A COMPARISON OF CONVENTIONAL PERCUSSION AND AUSCULTATION PERCUSSION IN DETECTING PLEURAL EFFUSIONS OF HOSPITALIZED PATIENTS

By

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A Research Project submitted in partial fulfillment of the requirements for the degree of

MASTER OF NURSING

WASHINGTON STATE UNIVERSITY

Intercollegiate Center for Nursing Education

May 1996
WE, THE UNDERSIGNED MEMBERS OF THE COMMITTEE, 
HAVE READ AND APPROVED THIS RESEARCH PROJECT

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PERCUSSION IN DETECTING PLEURAL EFFUSIONS OF HOSPITALIZED PATIENTS

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May 1996
ACKNOWLEDGMENTS

Rob, Stephanie and Michael McDermott

A special acknowledgment to those who made this academic achievement possible. They have been patient, supportive, and inspirational. I love them all very much.

Lorna Schumann PhD, ARNP

My Thesis Chairperson, advisor, mentor and friend. She has been instrumental in the learning of the Family Nurse Practitioner role, encouraging in the completion of this research project, and a role model for all of her students.

Renee Hoeksel PhD and Marian Sheafor RN, PhD

The supportive and helpful committee that assisted in the completion of this project.

Timothy Chestnut MD, FCCP

The physician that offered support, encouragement and guidance. This research project was the idea of Dr. Chestnut and inspired by his past affiliate, Dr. John Guarino. A special acknowledgment to them both.

Ronald Cocchiarella MD

He assisted in the preparation of this project and selflessly assisted in the "gold standard" of ultrasound for this research project.
Deaconess Medical Center

DMC is the institution in which this project was completed. They have donated the time of the ultrasound employees and the use of the ultrasound machine, as well as the access to the patients with pleural effusions.

All of my peers and colleagues

They have all been supportive and made the completion of the ICNE program memorable. Also, in the memory of our classmate, Sharon Deffenbaugh.
A COMPARISON OF CONVENTIONAL PERCUSSION AND AUSCULTATION PERCUSSION IN DETECTING PLEURAL EFFUSIONS OF HOSPITALIZED PATIENTS

Abstract

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The purpose of this study was to compare the efficacy of pulmonary Auscultation Percussion to Conventional Percussion in the detection of the extent of pleural effusions. The accuracy of pulmonary Auscultation Percussion is controversial, therefore this investigation attempted to determine the validity in detecting the extent of pleural effusions.

A Family Nurse Practitioner student and a Pulmonologist evaluated 14 patients with pleural effusions. A radiologist identified potential study subjects with a pleural effusion on routine chest x-rays. The patients were examined using Auscultation Percussion and Conventional Percussion to determine the exact level of the pleural effusion. The patient's back was zoned in tenths to give the level of effusion a numerical value. An ultrasound of the patient's posterior thorax during resting respiration was done to determine the exact level of the pleural effusion.

Pleural effusions of 14 patients were included in this study. The correlation between AusP and the ultrasound were statistically significant (R=.698, P=.006 on the left chest and R=.694, P=<.001 on the right side of the chest). ConP was statistically significant compared with the ultrasound on the left side of the chest (R=.680, P=.008).
However, on the right side of the chest it was not statistically significant (R=.287, P=.319). This study suggests that AusP is a more accurate tool in the detection of the extent of pleural effusion in comparison to ConP. Various speculations for the left and right discrepancy with ConP are discussed.
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Chapter 1

The incidence of pleural effusion is 800,000 cases annually in the United States (Marel, Zrustova, Stasny, & Light, 1993). Pleural effusions, unless very large, are usually asymptomatic (Tierney, McPhee, Papadakis, & Schroeder, 1995). Detection of pleural effusion is necessary to prevent further complications such as respiratory distress or failure.

The physical examination is a powerful diagnostic tool that is used for all patients entering the hospital setting. Physical examination consists of inspection, percussion, palpation and auscultation (Lauden, 1987). Traditionally, these techniques are a part of the assessment of the pulmonary system. Auscultation Percussion (AusP) is used by some practitioners to determine pleural effusions (Guarino, 1994, Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994). Research on Auscultation Percussion, although limited, is controversial (Bohadana, Coimbra, & Santiago, 1986, Bourke, Nunes, Stafford, Hurkey, & Graham, 1989, Guarino, 1994). Pleural effusions can be detected with the use of AusP (Guarino, Guarino, 1994). However, chest radiograph is the most common method used to detect pleural effusion. This study established the use of pulmonary Auscultation Percussion as a valuable diagnostic tool for detecting the extent of pleural effusion.
Specific Aims

The purpose of this study is to compare the efficacy of pulmonary AusP and Conventional Percussion (ConP) in the detection of the extent of pleural effusions. The validation of pulmonary AusP is controversial, therefore this investigation attempted to determine the value of AusP in detecting the extent of pleural effusions.

Background and Significance

AusP and ConP are viewed in the literature as both valid and invalid in the detection of pulmonary abnormality (Bohadana, Coimbra, & Santiago, 1986; Bourke, Nunes, Stafford, Hurkey & Graham, 1989; Guarino, 1974; Guarino, 1980; Guarino, Guarino, 1994; Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994; Roudebush, Sweeney, 1990). The validity in the detection of pleural effusion by AusP is more convincing than with other abnormalities (Guarino, 1994, Guarino, 1980, Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994, Bohadana, Coimbra, & Santiago, 1986). The detection of pleural effusion was investigated by several researchers using AusP, ConP, and auscultation. The ability to determine the extent of the effusion remains unresearched. The Nurse Practitioner will be able to detect pleural effusions upon physical exam and initiate appropriate diagnostics procedures to diagnose the cause. Early detection of potential threats to health will decrease morbidity and possibly mortality.
Clinical Literature Support

Pleural effusions are a result of increased hydrostatic pressure and/or oncotic pressure within the pulmonary capillaries. Hydrostatic pressure is the pressure exerted by the blood flowing through the capillaries (Guyton, 1991). An increase in hydrostatic pressure forces fluid through the capillary wall and into the pleural space, a process called transudation (Bartter, Akers, & Pratter, 1994).

Oncotic pressure is the force that pulls fluid from the vascular space into the pleural space. Increased osmotic pressure is the cause of the fluid shift known as exudation (Bartter, Akers, & Pratter, 1994). Leaky capillaries allow proteins to move into the pleural space. More than 90% of pleural effusions are due to congestive heart failure, malignancy, pneumonia, or pulmonary emboli (Marel, Zrustova, Stasny, & Light, 1993).

AusP is a method of physical assessment used to detect fluid in the chest cavity (Guarino, 1974). Abnormalities detected by this method include nodules, infiltrates, and effusions. The method involves tapping on the manubrium with the distal phalanx of the index or middle finger while auscultating the posterior portions of the chest with a stethoscope (Guarino, 1980). The sound of the tapping is referred and heard on the posterior chest. The sound heard over normal lungs is equally resonant bilaterally. Guarino stated, "the difference in sound transmission between the two sides of an abnormal chest is clear and often striking and does not require a trained ear" (Guarino, 1974, p. 193).
Guarino (1980) detected 20 abnormalities in 30 patients by AusP (Table 1). However, Conventional Percussion (ConP) detected only 3 pulmonary abnormalities in the same sample. Several case studies suggest that AusP results in detection of abnormalities that ConP and chest radiography may overlook. Guarino suggests that AusP is an important assessment technique in detecting an abnormality that prompts the physician to employ further diagnostic tests.

Guarino and Guarino (1994) reexamined the use of AusP in the detection of pulmonary effusion. A sample of 118 patients with pleural effusion noted on chest radiograph was compared to a control group of 175 randomly selected inpatients. The patients were sitting or standing in upright position for five minutes prior to AusP examination. The technique of this study differed from Guarino's first study in that the posterior trunk was percussed instead of the manubrium. AusP resulted in a sensitivity of 95.8% and a specificity of 100% in the detection of pleural effusions. The authors suggested that this method of physical examination should be incorporated into routine pulmonary assessment. They felt that this assessment would detect the presence of pleural effusions when symptomatology was absent.

HIV-Seropositive patients were examined using AusP, conventional percussion (ConP), and conventional auscultation (ConA) in an attempt to identify pulmonary abnormalities (Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994). Chest x-ray was used as the gold standard of diagnosis. The study included 63 patients with HIV (suspected or known) who were examined by physicians who were blind to existing
pulmonary abnormalities. The study concluded that AusP was the most sensitive of all of the assessment techniques with a sensitivity of 51.0 to 69.6% (among multiple examiners). The study further noted that no abnormality was detected with ConP that was not detected by ConA.

Bohadana, Coimbra, & Santiago, (1986) studied the validity of AusP and ConP. Two trained observers examined 281 inpatients, 170 men and 111 women. The patients were selected based on a chest x-ray that was taken as part of their medical regime. The sensitivity of AusP in detecting pleural abnormality was defined as the ability to identify a diseased subject. The specificity was defined as the ability to exclude disease of individuals with negative x-rays. The validity, sensitivity multiplied with specificity, was 8% and 9% (two researchers) for ConP. The validity of AusP was 9% and 13% (two researchers). The researcher concluded that the effectiveness of detecting lung abnormalities by AusP was not statistically superior to ConP. The authors noted the best results of AusP and ConP were with large pleural effusions.

A controlled blind study (Bourke, Nunes, Stafford, Hurkey, & Graham 1989), compared AusP and ConP in 50 patients randomly selected from diagnostic chest x-rays that were taken as part of the patients routine medical regime. The chest x-ray of 21 of the 50 patients was abnormal. The sensitivity of ConP was 15.4% and AusP was 19.2%. The specificity for ConP was 97.3% and AusP was 85.1%. This study suggests that ConP and AusP were limited in the ability to detect significant diseases of the chest. The abnormalities diagnosed were lesions, nodules, infiltrates, and effusions.
The literature, although conflicting, shows evidence of detection of pleural effusions by AusP in some disease processes. The detection of lesions, nodules, and infiltrates by AusP is not well founded by research. However, the ability of AusP to detect pleural effusions is documented in the literature (Bohadana, Coimbra, Santiago, 1986, Bourke, Nunes, Stafford, Hurley, & Graham, 1989, Guarino, Guarino, 1994). The literature consistently refers to the detection of lung abnormality, not to the extent of disease.

**Definition of Terms**

1. **Auscultation Percussion** - A physical assessment method of listening to changes in sound of the chest by tapping on the manubrium with the distal phalanx of the index or middle finger while auscultating the posterior portions of the chest with a stethoscope.

2. **Conventional Percussion** - A physical assessment method of direct percussion the of posterior thorax.

3. **Percussion** - A physical assessment performed by striking the finger of one hand on the finger of the other hand as it is placed over the organ being assessed.

Chapter II

The purpose of this study was to investigate the ability of Auscultation Percussion and Conventional Percussion to detect the level of pleural effusions.

Research Questions

The following research questions were addressed in this study:

1. To what extent is Auscultation Percussion an accurate method in detecting the extent of pleural effusions?

2. What is the relationship between Conventional Percussion and Auscultation Percussion in the detection of the extent of pleural effusions?

Research Design

The design is a one group quasi-experimental (Burns, Grove, 1993). The study includes a convenience sample that is nonrandom in selection.

Population and sample

The target population are all of the patients with a pleural effusion in a Pacific Northwest city. The sample was collected for 6 months ending March 1, 1996. Etiology is not a discriminatory factor. All exudative and transudative processes are included within the study population. The accessible population consists of the patients with pleural effusions located in a tertiary care hospital in the pacific northwest. A convenience sample of 14 patients was obtained from the accessible population. A radiologist selected patients with pleural effusions from chest radiographs that were taken as part of their standard medical regime. Patients that were scheduled for a
Thoracentesis were also included. The extent of the effusion was known only by the radiologist. Informed consent was obtained from the patients agreeing to be part of the study.

Patients included in the study were those between the ages of 18 and 80. They were physically able to sit upright without respiratory distress for 15 minutes. This included the five minutes prior to the exam, as well as the examination time. Patients were not excluded due to race, religion, diagnosis, body size, or gender.

Subjects excluded were patients: having undergone a coronary artery bypass surgery within the previous six months, without a sternum, having a known infection in the sternum, pregnant, or unable to physically meet the criteria of activity previously discussed (Table 2). In addition, patients with traumatic injuries to their backs that would cause them injury or pain to be examined were eliminated from the study (Table 2). Patients were able to withdraw from the study if they were unable to tolerate the examination.

**Setting**

A tertiary care center in the Pacific Northwest area was the setting for this investigation. Critical Care areas, Maternal Child areas, and Pediatric areas were excluded from the study. Patients were examined in the privacy of their rooms with doors shut and curtains closed or in the ultrasound examination room with the door closed.
Instrumentation

The instruments for this study were AusP and ConP. The assessment methods were done in exactly the same manner by both researchers with every patient.

AusP is the method of directly percussing over the manubrium sternum while auscultating the posterior thorax. Percussion is achieved with the phalanx of the middle and index fingers of the right hand. The diaphragm of the stethoscope was moved with the left hand in a systematic manner that allowed the examiner to listen to all areas of the posterior thorax. The lungs were examined from the apex to the base.

ConP is the method of directly percussing the posterior thorax. The middle finger of the left hand is placed over the area to be percussed. The other fingers and palm of the left hand are not in contact with the thorax. The right middle finger then taps the finger resting on the patient. The light tapping elicits a sound of dullness or resonance (Swartz, 1994). The posterior thorax was percussed entirely avoiding bony prominences.

Interrater reliability

The two researchers obtained Interrater reliability by examining 10 patients together. The percentage of agreement was 80%. The 20% disagreement were with the first two patients. This enabled consistency between researchers that the examinations were conducted essentially the same.
Procedure

A radiologist read all chest x-rays taken on a given morning. All patients with a pleural effusion were evaluated for inclusion in the study. All scheduled thoracentesis patients were also evaluated for inclusion in the study. Informed consent was obtained from the patients with the appropriate criteria. The consent allowed for use of the patient's chart so that the data sheet could be completed with the patient's diagnosis prior to the examination. The patient was placed in an upright sitting position. This position was assumed for five minutes before the physical examination was done. The patient's posterior thorax was marked with a washable marker to indicate the zones, as seen on the data sheet (Appendix A). Marked zones allowed for consistency between researchers and ultrasound.

The patient was examined by both AusP and ConP. The first researcher used the method of ConP followed by the method of AusP. The Rappaport model stethoscope was used to examine the patient. The examination took place during quiet respiration. The first researcher marked the zone indicating the level of pleural effusion determined by both methods on the data sheet.

The second researcher examined the patient within one hour of the first examination using ConP first, followed by AusP. Documentation of fluid levels of pleural effusions were recorded on separate data forms. The second researcher was blind to the findings of the first researcher.
Finally, the ultrasonographer performed an ultrasound of the patient's posterior thorax to locate the exact level of the pleural effusion. The results were documented on a third set of data sheets by the radiologist reading the x-ray and ultrasound findings.

**Data Analysis Plan**

The research questions were analyzed with correlation coefficients and descriptive statistics. A Pearson's R correlation coefficients was used to analyze Auscultation Percussion and Conventional Percussion as compared to Ultrasound (the gold standard). Both researchers' findings were analyzed for significant correlations between AusP and ConP with the ultrasound. Age, gender, and diagnosis were reported as frequencies.

**Human subject considerations**

Risk of ultrasound is still unknown at this time. This was stated verbally and written in the consent form to the participants of the study. Methods of AusP and ConP were virtually harmless to the patient. Patients with compromised sternal integrity were eliminated from the study to avoid potential injury. An informed consent was obtained from all volunteers of the study. Permission for the study was obtained from the hospital medical care committee, The Spokane Institutional Review Board and the Washington State University Institutional Review Board. To maintain confidentiality, data are reported without revealing the individuality of the subjects. The consent
forms, the patient names, and hospital numbers are maintained in a locked file and will not be used for purposes other than this study.

Patients were allowed to withdraw from the study at any time. Patients were instructed on the purpose and the procedure of the study. The names of the patients were confidential and code numbers were used in the place of proper names. No proper names were written on the data forms.

Limitations of Study

The sample size was a limitation to this study. Patients that were not critically ill and able to participate in this study were few. A larger sample size would increase the probability of being more representative of the population. The patients were obtained by a convenience sample which limits generalizability.

The availability of the Pulmonologist was limited. The number of patients examined by him were seven. A comparison of researchers was inaccurate reflecting the differences in sample sizes.

The ability to determine the exact level of pleural effusion was determined by the pattern of the pleural fluid. Often, thin tails of fluid were present around the sides of the lung. This made the top of the pleural effusion one to two zones higher than were here with AusP. Detection of the exact level was therefore hindered.
References


Chapter three is a manuscript prepared for submission to
the *Journal of the American Academy of Nurse Practitioners*
by Traci D. McDermott RN, M. Nurs, ARNP, CCRN &
Timothy Chestnut MD, FCCP
A COMPARISON OF CONVENTIONAL PERCUSSION AND AUSCULTATION PERCUSSION IN DETECTING PLEURAL EFFUSIONS OF HOSPITALIZED PATIENTS

ABSTRACT

The purpose of this study was to compare the efficacy of pulmonary Auscultation Percussion to Conventional Percussion in the detection of the extent of pleural effusions. The accuracy of pulmonary Auscultation Percussion is controversial, therefore this investigation attempted to determine the validity in detecting the extent of pleural effusions.

A Family Nurse Practitioner student, near the completion of the program, and a Pulmonologist evaluated 14 patients with pleural effusions. A radiologist identified potential study subjects with a pleural effusion on routine chest x-rays and pre-scheduled Thoracentesis. The patients were examined using Auscultation Percussion and Conventional Percussion to determine the exact level of the pleural effusion. The patient's back was zoned in tenths to give the level of effusion a numerical value. An ultrasound of the patient's posterior thorax during quiet respiration was done to determine the exact level of the pleural effusion.

Pleural effusions of 14 patients were included in this study. The correlation between AusP and the ultrasound were statistically significant \((R=.698, P=.006\) on the left chest and \(R=.694, P<0.001\) on the right side of the chest). ConP was statistically significant compared with the ultrasound on the left side of the chest \((R=.680, P=.008)\).
However, ConP was not statistically significant on the right side of the chest ($R=.287, P=.319$). This study suggests that AusP is a more accurate tool in the detection of the extent of pleural effusion in comparison to ConP. Various speculations for the left and right discrepancy with ConP are discussed.
Introduction

The history and physical examination are powerful tools used for the diagnosis of all patients. The physical assessment tool of chest percussion is used to delineate between pneumothorax, consolidation, and other diseases of the chest. The combination of auscultation with percussion may provide a more precise diagnostic image of pulmonary processes. This study explores reliability and validity of the technique of Auscultation Percussion in delineating the extent of pleural effusion.

Physical examination consists of inspection, percussion, palpation and auscultation (Lauden, 1987). Traditionally, these techniques are a part of the assessment of the pulmonary system. Auscultation Percussion (AusP) is used by some practitioners to determine pleural effusions (Guarino, 1994, Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994). Research on auscultation percussion, although limited, is contradictory (Bohadana, Coimbra, & Santiago, 1986, Bourke, Nunes, Stafford, Hurkey, & Graham, 1989, Guarino, 1994). Pleural effusions can be detected with the use of AusP (Guarino, Guarino, 1994). However, chest radiograph is the most common method used to detect pleural effusion.

Literature Review

Pleural effusions are a result of increased hydrostatic pressure and/or oncotic pressure within the pulmonary capillaries. Hydrostatic pressure is the pressure exerted by the blood flowing through the capillaries (Guyton, 1991). An increase in hydrostatic
pressure forces fluid through the capillary wall and into the pleural space, a process called transudation (Bartter, Akers, & Pratter, 1994).

Oncotic pressure is the force that pulls fluid from the vascular space into the pleural space. Increased oncotic pressure is the cause of the fluid shift known as exudation (Bartter, Akers, & Pratter, 1994). Capillaries leak fluid enabling proteins into the pleural space. More than 90% of pleural effusions are due to congestive heart failure, malignancy, pneumonia, or pulmonary emboli (Marel, Zrustova, Stasny, & Light, 1993).

AusP is a method of physical assessment used to detect fluid in the chest cavity (Guarino, 1974). Abnormalities detected by this method include nodules, infiltrates, and effusions. The method involves tapping on the manubrium with the distal phalanx of the index or middle finger while auscultating the posterior portions of the chest with a stethoscope (Guarino, 1980). The sound of the tapping is referred and heard on the posterior chest. The sound heard over normal lungs is equally resonant bilaterally. Guarino stated, "the difference in sound transmission between the two sides of an abnormal chest is clear and often striking and does not require a trained ear" (Guarino, 1974, p. 193).

Guarino (1980) detected 20 abnormalities in 30 patients by AusP (Table 1). However, Conventional Percussion (ConP) detected only 3 pulmonary abnormalities in the same sample. Several case studies suggests that AusP results in detection of abnormalities that ConP and chest radiograph may overlook. Guarino suggests that
AusP is an important assessment technique in detecting an abnormality that prompts the primary care provider to employ further diagnostic tests.

Guarino and Guarino (1994) reexamined the use of AusP in the detection of pulmonary effusion. A sample of 118 patients with pleural effusion noted on chest radiograph was compared to a control group of 175 randomly selected inpatients. The patients were sitting or standing in upright position for five minutes prior to AusP examination. The technique of this study differed from Guarino's first study in that the posterior trunk was percussed instead of the manubrium. AusP resulted in a sensitivity of 95.8% and a specificity of 100% in the detection of pleural effusions. The authors suggested that this method of physical examination should be incorporated into routine pulmonary assessment. They felt that this assessment would detect the presence of pleural effusions when symptomatology was absent.

HIV-Seropositive patients were examined using AusP, conventional percussion (ConP), and conventional auscultation (ConA) in an attempt to identify pulmonary abnormalities (Nelson, Rickman, Mathews, Beeson, & Fullerton, 1994). Chest x-ray was used as the gold standard of diagnosis. The study included 63 patients with HIV (suspected or known) who were examined by physicians who were blind to existing pulmonary abnormalities. The study concluded that AusP was the most sensitive of all
of the assessment techniques with a sensitivity of 51.0 to 69.6% (among multiple examiners). The study further noted that no abnormality was detected with ConP that was not detected by ConA.

Bohadana, Coimbra, & Santiago, (1986) studied the validity of AusP and ConP. Two trained observers examined 281 inpatients, 170 men and 111 women. The patients were selected based on a chest x-ray that was taken as part of their medical regime. The sensitivity of AusP in detecting pleural abnormality was defined as the ability to identify a diseased subject. The specificity was defined as the ability to exclude disease of individuals with negative x-rays. The validity, sensitivity multiplied by specificity, was 8% and 9% (two researchers) for ConP. The validity of AusP was 9% and 13% (two researchers). The researcher concluded that the effectiveness of detecting lung abnormalities by AusP was not statistically superior to ConP. The authors noted the best results of AusP and ConP were with large pleural effusions.

A controlled blind study (Bourke, Nunes, Stafford, Hurkey, & Graham 1989), compared AusP and ConP in 50 patients randomly selected from diagnostic chest x-rays that were taken as part of the patients medical regime. The chest x-ray of 21 of the 50 patients was abnormal. The sensitivity of ConP was 15.4% and AusP was 19.2%. The specificity for ConP was 97.3% and AusP was 85.1%. This study suggests that ConP and AusP were limited in the ability to detect significant diseases of the chest. The abnormalities diagnosed were lesions, nodules, infiltrates, and effusions.
The literature, although conflicting, shows evidence of detection of pleural effusions by AusP in some disease processes. The detection of lesions, nodules, and infiltrates by AusP is not well supported by research. However, the ability of AusP to detect pleural effusions is documented in the literature (Bohadana, Coimbra, Santiago, 1986, Bourke, Nunes, Stafford, Hurley, & Graham, 1989, Guarino, Guarino, 1994).

**Research Design**

A one group quasi-experimental study was used to investigate the correlation between the accuracy of AusP and ConP in the detection of the extent of pleural effusions.

The following research questions were addressed in this study:

1. To what extent is Auscultation Percussion an accurate method in detecting the extent of pleural effusions?

2. What is the relationship between Conventional Percussion and Auscultation Percussion in the detection of the extent of pleural effusions?

**Setting and sample**

The study was conducted in a 359 bed tertiary care hospital located in a Pacific Northwest city. A convenience sample of 14 patients was obtained from the population, meeting the criteria. A radiologist selected patients with pleural effusions from chest radiographs that were taken as part of their routine medical regime. Patients that were scheduled for a Thoracentesis were also included in the study. The extent of the effusion was known only to the radiologist. Patients included in the study
were between the ages of 18 and 80. They were physically able to sit upright without respiratory distress for 15 minutes. Table 2 includes exclusion criteria that were used for this study. Table 3 describes the pleural effusion categories of the sample.

Results

Pleural effusions of 14 patients (male=6, and female=8) were included in this study. Table 4 shows the demographic data of age and diagnosis. The age of the patients ranged from 41 to 80. The size of the patients were calculated with body surface area (BSA) with a mean of 3.57 m$^2$ (SD= .864) and ranged from 1.9 to 5.3 m$^2$. BSA was determined by the following formula: weight in kilograms x height in centimeters/ 3600=BSA meters$^2$. The mean supplemental oxygen use of the patients was 1.4 liters per minute (SD 1.778) with a range of 0 to 4 liters per minute. The patients that met the chosen criteria were assessed using AusP and ConP by the two researchers. The first researcher (the Family Nurse Practitioner student) received training but was relatively unexperienced with AusP. The second researcher (the Pulmonologist) was an experienced practitioner.
The patient was assessed by ConP followed by AusP. The zones in which the researcher heard a change in pitch from resonance to dullness were marked on the data collection sheet. The data were analyzed and the zones of the AusP and ConP were compared with the zones deciphered by the ultrasound. Researcher one found statistical significance to the ultrasound for the 14 patients examined (R=.698, P=.006 on the left chest and R=.694, P<0.001 on the right side of the chest). The second researcher revealed no statistical significance with the ultrasound for the seven patients examined (R=.461, P=.298 on the left side of the chest and R=.622, P=.136 on the right side of the chest).

ConP of both researchers was also compared to the ultrasound. The first researcher was noted to have a statistical significant correlation on the left side of the chest (R=.680, P=.008) and no statistical significance on the right side of the chest (R=.287, P=.319). The second researcher also showed no statistical significant correlation (R=.561, P=.298 on the left side of the chest and R=.540, P=.211 on the right side of the chest).

Discussion

The findings from the use of AusP for the 14 patients examined was correlated at a statistically significant with the findings of the ultrasound for the first researcher. This finding indicates that the use of AusP is a more reliable method of physical exam in the detection of the extent of pleural effusions than ConP. The large difference between the assessment of the right side of the chest and the left side of the chest
suggests the ConP is not an accurate and reliable assessment tool in detecting the level of pleural effusions. However, there may be some anatomical reason for the difference. The left side of the chest houses the heart and encompasses less space as compared to the left. The second researcher showed no significance with AusP with the examination of seven patients. It is conceivable that variations in individual practitioner technique accounted for this finding.

This study suggests that the use of AusP is a more valid assessment tool than ConP in the detection of level of pleural effusions. The sample size should be larger in order to allow this study to be more generalizable. This pilot project suggests the need to further investigate this assessment technique. This research project substantiates the research of Guarino and Guarino in that AusP is a useful diagnostic tool in detecting pleural effusions.

John Guarino stated, "the difference in sound transmission between the two sides of an abnormal chest is clear and often striking and does not require a trained ear". This study suggests that, as with all assessment skills, training and practice enhance the practitioners ability to detect abnormalities on physical examination. The use of AusP is a useful technique that could enhance the ability of the practitioner to detect pleural effusions in clinic patients that have few or no symptoms.
References for Manuscript


TABLE 1.

Lung abnormalities investigated with Auscultation Percussion and Conventional Percussion

<table>
<thead>
<tr>
<th>Lung masses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinoma</td>
</tr>
<tr>
<td>Pneumonia</td>
</tr>
<tr>
<td>Cavitary lesions</td>
</tr>
<tr>
<td>Tuberculous infiltrates</td>
</tr>
<tr>
<td>Mediastinal and hilar masses</td>
</tr>
<tr>
<td>Coin lesions</td>
</tr>
</tbody>
</table>
Exclusions from the Study

TABLE 2.

<table>
<thead>
<tr>
<th>Had a Coronary artery bypass graft in the past 6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>No sternum</td>
</tr>
<tr>
<td>An infection in the sternum</td>
</tr>
<tr>
<td>Younger than 18 or older than 80</td>
</tr>
<tr>
<td>Unable to sit up for 15 minutes without shortness of breath</td>
</tr>
<tr>
<td>Pregnant women</td>
</tr>
</tbody>
</table>
Table 3.

Pleural effusion category

<table>
<thead>
<tr>
<th></th>
<th>Right pleural effusion</th>
<th>Left pleural effusion</th>
<th>Bilateral pleural effusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEN</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>WOMEN</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 4.
Sample description

<table>
<thead>
<tr>
<th>PATIENT</th>
<th>AGE</th>
<th>DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>Congestive heart failure, Renal Failure</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>Blunt chest trauma</td>
</tr>
<tr>
<td>3</td>
<td>80</td>
<td>Pleural effusion, ?etiology</td>
</tr>
<tr>
<td>4</td>
<td>77</td>
<td>Lung Carcinoma with brain metastasis</td>
</tr>
<tr>
<td>5</td>
<td>73</td>
<td>Inferior myocardial infarction, congestive heart failure</td>
</tr>
<tr>
<td>6</td>
<td>66</td>
<td>Pleural effusion, ? etiology</td>
</tr>
<tr>
<td>7</td>
<td>49</td>
<td>Esophagus carcinoma, pneumonia</td>
</tr>
<tr>
<td>8</td>
<td>41</td>
<td>Pleural effusion, ? etiology</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>Congestive heart failure, chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>Anasarca</td>
</tr>
<tr>
<td>11</td>
<td>60</td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td>12</td>
<td>65</td>
<td>Atrial fibrillation, pacemaker insertion with pneumothorax</td>
</tr>
<tr>
<td>13</td>
<td>72</td>
<td>Coronary artery disease</td>
</tr>
<tr>
<td>14</td>
<td>72</td>
<td>Congestive heart failure</td>
</tr>
</tbody>
</table>
APPENDIX A
DATA COLLECTION SHEET
Auscultation Percussion and Conventional Percussion Data Sheet

Patient ID number ____________  Birth date ____________

Height _______  Weight ________  Diagnosis __________________

Respiration per minute ____________  Oxygen ____________

Hemoglobin Oxygen Saturation ____________

Auscultation Percussion

Zone of left ____________  Zone of right ____________
Conventional Percussion

Zone of left ________________ Zone of right ________________
ULTRASOUND

Zone of left ______________  Zone of right ______________
APPENDIX B
CONSENT FORM
Auscultation Percussion In The Detection of Pleural Effusions
CONSENT FORM

Traci D. McDermott RN, BSN, CCRN
(509) 536-4815

I __________________________ am being asked to participate in a study which examines the ability of Auscultation Percussion and Conventional Percussion to detect the extent of pleural effusion that I may have at this time. I am being asked to participate in this study by a Family Nurse Practitioner student that is currently enrolled at the Intercollegiate Center for Nursing Education.

Purpose:
The purpose of this study is to determine the best method of examination of a patient who has fluid in the lung. This study will compare Auscultation Percussion and Conventional Percussion. Auscultation and percussion are normal procedures done on patients every day.

Procedure:
1. I will be selected from a chest x-ray already taken as part of my medical treatment. The chest x-ray will show a pleural effusion (fluid in the space between the lung and the chest wall).
2. My back will be marked with a washable marker.
3. I will then be examined by a Family Nurse Practitioner Student and a Pulmonologist. The examination includes listening to my chest with a stethoscope while my breast bone is lightly tapped with a finger. My chest will also be examined by a light tapping on my back.
4. After the two examiners have done these exams, an ultrasound will be done to my back. This is to find the exact level of fluid in the chest. The ultrasound will not be charged to my account.
5. The time for the study will be needed will be about 1 1/2 hours. The first researcher will examine me for 30 minutes, the second researcher will examine me for 30 minutes and the ultrasound will take approximately 30 minutes.

Risks:
The risks of this examination is minimal. I may feel some shortness of breath while I am sitting and possibly some discomfort while the examiners are tapping on my breast bone.

Benefits:
The method of Auscultation Percussion may be able to detect the lung fluid that auscultation and percussion alone may not. Pleural effusions may be detected in patients that have pleural effusions and have no symptoms.
Alternatives:

The standard test to find fluid in the lungs is a chest x-ray. I understand that my treatment will not be altered in any way if I chose to not be part of this study.

Exclusions:

You will not be able to participate if you have:

a. had a Coronary artery bypass graft in the past 6 months.
b. no sternum
c. an infection in your sternum.d. younger than 18 or older than 80.
e. unable to sit up for 15 minutes without shortness of breath.
f. pregnant

Participant Costs and Payment:

There will be no cost to you. All tests will be done at the cost of the researcher.

Reimbursement or Compensation for Medical Treatment From Related Illness or Injury:

Should I suffer from illnesses or injury during participation in this study, emergency medical care will be provided by ______________________ at ______________________. Should I have questions regarding illness or injury related to this study I will contact the researcher at the number given.

Confidentiality:

Medical records relating to this study will be kept confidential and no publication of results of the study will identify me. My records will be reviewed by medical personnel associated with the study. All consent forms and information from your chart will be used for this study only and for no other purpose. All information will remain in the possession of Traci McDermott and strict confidentiality will be maintained.

Patient Rights:

I understand that if I have questions regarding my patient rights I may contact Traci McDermott RN, BSN, CCRN at (509) 536-4815. Should I have further questions regarding my rights I may contact the Institutional Review Board-Spokane at 358-7631.

Voluntary Participation and Withdrawal:

Participation in this study is voluntary and refusal to participate will not affect the care that I receive. Furthermore, I may withdraw from the study at any time without prejudice or loss of benefits to which I am entitled. I understand that should I withdraw from this study, it is important to notify Traci McDermott RN, BSN, CCRN. I understand that the researcher in charge of the study can remove me from the study without my consent if she feels that it is in my best interest.
Legal Rights and Patient Consent:
I have read or have had read to me the preceding information describing the study. All my questions have been answered to my satisfaction and this form is being signed voluntarily by me indicating my desire to participate in this study. I am not waiving any of my legal rights by signing this form. I understand I will receive a copy of this signed consent form. I understand that this project has been reviewed and approved by the WSU Institutional Review Board and the Spokane Institutional Review Board. If I have any questions or concerns I understand that I may contact Traci D. McDermott RN, BSN, CCRN at (509) 536-4815 at any time or Lorna Schumann PhD at (509) 324-7285.

Participant signature

__________________________

CCRN

Researcher signature

__________________________

Traci D. McDermott RN, BSN,

Witness