

## Is Pig-Tail Catheterisation a Better Option than Conventional Chest-Tube Drainage in Pleural Effusion?

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Pleural effusion is defined as a collection of fluid in the pleural cavity. Based on Light's criteria [1] and the underlying pathophysiology, this fluid may be transudative or exudative. In transudative pleural effusion, fluid accumulates in the pleural space due to increased hydrostatic pressure or decreased oncotic pressure across the intact capillary beds of pleural membranes [2]. In contrast, in exudative pleural effusions the capillary beds show increased permeability due to the underlying disease process, resulting in fluid leak into the pleural space [3].

In the adult population, cirrhosis of the liver and congestive cardiac failure are the commonest causes of transudative pleural effusions, while lung cancer, bacterial pneumonia and pulmonary embolism are responsible for more than 90% of exudative pleural effusions [4].

Empyema is defined as the presence of pus in the pleural cavity, most commonly caused by superadded infection of a long-standing pleural effusion (eg. tuberculous pleural effusion) or secondary to a bacterial pneumonia, while a lung abscess is a necrotic lesion of the pulmonary parenchyma usually due to pyogenic organisms, resulting in a thick-walled or thin-walled cavitation. Lung abscess may also occur due to necrosis and consequent cavitation within a malignant tumor mass.

Pleural effusion, empyema, and lung abscess are common clinical conditions that have been treated by antibiotics or by the placement of an intercostal drainage tube. A wide-bore thoracostomy tube is conventionally used for draining pleural fluid. However, the use of a thoracostomy tube has its own share of risks as these tubes, placed by either blunt dissection or by trocar assistance, may have significant morbidity.

With advancement in medical therapeutics, minimally invasive surgical procedures involving image-guided small percutaneous drainage tubes also known as pigtail catheters, have now been used in patients with pleural effusions and lung abscess because of their effectiveness in drainage of pleural fluid and the significantly low morbidity associated with the procedure [5-7].

In retrospective trials [8,9] conducted to determine the efficacy of pigtail drainage, time of clearance of the pleural effusion and duration of hospital stay following pigtail catheterisation was similar to that in patients treated with tube thoracostomy, while pain levels were significantly lower in the pigtail group when compared with the ICD group [8]. This is because, while the average intercostal space in an adult (measured at the 5th intercostal space in the mid-axillary line) is  $8.8 \pm 1.4$  millimeters, a pigtail catheter is comparably significantly smaller in size (2.8 mm), and so does not impinge on the neurovascular bundle or alter the geometry of the intercostal space [9]. In sharp contrast, a 24 F chest tube has an outer diameter of 8 mm, while a 32 F chest tube has an outer diameter of about 11 mm. Therefore, thoracostomy tubes, with their large size vis-à-vis the intercostal space, cause significant pain [10] by compressing on the neurovascular bundle which is present along the lower border of the upper rib.

In addition, the pigtail catheter also facilitates greater patient mobility post-procedure, as compared to the conventional intercostal chest tube.

In spite of the overall favorable response to the use of pigtail insertion in the treatment of pleural effusion, a proper patient selection is vitally important for the success of this procedure. In our experience, we have noticed that pigtail catheterisation is successful if inserted in patients with free-flowing simple pleural effusions. Following drainage of fluid, as the partially collapsed lung re-expands and abuts on the pigtail catheter, lung contusion does not occur due to the thin nature of the pigtail, unlike with the use of an intercostal chest tube where the large tube abutting on the re-expanding lung causes pain and sometimes lung injury.

In lung abscess, a 10F or 12F locking pigtail catheter is suitable for drainage of fluid from the abscess cavity and is definitely preferred over a thoracostomy tube due to its smaller lumen size.

Overall, a pigtail catheter definitely reduces morbidity by reducing the level of pain, chances of superadded infection, and the possibility of a fibrous pleural reaction, in a patient requiring pleural fluid drainage. Moreover, it also facilitates greater patient mobility post-procedure.

However, it is also our observation that if a pigtail catheter is inserted for drainage of thick pleural fluid, or an empyema, it invariably blocks the narrow lumen of the pigtail catheter after a short period of time, thereby rendering further drainage of fluid slow and ineffective. Hence, in these cases an intercostal drainage tube is preferred due to its large lumen size, which facilitates proper fluid drainage.

The pigtail catheter is also of limited use in the treatment of malignant pleural effusions, as the ability to perform talc pleurodesis through the catheter is restricted and the thick hemorrhagic nature of the fluid invariably leads to blockage of the tube after a short period of time. Also, malignant pleural effusions tend to rapidly refill, which slows the process of drainage through the narrow-lumen pigtail catheter.

In patients with trauma leading to a hemothorax or a hemopneumothorax, a pigtail catheter is generally not useful due to the presence of blood which soon blocks the catheter. Also, if there is the added danger of a tension pneumothorax in these patients, a pigtail catheter is ineffective in rapidly draining the air from the pleural cavity, and tube thoracostomy is urgently required in such cases.

In patients with multi-loculated effusions it is better to aspirate (tap) the fluid from the different loculated sites as more than one pigtail catheter insertion is generally not recommended. Moreover, in such multi-loculated conditions, due to the long-standing nature of the effusion, the fluid is generally thick or pus-like, which tends to block the narrow lumen of the pigtail catheter after a short period of time.

In conclusion, while a pigtail catheter certainly reduces morbidity in a patient requiring pleural fluid drainage, patient selection is of utmost importance for the success of this procedure.

It is most successful if inserted in a patient with a free-flowing simple pleural effusion where the fluid is not too thick or pus-like, not too large in quantity, and not rapidly refilling. However, it is unsuitable in draining multi-loculated effusions, empyemas, large and rapidly refilling malignant pleural effusions, and hemothorax or hemopneumothorax secondary to trauma.

### Conflict of Interest

We declare no conflict of interest.

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