Medical Journal of the
Islamic Republic of Iran

Volume 17
Number 3
Fall 1382
November 2003

DOES CIGARETTE SMOKING AFFECT MUSCLE FLAP SURVIVAL? AN 8 YEAR EXPERIENCE OVER 261 CONSECUTIVE CASES IN SOUTHERN IRAN

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ABSTRACT

Smoking has been shown to be a complicating factor in normal wound healing. Both nicotine and carbon monoxide adversely affect multiple stages of the healing process. From 1991 to 1999, 407 muscle flap procedures were performed on 374 patients in a single surgical unit. A retrospective review of 261 patients was completed. Patients were divided into three groups: Group A, no smoking history; group B, smokers for at least one year, and group C, active smokers up to the time of surgery. Patients were excluded who had diabetes, had a recurrent malignancy, or used steroids. A total of 261 patients were included in the study. The age, sex, number of patients and primary operative indications were matched in the 3 groups. Active smokers were shown to have a complication rate significantly higher in the immediate post-operative period compared with non-smokers and smokers who had quit. The most common complications were partial muscle necrosis and partial skin graft loss. This series suggests that active smoking at the time of muscle transposition significantly increases the rate of post-operative complications.

MJIRI, Vol. 17, No. 3, 213-216, 2003.

Keywords: Cigarettes, smoking, muscle flap.

INTRODUCTION

Cigarette smoking has been shown experimentally and clinically to be a complicating factor in normal wound healing. Recent studies have demonstrated that a number of factors are responsible. Although cigarette smoke has been shown to contain more than 3800 compounds,[1] the primary cardiovascular effects are believed to be the result of nicotine, carbon monoxide, nitrous oxide and hydrogen cyanide.[2] Nicotine, by the release of catecholamines, impairs the blood flow, epithelization and inflammatory phase of wound healing in the rabbit model.[3,4] The effect of nicotine and carbon monoxide has also been shown to increase platelet aggregation and adhesiveness significantly.[5,6] In a study of men with diabetes the rate of collagen deposition was dramatically depressed in active smokers.[7-10] Besides, the primary clinical effect of smoking has also been demonstrated in flap survival in face lift patients.[11]

However, the aim of this investigation was to find out the relationship between cigarette smoking and muscle flap survival.

MATERIAL AND METHODS

In the time period from 1991 to 1999, 407 muscle flap procedures were performed in 374 patients in a single surgical unit (Ali-Asghar Hospital). This hospital is a 90-bed university affiliated referral center, covering 5 Southern Iran Provinces and some neighbouring coun-

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tries. From this initial group 3 subgroups were formed along the following criteria: Group A, patients with no smoking history; Group B, smoking history of at least 5 packs/week but who had quit smoking for at least 1 year before surgery; and Group C, active smokers up to the time of surgery.

An attempt was made to exclude those patients with factors known to compromise wound healing or factors associated with post-operative complications. From these initial groups, patients were excluded who had diabetes, had received radiotherapy or chemotherapy, had a recurrent malignancy or were currently taking steroids or had used steroids within the previous year. The most recent 87 consecutive patients in each group were chosen for the study, a total of 261 patients.

Approximately half of the patients in all 3 groups had undergone resection for either cancer or osteomyelitis (Figure 1).

Other underlying causes for which the procedure was performed included soft tissue infections, trauma, breast reconstruction or coverage of an exposed vascular or orthopedic prosthesis. The fewer number of cancer patients in the active smoking group may be attributed to the number of patients who were trauma victims or had osteomyelitis secondary to previous trauma. The mean age in each group was comparable: Group A, 36 years; Group B, 38 years and Group C, 34 years.

All procedures were performed by the author in Ali-Asghar Hospital and consistency of the surgical technique assumed. Consecutive patients were chosen to minimize the effect of operator experience and reduce the bias of patient selection.

All complications were assessed by the same surgeon and the charts of all patients included in the study were reviewed by him. Partial or full muscle necrosis was defined as requiring operative debridement. Partial skin graft loss was judged to be significant when debridement and regrafting were required to achieve wound closure. Wound infections were confirmed by culture of the organism involved. Complication rates of the three groups were compared by chi square (χ^2) test and P value.

RESULTS

Complications for the total group and the individual rates per group are illustrated in Figure 2.

The overall complication rate for the total group of 261 patients was 21 percent. A significant difference was observed in the complication rate in active smokers compared with both the non-smokers ($p<0.005$) and the smokers who had quit ($p<0.002$). Sex had no influential effect. Between groups A and B there was no significant difference.

The most common complication seen was partial muscle necrosis in 16 percent of active smokers. This complication was more than double the incidence seen both in group A and B. However, the rate of complete muscle necrosis was comparable in all three groups. This finding may be attributed to compromise of the vascular pedicle during transposition or as the muscle was inset.

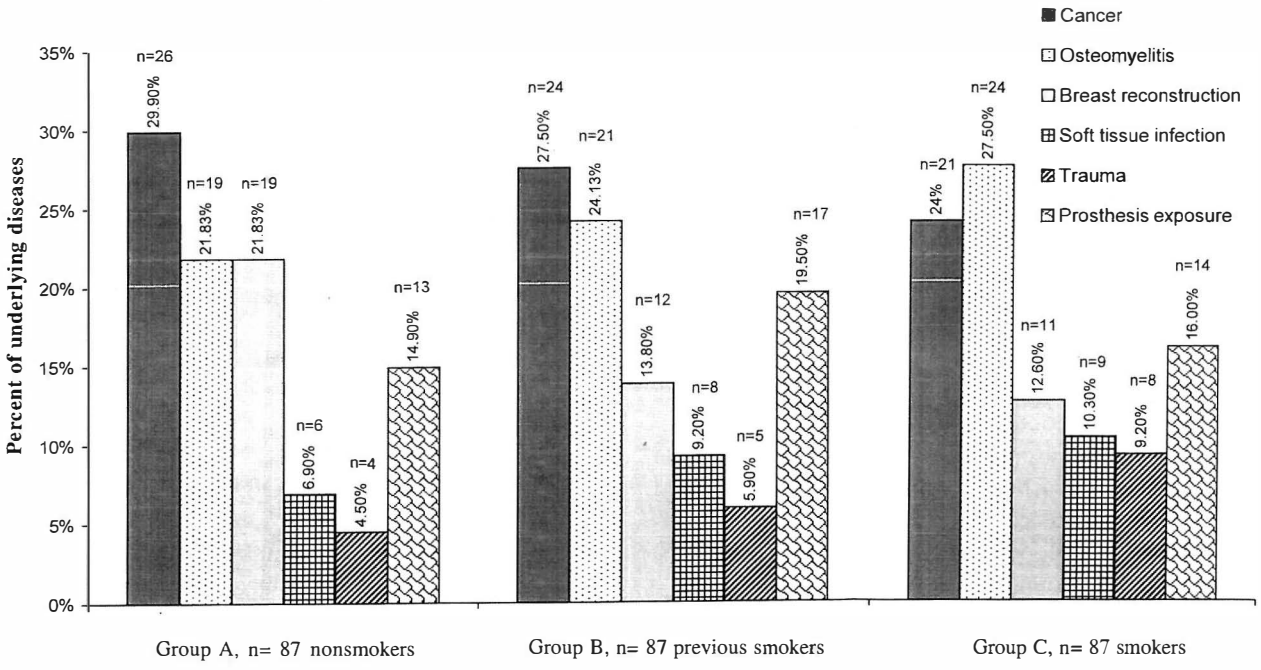

Fig. 1. Primary indication for surgery by group.

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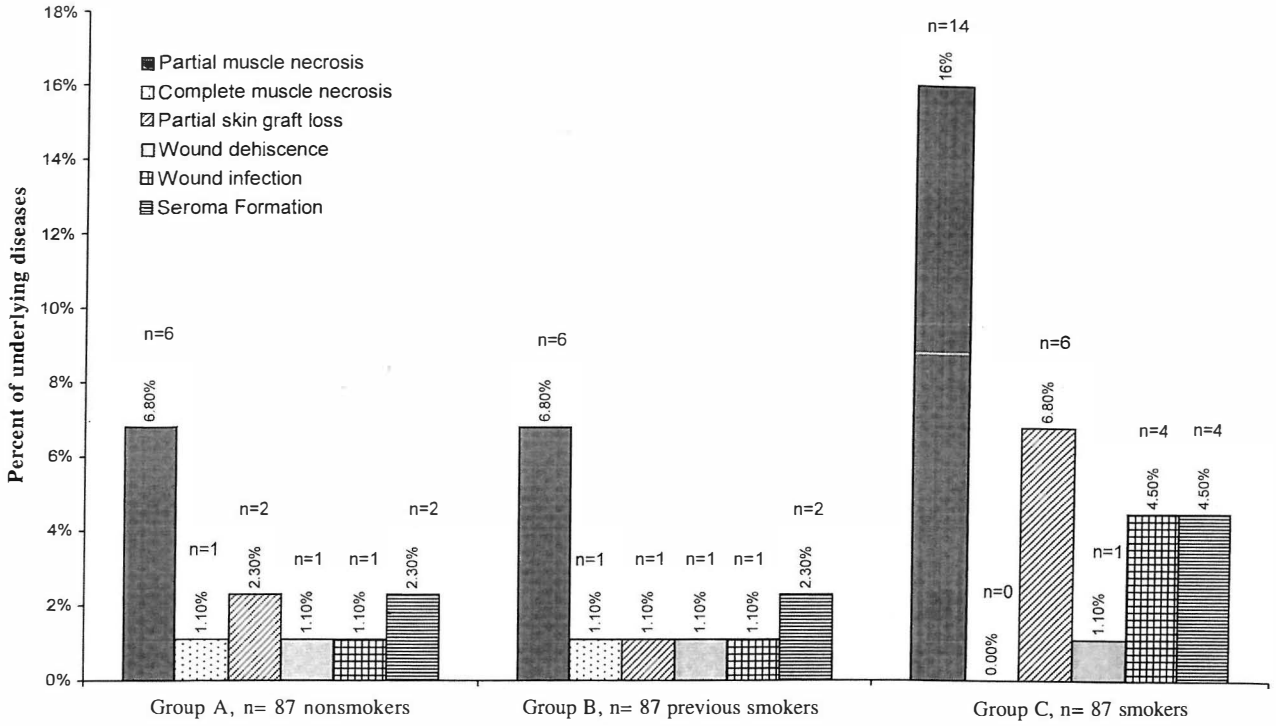

Fig. 2. Complications by group.

Similarly, partial skin graft loss requiring debridement and repeat skin grafting was significantly higher compared to the other two groups. Although the infection rate in the smoking group was also more in group C, the rate of wound dehiscence and seroma formation was comparable in all three groups.

In reviewing the hospital course, the average inpatient stay from the date of their first surgical procedure was 16 days and 19 days respectively, in groups A and B. However, the average hospital course was more than 38 days in group C. This difference is attributed to the higher rate of post-operative complications. Group A and B required an average of 1.6 operations to achieve a closed wound which involved debridement of the wound followed by muscle transposition while group C required an average of 2.4 procedures to achieve wound closure. In other words, in both groups A and B more than half the patients (54 percent and 57 percent, respectively) required a single operation and were discharged. This finding was observed in less than one-fourth (22%) of group C. The smokers required more frequent debridement before wound closure than the other two groups.

DISCUSSION

Active smoking has been recognized as a risk factor by most plastic surgeons. However, many of the effects of smoking, both histologically and clinically, have yet to be defined. Although some studies have implicated nicotine as an accelerating factor in the rate of vessel atherosclerosis,[12] it has not been confirmed by others.[13] It has recently been shown that smoking for 10 minutes causes a reduction in tissue oxygen tension for almost 1 hour. The same study predicts that someone who has smoked one pack a day would develop tissue hypoxia lasting up to 15 to 20 hours each day.[14] Furthermore, it has been demonstrated that nicotine significantly reduces skin blood flow in skin flap surgery.[15]

Therefore, the markedly higher complication rate in group C in our series may well be related to vasoconstriction and diminished blood supply.

Muscle transposition usually involves sacrifice of secondary and collateral perfusion to the muscle, and this diminished vascular supply could result in inadequate perfusion of the muscle which may not be obvious or recognized at the time of the procedure. In smokers this vascular compromise could be further aggravated. Platelet function has been shown experimentally to be highly affected by both nicotine and carbon monoxide. Platelet aggregation is enhanced up to 80 percent 10 minutes following a single cigarette smoked.[16] The combination of these factors puts the transposed muscle at a higher risk for failure. For this reason smoking must be prohibited at least during the perioperative period.

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The results of this study show that non-smokers and previous smokers have no statistical difference in their rate of post-operative complications.

In conclusion, active smokers were confirmed to have a higher complication rate in the immediate post-operative period compared with the other two groups. The most common complications were partial muscle necrosis and partial skin graft loss. Ultimately, this series suggests that active smoking at the time of muscle transposition significantly increases the rate of post-operative complications. For this reason, smokers must be encouraged to stop smoking in the perioperative course.

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