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Cannabis and the lung

Cannabis and the lung

Peter Lange

Cannabis smoking constitutes a substantial hazard to the lung

Cannabis (or marijuana) is not only the most widely used illegal drug in the western world but, after tobacco, also the most commonly smoked substance. In the UK almost 50% of young adults have tried to smoke cannabis at some time.[1] Among people aged 16–30 years of age there is a substantial number of frequent users, in some populations in the range of about 5%. The active substance responsible for the psychostimulating effect of cannabis is delta^9-tetrahydrocannabinol (THC). However, as with tobacco smoke, cannabis smoke consists of a large mixture of compounds including polycyclic aromatic hydrocarbons, carbon monoxide, cyanide, benzene and many others.

Cannabis is prepared from the hemp plant which—especially in the 19th and the beginning of the 20th century—was grown for industrial purposes in order to produce fibres, but it has gradually been replaced by other coarse-fibre plants. Archaeological findings show that cannabis was used in many ancient cultures in spiritual and religious contexts as a psychostimulating and trance-inducing drug. Later, in the 19th century, it was promoted for its medical properties including pain-relieving, antiemetic and anticonvulsant effects. Yet, after the invention of aspirin and other more effective drugs, the use of cannabis as a popular medical drug declined.

The so-called recreational use of cannabis became more widespread during the golden period of jazz in the 1920s and 1930s and later became a part of the youth culture in the 1960s. Although cannabis can be prepared for consumption in several forms (beverages, cakes, oils), the most usual intake is by inhalation through the lungs. Cannabis can be smoked in cigarettes (joints), pipes or in special devices such as bong or chillum. Irrespective of the device, the technique of smoking cannabis differs from smoking regular tobacco with larger puffs, deeper inhalation and greater breath holding time, sometimes accompanied by valsalva manoeuvres to achieve a higher systemic absorption of THC. In fact, this smoking technique (rather than cannabis itself) has been proposed as the mechanism responsible for cases of spontaneous pneumothorax and bullous lung disease reported in young cannabis smokers.[2] Most importantly, however, this smoking technique results in a far greater deposition of toxic substances in the lung than with regular tobacco smoking.[3]

The number of studies on the pulmonary effects of cannabis is quite limited. In particular, in contrast to the worldwide research on tobacco, relatively few research groups have conducted relevant studies on the pulmonary effects of cannabis. Most of our knowledge comes from the University of Southern California where Tashkin *et al*[4] have, since the early 1970s, performed several experimental, clinical and epidemiological studies. However, there is now an increasing focus on the possible harmful effects of cannabis on the lung. A recent systematic review of the literature identified 34 relevant publications evaluating either short-term or long-term effects of cannabis smoking on pulmonary function and respiratory symptoms.[5] This review confirms that, although cannabis smoking results in an acute bronchodilation, it exerts very potent inflammatory effects on the airways which, in the longer term, result in a very high prevalence of cough, sputum and wheeze. These clinical symptoms are paralleled by bronchoscopic findings showing mucosal swelling and erythema, increased airway secretions, goblet cell hyperplasia, loss of ciliated epithelium, squamous metaplasia and an increased number of alveolar macrophages with impaired microbiocidal activity.[4] The latter finding is consistent with case reports of opportunistic pulmonary infections in cannabis smokers.

With regard to the risk of developing respiratory cancer, the evidence is more controversial. Yet, as cannabis smoke contains similar carcinogens to tobacco smoke and the smoking technique results in an even higher concentration and the deposition in the airways of inhaled particles, it is likely that cannabis smoking could cause airway malignancies. However, a large epidemiological study failed to show an increased risk in cannabis smokers, but this study has been criticised by others because the follow-up period was too short.[4]

The findings regarding the long-term effects of cannabis smoking on pulmonary function are also conflicting and previous reviews have concluded that data on an association between cannabis smoking and reduced pulmonary function are inconclusive.[4 5] In this issue of *Thorax* (***see p 1058***), Aldington *et al*[6] present new data on this important problem. They compared lung function and high-resolution CT (HRCT) scans of

75 cannabis (only) smokers, 91 cannabis and tobacco smokers and 92 tobacco smokers with 81 non-smokers. They found a dose-response relationship between cannabis consumption and the degree of airways obstruction and hyperinflation. They estimated that one cannabis joint was equivalent to 2.5 cigarettes for the effect on forced expiratory volume in 1 s/forced vital capacity and to 6 cigarettes for the effect on specific airways conductance. In contrast, there was no association between cannabis use and the prevalence of HRCT-defined emphysema. This study supports the view that cannabis affects airway function and causes obstruction. It is likely that the present results differ from the previous negative studies due to the inclusion of subjects with a relatively high cumulated cannabis consumption (substantial number of joint-years) and because the cannabis cigarettes of today contain more than 10 times as much THC than cigarettes from the 1960s, as has been put forward by the British Lung Foundation (BLF).[7] The BLF also points out that there is a need for further research focusing on the link between cannabis and chronic obstructive pulmonary disease. Yet, the study by Aldington *et al* also shows the difficulties in conducting such studies.[6] In spite of the fact that the investigators invited a general population sample of 3500 individuals, there were only 19 eligible persons smoking cannabis. Another approach using specific advertising for cannabis smokers therefore had to be employed. However, as the authors point out, this approach is not without problems because many heavy cannabis consumers also smoke other substances, which makes it difficult to isolate the effects of cannabis.

In summary, although we know far less about the effect of cannabis on the lung than the effects of tobacco smoking, the study by Aldington *et al*[6] confirms that cannabis smoking constitutes a substantial hazard to the lung.

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Long-term exposures to air pollution

Long-term exposures to air pollution

Jon G Ayres

Methodological problems of retrospective studies

In the 1980s the comfortable belief that air pollution was no longer a public health issue was shaken by the appearance of the Six Cities study from the USA which revealed dose-related health effects (ranging from symptoms to mortality) at levels of air pollutants at that time considered to be safe.[1] Since then there has been a dramatic rise in the number of publications on air pollution from all parts of the world which have resulted in two broad outcomes: a far better understanding of the mechanisms by which ostensibly ''low'' concentrations of pollutants impact on the lung and increasing awareness within governments of the need to tighten air quality standards. Most epidemiological studies over this time have considered the effects of day-to-day changes in air pollution on daily events such as deaths and hospital admissions (so-called time-series studies).[2] While these studies are in theory easy to undertake, being based on routinely collected data, they usually lack individual information other than cause of death or admission, age and gender. Using this information, in 1998 the UK's Committee on Medical Effects of Air Pollutants (COMEAP) quantified the health impact of air pollution[3] as a stepping stone towards determining the cost effectiveness of further pollution control measures. However, at that time they were unable to quantify the impact of long-term exposures—which even then were thought likely to be far greater than the day-to-day effects—for lack of studies.

Subsequently, the Six Cities studies[4] and the much larger American Cancer Society (ACS) study of 151 US cities[5 6] have provided insights into the effects of long-term exposure on mortality and, to some extent, morbidity. While these studies have been used by COMEAP in their second quantification report (the first section on mortality is now on the COMEAP website[7]), there are no UK prospective longitudinal studies aimed at defining the effect of air pollution on health. Longitudinal studies from Norway and France[8 9] have shown associations between particles and mortality with coefficients ranging from 1.04 to 1.16 for a range of outcome and pollutant pairings, while a pilot study from the Netherlands[10] has shown much larger effect sizes than the ACS study. The Dutch results might be due to small population size or be a real effect; the full study results are awaited with interest.

The paper by Elliott and colleagues in this issue of *Thorax*[11] using a Geographical Information System-based small area approach should therefore be a welcome addition (***see p 1088***). This is a retrospective ecological study of total mortality and thus has the inherent problems of such studies, but the findings are intriguing if true, the effect sizes being larger than those in the ACS study and comparable to the Dutch pilot study. Using black smoke as an index of particle exposure, the adjusted relative risks for respiratory mortality were 3.6% per 10 μg/m^3 exposure to black smoke and 13.2% per 10 ppb sulphur dioxide. Puzzlingly, for the most recent period from 1994–8 the coefficients were substantially higher at 19.3% and 21.7%, respectively.

However, these findings need to be interpreted with some caution as timing of exposures, accuracy of estimated exposures and confounding may all be playing a part in inflating these effect sizes. This approach does consider past exposures as relevant to mortality, but only the few years immediately before the period of