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Original Research Article

Retrospective Study of Effect of Smoking in Tibial Fracture Healing: An Original Study

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Abstract: The objective is to review the systemic impact of smoking on bone healing and the outcome on fracture of the shaft of the tibia in the age group of 18 to 60 years. Does smoking have a strong relation with fracture healing? Screening, data abstraction and quality assessment was conducted by three review authors. Study conducted retrospectively, in Yenepoya Medical College. Data collected from 2005 to 2015, only closed tibia shaft fractures in the age group of 18 to 60 in males. A total of 150 cases were collected according to the inclusion and exclusion criteria. Out of 150 cases 75 each in united and non-united groups. Case control study was done in a retrospective manner. The primary outcome measures were based on clinical and/or radiological indicators of bone healing. Total 150 patients included and examined clinically and radiologically, out of that 75 unions and 75 non union.72.4% in non union groups are smokers and 27.6% in union groups are smokers. P value shows <0.001 and is considered significant. Smoking has a strong effect on bone healing, in terms of delayed union and non union. Before surgery one should properly elicit the history of smoking and should explain the implications of that to the patient.
Keywords: smoking, bone healing, fracture healing

INTRODUCTION

Tibial fractures can now be treated successfully in the majority of patients, yet nonunions of the tibia are not uncommon. They may result in significant morbidity, requires numerous operative procedures to treat and leave the patient with functional deficits. The adverse effects of cigarette smoking and its strong association with cardiovascular and respiratory disease have been well documented. In recent years there has been increasing interest in possible adverse effects of nicotine consumption on soft tissue and bone healing following injury. Experimental studies [1,2] have suggested that nicotine may impair wound healing and bone healing. Adverse effects on bone healing have been noted in patients after spinal fusion, with a higher pseudarthrosis rate in smokers [3,4]. A more recent study of smoking in a small series of closed and grade I open tibial fractures suggested there may be a higher incidence of delayed union in smokers [5]. The rate of non-union in closed tibial fractures is low with modern methods of treatment. In contrast, smoking has an adverse effect on bone and soft tissue healing.The present study assesses the influence of smoking on complication rates following closed tibial fractures. In particular, the study aimed to evaluate whether smokers are at a higher risk of surgical failure, infection and non-union following closed tibial fractures.

MATERIALS AND METHODS

Screening, data abstraction and quality assessment was conducted by three review authors. Study conducted retrospectively, in Yenepoya Medical College. Data collected from 2005 to 2015, only closed tibia shaft fractures in the age group of 18 to 60 in males. A total of 150 cases were collected according to the inclusion and exclusion criteria. Age group less than 18 and more than 60, female patients, compound fractures, fractures with bone loss and polytrauma cases were excluded from the study. Patient who was satisfied the inclusion criteria were evaluated thoroughly preoperatively with routine blood investigation and x rays. Postoperatively all patients treated with same antibiotics and analgesics, dressing was done thrice before suture removal and followed up subsequently. Out of 150 cases 75 each in united and non united groups. Case control study was done in a retrospective

manner. The primary outcome measures were based on clinical and/or radiological indicators of bone healing

In group I, 75 fractures were treated with reamed interlocking nails. In group II, 75 patients were treated with reamed interlocking nails. Soft tissue management was taken. In general, patients were reviewed 2 weeks after discharge and monthly thereafter until fracture union occurred or clinical intervention for non-union was required. Clinical records were reviewed to evaluate the complication rates in the two groups. All the patients were followed up until the fractures healed. There were data regarding the complication rates and fracture union of all the patients. The incidence of early complications including fat embolism and compartment syndrome was recorded and treated accordingly. Fracture union was assessed on the basis of clinical and radiographic criteria. A fracture was deemed to be united when the patient could fully bear weight with no pain at the fracture site and there was radiographic evidence of bridging of three of the four cortices on standard antero-posterior and lateral views (Fig 1). Fractures that required revision surgery to achieve healing were designated as nonunions (Fig 2) and delayed union if union at 6-9 months (Fig 3). Statistical comparison of complication rates and union rates between the two groups was made. The mean consumption in the smokers was 20 cigarettes per day. Both the groups were broadly comparable epidemiologically. The mean age was 41 years to 50 years. The two groups were well matched in terms of fracture causation, fracture morphology classified by the AO system [6]

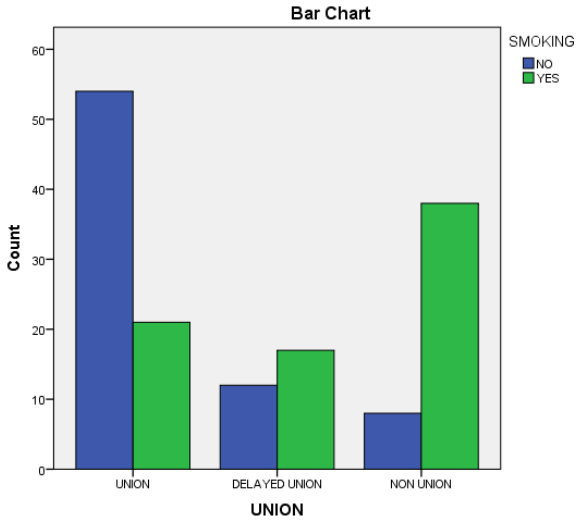
RESULTS

Total 150 patients included and examined clinically and radiologically, out of that 75 unions and 75 non union.72.4% in non union groups are smokers and 27.6% in union groups are smokers. P value shows <0.001 and is considered significant. Charts as follows:

UNION

Crosstab					
			SMOKING		Total
			NO	YES	
UNION	UNION	Count	54	21	75
		% within SMOKING	73.0%	27.6%	50.0%
	DELAYED UNION	Count	12	17	29
		% within SMOKING	16.2%	22.4%	19.3%
	NON UNION	Count	8	38	46
		% within SMOKING	10.8%	50.0%	30.7%
Total		Count	74	76	150
		% within SMOKING	100.0%	100.0%	100.0%

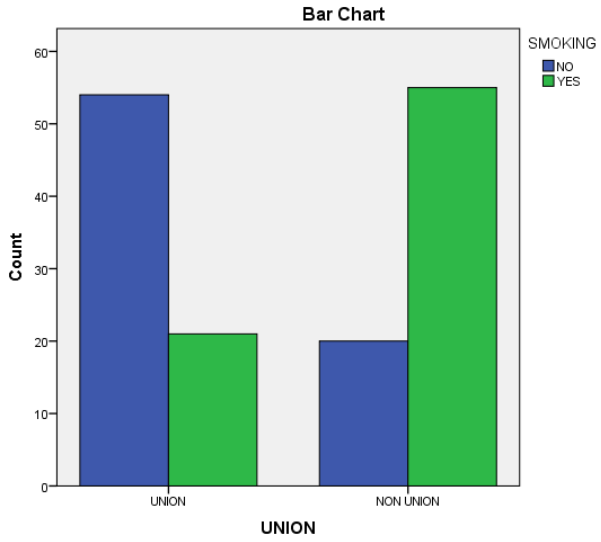
Chi-Square Tests		
	Value	P VALUE(<0.05 is considered significant)
Fisher's Exact Test	36.377	<0.001
N of Valid Cases	150	



UNION

Crosstab					
			SMOKING		Total
			NO	YES	
UNION	UNION	Count	54	21	75
		% within SMOKING	73.0%	27.6%	50.0%
	NON UNION	Count	20	55	75
		% within SMOKING	27.0%	72.4%	50.0%
Total		Count	74	76	150
		% within SMOKING	100.0%	100.0%	100.0%

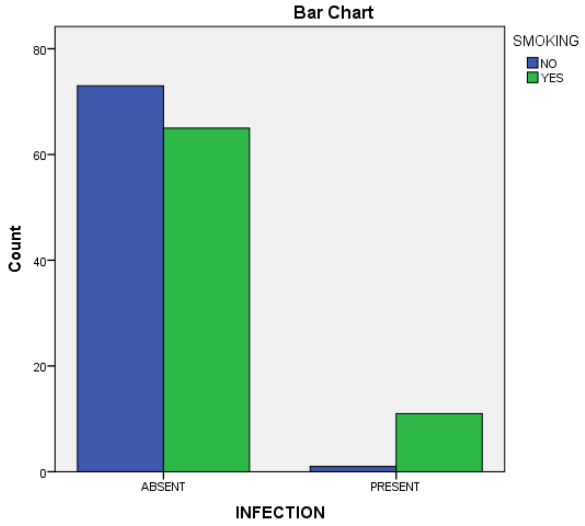
Chi-Square Tests		
	Value	P VALUE(<0.05 is considered significant)
Pearson Chi-Square	30.832	<0.001
N of Valid Cases	150	
b. Computed only for a 2x2 table		

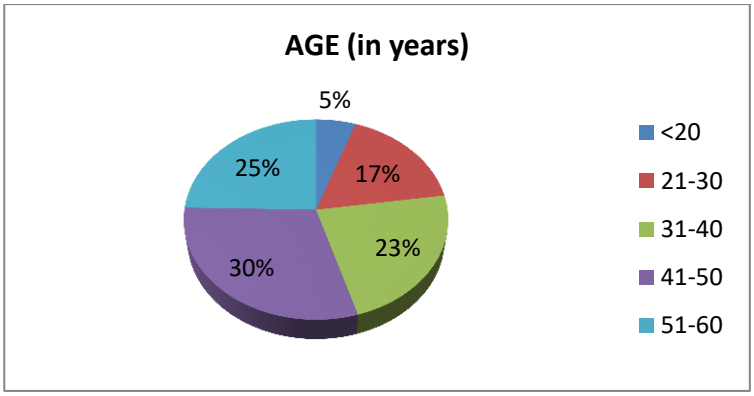


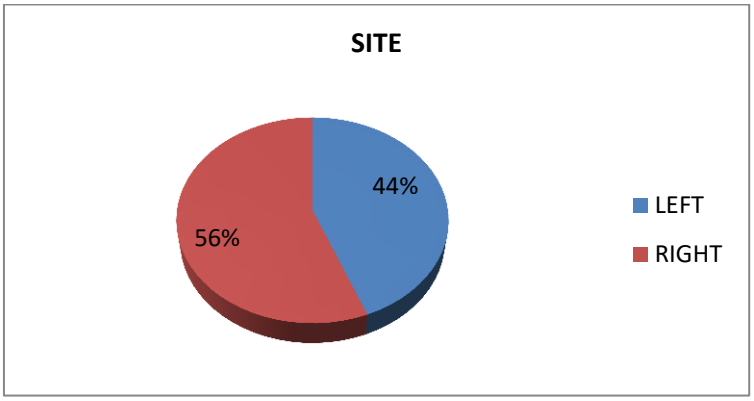
INFECTION

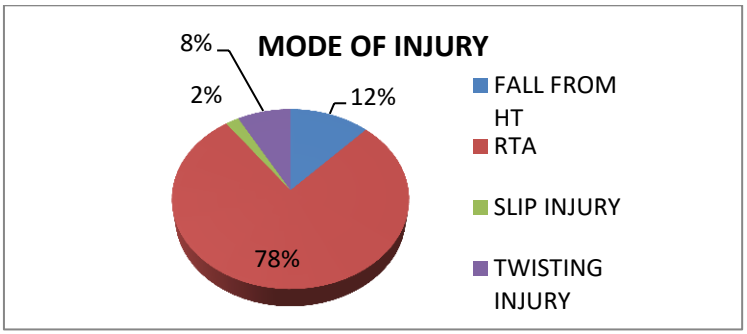
Crosstab					
			SMOKING		Total
			NO	YES	
INFECTION	ABSENT	Count	73	65	138
		% within SMOKING	98.6%	85.5%	92.0%
	PRESENT	Count	1	11	12
		% within SMOKING	1.4%	14.5%	8.0%
Total		Count	74	76	150
		% within SMOKING	100.0%	100.0%	100.0%

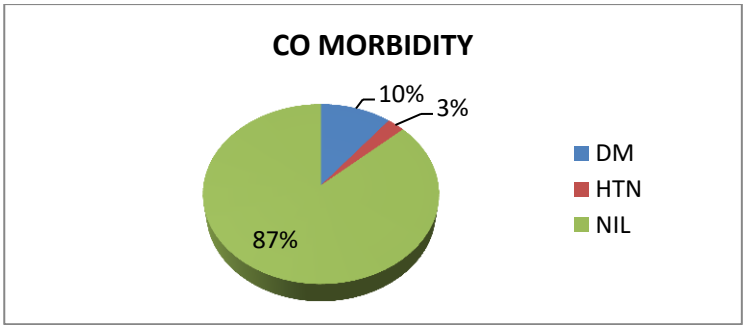
Chi-Square Tests		
	Value	P VALUE(<0.05 is considered significant)
Pearson Chi-Square	8.772	.005
N of Valid Cases	150	

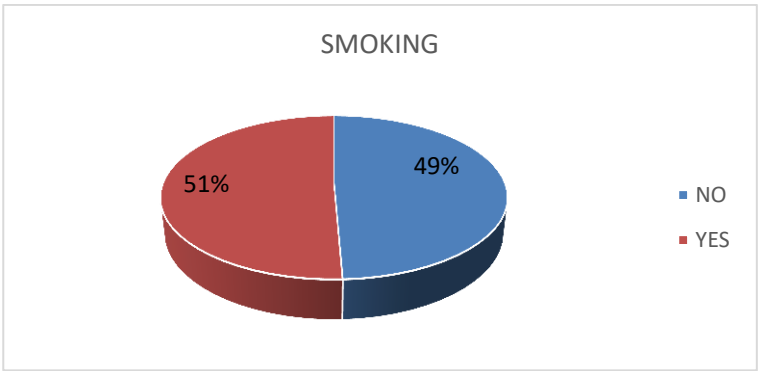


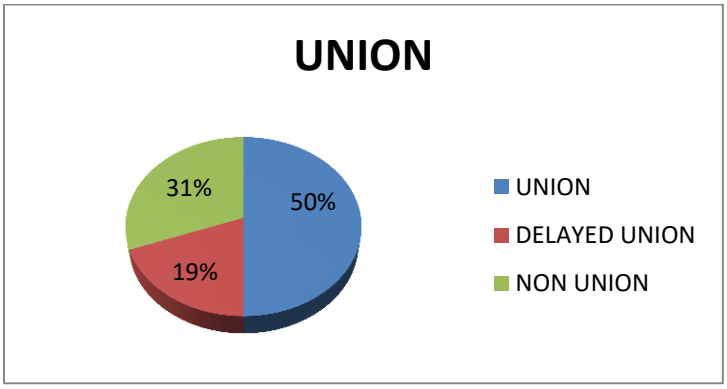


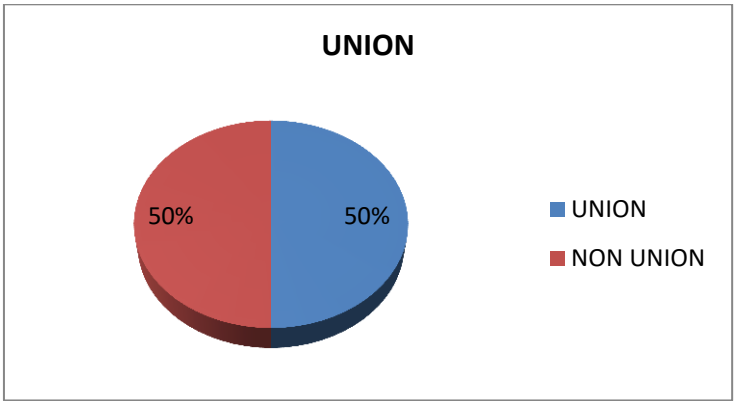

SITE
44%
56%
LEFT
RIGHT


MODE OF INJURY
8%
2%
12%
78%
FALL FROM HT
RTA
SLIP INJURY
TWISTING INJURY


CO MORBIDITY
10%
3%
87%
DM
HTN
NIL


SMOKING
49%
51%
NO
YES


UNION
31%
50%
19%
UNION
DELAYED UNION
NON UNION


UNION
50%
50%
UNION
NON UNION

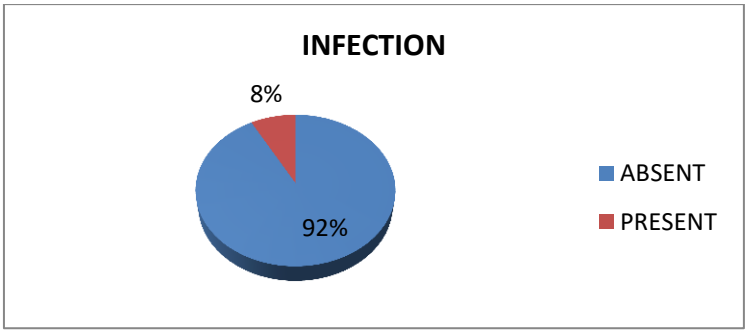

INFECTION
8%
92%
ABSENT
PRESENT

Fig-1: Antero-posterior and lateral views showing union

Fig-2: Antero-posterior and lateral views showing nonunions

Fig-3: Antero-posterior and lateral views showing delayed union

DISCUSSION

Our results show that smoking is deleterious to fracture union. Smokers healed their fractures more slowly and had a higher rate of non-union than non-smokers. As a consequence of the higher rates of non-union there was a correspondingly greater requirement for further surgical intervention in the smoking group. The finding is consistent with the data of the experimental studies that have demonstrated that nicotine impairs blood flow [2,7]. Infective complications were also higher in smokers, although the difference was not as marked. The development of infection following a closed tibial fracture is rare even though the smoking group's shows higher chances compared to non smokers inspite of good fixation. The effect of smoking may, therefore, be relatively influential in the development of infective complications. Other clinical studies of fracture healing in smokers have been infrequent. Kyro et al. [8] studied 135 patients with tibial fractures. The fractures were treated non-operatively and 86% were closed injuries. They found the mean time to union was significantly longer in smokers as compared with non-smokers (166 vs. 134 days). Further surgery to achieve bone union was necessary in 25% of smokers and 17% of non-smokers. Schmitz et al. [5] reported on a series of 123 closed and grade I open fractures. The mean time to union in this study was also significantly longer in smokers (276 days in smokers as compared with 146 days in non-smokers). The possibility that alcohol is a confounding variable has to be considered. Kyro¨ et al [8] showed a slight but statistically non-significant lengthening effect due to the consumption of alcohol on the time to clinical union. They also found a correlation between smoking and alcohol consumption, which is also present in our study. Other authors [5] have found no association between delayed union and alcohol consumption. One drawback of the earlier studies, is that, they didn't isolate the treatment options, but here we treated similar fractures in 150 patients with intramedullary fixation and made the correlation with smoking. The present study evaluates the risk of smoking in patients with closed tibial fractures treated with intramedullary fixation. Our results indicate an unequivocal increase in the rate of non-union in smoking patients which was statistically significant. Other complications were also higher in the smoking group although the effect failed to achieve statistical significance. The findings lend credence to the belief that smoking is associated with increased problems following these fractures. Smoking has been implicated in other fields of orthopaedics with adverse consequences [9]. It has been linked with the development of osteoporosis [10–13] and has also been identified as a risk factor for the development of infection after spinal fusion [14, 15]. Experimental evidence highlighting the adverse effects of smoking has been accumulating. There is ample evidence that smoking has a detrimental effect on the supply of blood to the skin and soft tissues [16–18, 20], a nicotinic effect. Nolan et al. [2] demonstrated that cigarette smoke diminished the blood supply of experimental skin flaps. Lawrence et al. [19] found similar effects in a flap model in the rat. It seems reasonable to assume that this nicotinic effect on the blood flow may be disadvantageous in fracture patients, considering the

critical influence of blood flow on fracture healing. This view is supported by the work carried out by Lau et al. [21] who demonstrated bone atrophy at a fibular fracture site. They proposed the effect of smoking on union is exerted by bone resorption at the fracture site.

CONCLUSIONS

Smoking has a strong effect on bone healing, in terms of delayed union and non union. Before surgery one should properly elicit the history of smoking and should explain the implications of that to the patient.

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