Significance of physiotherapy post thoracotomy

Many people who suffers from orthopedic, cardiopulmonary or neurology problems go to physical therapy seeking help. Physiotherapy is considered to be an important aspect of full recovery stages. It is an art and science which contributes to the development of heath. Physical therapy is one of the most important professions in the health care community where it can help the patients to recover through rehabilitation programs and exercises. The importances of physical therapy are represented in improving the quality of life for the patient, and returning the patient to his normal life without difficulties in performing his activity of daily living (ADL'S) (1, 2). Also, physical therapy helps in the prevention of impairments and limitations of activities, promotion of the general health of the patient, and providing post-operative care after surgery (3, 2, 4). Following any surgery, the patient must take physiotherapy in order to increase his endurance and functional independence (2). More over, physiotherapy interventions can be used in assisting for the prevention and treatment of the complications whether it is a pulmonary or musculoskeletal after major surgeries (5). One of these major surgeries is thoracotomy. Thoracotomy is a surgical procedure where an incision is made in the chest wall to reach the thoracic organs (6). It can be done either laterally or anteriorly in order to enter the lungs, heart, esophagus, and major blood vessels (7). Thoracotomy can be done for several reasons such as: removing blood clots from the chest, removing a portion or entire lung, repairing the heart or the vessels of the lung and heart, and removing pus from the chest (8). Also, it is needed with collapsed lung, pneumothorax, emphysema, and with several situations like stab or gunshot wound that is located in the chest (7). Dealing post-operatively with thoracotomy is considered to be hard because this

procedure is very painful so that it prevents the patient from breathing effectively causing pneumonia or atelactasis (8). Regarding to that, physiotherapy is very important post-thoracotomy. Physiotherapy can help patients post-thoracotomy in reducing the length of hospital stay, and improving the general fitness of the patient (9). Furthermore, physical therapy can clear the secretion and improve the chest wall mobility for those patients by breathing exercises and encourage them to cough (10). In addition to that, physiotherapists will make sure that these patients can walk independently by themselves or if they need another member to help them (10). Also, patient's ability to ascend and descend the stairs will be assessed before going back home (10).

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Body of knowledge:

As mentioned above, there are some diseases or situations that may lead to thoracotomy surgery. One of these diseases is pneumothorax. Pneumothorax is defined as air leaking to the space that is located between the lungs and the chest wall (11). This air will lead the lung to be collapsed (11, 12). There are many causes that can lead to pneumothorax. Pneumothorax can be caused chest injuries and some medical procedures such as fractured rib, knife or gun shot wounds, car crash, insertion of chest tubes, and procedures using a scope down the throat and into the lung (11, 12). Also, underlying lung disease which causes the lung to be damaged leads to lung collapse. These diseases include cystic fibrosis, emphysema, chronic obstructive pulmonary disease, pneumonia, asthma, lung cancer, and other lung infections (11, 12). Moreover, ruptured of the air blisters is one of these

causes (11). These air blisters appears on the top of the lung and there is no apparent reason of the appearance of these blisters (11). Rupture of these air blisters can occur from the change in the air pressure like scuba diving, flying, and mountain climbing (11). Further more, severe pneumothorax can be caused by the mechanical ventilation for the breathing process (11). The mechanical ventilator works on pushing and pulling the air inside and out side the lung (11). This can lead to imbalance in the air pressure of the chest and that will cause the lung to be completely collapsed (11). Pneumothorax has three types. First one is traumatic pneumothorax that is caused by penetrating chest wound (knife stab) (12, 13, 14). Second one is spontaneous pneumothorax, which is caused by emphysema or other lung disease (12, 13, 14). The last one is tension pneumothorax where the leaking air will cause a compression on

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the chest structures and it can be caused by trauma, lung infection, and medical procedure (12, 13, 14). Moving to the sign and symptoms that are caused by pneumothorax, they involved sharp sudden chest pain that doesn’t become worse by breathing (11, 12). This pain is felt at the site of affected lung where it can lead to tightness in the chest that is felt by the patient (11, 12). Also, the symptoms contain mild or severe shortness of breath (11, 12). And that will be determined by having any underlying lung disease and depending on the extent of the collapse in the lung (11, 12). In addition to that, pneumothorax symptoms may include: rapid heart rate, rapid breathing, cough, fatigue, and skin cyanosis (bluish color) because of decreasing in the oxygen levels in the blood (12). There are some risk factors

that contribute in developing pneumothorax. Some of these factors are: the gender and age of the patient where men age range between 20 and 40 years who are tall and thin are more likely to develop pneumothorax than women does (12, 11). More over, risks of pneumothorax are increased by cigarettes smoking, genetic factors where it can cause a certain type of pneumothorax, and history of previous pneumothorax (11). Any individual may develop another pneumothorax after two or three years of having an old one (11). It can be developed either in the same or the other lung (11). After discussing the risk factors of pneumothorax, complications will be now debated. Complications of pneumothorax resulted from an injury or a disease may include: recurrence of pneumothorax and persistent air leak (11). This leaking air is resulted from the lung opening that fails to close where it requires surgery in order to close that leaking (11). And, in the case of severe pneumothorax, complications may involve: cardiac arrest, respiratory failure, low blood oxygen levels, and shock (11).

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Pneumothorax can be identified or diagnosed by examining the chest using stethoscope where it shows the decreasing or the absent in the breathing sounds (12). This examination can be supported by chest x-ray to confirm the existence of pneumothorax (12, 11). In certain situations, computerized tomography can be used in order to give detailed images (11). Regarding to the treatment of pneumothorax, it

rely on the severity of the disease (11). The goal of this treatment is represented in relieving the pressure that lies on the lung, preventing

recurrences, and give the lung its freedom to re-expand again (11). In case of small pneumothorax the treatment contains bed rest so that the collapse is not aggravated and it will be resolved by itself within one to two weeks (11, 12). While in case of larger pneumothorax, which is companion of underlying lung disease, chest tube is used (12, 11, 14). This chest tube is located between the ribs to the area that is filled by the air which compresses on the lung (11). The chest tube works on the removing that air from the chest cavity and it can be kept for hours or days (11). Chest tube may have some complications such as pain, infection, hemorrhage, and fluid accumulation in the lung (12). In certain situations, chest tube cannot do the desired job so that surgery is required (11, 12). Some of these situations are bronchopleural fistula (leaking that doesn’t close), failure of lung re-expansion, and recurrent spontaneous pneumothorax (12, 11). Example of the surgical options involves thoracotomy (13). Pneumothorax prognosis depends on two important things: extent and type of pneumothorax (12). As mentioned before, small pneumothorax doesn’t need treatment (12). But the other type (larger pneumothorax), leads to 15% of mortality rate so that it needs urgent and immediate treatment (12). Both types of pneumothorax create a recurrence rate about

40% (12). Shifting to another disease stage that also may requires thoracotomy. This

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disease is hemothorax disease. Hemothorax is an accumulation of blood in the pleural cavity which is a space located between the chest wall and the

lung (15, 16). The main cause that can leads to the development of hemothorax is a trauma to the chest (15, 16, 14). This trauma leads to a rupture for the serous membrane that covers the lung or line the thorax causing the leakage of blood to the pleural cavity (15). Other causes of hemothorax may include patients with a defect of blood clotting, placement of central venous catheter, death of lung tissue, lung or pleural cancer, and tuberculosis (15). This disease is associated by many signs and symptoms such as chest pain low blood pressure, rapid heart rate, shallow breathing, shortness of breath, and restlessness (16). Also, the symptoms may include tracheal which means a deviation to normal side, cyanosis, decreased or absent of breath sounds on the affected side, and possibility of subcutaneous emphysema (15). Every disease is accompanied by complications. In hemothorax, the complications that are associated with it may involve pneumothorax, shock, fibrosis or scarring of the pleural membrane, and death. Hemothorax diagnosis can be done using several tests like chest x-ray, CT scan, pleural fluid analysis, and thoracentesis (16). After diagnosing hemothorax, immediate intervention should be taken to stop the bleeding and removing the blood from the pleural cavity (15). Removing that blood is the job of the chest tube which is inserted in the chest wall in a procedure that is tube thoracostomy (16, 15). The blood that is existing in the chest can be thickened and clot in the pleural cavity or within the chest tube (16). That will cause retained hemothorax in the plural cavity or occlusion of chest tube (16). As pneumothorax, if the chest tube fails in the control of the bleeding, thoracotomy surgery is necessary in order to control and stop the bleeding (15). Regarding to the prognosis of hemothorax, it rely on the cause and the

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quick treatment for hemothorax. If hemothorax doesn’t be treated, the collected blood will place a pressure on the mediastinum and the trachea (15). And this pressure will play a role in causing the deviation of trachea to normal side (15). Last disease that will be discussed is lung cancer. Lung cancer is a disease where an uncontrolled growing of the cells in the lung tissue occurs (17). This disease is the leader of the death in 1. 3 million men and women worldwide (17). In case of the cancer that develops in the airway, it can causes obstruction in the air flow leading to difficulty in breathing (17). Because of this obstruction, the secretion will be accumulated and will cause pneumonia (17). Lung cancer can be caused by carcinogens like tobacco smoke that leads to synergistic effect and cause lung cancer. Also, viruses can cause lung cancer by affecting the cell cycle and by the inhibition of apoptosis which plays a role in the uncontrolled cell division. There are two main types of the lung cancer: non-small-cell lung carcinoma and small-cell lung carcinoma. It is important to determine the type of the cancer because depending on that, the treatment will vary. Sometimes non-small-cell lung carcinoma is treated by a surgery that is called lobectomy in the early stage. While in small-cell lung carcinoma using chemotherapy and radiation are more effective and give better results. Having lung cancer is associated by some signs and symptoms. These signs and symptoms involve shortness of breath, hemoptysis that means coughing up blood, wheezing when listening to the chest, fatigue, and loss of appetite. Moreover, chest pain or abdomen pain, weight loss, dysphagia where the patient face difficulty in swallowing, and dysphonia which means having a

hoarse voice. This disease can be diagnosed by the chest radiograph and the CT scan. In order to detect the lung cancer early, examining of the patients sputum with other screening examination are necessary. Lung cancer treatment contains several ways:

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surgery, chemotherapy, and radiation therapy. For the prognosis of the lung cancer, it is poor for the both main types. There are some prognostic factors that may affect the prognosis. In non-small-cell lung cancer, these factors include the pulmonary symptoms, tumor size, cell type, and vascular invasion. And in the small-cell lung cancer, the factors are the performance status, gender, and the stage of the disease (17). All of these diseases may require thoracotomy surgery. Regarding the thoracotomy surgery here in Kuwait, the most common surgery that is performed normally during thoracotomy is the lobectomy surgery where it means removal of a whole lung lobe. Thoracotomies surgeries usually take 3 to 4 hours (8). During the procedure, the patient will be under general anesthesia and he will be lying on his side with an elevation of his arm (7, 8). Then an incision will be made (7, 8). If it is an anterior thoracotomy, the incision will be vertical from the base of the neck to the lower end of the sternum (7). And if it is a lateral thoracotomy, the incision will be between two ribs from the front to the back where the ribs will be spread from each other (7, 8). In some cases part of the ribs will be removed (7, 8).

Lateral thoracotomy

Anterior thoracotomy

After that, chest tube will be inserted when the procedure is done in order to ensure and allow the blood and the air to get out from the chest (7, 8). Finally, stitches will be used to close the incision and the chest will be bandaged to avoid the infection (7, 8). Following thoracotomy, the patient will stay at the hospital for 5 to 10 days unless

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complications have been developed (8). Some of these complications are: bleeding, infections, blood clots, and severe pain (8, 7, 6). The risk of these complications may be increased by several factors such as previous stroke or heart attack, age, trauma, and heavy smoking (8). AS any surgery thoracotomy patients will receive post-operative care. At the hospital, the patient will be on IV lines and tubes and he will receive antibiotics, pain medicine, anti nausea drugs. And the patient will be referred to the physical therapy (8). After being discharged from the hospital, the patient must follow some guidelines in order to help in early recovery. Some of these guidelines are drinking plenty of fluids, avoid smoking, and avoid environments that have germs or chemical irritants (8). Most of the patients are worried about returning to the work after the surgery. While working some activities should be avoided like lifting or pushing heavy objects until he completely recovers and the incision completely healed (8). Also, patient should avoid prolonged standing for several weeks (7). Moreover, the patient must contact his doctor in case of any of the following occurs: difficulty in breathing, coughing up yellow, green or bloody mucus, severe vomiting, excessive bleeding and increasing in pain (8).

PT Role:

Back to the role of physiotherapy, it is very important in enhancing the patient’s health after thoracotomy surgery. Physiotherapy interventions will cover three main areas: chest care, general mobility, and home advices (18). Regarding to the chest care, any individual who is undergoing major surgery will develop chest problems (18). These chest problems will occur either if the patient has or has no history of smoking and chest problems (18). There are many reasons behind the development of these problems after thoracotomy surgery. These reasons include: the anesthetic gases

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where they work on increasing the amount of secretion production, making the patient breaths shallowly, and making the patient cough less effectively of the gluey secretion (18). Also, the operation itself is one of these reasons. While performing thoracotomy surgery, the lungs are not fully inflated so that they need to be re-expanded following the surgery (18). Other reasons are the wound and the patient posture where the feeling of the discomfort may leads to the inhibition of the deep breathing and coughing effectively, and the patient’s posture also leads to chest problems. Slumped posture whether it was in sitting or lying can leads to the inability of taking full deep breath. In addition to all that reasons, decreased in the activity level of the patient considered to be one of the chest problem reasons. This decrease in the level of the activities after the operation can cause an accumulation of the secretion and the shallow breathing. In order to recover and prevent the chest problems, the physiotherapist will give the patient a variety of breathing exercises like segmental breathing exercise and sustained

breathing exercise. And these exercises must be done in the up right position. Also, physiotherapists will teach the patient the effective way of coughing in order to get rid of the secretion. In addition to that, the patient will be taught how to use the spirometer to increase the amount of inhaled and exhaled air. Moving to the general mobility that can also aids in the prevention of the chest problems and other complications. Following the surgery, physiotherapist will make the patient sit out of the bed in a chair to enhance and increase the depth of breathing. Then, the physiotherapist will work on making the patient walks as soon as possible. Walking exercises helps in the airway clearance, taking deep breath, and increasing the patient's strength after thoracotomy surgery. Day by day the physiotherapist will increase the amount of walking. Also, shoulder mobility is one of the mobility

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exercises that will be given to the patient. Shoulder mobility on the affected side is an important exercise that must be done after the surgery to help in the improvement of the range of motion and in the prevention of the joint stiffness. Moreover, physiotherapist will provide the patient with postural exercises and advices because he will lean toward the operated side in order to decrease the pain. This leaning will lead to a neck and back pain and stiffness. So being in the up right position will prevent that pain and stiffness. When it's the time to return back home and being discharged, the physiotherapist will give the patient a home program. After being discharged, the patient must continue with the exercises that he was doing

with the physiotherapist in the hospital. The patient must keep on doing the breathing exercises

to enhance the function of the lungs. Also, the patient must not stop the shoulder and the postural exercises so that the therapist makes sure that the movement will be maintained. Finally, the patient has to continue with the walking exercise and gradually increase its amount and he also can climb stairs to improve his strength (18). There are some studies that were done in order to prove the effectiveness of the physiotherapy post-thoracotomy surgery. Back in the year 2006, Ganzalo Varela and others did a study. This study was done to evaluate the influence of implementing a routine program of intensive chest physiotherapy on post operation respiratory morbidity and hospital costs in a series of pulmonary lobectomy patients during thoracotomy. 639 patients were asked to stop smoking before 3 weeks from the surgery. Subjects were assigned into control and physiotherapy treatment group. Before starting the physiotherapy program, patients were encouraged by the nurses to ambulate and to perform deep breathing maneuvers using incentive spirometer. The physiotherapy program was started before one day of surgery till the discharge day.

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During the physiotherapy program, the patients were using a treadmill and an ergometer bicycle under the supervision of the physiotherapist. Using the treadmill and the ergometer bicycle helps in performing an effective cough and deep inspiratory maneuvers. Also, the program contains arm and shoulder exercises to prevent upper extremity impairment. The outcomes

that were studied were the occurrence of post operative pulmonary complications (pneumonia and atelectasis), post operative death, and the length of hospital stay. Regarding the length of stay, it was measured from the admission date to the discharged date. The results of the study were positive. Concerning the mortality rate, it was lower in the physiotherapy treatment group (0. 8% in physiotherapy group, 3. 5% in the control group). And for the rates of the

pneumonia and atelectasis, they were also lower in the physiotherapy treatment group. Rates of pneumonia were 5% in physiotherapy group, and 9. 2% in the control group. For the atelectasis rates, they were 2% in the physiotherapy group and 7. 7% in the control group. Finally concerning the length of stay, its median was 5. 73 days (range, 3-22 days) in the physiotherapy group and 8. 33 days (range, 3-40 days) in the control group (19). Another study was done in the year 2008, in order to look for the physiotherapy effectiveness in the reduction of the post operative pulmonary complications, pain, and lenght5 of stay. The subjects were assigned to a group that receive physiotherapy treatment or a group that receive an information sheet only. And the results of the study were proving the effectiveness of physiotherapy interventions (20).

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Conclusion:

According to the previous discussion and studies, the physical therapy has a role in preventing and treating the patient’s problems post- thoracotomy surgery. From the preventive side, the physiotherapists work on eliminating,

decreasing, and preventing the impairments and the limitations of the patient’s activity. These limitations and impairments can be developed after the surgery if there was no care or if they have been neglected. Because of that, the physiotherapists are taking these preventions in order to limit those limitations and impairments. And from the treatment side, the physiotherapists are giving the patients treatment exercises that help in solving and treating the complications that already develop after thoracotomy or any surgery. These complications are the chest problems either it was secretion production, decreased chest expansion.

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