



EFFICACY OF EARLY PHYSIOTHERAPY INTERVENTION ON POSTOPERATIVE OUTCOMES FOLLOWING LEFT HEPATECTOMY : A CASE REPORT

Physiotherapy

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ABSTRACT

'Hepatectomy' is also known as liver resection. It is a surgical procedure involving the removal of a portion / lobe or entire liver, commonly performed for liver carcinoma or donor purposes. Depending on the patient's condition, the procedure can be performed by using either Open procedure or laparoscopic approach. In open procedure / traditional procedure, the abdomen is exposed through a Chevron, midline or J incision to provide access to the liver and surrounding organs. This approach is typically indicated in cases of metastatic carcinoma, large tumour (>10cm), Hepatocellular cancer or multiple liver segments are involved mostly at the region of posterosuperior segments of damaged liver. The other advanced procedure is laparoscopic Hepatectomy which was performed by using specialized instruments through small incisions. It is generally indicated for benign and malignant tumours in smaller size (<5 cm), tumours in segments 2, 3, 4b, 5 & 6 are generally preferred. This case report describes a 77 old male patient with a history of smoking and alcoholic consumption, presenting with intermittent fever and significant weight loss. His past medical history included hypertension and chronic obstructive pulmonary disease (COPD). Following stabilization, the patient underwent open left hepatectomy. Postoperatively, due to midline incision and underlying COPD, the patient developed a restrictive pattern of breathing, early atelectasis with fever, incisional pain during respiration and reduced mobility. The early intervention of physiotherapy played a crucial role in improving pulmonary function, reducing postoperative complications and promoting early recovery.

KEYWORDS

hepatectomy, hepatocellular carcinoma, postoperative complications, COPD, Physiotherapy.

INTRODUCTION

Liver is the largest visceral organ which weighs approximately 1.5 kg located in the upper right quadrant of abdominal cavity beneath the diaphragm. Anatomically, the liver divided into four lobes (right lobe, left lobe, caudate lobe & quadrate) and functionally it is segmented into 8 segments based on Couinaud classification. Liver cancer, predominantly hepatocellular carcinoma (HCC) accounts of nearly 90% of primary liver malignancies and originates from hepatocytes. Other less common types include intrahepatic, Cholangiocarcinoma and hepatoblastoma. Hepatocellular carcinoma is now the fifth most common cause of cancer worldwide second leading cause of death. The major etiological factors include chronic infections such as Hepatitis – B and C, Alcoholic liver disease and Non – alcoholic fatty liver disease & cirrhosis. In early stages, liver cancer is often asymptomatic; however, as the disease progress, patient may present with symptoms such as abdominal pain, weight loss and jaundice. The pathogenesis involves chronic hepatic inflammation and multiple molecular alterations including cell cycle dysregulation, changes in DNA methylation, Chromosomal instability etc. Investigations of HCC includes contrast CT/MRI, high alpha fetoprotein (AFP) levels, ultra sound scanning and liver biopsy. Management of HCC depends on the stage of the disease and includes surgical and non-surgical approaches. Surgical options such as liver resection (hepatectomy) and liver transplantation are considered in early stages, while non-surgical treatments includes Trans arterial chemoembolization (TACE), target therapy and immunotherapy advanced cases.

Hepatectomy remains one of the most effective surgical procedures for the removal of liver tumours. However, patients undergoing open Hepatectomy are at increased risk of postoperative complications such as atelectasis, pyrexia, DVT, wound infections, bed sores etc. The impact of early physiotherapy improves pulmonary functions, reducing post-operative complications, enhancing mobility, decreasing hospital stay and improving overall patient outcomes

CASE REPORT

A 77 years old man with known hypertension and Chronic Obstructive Pulmonary Disease was admitted for surgical management of hepatocellular carcinoma, previously diagnosed at another hospital. The patient presented with complaints of intermittent fevers, severe weight loss, nausea and loss of appetite. The personal history reveals chronic smoking and alcoholic consumption for over 50 years. Family history was significant for cancer in his father and sister. On admission, the patient received symptomatic management which includes paracetamol and tramadol injections for fever and pain. Antibiotics for infection prophylaxis and fluids through IV's. Preoperative investigations was conducted to confirm the diagnosis and assess surgical fitness. Ultrasonography revealed heterogeneously hyper echoic lesion (5.0 x 3.9cm) in left lobe of liver, PET – CT scan showed

low grade FDG avid lobulated mixed density lesion is noted in the segment two/three of the left lobe of liver (5.3 x 6.1 cm with SUV max 5.93). Histopathological examination (Biopsy) suggested a malignant epithelial neoplasm consistent with hepatocellular carcinoma. Blood investigations indicated anaemia with low Hb % and packed cell volume. Arterial blood gas analysis showed pCO₂ of 51.7mmHg, pO₂ of 382.7mmHg, Sodium - 132.6mmol/L, Potassium - 3.29mmol/L, Chloride - 92.8mmol/L, total haemoglobin - 7.6g/dL, haematocrit 22.4%, Oxygen saturation – 99 %, Lactate – 2.3mmol/L. Chest X – ray shows hyper inflated bilateral lungs, prominent Broncho vascular markings and flattened both domes of diaphragm which tends to COPD changes, Borderline ECG with 55% EF and grade 1 diastolic dysfunction.

After ruling out the condition, the surgeon plans for an open left Hepatectomy when patient got stabilized. The surgical team explains the pros and cons of surgery with consent. At pre op preparation includes blood and plasma transfusion, cleaning the stomach by pleglec powder. Foley's was placed to collect the urine. On intra operative day, the patient was cleansed with antiseptics wore surgical drape and shifted to OT. The anaesthetist starts to monitor vitals and injects General anaesthesia as per dose and ventilated. The surgical team initiates the procedure through midline incision and expose the internal organs by retractors. Then surgeon identifies the carcinoma sight of liver (in this case left lobe of liver was involved) was removed by isolating blood vessels and bile ducts. And a drain was placed at surgical site to collect pus / blood / waste fluid. At last, surgeon closes the incision with suitable sutures. The patient was extubated by anaesthetist and shifted to Intensive Care Unit for postoperative monitoring. Medical management includes intravenous antibiotics ceftazidime + avibactam 2.5mg (BD), pantop - 40 mg (OD) and omeprazole 8 mg (BD) for gastritis and nausea, perinorm 2cc (BD) for gastro paresis, PCM & Tramadol (BD) for pain management, Calcium gluconate (OD) prior to blood transfusion, Glutathione 50 ml (OD) for hepatic support. The physiotherapy initiated from Post-operative day - 1.

PHYSIOTHERAPY MANAGEMENT

The primary objective of interventional physiotherapy in the postoperative phase was to promote early recovery, improve cardiopulmonary function, prevent from secondary infection and restore functional independence. A structured rehabilitation protocol was initiated from postoperative day (POD-1) following detailed assessment and continuous monitoring of vital parameters. As per collected documentation, the therapist plans the treatment in two phases.

CHEST PHYSIOTHERAPY

CPT mainly focuses on mucus airway clearance, improving lung volumes and enhancing respiratory muscle performance to prevent

postoperative pneumonia. It is a traditional non-invasive therapy which consists of group of techniques and exercises to maintain hygiene lungs in post-operative days. Considering patient's history of COPD lungs, the therapist concentrate on respiratory tract opening, mucus draining & full expansion of lungs.

NEBULIZERS:

It is a medical device which consists of compressor, tubing, nebulizer chamber, face mask and nebulizer filter. Principle of nebulizer is to convert liquid medicine into mist to inhale easily by patients. Nebulizers acts as adjacent to CPT which facilitates to reduce airway inflammation and aided in loosening secretions. In this case, Duolin, Budecort, and Mucomix are the bronchodilators was administrated by TID per day.

RELAXED BREATHING:

The patient was instructed to perform slow inhalation through nostrils followed by gentle exhalation through oral cavity (3-4 times). This technique promoted relaxation, reduced anxiety and served as a preparatory exercise for advanced breathing techniques.

POSTURAL DRAINAGE:

It is a traditional technique where mucus was drained with the help of gravity assisted postures. In some cases manipulations like percussion, vibration, shaking was included to mobilise the thick mucus from peripheral to central airway. Due to the presence of midline incision and underlying COPD, modified positioning in supported long sitting was adopted. The therapist performed gentle percussion and vibration were applied cautiously to mobilize secretions.

ACTIVE CYCLE OF BREATHING TECHNIQUE:

It is an advanced technique to drain the mobilized mucus from both peripheral and central airway. It consists of 3 phases namely Breathing control (inhale and exhale through nostrils/mouth), Thoracic expansion exercises (deep inhale through nostril and hold for 2 – 3 seconds and exhale through mouth), Forced expiration (perform a huff). This cycle was repeated 3 – 5 times per session.

DIAPHRAGMATIC BREATHING:

Diaphragmatic breathing was initiated to improve diaphragmatic excursion and enhance basal lung expansion. Manual facilitation was provided by placing his/her hand on diaphragm and asked to take deep inhalation through nostril and exhale through mouth to feel the upward and downward movement of diaphragm.

SEGMENTAL BREATHING:

It is a highly potential breathing exercise in post-operative care which reduces pain, lung expansion and prevents from pulmonary infection. Segmental breathing mainly focuses on localized or target areas of lungs. In this technique, the therapist places the hand on specific areas of chest (lateral costal, posterior basal and apical) and instructed to inhale through nostrils, while exhalation (through mouth) manual pressure was applied over selected thoracic areas in inward and downward direction.

PURSED LIP BREATHING:

Pursed lip breathing was emphasized to improve oxygenation. The main motto of this exercise includes more exhalation where more trapped air was released. The therapist guides the patient to inhale deeply with nostrils and exhale slowly with lips pursed like whistling.

SPIROMETRY:

It is also called as Respirometer which consists of 3 chambers with 3 balls, connector and mouth piece. Spirometry was used to enhance lung expansion, improve inspiratory capacity and prevent atelectasis. The patient inhales through mouth piece to raise 3 balls for deep inspiration. Forced expiration is also performed through mouth piece by inverting the device to raise the balls.

GENERAL PHYSIOTHERAPY

It mainly focused on preventing complications associated with immobilization, post-operative pain, DVT, muscle weakness, joint stiffness and bedsores. General physiotherapy assists to reduce pain, stiffness and ambulate the patient to improve quality of life.

SLR & STRONG ANKLE TOE MOVEMENTS:

Therapist advices to initiate ankle toe movements and straight leg raising hourly to prevent from DVT and oedema of lower limbs.

ACTIVE & PASSIVE MOVEMENTS:

The therapist advised the patient to perform active movements of both upper and lower limbs involving all major joints. In cases of joint stiffness, passive movements was administrated by the therapist to maintain joint mobility and prevent contractures.

TURNINGS:

The patient was instructed to perform side by side turning in bed at regular intervals (hourly) to prevent pressure sores and improve ventilation.

AMBULATION:

Ambulation, also referred to as mobilization, is a low intensity activity to improve oxygenation, gastrointestinal movements and urine output. Once post-operative pain was reduced with stable vitals, therapist assist the patient to stand without support and encourage to ambulate (walking) every morning and evening.

Progression of physiotherapy (POD: 1 – 6)

***POD 1** – Relaxed breathing, Postural drainage, ACBT, Spirometry, SLR & Strong ankle toe movements.

***POD 2** – In addition to pod 1 protocol Diaphragmatic breathing, Turnings and Assisted sitting was included.

***POD 3** – Relaxed breathing, ACBT, Diaphragmatic breathing, Segmental breathing, Spirometry, active assisted limb movements, Shoulder passive movements, Sit to stand training was initiated.

***POD 4 - 6** – The patient continued with breathing exercises which includes diaphragmatic, segmental and pursed lip breathing with airway clearance techniques such as huffing and removing thick mucus through hot water gargling. Mobilization was progressively advanced to standing and ambulation training along with functional limb exercises.

At **POD – 7** – Patient underwent post-operative tests.

At **POD – 8** – Patient was declared as haemodynamically stable and discharged by surgical team.

RESULTS (Postoperative outcomes)

Table - 1 : Postoperative Physiological Parameters and Functional Status (POD 1–6)

POD	SpO ₂ (Pre)	SpO ₂ (Post)	HR (Pre)	HR (Post)	Pa-in (VAS Pre)	Pa-in (VAS Post)	Functional Status
1	96% on 6L O ₂	94% on 3L O ₂	111	104	8	7	Bed mobility
2	92% on 3L O ₂	90% on 2L O ₂	124	109	6	6	Sitting
3	89% on 2L O ₂	94% on 2L O ₂	105	99	6	5	Standing
4	92% on 2L O ₂	96% on 2L O ₂	99	90	5	5	Assisted walking
5	90% on RA	95% on RA	90	85	4	4	Independent walking
6	93% on RA	97% on RA	89	82	4	3	Functional ADL

DISCUSSION

Early physiotherapy intervention plays a vital role in enhancing postoperative recovery and preventing complications following major abdominal surgeries such as left Hepatectomy. In the present case, a structured and progressive physiotherapy protocol was initiated from postoperative day (POD) 1, incorporating respiratory exercises, airway clearance techniques, and gradual mobilization.

A consistent improvement in oxygen saturation (SpO₂) was observed from POD 1 to POD 6, along with a reduction in oxygen dependency from supplemental oxygen to room air. This improvement can be attributed to effective breathing exercises, including diaphragmatic breathing and active cycle of breathing techniques (ACBT), which enhanced lung expansion and secretion clearance.

Heart rate (HR) demonstrated a decreasing trend over the postoperative period, indicating improved cardiovascular stability and reduced physiological stress. Pain levels, assessed using the Visual Analog Scale (VAS) and also showed gradual reduction which facilitated better patient participation in physiotherapy sessions.

Functional recovery was progressive, with the patient advancing from bed mobility on POD 1 to independent ambulation and functional

activities of daily living (ADL) by POD 6. Early mobilization played a crucial role in preventing postoperative complications such as atelectasis, deep vein thrombosis and physical deconditioning.

The findings of this case highlight the effectiveness of early, structured physiotherapy intervention in improving cardiopulmonary function, reducing pain, early wound healing and promoting functional independence in postoperative patients following Hepatectomy.

CONCLUSION

Early initiation of physiotherapy following left Hepatectomy significantly contributes to improved postoperative outcomes, including enhanced pulmonary function, reduced pain, improved cardiovascular stability, and faster functional recovery. A structured and progressive rehabilitation approach facilitates early mobilization and independence in activities of daily living, thereby minimizing postoperative complications. This case emphasizes the importance of incorporating physiotherapy as an essential component of multidisciplinary postoperative care.

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