KHALID'S MANEUVER; A NEW APPROACH TO GROCCO'S SIGN IN PATIENTS WITH PLEURAL EFFUSION

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ABSTRACT

Objective: To compare the usefulness of Grocco's sign with an alternative method, Khalid's maneuver, which does not require any change in patient's position to elicit Grocco's sign.
Study Design: A comparative prospective study.
Place and Duration of Study: Combined Military Hospital Lahore, from Jan 2019 to Jul 2019.
Methodology: A total of 200 patients who were divided into two groups (group A and group B) with 100 patients in each group. Group A was a control group. Group B was subdivided into group B1 containing patients with serous pleural effusion and group B2 containing patients with empyema. Two independent operators were asked to do chest percussion in all patients to elicit Grocco's sign. Furthermore Positional method and Inspiratory method (Khalid's maneuver) to elicit disappearance of dullness in Grocco's triangle were compared in patients with positive Grocco's sign Statistical significance & 95% confidence interval was calculated using nonparametric unpaired t test (Mann-Whitney U-Test).
Results: Grocco's sign was negative in all patients in group A while it was positive in all patients in group B. In group B1 patients, the percussion dullness disappeared in Grocco's triangle in 48 (96%) (95% CI 93.2-98.1) patients by the positional method and 46 (92%) (95% CI 90.1-95.6) patients by Khalid's maneuver with statistically insignificant *p*-value i.e. 0.44. In group B2 patients, the percussion dullness failed to disappear by both methods.
Conclusion: Grocco's sign helps in assessment of the patients with simple and complex pleural effusion and thus guiding further management decisions early in time. Khalid's maneuver which has the ability to elicit Grocco's sign with near similar accuracy provides handy alternative for such patients with comparable *p*-value to the standard procedure.

Keywords: Empyema thorax, Grocco's sign, Khalid's maneuver, Paravertebral triangle pleural effusion.

INTRODUCTION

Pleural effusion is the excess of fluid in the pleural cavity. Under normal circumstances, the pleural space contains only small amounts of serous fluid which facilitate sliding of the two pleural surfaces during respiration[1]. The estimated prevalence of pleural effusion in industrialized countries is 320 per 100,000 population[2]. The pleural fluid may be serous, exudative or purulent and can develop spontaneously or it can be by product of various thorax, abdominal or gynecological diseases[3,4].

Accumulation of pus in pleural cavity is called empyema. The British Thoracic Society (BTS) guidelines differentiate a simple effusion from a complicated effusion and empyema based upon different pleural fluid characteristics including pleural fluid PH, Lactate Dehydrogenase (LDH), glucose and presence or absence of organisms on gram stain or culture[5]. When the pleural fluid accumulation exceeds 500 ml, it usually becomes clinically detectable. Amongst all the clinical signs percussion dullness is the most accurate for detection of pleural effusion. Simple percussion, however, cannot differentiate a serous effusion from empyema, a differentiation that holds immense importance for health and prognosis of the patient. The two noninvasive investigations to confirm the presence of pleural effusion are plain x-ray chest and ultrasound[6].

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Though ultrasound chest is a better technique for confirming as well as quantifying pleural effusion however CT chest is a well-established modality especially in patients being managed in intensive care[7,8]. Thoracocentesis is the investigation of choice to confirm whether an effusion is simple, complicated or an empyema however differentiation between benign an malignant pleural effusion can only be made by resorting to detection of chemical markers like apolipoprotein E[9]. It is however an invasive investigation and the results usually are not rapidly available. It is therefore important to have a clinical method which could differentiate between simple effusion and empyema to guide initial management decisions.

The Grocco's sign, first described by Peter Grocco of Florence, is a useful bedside sign which can help in this regard. Peter Grocco described a paravertebral triangle of dullness on the side opposite to the effusion. Grocco's sign is the disappearance of this triangle of dullness when the patient is made to lie on the diseased side. Failure of the disappearance of dullness indicates either a larger effusion, loculated effusion or an empyema[10]. We describe a different maneuver to elicit Grocco's sign, one which does not require the patient to change position. The new maneuver makes use of Valsalva maneuver which is well known to medical professionals. We call the new maneuver Khalid's maneuver, according to which if a patient with pleural effusion is asked to perform Valsalva maneuver, the triangle of dullness disappears in simple effusion just like positional method. Khalid's maneuver has the advantage that it does not require the patient to change position and so helps those who are in severe pain or are breathless. This may also be useful in intensive care settings where patients are usually attached to many intra venous lines and monitors. The new method, however, requires more cooperation from the patients which may not be available in severely ill patients.

METHODOLOGY

This prospective comparative study was conducted in CMH Lahore, from Jan 2019 to Jul 2019 wide research review board number 177/2020 to compare Khalid's maneuver with Grocco's sign, we randomly included 200 patients by lottery method after taking their written consent. Sample of 200 was calculated keeping in view the 80% statistical power of the study and 5% statistical significance level by using formula $n = [(Z\alpha/2 + Z\beta)2 \times \{2(ó)2\}]/ (\mu1 - \mu2)^2$. Literature endorses that sample of 200 is enough is to detect the significance level of 0.5 or 5% between groups[11]. They ranged in age from 20 to 60 years and belonged to either gender. The patients were further divided into two groups. Group A contained 100 patients who did not have any detectable lung pathology on chest x-ray or Ultrasonography. Group B consisted of 100 patients with pleural effusion which had been previously quantified by Ultrasonography and the pleural fluid was quantified in the range of 1L to 4L. This group was further subdivided into two. Group B1 consisted of 50 patients with pleural effusion who had biochemically serous pleural effusion as confirmed earlier by thoracocentesis and biochemical tests. Group B2 consisted of 50 patients with pleural effusion who had biochemically proven empyema as confirmed earlier by thoracocentesis and biochemical tests. Two independent operators without prior knowledge of the diagnosis were assigned to examine these patients. They were instructed to elicit the percussion dullness and then to elicit Grocco's sign and demarcate the Grocco's triangle on the healthy side. After demarcation, both the observers were instructed

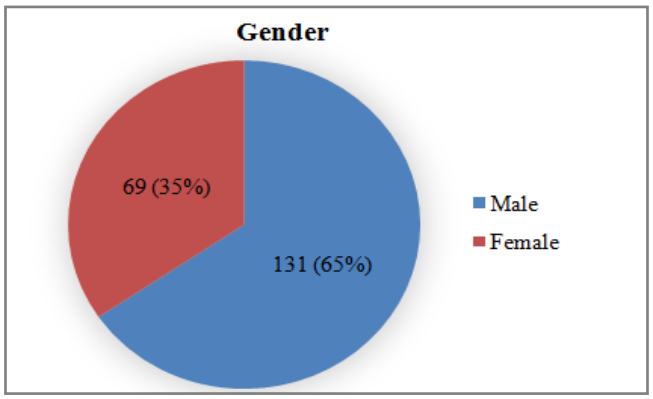

Figure: Gender distribution participants (n=200).

to elicit disappearance of dullness in the Grocco's triangle by two methods:

Positional method by asking the patient to lie down on the diseased side for one minute and then testing for dullness in the Grocco's triangle.

Inspiratory method by asking the patient to perform the Valsalva maneuver and testing for the disappearance of dullness in the triangle in phase 1 of Valsalva maneuver. We called this method "modified Grocco's test" or "Khalid's maneuver" to elicit Grocco'ssign.

Statistical Analysis

Data were analyzed through use of Statistical Package for Social Sciences (SPSS) version 20.0. Both 95% Confidence Interval and *p*-value keeping in view 5% significance level was calculated using Mann-Whitney U-Test[12]. Results of group B1 & B2 were compared for any statistical significance.

RESULTS

A total 200 patients, 131 (65.5%) male and 69 (34.5%) females were recruited in study (figure) and were randomly divided in two groups. The age of patient was between 20 years to 60 years with mean age 44.48 ± 5.338 years. No dullness was percussed in group A patients. In group B1 and B2 dullness was percussed in all patients by both observers. Grocco's sign was positive in all group B patients. In group B1 the dullness disappeared in 48 (96%) (95% CI 93.2-98.1) patients by the positional method (table-I) and 46 (92%) (95% CI 90.1-95.6) patients by Khalid's maneuver (table-II). In group B2 the dullness failed to disappear by both methods. There was no significant difference between both the techniques employed to elicit Grocco's sign in two groups (96% vs 92% with *p*-value <0.05) i.e. 0.44.

Table-I: Comparison of Grocco's sign by positional method vs Khalid's maneuver (n=200).

S. No.	Complaints/Conditions	Positional Method	Khalid's Maneuver	*p*-value
1.	Grocco's sign elicited	48 (96%)	46 (92%)	0.44
2.	Grocco's sign not elicited	2 (4%)	4 (8%)	
Total		50 (100%)	50 (100%)	

Table-II: Comparison of a simple effusion from a complicated effusion and empyema.

Stage	Macroscopic Appearance	Plural Fluid Characteristics
Simple	Clear fluid	PH>7.2, LDH<1000IU/L Glucose>2.2 mmol/L No organism or culture or gram stain
Complicated	Clear fluid or cloudy turbid	PH<7.2, LDH> 1000IU/L Glucose <2.2 mmol/L May be positive gram stain or culture
Empyema	Frank pus	May be positive gram stain or culture

DISCUSSION

Pleural effusion is the excess of fluid in the pleural cavity, the potential space between the visceral and parietal pleura[11]. Normally the pleural space contains only a small amount of serous fluid acting as a lubricant facilitating the effortless sliding of the two pleural layers against each other during respiration[1]. The surface tension of the pleural fluid allows close apposition of the lung against the chest wall allowing optimal inflation of the alveoli. Most of the pleural fluid is produced from the intercostal arterial circulation by bulk flow and reabsorbed by the lymphatic system forming a film about 10 mm thick. Water and small molecules pass freely between the mesothelial cells. While cytoplasmic transport can shift larger particles into the space or by pleuro-lymphatic communication. The last is poorly defined and consists of a series of stomas in the pleura and a series of dilated lymphatic vessels with regulatory valves[13,14].

The pleural fluid may be serous (transudative), exudative or purulent[14]. Light's criteria may be applied to differentiate a serous from exudative effusion. In exudative effusions, the ratio of pleural fluid to serum protein ratio is >0.5

and the ratio of pleural fluid to serum LDH is >0.6 or more than two thirds of the serum level. 25% of the patients who have transudative effusion may be spuriously misdiagnosed as exudates by light's criteria. If there is no clinical correlation with the biochemical result, the albumin level in the blood and pleural fluid should be measured. If the difference is greater than 1.2g/dL then it is a transudate[1].

The British Thoracic Society (BTS) guidelines differentiate a simple effusion from a complicated effusion and empyema according to the modified table-III[9,14].

The accumulation of pus in the pleural cavity is called empyema. The formation of pus from serous effusion passes through three distinct stages, Exudative stage when the effusion forms, fibrinopurulent stage when it loculates and organizing stage when the pleura is turned into a scar tissue and the lungs may become entrapped within the scarred pleura. When the pleural fluid accumulation exceeds 500 ml then it usually becomes clinically detectable. The clinical signs of pleural effusion are decreased chest movements on the affected side, dull to stony dull percussion, diminished intensity of breath sounds to absence of breath sounds over the effusion and decreased vocal resonance and fremitus. Above the effusion the lung is compressed and this may create bronchial breathing and egophony at this level. Amongst all these clinical signs percussion dullness is the most accurate for detection of pleural effusion[4,14].

Percussion has been a valuable sign in chest examination since the 18th century when Leopold Auenbrugger published "inventumnovum" in 1761 and he began his illustration with "I present to you charitable reader a new sign which I have discovered for detecting diseases of the chest. This consists of percussion of the human thorax, from the varying resonance of the sounds of which an opinion can be formed of the internal condition of the cavity"[10].

However, simple percussion cannot differentiate a serous effusion from empyema, a differentiation that holds immense importance not only for the health of the patient but for the clinician as well to choose the subsequent investigations and devise subsequent management.

All the above signs are well familiar to the medical professionals. Perhaps the least well known sign in physical examination of the chest is the Grocco sign, first described by Peter Grocco of Florence[8]. In present study Grocco's sign was elicited clinically by positional method in 48 (96%) versus 46 (92%) in newly introduce Khalid's manure. As positional method is quite cumbersome for patients especially in old age and trauma patient so this new technique can help early diagnosis of pleural effusion in urgent clinical settings.

The other two non invasive investigations to confirm the presence of a pleural effusion are plain x-ray chest and ultrasound although CT scan is considered a gold standard[15,16]. A plain x-ray chest can detect 75ml of fluid in the lateral view when the posterior costo-diaphragmatic recess is filled with fluid and 300ml on the PA view when the costo-phrenic angle becomes blunt. The diagphragmatic border is obscured by 500ml of fluid on the PA film and when the upper border of the effusion is at the level of the 4th rib anteriorly, it approximates about 1L of pleural fluid[17].

Ultrasound is a better technique at quantifying effusions. Ultrasound machines have advanced into light weight and compact machines and are now available in almost every medical ward for bedside examination. For optimal lung visualization an emission frequency of 5-7 MHz is desirable. The intercostal spaces offer an acoustic window to visualize the underlying pleura and lung. For better placement in the intercostal spaces the probe should be light weight and should have a convex tip[14]. The patient can be examined in the supine position but the later decubitus position is better or visualizing the posterior regions of the lower lobes. As ultrasound waves are not transmitted through air, the normal aerated lung is not visualized. Water is an excellent medium for transmitting ultrasonic waves and the ultra-

sound waves are transmitted through a pleural effusion into deeper structures[15].

The dependent lung regions are easy to visualize by ultrasound. The probe should be placed perpendicular to the ribs in the intercostal space of interest. A hyperechoic pleural line is visible approximately 0.5cm below the level of the ribs. The pleural line is formed by movement of the visceral pleura against the parietal pleura. The pleural line slides forward and backwards with respiration. In real time picture the moving pleural line with the overlying motion less parietal tissue and granular homogenous lung tissue gives the characteristic picture of waves striking the shore. This is called the "sea shore" sign[15]. Beyond this pleural line horizontal and vertical linear artifacts called horizontal A lines and vertical B lines may be visible and have no significance. The pleural effusion appears as an homogenous anechoic dark zone. In the supine position the interpleural distance between the lung and posterior chest wall is measured to quantify the pleural fluid.

Aninterpleural distance of 5cm correlates with pleural fluid of 500ml approximately. The interpleural distance can be measured at end expiration or end inspiration. Although ultrasound is very useful in quantifying effusion, it is not an accurate method for differentiating a transudate from exudate. The exudative effusion may contain echodense shadows while the transudate is echo free[14].

As CT scan is considered gold standard to diagnose pleural effusion that is why there is less focus on clinical techniques to diagnose it[18]. Extensive literature search revealed that there is no study up till this date to compare clinical examination technique or methods for pleural effusion.

CONCLUSION

Grocco's sign helps in assessment of the patients with simple and complex pleural effusion and thus guiding further management decisions early in time. Khalid's maneuver which has the ability to elicit Grocco's sign with near similar accuracy provides handy alternative for such patients with comparable p-value to the standard procedure.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Widmaier, Eric P, Vanders. Human physiology: The mechanisms of body functions, 10 ed. Mc Graw Hill 2006; 1-481.
2. Karki A, Riley L, Mehta HJ, Ataya A. Abdominal etiologies of pleural effusion. Dis Mon 2019; 65(4): 95-103.
3. Riley L, Karki A, Mehta HJ, Ataya A. Obstetric and gynecologic causes of pleural effusions. Dis Mon 2019; 65(4): 109-14.
4. Xue Q, Fang G, Deng X, Peng Z. The value of apolipoprotein E in distinguishing benign and malignant unilateral pleural effusions. Medicine (Baltimore) 2020; 99(10): e19320.
5. Fysh ETH, Smallbone P, Mattock N, McCloskey C, Litton E, Wibrow B, et al. Clinically significant pleural effusion in intensive care: A prospective multicenter cohort study. Crit Care Explor 2020; 2(1): e0070.
6. Syer T, Arnold DT, Patole S, Harvey J, Medford A, Maskell NA, et al. Investigation of a unilateral pleural effusion: What CT scan coverage is optimal? Thorax 2020; 214309: 1-6.
7. Trovato FM, Catalano D, Trovato GM. Thoracic ultrasound: An adjunctive and valuable imaging tool in emergency, resource-limited settings and for a sustainable monitoring of patients. World J Radiol 2016; 8(9): 775-84.
8. Jule B, Frankenheimer. Grocco's sign. Cal State J Med 1907; 5(9): 224-28.
9. Light RW, Mac gregor MI, Luchsinger PC, Ball WC. Pleural effusions the diagnostic separation of transudates and exudates. Ann Intern Med 1972; 77(4): 507-13.
10. Edward O, Otis. President's address: Auen brugger and leannec, the discoverers of percussion and auscultation. Trans Am Climatol Assoc 1898; 14(1): 1-23.
11. Way N. Anatomy of the pleura. Cli Chest Med 1998; 19(1): 229-40.
12. McKnight PE, Najab J. Mann-Whitney U Test. Corsini Encyclopedia Psychol 2010; 1(1): 1-2.
13. Maskell, Nick A, Laursen, Christian B, Lee YC, Rahman, et al. Pleural disease. Eur Respiratory Soc 2020; 1(1): 1-120.
14. Meriggi, Fausto. Malignant pleural effusion: Still a long way to go. Reviews Recent Clini Trial 2019; 14(1); 24-30.
15. 15 Balik M, Plasil D, Waldauf P, Pazout J, Fric M. Ultrasound estimation of volume of pleural fluid in mecha-nically ventilated patients. Intensive Care Med 2006; 32(2): 318-21.
16. Jiang B, Lian Li X, Yin Y, Zhang Q, Zang T, Song WS, et al. Ultrasound elastography: a novel tool for the differential diagnosis of pleural effusion. Eur Resp J 2019; 54(1): 22-25.
17. Bates D, Natalie Y, Bailey M, Bellomo R. Prevalence, characteristics, drainage and outcome of radiologically diagnosed pleural effusions in critically ill patients. Critical Care Resuscitation 2020; 22(1): 21-25.
18. Fusoon L, Ying CH, Yu BN, Joseph HL. Differentiate pleural effusion from hemothorax after blunt chest Trauma; comparison of computed tomography attenuation values. J Acute Med 2016; 6(1): 1-6.