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Original Article

Alvarado Score is a Helpful Tool to Improve Outcomes of Acute Appendicitis at Lampang Regional Hospital

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Abstract

Background: The diagnosis of acute appendicitis is still problematic due to various stages of clinical presentation. Alvarado Score is one of the tools expected to help the diagnosis and our institute has used it as appendicitis protocol since October 2016. We aimed to assess the usefulness of Alvarado Score.

Methods: Cross-section study was carried out in all patients who underwent appendectomy at the Lampang Regional Hospital between October 2013 and December 2016. Data were compared and analyzed between “Alvarado Assessment” group (AA group) and “No Assessment” group (NA group).

Results: Alvarado score was used more frequently in a period after October 2016 compared to a prior period (72.9:17.7 %, $p < 0.01$). A total of 5,087 patients were included, with 45.7% of men and 54.3% of women. In the AA group, appendectomy was performed earlier (operation performed within 24 hours = 98.8% vs. 97.1%; $P < 0.01$), length of stay was shorter (mean \pm SD = 2.8 \pm 1.53 vs. 3.1 \pm 2.34 days, $P < 0.01$), perforation rate was lower (5.8% vs. 12.2%, $P < 0.01$) and the negative appendectomy rate (NAR) was lower (23.8% vs. 30.4%, $P < 0.01$) compared to the NA group. However, there were no differences in surgical site infection and mortality rate.

Conclusion: Advantages of Alvarado assessment included support of correct diagnosis, easier decision making resulting in faster time to operate and better clinical outcomes.

Keywords: Pending, Alvarado Score

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INTRODUCTION

Acute appendicitis is the most common condition in acute abdomen. The incidence rate is approximately 233/100,000 population¹. Lifetime risk is about 7%². Appendectomy is the most surgical abdominal procedure performed^{3,4} due to its high volume of cases. Delayed diagnosis leads to poor clinical outcomes including ruptured, infective process, prolonged hospital stay and increase mortality⁵.

In general, the diagnosis of acute appendicitis is made by clinical presentation including basic laboratory tests but there are still problems. The physicians having different experiences made different diagnosis, investigation and management with varied clinical outcomes. Several scoring systems for diagnosing appendicitis have been reported⁶⁻¹¹. The best known is the Alvarado score. In 1986, Alvarado⁶ constructed a 10-point clinical scoring system, also known by the acronym MANTRELS, for the diagnosis of acute

appendicitis as based on symptoms, signs and diagnostic tests in patients presenting with suspected acute appendicitis.

Previously the use of Alvarado score assessment for diagnosis of acute appendicitis at Lampang Regional Hospital varied based on individual physicians and not mandatory. Since October 2016 we started a project using appendicitis protocol or Alvarado score assessment routinely in the Surgery Unit (Figure 1). This project was used to support the government policy of surgery service plan that aimed to reduce morbidity and mortality of acute appendicitis. One of our processes was Alvarado score assessment. The aim of this study was to determine the advantages of the score assessment compared with no score assessment. We aimed to compare possible complications including perforation, wound infection, and mortality rate and potential benefits in term of time to operation, length of hospital stay and negative pathologic specimens.

Guideline for Acute appendicitis at Lampang Regional Hospital Alvarado Score for Acute Appendicitis		
Signs	Yes	No
Right Lower Quadrant Tenderness	②	①
Elevated Temperature (> 37.3°C)	①	①
Rebound Tenderness	①	①
Symptoms		
Migration of Pain to the Right Lower Quadrant	①	①
Anorexia	①	①
Nausea or Vomiting	①	①
Laboratory Values		
Leukocytosis > 10,000	②	①
Leukocyte Left Shift	①	①
Score < 4 (96% probability diagnosis is not appendicitis) → observe and reevaluate		
4 ≤ Score < 7 → Consider imaging ○ CT ○ US ○ observe ○ Other.....		
Score ≥ 7 (58 – 88% chance of positive appendicitis) → Consider surgery		

Figure 1 Appendicitis Protocol

MATERIALS AND METHODS

This cross sectional study was carried out at the Lampang Regional Hospital between October 2013 and December 2016. The study included patients with final diagnosis of acute appendicitis (K352, K353 and K358 on ICD 10 version 2009). Alvarado score assessment was recorded anytime during visit from admit to discharge. Compared data between Alvarado score assessment group (AA group) and No assessment group (NA group). Data including patient general characteristics, results of treatment and pathologic reports were recorded.

Statistics

Comparative data were analyzed by Fisher's exact test and variable data by 2 sample t-test using Strata software version 11.0.

RESULTS

The protocol was started in October 2016, we found more Alvarado score assessment compared to previous time (72.9:17.7 %, $p < 0.01$). Data of 5,087

patients were analyzed. Patients' age was between 2 to 100 years old (mean \pm SD = 39.9 ± 20.6 years old). There were 2,759 women (54.3%) and 2,328 men (45.7%). There were more female ratio (57.1% vs. 53.5%, $p = 0.03$) and older (mean \pm SD = 41.9 ± 19.07 vs. 39.4 ± 21.02 years old, $p < 0.01$) when compared between AA group and NA group. But there were no difference in term of concurrent comorbidity equal or more than 3 diseases (Table 1).

Faster appendectomy was found in the AA group that presented in term of appendectomy within 24 hours (98.8:97.1%, $p < 0.01$) synchronously but not statistically significant when we concerned the time from admission to operation (mean \pm SD = 6.08 ± 4.66 : 14.4 ± 234.76 hr., $p = 0.13$)

Clinical benefit of the AA group was also found in term of shorter length of stay (mean \pm SD = 2.8 ± 1.53 : 3.1 ± 2.34 days, $p < 0.01$), and less perforated rate (5.8:12.2%, $p < 0.01$) (Table 2). There were no differences between groups in term of infected wound (0.37:0.45%, $p = 0.49$) and mortality rate (0.1:0.2%, $p = 0.69$).

Appendix specimens were sent for pathologic

Table 1 Patients' characteristics

	No Alvarado assessment	Alvarado assessment	p-value	Both groups
N (%)	4,016 (78.9)	1,071 (21.1)	NA	5,087 (100.0)
Age (mean \pm SD) yr.	39.4 ± 21.02	41.9 ± 19.07	< 0.01	39.9 ± 20.6
Female : male (%)	53.5 : 46.5	57.1 : 42.9	0.03	54.2 : 45.7
Co-morbid > 3 dis. (%)	4.03	3.92	0.93	4.01
Before:after project* (%)	82.3 : 27.1	17.7 : 72.9	< 0.01	

*Appendicitis protocol for improved diagnosis and treatment of appendicitis since October 2016

Table 2 Clinical outcomes

	No alvarado assessment	Alvarado assessment	p-value	Both groups
Time to operation (mean \pm SD) hour	14.4 ± 243.76	6.08 ± 4.66	0.13	12.7 ± 216.61
Appendectomy within 24 hr (%)	97.1	98.8	< 0.01	97.5
Perforated (%)	12.2	5.8	< 0.01	10.8
Length of stay (mean \pm SD) days	3.1 ± 2.34	2.8 ± 1.53	< 0.01	3.07 ± 2.20
Infected wound (%)	0.45	0.37	0.49	0.43
Mortality (%)	0.2	0.1	0.69	0.18

Table 3 Negative Appendectomy Rate (NAR)

	No alvarado assessment	Alvarado assessment	p-value	Both groups
Pathologic report : Total (%)	3,556:4,016 (88.5)	790:1,071 (73.8)		4,346:5,087 (85.4)
Negative appendectomy NAR (%)	1,081 (30.4)	188 (23.8)	<0.01	1,269 (29.2)

examination in 4,346 of 5,087 (85.43%) and confirmed acute appendicitis in 70.8%, making negative appendectomy rate (NAR) of 29.2%. Data showed less NAR in the AA group (23.8 versus 30.4%, $p < 0.01$) (Table 3)

DISCUSSION

Because of high volume of acute appendicitis in Thailand, the Thai Ministry of Public Health aims to reduce the morbidity and mortality. Previous studies concluded advanced disease at presentation, duration of symptoms, old age increase perforation rate, infection and mortality¹²⁻¹⁶. Generally early diagnosis and treatment yield better result. Conversely early surgical treatment leads to high negative and unacceptable appendectomy specimen. Therefore early diagnosis not delayed or exaggerated is the key of success.

Only clinical presentation for diagnosis of acute appendicitis may be inadequate, many tools including history, physical examination and basic laboratory were applied to improve accuracy of diagnosis. Among various scores, for example appendicitis inflammatory response, Lintula, Lindberg, Ohmann, RIPASA, and pediatric (Samuel) score^{7-11,17,18}, strong evidences from systematic review suggests that Alvarado score is the most popular and can be applied easily in all ages and make accurate diagnosis¹⁹. A recent clinical policy document from the American College of Emergency Physicians reviews the value of using clinical findings to guide decision making in acute appendicitis²⁰. Additional investigations such as serum C reactive protein, abdominal ultrasonography, CT scan or even MRI may help to make more accurate diagnosis²¹⁻²⁹ but these are time consuming, costly and have no practical use in many parts of Thailand.

The advantages of Alvarado score assessment

conclude from this study is shorter length of hospital stay and less perforated rate. The possible reasons may be from early time to operation same as previous studies³⁰. In our hospital patients with a score less than 4 were on observation, with 5-6 were sent to imaging or on observation and reevaluated score subsequently depending on surgeon's desire. Patients with score equal or greater than 7 were sent to operation. So it is easier to make decision for management in Alvarado assessment group and may explain why it is faster to operate. However, there was no difference in mortality rate or infected wound for both groups in this study due to too low incidence, perhaps long-term study should be continued.

One interesting finding was the negative appendectomy rate (NAR) - defined as the portion of pathologically normal appendices removed surgically in patients suspected of having acute appendicitis³¹ that showed up to 30% in this study higher than other studies that range from 15 to 25%^{8,32}. NAR decreases nowadays over the past conversed to rising of pre-operative CT³³. Many preoperative investigations such as ultrasound or CT hope to decrease the NAR but only CT use had demonstrated a reduction in the NAR³⁴⁻³⁶. In our hospital like many others in Thailand, CT was too expensive and not routinely used. Our results support Alvarado score assessment to decrease NAR regardless of CT use.

High rate of NAR from this study synchronized to early appendectomy rate as referred to over 97% operated within 24 hours in all groups. This may explain better results than many studies such as lower wound infected rate (0.43% in this study against 4.2 - 5.8% in previous studies^{8,37-39} and lower perforated rate (10.8% vs. 16-30%) in others⁴⁰⁻⁴¹. Again, faster operation may be a good explanation of no difference in perforated or mortality rate whether using Alvarado assessment or not.

Limitation of this study was that it cannot control exact time to further investigation or operations when assigned. These factors depended on volume of cases and operative room vacancy. So the diagnosis or treatment may be delayed. Another limited point was still alternative choice in question (score 5-6) that patients were observed or investigated by imaging depending on doctor's preference. So some of this group had faster appendectomy than other group and yield better outcomes.

Finally, despite limited data or doctor bias, Alvarado score assessment is still cheap, safe, advantageous and practical for acute appendicitis diagnosed in our area.

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บทคัดย่อ **การใช้แบบประเมิน Alvarado score ในโรงพยาบาลลำปางต่อผลการรักษาภาวะไส้ติ่งอักเสบ**
สหธรรม สมินทรปัญญา
กลุ่มงานศัลยกรรม โรงพยาบาลลำปาง

ความเป็นมา: ปัจจุบันยังคงมีปัญหาในการวินิจฉัยภาวะไส้ติ่งอักเสบเฉียบพลัน อันเนื่องมาจากระยะของโรคและอาการแสดงที่แตกต่างกัน แบบประเมิน Alvarado score ถูกกำหนดเป็นนโยบายและเริ่มนำมาใช้ในโรงพยาบาลลำปางอย่างจริงจังตั้งแต่เดือนตุลาคม พ.ศ. 2559 โดยหวังว่าจะพัฒนาการการวินิจฉัยและรักษา อย่างไรก็ตามยังไม่มีการศึกษาถึงผลลัพธ์ของการใช้แบบประเมินนี้

วัตถุประสงค์และวิธีการ: เป็นงานวิเคราะห์ตามขวางของข้อมูลผู้ป่วยที่ได้รับการวินิจฉัยเป็นไส้ติ่งอักเสบในโรงพยาบาลลำปางที่ได้รับการผ่าตัดระหว่างเดือนตุลาคม พ.ศ. 2556 ถึงสิ้นเดือนธันวาคม พ.ศ. 2559 โดยเปรียบเทียบระหว่างการใช้และไม่ใช้แบบประเมิน Alvarado score

ผลการศึกษา: มีการประเมิน Alvarado score หลังเริ่มโครงการมากขึ้นอย่างมีนัยสำคัญ เมื่อเปรียบเทียบกับช่วงก่อนหน้า (72.9:17.7%, $p < 0.01$) จำนวนผู้ป่วยทั้งสิ้น 5,087 ราย ประกอบด้วยเพศชาย 45.7% และ เพศหญิง 54.3% ผลการเปรียบเทียบระหว่างกลุ่มพบว่า ในกลุ่มที่ใช้แบบประเมิน ได้รับการผ่าตัดที่เร็วขึ้น โดยได้รับการผ่าตัดภายใน 24 ชั่วโมง (98.8:97.1%, $p < 0.01$) มีระยะเวลาอนโรโรงพยาบาลสั้นกว่า (2.8 ± 1.53 วัน: 3.1 ± 2.34 วัน, $p < 0.01$) มีอัตราการแตกของไส้ติ่งต่ำกว่า (5.8%:12.2%, $p < 0.01$) และอัตราการผ่าตัดผิด (negative appendectomy rate) น้อยกว่า (23.8:30.4%, $p < 0.01$) อย่างไรก็ตามไม่พบความแตกต่างของการติดเชื้อแผลผ่าตัด และอัตราการตายระหว่างกลุ่ม

สรุป: การใช้แบบประเมิน Alvarado score มีประโยชน์ในการช่วยสนับสนุนการวินิจฉัยที่ถูกต้อง ทำให้ตัดสินใจง่ายขึ้น และส่งผลให้ผู้ป่วยได้รับการผ่าตัดเร็วขึ้นและมีผลการรักษาดีขึ้น