



Original Research Article

Complications of therapeutic thoracentesis with respect to time

T.V. Uday Krishna¹, V Venkateswara Rao^{1,*}, Syed Umer Ahmed¹, B Vishwanath¹¹Dept. of Pulmonary Medicine, Govt. Medical College and Hospital, Nizamabad, Telangana, India

ARTICLE INFO

Article history:

Received 06-02-2021

Accepted 15-02-2021

Available online 25-02-2021

Keywords:

Pneumothorax

Pulmonary oedema

Thoracentesis.

ABSTRACT

Background : Thoracentesis can be done for both therapeutic and diagnostic purposes, with the objective of symptomatic relief and improve of quality of life due to dyspnoea. The underlying mechanism for symptom relief following thoracentesis is multifactorial but principally includes progress in respiratory muscle mechanics with a smaller effect from progress in lung volumes and pulmonary function.

Materials and Methods : This is prospective and randomized study was carried out on 90 patients who were admitted to the Department of Pulmonary Medicine, Govt. Medical College and Hospital, Nizamabad during the period of February 2020 to October 2020. Inclusion Criteria: The patients with chest X-ray features suggestive of pleural effusion and undergoing therapeutic thoracentesis. Exclusion Criteria: Patients known to have loculated effusion on ultrasonography and having bleeding diathesis were excluded from the study.

Conclusions : Most complication of thoracentesis is unprecedented. Clinician consciousness of risk factors for procedural complexities and experience with techniques that improve results are fundamental segments for carefully performing thoracentesis.

© This is an open access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

1. Introduction

Thoracentesis is normally called as a chest tap or pleural tap, is a method where extra pleural fluid is removed from the pleural space for therapeutic and diagnostic purposes, with the objective of symptomatic relief and improve of quality of life due to dyspnoea. The needle is introduced into pleural space between lungs and chest wall. It could be done to decide the reason for pleural effusion. A few conditions, for instance, lung diseases, heart attack and tumours can cause pleural effusions.¹

Thoracentesis is a usually performed procedure for therapeutic or diagnostic purposes in up to 173,000 cases in the United States.² Though it is generally considered safe and has a low risk during the procedure, complications have been reported. Iatrogenic pneumothorax is the most common complication following thoracentesis, leading to increased morbidity, mortality, and health care costs due to

increased length of hospital stay.³ It requires the insertion of a chest tube for up to 4 days in up to half of the cases, further increasing hospital stays, resulting in an additional increase in cost of approximately 18,000 dollars.⁴

Previous studies have reported the incidence of thoracentesis-related pneumothorax as 4–30% without the use of ultrasound and 1.3–6.7% with the use of ultrasound.⁵ A systematic review and meta-analysis of 24 studies, including a total of 6,605 cases that received thoracentesis, reported an overall 6.0% incidence of pneumothorax.⁶ However, there are a few studies of the incidence of pneumothorax in patients in emergency department (ED) settings, where thoracentesis is commonly used.

Clinical practice that incorporates system changes focused on high-quality training, referrals to experienced practitioners and team-centered procedure care have been shown to reduce complications following thoracentesis.⁷ A recent study of 9,320 thoracentesis in 4,618 patients

* Corresponding author.

E-mail address: 1977vvr Rao@gmail.com (V. V. Rao).

has reported a 0.61% incidence of thoracentesis-related pneumothorax.⁸ Accordingly, routine chest radiography may not be required following thoracentesis in asymptomatic patients in cases where the primary purpose of post-procedural radiography is to identify thoracentesis-related pneumothorax. However, the low incidence of pneumothorax observed in this previous study may not apply to general populations as all thoracentesis were performed by expert practitioners.

A therapeutic thoracentesis is done to relieve symptoms, for instance, dyspnoea, to relieve hemodynamic compromise or to clear the pleural space of contamination.⁹ The therapeutic thoracentesis is regularly accomplished utilizing a temporary catheter that is taken out at the finish of volume removal. These orders are frequently obscured in fact that an underlying goal might be done to give both analysis and relief of symptoms. It is sensible to consider maximal expulsion of pleural effusion if an aspiration is previously appearing. With this mentality, a diagnostic thoracentesis would possibly be performed if a therapeutic aspiration were undependable, not feasible, or under other irregular conditions.

2. Materials and Methods

This is prospective and randomized study was carried out on 90 patients who were admitted to the Department of Pulmonary Medicine, Govt. Medical College and Hospital, Nizamabad, India during the period of February 2020 to October 2020. An IEC approval and written informed consent was obtained from study subjects.

2.1. Inclusion criteria

1. Patients of either gender with more than five years old.
2. The patients with chest X-ray features suggestive of pleural effusion and undergoing therapeutic thoracentesis.
3. Patients are willing to participate in the study.

2.2. Exclusion criteria

1. Patients whose age < 5 years.
2. Patients known to have loculated effusion on ultrasonography and having bleeding diathesis were excluded from the study.
3. Patients are not willing to participate in the study.

2.3. Procedure

Thoracentesis is generally takes 10 to 15 minutes, except if patients have a more pleural fluid in pleural space. For the process, most patients sit peacefully on the edge of a chair or bed with their head and arms laying on a table. Physician utilizes ultrasound to decide the best area to inject the needle. After cleaning the skin around the zone where

the needle to be inserted, Physician are infused anaesthetic drug. A needle is inserted between ribs into the pleural space. Patients can sense some uneasiness or pressure when the needle is inserted. As Physician draws out extra fluid from around lungs, patients may sense like chest pain or coughing. The needle is removed, and a little bandage are applied at the site.

After the procedure, patients' BP and breathing are checked. The fluid that are taken out from chest are sent for testing to diagnose the reason for pleural effusion and plan of treatment. Physician may request a chest X-ray to check for lung issues. The risk of thoracentesis consists of collapsed lung, pneumothorax, bleeding, pain, wound, or bruising. Liver or spleen wounds are occasional complications.

3. Results

In our study, the most of the patients the age group of 41-60 years i.e., 33 out of 90 (36.6%), followed by 41-60 years, i.e., 21 out of 65 (32.3%) in Table 1.

Table 1: Distribution of different age groups of patients

Age in years	No. of patients	Percentage
1-20	8	8.8
21-40	27	30.0
41-60	33	36.6
>61	22	24.4
Total	90	100

Table 2: Distribution of gender

Gender	No. of patients	Percentage
Male	54	60.0
Female	36	40.0
Total	90	100

In Table 2, maximum number of patients were male 54 (60.0%) and female 36 (40.0%) in our study.

Table 3: Complications of therapeutic thoracentesis within 0 – 30 minutes

Complications	N (%)
Chest Pain	33 (36.6)
Sudden Dyspnoea	17 (14.4)
Pernicious cough, Chest tightens, Frothy pink Sputum, Vomiting, dyspnea, Cyanosis	3 (2.2)
Cough	9 (10.0)
Reduce Blood Pressure	8 (8.8)
Pulse rate (Mean ± SD)	90.21 ± 8.73

In Table 3, in our study 33 of the cases had chest pain within 0 – 30 minutes after the procedure. Sudden dyspnoea was seen in 17 patients, only 3 patients had pernicious cough

and cough was noted in 9 patients. Total 8 patients were had reduced blood pressure.

Table 4: Complications of therapeutic thoracentesis within 2 hours

Complications	N (%)
Chest Pain	1 (1.1)
Pernicious cough, Chest tightness, Frothy pink sputum, Vomiting, dyspnoea, Cyanosis	1 (1.1)
Cough	2 (2.2)
Reduced blood pressure	7 (7.7)

In Table 4, within 2 hours complication such as chest pain and pernicious cough was seen in only in 2 patients, 2 patients had cough, 7 patient's experienced decreased blood pressure.

Table 5: Complications of therapeutic thoracentesis after 24 hours

Complications	N (%)
Chest Pain	1 (1.1)
Dyspnoea	2 (2.2)
Fever	1 (1.1)

In Table 5, in our study after 24 hours of the procedure, chest pain was noted one patients, dyspnoea in two patients and fever in one of the patients.

4. Discussion

The most well-known problem of thoracentesis is pneumothorax. A wide range of pneumothorax rates has been revealed in the literature (0%-39%). Other complications consist of breathlessness, pain, vasovagal responses. More uncommon however serious complications are pulmonary oedema, bleeding, and incidental organ puncture.⁹ Now-a-days, the complication rate related with thoracentesis has diminished with the utilization of ultrasound (US) direction, right site selection, experience team, and strict follow to the universal protocol.¹⁰ Observation of these safety measures has considered performance of thoracentesis on a wider range of patients without increased problems, incorporating those with underlying bleeding risk and patients with bilateral pleural effusion. The following will following current advances in thoracentesis procedure safety, indication relief following thoracentesis, and comprehension of the physiologic basis for such upgrades.¹¹

In our study was mainly undertaken to study the complications of the therapeutic thoracentesis, total 36.6% of the patients in routine procedure belonged to 41 – 60 years age group followed by aged between 21 – 40 years were 30%. Maximum number of patients in our study were male.

In our study, 0-30 minute's chest pain, dyspnoea, cough and reduced blood pressure was seen. The signs of re expansion pulmonary oedema also noted. After two hours of

the procedure, dyspnoea, signs of re-expansion pulmonary oedema, cough hematoma was seen. After 24 hours of the procedure, chest pain was noted in 1 patients, dyspnoea in 2 patients and fever in 1 patients.

According to Perazzo et al., had demonstrated that, the significant difficulties happened in 14% of the routine procedure and minor in 33% of the cases.¹² The significant problems included splenic laceration, pneumothorax, and sheared off catheter. Minimal consist sign of pain, re-expansion pulmonary oedema, dry taps and subcutaneous fluid collections.¹³ Patel et al., revelled that the re-expansion oedema was noted in 2 of 941 procedures.¹⁴ Another study by Josephson T et al had demonstrated that, 2% had hematoma and 7% had pneumothorax in a group of patients with hematologic malignancy.¹⁵

According to Cavanna et al., noted that site pain, pneumothorax and cough were the common complications of the thoracentesis.¹⁶ A study by Sirotkin et al., had reported that, the sonography guided technique was related with significantly with less serious complications (0 of 19) than the needle-catheter (9 of 18) or needle-only methods (5 of 15).¹⁷ The sonography-guided technique was related with less pneumothorax (0 of 19) than the needle-catheter (7 of 18) or needle-only methods (3 of 15). The contrast between needle-catheter and needle-only strategies was insignificant.¹⁸

5. Conclusions

Thoracentesis have significant effect on symptom relief and physiological parameters. Alterations in the way to deal with thoracentesis have considered improved safety. The state of the art of approach to thoracentesis includes utilization of US, insertion of the pleural space in the triangle of safety, and utilization of a dedicated group of practitioner's experts. Utilizing this methodology, expectedly high-risk patients, including those with supposed bleeding risk and bilateral effusions, may possibly be dealt with all the more quickly.

6. Acknowledgement

None.

7. Source of Funding

No financial support was received for the work within this manuscript.

8. Conflict of Interest

The authors declare they have no conflict of interest.

References

- Gordon CE, Feller-Kopman D, Balk EM. Pneumothorax following thoracentesis: a systematic review and meta-analysis. *Arch Intern*

- Med.* 2010;170:332–9.
2. Mercaldi CJ, Lanes SF. Ultrasound Guidance Decreases Complications and Improves the Cost of Care Among Patients Undergoing Thoracentesis and Paracentesis. *Chest.* 2013;143(2):532–8. doi:10.1378/chest.12-0447.
 3. Puchalski JT, Argento AC, Murphy TE, Araujo KLB, Oliva IB, Rubinowitz AN, et al. Etiologies of bilateral pleural effusions. *Respir Med.* 2013;107(2):284–91. doi:10.1016/j.rmed.2012.10.004.
 4. Goligher EC, Leis JA, Fowler RA, Pinto R, Adhikari NKJ, Ferguson ND, et al. Utility and safety of draining pleural effusions in mechanically ventilated patients: a systematic review and meta-analysis. *Crit Care.* 2011;15(1):R46. doi:10.1186/cc10009.
 5. Mokotedi CM, Balik M. Is the mechanism of re-expansion pulmonary oedema in a heart–lung interaction? *BMJ Case Rep.* 2017;p. 1–5. doi:10.1136/bcr-2017-219340.
 6. Labidi M, Baillot R, Dionne B, Lacasse Y, Maltais F, Boulet LP, et al. Pleural effusions following cardiac surgery: prevalence, risk factors, and clinical features. *Chest.* 2009;136(6):1604–11.
 7. Vetrugno L, Bignami E, Orso D, Vargas M, Guadagnin GM, Saglietti F, et al. Utility of pleural effusion drainage in the ICU: An updated systematic review and META-analysis. *J Crit Care.* 2019;52:22–32. doi:10.1016/j.jcrc.2019.03.007.
 8. Schildhouse R, Lai A, Barsuk JH, Mourad M, Chopra V. Safe and Effective Bedside Thoracentesis: A Review of the Evidence for Practicing Clinicians. *J Hosp Med.* 2017;12(4):266–76. doi:10.12788/jhm.2716.
 9. Cantey EP, Walter JM, Corbridge T, Barsuk JH. Complications of thoracentesis: incidence, risk factors, and strategies for prevention. *Curr Opin Pulm Med.* 2016;22(4):378–85.
 10. Lentz RJ, Lerner AD, Pannu JK, Merrick CM, Roller L, Walston C, et al. Routine monitoring with pleural manometry during therapeutic large-volume thoracentesis to prevent pleural-pressure-related complications: a multicentre, single-blind randomised controlled trial. *Lancet Respir Med.* 2019;7(5):447–55. doi:10.1016/s2213-2600(18)30421-1.
 11. Wilcox ME, Chong CA, Stanbrook MB, Tricco AC, Wong C, Straus SE. Does this patient have an exudative pleural effusion? The Rational Clinical Examination systematic review. *JAMA.* 2014;18(23):2422–2453.
 12. Perazzo A, Gatto P, Barlascini C, Ferrari-Bravo M, Nicolini A. Can ultrasound guidance reduce the risk of pneumothorax following thoracentesis? *J Bras Pneumol.* 2014;40(1):6–12. doi:10.1590/s1806-37132014000100002.
 13. Mercaldi CJ, Lanes SF. Ultrasound Guidance Decreases Complications and Improves the Cost of Care Among Patients Undergoing Thoracentesis and Paracentesis. *Chest.* 2013;143(2):532–8. doi:10.1378/chest.12-0447.
 14. Patel PA, Ernst FR, Gunnarsson CL. Ultrasonography guidance reduces complications and costs associated with thoracentesis procedures. *J Clin Ultrasound.* 2012;40(3):135–41. doi:10.1002/jcu.20884.
 15. Josephson T, Nordenskjold CA, Larsson J, Rosenberg LU, Kaijser M. Amount drained at ultrasound-guided thoracentesis and risk of pneumothorax. *Acta Radiol.* 2009;50(1):42–7. doi:10.1080/02841850802590460.
 16. Cavanna L, Mordenti P, Bertè R, Palladino M, Biasini C, Anselmi E, et al. Ultrasound guidance reduces pneumothorax rate and improves safety of thoracentesis in malignant pleural effusion: report on 445 consecutive patients with advanced cancer. *World J Surg Oncol.* 2014;12(1):139. doi:10.1186/1477-7819-12-139.
 17. Wand O, Levy Y, Natour A, Sirotkin T. Fatal consequences of therapeutic thoracentesis in patients with systemic sclerosis. *Sarcoidosis Vasc Diffuse Lung Dis.* 2020;37(3):e2020006.
 18. Zielinska-Krawczyk M, Krenke R, Grabczak EM, Light RW. Pleural manometry—historical background, rationale for use and methods of measurement. *Respir Med.* 2018;136:21–8. doi:10.1016/j.rmed.2018.01.013.

Author biography

T.V. Uday Krishna, Assistant Professor

V Venkateswara Rao, Associate Professor

Syed Umer Ahmed, Senior Resident

B Vishwanath, Assistant Professor

Cite this article: Krishna TVU, Rao VV, Ahmed SU, Vishwanath B. Complications of therapeutic thoracentesis with respect to time. *IP Indian J Immunol Respir Med* 2021;6(1):40-43.