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Research Article

Respiratory Status in People with Spinal Cord Injuries after Discharge

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Abstract

Objective: To evaluate the respiratory status of Spinal Cord Injury (SCI) patients after discharge from the Tertiary hospital.

Setting: Indian Spinal Injuries Centre, Vasant Kunj, New Delhi, India.

Methodology: A cross-sectional survey study was conducted on SCI subjects. All discharged SCI subjects from year 2016 and 2017 who met the inclusion and exclusion criteria were included in this study. The self-administrated questionnaire was circulated among 263 discharged patients. Out of which 131 patients were included in the study and their responses were recorded and data was analysed.

Results: 131 subjects were included in this study and amongst them 73 patients were from year 2016 and 58 patients were from year 2017 with mean age 38.52±13.93 years in 2016 and 41.55±15.42 in 2017. Majority of patients have reported that they did not have dyspnoea and they could cough independently, their cough effort was good because proper chest physiotherapy was done in hospital and effective cough technique were taught to the patient during post discharge.

Conclusion: The study concluded that respiratory status improved post discharge, respiratory rehabilitation plays an important role in maintaining a good respiratory hygiene. Moreover respiratory complications are not the major cause of morbidity and mortality after 1 and 2 year of discharge from ISIC hospital.

***Keywords:** Spinal cord injury (SCI), Respiratory rehabilitation, Cross Sectional Survey Study*

Introduction

Spinal cord injury (SCI) is an insult to the spinal cord resulting in a change either temporary or permanent in its normal motor, sensory or autonomic function.(1) Spinal Cord Injury can manifest itself in the form of multiple acute and chronic complications depending upon level of injury, duration and type of injury which can predispose an SCI individual to viscous cycle of multiple interrelated outcome mainly respiratory consequences which can add disability and can leads to death.(2) (4) Common causes of spinal injuries in India is road traffic accidents and fall from height (3).

Patients are most vulnerable to respiratory illness in the first year after injury but continue to suffer from respiratory complications throughout the life. [7]

The degree of respiratory dysfunction depends on pre-existing pulmonary status, the extent and level of neurological injury, and any associated chest wall or lung injuries as well as on the quality of the management of the physiologically impaired respiratory function.[6] [7] The most devastating respiratory consequences occur with upper cervical SCI which may directly compromise phrenic motor neurons(C3–C5/6) innervating the diaphragm and due to disruption of supra-spinal input respiratory motor neurons caudal to injury – intercostal and abdominal) but it can also compromise in lower cervical SCI (below C4) in 23% cases and Thoracic SCI in 99% cases.[8] High cervical incomplete lesions (C2-C4) or cervical lesion below C5 (C5-C8) are likely to produce paralysis, weakness or spasticity in the muscles used to perform forced respiration.

Respiratory consequences due to spinal injuries are paradoxical/abnormal breathing pattern, poor cough reflex, reduced chest expansion. These manifestations can lead to atelectasis, pneumonia and respiratory failure which in turn affects their oxygen uptake while performing different activities and can result in high mortality and morbidity rate. [5] The main physiologic consequence of expiratory muscles paralysis is impaired cough resulting in poor bronchial hygiene due to articulation of secretions. [9] The cough is markedly impaired in tetraplegic and high paraplegic subjects. [6]

Evidence suggests that in spinal cord injury patients, psychological, sociological problems are usually assessed after discharge, but respiratory status are not assessed generally, which is one of the complaints after spinal cord injury. So, after discharge there are chances of developing morbidity and mortality due to respiratory impairment which should be assessed during follow up. So, it is a dire need to assess the respiratory status of patients with spinal cord injury after discharge.

There are various study done which revealed that respiratory complication is the main cause of morbidity and mortality in the SCI patients. [6][7][8][9][10]

AM Spungen et al in 1997 done a survey to know the pulmonary symptoms in subjects with SCI as a part of their routine annual physical examination by using a standard respiratory questionnaire and found that subjects report one or more respiratory symptoms with breathlessness is the most frequent complaint.[11] E.Garshick et al in 2005 has done a study for assessment of mortality in chronic SCI and found that risk factors for death included diabetes, heart disease, lower levels of pulmonary function and current and recent cigarette smoking.[12] There are various telephonic follow-up are also done to know the psychological and Socioeconomic status, complications and quality of life in people with SCI and to know the demographic profile of traumatic sci.[3][13] However there were no follow-up studies done to know the respiratory status of SCI patients.

Methodology

A retrospective cross- sectional survey study was conducted on post discharged traumatic spinal cord injury patients with level of injury C3-T6 to assess the respiratory status of SCI patients after discharge from the Tertiary hospital. New Delhi and the inclusion criteria for the study was post discharged patients of traumatic spinal cord injury with level of injury C3-T6 in between 1st January 2016 to 31st December 2017. The Patients with primary neurological disorder, and who was suffering from any other primary pathological disease other than traumatic SCI and Patients with difficulty in understanding Hindi or English were excluded from this study.

After Approval from Research Review Committee and ISIC Institutional ethical committee, data were retrieved from MRD of ISIC in between 2016-2017. All SCI patients discharged from hospital who met the inclusion were included in this study 154 patients from year 2016 and 109 patients from year 2017 were retrieved from MRD. After obtaining the written and verbal consent from patients who were willing to participate in this study and explaining the purpose of study, The self-administered Hindi questionnaire was sent via email and from few patients questions were asked on telephonic mode.

Development of Tool

The study was conducted in three phases: Phase- 1 Development of questionnaire, Phase-2 Validation of questionnaire and last Phase- 3 Administration of questionnaire.

Phase 1: Development of questionnaire

After a thorough review of literature, seven domains were screened for the sample questionnaire development and were discussed with the experts after discussion, the sample questionnaire was formed that includes domain like mode of ventilation/breathing, general respiratory information, respiratory issues, medications for respiratory problems, dyspnea, cough and sleep disorder breathing.

Phase 2: Validation of questionnaire:

The developed sample questionnaire was thereby put under the expert panel review. Expert panel consisted of 10 members (in which 6 doctors, 1 spine nurse, 1 respiratory nurse and 2 cardiopulmonary physiotherapists were there). The questionnaire was then subjected to qualitative validation using Lawshe's method.

For computing content validity (CVR) ratio was calculated. In this method, panels were asked to indicate whether a measurement item in a set of all measurements is essential to the operationalization of the theoretical construct or not. Thus panel were asked to rate items of scale as:

- Essential
- Useful but not essential
- Not necessary

After receiving each panel's rating values, CVR was calculated for each item based on the formula developed by Lawshe's, the calculated CVR was then compared to the required level for statistical significance. The minimum value of CVR was 0.78, which was necessary for statistical significance at $p < 0.05$ based on 10 panelists. Out of 25 items, 7 items were found to have negative CVR and the experts suggested the modification of those questions. After the suggested modification the questions were redrafted, and a test retest of the modified questionnaire was done.

For test retest reliability, a convenient sample of 30 SCI patients with level of injury C3-T6 was recruited for assessing reliability of the questionnaire according to the inclusion and exclusion criteria as per the study. The questionnaire was then administered at 0 week and after 1 week and correlation method was used to establish the test-retest reliability. It was found that all the questions were significant except two questions but that were included in the study after discussion with the experts as those questions were clinically important.

The questionnaire was then translated in Hindi Language by forward and backward translation method as Hindi is the most widely spoken language in the northern part of India.

Phase 3: Administration of questionnaire

All discharged SCI patients from 2016 and 2017 who met the inclusion criteria were included in this study. They were given detailed information about the purpose of the study. Written and verbal consent form was obtained from those who were willing to participate after being explained about the purpose of the study.

The modified questionnaire was then administered to 261 patients. The questions were asked on telephone and a self administered questionnaire was also sent on personal email The response were recorded on phone, if the respondent not answer the call then two subsequent calls were made at the gap of 7 days.

From the year 2016 out of 154 patients, 73 patients gave responses, and 81 patients did not respond. Out of 81 non-respondent, 19 patients were dead, 6 patients phone numbers were switched off, 3 patients were not interested in this study and 53 patients phone number was either not responding, not reachable or the wrong number.

From the year 2017 out of 107 patients, 57 patients gave response to the calls, 1 patients give response in person, and 49 patients did not respond. Out of 49 non-respondents, 9 patients were dead, 5 patients phone number were switched off, 13 patients were not interested and 22 patients phone number was either not reachable, invalid number, not responding or wrong number and they were not responding to emails also.

So, out of 261 patients only 130 patients were included in this study for further analysis.

Data Analysis

Before administering the questionnaire, test-retest reliability and CVR was calculated and then Descriptive statistics were used to analyse the data for the survey and excel was used for the calculation.

Results

This survey is conducted to determine the respiratory status of spinal cord injury patients after discharge.

Validation of questionnaire

In order to finalize the items of the questionnaire and to determine content validity, questionnaire was distributed to 10 expert panels with minimum 2 years of experience

Using the Lawshe method, content validation was done in which content validity ratio (CVR) was computed for each question and was compared with a minimum value of .78 CVR for 10 expert panels as stated in Lawshe table at 5% level of significance.

Table 1: Content validation through Lawshe's method.

QUESTIONS (TOTAL NUMBER OF QUESTIONS)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
CVR	0.4	0.4	0.4	0.6	1	1	0.8	0.8	1	0.8	0.8	0.6	1

Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26
1	0.8	0.8	1	1	1	1	0.6	1	1	0.8	1	0.6

After content validity, questionnaire was modified as suggested by the experts and after modification of the questionnaire, test-retest was done through correlation method to know that the questions are significant or not.

Table 2: Test retest reliability

	FA1	FA2	FA3	FB1	FB2	FC1	FC3	FC4	FD1
A1 r P	1.000** (.000)								
A2 r P		1.000** (.000)							
A3 r P			1.000** (.000)						
B1 r P				.447* (.013)					
B2 r P					.196 (.299)				
C1 r P						.117 (.538)			
C3 r P							.969** (.000)		
C4 r P								1.000** (.000)	
D1 r P									.802** (.000)

	FD2	FD3	FE1	FE2	FF1	FG1	FG2	FG3
D2 r P	.695** .000							
D3 r P		.1000** .000						
E1 r P			.447* .013					
E2 r P				.712** .000				
F1 r P					.843** .000			
G1 r P						1.000** .000		
G2 r P							.523** .003	
G3 r P								.915** .000

In test-retest reliability all the questions were significant except two questions but are included in the survey because of clinical importance.

Table 3: Demographic details of the subject

In present study a total of 131 C3-T6 level of SCI individuals were enrolled from year 2016 and 2017.

VARIABLES	2016	2017
AGE (IN YEARS)	38.52±13.93	41.55±15.42
LEVEL OF INJURY	High cervical=8 Low cervical=47 High thoracic=18	High cervical=6 Low cervical=37 High thoracic=16

2016

Male n = 65 female = 8

2017

Male n = 48 female = 11

Administration of questionnaire

The questionnaire was then administered to discharged patients from 2016 and 2017. There were total of 154 patients from 2016 and 109 patients from 2017.

Number of respondent 2016 for each questions

Mode of ventilation/breathing

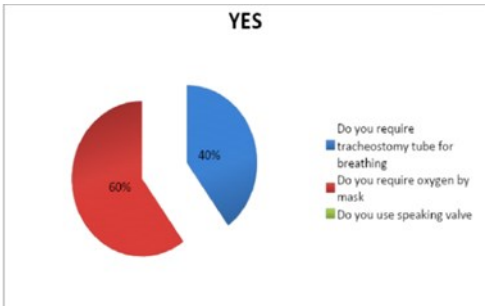
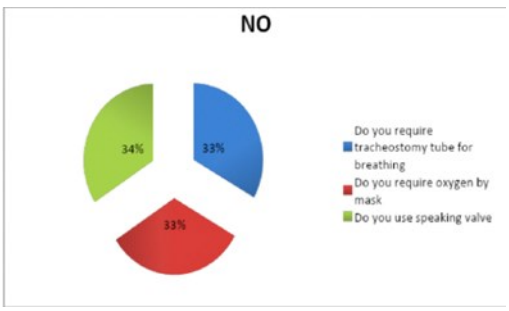


Figure: 1



Figure; 2

General respiratory information

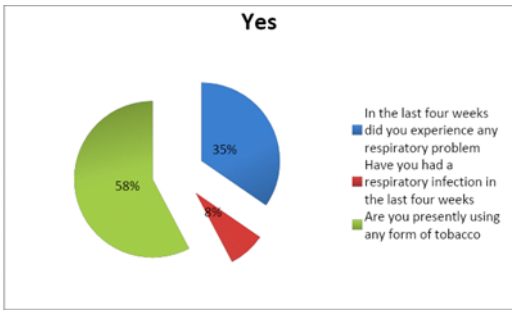


Figure 3

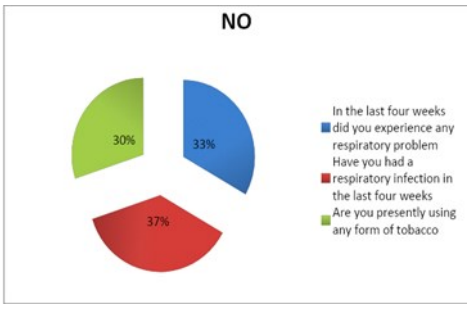


Figure 4

Medication

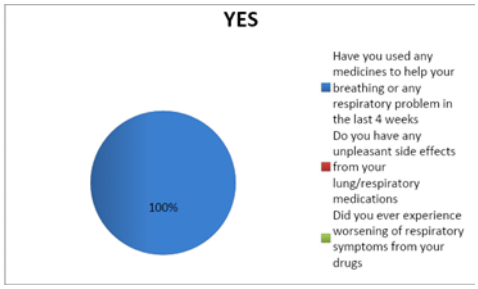


Figure 5

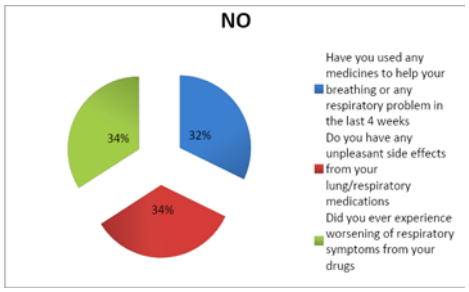


Figure 6

Dyspnoea

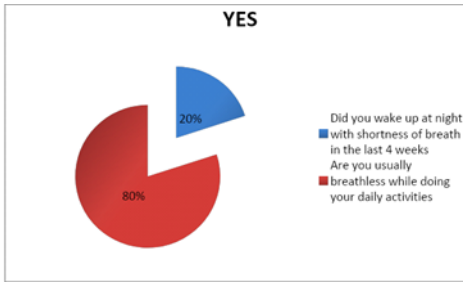


Figure 7

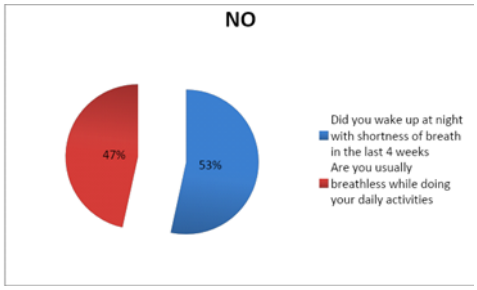


Figure 8

Cough

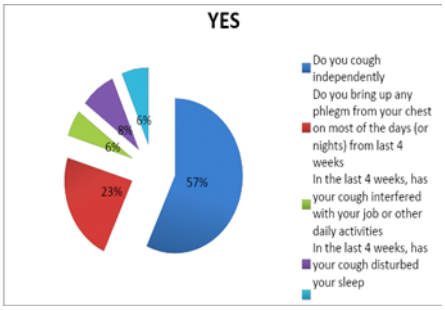


Figure 9

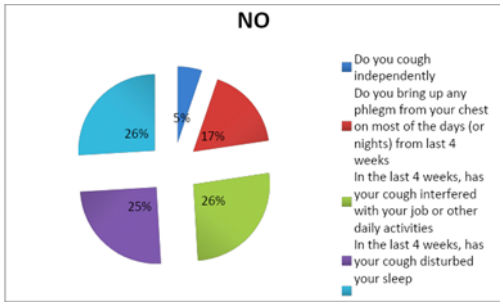
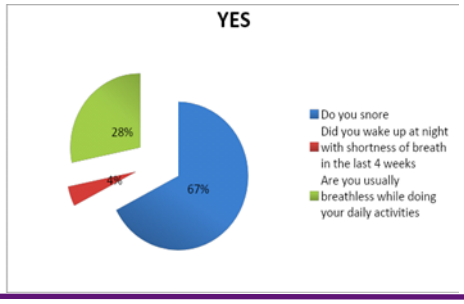
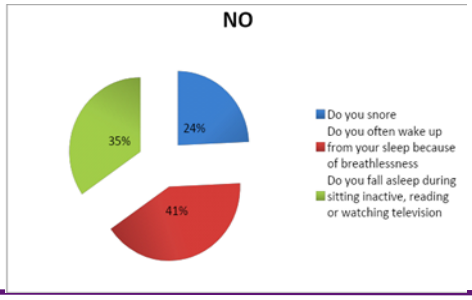


Figure 10

Sleep disorder breathing

Figure 11 & 12





Number of respondent from 2017 for each question

Mode of ventilation/breathing

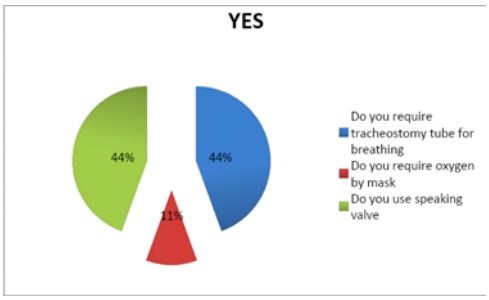


Figure 13

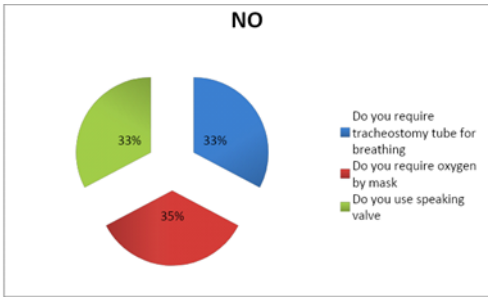


Figure 14

General respiratory information

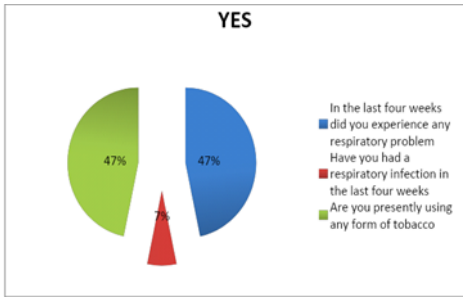


Figure 15

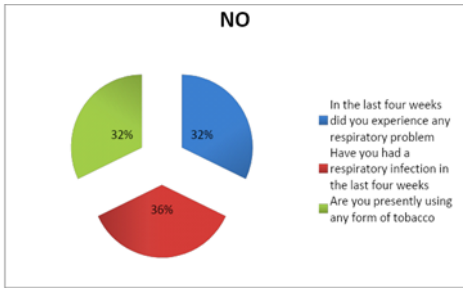


Figure 16

Medication

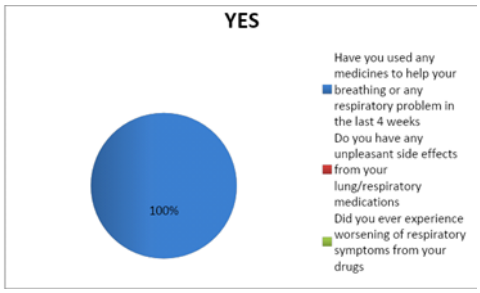


Figure 17

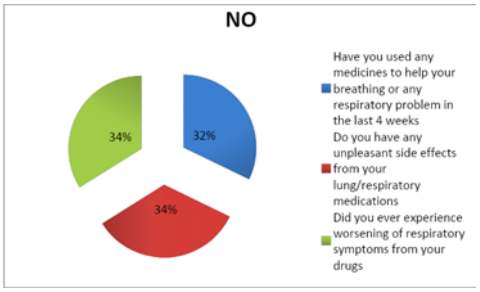


Figure 18

Dyspnoea

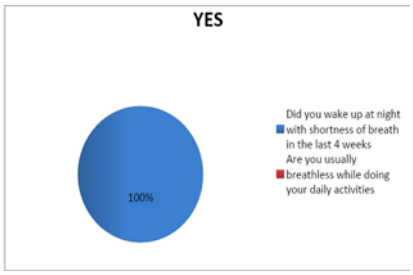


Figure 19

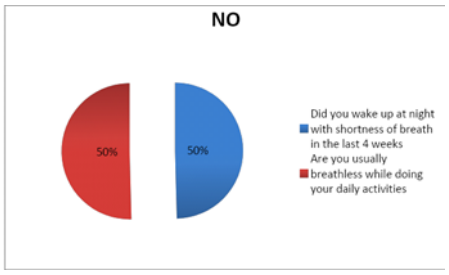


Figure 20

Cough

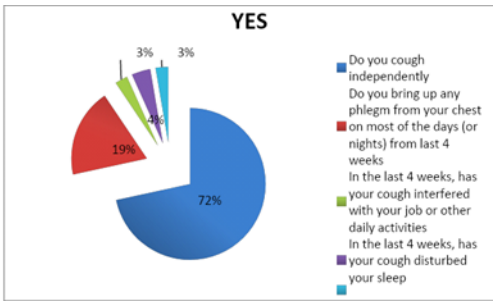


Figure 21

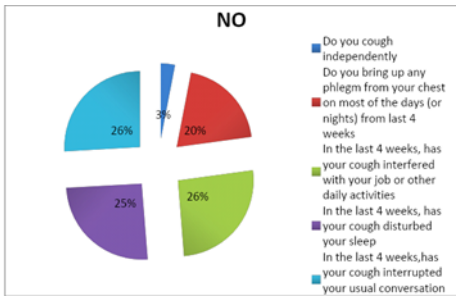


Figure 22

Sleep disorder breathing

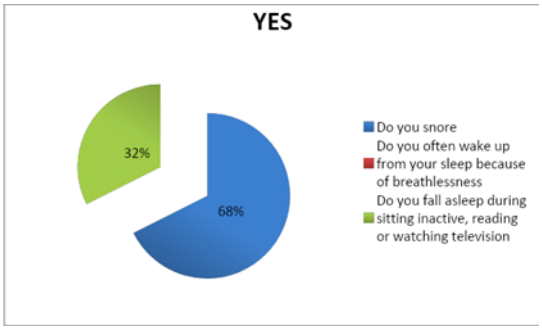


Figure 23

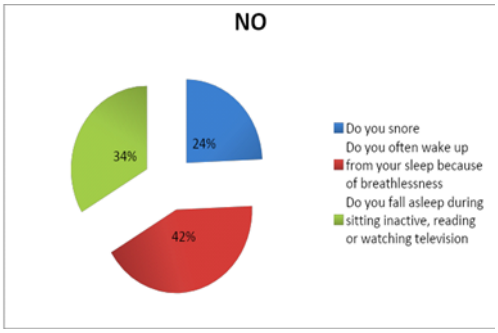


Figure 24

Discussion

The study aims to know the respiratory status of patients post discharge from tertiary hospital. Many studies quoted that respiratory complication is one of the major causes of morbidity and mortality among SCI patients.[6][7][8][9][10] In India, there are limited follow up studies performed to know the respiratory status of post discharge patients from a tertiary hospital. Therefore, there was a dire need to know the respiratory status of the patient after discharge from tertiary hospital. Before the recruitment of the participants for the study, the questionnaire was developed for the survey of this study and then the questionnaire was validated by an expert panel and CVR ratio was calculated for each item. Then a test-retest was run to check that the modified questionnaire was significant or not. After completion of test-retest reliability, the modified questionnaire was then asked to subject who were discharged in 2016 and 2017 for the respiratory follow-up with level of injury C3-T6. The questionnaire was asked through telephonic follow up and in person as no patients were responding in email. The response rate of telephonic questionnaires was 53% and 55% from patients who were discharged in 2016, 2017 respectively.

Responses of the patients from 2016 and 2017

For mode of ventilation/breathing, the result has been shown that majority of patients do not require tracheostomy tube, oxygen mask and speaking valve after discharge which may be due to proper primary care, respiratory care, proper and effective patient education during post discharge was done when they were at ISIC hospital.

For general respiratory conditions, the result has been shown that majority of patients do not have respiratory problem, respiratory infections, they are not suffering from disease like asthma, pneumonia, COPD, allergies and others as proper respiratory hygiene was maintained and cessation of smoking after injury helps to reduce their respiratory problems. For medications, the result has been shown that the majority of patients do not require medication to help their breathing or any respiratory problem as they are properly following the respiratory care regime and also go to the hospital for regular follow up.

For respiratory symptoms like dyspnoea, the majority of patients reported that they do not have any respiratory issues, and do not wake up at night due to shortness of breath, do not feel breathlessness while doing their daily activities because they were doing proper breathing exercises, using devices like IMT, Incentive Spirometer to help their breathing problems and maintaining their physical fitness.

For cough effort, the majority of patients reported that they can cough independently and can bring up their phlegm by their own and cough is not disturbing their sleep, their conversation and their daily activities because proper chest physiotherapy was done in hospital and effective cough technique were taught to the patient during post discharge and they were educated to continuing the cough clearance techniques and attendant education after discharge from ISIC hospital.

For sleep disorder breathing, the result showed that the majority of patients do not have a sleep disorder breathing as they were properly following all the exercises and taking proper care of themselves.

The result from the current survey revealed that post discharge SCI patients has reduced respiratory complications which is supported by several studies which found that respiratory complications are predominant in the 1st year following SCI but subsequently it decreases following the year.[20] It has been suggested that life style modification, smoking cessation, treatment of wheeze, and efforts to improve respiratory muscle strength may show lung function decline after SCI.[21] One review article on respiratory care in traumatic SCI, found that good respiratory health is more likely to ensure full aeration of the lung, with proactive chest clearance regimes and monitoring in the acute stage This will also reduce the likelihood of secondary hypoxic cord damage. Advice, guidance and support from the local tertiary spinal centre shows improvement in respiratory condition. [6]

Limitations of the current study

There was no early follow up studies done to evaluate the better correlation of the respiratory condition of patients after discharge from ISIC hospital.

Future recommendations

This information might be used for regular follow up of the patients to know the respiratory status of patients after discharge from hospital and to evaluate the cause for the morbidity and mortality of patients.

Conclusion

Survey of 131 patients indicated that respiratory status improved post discharge, good care in tertiary hospital are associated with improvement in respiratory conditions and respiratory complication is not the major cause of morbidity and mortality after 1 and 2 year of discharge from ISIC hospital.

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