Evaluation of the Alvarado score in acute appendicitis

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Summary
Use of the Alvarado scoring system was assessed prospectively in a consecutive series of 215 patients with suspected appendicitis over a 12 month period at the University Hospital of Wales, Cardiff. In comparison the high negative appendicectomy rate during the year prior to the study was reduced considerably with the scoring system without increasing morbidity or mortality.

Introduction
Acute appendicitis is a common cause of abdominal pain and can be difficult to diagnose, especially during the early stages. There is still appreciable morbidity and occasionally mortality which may be related to failure of making an early diagnosis[1].

As a result of their concern about this surgeons create for themselves 'a surgical security zone which allows them to accept a 15-30% negative laparotomy rate with impunity'[2].

Although various aids exist to facilitate more accurate diagnosis and reduce the rate of negative appendicectomy, many are complex. Whereas simple scoring systems have been available for some time, they have not been widely tested. The aim of this study was to assess one of these which was described by Alvarado in 1985[1], against a background of a high negative appendicectomy rate (44%) which had occurred at the same hospital during the year prior to the study.

Materials and methods
A prospective study of the use of the Alvarado score was made on a consecutive series of 215 patients admitted to the University Hospital of Wales with a provisional general practitioners referral of possible acute appendicitis over a 12 month period to July 1990. The scoring system is based on three symptoms, three signs and two laboratory findings (see Table 1). Interpretation and use of the system was as follows: Patients with a score of 1-4 were considered very unlikely to have acute appendicitis and were observed; those patients with a score 5-6 were considered to have a diagnosis compatible with acute appendicitis, but not convincing enough to warrant appendicectomy and were regularly reviewed; those with a score of 7-8 were considered to have a probable acute appendicitis, and those with a score of 9-10 were considered to have an almost definite acute appendicitis and were submitted to operation. The Alvarado score is dynamic and a patient's score can increase or decrease on reassessment. If after 24 hours observation, regardless of score, patients were thought on clinical reevaluation to require appendicectomy, then this was performed.

For assessment the series was divided into three groups: men, women and children.

Table 1. The Alvarado Score

		Score
Symptoms	Migratory RIF pain	1
	Anorexia	1
	Nausea/vomiting	1
Signs	Tenderness RLQ	2
	Rebound pain RIF	1
	Elevation of temperature	1
Laboratory Findings	Leukocytosis	2
	Shift to the left of neutrophils	1
	Total score	=10

Results
The results (Table 2) showed that appendicitis was confirmed histologically in 47 of the 50 men (94%), 31 of the 40 women (78%), and 40 of the 45 children (88%) who had an appendicitis predicted on the basis of the admission Alvarado score (ie a score of 7 or greater). The percentage of appendiceal perforation in these three groups were 22%, 15% and 23% respectively. Of those who had a normal appendix, positive final diagnoses were made in almost all cases (Table 3). Gynaecological conditions were predominant amongst women (9%), mesenteric adenitis in children (8%), and gastroenteritis in men (4%).

Twenty patients failed to settle during the 24 hours after admission and appendicectomy was performed in 10 cases. In 6 of these, acute appendicitis was confirmed histologically, but there were no cases of appendiceal perforation. Of the 10 patients who were not operated on, two were subsequently diagnosed as having urinary tract infections and two had pelvic inflammatory disease. The rest including those who had negative appendicectomies had no final diagnosis and all made uneventful recoveries.

All the patients who failed to settle and had an appendicectomy had an Alvarado score of 5-6. No patient with a score of less than 5 had symptoms severe enough after 24 h to warrant appendicectomy, and no patient in the trial with a score of less than 5 had an appendicectomy at the time or subsequently.

Discussion
The study shows that use of a simple scoring system in patients suspected of having acute appendicitis provides a high degree of sensitivity and specificity. It has an easy application since it relies purely on clinical history, examination, and few simple investigations. An explanation for its success may be

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Table 2. Results of the Alvarado score

	Patients (n)	*Score 7 or >7*	*Appendicitis histologically confirmed*	*Score 6 or <6*	*Appendicitis histologically confirmed*	*False +*	*False −*
Men	75	50	47 (94%)	25	1 (4%)	6%	4%
Women	70	40	31 (78%)	30	2 (6%)	22%	6%
Children	70	45	40 (88%)	25	3 (12%)	12%	12%

Table 3. Final diagnosis of patients with Alvarado Score >7 having appendicectomy

Final diagnosis	*Men*	*Women*	*Children*
Acute appendicitis	94%	78%	88%
Normal appendix	6%	22%	12%
Mesenteric adenitis	1%	2%	8%
Gastroenteritis	4%	2%	3%
Carcinoid tumour	—	1%	—
Appendix fibrosis	—	1%	—
Pelvic inflammatory disease	—	6%	—
Salpingitis	—	2%	—
Ruptured ovarian cyst	—	1%	—
Urinary infection	—	2%	—
No diagnosis	1%	4%	1%

related to the possibility that the clinician is submitted to greater discipline in making the diagnosis, since it is known that units which employ regular critical audit of appendicectomies have been able to reduce the negative appendicectomy rate to below 10%[2].

Of crucial importance was the finding that there were no perforations amongst the group with a score on admission of less than 6 who were observed for the first 24 hours. For this reason the scoring system could be safely used by general practitioners in deciding whether to refer a patient to hospital. At present some patients are referred either too late because the majority of perforations have already occurred before admission[2], or perhaps unnecessarily because many settle without surgery.

The main difficulty in assessment remains in women of childbearing age particularly those in the low score range 5-6 where there is an unacceptably high negative appendicectomy rate. Clearly other aids to diagnosis are required and it would be of interest to know whether the additional use of ultrasound or laparoscopy could reduce the negative appendicectomy rate in this group. There remains doubt on the efficacy of a scoring system now that clinical audit increases the awareness of inappropriate surgery, and consideration should now be given to a controlled trial.

References

1 Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986;**15**:557-65

2 Hoffmann J, Rasmussen O. Aids in the diagnosis of acute appendicitis. *Br J Surg* 1989;**76**:774-90

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