International Surgery Journal
Nigam VK et al. Int Surg J. 2025 Mar;12(3):326-332
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20250563

Original Research Article

Nigam's scoring system: a reliable and accurate scoring system to diagnose acute appendicitis

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Received: 02 December 2024
Revised: 15 January 2025
Accepted: 23 January 2025

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ABSTRACT

Background: Acute appendicitis is one of the commonest surgical emergencies. The early diagnosis of acute appendicitis is essential and should be treated by appendicectomy at earliest to avoid complications like perforation and gangrene. Various scoring systems are in use for this purpose. Nigam's scoring system (NSS) is a reliable, easy and accurate scoring system to diagnose acute appendicitis. NSS covers up the shortcomings of other commonly used scoring systems and thus increases its accuracy factor.
Methods: NSS is based on clinical features and basic investigations without depending upon advanced investigative techniques such as USG and CT scan. The scoring points in NSS are 17 which are divided into the 3 groups, 6 and less, 7 to 10 and 11 and more. The study includes 72 patients of acute appendicitis between January 2014 and January 2024. The results of operation were compared with histopathological results.
Results: Out of 72 patients 4 patients scored 6 and less, 7 patients scored 7 to 10 and 61 patients scored 11 and more. The histopathological reports did not show any normal appendix (negative appendicectomy). Diagnostic accuracy of NSS is found to be 100% correct.
Conclusions: NSS is found as the ideal scoring system among available scoring systems due to its 100% accuracy and 0% negative appendicectomy rate (NAR). It is a reliable, simple and accurate scoring system. It requires awareness about NSS among surgeons so can be adopted in various hospitals globally.

Keywords: Accuracy, Appendicitis, Complications, Diagnosis, Nigam's scoring system

INTRODUCTION

Acute appendicitis is a global problem. It is one of the main causes of acute abdomen and appendicectomy is the most performed abdominal emergency operation. Early diagnosis and urgent appendicectomy are the most important factors to avoid complications in acute appendicitis. NSS helps in early and accurate diagnosis of acute appendicitis which leads to early admission of the patient to the hospital and early surgical treatment.

Unnecessary appendicectomies also should be avoided to avoid potential complications such as ileus (found in 102% of cases) incisional hernia (found in 0.68% of cases) and increased cost to the patient.[1] Hence it is beyond doubt that a quick and easy method to diagnose appendicitis in the clinical setting can be of great use to clinicians, with this purpose in mind, various scoring systems have been developed to aid in the clinical diagnosis of acute appendicitis.[2]

Though some writers believe that overnight delay in appendicectomy does not increase the incidence of complications but it is confirmed by various researches that it increases the chances of wound infection. The necessity for prompt appendicectomy is still widely supported by many authors.[3] Ditillo et al found that the risk of developing advanced pathology and complications increased with time in adult patients with acute appendicitis suggesting that a delay in performing the

appendectomy was unsafe.[4] In addition, the consensus from the 2015 meeting of European Association of Endoscopic Surgery recommended an early appendicectomy as an official opinion regardless of contrary views.[5]

Nigam's scoring system (NSS) is developed to overcome the problems of other scoring systems specially of the most popular Alvarado system, developed by Alfredo Alvarado, an American surgeon, for scoring to diagnose acute appendicitis correctly. Alvarado scoring system was first described in 1986, has remained the most popular scoring system in acute appendicitis for many decades. The scoring system remains popular as this scoring system has been proved to have very good sensitivity and specificity.[6,7] NSS takes care of the factors which were not given proper importance and consideration in Alvarado scoring system so required alteration and have thus increased the accuracy of the diagnosis of acute appendicitis by NSS. The role of NSS becomes more crucial in complicated cases of acute appendicitis as early and accurate diagnosis avoids a considerable amount of morbidity and mortality. NSS has reduced the period between diagnosis and operation theater transfer of the patient of acute appendicitis significantly by avoiding delay in doing CT scan and such other advanced investigations in hour of rush and overbooking. This reduces the advancement of pathology and complications due to delay in diagnosis and appendicectomy. McKay et al recommended a CT scan for a score of 4-6 and surgical consultation for a score of >7. For a score of <3, the authors suggest that a CT scan is unnecessary for diagnosing appendicitis given, the low likelihood of appendicitis.[8] Globally acute appendicitis is a common surgical emergency with a life risk of 1 in 7, which means that 6% of the individuals suffer an attack during their life time, so we cannot take acute appendicitis lightly.[9,10]

Recently, Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) score has been developed for the diagnosis of acute appendicitis in Asian population by Cher Fui Chong, Department of Surgery RIPAS Hospital Brunei, Darussalam.[11] It has several parameters that are absent in the Alvarado score, such as age, gender, and deviation of symptoms prior to presentation, which were shown to effect the sensitivity and specificity of Alvarado scoring system in diagnosis of acute appendicitis.[12] Similarly Nigam's scoring system (NSS) deals with important points missed in Alvarado scoring system.

Most of the scoring systems developed to diagnose acute appendicitis early and reduce the incidence of morbidity and mortality. Furthermore, severe cases have been associated with increased mortality. Hence, the diagnosis of AA can pose challenges with various differential diagnosis especially in females, and any delay in treatment can result in elevated mortality and morbidity rates.[13,14]

We in our centre first did clinical diagnosis after through clinical examination then performed preliminary laboratory tests and scored the case, then we decided for management of the case according to the NSS. In cases where time permitted, we performed USG and or CT scan and studied the findings and compared the results of these findings with NSS scoring. In most of our cases in this study we did not wait for the USG and CT scan if there was delay. Our decision to depend more on NSS than wait for special investigations to be done was also performed keeping negative appendicectomy rate in mind. We know that doing appendicectomy based on scoring system alone can lead to negative appendicectomy if the scoring system is not very accurate. Appendicectomy has been associated with negative appendectomy rates (NARs) of 15-39% in large series. The NAR is well determined by the definition of the term applied in the published study, but unfortunately, there is currently no widely accepted standard definition of a negative appendicectomy.[15] NSS diagnoses acute appendicitis with high accuracy rate without negative appendicectomy.

In patients with acute pain in the right lower quadrant, the sonographic diagnosis of appendicitis can be established with confidence if a noncompressible appendix is visualized with anteroposterior measurements consistently 7 mm or greater.[16] The primary criteria for a CT scan to diagnose acute appendicitis are appendicular swelling, defined as an appendicular diameter greater than 6 mm, and periappendiceal inflammatory alterations. Nevertheless, normal appendices with a diameter >6 mm are frequently encountered in daily practice.[17,18] CT scan we could do only preoperative in 20 (27.7%) patients due to early availability and without waiting. USG was done preoperatively in 24 patients (33.3%).

Objective

The objective of this study was to find a scoring system which is highly accurate with high sensitivity and specificity to diagnose acute appendicitis without the need of special investigative techniques like CT scan and USG. NSS is the scoring system which fulfills all these required features.

METHODS

This study was an original research work based on physical examination of the patients with minimum laboratory tests to score the disease and plan the treatment accordingly.

The statistical side of our surgical research had gone through statistical analysis and inferential statistics.

Informed consent was taken from all patients in writing after explaining the details.

This study of diagnosing acute appendicitis by NSS was done at our centre for its accuracy. This study included 72 cases of acute abdomen with pain in right iliac fossa which were assessed by NSS for acute appendicitis, perforation and gangrene of appendix between January 2014 to January 2024 at Max Hospital, Gurgaon, Haryana, India. These patients were suspected as cases of acute appendicitis by doctor on duty and surgical resident of the hospital. Patients were referred to our team for further management. We gave the scoring points according to NSS after clinical examination and preliminary laboratory tests and managed the cases as per NSS guidelines. Age of patients in this series varied between 16 and 51 years. There were 58 male (80.5%) and 14 were female (19.5%) patients in this study.

Inclusion criteria

All cases of acute abdomen with right iliac fossa pain were included.

Exclusion criteria

Cases of acute abdomen with pain elsewhere than RIF were not included in this series. This was the limitation factor in this study.

NSS has maximum 17 points based on clinical features and preliminary laboratory tests such as migratory right iliac fossa, anorexia, nausea/vomiting, pain precedes vomiting, vomiting precedes pain, tenderness and leucocytosis (Table 1).

Table 1: NSS.

Variables	Score
Symptoms	
Migratory right iliac fossa	1
Anorexia	1
Nausea/vomiting	1
Pain precedes vomiting	1
Vomiting precedes pain	-1
Signs	
Tenderness RIF (mild)	2
Tenderness RIF (moderate)	3
Tenderness RIF (severe)	4
Rebound tenderness in RIF	2
Guarding in RIF	2
Elevated temperature	1
Laboratory findings	
Leucocytosis 10000-12000 per microliter of blood	2
Leucocytosis 12000-15000 per microliter of blood	3
Leucocytosis more than 15000 per microliter of blood	4
Maximum score 17	

Score by NSS was divided into three groups. First group of patients earned less than 6 points were considered as probably not having acute appendicitis. Second group of patients earning 7 to 10 points probably have acute appendicitis. Third group having 11 or more points are confirmed cases of acute appendicitis (Table 2).

Table 2: Interpretation of NSS.

NSS	Interpretation
6 and less than 6	Probably not acute appendicitis
7 to 10	Probably acute appendicitis
11 and more	Confirmed diagnosis of acute appendicitis

Table 3: NSS management guidelines.

Score	Management
6 and less than 6	Discharge with treatment
7 to 10	Admit for observation
11 and more	Admit for appendectomy

Patients who scored 6 or less than 6 points were discharged with advice about treatment, but not considered for appendicectomy as they were not cases of acute appendicitis. Patients who scored 7 to 10 were admitted in the hospital as they were suspected cases of appendicitis. Patients who scored 11 or more points were diagnosed as confirmed cases of acute appendicitis and were admitted for appendicectomy (Table 3).

Cases of acute appendicitis who scored 11 or more points (61 cases, 84.7%) were subjected to emergency appendicectomy directly whereas the cases scored less than 6 points (4 cases, 5.6%) were discharged. The cases scored between 7 and 10 points (7 cases, 9.7%) were admitted for observation and reassessment according to NSS. Four cases (5.6%) out of 7 turned out with more points in due course were operated for appendicectomy. Three cases out of 7 were discharged as their points reduced after sometimes. Total 65 cases (90.2%) were operated for appendicectomy as they earned 11 and more points (Table 4 and Figures 1-5).

Histopathological results were compared with NSS score which showed no negative appendicectomy, making negative appendicectomy rate zero (Table 5). All 65 patients (90.2%) operated for appendicectomy were confirmed as suffering with acute appendicitis by operative and histopathological findings also. It was observed that patients who had more than 15000 or more leukocyte count (per microliter of blood) with higher score had complicated acute appendicitis, gangrene or perforation of appendix. Nine cases (12.5%) earned higher points with more than 15000 leukocytes count per microliter of blood turned out as perforation or gangrene of the appendix. Higher the score on NSS higher was the inflammation of appendix even impending perforation or gangrene.

RESULTS

Patients were scored according to NSS. Four patients (5.6%) earned 6 or less than 6 points were discharged with advice about treatment as they were not cases of acute appendicitis so not considered for appendicectomy.

Table 4: NSS results of our study, n=72.

Score	No. of patients	Percentage
6 and less than 6	4	5.6
7 to 10	7	9.7
11 and more	61	84.7

Table 5: Histopathology results of appendectomy.

Results	No. of patients	Percentage
Negative appendectomy	0	0
Appendicitis confirmed by histopathology	65 (65 patients were operated)	90.2 of total cases, 100% operated cases

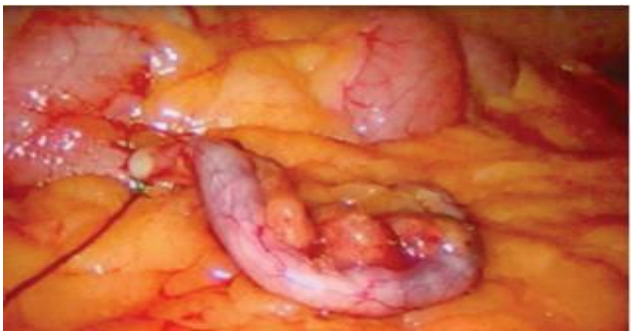

Figure 1: NSS score 8 (acute appendicitis).

Figure 2: NSS score 10 (acute appendicitis).

Seven cases (9.7%) were admitted in the hospital as suspected cases of acute appendicitis, but not with confirmed diagnosis of acute appendicitis, 4 (5.6%) out of these 7 cases (9.7%) earned 11 and more in due course were considered for appendicectomy and 3 remaining cases (4.1%) out of 7 were discharged with advice. Sixty-one cases (84.7%) earned 11 and more points by NSS were directly prepared for emergency appendicectomy.

Figure 3: NSS score 15 (acute perforated appendicitis).

Figure 4: NSS score 16 (acute gangrenous appendicitis).

Figure 5: NSS score 17 (perforated appendicitis with general peritonitis).

We did not keep patient waiting overnight due to fear of complications and operated urgently after NSS scoring. Nine cases (12.5%) earned higher points in the third group (11 and more) with leucocyte count more than 15000 per microliter of blood were diagnosed as having acute appendicitis with complications such as perforation or gangrene of appendix. All these 9 cases were confirmed with operative and histopathological findings as cases of perforation (7 cases) or gangrene (2 cases). Two cases (2.7%) out of 7 cases of perforation also had general peritonitis, these cases were brought late to the hospital. Out of 65 patients (90.2% of total number of study and 100% operated cases) operated, no histopathological report came as normal appendix (negative appendix).

Statistics

In this study probability of appendicitis and its complications with management and probability distribution are mentioned with assessment of accuracy and sensitivity.

Accuracy

The accuracy of a test is its ability to differentiate the patient and healthy cases correctly. Mathematically, this can be stated as:

Accuracy= TP + TN/ TP + TN + FP + FN

In our study=72+0/72 + 0 + 0 + 0=100%.

Sensitivity

The sensitivity of a test is ability to determine the patient cases correctly. Mathematically, this can be stated as:

Sensitivity= TP/TP + FN

In our study= 72/72 + 0=100%.

(TP= true positive, TN= true negative, FP= false positive, FN= false negative).

It was small study but we feel that NSS gives better diagnostic accuracy than Alvarado and other scoring systems.

DISCUSSION

Acute appendicitis is a common and significant surgical problem. Early diagnosis and urgent appendicectomy are the main factors for its management without further advancement of pathology. It is important to note that in cases of typical appendicitis the use of imaging may potentially lead to a delay in surgical consultation and intervention, therefore, increasing the risk of complication.[19] Though some people say that scoring systems help in suspecting acute appendicitis but cannot definitely label as appendicitis. We feel that suspecting a case of acute abdomen as acute appendicitis, is simple and doesn't require any scoring system but diagnosing definitely requires scoring system.

The development of various scoring systems for diagnosis of acute appendicitis has helped most the surgeons working at primary health centre level or town or village level and small hospitals which are not equipped with sophisticated diagnostic techniques such as CT scan. In small hospitals or nursing homes, in underdeveloped and developing countries scoring systems have contributed a lot by definitively diagnosing acute appendicitis only by history, clinical findings and preliminary laboratory tests without CT scan economically.

Basically, we all surgeons, in various countries globally, working to find an easy and accurate scoring system to diagnose acute appendicitis and do appendicectomy at earliest and reduce the sufferings caused by delay and complications. The delay in treating complicated cases of acute appendicitis definitely increases mortality and morbidity which we have to reduce at all costs. How rightly Paul Georges Dieulafoy had said, "no one should die of appendicitis". We must feel the sentiments and desire of this statement. We felt that and dedicated about 20 years in search of developing an ideal scoring system. Every senior surgeon worldwide must have felt helplessness and despair when treated delayed case of complicated appendicitis, with perforation and gangrene, unsuccessfully with all the ability and experience.

The search of a method of scoring system which is easy, accurate and relying on clinical findings and basic laboratory investigations has led to the development of NSS. Consequently, there has been a growing need to search and develop a variable diagnostic score that enables accurate diagnosis, while reducing the rate of NA and over reliance on radiological assessments.[20]

Acute appendicitis is one of the commonest surgical problems world over. Alvarado scoring system though very famous but is challenged by various other scoring systems due to its certain short comings, however, the diagnostic power of Alvarado score in predicting AA was assessed in a previous study and concluded that it was insufficient to be considered the main scoring system in our institution.[21,22] A known limitation of the score is that only 20% of elderly patients present with classic findings on which score focuses.[23] Alvarado scoring has largely been superseded as a clinical prediction tool by the appendicitis response score similarly the Nigam's scoring system is developed to cover few factors missed by Alvarado scoring system to improve the accuracy of diagnosis of acute appendicitis.[24] Tenderness in RIF and leucocytosis are the most important factors and that's why more points are given to various stages of these two factors in NSS.[25] Alvarado himself modified his scoring system in 2016 and refined the criteria of the MANTRELS mnemonic giving more importance to tenderness and leucocytosis which was not given such importance earlier.[26]

The abdominal surgical procedures or a perforated appendix, can cause severe morbidities, such as recurrent episodes of intestinal obstruction due to intra-abdominal adhesions, ectopic pregnancy etc.[27,28] Thus, timely and accurate diagnosis is essential for the proper management and prevention of complications.[29,30]

CONCLUSION

Acute appendicitis is one of the most common causes of acute abdomen and important too. Delay in diagnosis and appendicectomy can lead to serious complications. NSS diagnoses acute appendicitis accurately without the help

of USG, MRI or CT scan. NSS is solely based on clinical examination and preliminary laboratory tests. NSS is reliable and accurate so its application helps in diagnosing without causing any delay and avoiding complications. Though this study was small so more work should be done and NSS should be taken as an ideal scoring system widely to diagnose acute appendicitis.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. Charvi Chawla for her efforts to arrange data and other information required for this research work. We are also thankful to Mr. Vipin Sharma for preparation of manuscript and computer related work.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Nigam VK, Nigam S. Nigam's scoring system/NSS- a reliable and accurate scoring system to diagnose acute appendicitis. Int Surg J 2025;12:326-32.