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SCIENTIFIC ARTICLE

Surgery is unlikely to be enough for a patient to stop smoking 24 h prior to hospital admission

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KEYWORDS
Smoking;
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Abstract
Introduction: The need for surgery can be a decisive factor for long-term smoking cessation. On the other hand, situations that precipitate stress could precipitate smoking relapse. The authors decided to study the impact of a surgery on the patient's effort to cease smoking for, at least, 24 h before hospital admission and possible relapse on the last 24 h before hospital admission for ex-smokers.
Methods: Smoker, ex-smokers and non-smokers adults, either from pre-anesthetic clinic or recently hospital admitted for scheduled elective surgeries that were, at most, 6 h inside the hospital buildings were included in the study. The patients answered a questionnaire at the ward or at the entrance of the operating room (Admitted group) or at the beginning of the first pre-anesthetic consultation (Clinic group) and performed CO measurements.
Results: 241 patients were included, being 52 ex-smokers and 109 never smokers and 80 non-smokers. Smokers had higher levels of expired carbon monoxide than non-smokers and ex-smokers (9.97 ± 6.50 vs. 2.26 ± 1.65 vs. 2.98 ± 2.69; $p = 0.02$). Among the smokers, the Clinic group had CO levels not statistically different of those on the Admitted group (10.93 ± 7.5 vs. 8.65 ± 4.56; $p = 0.21$). The ex-smokers presented with no significant differences for the carbon monoxide levels between the Clinic and Admitted groups (2.9 ± 2.3 vs. 2.82 ± 2.15; $p = 0.45$).
Conclusion: A medical condition, such as a surgery, without proper assistance is unlikely to be enough for a patient to stop smoking for, at least, 24 h prior to admission. The proximity of a surgery was not associated with smoking relapse 24 h before the procedure.

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PALAVRAS-CHAVE
Fumar;
Monóxido de carbono;
Cirurgia eletiva

É improvável que a cirurgia seja suficiente para que o paciente pare de fumar 24 horas antes da internação hospitalar

Resumo
Introdução: A necessidade de cirurgia pode ser um fator decisivo para a cessação do tabagismo a longo prazo. Por outro lado, situações que precipitam o estresse podem precipitar a recaída do tabagismo. Decidimos avaliar o impacto de uma cirurgia no esforço do paciente para deixar de fumar durante pelo menos 24 horas antes da internação hospitalar e a possível recaída nas últimas 24 horas anteriores à internação em ex-fumantes.
Métodos: : Fumantes, ex-fumantes e não fumantes adultos, quer de clínica pré-anestésica ou recentemente internados para cirurgias eletivas programadas que ficariam, no máximo, seis horas dentro das unidades hospitalares, foram incluídos no estudo. Os pacientes responderam um questionário na enfermaria ou na entrada da sala de operação (Grupo Internação) ou no início da primeira consulta pré-anestesia (Grupo Clínico) e fizeram mensurações dos níveis de CO.
Resultados: No total, 241 pacientes foram incluídos: 52 ex-fumantes, 109 que nunca fumaram e 80 não fumantes. Os fumantes apresentaram níveis mais elevados de monóxido de carbono expirado que os não fumantes e ex-fumantes ($9,97 \pm 6,50$ *vs.* $2,26 \pm 1,65$ *vs.* $2,98 \pm 2,69$; $p = 0,02$). Entre os fumantes, o Grupo Clínico apresentou níveis de CO não estatisticamente diferentes daqueles do Grupo Internação ($10,93 \pm 7,5$ *vs.* $8,65 \pm 4,56$; $p = 0,21$). Os ex-fumantes não apresentaram diferenças significativas entre os grupos Clínico e Internação para os níveis de monóxido de carbono ($2,9 \pm 2,3$ *vs.* $2,82 \pm 2,15$; $p = 0,45$).
Conclusão: É improvável que uma condição médica, como uma cirurgia, sem assistência adequada seja suficiente para que um paciente pare de fumar, pelo menos, 24 horas antes da internação. A proximidade de uma cirurgia não foi associada à recaída do tabagismo nas 24 horas anteriores ao procedimento.

Introduction

In the surgical population, smoking habit can cause serious complications on the perioperative period. This habit cessation in the preoperative period could minimize possible cardiovascular, pulmonary, cicatrization and bone healing effects due to tobacco, decreasing the incidence of intraoperative and postoperative complications.[1,2] Based on this, there is a growing interest in encouraging the patients undergoing elective surgery to stop smoking in the preoperative period.[3]

Health conditions in tobacco users, such as the need for surgery, are recognized as decisive factors for long-term smoking cessation.[4] Undergoing surgery was associated with an increased likelihood of smoking cessation, especially when major procedures were performed. However, little is known about patients' own effort to quit smoking when a health condition, such as surgery, approaches.

Traditionally, the minimum duration necessary to define clinically a patient as an ex-smoker is complete abstinence from smoking over at least 24 h.[5] Nevertheless, patients who present to surgery with more than 24 h of habit's cessation may declare themselves as ex-smokers. However, patients who cannot remain abstinent for at least 24 h most likely will not report the effort as a true quit attempt.[6]

On the other hand, situations that precipitate stress, such as work, finances and relationships, and mood-related situations (i.e., anxiety), could precipitate smoking relapse.[7,8] Health conditions, as the need for surgery, are known to cause great anxiety and stress on the patient and could also be a potential factor for smoking relapse.[9]

Based on these facts, the authors aimed to compare the CO levels, which are a sensible marker for smoking in the last 24 h, of patients who were admitted to the hospital for an elective surgery with those coming for an outpatient consultation.[10] The hypothesis was that an elective hospital admission for surgery would make the patient try to cease smoking for, at least, 24 h before hospital admission. However, an operation could also be a cause for smoking relapse, since it causes stress and anxiety.[9] Thus, the authors also investigated the CO levels of ex-smokers in order to detect possible relapse.

Methods

The study was approved by the Ethics Committee for Analysis of Research Projects of the Hospital das Clínicas, Faculty of Medicine, University of São Paulo (CAPPesq Project n° 0824/10) and subjects signed the informed consent form.

The recruited patients were adults (>18 years-old), either from pre-anesthetic clinic or recently admitted for scheduled elective surgeries. The patients were recruited between August 2012 and February 2013. The smoking status was defined by patient's own statement: ''smoker'', ''ex-smoker ''or'' never smoker''. For the term ''ex-smoker'',

the participant had to be free from smoking for at least three months.

The hospital admitted patients were, at most, 6 h inside hospital buildings before study inclusion. Patients that were hospital admitted for more than 6 h were excluded from the study. After signing the written informed consent, the included patients performed the CO measurements at the bed or at the entrance of the operating room (Admitted group) or at the beginning of the first pre-anesthetic consultation (Clinic group). As part of the routine of pre-operative consultation, every smoker patient had brief advice about smoking cessation.

The patients answered a specific questionnaire, contemplating age, gender, education level, marital status, occupation status (employed, unemployed or retired), body mass index, comorbidities, surgical history, type of surgery to be performed, number of cigarettes packages per year, drinking and smoking habits.

Before and after answering the questionnaire, the patients were asked to take a deep breath and exhale into an expired carbon monoxide (CO) analyzer (electronic monoximeter ''piCO + Smokerlyzer'' – Bedfont Scientific Ltd., from Harrietsham, England, calibrated). The average value between those two measurements was considered for analysis. ''Monoximetria risk'' was defined as exhaled CO above 6 ppm.

Statistical analysis

Convenient sample was used, including patients that were inside hospital building for, at most, 6 h from August 2012 to February 2013.

Data were processed and analyzed using specific software for data analysis (IBM SPSS Statistics, version 20). Statistical significance was considered for p-values lower or equal to 0.05. The variables were tested for normal distribution using Shapiro–Wilk test. To compare the levels of CO, Student's t-test was used. When two or more groups were compared, ANOVA one-way was used. When normality was not achieved, Mann Whitney's test was used. For comparison between proportions, chi-square test was used if cell values were greater than 5. If individual cell values were lower than 5, Fisher's exact test was used.

Results

Epidemiology

The study recruited 241 patients, 146 women (60.6%) and 95 men (39.4%). Fifty-two reported being current smokers (21.6%), 80 as ex-smokers (33.2%) and 109 denied smoking (45.2%) (Table 1).

Fifty patients (20.7%) had average CO levels classified as ''at monoximetria risk'' (expired CO > 6 ppm). Among these, 41 (82%) said they were smokers, 7 (14%) were ex-smokers, and 2 (4%) denied smoking (Table 2). Patients that declared themselves as smokers had statically higher levels of expired CO than non-smokers and ex-smokers (9.97 ± 6.50 vs. 2.26 ± 1.65 vs. 2.98 ± 2.69; $p = 0.02$).

The medical specialty with the highest prevalence of smoking was ophthalmology and urology (33.33%) and the lower prevalence of never smokers was general surgery (26.47%).

In the opinion survey about which health professional would be better to assist a patient candidate for elective surgery to quit smoking, 13 people (5.4%) reported being a nurse, 53 (22%) chose a doctor, 55 (22.8%) chose a psychologist and 120 (49.8%) stated that none of them would be effective in the task mentioned.

Smokers

Regarding the 52 smoking patients, there were 30 patients that had CO levels checked on the clinic consultation (Clinic Group) and 22 patients that were evaluated during hospital admittance (Admitted Group). Of these patients, there were 13 patients that had CO levels recorded at the operating room entrance and 9 patients that had the evaluation performed at patient's bed.

Patients in the Clinic group had CO levels not statistically different when compared to those on the Admitted group (10.93 ± 7.5 vs. 8.65 ± 4.56; $p = 0.21$). When comparing those admitted at the operating room entrance with those recently admitted to the hospital, no significant differences were found (9.08 ± 5.39 vs. 8.11 ± 3.91; $p = 0.83$). No significant differences were found between the proportions of patients that were at monoximetria risk on the admitted (80%) and on the clinic group (77%, $p = 0.53$).

Ex-smokers

Eighty patients declared themselves as ex-smokers. There were 51 patients on the Clinic group and 29 patients on the Admitted group. The median (25- and 75-percentiles) for the time free from smoking was 22 (10–60), being 19 (10–36) for the Admitted group and 30 (12–168) for the Clinic group.

No significant differences were found for the CO levels between the Clinic and Admitted groups (2.9 ± 2.3 vs. 2.82 ± 2.15; $p = 0.45$). There was 1 patient with monoximetria risk in the Admitted group and 6 patients on the Clinic group, but no significant difference was found between the groups ($p = 0.41$). When comparing the CO levels of patients that declared themselves ex-smokers with non-smokers, there was a tendency for ex-smokers to have higher levels of CO, but it was not of statistical significance (2.98 ± 2.69 vs. 2.25 ± 1.69; $p = 0.09$).

There was a higher proportion of patients at monoximetria risk on the ex-smokers (13.8%) than on the non smokers group (5.8%; $p = 0.05$). When compared the number of smokers at home, ex-smokers and non-smokers had similar values (median 0 IQ25-75 0–1 vs. 0 IQ25-75 0–1; $p = 0.64$).

Discussion

The main finding of this study was that, independently if the patient was admitted for a medical condition or just coming to an outpatient consultation, the levels of CO did not differ. Thus, we can infer that a medical condition, such as surgery, without proper assistance is unlikely to be enough for a patient to stop smoking for, at least, 24 h prior to the procedure. For these reasons, there is a growing interest

Table 1 Data of the study population.

	Demographics								
	Non-smoker (109)			Ex-smoker (80)			Smokers (52)		
	Total	Admitted (72)	Clinic (37)	Total	Admitted (51)	Clinic (29)	Total	Admitted	Clinic
Gender									
Male	31 (28.4%)	23 (31.9%)	8 (21.6%)	40 (50%)	23 (45.1%)	17 (58.6%)	24 (46.2%)	15 (50%)	9 (42.9%)
Female	78 (71.6%)	49 (68.1%)	29 (78.4%)	40 (50%)	28 (54.9%)	12 (41.4%)	28 (53.9%)	15(50%)	13 (61.9%)
Age[a]	50.6 ± 17.8	51.9 ± 18.2	47.9 ± 16.9	59.5 ± 13.4	59.3 ± 13.7	59.8 ± 13.3	53.4 ± 12.5	52.9 ± 11.9	52.2 ± 15.0
BMI[a]	27.8 ± 5.53	27.9 ± 5.5	27.6 ± 5.6	28.6 ± 6.4	29.1 ± 7.2	27.8 ± 4.7	26.1 ± 5.9	26.6 ± 5.4	25.5 ± 6.6
Marital status									
Married	41 (37.6%)	25 (34.7%)	16 (43.2%)	35 (43.8%)	20 (39.2%)	15 (51.7%)	28 (53.8%)	18 (60%)	10 (45.5%)
Divorced	15 (13.7%)	12 (16.7%)	3 (8.1%)	18 (22.5%)	11 (21.6%)	7 (24.1%)	3 (5.7%)	2 (6.7%)	1 (4.5%)
Single	32 (29.3%)	22 (30.6%)	10 (27.0)	18 (22.5%)	14 (27.5%)	4 (13.8%)	15 (29.1%)	6 (20%)	9 (40.9%)
Widower	21 (19.4%)	13 (18.1%)	8 (21.6)	9 (11.2%)	6 (11.8%)	3 (10.3%)	6 (11.4%)	4 (13.3%)	2 (9.1%)
Level of education									
Illiterate	11 (10.1%)	8 (11.6%)	3 (8.1%)	5 (6.3%)	3 (5.9%)	2 (6.9)	5 (9.6%)	0 (0.0%)	5 (22.7%)
Primary	6 (57.8%)	44 (63.8%)	19 (51.4%)	47 (58.8%)	33 (64.7%)	14 (48.3%)	22 (42.3%)	13 (43.3%)	9 (40.9%)
Secondary	28 (25.7%)	15 (21.7%)	13 (35.1%)	25 (31.3%)	12 (23.5%)	13 (44.8%)	20 (38.5%)	15 (50.0%)	5 (22.7%)
College/University Level	7 (6.5%)	5 (7.2%)	2 (5.4%)	3 (3.4%)	3 (5.9%)	0 (0.0%)	5 (9.6%)	2 (6.7%)	3 (13.6%)
Occupation status									
Employed	57 (52.29%)	35 (48.6%)	22 (59.5%)	25 (31.3%)	16 (31.4%)	9 (31.0%)	27 (51.92%)	18 (60.0%)	9 (40.9%)
Unemployed	6 (5.50%)	5 (6.9%)	1 (2.7%)	5 (5.3%)	0 (0.0%)	5 (17.2%)	5 (9.61%)	2 (6.7%)	3 (13.6%)
Retired	46 (42.21%)	32 (44.4%)	14 (37.8%)	50 (62.5%)	35 (68.6%)	15 (51.7%)	20 (38.46%)	10 (33.3%)	10 (45.5%)
Commorbity									
Yes	45 (41.2%)	29 (40.3%)	16 (43.2%)	38 (47.5%)	19 (37.3%)	19 (65.5%)	31 (59.6%)	18 (60.0%)	13 (59.1%)
No	64 (58.8%)	43 (59.7%)	21 (56.8%)	42 (52.5%)	32 (62.7%)	10 (34.5%)	21 (40.4%)	12 (40.0%)	9 (40.9%)
Drug usage									
Yes	4 (3.7%)	3 (4.2%)	1 (2.7%)	4 (5%)	2 (3.9%)	2 (6.9%)	3 (5.8%)	0 (0.0%)	3 (13.6%)
No	105 (96.3%)	69 (95.8%)	36 (97.3%)	76 (95%)	49 (96.1%)	27 (93.1%)	49 (94.2%)	30 (100%)	19 (86.4%)
Alcohol usage									
Yes	4 (3.7%)	3 (4.2%)	1 (2.7%)	20 (25%)	13 (25.5%)	7 (24.1%)	16 (30.8%)	9 (30.0%)	7 (31.8%)
No	105 (96.3%)	69 (95.8%)	36 (97.3%)	60 (75%)	38 (74.5%)	22 (75.9%)	36 (69.2%)	21 (70.0%)	15 (68.2%)
Packs-year[b]	0	0	0	20.5 (10.60)	20.0 (9.5 ± 45.5)	15 (29 ± 64)	30 (8.75 ± 42.75)	30 (9.25 ± 40.75)	23 (8.5 ± 43.8)
CO levels[a]	2.26 ± 1.65	2.29 ± 1.8	2.15 ± 1.25	2.98 ± 2.69	3.45 ± 3.6	2.7 ± 2.2	9.97 ± 6.50	10.9 ± 7.6	8.7 ± 4.6

Table 1 (*Continued*)

Demographics									
	Non-smoker (109)			Ex-smoker (80)			Smokers (52)		
	Total	Admitted (72)	Clinic (37)	Total	Admitted (51)	Clinic (29)	Total	Admitted	Clinic
Specialty									
Orthopedics	11 (10.1%)	11 (15.3%)	0 (0.0%)	4 (5.0%)	0 (0.0%)	4 (13.8%)	6 (11.5%)	0 (0.0%)	6 (27.3%)
General surgery	18 (16.5%)	11 (15.3%)	7 (18.9%)	31 (38.8%)	22 (43.1%)	9 (31.0%)	19 (36.5%)	13 (43.3%)	6 (27.3%)
Ear, nose, throat	14 (12.8%)	10 (13.9%)	4 (10.8%)	14 (17.5%)	12 (23.5%)	2 (6.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Ophthalmology	6 (5.5%)	5 (6.9%)	1 (2.7%)	6 (7.5%)	3 (5.9%)	3 (10.3%)	6 (11.5%)	3 (10.0%)	3 (13.6%)
Cardiology	3 (2.8%)	2 (1.4%)	1 (2.7%)	2 (2.5%)	2 (3.9%)	0 (0.0%)	1 (1.9%)	1 (3.3%)	0 (0.0%)
Head and neck surgery	23 (21.1%)	12 (16.7%)	11 (29.7%)	7 (8.8%)	4 (7.8%)	3 (10.3%)	6 (11.5%)	5 (16.7%)	1 (4.5%)
Urology	4 (3.7%)	2 (2.8%)	2 (5.4%)	4 (5.0%)	2 (3.9%)	2 (6.9%)	4 (7.7%)	2 (6.7%)	2 (9.1%)
Gynecology	17 (15.6%)	13 (18.1%)	4 (10.8%)	5 (6.3%)	3 (5.9%)	2 (6.9%)	7 (13.5%)	3 (10.0%)	4 (18.2%)
Dermatology	3 (2.8%)	1 (1.4%)	2 (5.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.9%)	1 (3.3%)	0 (0.0%)
Gastric surgery	6 (5.5%)	3 (4.2%)	3 (8.1%)	5 (6.3%)	3 (5.9%)	2 (6.9%)	2 (3.8%)	2 (6.7%)	0 (0.0%)
Plastic surgery	4 (3.7%)	2 (2.8%)	2 (5.4%)	2 (2.5%)	0 (0.0%)	2 (6.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

[a] Mean ± SD.
[b] Median (25, 75 percentiles).

Table 2 Average expired Carbon Monoxide according to smoking status.

Current smoking habit	Average of Carbon Monoxide expired before and after the interview		
	Acceptable (<6 ppm)	At risk (≥6 ppm)	Mean values
Never-smoker (45.2%)	107 (98.2%)	2 (1.8%)	2.26 ± 1.65
Ex-smokers (33.2%)	73 (91.2%)	7 (8.75%)	2.98 ± 2.69
Smokers (21.6%)	11 (21.2%)	41 (78.8%)	9.97 ± 6.50[a]
Total	191 (79.3%)	50 (20.7%)	

Values presented as number (percentage) and mean ± standard deviation.
[a] $p = 0.02$ vs. other groups.

in encouraging the candidates for elective surgery to stop smoking in the preoperative period.[3] Another finding of this study was a higher proportion of patients at monoximetria risk on the ex-smokers than on non-smokers group.

Many health conditions are teachable moments for stimulating smoking cessation. Teachable moments for smoking cessation includes three constructs that are analyzed to verify if this moment is significant enough: the extent to which the event increases perceptions of personal risk; promotes strong affective or emotional responses and impacts on self-concept.[11] Based on these facts, the indication for surgery can be considered a teachable moment, since it fulfills all of the above criteria. This means that if proper counseling is performed throughout the perioperative period, a higher incidence of long period smoking cessation can be achieved.

Regarding the smokers, we observed no significant differences on the proportions of patients with monoximetria risk and CO levels between outpatient and hospital-admitted patients. This finding showed that outpatient and hospital-admitted patients had similar proportions of smokers in the last 24 h. It could be inferred that a medical condition, such as a hospital-admission for a surgery, was not, by itself, sufficient to promote a 24 h tobacco free among the surgical patients. At our institution, we routinely encourage every surgical patient to quit smoking during the perioperative consultations, but no referral to formal program of smoking cessation is done. Although it is expected a spontaneous quitting rate of 2–3% among tobacco users, it is known that a brief advice intervention during medical consultation can increase the quitting rates by a further 1–3%.[12] However, for our studied population, brief advice during pre-operative consultation together with the presence of a health condition, such as a surgery, without proper assistance was likely not enough for a patient to cease smoking. If proper management of the surgical smoking patient is not adequately pursued, this teachable moment could be wasted.

Regarding the assistance for smoking cessation, the results of the opinion poll pointed to the lack of proper management by the health professional, since about half (49.8%) of the public surveyed considered that none of the health professionals mentioned were adequate to assist a patient in the preoperative smoking cessation. This emphasizes that further training in how to handle the smoker is necessary. A meta-analysis by Cochrane showed that healthcare professionals who received training were more likely to perform tasks of smoking cessation, like setting a quit date, making follow-up appointments and provision of self-help materials.[13] This study also concludes that by training health professional to provide interventions to cease smoking habits had a measurable effect on the prevalence of smoking. Thus, we can infer that if proper assistance with trained professional is not available, just a health condition is not enough for a patient to quit smoking.

Another finding of this study was a higher proportion of patients at monoximetria risk in the ex-smokers groups than on non-smokers. We expected similar levels of CO between patients that were ex-smokers and non-smokers, since the number of smokers they lived with were not statistically different. This finding might suggest that either patient hide their true smoking status from the health professional or a relapse occurs. Since no statistical differences were found between patients that were on an outpatient basis and those hospital admitted, we could infer that more likely the patients gives wrong information. Shipton et al. also verified this finding where the authors found that self reporting in pregnant smokers significantly underestimates the number of pregnant smokers in Scotland.[14] This was also true among a Brazilian population, where 38% of the patients with asthma or COPD had disagreement between the self-reported smoking status and those determined on urinary cotinine concentration.[15]

Obviously, this study had many limitations. The first limitation was that by performing CO measurements during pre-anesthetic consultation, the patient already had been told the need for surgery. Thus, the effect of a medical health condition could already had done its effect in tobacco cessation. We tried to avoid this by defining ex-smokers as not smoking for, at least, the past three months. Another limitation was that CO is produced endogenously as well as absorbed through the lungs. Since most smokers, ex-smokers and non-smokers are probably exposed to significant pollution from burnt fossil fuels, this could also raise expired air CO, confusing whether the patient stopped smoking or was just too exposed to CO. The CO measurement could also be elevated based on patient's professional exposure, for example, working with combustion engines, were CO could be elevated, but not due to smoking. Another limitation regarding the CO levels was that it evaluate if the patient reduced the amount of tobacco used before the surgery, since the CO levels can only consider the patients as smokers or non-smokers and only one measurement was performed. Since CO levels can only evaluate the last 24 h of smoking, we could have lost smoking cessation of patients that could have stopped the whole pre-operatory period, but decide

to smoke just before hospital admission.[16] The sample size was another limitation of the study, since it was based on convenience sampling and not all patients of the institution were tested. Lastly, by performing a cross-sectional study, we could not clearly draw conclusions about cause and effect.

In conclusion, smoking counseling with professional assistance should be provided for all smoking surgical patient, since patient's own willingness associated with a brief medical advice and a health condition might not be enough for pre-operatory smoking cessation. Further studies are necessary in order to better elucidate this hypothesis, since this study had limitations.

Conflicts of interest

The authors declare no conflicts of interest.

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