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PHYSIOTHERAPY PERSPECTIVE FOR LIVING DONOR LIVER TRANSPLANT RECIPIENT IN POST-OPERATIVE PHASE- A CASE STUDY

Physiotherapy

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ABSTRACT

Liver transplantation, a life saving surgical procedure for patients with end-stage liver disease and acute liver failure, initiates a cascade of patho-physiological responses, potentially causing post-operative pulmonary complications and functional dependency. Early post-operative physiotherapy aims to avoid those complications and also to improve the functional status of the patient. Therefore, this case study describe the course and effect of physiotherapeutic measures for a patient of 54 years who undergone living donor liver transplantation in a tertiary care hospital. Understanding the effectiveness of physiotherapeutic treatment in early post-operative transplantation surgery will help the physiotherapists to gain fundamental knowledge, which will help them to select the appropriate respiratory and functional exercise for patient with liver transplantation.

KEYWORDS

Post-operative pulmonary complication, liver transplant surgery, physiotherapy, ambulation, activities of daily living.

INTRODUCTION:

Liver transplantation has become a life saving surgical procedure for patients with chronic end-stage liver disease and acute liver failure [1-2]. Due to the improved immunosuppressive regimens, tissue preservation, reduction of infectious disease and better post-operative management, living donor liver transplantation has achieved patient and allograft survival rates that have expanded both the indications for transplantation[3].There is no doubt that standard medical care following liver transplantation seldom includes physiotherapeutic measures that focuses mainly on improving lung expansion, early ambulation programme and better physical fitness. Few studies have investigated the physical fitness after liver transplant surgery[4], but limited literature retrieved which suggests the effect of intensive care physiotherapy in immediate to late post-operative phase. Therefore, this case study reports to list the impact of physiotherapeutic intervention for a post-operative case of liver transplantation surgery.

Case Presentation:

A 54 year male with diagnosis of chronic end stage liver disease (liver cirrhosis), decompensate with ascites and jaundice. Pre-operatively, body mass index was 22.3 kg/m^2 (height=173 cm, weight=67 kg), presence of icterus, pallor, distended abdomen and with normal cardio-respiratory function. The patient undergone live donor liver transplantation on September 2019 and immediately following the surgery, the patient was extubated from the ventilator support at the end of the surgery and shifted to the surgical intensive care unit (ICU) with oxygen support. During the ICU stay, close monitoring and attention were being paid to the management of vital sign, fluid and electrolytes balance by the surgical and medical team as well as by nursing staff.

MANAGEMENT AND OUTCOME:

Based on specific protocols and on the patient's renal function, immunosuppressive agents were started and doses were adjusted according to blood levels and functional status of the transplanted liver. The vital sign, fluid and electrolyte status, haemoglobin level, liver and kidney function, chest x-ray and Doppler ultrasound were monitored on daily basis in order to reduce the risk of certain complications like sudden vascular occlusions (hepatic artery thrombosis, portal vein thrombosis), acute respiratory distress, renal failure, sepsis or septic shock, hypomagnesaemia (which causes cardio-vascular, neuro-muscular and coagulation dysfunctions), acute cellular rejection and for an uneventful recovery. The mean values of vital sign, oxygen saturation, and amount of oxygen (in litre/hour) and laboratory values of blood investigation on post-operative days were shown in table no.1.

Table no. 1: Mean values of vital sign, oxygen saturation, amount of oxygen and laboratory values of blood investigation on postoperative days

Mean value (per hr in 24 hrs)							Per day value							
Day	Temp	HR	SBP/DBP	SpO_2	RR	FiO_2	Hb	PT/INR	Creat	Mg	Ca	SGOT	SGPT	Bil T/D
1	96.3	62	152/84	100	16	3	9.2	22.0/1.83	0.95	2.34	10.46	145	99	9.76/3.7
2	93.2	64	118/62	94	14	2	7.4	23.9/1.99	1.14	2.16	9.9	141	128	15.36/8.9
3	95.6	66	114/72	98	20	3	7.2	30.1/2.5	0.65	1.95	9.33	159	141	9.03/4.03
4	95.8	76	116/72	97	16	3	7.8	25.0/4.08	0.71	2.44	8.97	296	164	8.8/ 5.4
5	96.0	84	128/80	94	18	CPAP	6.8	21.7/1.85	0.75	2.52	8.90	304	167	8.19/5.0
6	97.4	90	134/82	90	20	CPAP	7.8	13.2/1.12	1.00	2.43	9.39	261	161	6.10/3.8
7	96.2	84	140/82	94	20	CPAP	7.8	19.5/1.66	1.57	2.36	9.24	228	152	7.20/4.8
8	96.2	96	144/80	97	20	2	8.1	18.1/1.50	1.17	2.17	9.11	172	136	7.14/4.7
9	97.2	80	148/78	97	20	RA	7.8	-	1.01	1.76	7.87	141	122	7.88/5.2
10	96.0	90	136/82	98	18	RA	7.5	18.2/1.55	0.89	1.72	9.33	133	124	8.79/6.4
11	96.4	82	134/90	98	18	RA	6.8	-	0.74	1.87	8.99	99	115	9.18/7.1
12	96.0	78	132/80	99	18	RA	8.3	-	0.80	1.93	9.05	78	109	9.73/7.8
13	96.4	78	122/82	99	18	RA	8.1	-	0.98	1.85	9.25	87	113	8.61/7.2
14	97.2	76	124/84	99	18	RA	7.9	-	1.07	1.73	9.60	92	118	8.37/6.9
15	96.6	82	124/82	100	16	RA	7.8	-	1.08	1.68	9.40	83	118	7.12/5.9
16	97.2	82	126/82	100	18	RA	7.8	-	0.99	1.74	9.74	84	130	6.18/5.1
17	96.4	82	124/80	100	16	RA	7.1	-	1.13	1.55	9.37	81	133	5.49/4.6
18	97.6	68	126/78	100	18	RA	6.8	-	1.34	1.62	9.65	81	128	4.54/3.9
19	96.2	76	130/84	100	18	RA	8.9	-	1.70	1.83	9.75	60	111	4.58/3.8

Temperature (Temp) = degree Fahrenheit, Heart rate (HR) = Beat/minute, Systolic blood pressure/diastolic blood pressure (SBP/DBP) = mm Hg, Oxygen saturation(SpO_2) = Percentage, Respiratory rate (RR) = Per minute ,Fraction of inspired oxygen (FiO_2)= litre/hour, Haemoglobin (Hb) = g/dL ,Prothrombin /International normalized ratio (PT/INR) =Unit/ratio ,Serum creatinine (Creat) =mg/dL, Serum magnesium (Mg) = mmol/L, Serum calcium (Ca) = mmol/L, Serum glutamic-oxaloacetic transaminase (SGOT) = units/L , Serum glutamic-pyruvic transaminase (SGPT) = units/L, Bilirubin total/direct (Bil T/D) = mg/dL, Continuous positive airway pressure =CPAP, RA= Room air .

On the very first post-operative day, physiotherapy reference was given, as to maintain and improve clear lung airways and for early ambulation. The post-operative physiotherapeutic measures from early (Day 1) to discharge from hospital including the number of treatment visits were listed in table no 2.

Table no. 2: Physiotherapeutic measures from early post-operative day to discharge from hospital

Post-op day	Physiotherapeutic measures	Number of Session (hourly basis)
1	Deep breathing exercise; pursed lip breathing exercise; thoracic expansion exercise; incentive spirometry ; forced expiratory technique like huffing; preparatory walking exercise like ankle pump, hip-knee flexion up to 60 degree in supine position.	2 (12 hourly)
2	Same like as Day 1 plus training for bed mobility and sitting over edge of bed with oxygen support.	3 (8 hourly)
3	Same like as Day 2 plus training for sit to stand, standing near the edge of bed for 30 second for 2-3 minute with oxygen support and isotonic quadriceps exercise in high sitting position.	4 (6 hourly)
4	Same like as Day 3 plus assisted ambulation/walking for 10 metre under supervision with oxygen support.	4 (6 hourly)
5	Active cycle of breathing technique plus chest percussion for lung posterior segment, incentive spirometry plus sitting over edge of bed with oxygen support.	6 (4 hourly)
6	Same as like Day 5 plus sitting in a chair/standing & walking for 10 metre activities (6 times in 24 hour) with oxygen support.	8 (3 hourly)
7	Same as like Day 6, isotonic quadriceps exercise in high sitting position (twice daily)and walking distance increased by 20 metre(6 times in 24 hour).	8 (3 hourly)
8	Same as like Day 7, plus isotonic quadriceps exercise in high sitting position (thrice daily)and walking distance increased by 30 metre(6 times in 24 hour) without oxygen support.	8 (3 hourly)
9	Same as like Day 8, plus isotonic quadriceps exercise in high sitting position (thrice daily) and walking distance increased by 40 metre(6 times in 24 hour).	8 (3 hourly)
10	Diaphragmatic breathing exercise, pursed lip breathing exercise, thoracic expansion exercise, incentive spirometry plus isotonic quadriceps exercise in high sitting position and walking activities as earlier.	6 (4 hourly)
11	Same as like Day 10, sitting and walking activities intensity increased. Walking independently.	4 (6 hourly)
12	Same as like Day 10	3 (8 hourly)
13	Same as like Day 10	2 (12 hourly)
14	Same as like Day 10	2 (12 hourly)
15	Diaphragmatic breathing exercise ,pursed lip breathing exercise, thoracic expansion exercise and incentive spirometry	1 (once in 24 hour)
16	Same as like Day 15	1 (once in 24 hour)
17	Same as like Day 15	1 (once in 24 hour)
18	Same as like Day 15	1 (once in 24 hour)
19	Same as like Day 15 plus advice for home exercise programme	1 (once in 24 hour)

On 5th post-operative day, the patient's oxygen saturation was less than 90 % and significant chest x-ray finding with mild haziness in right mid lung zone- suggestive of pneumonitis were noted, following which continuous positive airway pressure(CPAP) therapy was initiated and the number of physiotherapist visits were increased.8th post-operative day onward, oxygen saturation level were within normal limit and lung fields were clear on chest x-ray and the patient was able to maintain saturation at 2 litre/hour oxygen. By 9th post-operative day, oxygen saturation was maintained within normal limit even in the room air. From 10th post- operative day to 15th post-operative the sessions of physiotherapy were minimised from 6 visits to 1. Functional evaluation was assessed using the Barthel index to measure independence in activities of daily livings (ADLs) on 5th, 10th and 15th post-operative day with the score of 20, 55 and 85 respectively. Partially dependent in ADLs, independent ambulation, increased sitting activities and improved lung expansion suggest us to determine the lesser number of physiotherapeutic measures for the patient. On the day of discharge from hospital i.e. 19th post-op day, body mass index re-measured with 21.3 kg/m^2 and the patient was motivated to be regular with self physiotherapeutic home exercise programme (Diaphragmatic breathing exercise, pursed lip breathing exercise and incentive spirometry – twice a day of 25 repetition for each; walking activities and to minimize the sedentary lifestyle).

DISCUSSION:

It is known that surgical procedures in the upper abdominal area promote changes in pulmonary function and respiratory mechanics, leading to post-operative pulmonary complications (PPCs) [5]. Factors such as surgical duration, anaesthesia and nociception impair respiratory function, exacerbate muco-ciliary clearance depression and suppress the cough reflex leading to secretion retention and reduced lung volumes, thereby contributing to atelectasis and development of infection [6-8]. Therefore, intensive chest physiotherapeutic measures and early ambulation in the immediate post-operative period is essential for the prevention of PPCs. However, evidence suggests that early post-operative mobilization is a sufficient standalone treatment for patients following upper abdominal surgery (UAS) and does not require respiratory interventions to further reduce PPCs [8-10]. Certain barriers associated with high-risk open UAS like surgical stress syndrome which includes a wide range of physiological effects that directly impair cardiopulmonary muscle and neurological function [11], and contribute to an accelerated loss of lean tissues [12] which was reflected in this case study as the changes in body mass index and variability in heart rate and blood pressure on diurnal basis post-operatively and secondly, compromised diaphragmatic function by reflex inhibition of phrenic nerve output[13] because of high level of abdominal incision increases the risk of PPCs which was also noted in 5th post-operative day in our study which necessities that intensive physiotherapeutic measures needs to be under the umbrella of standardised medical care for preventive purposes in post-operative cases of liver transplantation surgery. Importantly, interventions implemented by physiotherapist for such high risk surgeries should use appropriate clinical assessment and prioritising to ensure physiotherapy treatment time and sessions based on vital sign and laboratory values. Therefore, future research may include the development of specific screening tools and post-operative physiotherapeutic protocol which emphasizes the prevention of PPCs in liver transplant surgeries.

CONCLUSION:

This study found that specific and well-planned physiotherapeutic measures based on individual needs of each patient are required after liver transplantation surgery in order to prevent PPCs, lean muscle tissue loss and physical fatigue. The variability of vital sign, oxygen saturation, laboratory blood investigation values in liver transplantation post-operative phase were reflective of the need to

clarify when and how respiratory exercises should be used to prevent and /or treat PPCs and to enhance lung expansion, aerobic capacity and maximize physical activity level in patients.

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