Original Article

Carcinoembryonic antigen (CEA) levels in hookah smokers, cigarette smokers and non-smokers

Khan Mohammad Sajid1, Riffat Parveen2, Durr-e-Sabih3, Kamal Chaouachi4, Ayisha Naeem5, Rubaida Mahmood6, Rahat Shamim7

Multan Institute of Nuclear Medicine and Radiotherapy1,3,6, Department of Chemistry, Bahauddin Zakariya University2,4,5,7, Multan

Abstract

Objective: To find CEA levels in smokers of different categories (hookah smokers, cigarette smokers smoking different brands of cigarettes and different number of cigarettes per day) and to correlate CEA levels with type and rate of smoking.

Methods: A total of 122 cigarette smokers (115 men and 7 women) and 14 hookah smokers (all men) with age ranging from 16-80 years were studied. CEA levels were also measured in 36 non-smokers who served as controls. Enhanced chemiluminescent immunometric technique was applied to measure CEA levels in our subjects.

Results: The mean CEA levels of cigarette smokers were compared with the mean CEA levels observed in hookah smokers (7.16 ± 10.4 ng/ml) and non-smokers (2.15 ± 0.68 ng/ml). The mean value of CEA level observed in cigarette smokers, 9.19 ± 14.9 ng/ml (n=122) was significantly higher than the levels in non-smokers and hookah smokers (p<0.0067). It was also observed that CEA levels increased with the number of cigarettes smoked per day. The highest levels were observed in smokers who smoke more than 31 cigarettes per day. The smokers that use relatively cheaper brands of cigarettes had higher levels of CEA compared to those who use high quality brands.

Conclusion: It was concluded that the brands of cigarettes (which were ranked on the basis of price) and the rate of smoking both play an important role in raising the CEA levels. Further the common belief that hookah also called narghile or shisha is a relatively safe mode of smoking is not completely correct; a significant proportion of hookah smokers have high levels of CEA compared to those who use high quality brands.

Introduction

Smoking is a world health problem. More than one billion people (men, 1 billion women, 250 million) smoke in the world resulting in 4.2 million annual deaths. In addition to premature aging, it causes many diseases including cancer.1 Tobacco smoke contains over 4800 different chemicals out of which 69 are carcinogens, and several are tumour promoters or cocarcinogens.2

The cancers related to smoking are cancers of lung, oral cavity, pharynx, larynx, oesophagus, pancreas, urinary bladder, and renal pelvis. There is also sufficient evidence for a causal association between cigarette smoking and cancers of the nasal cavities and nasal sinuses, oesophagus (adenocarcinoma), stomach, liver, kidney (renal-cell carcinoma), uterine cervix and myeloid leukaemia.3 Doll

595 J Pak Med Assoc
and Peto\textsuperscript{4} mathematically proved that the exposure duration to tobacco smoke is much more important than the daily number of cigarettes. Quitting as early as possible remains the most powerful factor in reducing the cancer risk. Pipe and cigar smoking can also cause lung cancer, although the risk is not as high as with cigarette smoking\textsuperscript{5}.

It has been reported that the concentration of carcinoembryonic antigen (CEA), known as a marker of malignant transformation and chronic inflammation, is increased in a variety of cancers e.g., carcinoma of pancreas\textsuperscript{6}, uterine cancer\textsuperscript{7} and cancers of lung\textsuperscript{8} and breast\textsuperscript{9} and among smokers.\textsuperscript{10,11} Greater-than-normal values of CEA may therefore indicate the presence of cancer.

Heavy smoking over many years might also raise blood CEA levels. Most of the studies done so far are on cigarettes and pipe smokers. Effect of hookah smoking on CEA levels has not been studied in detail although hookah/shisha is now considered as an extremely important world health problem.\textsuperscript{12} The aim of this study was to find CEA levels in smokers of different categories (hookah smokers, cigarette smokers smoking different brands of cigarettes and different number of cigarettes per day) and to correlate CEA levels with type and rate of smoking.

**Subjects and Methods**

Harriet Becher\textsuperscript{13} has classified cigarette smokers into regular smokers, occasional smokers and non-smokers. Regular smokers are defined as smokers usually smoking at least one cigarette a day. Occasional smokers are defined as smokers smoking less than one cigarette a week. Regular smokers are further classified according to the number of cigarettes they smoke: light: 5-10 cigarette/day, medium smokers: 10-20 cigarette/day and heavy smokers: 20-60 cigarette/day.

A total of 122 regular cigarette smokers (115 men, 7 women) and 14 hookah smokers (not mutually exclusive and covering the whole range) who smoked at least once daily (all men) of age ranging from 16 to 80 years were studied. Most of these volunteers (smokers) belonged to different cities of Southern Punjab. For cigarette smokers, those who smoked cigarettes only, were included and the individuals who used other modes of smoking or used bedi or even chewed tobacco were excluded. In case of hookah smokers the individuals who used mostly hookah were included. However due to difficulties in approaching the ever hookah smokers, the hookah smokers who occasionally used cigarettes were also included in the study. Further they were also examined to exclude any illness. The subjects were individually approached by the researchers and belonged mostly to urban areas of Multan district. Depending on the rate of smoking (number of cigarettes smoked per day) the cigarette smokers were divided into five groups. The number of cigarettes smoked per day ranged from 3-60 cigarettes per day (8-48 packets/year). The cigarette smokers used different brands of cigarettes.

The hookah smokers mostly used Desi Punjab tobacco (leaves of a local variety of tobacco dried in air and sunlight) mixed with molasses (dense brownish sap formed during purification of cane sugar by boiling the extract from sugar cane) in 1:1 ratio by weight. The product was home made and without glycerine and any flavouring essences as is found in tobacco-molasses based mixtures smoked in shisha in other parts of the world particularly in Europe and the USA.\textsuperscript{14}

The smoking device consisted of a Chilam (a funnel of volume approximately 500-700 ml) containing tobacco at its bed on a small stone covered by glowing charcoal. The individuals consumed about 2 "chattaks" of tobacco-molasses mixture (more than 120 grams) a day. The smoke was inhaled after passing through water and a long pipe. The individuals had been smoking hookah for durations varying from 2-15 years.

In case of non-smokers, the volunteers who never smoked in their life were included and occasional smokers were excluded. A total of 36 non-smokers served as controls. The age of these non-smokers ranged from 20 to 75 years. These controls were hospital staff and university students and belonged mostly to district Multan. Each smoker was interviewed to get the detail of his/her history of smoking. All the individuals were examined by a clinician to exclude the possibility of any disease, which causes elevated CEA levels.

Five cc of blood was taken from each smoker which was allowed to clot followed by centrifugation to get serum. Serum was then used in imumnoassays to find the CEA level. The serum samples were stored at 4°C in a refrigerator for use in future.

Chemiluminiscence immunometric technique was applied using immulite-2000 system to estimate CEA levels in sera of the subjects.

SPSS Version 10 was used for data entry and analysis. Student's t-test was applied to compare the levels of CEA to study different groups. Analysis of variance (ANOVA) was applied to compare results of different groups to find the statistical significance of our findings.

All the subjects voluntarily donated their blood samples. The smokers were informed well about the significance of the test before they donated blood samples and were assured of privacy of the test values.

Following values provided by the manufacturer were used as reference to draw conclusions in our study.
Normal values for male smokers (153 persons study): 2.1-6.2 ng/ml.

Normal values for male non-smokers (226 persons study): 1.1-3.2 ng/ml.

Normal values for female smokers (81 person study): 1.3-4.9 ng/ml.

Normal values for female non-smokers (262 persons study): 0.8-2.5 ng/ml.

Results

The CEA levels observed in different groups of smokers with different smoking rates are summarized in Table-1. The duration of smoking ranged from 8-15 years. There was a relationship between CEA level and number of cigarettes smoked per day. The mean levels of all smokers were above normal limits although the individual levels were sometimes within normal limits. A range of values between 0.85 to 13.9 ng/ml was observed in smokers of group-1(n=32; %High=56.25) who smoked 3-10 cigarettes per day. However, applying statistical test showed that these levels were significantly higher than the levels of non-smokers (p=0.0002). Similarly in group-2 (n=39; %High=66.7) and group 3 (n=17; %High=58.82) who smoked 11-30 cigarettes per day mean CEA levels varied widely and were significantly higher (p-values <0.0032 to 0.0001) than the levels of non-smokers. Significantly very high (p-value=0.0001) mean levels were observed in group 4 (%High=65) and 5 (%High=65) smoking 31-60 cigarettes a day. The CEA levels observed in different brands of cigarettes are given in Table-2. People smoking cigarettes of 15 different brands were included in this study. The mean CEA levels observed in 3, 4 and 3 smokers of Wills King, Pine and Red and White respectively were less than 4 ng/ml. The values in these individuals were also significantly higher (p=0.016 and 0.0035 respectively) than mean values observed in hookah smokers. The mean CEA levels in rest of the brands were also significantly high (p<0.001) when compared with controls. Analysis of variance (ANOVA) showed a significant variation of CEA levels between different brands of cigarettes (p<0.001). However a significant proportion of the smokers were within normal limits. In hookah smokers the mean value of CEA observed was 7.16 ±10.4 ng/ml %High=42.8). The mean CEA level observed in non-smokers was 2.35 ± 0.71 ng/ml. The overall mean levels in cigarette smokers and hookah smokers did not differ significantly shown in Table-1. Significantly raised CEA levels (p<0.0067) were observed in 122 cigarette smokers when compared with non-smokers (p=0.0067). However comparison of these values with values of hookah smokers showed no significant difference (p=0.61). Levels were also high in 14 hookah smokers when compared with controls (p=0.0079).

Discussion

Smoking is inhalation and exhalation of the fumes of burning tobacco in cigars, cigarettes, pipes and hookah. In contrast with cigarettes, hookah (also called narghile or
shisha) smoking involves important differences in temperatures (several hundreds of degrees). In many cases the tobacco-molasses mixture is not burnt but rather heated by a piece of charcoal according to a chemical reaction of the Maillard type.14

Sajid et al have shown that hookah smoke may contain, depending on the size of the apparatus and the nature of charcoal and tobacco, very high content of CO, which could induce heart diseases in hookah smokers.17 Work on shisha smoking in Saudi Arabia, very similar to Pakistani hookah use, suggests that some carcinogens may be filtered by the device.18 Rakower and Fatal19 early hypothesized the influence of the lower temperatures on the formation of the carcinogenic PAH (Polynuclear Aromatic Hydrocarbons). A comprehensive review of the world literature showed a weak relation between lung cancer and hookah smoking.20 Lung cancer is mainly due to the action of the PAHs and the TSNA (Tobacco-Specific Nitrosamines) and, to a lesser degree, to polonium 210 and volatile aldehydes,21,22 Aldehydes (acetaldehyde, formaldehyde, acrolein) are filtered in great proportions and the two first elements are known contributors to lung cancer.21,23

Carcinoembryonic antigen (CEA) is elevated in malignant tumours. It has also been found elevated in some nonmalignant tumours such as pleural effusions.24 One of the most useful applications of this marker is as a post surgical prognostic indicator in the treatment of neoplasms. Greater-than-normal value of CEA might indicate the presence of cancer of the large intestine (colon and rectum).

However, heavy smoking can raise CEA levels.10 Work of Fukuda et al showed that CEA-positive subjects were heavy smokers.11

In the current study smokers using more than 30 cigarettes a day, had highest mean levels of CEA and the percentage of persons with elevated CEA levels in these groups were 65%-71.4%. These smokers were therefore at high risk of cancer compared to the smokers smoking less than 30 cigarettes a day.

Highest mean levels were observed in two brands of cigarettes i.e. Morven Gold and Derby, which reached the CEA levels up to about 30 ng/ml. The rate of smoking (number of cigarettes smoked per day) is also high in these smokers (i.e., 30 and 45 cigarettes of cigarettes per day. These are low price and probably poor quality brands and are being used by low-income groups (the volunteers using these brands belonged to low socioeconomic classes).

The observed CEA levels in hookah smokers were 7.1 ± 10.48 ng/ml. The percentage of individuals with high CEA levels in hookah smokers was 43%. This result indicated that a significant proportion of hookah smokers have very high levels of CEA. On one hand, this might be due the fact that water filtration does not remove all the carcinogenic and toxic chemicals. It is also possible that the selected volunteers were also cigarette smokers, ex-cigarette smokers with a smoking career varying in duration, or even recent cigarette (or bidi) smokers having switched to hookah smoking, naively believing that this mode of tobacco use would be less detrimental to their health.

Conclusion

In the light of findings, it was concluded that the brands of cigarettes and the rate of smoking both play an important role in raising the CEA levels and the belief that hookah is a safer device for smoking undoubtedly requires further investigations involving a higher number of hookah smokers.

Acknowledgement

The authors acknowledge with thanks the financial support provided by Bahauddin Zakariya University, Multan for this work.

References

Infant feeding and Hospitalization during the first six months of life

Farideh Shiva, Fatemeh Ghotbi, Mojgan Padyab
Department of Pediatrics, Taleghani Medical Center, Shaheed Beheshti Medical University, Tehran.

Abstract

Objective: To compare the frequency of hospitalization during the first six months of life between breast-fed and bottle-fed infants.

Method: A descriptive cross-sectional study was conducted over twelve months, in hospital-based outpatient clinics. Mother-infant pairs, seen at the clinics during the study period, were enrolled. Infants were between the ages of 6-24 months and had been brought for routine check-ups, vaccinations or common childhood ailments. Subjects were recruited from babies with no congenital anomalies or chronic illnesses. Study team recorded necessary information about feeding practices, previous illnesses and hospitalizations on a structured questionnaire. Hospitalization rates in 3 groups of infants with different feeding methods i.e. predominant breast-feeding, partial breast-feeding, and bottle-feeding were compared. Results were analyzed using SPSS software, ANOVA was used for comparison of means between groups, and a p-value <0.05 was regarded as significant.

Results: A total of 606 mother-infant dyads were enrolled, of which 73% infants were on predominant breast-feeding at 6 months of age. The rate of all-cause hospitalization before six months of age was: 6.3%, 22.2% and 27.2 % in infants with predominant breast-feeding, partial breast-feeding and bottle-feeding, respectively, (p<0.001). Figures for admission due to infectious cause were 6%, 17.6% and 25.6%, respectively, (p<0.001). Adjusted Odds ratio between bottle-fed and breast-fed babies was 5.3 for all-cause hospitalization, and 6.1 for hospitalization due to infectious illnesses.

Conclusion: Our findings show that protective effect of breast-feeding is not limited to developing countries; it extends to young infants living in urbanized environments equipped with adequate sanitation and clean water supply (JPMA 57:599;2007).

Introduction

Feeding practices during the first 6 months of life have a profound effect on infant health in the developing world and thus remain as a major issue for public health consideration. Association of breast-feeding with a decline in morbidity and mortality in breast-fed infants has been accepted as an indisputable fact in the under-developed countries, where access to safe drinking water is limited, basic amenities unavailable, and sanitation either inadequate or non-existent.1-6 It is estimated that an increase in breast feeding worldwide by 40% would reduce deaths from respiratory infection by 50% in children less than 18 months of age7; however it is not clear whether this statement holds true in satisfactory living conditions as well. Although most research from developed countries accepts the protective role of breast feeding for the first six months of life some reports are controversial.8-12

We have attempted to study the protective effect of breast-feeding by comparing the frequency of hospitalization due to acute infectious illnesses between young breast-fed and bottle-fed infants in Tehran, an...