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LETTER TO THE EDITOR

E-cigarette, Obesity and Bariatric Surgery: Guidelines for the Bariatric Societies

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Need for This Letter

We have had patients in our bariatric pathway who have been using electronic cigarettes (e-cigarette) in the perioperative period. They justify vaping to help them reduce or quit conventional smoking. The message in the community is that it is safe to use. Currently, we could not find any recommendations to help guide our bariatric patients. Hence, we decided to review the literature.

Background and Epidemiology

E-cigarettes were first patented and launched in 2003 in China by the company Ruyan (translates *resemble smoking*) [1]. It is composed of heterogenous group of products which consolidates in a battery-powered device. Nicotine, heavy metals, volatile organic compounds, glycerol, propylene, ethylene glycol and ultrafine particles are delivered to the users through inhaled aerosol. These electronic nicotine delivery systems are known by different names such as e-cigs, e-hookahs, vapes, mods and tanks and come in various shapes and sizes and vary from 1st to 4th generation [2, 3].

Around 2007 to 2014 in the USA, e-cigarettes were the most commonly used tobacco product among the youth, with an evident increase of 900% among middle and high school students. Currently, more than 3.6 million youth are users [4]. In the UK, a study in 2017 showed that 2.9 million adults (6% of the population) used e-cigarettes [5].

Why Is E-cigarette Use Increasing in the World?

At present, nicotine-containing e-cigarettes are endorsed by guidelines as alternatives to traditional tobacco cigarette [6]. Evidence show that they are less harmful to health since there is decreased exposure to numerous toxicants and carcinogens present in combustible tobacco cigarettes and many users have found them also helpful to quit smoking cigarettes [7, 8]. Furthermore, completely switching from regular use of traditional cigarettes to e-cigarettes results in reduced short-term adverse health outcomes in several organ systems [7].

Why Is E-cigarette an Issue with Obese Population?

There have been plenty of researches connecting obesity and cigarette smoking; hence, looking into the potential of e-cigarette to reduce risks associated with excess weight deserves exploration. A study conducted showed that higher weight status and cigarette smoking/electronic tobacco use are co-occurring health-risk behaviours [9]. Glover et al. noted that in many developed countries, obesity is overtaking smoking as the leading preventable causes of diabetes, cardiovascular, cancer and early death. Weight gain usually prevents smokers from quitting. With the aid of appetite-suppressant effects of nicotine and behavioural aspects of vaping, it could help even a small proportion of people reduce the health risks associated with excess weight [10].

Delk et al. evaluated 2524 adolescents and concluded that there is a positive correlation between male adolescents' being obese and use of cigarette/e-cigarette. This coincides with current researches that showed adolescents are at a greater risk of cigarette smoking if they are overweight or obese [11]. The role of flavoured e-liquids as food substitutes and the behavioural aspects of vaping are being explored.

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Risks of E-cigarette

Nicotine

Nicotine can be highly addictive and exposure during adolescence can impact learning, memory and attention and have lasting adverse consequences for brain development [2, 4]. Nicotine intake from e-cigarettes among users varies depending on the overall characteristic of the device and how it is used [7].

Effect on the Cells

E-cigarette aerosols can cause DNA damage to epithelial cells and induce acute endothelial cell dysfunction, which supports the biological possibility of tissue injury and disease from long-term exposure. Likewise, it promotes the formation of reactive oxygen species or oxidative stress induction but still generally lower than from combustible tobacco cigarette [7].

Cardiovascular

Using the data from the National Health Interview Survey, a study including 96,467 participants found that compared with nonusers, e-cigarette users had more chances of having a heart attack, coronary artery disease and stroke (165%, 94% and 78% increase respectively). Users were also more likely to have circulatory problems, high blood pressure (BP) and diabetes [12].

Although e-cigarettes deliver lower levels of carcinogens than conventional cigarettes, their content has the potential to cause damage to blood vessels and encourage blood clotting [13]. Researches also show that heart rate and diastolic BP increases shortly after nicotine intake from e-cigarettes [7].

Cancer

Investigation done in 2014 have shown that high-voltage vapes can trigger a thermal breakdown of the solvents, producing carbonyl compounds such as formaldehyde and acetaldehyde. This would inevitably expose users to high levels of toxic and carcinogenic carbonyl compounds with every inhaled aerosol [14]. Few investigations showed that e-cigarettes can cause DNA damage and mutagenesis when exposed for an extended period, theoretically increasing risk of cancer and adverse reproductive outcomes [7].

Respiratory System

Alexander and colleagues suggested that the virulence of methicillin-resistant *Staphylococcus aureus* (MRSA) is increased by exposure to e-cigarette vapours (ECV) [15]. Moreover, components of ECV can cause acute lung injury, chronic obstructive pulmonary disease (COPD), asthma and lung cancer [16]. Nevertheless, there is minimal evidence for reduction of COPD exacerbations and improvement in lung function and symptoms among adult smokers with asthma who switch to e-cigarettes completely or in part (dual use) [7].

Dependence and Abuse

Vaping may result in symptoms of dependence. The seriousness and risk of dependence was determined by the e-cigarette's characteristics, which includes nicotine concentration, flavouring and device type and brand [7]. Users were also likely to suffer from depression, anxiety and other emotional problems [12].

Accidental Injuries

E-cigarette devices have the potential to explode and cause burns and projectile injuries, especially when batteries are of poor quality, stored improperly or modified by users. Other adverse health effects, due to intentional or accidental exposure to e-liquids (from drinking, eye contact or dermal contact), include seizures, anoxic brain injury, vomiting and lactic acidosis among possibly many others [7].

Conclusion

There are three essential components that dictate the overall effect, harm or benefit, of vaping to public health: their influence on adult's abstinence from smoking, their influence on youth to commence use of traditional cigarettes and the toxicity of the aerosols. The advantage to public health may only be taken into consideration if its use encourages adult smokers to permanent stop from smoking [7].

Overall, there is limited evidence that e-cigarettes may be effective aid to promote smoking cessation. Urgent research is needed since there are gaps in the knowledge regarding e-cigarette. Long-term animal studies should be conducted using e-cigarette aerosols to understand risks. Also, there is no confirmation whether long-term e-cigarette use among smokers' changes morbidity or mortality compared with those who only smoke combustible tobacco cigarettes [7]. Making certain that vaping does not exacerbate the tobacco epidemic, it is vital to have regulatory measures as stated by the World Health Organization Convention on Tobacco Control. Presently, the use of vape is not covered by the smoking legislation and, hence, is not banned in all enclosed public and work places [5]. Therefore, the effect of second-hand and third-hand smoke is something that needs to be delved into.

Suggested Recommendations for Bariatric Societies

- International bariatric societies to come up with robust guidelines.
- We should ask our patients about e-cigarette use in detail including frequency and duration of use, nicotine dependence, reason for use and intention to quit, and document it and educate them about the risks of all forms of tobacco product use.
- Longitudinal cohort studies and cross-sectional studies of e-cigarette to study its effect on health outcomes in obese population and on bariatric surgery patients.
- Trials to compare e-cigarette to FDA-approved smoking cessation pharmacotherapies and other evidence-based cessation treatments.
- Until there is a definite evidence, we should recommend at least 6 weeks of perioperative abstinence from e-cigarette.

Author Contributions CP conceived the idea. All authors participated in literature search. All authors contributed in manuscript writing. All authors have seen the final version and approve of it.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This type of study does not need ethical approval.

Abbreviations E-cigarette, electronic cigarette; MRSA, Methicillin-resistant *Staphylococcus aureus*; FDA, The Food and Drug Administration

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