AIR SCORE ASSESSMENT FOR ACUTE APPENDICITIS

Avaliação do escore de AIR para apendicite aguda

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ABSTRACT - Background: Acute appendicitis is the most common cause of acute abdomen. Approximately 7% of the population will be affected by this condition during full life. The development of AIR score may contribute to diagnosis associating easy clinical criteria and two simple laboratory tests. Aim: To evaluate the score AIR (Appendicitis Inflammatory Response score) as a tool for the diagnosis and prediction of severity of acute appendicitis. Method: Were evaluated all patients undergoing surgical appendectomy. From 273 patients, 126 were excluded due to exclusion criteria. All patients were submitted o AIR score. Results: The value of the C-reactive protein and the percentage of leukocytes segmented blood count showed a direct relationship with the phase of acute appendicitis. Conclusion: As for the laboratory criteria, serum C-reactive protein and assessment of the percentage of polymorphonuclear leukocytes count were important to diagnosis and disease stratification.

INTRODUCTION

Acute appendicitis is the most common cause of acute abdomen. Approximately 7% of the population will be affected by this condition during full life\(^1\). It most often occurs in adolescence and in the 20's, in a 3:2 man-woman ratio. The acute appendicitis continues to be an important cause of morbidity in the population when its diagnosis is late or only known in developed stages of diffuse peritonitis\(^2\).

The inflammation of the vermiform appendix happens mainly due to the obstruction of its lumen\(^3\). From the anatomopathologic point of view, the acute appendicitis is classified as: catarrhal, phlegmonous, gangrenous and perforated. These categories represent the evolutionary stages of the disease\(^4\).

Pain in the abdomen is the main and most frequent symptom of acute appendicitis, with classic migration from periumbilical or epigastric to location in the right iliac fossa in 75% of patients. It may occasionally be reported in other places depending on the position occupied by the cecal appendix.

In most cases it is associated with muscular defense, nausea, vomit and low fever. These symptoms generally aggravate as the disease progresses. The diagnosis is eminently clinical, being associated with laboratory and image exams in case of diagnostic uncertainty\(^4\).

The development of AIR score contributes to diagnosis because through associating easily applicable clinical criteria and two simple laboratory tests it is attributed the score which classifies the patients regarding the probability of diagnosis\(^5\).

The main aim of this study was to assess the AIR criteria as a tool for diagnosis and predicting the seriousness of the acute appendicitis cases.

METHODS

The project was approved by the local Research Ethics Commission. A retrospective cohort has been performed at Hospital Regional de São José, São José, SC, Brazil. A
monthly data collection was made, which helped review the medical records and the medical exams of patients who underwent appendectomy between July of 2013 and July of 2014.

A hundred and twenty-six out of 273 patients who underwent appendectomy did not meet the inclusion criteria (absence of physical exam data in medical record and absence of CBC (complete blood count) and/or CRP (C-reactive protein), leaving out 147 patients. The only included were the ones who had conditions to satisfy the full AIR score criteria.

As criteria for assessment, were used the data from the physical examination (abdominal pain in the right iliac fossa, degree of abdominal defense, fever, vomit) and lab criteria from CBC and dosage of CRP to establish stratification of AIR score (Table1).

A data base was built in the SPSS program (Statistic Package for Social Sciences) in its version 17.0. The program made possible to analyze the information and build graphs, tables and descriptive statistics.

The descriptive analysis was performed from the absolute simple frequencies, percentage and descriptive measurements (mean, medium, standard variation and maximum/minimum values). A test t of Student was used for the continuous variables and a test U of Mann-Whiney for independent samples. The fixed significance level was 5% (p<0,05).

### TABLE 1 - Appendicitis Inflammatory Response (AIR) score

| Diagnosis                  | score |
|----------------------------|-------|
| Vomit                      | 1     |
| Pain in RIF                | 1     |
| Abdominal Defense          |       |
| low                        | 1     |
| Mild                       | 2     |
| Severe                     | 3     |
| Temperature >38.5 C        | 1     |
| Segmented Neutrophils      |       |
| 70-84%                     | 1     |
| >85%                       | 2     |
| Leukocytes                 |       |
| >10.0–14.9 x 10⁹/l         | 1     |
| >15.0 x 10⁹/l              | 2     |
| CRP                        |       |
| 10–49 g/l                  | 1     |
| >50 g/l                    | 2     |

AIR: sum 0–4=low probability; sum 5–8=mild probability; sum 9–12=high probability.
RIF=Right Iliac Fossa; CRP=C-reactive protein.

### TABLE 2 – Complete description according to age, days of development and AIR score (n=147)

| Description | Age | Days of development | AIR score |
|-------------|-----|---------------------|-----------|
| Mean        | 34.3| 2.8                 | 7.7       |
| Medium      | 31  | 2                   | 7         |
| Standard Variation | 14.5 | 2.7               | 1.7       |
| Min         | 16  | 1                   | 5         |
| Max         | 87  | 15                  | 12        |
| Number of Patients | 147 |                 | 147       |
| IC          | 2.3 | 0.4                 | 0.3       |

The AIR score criteria was on average 7.7 with mean of 7, its minimum value of 5 and maximum of 12. All were placed in subgroups as mild (65,3%) and high probability (34.7%) for acute appendicitis.

Pain in the right iliac fossa was observed in 140 patients (95.3 p<0.0001) as variables in the AIR criteria.

Vomit was reported in 51.7% and the axillary temperature went up beyond 38.5ºC in just 27.9% of the patients (p<0.0001). The abdominal defense was described as low (44.2%), mild (35.4%) and intense (20.4%).

As for the development of acute appendicitis, all have been stratified during intraoperative procedure. Regarding the aspect of the cecal appendix, it was considered stage 1 catarrhal, stage 2 suppurated, stage 3 gangrenous and stage 4 perforated. Stage 2 was the most prevalent (37.4%).

When the percentage of segmented neutrophils was associated with the acute appendicitis phase, it demonstrated that the phase 1 had 85% smaller value of segmented neutrophils in 95% of cases (p<0.05).

When the stage 4 appendicitis was analyzed, was noticed an inversion in tendency with a higher than 85% more segmented neutrophils predominance in 60% of patients (Table 3).

By analyzing the CRP value, in initial cases - stage 1, the CRP remained between 10-49 in 95% of cases, and above 50 in 60% of stage 4 cases.

### TABLE 3 – Reference of appendicitis stage with percentage of segmented neutrophils in WBC and CRP

| Appendicitis phase | Stage 1 | Stage 2 | Stage 3 | Stage 4 | Total | P     |
|--------------------|---------|---------|---------|---------|-------|-------|
|                    | n %     | n %     | n %     | n %     | n %   |       |
| Segmented Neutrophils | 70% to 84% | 18 | 95% | 35 | 64% | 22 | 67% | 16 | 40% | 91 | 62% | <0.001 |
| > 85%              | 1 | 5% | 20 | 36% | 11 | 33% | 24 | 60% | 56 | 38% |
| CRP                | 10–49 g/l | 18 | 95% | 49 | 89% | 18 | 55% | 16 | 40% | 101 | 69% | <0.001 |
| > 50 g/l           | 1 | 5% | 6 | 11% | 15 | 45% | 24 | 60% | 46 | 31% |

CRP=C reactive protein

### TABLE 4 – Relation between AIR score with the stage of appendicitis, percentage of segmented neutrophils and CRP

| Total score | Mild | High | Total | P     |
|-------------|------|------|-------|-------|
| n %         | n %  | n %  | n %   |       |
| Segmented neutrophils | 70% to 84% | 75 | 78% | 16 | 31% | 91 | 62% | <0.001 |
| > 85%       | 21 | 22% | 35 | 69% | 56 | 38% |

Stage of appendicitis

| Phase 1 | 18 | 19% | 1 | 2% | 19 | 13% |
| Phase 2 | 41 | 43% | 14 | 27% | 55 | 37% |
| Phase 3 | 21 | 22% | 12 | 24% | 33 | 22% |
| Phase 4 | 16 | 17% | 24 | 47% | 40 | 27% |

| CRP    | 10 to 49 | 85 | 89% | 16 | 31% | 101 | 69% | <0.001 |
| > 50 g/l | 11 | 11% | 35 | 69% | 46 | 31% |

CRP=C reactive protein; AIR=Appendicitis Inflammatory Response
When connected the AIR score to the appendicitis evolutionary stage, was noticed that a mild score relates to the initial stages (1 and 2) in 62% of cases, while the high probability score was related to developed stages (3 and 4) in 71% (Table 4).

**DISCUSSION**

All patients who underwent appendectomy were stratified by the AIR criteria as mild (65.3%) and high probability (34.3%) for acute appendicitis, which made possible to infer that the patients assessed in the emergency suffering from abdominal pain and that had been stratified as low probability, in fact did not need surgical intervention.

The pain in the right iliac fossa is the main symptom for acute appendicitis and in this sample, it was present in 95.2% of patients.

Patients with score for high probability had statistically significant chance of showing more developed stages of acute appendicitis.

When criteria were analyzed in a isolated manner, as previously described by other authors, was noticed that CRP and segmented neutrophils show direct relation with the acute appendicitis stage. CRP was below 50 in patients in stage 1 and segmented neutrophils below 85% in 95% of the cases, and in stage 4, CRP was above 50 and segmented neutrophils above 85% in 60% of patients.

**CONCLUSION**

The AIR score is useful for diagnosing acute appendicitis. The serum CRP and assessment of percentage of segmented neutrophils in WBC are important in the diagnosis and stratification of evolutionary stage of the disease.

**REFERENCES**

1. Andersson R. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. Br J Surg 2004; 91(1):28-37.
2. Borges PSG, Nogueira LMC, Neto GHF. Validação do escore de Alvarado no diagnóstico de apendicite aguda em crianças e adolescentes no Instituto Materno Infantil de Pernambuco - IMIP. Rev Bras Saúde Matern. Infant.2003; 3(4):439-445.
3. Brenner AS, Santin JVN, Frederico BT, Valarini RR. Apendicectomia em pacientes com idade superior a 40 anos: análise dos resultados de 217 casos. Rev bras. colo–proctol. 2006 Jun26(2): 128-132.
4. Carvalho BR, Diogo-Filho A, Fernandes C, Barra CB. Leucograma, proteína C reativa, alfa-1 glicoproteína ácida e velocidade de hemossedimentação na apendicite aguda. Arq Gastroenterol. 2003 Mar; 40 (1):25-30.
5. Castro SM, Ünlü C, Steller EP, van Wagensveld BA, Vrouenraets BC. Evaluation of the Appendicitis Inflammatory Response Score for Patients with Acute Appendicit. World J Surg (2012) 36:1540–1545
6. Fischer CA, Pinho MSL, Ferreira S, Milani CAC, van Santen CR, Marquardt RA. Apendicite aguda: existe relação entre o grau evolutivo, idade e o tempo de internação. Rev. Col. Bras. Cir. 2005; 32(3): 136-138.
7. Franzon O, Picoli MC, Neves TT, Volpato MG. Apendicite aguda: análise institucional no manejo perioperatorio. ABCD Arq Bras Cir Dig Artigo Original 2009;22(2):72-75
8. Freitas RG, Pitombo MB, Maya MCA, Leal PR. Apendicite Aguda. Revista do Hospital Universitário Pedro Ernesto, UERJ. Vol. 8, N. 1 Jan-Jun - 2009.
9. Goldman L, Ausiello, Cecil, D. Tratado de Medicina Interna. Tradução de Ana kemper et al. Rio de Janeiro Elsivier, 2005.
10. Goulart GS, Silvério GS, Moreira MB, Franzon O. Achados principais de exames laboratoriais no diagnóstico de apendicite aguda: uma avaliação prospectiva. ABCD Arq Bras Cir Dig 2012;25(2):88-90
11. Reis JMO, Lucatto TM, Reis Júnior WB. Diagnóstico e tratamento de 300 casos de apendicite aguda em crianças e adolescentes atendidos em um hospital universitário. Revista Médica de Minas Gerais 2008; 18(1): 11-15.