

Benefit of Serum-Effusion Albumin Gradient in Congestive Heart Failure Patients

Piamlarp Sangsayunh MD*,
Boonjong Saejueng MD**

* Chest Department, Nonthaburi, Thailand

** Cardiovascular Department, Central Chest Institute of Thailand, Nonthaburi, Thailand
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Objective: To compare between light's criteria and serum-effusion (S-E) albumin gradient in diagnosis of transudate effusion in congestive heart failure (CHF) patients.

Material and Method: Eighty-six patients who had pleural effusion and suspected CHF were enrolled in the present study between October 2008- September 2010. Suspected CHF was defined by clinical or echocardiography. Informed consents were given by all volunteers. Exclusion criteria was previous thoracotomy or coronary bypass graft 3 months before present study. Thoracentesis was done to evaluate transudate effusion by light's criteria and S-E albumin gradient > 1.2 mg/dl.

Results: 12 (13.95%), 56 (65.11%), 17 (19.76%) of all were pure pleural disease, pure CHF, combination of pleural disease and CHF. Sensitivity/specificity/accuracy of S-E albumin gradients and light's criteria in diagnosis of CHF (both pure and combined) were 90.1/33.3/80.2%, 64.7/80.0/67.4%. No correlation between amount of diuretic drug and "exudate" criteria from lights' ($p = 0.66$). 25 (27.2%) patients were previous post thoracotomy or coronary bypass graft. 7 of 25 patients had loculated effusion. There was correlation between previous surgery with loculated effusion and effusion from combination of pleural disease and CHF ($p = 0.22$).

Conclusion: There is benefit to use S-E albumin gradient > 1.2 mg/dl to diagnosis patients who were suspected CHF with or without pleural disease. The authors recommended to use S-E albumin gradients combined with Light's criteria in suspected CHF patients.

Keywords: Congestive heart failure, Serum-effusion albumin gradient, Lights' criteria

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The differentiation of pleural effusions resulting from heart failure and other causes is usually made by clinical criteria supported by the finding of a transudative effusion according to the criteria of Lights'⁽¹⁾. However, as these criteria were developed to detect exudative pleural effusions, their ability to exclude transudative effusions is lower⁽¹⁾. Some studies such as Roth⁽²⁾ have found a misclassified as exudative especially after having received diuretic therapy. Candeira⁽³⁾ showed repeated pleurocentesis increased proportion of pleural/serum lactate dehydrogenase (LDH), protein gradient but no more change in serum-albumin gradient. Brosddus⁽⁴⁾ have found repeated pleurocentesis increased in proportion of pleural/serum LDH ratio but not in protein ratio. Diuresis changed

proportion of protein/serum protein ratio and induced misclassified transudate. Kolditz⁽⁵⁾ found that N-terminal pro B type natriuretic peptide (NT-proBNP) in serum and pleural effusion was correlation. The cut off value in pleural effusion was 4,000 ng/l by accuracy 92%. The previous studies⁽²⁾ were produced in general pleural effusion population, not specific in congestive heart failure (CHF) population. The aim of the present study was to compare between light's criteria and serum-effusion (S-E) albumin gradient in diagnosis of transudate effusion in CHF patients population.

Material and Method

The present study was conducted between October 2008-September 2010. The present study was approved by the local institutional review boards. All patients provided written informed consent to the procedure. Patients who had pleural effusion and suspected CHF were enrolled in the present study. All patients were inpatients of the cardiovascular ward.

Correspondence to:

Sangsayunh P, Chest Department, Central Chest Institute of Thailand, Nonthaburi 11000, Thailand.
Phone: 08-1845-4950
E-mail: piamlarp@yahoo.com

Exclusion criteria was previous thoracotomy or coronary by pass graft 3 months before the present study. Thoracocentesis was done to evaluate transudate effusion by light's criteria and S-E albumin gradient > 1.2 mg/dl.

Meaning of word

Suspected CHF was defined by clinical or echocardiography showed pattern of CHF.

Transudative pleural effusion by serum-albumin gradient was defined as gradient more than 1.2 mg/dl.

Exudative pleural effusion by light's criteria was defined as more than one criteria of

1. LDH level more than 2/3 upper limit of normal serum.
2. pleural effusion(PF)/ serum LDH ratio more than 0.6.
3. PF/serum protein ratio more than 0.5.

Statistical analysis

All case record files were evaluated and analyzed using SPSS program version 11.5. The data were presented as descriptive analysis. Sensitivity and specificity of light's criteria and S-E albumin gradient

in diagnosis of congestive heart failure was used. Chi-square test or Fishers' exact test was used to determine correlation. $P < 0.05$ was set for statistical significant.

Results

The authors enrolled 100 suspected CHF with pleural effusion in the present study. The 14 suspected CHF were withdrawn because of many conditions such as incomplete data collection, failure to thoracocentesis, bloody contamination in the specimen. Characteristics of 86 patients are shown in Table 1. Definite diagnosis of disease was classified by

- Pure CHF was no effusion after treatment with diuresis and pleural ProBNP > 4000 ng/dl.

- Pure pleural disease was diagnosis by results from thoracocentesis, pleural Biospy and/or Video-assisted thoracoscopy (VAT).

- Combination of pleural disease and CHF were defined by confirmed pleural disease by pleural biopsy and/or VAT and partial response with diuresis and high pleural ProBNP.

The twelve (14.0%), fifty-seven (66.3%), seventeen (19.7%) of all patients were pure pleural disease, pure CHF, combination of pleural disease and CHF. Character of definite diagnosis was classified.

Table 1. characteristics of patients

Characteristics	
Patients No	86
Male/Female gender No	46/40
Median ages (range) yr	64 (39-91)
Method of diagnosis: Congestive heart failure (%)	
Clinical	64 (74.4)
Echocardiogram	22 (25.5)
Effusion (%)	
Rt side	61 (71)
Lt side	25 (29.0)
Amount of pleural effusion of thoracic cage	
< 1/3	51 (59.4)
Between 1/3 to 2/3	34 (39.5)
> 2/3	1 (1.2)
Method for thoracocentesis by (%)	
Physical exam	36 (41.9)
Ultrasound guide	50 (58.1)
Previous cardiac surgery (%)	25 (29.0)
Mitral value repair	16 (18.6)
Aortic value repair	1 (1.1)
Aortic and mitral value repair	2 (2.3)
Coronary bypass graft (CABG)	3 (3.4)
Combined CABG and mitral value repair	3 (3.4)
No previous surgery	61 (71.0)

(Table 2).

In Table 3 and 4, the patients who had congestive heart failure were both pure CHF and combination of CHF and pleural disease. Sensitivity and specificity of both criterias for diagnosis of congestive heart failure was shown (Table 5).

No correlation between amount of diuretic drug and “exudate” criteria from lights’ ($p = 0.66$). 25 (27.2%) patients were previous post thoracotomy or coronary bypass graft. 7 of 25 patients had loculated

effusion. There was correlation between previous surgery with loculated effusion and effusion from combination of pleural disease and CHF ($p = 0.22$).

Conclusion

Use of light’s criteria in differentiated transudate from exudates in CHF is complicated. The present study aimed to use the others to help physician diagnosis. Roth⁽²⁾ and et al studied serum-effusion albumin gradient to analyze pleural effusion. The authors found that light’s criteria was not proper in analysis “transudate” in case of CHF and suggested to use serum-effusion albumin gradient > 1.2 g/dl. Those present was limitation because of small size of congestive heart failure subgroup (only 5 patients). Brosddus⁽⁴⁾ analysed Candeira⁽³⁾ study, PF/serum LDH ratios were 0.45 in single thoracentesis but increased to 0.7 in repeated. PF/serum protein ratios were the same value, 0.45 in single or repeated thoracentesis. Those study was small CHF population (21 patients). The present study was pointed in patients who had clinical or echocardiogram shown CHF in a large population (86 patients). The present study found 17 pateints had a combination of pleural disease and CHF (identified by partial response to diuresis and/or pleural Pro BNP $> 4,000$ ng/l⁽⁵⁾ with other pleural diseases such as parapneumonic effusion, TB pleural effusion, loculated pleural effusion). Sensitivity of serum-

Table 2. definite diagnosis

Characteristic	Patients Number
Pure pleural disease	12
Non-Hodgkin lymphoma	2
TB	3
Malignancy	2
Pleural thickening and loculated effusion	3
Parapneumonic effusion	1
Chylothorax	1
Pure CHF	57
Combination of pleural disease and CHF	17
TB pleuritis	2
Malignancy	1
Pleural thickening and loculated effusion	13
Parapneumonic effusion	1
Chylothorax	0

Table 3. S-E albumin gradient for diagnosis of congestive heart failure (n= 86)

	Congestive heart failure(n)	No congestive heart failure (n)
S-E albumin gradient: transudate	64	7
exudate	10	5

Table 4. light’s criteria for diagnosis of congestive heart failure (n= 86)

	Congestive heart failure(n)	No congestive heart failure (n)
Light’s criteria: transudate	46	3
exudate	25	12

Table 5. Comparison between pleural effusion/serum albumin gradient > 1.2 g/dl and light’s criteria for diagnosis of congestive heart failure

	Sensitivity(%)	Specificity (%)	PPV	NPV	Accuracy
Albumin gradient	90.1	33.3	90.1	41.6	80.2
Light criteria	64.7	80.0	93.8	32.4	67.4

effusion albumin gradient was higher than light's criteria for diagnosis of CHF in the present study, 90.1% vs. 64.7% but specificity was lower than, 33.3% vs. 80.0%. This present study assumed that patients who had exudate from light's criteria and transudate from serum-effusion albumin gradient had combination between CHF and abnormal of pleura. Common cause of pleural disease in the present study were previous procedure which induced pleural inflammation such as repeat thoracentesis^(3,4), thoracic surgery. 13 patients in the present study were loculated effusion. 25 (27.2%) patients were previous post thoracotomy or coronary bypass graft. Most of previous cardiac surgery patients were mitral value repairment. Because high prevalence of mitral value diseases in Thailand, The authors found more pleural effusion in mitral value repairment than Coronary bypass graft (CABG). 7 of 25 previous post cardiac surgery patients had loculated effusion. There was correlation between previous cardiac surgery with loculated effusion and combination of pleural disease and CHF ($p = 0.22$). The authors sometimes assumed that it's still had loculated effusion when the authors treated suspected CHF in previous cardiac surgery and partial response in diuresis. All of the patients received a diuretic drug. There was correlation between amount of diuretic drug and "exudates" criteria from lights' ($p = 0.66$).

Summary

The authors recommended to use S-E albumin gradients combined with Light's criteria in suspected CHF patients. Diuresis didn't change the pattern of LDH or Protein in CHF patients.

Potential conflicts of interest

None.

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ประโยชน์ของการใช้ความแตกต่างระหว่างอัลบูมินในน้ำเยื่อหุ้มปอดและในเลือดในผู้ป่วยหัวใจล้มเหลว

เปี่ยมลภ แสงสายัณห์, บุญจง แซ่จิ่ง

วัตถุประสงค์: เพื่อเปรียบเทียบการใช้ *light's criteria* และ *SE albumin gradient* ในการแยกภาวะ *transudate* ออกจาก *exudate* ในผู้ป่วยหัวใจล้มเหลว

วัสดุและวิธีการ: ศึกษาไปข้างหน้า ในกลุ่มผู้ป่วยหัวใจล้มเหลวที่มีน้ำท่วมปอดที่มาทำการรักษา ณ สถาบันโรคทรวงอก ระหว่างตุลาคม พ.ศ. 2551 ถึง กันยายน พ.ศ. 2552 จำนวน 86 ราย โดยผู้ป่วยทุกรายต้องยินยอมเข้าทำการวิจัย และมีเกณฑ์ในการเลือกผู้ป่วยเข้าร่วมงานวิจัยคือมีภาวะน้ำท่วมปอดที่มีภาวะหัวใจล้มเหลวการตรวจร่างกายหรือภาพรังสีทรวงอกหรือการตรวจพิเศษ อันได้แก่ *echocardiogram*, *cardiac catheterization* ที่ชี้บ่งว่ามีภาวะหัวใจล้มเหลว เกณฑ์ในการคัดออกคือผู้ป่วยที่มีประวัติผ่าตัด *thoracotomy* หรือ *coronary bypass graft* ในช่วง 3 เดือน ผู้ป่วยทุกรายรับการเจาะน้ำเพื่อการวินิจฉัยและนำมาคำนวณตาม *light's criteria* และ *SE albumin gradient*

ผลการศึกษา: ผู้ป่วย 12 (13.95%) รายมีภาวะน้ำท่วมปอดจากโรคของเยื่อหุ้มปอดแต่เพียงอย่างเดียว ขณะที่ผู้ป่วย 56 (65.11%), 17 (19.76%) มีภาวะน้ำท่วมปอดจากหัวใจล้มเหลวและโรคเยื่อหุ้มปอดร่วมกับหัวใจล้มเหลว ตามลำดับ ค่าความไว ความเฉพาะเจาะจง และค่าความแม่นยำของการใช้ความแตกต่างระหว่างอัลบูมินในน้ำเยื่อหุ้มปอด เปรียบเทียบกับในเลือด เป็นดังนี้ 90.1/ 33.3/80.2% เปรียบเทียบกับ *light's criteria* 64.7/80.0/67.4%. ไม่มีความสัมพันธ์ระหว่างปริมาณยาขับปัสสาวะและภาวะ "exudate" จากการวินิจฉัยด้วย *light's criteria* ($p=0.66$). ผู้ป่วย 25 (27.2%) รายเคยผ่าตัดปอดชนิด *thoracotomy* หรือผ่าตัดหัวใจชนิดเส้นเลือดตีบ *coronary bypass graft* ผู้ป่วย 7 ราย ในทั้งหมด 25 ราย มีภาวะน้ำในช่องเยื่อหุ้มปอดเฉพาะที่ (*loculated effusion*) และพบความสัมพันธ์ระหว่างประวัติการผ่าตัดช่องปอดที่มีภาวะน้ำในช่องปอดเฉพาะที่ และภาวะโรคเยื่อหุ้มปอดร่วมกับหัวใจล้มเหลว ($p=0.22$)

สรุป: มีประโยชน์ของการใช้ *SE albumin gradient* ที่มากกว่า > 1.2 mg/dl เพื่อช่วยวินิจฉัยผู้ป่วยที่สงสัยหัวใจล้มเหลว ที่มีโรคเยื่อหุ้มปอดร่วมด้วยหรือไม่ก็ได้และแนะนำให้ใช้รวมทั้ง *SE albumin gradient* และ *light's* ในการวินิจฉัยภาวะหัวใจล้มเหลว
