotally observed to be frequent and severe in cannabis smokers following general anesthesia in the Caribbean. The aim of this study was to compare the frequency and intensity of postoperative shivering in cannabis users versus non-users.

**Design:** A prospective, cross-sectional, observational design was used.

**Methods:** Demographic data were obtained. Patients were grouped into cannabis users and non-users. All patients received standardized general anesthesia and were administered warmed fluids intraoperatively. Ambient room temperatures and clinical data were recorded. Patients' core body temperature was recorded at 10-minute intervals both in the operating room and the post-anesthesia care unit (PACU). Postoperatively an independent observer assessed the patients who had shivering using a scoring system ranging from 0 to 3. Treatment for shivering and post-treatment shivering scores were also recorded.

**Findings:** Fifty-five patients were studied, of which 71% were male. There were 25 (45%) cannabis users, of which 50% smoked < 5 joints per week, and 35% smoked > 10 joints per week; 30 (55%) patients were non-users. The overall incidence of postoperative shivering was 36%; 16% had a shivering score of '3', 13% had '2' and 7% had a score of '1'. The incidence of postoperative shivering among cannabis users was 40% while it was 33.3% in non-users. Also, 90% of cannabis users had shivering scores of 2 and 3, compared to 70% of non-users.

**Conclusions:** There was a higher incidence and intensity of shivering in cannabis smokers, although the study could not establish a statistically significant difference in the frequency and severity of shivering between cannabis users and non-users.

**Keywords:** postoperative shivering, incidence, cannabis smokers, Caribbean.

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**POSTOPERATIVE SHIVERING IS A** common occurrence observed in the postanesthesia care unit (PACU). Previous studies have reported an incidence of 5% to 65% after general anesthesia and 30% to 33% after epidural procedures in the British population.<sup>1,2</sup> In addition to being unpleasant and physiologically stressful, shivering is associated with several adverse effects including an increase in oxygen consumption, carbon dioxide production, lactic acidosis, left ventricular work index, hypoxemia, and adrenergic stimulation.<sup>1,3,4</sup> Shivering may increase the likelihood of ischemia among patients with coronary artery disease.<sup>5</sup> There is also an increase in intracranial and intraocular pressures with adverse implications for postoperative neurosurgical and ophthalmology patients.<sup>6</sup> Shivering may be associated with delayed wound healing and increased hospital stay.<sup>7</sup>

Cannabis consumption occurs commonly in the Caribbean population. Figueroa et al<sup>8</sup> reported that 49% of men and 15% of women among the 15- to 74-year age groups in Jamaica smoked marijuana. Smirkle et al<sup>9</sup> reported marijuana use in 60% of sexually active males in Jamaica. Soyibo and Lee<sup>10</sup> reported that 10.2% of the Jamaican school-attending adolescents use marijuana. The female plant *Cannabis sativa* gives rise to >60 different identified compounds collectively referred to as cannabinoids. The primary psychoactive and most abundant of which  $\delta$ -9 tetrahydrocannabinol (THC) is highest in content in the flowering tops of the plant.<sup>11</sup> The pharmacokinetic profile of THC reveals rapid absorption and distribution following inhalation, with maximum brain concentration and peak psychological and physiological effects within 15 minutes of inhalation. Effects last for 2 to 4 hours after inhalation compared with 6 hours after oral administration, before declining.

Systemic effects of cannabis are due to activation of two separate receptors—CB1 and CB2, both of which are G protein coupled. Through these receptors, cannabis has several physiological and psychological effects on the body including profound effects on motor, cognitive, nociceptive, and thermoregulatory processes.<sup>12</sup> Postanesthetic shivering may be thermogenic secondary to perioperative hypothermia or nonthermogenic with links

to the pain pathways.<sup>13,14</sup> There is also evidence that there may be hypothermic and nociceptive effects associated with THC.<sup>15</sup> The antinociceptive effects of cannabis have been well demonstrated in the literature. It has been suggested that these effects are mediated via CB1 receptors in synergy with opioid and noradrenergic receptors (alpha-2 effects) and result in pain modulation at the level of the dorsal horn of the spinal cord. There is suggestion that pain and temperature signals are transmitted along similar fiber systems in the dorsal horn of the spinal cord, and hence many analgesic drugs such as meperidine and parecoxib possess antishivering properties.<sup>16,17</sup>

Perioperative hypothermia is defined as a core temperature < 33°C to 35°C, while the shivering threshold in nonanesthetized patients is 35.5°C. Anesthetic agents increase the heat response thresholds and decrease the cold response thresholds such that the normal interthreshold range (hypothalamic set point) is increased.

The effects of cannabis (THC) and endocannabinoids on the thermoregulatory processes have been well established.<sup>18</sup> This may suggest that cannabis may be a factor which can influence postoperative shivering. Furthermore, anecdotally, anesthesiologists in the Caribbean have observed a higher frequency and severity of shivering episodes in cannabis smokers after general anesthesia in the PACU. With this background, the present study sought to determine if cannabis users had higher incidence and severity of shivering after general anesthesia.

## Methods

Approval was obtained from the Ethics Committee of the University of the West Indies and from the Institutional Review Board of the Port of Spain General Hospital for the conduct of this study. Informed consent was obtained from all patients included in the study.

This was designed as a prospective, observational, convenience sampling, cohort control study. The study included patients aged 18 years and above with an American Society of Anesthesiologists (ASA) physical status I and II, who presented for elective orthopaedic surgery over a 6-month period. Patients with fever (temperature

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