

Do electronic cigarettes cause serious accidents?

Use of electronic cigarette or e-cigarette, almost unknown in 2010, has very quickly become widespread in Europe, where it is seen as a new product that could gradually replace tobacco use, mainly with the aim of stopping smoking altogether. In 2014, INPES¹ (now *Santé Publique France*) stated that 26% of the French population had reported smoking an e-cigarette and more than one and a half million people may use them daily [1].

These electronic cigarettes come with e-liquid refill cartridges or containers containing a solvent (mainly propylene glycol), possibly with nicotine and flavourings (used in food or not). The liquid content of these cartridges or containers could accidentally come into contact with the skin or mucous membranes in the event of a leak, when the cartridge is filled, or if the battery were to explode. These cases of accidental exposure can be hazardous and cause adverse health effects, especially in children.

Do electronic cigarettes cause serious accidental exposure?

To answer this question, a group of expert toxicologists coordinated by the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) retrospectively analysed the cases recorded by French poison control centres (PCCs) between 1 January 2013 and 30 June 2014.

The cases selected for this study corresponded to all accidents, with or without symptoms, related to electronic cigarettes, refills, disposable e-liquid containers or cartridges, with or without nicotine. Cases of deliberate exposure and those where causality² was zero were excluded.

In the end, 1,178 cases were identified for the given study period. The age of the exposed subjects ranged from two months to 95 years, with a median at 25 years. Almost half of the subjects in the cases (47%) were aged from 18 to 39 years, which also corresponds to the age group with the highest proportion of e-cigarette users according to INPES (9.6% for men, 6.6% for women) [1].

Children under four years of age accounted for 27% of exposure cases.

Of these 1,178 people, 683 were symptomatic (58%): 32% suffered eye exposure, 57% oral and 5% respiratory exposure.

In the cases of eye exposure, symptoms were almost always observed (88% of cases), with eye redness (64%) and pain (48%) reflecting the irritating nature of the e-liquid.

With oral contact or accidental ingestion of e-liquid, 49% of cases were symptomatic, including mouth and throat irritation (9.3%), vomiting (9.2%) and local pain (8.7%).

No very serious cases were reported among the 683 symptomatic cases. Almost half of the cases of oral contact or ingestion of e-liquid were of low severity, in children under four years of age and adults (there were fewer than 10 cases in children over five years of age and adolescents). For eye exposure, cases mainly concerned people over 18 years of age and were of low severity.

Fewer than 5% of the cases were of moderate severity. As an example, regarding the oral route, two children four to six years of age ingested an e-liquid containing nicotine. The accident occurred because an adult had poured the e-liquid into a glass. Vomiting following ingestion, abdominal pain and pallor were reported. The one case in which progression was known had a favourable outcome. In any event, the quantities ingested seemed to be small, probably due to the unpleasant taste of the e-liquid. Regarding eye exposure, four accidents in adults involving splashes of e-liquid when filling the electronic cigarette caused burning sensations, eye pain, swelling of the eyelids and conjunctival redness. In principle, the splashed quantities were very small and all came from e-liquids containing nicotine. After treatment, progression was favourable for three of them (and was unknown in one case). Lastly, a 12-year-old child mistakenly received an e-liquid instillation in the eye due to confusion with a bottle of eye drops, causing a burning sensation that progressed favourably after treatment. This situation of confusion with a medicine accounted for 4% of eye exposure cases, underlining the need for greater vigilance on the part of users during therapeutic treatment involving eye drops.

1. National Institute of Prevention and Health Education

2. Causality is the link between exposure to the e-cigarette and the patient's symptom. This causality was calculated according to version 7.6 of the method for determining causality in toxicovigilance (the method and a calculator are available at tv.antipoison.fr). When this causality was zero, it meant that the symptoms presented by the exposed individual were not related to the e-liquids, which explains why these individuals were excluded from the study.

The study of exposure circumstances by route showed that for the ocular route, most exposure was due to splashes when filling the electronic cigarette. This high proportion raises issues about the safety of the devices sold. The symptoms observed seemed to relate to an irritative syndrome explained by the irritant or sensitising nature of the e-liquid compounds, particularly nicotine. However, the experts were unable to unequivocally correlate an irritant syndrome with the nicotine concentrations in e-liquids, due to a lack of knowledge or doubts about the nature of the products allegedly involved according to the calls to the PCCs.

Electronic cigarettes were also responsible for symptomatic **respiratory** exposure in vapers at the time of vaping. In some cases, symptoms were reported immediately after vaping, presumably under normal conditions of use of the electronic cigarette, raising the question of nicotine's role in the occurrence of these symptoms. More often, they were individuals who had recently started vaping, in whom a nicotine overdose was suspected. Despite uncertainties during calls to the poison control centres about the exact nature of the products to which individuals were exposed, the observation of these cases raises questions about the information and relevance of the advice received or not by vapers when purchasing electronic cigarettes. Even though the outcome was favourable, the nicotine contained in e-liquids is still a pharmacologically active substance which, even at very low concentrations, can cause toxic effects.

During the study period, two cases of explosion were reported, both symptomatic, with eye pain and conjunctivitis that rapidly improved. An electronic cigarette caught fire and emitted smoke exposing twenty-four people very briefly, showing no symptoms. This is the only recorded case of combustion. Since the study ended, several other cases of explosion have been recorded by the PCCs, some of which have resulted in severe burns.

References

[1] National Institute of Prevention and Health Education (INPES). 2015. Premiers résultats tabac et e-cigarette – Caractéristiques et évolutions récentes. [Initial results for tobacco and e-cigarettes – Characteristics and recent developments.] Results of the INPES 2014 Health Barometer

Since its introduction, the electronic cigarette has stimulated and continues to stimulate scientific and societal discussions on the risks associated with its use, and on its potential benefits in helping people stop or reduce smoking. The acquisition of additional data, through epidemiological or experimental studies, should provide answers to these questions.

According to this review between January 2013 and June 2014, although the severity of the poisoning cases was low or moderate, caution should still be exercised when using e-cigarettes, as well as regarding possible confusion with drug treatments, and accessibility of the devices to children. On this point, regulations now require manufacturers to provide their e-liquid refills with safety caps, which should reduce the exposure of children.

The regulations applicable to e-cigarettes will make it possible to acquire more precise information on the composition of e-liquids. Indeed, the European Directive 2014/40/EU (the Tobacco Products Directive) has been transposed into French law by Ordinance 2016-623, incorporating new provisions in the French Public Health Code (Article L. 3513-1 *et seq.*). By the Decree of 22 August 2017, ANSES has been given responsibility for receiving and analysing the information provided by manufacturers and importers of e-cigarettes and e-liquids containing nicotine. Before they can place their products on the market, these companies will have to submit data on the composition, toxicity and emissions generated by their e-liquids, to a European portal. These data will be analysed to more precisely characterise the risks – particularly the chronic risks to human health – of these new devices.

Cécilia SOLAL (Anses)

TO FIND OUT MORE, VISIT:

http://www.centres-antipoison.net/CCTV/CCTV_Rapport_Cigarettes_electroniques_VFINALE.PDF