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Role of Pigtail Catheter in Patients with Encysted Empyema and in Pleurodesis of Patients with Malignant Pleural Effusion

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ABSTRACT

Background: The use of pigtail catheter has developed as a viable choice for thoracostomy tube being less invasive, less painful and fewer procedure-associated complications.
Aim of The Work: To assess the role of pigtail catheter in encysted empyema and compare the use of it versus the chest tube in pleurodesis in candidates with malignant pleural effusion.
Patients and Methods: There were 60 patients in this study, divided into two groups: Group I included 20 patients with encysted empyema and a pigtail catheter was placed using chest ultrasonography guidance. Group II included 40 patients with malignant pleural effusion who were subdivided into two groups: Group IIA included 20 patients who had a pigtail catheter inserted under the guidance of chest ultrasonography until the pleural effusion was completely drained, after which the pleurodesis with povidone-iodine was performed. Group IIB included 20 patients who had a chest tube implanted until the pleural effusion was completely drained, after which the pleurodesis with povidone-iodine was performed.
Results: As regards the role of pigtail catheter in encysted empyema showed successful drainage in 85% of the studied patients with fewer complications. And as regard role of it in pleurodesis in patients with malignant pleural effusion showed the same efficacy, more safety and fewer complications than a chest tube.
Conclusion: The use of a pigtail catheter to drain encysted empyema and malignant pleural fluid might be regarded a safe, simple, and successful approach. And we recommend it in draining that fluid.

Keywords: *Encysted empyema; pigtail; Pleurodesis; Malignant pleural effusion.*

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INTRODUCTION

The abnormal collection of fluid in the pleural space is known as pleural effusion. A pleural effusion is usually abnormal and signals the existence of a serious underlying condition.[1] Empyema is a dynamic condition that has a high rate of morbidity and death. The best method to decrease morbidity and death, as well as health-care costs, is to prevent it from progressing through proper assessment and intervention.[2] Malignant pleural effusion (MPE) is a prevalent consequence of advanced cancer; it is a typical clinical concern in these patients and is linked to a poor prognosis and reduced quality of life.[3] In most institutions, tube thoracostomy is still the mainstay of therapy for uncomplicated effusions. Because the insertion of a large bore chest tube is an intrusive surgery with the risk of morbidity and difficulties, a small-bore pigtail catheter may be preferable.[4] Pigtail catheters, which are more flexible and have a smaller diameter, have recently evolved as a viable option to thoracostomy tubes. Because it is a less traumatic operation, it causes less pain and leaves fewer scars during and after the surgery, as well as probably fewer procedure-related problems.[5]

The purpose of this research was to evaluate the role of a pigtail catheter in encysted empyema and compare it with a chest tube in pleurodesis in patients with malignant pleural effusion.

PATIENTS AND METHODS

This study was conducted between October 2019 and October 2021, on 60 patients attended and admitted to El-Hussein University Hospital and Damanhour Chest Hospital. They were studied during the time of the study. All patients had a comprehensive medical history taken, thorough clinical examination, plain chest X-ray, routine laboratory blood tests, and chest CT scan, after which the selected candidates were established into two groups: Group I: This group had 20 participants with encysted empyema which was diagnosed clinically, radiologically and pleural fluid analysis including physical, chemical and bacteriological examinations of pleural fluid. B-mode ultrasonography was used to determine the location

and quantity of effusion in each patient. A 12–14 French pigtail catheter was inserted percutaneously using the Seldinger method through ultrasound guidance. A hollow needle trocar connected to a syringe was used to pierce the pleura, and pleural fluid was sucked to verify placement. The syringe was removed and a guide wire was advanced through the needle lumen. The guide wire stayed in place while the needle was removed and a dilator was passed over the guide wire to enlarge the opening through which the catheter would be placed. Next, the dilator was removed, the pigtail was uncoiled, and the catheter was threaded over the guide wire into the pleural space. Finally, the guide wire was removed as the distal end of the catheter curling inside the chest. The catheter was then connected to a drainage device till complete drainage of the fluid and lung radiologically re-expanded against the chest wall by chest X-ray and ultrasound. Follow up of the drained fluid volume every day till stoppage of drainage or decreased drainage then chest X ray and ultrasound were done to confirm that there was no more fluid to be drained and to check for septations, to assess for catheter removal. The patient was discharged and had a one-month clinical and radiological follow-up with a chest x-ray and ultrasound (to confirm successful or failed drainage guided by the re-accumulation of empyema).

Group II: This group consisted of 40 patients who had a malignant pleural effusion 20 patients of them were diagnosed on basis of cytopathological examination of the pleural fluid only then the pigtail catheter was inserted using the Seldinger procedure (group IIA), while the other 20 patients were diagnosed on basis of cytopathological examination of the pleural fluid (4 patients) and histopathological examination of the pleural tissue biopsies using the medical thoracoscopy (16 patients) and then the chest tube was inserted (group IIB). All patients in group II were followed up until the volume of the drained pleural fluid drop to 100 mL or less per day and the lung re-expanded guided by radiological assessment (chest x ray and ultrasound), at which pleurodesis with povidone-iodine was performed. Patients were followed up clinically and radiologically by chest ultrasonography and chest X-ray after 24 hours till removal of the tube or pigtail catheter. Patients were then discharged and followed up weekly for one month, then monthly for three months to check for recurrence of effusion and failure of pleurodesis. Pleurodesis is considered successful if no effusion recurrence occurs within three months. The following factors were examined while determining the efficacy of pleurodesis: Pleural effusion resolves completely in a complete response (CR). Symptomatic loculated effusion appears as a partial response (PR). No response (NR): Pleural effusion has re-accumulated to a level similar to that reported at the presentation.

Ethical consideration: Patients' or their families signed written informed consent according to The Research Ethical Committee, Faculty of medicine Al-Azhar University. Across the research, privacy and secrecy were preserved and the intervention outcomes were written to the subjects or their family.

Statistical analysis**:** Data were fed to the computer and analysed using IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp). Qualitative data were described using numbers and percentages. The Kolmogorov- Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. The significance of the obtained results was judged at the 5% level.

Inclusion criteria: group I included any patient with encysted free flowing empyema, group II included any patient with malignant pleural effusion who planned for drainage.

Exclusion criteria: multiple loculations with no free flowing pus by ultrasound which no benefit from drainage and need surgery, atelectasis due to endobronchial obstruction, hemorrhagic blood diseases, Bronchopleural fistula and Tuberculous pleural effusion.

RESULTS

This research had 60 patients who were separated into two groups, Group I: This group included 20 patients with encysted empyema in which pigtail catheter was inserted for drainage of pus. The effectiveness and risks of pigtail catheter insertion in the treatment of encysted empyema were investigated.

Demographic data		Studied patients (N = 20)
Sex	Male	15 (75%)
	Female	5 (25%)
Age (years)	Mean ± SD	57 ± 11.1
	Min – Max	35 – 70
Smoking	Smoker	11 (55%)
	Non-smoker	9 (45%)

Table 1: Description of demographic data in Group I patients.

Clinical Data		Studied patients (N = 20)	
Risk factors	No Risk factors	7	(35%)
	DM	12	(60%)
	Postictal	5	(25%)
	Postoperative	4	(20%)
	Mental retardation	1	(5%)
Duration of drainage (/day)	Mean ±SD	6 ± 1.6	
	Min – Max	3 – 10	

Table 2: Description of risk factors and duration of drainage per day in Group I patients.

Complications of pigtail	Studied patients (N = 20)	
No complications	11	55%
Blocked catheter	2	10%
Dislodged catheter	1	5%
Pneumothorax	2	10%
Chest pain at site of insertion	4	20%

Table 3: Description of complications of pigtail catheter drainage in group I patients.

		Studied patients (N = 20)	
Outcome at discharge	Failed drainage	3	(15%)
	Successful drainage	17	(85%)
Outcome after 1 month	Failed drainage	2	(10%)
	Successful drainage	18	(90%)

Table 4: Description of outcome of pigtail catheter drainage in group I patients.

Group II: This group included 40 patients with malignant pleural effusion 20 patients of them had a pigtail catheter insertion (group IIA) while the other 20 patients had a chest tube insertion (group IIB).The effectiveness and complications of pigtail catheter vs chest tube in pleurodesis of malignant pleural effusion were investigated.

		Group IIA (N = 20)		Group IIB (N = 20)		Stat. test	P-value
Age (years)	Mean ± SD	61.05 ± 6.7		64.6 ± 6.04		T = 1.77	0.083 NS
	Min - Max	48 - 70		55 - 76			
Sex	Male	8	40%	13	65%	X^2 = 2.5	0.113 NS
	Female	12	60%	7	35%		
Smoking	Smoker	10	50%	12	60%	X^2 = 0.4	0.525 NS
	Non-smoker	10	50%	8	40%		

Table 5: Description of demographic data in group II patients

		Group IIA (N = 20)		Group IIB (N = 20)		Stat. test	P-value
Duration of drainage (days)	Mean ± SD	6.25 ± 1.2		7.1 ± 1.6		MW = 144	0.134 NS
	Min - Max	4 – 8		5 – 10			
Hospitalization	Yes	2	10%	20	100%	X^2 = 32.7	< 0.001 HS
	No	18	90%	0	0%		

Table 6: Description of duration of drainage per day and the need for hospitalization in group II patients

This table shows: No statistically substantial variation (p-value = 0.134) between group IIA and group IIB as regard duration of drainage till pleurodesis. But there is high statistically substantial (p-value < 0.001) increased percentage of need for hospitalization in group IIB (20 patients, 100%) when compared with group IIA (2 patients, 10%).

Complications	Group IIA (N = 20)		Group IIB (N = 20)		X^2	P-value
No complication	12	(60%)	0	(0%)	17.1	< 0.001 HS
Blocked catheter or tube	2	(10%)	2	(10%)	0.0	1.0 NS
Dislodged catheter or tube	1	(5%)	3	(15%)	1.11	0.292 NS
Pneumothorax	2	(10%)	2	(10%)	0.0	1.0 NS
Chest pain at site of insertion	3	(15%)	20	(100%)	29.6	< 0.001 HS
Wound infection	0	(0%)	4	(20%)	4.44	0.035 S

Table 7: Complications of pigtail catheter and chest tube drainage in groups IIA and IIB patients

This table shows: Highly statistically substantial (p-value < 0.001) increased percentage of no complications in group IIA (12 patients, 60%) when compared with group IIB (0 patients, 0%). Highly statistically substantial (p-value < 0.001) increased percentage of chest pain at insertion site in group IIB (20 patients, 100%) when compared with group IIA (3 patients, 15%). Statistically substantial (p-value = 0.035) increased percentage of wound infection in group IIB (4 patients, 20%) when compared with group IIA (0 patients, 0%). No statistically substantial variation (p-value > 0.05) between IIA group and IIB group regarding the following complications: blocked catheter or tube, dislodged catheter or tube and pneumothorax.

Outcome of pleurodesis after 3 months	Group IIA (N = 20)		Group IIB (N = 20)		X^2	P-value
No response	1	(5%)	1	(5%)	0.23	0.891 NS
Partial response	2	(10%)	3	(15%)		
Complete response	17	(85%)	16	(80%)		

Table 8: Outcomes of pleurodesis after 3 months in groups IIA and IIB patients

This table shows no statistically substantial variation (p-value = 0.891) in group IIA and group IIB as regard Outcome of pleurodesis after 3 months.

DISCUSSION

The purpose of this research was to evaluate the role of a pigtail catheter in encysted empyema and compare it with a chest tube in pleurodesis in patients with malignant pleural effusion.It was tested on 60 patients who were split into two groups:

Group I: this group had 20 patients with encysted empyema and pigtail catheter was inserted guided by chest ultrasound. 15 patients (75%) were males and 5 patients (25%) were females, 11 patients (55%) were smokers while 9 patients (45%) were non-smokers and their ages ranged between 35 years and 70 years old with 58.33 years mean age (Table 1).

As regards of patients risk factors 12 patients (60%) were DM, 5 patients (25%) were postictal, 4 patients (20%) were postoperative and 1 patient (5%) was mentally retarded patient while there were 7 patients (35%) without risk factors (Table 2). This correlated with Lemmer et al., [6] which showed that Diabetes increases the chance of pleural infection, and risk variables for aspiration (seizures, mental retardation, alcohol usage, and sedative medication use) also enhance the risk of empyema. Approximately one-third of cases occur with no known risk factors.

As regards the duration of drainage per day in this studied group, the mean duration of drainage per day was 6 ± 1.6 days with three days is the minimum and ten days is the maximum time (Table 2).This correlates with the studies of Liu et al., [9] that reported a mean period of drainage of 6.1 days in empyema.

In this study complications of pigtail were blocked catheter in 2 patients (10%), dislodged catheter in 1 patient (5%), pneumothorax in 2 patients (10%) which resolved spontaneously through the same catheter and chest pain at the site of insertion requiring analgesia in 4 patients (20%) while there were no complications in 4 patients (20%) of this studied group (Table 3).

The study by Bediwy and Amer, [8] reported that Pain during pigtail catheter insertion (45.09 percent), pneumothorax (19.6 percent), and catheter obstruction were all reported as problems (3.92 percent) and infection (1.96%). Ahmed et al., [7] reported that most common complications associated with pigtail catheter insertion were obstruction, infection, dislodgment and wound haemorrhage.

In this study, the outcome of the patients was 17 patients (85%) who had successful drainage and 3 patients (15%) who had failed drainage. And follow up after 1 month and good antibiotic coverage 18 patients (90%) showed successful drainage and 2 patients (10%) showed failed drainage (Table 4).

Other trials' success rates with pigtail catheters were similar to ours. In parapneumonic effusion and empyema, Liu et al., [9] discovered that pigtail catheter insertion was successful in 72.2 percent.

In another research, Liang et al., [5] found that in the ICU, the rate of success of ultrasound-guided pigtail catheter draining of pleural effusions was greatest while treating traumatic heamothorax (100%), postoperative pleural effusions (85%), complex parapneumonic effusion, and empyema (82 percent).

Group II: This group included 40 patients with malignant pleural effusion 20 patients of them had a pigtail catheter insertion (group IIA) while the other 20 patients had a chest tube insertion (group IIB).

The mean age in group IIA was 61.05 ± 6.7 years while in group IIB it was 64.6 ± 6.04 years. In group IIA there were 8 males (40%) and 12 females (60%) while in group IIB there were 13 males (65%) and 7 females (35%) (Table 5)

In this study as regard duration of drainage till pleurodesis, it was 6.25 ± 1.2 days in group IIA while it was 7.1 ± 1.6 days in group IIB and as regard need for hospitalization in group IIA (2 patients, 10%) needed hospitalization because of their comorbidities, their need for oxygen supply and catheter complications, while in group IIB (20 patients, 100%) needed hospitalization with highly statistically substantial variation between two groups (Table 6)

This correlates with the study of Farrag et al., [10] which noted that when evaluating the tube and catheter durations of both groups, there was a statistically substantial variation between them, with the tube lasting 11.52±1.90 days and the pleural catheter lasting 4.48±1.73 days. And there was a highly statistically substantial distinction between the two groups when it came to the need for hospitalization, as all patients with a chest tube were hospitalized and all patients with a small bore catheter were discharged to home, except one patient who required admission due to complications.

In this research regarding complications of pigtail catheter and chest tube there was highly statistically substantial distinction between two groups as regard no complications in group IIA in 12 patients (60%) and in group IIB 0 patients (0%), chest pain at the insertion site in group IIA 3 patients (15%) and in group IIB 20 patients (100%) and wound infection in group IIA 0 patients (0%) and in group IIB 4 patients (20%). And as regard blocked catheter or tube, dislodged catheter or tube and pneumothorax there were no statistically substantial distinctions between the two groups (Table 7).

This correlates with Saeed et al.,[11] who reported that pigtail complications were present only in six (18.2%) patients and were in the form of pigtail obstruction in one (3%) patient, chest pain in one (3%) patient, and obstruction and pain together in four (12.1%) patients. No extrapleural catheter placement no perforation of intrathoracic organs, no perforation of abdominal organs, no diaphragmatic laceration, no empyema and no pulmonary oedema were noted.

In this study as regards the outcome of pleurodesis, In group IIA there was no response in 1 patient (5%), partial response in 2 patients (10%) and complete response in 17 patients (85%) while in group IIB there was no response in 1 patient (5%), partial response in 3 patients (15%) and complete response in 16 patients (80%) with no statistically substantial distinction across two groups (Table 8). This correlates with Caglayan and Torun, [12] who reported that 83% of patients had a complete response and 10% of patients had a partial response and 7% of patients had no response according to CXR and chest sonography findings 4 months after pleurodesis through pigtail catheter.

CONCLUSION

Pigtail catheter insertion is an effective and safe method of draining encysted empyema**.**

Pigtail catheter could be considered a safe, easy, tolerable and effective alternative method in comparison to the traditional intercostal tubes in pleurodesis of malignant pleural effusions.

Conflict of interest : none

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