DRAINAGE OF HEPATIC HYDROTHORAX USING CENTRAL VENOUS CATHETER WITH PLEURODESIS BY DOXYCYCLINE

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Abstract:

Objectives: The purpose of this study was to assess the effectiveness of the use of the small bore CV-Line (CV-catheter) as a tool for draining the pleural cavity in cases of hepatic hydrothorax (HH), and the effectiveness of using doxycycline as a sclerosing agent in these cases. Method: in this study 35 patients with liver cirrhosis, complicated by pleural effusion (hydrothorax), treated by draining the hydrothorax by inserting CV-line in the affected pleural space, then after complete evacuation of the pleural cavity, doxycycline injected intrapleural via the CV-line. Results: in all patients draining the hydrothorax via the CV-line was successful. however, the success rate of using doxycycline as a sclerosing agent in these cases was > 77%, which is an accepted success rate in these patients. Conclusion: drainage of HH using CV-catheter is effective, and chemical pleurodesis in these patients using doxycycline carry accepted results.

Introduction

Hepatic hydrothorax (HH) is defined as significant pleural effusion, usually greater than 500 ml, in a patient with cirrhosis of the liver with no primary cardiac or pulmonary disease. Its development is not associated with any particular cause of cirrhosis. (Bitar et al., 2008) Pleural effusion occurs in approximately 6% of patients with cirrhosis of the liver and clinical ascites. (Glazer et al., 2000)In most cases (85%) hepatic hydrothorax develops on the right side, with 13% of cases occurring on the left side and 2% being bilateral. (Strauss and Boyer, 1997) & (Cardenas et al., 2004) Although the exact mechanisms involved in the development of hepatic hydrothorax are not well defined. (Cardenas and Arroyo, 2007) There are several proposed mechanisms to explain how HH may develop in end stage liver disease (ESLD) patients. The presence of synthetic liver dysfunction, hypoalbuminemia and decreased oncotic pressure are nearly universal in ESLD patients. But, The absence of HH in most ESLD patients and its right-sided predominance makes this mechanism difficult to rectify. Increased flow and elevated pressure in the azygous vein and thoracic duct due to portal hypertension are common in ESLD patients but similar to above, these mechanisms cannot explain the uncommon nature and right-sided HH predominance. (Haas and Machuzak, 2009) also, The presence of portal hypertension, the accumulation of ascites, and subsequent fluid translocation through
diaphragmatic fenestrations is a suggested cause of this complication, as a Large diaphragmatic defect has been identified by some authors using the magnetic resonance imaging. (Haas and Machuzak, 2009) & (Ajmi et al., 2004) But, this still not explaining the presence of pleural effusion without ascites which reported in many cases. (Bitar et al., 2008)

The definitive treatment of HH due to ESLD is liver transplantation, other modalities of treatment are being used either as a bridge to liver transplantation or being the only available treatment option if liver transplantation is not possible; these includes: medical treatment in the form of Sodium restriction and diuretics, Transjugular intrahepatic portosystemic shunt (TIPS), repair of defects in the diaphragm, pleurodesis either by video-assisted thoracocopy or intrapleural injection of a sclersing agent. (Cardenas and Arroyo, 2007) & (Conklin et al., 2000) chest tubes should not be placed or event contraindicated in hepatic hydrothorax because of the significant morbidity and mortality associated with the procedure. (Orman and Lok, 2009) & (Runyon et al., 1986) pleurodesis is one of the common methods to treat HH, Pleurodesis is intended to achieve symphysis between the parietal and the visceral pleurae to prevent accumulation of either air or fluid in the pleural space. Indications for this procedure include malignant effusion, recurrent spontaneous pneumothorax, and recurrent benign pleural effusions. (Walker-Rennard et al., 1994) Since 1935, the year in which Bethune reported the application of talc into the pleural space to provoke adhesions, more than 30 agents have been proposed as sclerosants to induce pleurodesis. (Rodriguez-Panadero and Antony, 1997) Among the various types of sclerosing agents talc, tetracycline, doxycycline, or bleomycin are the commonly used. (Light, 2002) Doxycycline has been used and evaluated in numerous clinical trials, achieving a mean success rate of 76% as sclerosing agent for pleurodesis, and the usual dose is 500mg, it’s one of cheapest sclerosing agents. (Antunes et al., 2003) doxycycline has a capacity to inhibit matrix-degrading metalloproteinases and to promote unopposed collagen and fibrin deposition in the inflamed pleural space. (Hurewitz et al., 1993) Over the last few years, the use of small bore (8 – 14 F) wire guided (Seldinger) chest drains has become increasingly common. The British Thoracic Society recommended small bore catheters for the treatment of pneumothoraces and malignant effusions. (Antunes et al., 2003) & (Henry et al., 2003)

Material and Methods:

This study included 35 patients with liver cirrhosis and large unilateral pleural effusion, the study done in El-Mabara (Misr Al-Qadema) hospital and Banha University hospital, between December, 2007 to January, 2010. all patients were subjected to:

- Clinical examination and history taking
- Chest X-ray and chest CT, ECG
- CBC, Liver function tests, and kidney function tests
- Abdominal ultrasound
- Full coagulation profile
- Chemical, Cytological and pathological examination of the pleural fluid.

**Exclusion Criteria for patients include:**
- Patients with chest disease other than the pleural effusion
- Patients in whom the pleural effusion could be caused by a disease other than liver cirrhosis
- Patients with bilateral pleural effusion
- Patients with suspected loculated effusion
- Patients with renal failure or abnormal kidney functions
- Patients with chest wall deformities.
- Patients sensitive to doxycycline.

**Technique of the Procedure:**
- Using a 16 G central venous catheter, on a sterile tray.
- The procedure done while the patient is laying in semi-recumbent position with bed-back elevated to 60°, and elevation of the ipsilateral arm above the head (with or without assistance of a nurse)
- The 6th intercostal space, in the mid-axillary line is the chosen site for catheter insertion, is marked before skin sterilization
- Skin sterilization by povidine-iodine
- Using ordinary 10 ml syringe, infiltration of the chosen site with 5-10 ml of 1% lidocaine, the infiltration includes the subcutaneous tissues, muscles and the parietal pleura, with aspiration before every injection, and injection continued till pleural fluid comes back in the syringe
- Waiting for 5 minutes, till the local anesthetic work. At that time the CV-line syringe is tested and 3-way (Stop-cock) valve attached to the terminal end of the port of the CV-line and kept opened, and a 10ml syringe attached to its side port.
- The CV-line syringe is used, inserted through the chosen site and negative pressure is applied till pleural fluid comes back into the syringe
-Using Seldinger’s technique, while the syringe is in-place the guide-wire is inserted by its J-shaped end through the metal central part of the syringe, till it enters the pleural cavity, then the syringe removed while the guide-wire in place

-The dilator of the CV-line set is used to dilate the area around the guide-wire, then the CV-line catheter passed over the guide-wire till it enters the pleural cavity and advanced more for about 5 cm, then the guide wire withdrawn while the catheter left in place

-Just before withdrawing the final part of the guide-wire the free port of the 3-way valve closed, while the side port is opened

-An intravenous infusion set is connected to the free port of the 3-way valve, and the free end of the infusion set connected to the line of a urinary bag with non-return valve, and ensuring that they are fitting well together and being air-tight

-Aspiration is done through the 10 ml syringe (that connected to the side port of the 3-way valve), till the fluid comes at ease then the free port of the 3-way valve (that connected to the line of the urinary bag) is opened to allow free flow of the pleural fluid to the urinary bag, the side port of the 3-way valve closed, the syringe connected to it removed and the port closed by its plastic cover.

-The CV-line marked over the skin by a silk suture over it, and its remaining part is wrapped over a piece of gauze, then fixed to the skin by a piece of wide medical plaster tape

-The connection between the wide end of the infusion set and the line of the urinary bag fixed with a piece of medical plaster tape.

-Chest X-ray is done.

-The drainage noted and recorded every day, flushed with 10ml of normal saline if blocked, daily dressed and when the drainage is ≤100 ml day, a plain chest X-ray is done, if the lung inflated with no pleural effusion, 150mg of lidocaine injected intrapleural, then after 5 minutes 500mg of doxycycline added to normal saline in 60ml syringe … then, injected into the pleural space through the CV-line, which disconnected from the line of the urinary bag, then the CV-line closed 4 hours, during which the patient advised to do rotational maneuvers, after that CV-line removed.

-Chest X-ray done after one week, if there is pleural effusion in the same side, this is considered as failure of the procedure.

-Follow-up X-rays after one month and three months are done for all cases.

**Results:**

-Table (1) summarizes the results of the study.
The age rage of the studied cases was 39-68 years with mean age of 54.14 ±8.77, 28 males and 7 females with 4:1 male to female ratio. (Fig.1)

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Table (1)

-31 cases (88.6%) had right sided pleural effusion and 4 cases (11.4%) had left sided pleural effusion. (Fig. 2)

-The duration of pleural drainage ranged from 4-10 days, with mean of 7.29±1.4, and the amount of total drainage ranged from 4700-12400 ml, with a mean of 7837.14±1802.79. (Fig. 3)
21 of these cases (60%) had no complications, 5 cases (14.28%) had chest pain and fever and 13 cases (37.14%) complained of recurrent local pleuretic pain.

Figure (1)

Figure (2)
Figure (3)

Figure (4)
-The results of the procedure were successful in 27 cases (77.1%) and failed in 8 cases (22.9%) (Fig. 4)

-X-rays that done after one and three months for all successful cases showed no new accumulation of any pleural fluid in the same side.

**Statistical Method:**

Statistical Package of Social Science (SPSS) version 11.0 was used for analysis of data.

**Discussion:**

This study was designed to evaluate the effectiveness of the small bore CV-line in draining the pleural cavity as well as to evaluate the effectiveness of the intrapleural doxycycline as a sclerosing agent. In our study we used small bore CV-line (16 F) to drain HH, and injecting 500mg of doxycycline as a sclerosing agent to induce pleurodesis. Using a small bore catheter for draining the pleural cavity and sclerotherapy in our study was successful and effective method, and the same results regarding this point obtained by Parulekar et al., who compared the efficacy of ultrasound guided small bore (12 F) catheters with standard large bore chest tubes in the drainage and sclerotherapy of malignant pleural effusions. (Parulekar et al., 2001) In our study the amount of total drainage ranged from 4700- 12400 ml, with a mean of 7837±1802, and the duration of pleural drainage ranged from 4-10 days, with mean of 7.29±1.4 there was a great variation of the amount of pleural drainage and duration of hospital stay in different studies, in one study done by Davila F., one of the patients (who was treated by chest tube drainage and pleurodesis using tetracycline) had a period of hospital stay of 40 days, and the total amount of drainage in that period was 83 L. (Davila, 1988) In our study the observed complications were in the form of chest pain, and fever. 5 cases (14.28%) had chest pain and fever and 13 cases (37.14%) complained of recurrent local pleuretic pain, which is accepted percent in comparison with the pain and fever result from chemical pleurodesis as reported by Walker-Renard et al., who showed that chest pain varies from 7 to 43% and fever from 10 to 59% in most cases treated by chemical pleurodesis. (Walker-Renard et al., 1994) also, our reported complications of the use of doxycycline as sclerosing agent not far from the results obtained by Porcel et al., who reported pain (36%), fever (8%) in his study, there was no pneumothorax reported in our cases while in Porcel et al., study pneumothorax occurred in (6%) of the cases. (Porcel et al., 2006) There was no serious complications from pleurodesis using doxycycline in our study, unlike DeBardino et al., who reported acute respiratory failure after pleurodesis using doxycycline. (DiBardino et al., 2002) The success rate in our study of pleurodesis using doxyxcline in hepatic hydrothorax was 77.1% (27 cases), which little bit less that the result of El-Badrawy and Mohamed as the success rate in their study of pleurodesis using doxycycline in hepatic hydrothorax was 85%. (El-Badrawy and Mohammed, 2006) But, this little difference may be due to that El-Badrawy and Mohamed gave their patients a second trial if there is a new collection after one week. and if pleurodesis not achieved after the second trial this was
considered failure in their study, while in our study there was no second trial and if pleurodesis not achieved after only one trial this was considered failure in our study.

**Conclusion:**

From this study we can come to the conclusion that, draining the pleural cavity in cases of hepatic hydrothorax using the small bore CV- catheter is effective method for drainage and doesn’t carry any morbidity or mortality unlike the chest tube drainage in these patients which carry high morbidity and mortality. The use of doxycycline as a sclerosing agent to induce pleurodesis in these patients carry accepted success rate, with no serious complications.

**References:**


