

Impact of Cigarette Smoking on Respiratory, Neurological and Dermatological Disorders: A Hospital-Based Study

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ABSTRACT

Background: Cigarette smoking is one of the largest preventable risk factors for morbidity at a systemic level. While the effects of smoking on the respiratory system are known, smoking may also cause neurological and dermatological disease via inflammation, oxidative stress, vascular dysfunction and impaired tissue oxygenation.

Aims: This study was carried out to evaluate the effect of smoking on respiratory, neurological and dermatological diseases in adults in a clinical hospital setting.

Methods: This hospital-based comparative cross-sectional study was conducted at Multan Medical and Dental College, Multan, from June 2022 to June 2023. One hundred twenty (120) adult subjects were recruited and split into two groups of equal size – 60 current cigarette smokers and 60 non-smokers. Demographic information, smoking history, number of cigarettes per day and pack-year exposure were documented. Patients were clinically evaluated for respiratory, neurological and dermatological manifestations in all. The data was analysed using SPSS version 26.0. Statistically significant difference between the groups was set at a p-value < 0.05.

Results: Among the smokers, the frequency of chronic cough, sputum production, wheezing, dyspnea on exertion, chronic bronchitis and recurrent respiratory infections were found to be significantly higher than the non-smokers. Smokers also had more neurological symptoms like headache, sleep disturbance, dizziness, memory complaints, and numbness or tingling. Smoking was significantly correlated with dermatological parameters like early wrinkles of the face, dryness of skin and delayed wound healing. Among smokers, those with > 10 pack-years had higher multisystem involvement.

Conclusions: The respiratory, neurological and dermatological morbidity was significantly higher in the cigarette smoking group. Smoking status assessment and early smoking screening should be strengthened as routine practice in the hospital, along with smoking cessation counselling.

Keywords: Cigarette smoking, respiratory disorders, neurological symptoms, dermatological disorders, hospital-based study

INTRODUCTION

Cigarette smoking is a major public health problem in both developed and developing countries and one of the most important preventable causes of disease in the world¹. Although numerous awareness campaigns and laws against smoking have been established, millions of people continue to smoke, and smoking plays a major role in hospital admissions, population of outpatients, long-term disability and premature deaths². Tens of thousands of toxic chemicals are present in cigarette smoke, such as nicotine, carbon monoxide, tar, oxidizing agents, heavy metals and cancer-causing chemicals³. Inhaled into body and locally and systemically damaging⁴. Hence, smoking should not be treated as a habit or a lifestyle factor, but as a big risk factor for medical complications that can impact many different organ systems⁵.

Cigarette smokers' respiratory system is the first and most directly affected system⁶. Inhaled smoke is in direct contact with airway mucosa, bronchial epithelium and alveolar tissue⁷. Repeated exposure results in irritation of the respiratory tract, inflammation of bronchi, excess secretions, reduced mucociliary clearance and destruction of alveolar walls⁸. These changes lead to common respiratory symptoms including chronic cough, sputum production, wheezing, chest tightness, dyspnea on exertion and recurring respiratory tract infections⁹. Chronic smokers are more prone to suffer from chronic bronchitis, emphysema, chronic obstructive pulmonary disease (COPD), decreased pulmonary function and lung cancer¹⁰. In hospital environments, many smokers may complain of respiratory symptoms, which may be insidious and go unrecognized until lung function is well compromised¹¹.

Cigarette smoking has significant effects on the nervous system besides damage to the lungs¹². Nicotine has a direct effect

on the brain, stimulating nicotinic acetylcholine receptors and affecting the release of chemical substances, such as dopamine¹³. This leads to dependency, and encourages him/her to keep smoking¹⁴. Exposure to the nicotine and other toxins in tobacco can cause headaches, dizziness, disrupted sleep, trouble concentrating, irritability, anxiety, and complaints about memory¹⁵. Smoking also causes damage to blood vessels and stimulates the development of atherosclerosis, which decreases the blood flow to the brain and contributes to stroke and other vascular neurologic problems¹⁶. Microvascular damage, oxidative stress due to impaired tissue oxygenation may also cause peripheral nerve symptoms of numbness, tingling, and burning sensations¹⁷. The relevance of these neurological manifestations is that they can negatively impact the quality of life and functional performance of smokers¹⁸.

The dermatological effects of cigarette smoking, however, are also well known, but are underreported in clinical practice¹⁹. The skin is very responsive to alterations in blood flow, oxygenation, collagen metabolism, and immune response²⁰. The cigarette smoke impairs the blood flow and reduces the oxygen supply to the skin, increases oxidative stress and damages collagen and elastin fibers¹. These effects can be ageing effects which hasten the ageing process and can cause premature facial wrinkling, skin dryness, dull skin, slow wound healing, hyperpigmentation, acneiform lesions and recurrent skin infections². Also smokers might have impaired fibroblast activity and reduced tissue repair leading to poorer surgical wound healing and increase in postoperative complications³. Thus, the skin can serve as a visible sign of permanent systemic damage due to smoking⁴.

Chronic inflammation, oxidative stress, endothelial dysfunction, immune suppression, and tissue hypoxia are primary mechanisms that account for the multisystem effects of cigarette smoking⁵. Carbon monoxide decreases the oxygen carrying

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capacity of hemoglobin and nicotine produces vasoconstriction and increases sympathetic activity⁶. Tobacco smoke contains oxidants which harm cellular structures and stimulate inflammatory reactions⁷. The effects of these mechanisms are all on the lungs, brain, nerves, blood vessels and skin⁸. Damage can be more serious the longer and more heavily someone smokes, which can be calculated by the number of pack years⁹. The smoking history, therefore, is pertinent in clinical evaluation, and the number of cigarettes smoked daily and number of years smoked should be detailed¹⁰.

While the effects of smoking on respiratory disease have been the subject of many studies, there are fewer studies that examine respiratory, neurological, and dermatological disorders in the same patient population on a hospital basis¹¹. This simultaneous evaluation is significant as often smokers will have symptoms of more than one organ system¹². Patients with a cough that present in a hospital may also have the following symptoms: sleep disturbance, headache, premature wrinkling, or delayed wound healing¹³. Likewise, dermatological or neurological complaints can be early signs of overall tobacco-related injury¹⁴. Assessing these manifestations together can be useful in identifying the full clinical impact of smoking¹⁵.

One of the most valuable types of studies is the hospital-based study, which is an actual representation of the clinical presentation of the patient as he presents himself for medical care¹⁶. These studies can detect patterns of smoking-related diseases and serve as a basis for early detection, counseling, and prevention¹⁷. Smoking history is often short and shortness of breath may be the only symptom associated with smoking that is captured in many clinical settings¹⁸. A systematic review of smoking associated respiratory, neurological and dermatological diseases could help to better manage patients and enhance smoking cessation efforts¹⁹.

Hence, the present study was performed to assess the association of cigarette smoking with the respiratory, neurological and dermatological disorders among patients attending the hospital based clinical setting²⁰. The study was also designed to compare the prevalence of these disorders in smokers and non-smokers and to determine if there was any correlation between smoking exposure and the burden of multisystem disease¹.

MATERIALS AND METHODS

The present study is a comparative cross sectional study carried out in a hospital setting to evaluate the effects of cigarette smoking in respiratory, neurological and dermatological disorders of adults. Study was conducted in Multan medical and dental college, Multan in various clinical departments in hospital as well as OPD.

The study was carried out during a one-year period from June 2022 to June 2023. All adult patients who presented to the hospital during the study period were enrolled. The participants were split into two groups based on their smoking status. Group I included current cigarette smokers, while Group II included non-smokers.

The study comprised of 120 participants. Of these, 60 were cigarette smokers and 60 were non-smokers. Non-probability consecutive sampling technique was used. Patients that met the selection criteria were selected consecutively until the required sample size was reached.

The study included adult patients (aged 18 years and older). Both male and female patients were eligible. Only current cigarette smokers, or those who were not smokers but stated that they would be willing to participate and signed informed consent were included. Patients who had occupational exposure to dust, smoke, industrial chemicals or toxic fumes were excluded. Patients with prior diagnosis of chronic respiratory disease who were not smokers, history of major neurologic disease, chronic autoimmune skin disease, malignancy, severe systemic disease, history of smoking, and incomplete clinical records were also excluded. Ex-smokers were not included because of potential misclassification of smokers and non-smokers.

A current cigarette smoker was defined as one who was a cigarette smoker at the time of enrollment and who had smoked at least 100 cigarettes during his or her lifetime. Non-smokers were people who had never smoked or smoked less than 100 cigarettes in their lifetime. Smoking exposure was determined by the number of years smoked and the average number of cigarettes per day. The pack-years were computed by multiplying the daily amount of packs smoked times the number of years. One pack was considered equal to 20 cigarettes. Additionally, smokers were divided into two groups: ≤ 10 pack years and > 10 pack years.

A structured clinical proforma was used to collect data after informed consent from each participant. Demographic data such as age, gender, residence and socio-economic status was taken. Smoking information consisted of smoking status, years of smoking, and number of cigarettes smoked per day, and pack years were calculated. Each subject was clinically evaluated for respiratory, neurological and dermatological diseases.

Detailed clinical history and physical examination were done to assess the respiratory system. The presence of chronic cough, sputum production, wheezing, dyspnea on exertion, recurrent respiratory tract infection and clinical evidence of chronic bronchitis were noted. Cough was considered chronic if it was present for ≥ 3 months. Chronic bronchitis was taken as a possibility if the participant complained of chronic productive cough for at least three months each year without any other obvious cause.

Neurological assessment was done with history and clinical examination. The following peripheral neuropathic symptoms were documented: headache, dizziness, sleep disturbance, memory complaints, tremors, numbness, tingling, burning sensations, etc. For the purposes of this study, peripheral neuropathic symptoms were tabulated as positive if the participant reported numbness, tingling, burning sensation or altered sensation in the hands or feet.

Dermatological examination was conducted in the form of clinical examination of the skin. The following were recorded: premature facial wrinkling, dry skin, acneiform eruptions, hyperpigmentation, delayed wound healing and recurrent skin infections. Delayed wound healing was determined by history and clinical observation, as available.

The data were coded and analyzed by SPSS software version 26.0. For quantitative variables like age and smoking exposure mean and standard deviations were used. Qualitative variables including gender, smoking status, respiratory disorders, neurological disorders and dermatological disorders were presented in frequency and percentage. Independent sample t-test was used to compare continuous variables between smokers and non-smokers and chi-squared test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Ethical approval was obtained from the institutional ethical review committee of Multan Medical and Dental College, Multan before the start of the study. All participants gave written informed consent. The confidentiality of the participant information was respected during the study. Those who were smokers were counselled about the negative effects of smoking, and were counselled to quit smoking.

RESULTS

A total of 120 participants were included in the study, comprising 60 current cigarette smokers and 60 non-smokers. No statistically significant difference was found between the mean age of smokers 41.8 ± 10.6 years and non-smokers 39.2 ± 9.8 years. The distribution in the dwellings was also similar. But, there was a significant difference between the groups with respect to male participants, where the smoking group had more male participants. Smokers were characterized by a long smoking duration (70.0% smoked for more than five years) and high level of tobacco exposure (45.0% smoked more than 10 pack-years) (Table 1).

Smokers had a significantly higher respiratory morbidity. The most commonly reported respiratory symptom was chronic cough, with 35 smokers having a chronic cough versus 13 non-smokers.

More sputum production, wheezing, dyspnea on exertion, chronic bronchitis and recurrent respiratory tract infections also occurred in the smoking group with significant differences. These findings indicate that there is a significant relationship between chronic irritation of airways, increased mucus production, and inflammation of the respiratory system and cigarette smoking (Table 2).

Smokers also complained of neurological symptoms more often. Twenty-seven smokers and 14 non-smokers reported headache, and sleep disturbance, dizziness, memory complaints and numbness or tingling were significantly more common in the smokers. Smokers also had more tremors, but this was only marginally non-significant. These findings suggest that smoking cigarettes might be linked to neurological symptoms both centrally and peripherally in hospital presenting patients (Table 3).

A similar trend was observed with dermatological manifestations. Twenty-six smokers were observed to experience wrinkling of the face at an earlier age than 10 non-smokers. Smokers were also more likely to experience dry skin and slow wound healing, both of which significantly occurred. Smokers were more likely to experience acneiform eruptions and hyperpigmentation, and to have recurrent skin infections; however, none of these differences was statistically significant. Data from these studies indicate that cigarette smoke could generate an aging effect on the skin, skin dryness, and delayed wound healing (Table 4).

In those who smoked, the more they smoked the more disease burden. A higher number of pack-years was associated with a higher frequency of respiratory, neurological, and dermatological involvement in the participants with over 10 pack-years compared to those with 10 or less pack-years. Three-system involvement and respiratory involvement were statistically significant in the higher exposure group, and neurological, dermatological and two-system involvement were nearly significant. This helps to explain the dose-response relationship between cigarette smoking exposure and multisystem clinical morbidity (Table 5).

Table 1: Baseline characteristics of study participants

Variable	Smokers (n=60)	Non-smokers (n=60)	p-value
Mean age, years	41.8 ± 10.6	39.2 ± 9.8	0.164
Male gender	49 (81.7%)	34 (56.7%)	0.003
Female gender	11 (18.3%)	26 (43.3%)	0.003
Urban residence	37 (61.7%)	35 (58.3%)	0.708
Rural residence	23 (38.3%)	25 (41.7%)	0.708
Smoking duration >5 years	42 (70.0%)	—	—
Smoking exposure >10 pack-years	27 (45.0%)	—	—

Table 2: Frequency of respiratory disorders among smokers and non-smokers

Respiratory disorder	Smokers (n=60)	Non-smokers (n=60)	p-value
Chronic cough	35 (58.3%)	13 (21.7%)	<0.001
Sputum production	29 (48.3%)	11 (18.3%)	<0.001
Wheezing	24 (40.0%)	9 (15.0%)	0.002
Dyspnea on exertion	26 (43.3%)	12 (20.0%)	0.006
Chronic bronchitis	20 (33.3%)	6 (10.0%)	0.002
Recurrent respiratory infections	17 (28.3%)	7 (11.7%)	0.023

Table 3: Frequency of neurological disorders among smokers and non-smokers

Neurological disorder	Smokers (n=60)	Non-smokers (n=60)	p-value
Headache	27 (45.0%)	14 (23.3%)	0.012
Sleep disturbance	25 (41.7%)	12 (20.0%)	0.010
Dizziness	18 (30.0%)	8 (13.3%)	0.026
Memory complaints	15 (25.0%)	6 (10.0%)	0.031
Tremors	11 (18.3%)	4 (6.7%)	0.052
Numbness or tingling	17 (28.3%)	7 (11.7%)	0.023

Table 4: Frequency of dermatological disorders among smokers and non-smokers

Dermatological disorder	Smokers (n=60)	Non-smokers (n=60)	p-value
Premature facial wrinkling	26 (43.3%)	10 (16.7%)	0.001
Dry skin	22 (36.7%)	11 (18.3%)	0.024
Delayed wound healing	15 (25.0%)	5 (8.3%)	0.014
Acneiform eruptions	13 (21.7%)	6 (10.0%)	0.080
Hyperpigmentation	12 (20.0%)	5 (8.3%)	0.064
Recurrent skin infections	10 (16.7%)	4 (6.7%)	0.091

Table 5: Disease burden according to smoking exposure among smokers

Clinical involvement among smokers	≤10 pack-years (n=33)	>10 pack-years (n=27)	p-value
Any respiratory disorder	19 (57.6%)	22 (81.5%)	0.047
Any neurological disorder	15 (45.5%)	19 (70.4%)	0.052
Any dermatological disorder	14 (42.4%)	18 (66.7%)	0.061
Two-system involvement	10 (30.3%)	14 (51.9%)	0.089
Three-system involvement	6 (18.2%)	11 (40.7%)	0.049

As a whole, smokers had more respiratory, neurological and dermatological diseases than non-smokers. The most frequent were respiratory complaints, followed by neurological and dermatological complaints. There was an increase in multisystem involvement with greater pack-year exposure, which further underscored the wide range of detrimental effects that cigarette smoking has on various organ systems.

DISCUSSION

This comparative study conducted in a hospital setting revealed that cigarette smoking was significantly related to higher morbidity in respiratory, neurological and dermatology diseases among adult patients¹. The smokers had a higher prevalence of chronic cough, sputum production, wheezing, dyspnea on exertion, chronic bronchitis, headache, sleep disturbance, dizziness, memory complaints, numbness, tingling, premature facial wrinkling, dry skin, and delayed wound healing than the non-smokers². The results show that cigarette smoking is not only confined to damage to the respiratory system but is also associated to multisystem clinical involvement³.

The most common manifestations observed among smokers in this study were respiratory disorders⁴. Smokers were more likely to have chronic cough than non-smokers (58.3% vs 21.7%)⁵. Likewise smokers were more likely to have an increased production of sputum, wheezing, dyspnea on exercise, chronic bronchitis, and repeated respiratory tract infections⁶. This is clinically predictable as cigarette smoke directly damages the airway epithelium, stimulates mucous production, reduces mucociliary clearance, and causes chronic inflammation of the airways⁷. Almost all individuals who smoke tobacco have bronchitis and a limitation in airflow, as a result of the chronic irritation of the bronchi from tobacco smoke⁸.

Smokers were also more likely to have chronic bronchitis, further evidence of the harmful effects of cigarette smoke on the respiratory tract⁹. Persistent productive cough is a key clinical finding to help identify airway inflammation and mucus hypersecretion¹⁰. Repeated exposure to the toxic particles in smokers leads to goblet cell hyperplasia, loss of ciliary function and infiltrations of the bronchial wall by inflammatory cells¹¹. These changes also make it easier to become infected again and suffer from progressive lung disease¹². The considerable distinction between smokers and non-smokers regarding respiratory symptoms further indicates the need for early respiratory screening of smokers in hospital settings¹³.

Smokers in the present study also had more neurological symptoms¹⁴. The most frequent neurological symptoms were headache and sleep disturbances, then numbness/tingling, memory complaints and dizziness¹⁵. Nicotine has a variety of effects on the central nervous system, including activation of nicotinic acetylcholine receptors as well as modulation of neurotransmitter release, particularly dopamine¹⁶. This mechanism

can lead to dependence, sleep disturbances, irritability and withdrawal symptoms¹⁷. Furthermore, chronic smoking can cause vascular dysfunction and decrease tissue oxygenation, thus leading to headache, dizziness and cognitive complaints¹⁸.

Smokers were much more likely to have peripheral neuropathic symptoms than non-smokers¹⁹. Microvascular compromise, oxidative stress and impaired nerve oxygenation may cause numbness and tingling²⁰. Cigarette smoke contains CO, which decreases the ability to transport oxygen, and nicotine, which leads to vasoconstriction and sympathetic stimulation¹. These effects may lead to diminished blood flow to the peripheral nerves and sensory symptoms². Detailed nerve conduction studies were not carried out in this study, but there seems to be an increase in neuropathic complaints among smokers, so further neurological evaluation is recommended for chronic smokers³.

Smokers were also more likely to have dermatological manifestations⁴. Smokers had a highly significant increase in premature facial wrinkling, dry skin and delayed wound healing⁵. These changes have been attributed to decreased dermal blood flow, decreased delivery of oxygen, collagen degradation, and oxidative damage⁶. Collagen and elastin fibers in the skin are affected when exposed to cigarette smoke leading to a loss of skin elasticity and early signs of wrinkles⁷. The skin findings in this study are important because they are visible skin markers of chronic injuries that have occurred from tobacco use⁸.

Smokers have been known to have delayed wound healing which is a clinically important finding⁹. Smoking decreases the delivery of oxygen to tissues, slows down the immune system, slows down the activity of the fibroblasts, and slows down the production of collagen¹⁰. These mechanisms prevent or slow down the repair process of the tissue and may predispose to wound infections and to poor surgical results¹¹. Smoking should therefore be taken into consideration prior to any surgical interventions and patients should be advised to quit smoking to aid healing and minimise complications¹².

The present study also revealed that there was a significant association between smoking exposure and multisystem disease burden¹³. Respiratory involvement and three system involvement were higher in smokers with >10 pack years than in smokers with 10 pack-years or less¹⁴. This indicates that there is a dose-response relationship between cumulative exposure to cigarettes and clinical morbidity¹⁵. The recording of pack-year history, therefore, is important as it gives a better estimation of the tobacco burden than smoking status alone¹⁶.

There are important clinical implications of the findings of this study¹⁷. Smoking history is short and non-respiratory effects of smoking can be missed in the routine hospital practice¹⁸. This study indicates, however, that smokers may exhibit symptoms related to the lungs, nervous system and skin¹⁹. A comprehensive clinical approach is needed when evaluating smokers²⁰. Ask physicians to ask, be proactive, inquire about respiratory issues, headache, sleep disturbances, sensory issues, skin changes, and wound healing¹. Understanding the signs and symptoms early in the course of disease can help minimize progression and counsel the patient².

Smoking prevention and therapy through smoking cessation remains the most important intervention³. Each hospital visit is an opportunity to educate smokers on the harmful effects of tobacco⁴. Counselling, behavioural support, nicotine replacement and follow up cessation programmes can reduce morbidity related to smoking for a brief period of time⁵. Many of the diseases associated with smoking are slowly developing, so early quitting can still help decrease respiratory symptoms, improve vascular function, help keep skin healthy, and lower long-term systemic issues⁶.

This study was limited in some aspects⁷. First, it was done in one center, so the results may not apply to other centers⁸. Second, the cross sectional design can only show correlation and not cause and effect⁹. Third, smoking exposure was self-reported and could be subject to recall bias or to underreporting¹⁰. Fourth, objective investigations like Spirometry, Nerve conduction studies and

dermatological scoring system were not done in all the participants¹¹. Higher multicenter studies with more patients and objective diagnostic methods are suggested to validate these results¹².

Given these limitations, the study offers hospital-based valuable information on the multisystem effects of cigarette smoking¹³. Results indicate that there are significantly more respiratory, neurological and dermatological disorders among cigarette smokers¹⁴. The fact that there is dose-related multisystem involvement adds to the importance of detailed smoking assessment and early preventative intervention¹⁵.

CONCLUSION

Among adult patients, cigarette smoking had significant association with respiratory, neurological and dermatological disorders in the patients presented to Multan Medical and Dental College Multan. Smokers were more likely to have chronic cough, sputum production, wheezing, dyspnea on exertion, chronic bronchitis, headache, sleep disturbance, dizziness, memory complaints, numbness, tingling, delayed wound healing, and premature facial wrinkling than non-smokers. The most common complaints were respiratory, neurological and dermatological. Multisystem disease burden was higher with increased cumulative exposure among smokers, especially ≥ 10 pack-years. The results highlight the importance of regular smoking history taking, early identification of smoking related problems and effective smoking cessation advice in hospital practice.

Authors' Contributions

SSK contributed to the study concept, clinical supervision, and manuscript review.

KS contributed to respiratory assessment, data interpretation, and manuscript revision.

UUA contributed to neurological assessment, data collection, and clinical evaluation.

NF contributed to dermatological assessment, data interpretation, and manuscript review.

ZHQ contributed to study design, data analysis, manuscript drafting, and correspondence.

BF contributed to biochemical and academic review, data interpretation, and final manuscript approval. All authors reviewed and approved the final manuscript.

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