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Acute effects of electronic cigarette on lung function and airway inflammation in patients with asthma

Submission date
31/07/2018

Recruitment status
No longer recruiting

Registration date
08/08/2018

Overall study status
Completed

Last Edited
18/09/2024

Condition category
Respiratory

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
Bronchial asthma is a chronic inflammation of the airways. it affects a large proportion of the population and in severe cases can prove fatal. Several factors can lead to the worsening of lung function and airway inflammation in asthma patients, one of the key ones being cigarette smoke. In recent years, e-cigarettes have been suggested as replacements for cigarettes. It is not yet clear whether the use of e-cigarettes in asthma patients is also dangerous, or if it proves helpful in stopping smoking. This study aims to look at the short term effects of e-cigarette use on lung function and airway inflammation in asthma patients.

Who can participate?
Adult patients with moderate asthma who smoke every day.
Healthy volunteers to match the patients must be adults who smoke every day and are matched to the patients on the basis of age, gender, height, weight, BMI and how much they have smoked.

What does the study involve?
Participants will be asked to undergo various breath tests, designed to measure lung function (pulmonary function tests (PFTs) and impulse oscillometry (IOS)), exhaled carbon monoxide and nitric oxide (FENO), and airway inflammation (exhaled breath condensate (EBC)). They will then be asked to smoke an e-cigarette for 5 minutes. 15 minutes later, the PFT and IOS tests will be repeated. 30 minutes after smoking the e-cigarette, participants will be asked to repeat the FENO and EBC tests. All participants will be offered a session to help with stopping smoking at the end of the study.

What are the possible benefits and risks of participating?
The possible benefit to participants taking part in the study is the in-depth assessment of lung function and airway inflammation they receive, which is not part of standard clinical practice. Additionally, the smoking cessation session offered at the end of the session may help participants will the process of quitting smoking. There are no known risks to participants taking part in this study.

Where is the study run from?
Pulmonary Clinic and Respiratory Failure Unit of the Aristotle University of Thessaloniki in the General Hospital of Thessaloniki "Georgios Papanikolaou"

When is the study starting and how long is it expected to run for?
November 2016 to May 2018

Who is funding the study?
Hellenic Society of Respiratory and Occupational Chest Diseases (Greece)

Who is the main contact?
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Contact information

Type(s)
Scientific

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Protocol serial number
5988/16/9-5-2017

Study information

Scientific Title
Acute effects of electronic cigarette on pulmonary function and exhaled inflammatory mediators in patients with asthma

Study objectives
E-cigarette use acutely deteriorates pulmonary function and airway inflammation in patients with asthma compared to healthy controls

Ethics approval required
Old ethics approval format

Ethics approval(s)

Bioethics and Deontology Committee of the Medical School of the Aristotle University of Thessaloniki, 18/05/2017, 8/22.2.2017, protocol number 369

Primary study design
Other

Study design
Single-center trial

Study type(s)
Other

Health condition(s) or problem(s) studied
Asthma

Interventions
25 patients with asthma were randomly selected from a group of asthma patients at the hospital who met the inclusion criteria using a random number generator. Each participant had a matched healthy control, based on characteristics such as age, gender, height, weight, body mass index (BMI) and the number of packyears.
The patients smoked an e-cigarette of the same brand and device, with the same liquid and quantity of liquid, for 5 minutes. The liquid had a nicotine concentration of 12 mg/ml. The procedure for each participant took place on the same day and last approximately 1.5 hours. First, exhaled CO measurements were taken from participants. If the exhaled CO was 5 ppm or less, then they were allowed to participate that day. If the exhaled CO was higher than this, they would be asked to re-complete this measurement and participate in the study another day.
For those passing the exhaled CO measurement, participants underwent various measurement, including fraction of exhaled nitric oxide (FENO), pulmonary function tests (PFTs), impulse oscillometry (IOS) and exhaled breath condensate (EBC) gathering. Following this, participants were asked to smoke an e-cigarette of the same brand and device, with the same liquid and quantity of liquid, for 5 minutes. The liquid had a nicotine concentration of 12 mg/ml.
15 minutes after smoking the e-cigarette, participants then repeated PFT and IOS measurements. 30 minutes after smoking the e-cigarette, participants then repeated the FENO and EBC measurements.
At the end of this process, participants were offered a smoking cessation session.

Intervention Type
Device

Phase
Not Applicable

Drug/device/biological/vaccine name(s)
Not provided at time of registration

Primary outcome(s)
Changes in the Fraction of Exhaled Nitric Oxide (FENO) before and after the use of the e-cigarette in patients with asthma, compared to changes at the same timepoints in healthy controls. Participants underwent FENO measurements, and then were asked to smoke an e-cigarette for 5 minutes. After 30 minutes, participants underwent another FENO measurement. FENO measurements were performed using the Denox 88 ECOMEDICS.

Key secondary outcome(s)
1. Pulmonary function, assessed at the baseline and 15 minutes after participants smoked the e-cigarette to measure the following:
1.1. Pulmonary function tests (PFTs) using the MasterScreen PFT JAEGER, including:
1.1.1. Vital capacity (VC)
1.1.2. Inspiratory capacity (IC)
1.1.3. Maximum voluntary ventilation (MVV)
1.1.4. Forced vital capacity (FVC)
1.1.5. Forced experiatory volume in 1 second (FEV1)
1.1.6. FEV1 to FVC ratio
1.1.7. Mean mid-expiratory flow (MMEF)
1.1.8. Peak expiratory flow rate (PEFR)
1.1.9. Forced expiratory flow at 25%, 50% and 75% of FVC manoeuvre
1.1.10. Peak inspiratory flow (PIF)
1.1.11. Tidal volume and breathing frequency during MVV manuoeuvre
1.1.12. Vital capacity IN during diffusion manuoevre (VIN)
1.1.13. Functional residual capacity (FRC)
1.1.14. Residual volume (RV)
1.1.15. Expiratory reserve volume (ERV)
1.1.16. Total lung capacity (TLC)
1.1.17. RV to TLC ratio
1.1.18. FLC to TLC ratio
1.1.19. Alveolar volume (VA)
1.1.20. Transfer factor for carbon monoxide with the single-breath method (TLCOSB)
1.1.21. TLCO to VA ratio
1.2. Impulse oscillometry (IOS) using the Viasys Jaeger Masterscreen IOS system, including:
1.2.1. Tidal volume (VT)
1.2.2. Impedance at 5 Hz (Z5)
1.2.3. Resistance at 5, 10, 15, 20, 25 and 35 Hz (R5, R10, R15, R20, R25 and R35)
1.2.4. Reactance at 5, 10, 15, 20, 25 and 35 Hz (X5, X10, X15, X20, X25 and X35)
1.2.5. Resonant frequency (Fres)
1.2.6. Central and peripheral resistances (Rcentral and Rperipheral)
2. Airway inflammation, assessed using exhaled breath condensate (EBC) gathering at the baseline and 30 minutes after participants smoked the e-cigarette, using the EcoScreen for EBC at -10 °C, to measure the following:
2.1. pH, measured using an Orion Ross microelectrode and an Orion Star pHmeter
2.2. Concentrations of interleukins (IL) 1β, 4, 5, 6, 8, 10, 13 and 17A, measured using flow cytometry
2.3. Tumour necrosis factor alpha (TNFα), measured using flow cytometry
2.4. 8-isoprostane (ISO8), measured using ELISA
2.5. Leukotriene B4 (LTB4), measured using ELISA

Completion date
30/05/2018

Eligibility

Key inclusion criteria
Asthma patients:
1. Every-day smoker:

1.1. Smoked at least 100 cigarettes in their lifetime
1.2. Smoke every day at the time of research
2. Moderate asthma
3. Aged over 18 years old

Healthy controls:
1. Every-day smoker:
1.1. Smoked at least 100 cigarettes in their lifetime
1.2. Smoke every day at the time of research
2. Visited the smoking cessation clinic or other pulmonary dispensaries of the hospital during the research
3. Aged over 18 years old
Healthy controls were matched with asthma patients on baseline characteristics including age, gender, height, weight, BMI and number of pack-years.

Participant type(s)
Mixed

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 Years

Sex
All

Total final enrolment
50

Key exclusion criteria
For the group of asthma patients:
1. Mild or severe asthma and not receiving therapy of "step 3" according to 2016 GINA guidelines
2. Any chronic disease other than asthma
3. Acute asthma exacerbation the last month before the study
4. Use of corticosteroids
5. Any acute disease 2 weeks prior to the study.
6. Use of any medication except for asthma treatment currently or in the 2 weeks prior to study participation
7. Having smoked since their morning awakening and/or had an Exhaled CO measurement of over 5 ppm the day they would take part in the study

For the control group:
1. Any chronic disease
2. Any acute disease currently or in the 2 weeks prior to study participation
3. Having smoked since their morning awakening and/or had an Exhaled CO measurement of over 5 ppm the day they would take part in the study

Date of first enrolment
26/06/2017

Date of final enrolment
07/11/2017

Locations

Countries of recruitment
Greece

Study participating centre
General Hospital of Thessaloniki ''Georgios Papanikolaou''
Agiou Stefanou 105
Exohi, Thessaloniki
Greece
57010

Sponsor information

Organisation
Pulmonary Clinic and Respiratory Failure Unit of Aristotle University of Thessaloniki, General Hospital of Thessaloniki ''Georgios Papanikolaou''

ROR
https://ror.org/02j61yw88

Funder(s)

Funder type
Not defined

Funder Name
HELLENIC SOCIETY OF RESPIRATORY & OCCUPATIONAL CHEST DISEASES

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan

There are two copies of participant level data, one in the possession of the PhD candidate and one in the possession of the supervising teacher. Both copies are stored in a publically available repository, in the repository of the Pulmonary Clinic and the Respiratory Failure Unit of the Aristotle University of Thessaloniki in General Hospital of Thessaloniki ''Georgios Papanikolaou''. The data that can be shared includes all the results of all the examinations of the 50 participants before and after the e-cigarette (raw data). The data are already available and will be available for 10 years after the completion of the doctoral thesis, which will be a date between 29/11 /2019 and 29/11/2022, according to the regulation of the university. All participants are able to take a copy of only their own examination results. Apart from the participants, the data will only be shared with any journal which will be willing to publish an article with the results of the study. In that case, the journal will be able to receive a copy of the whole data, after conduct with the PhD candidate or the supervising teacher. The copy of the whole data that will be available for the journal that will be willing to publish an article with the results of the study will be available only for the confirmation of the results and for no other use. All participants gave their informed consent for the use of the data as long as they keep their anonymity, therefore the data that will be shared, will not be referred to names but to the code numbers which were given to every participant in the study.

IPD sharing plan summary

Stored in repository

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article	results	01/10/2020	07/04/2020	Yes	No
Results article		20/06/2024	18/09/2024	Yes	No