

## Original Research Article

# Validation of the Dutch leakage score as a predictor of anastomotic leakage in intestinal surgery in a third level hospital

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### ABSTRACT

**Background:** Intestinal surgery can present multiple complications that can lead to patient death; therefore, it is important to design early detection strategies to reduce complications in patients with intestinal anastomosis and thus avoid patient death. The aim of this work is to evaluate the diagnostic performance of the Dutch leakage score in 125 patients with intestinal anastomosis as a predictor of anastomotic leakage.

**Methods:** In a sample of 125 patients undergoing intestinal anastomosis, demographic variables were identified and the Dutch leakage score was applied. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were obtained using a 2x2 table.

**Results:** The Dutch leakage score was positive in 23.2% (29 patients) of whom 24 had anastomotic leakage and 5 had no anastomotic leakage. It presents a sensitivity in the test of 100%, a specificity of 95%, a positive predictive value of 82.7%, a negative predictive value of 100%. The diagnostic accuracy is 96%.

**Conclusions:** The Dutch leakage score is a versatile tool, inexpensive, easy to apply and available in any hospital center. It is capable of early diagnosis of anastomotic leakage. It favors early re-intervention, improves prognosis and survival, decreases hospital stay and health care costs.

**Keywords:** Anastomosis leak, Intestinal surgery, Intestinal anastomosis, Dutch leakage score

### INTRODUCTION

Intestinal surgery can present multiple complications that can lead to the death of the patient. The incidence of complications after intestinal surgery varies according to different series, but it is estimated to range between 10 and 30%, most of these complications require a new surgical intervention.<sup>1</sup> The causes are related to the surgical technique, bowel conditions, the cause of the disease and the biological reserve of the patient.<sup>2</sup> The most serious consequence of an anastomotic leak is abdominal sepsis, a life-threatening condition that requires multidisciplinary management by highly trained personnel, increases the number of days of hospital stay, leading to disability and a decrease in the useful life of

the patient. Therefore, it is important to design early detection strategies to reduce complications in patients with intestinal anastomosis and thus avoid the death of the patient.

Different risk factors related to the development of intestinal anastomotic leakage have been studied. Among the risks inherent to the patient are malnutrition, male sex, obesity BMI >30, use of corticosteroids, smoking, alcohol consumption, cardiovascular disease, as well as inflammatory intestinal processes. Risk factors related to surgery include low anastomosis, vascular compromise of the anastomosis, operative time greater than 2 hours, intestinal obstruction, use of blood transfusion during surgery, and sepsis, among other conditions not

conducive to intestinal anastomosis.<sup>3</sup> In an observational study reviewing the complications of 378 patients undergoing gastrointestinal surgery, the prevalence of anastomotic dehiscence was 2.4% in scheduled surgery and 4.3% in emergency surgery.<sup>4</sup> The rate of anastomotic leakage varies from 1% to 30%, although rates of 3% to 6% are cited as an acceptable range.<sup>5</sup>

There are clinical scoring scales for the early diagnosis of anastomotic leakage in order to reduce the time delay in the diagnosis of leakage and reduce its mortality. Among the scales proposed is that of the study carried out by Dulk and collaborators, where clinical criteria were used to create a scoring system called The Dutch leakage score (Table 1) where points are attributed to certain clinical symptoms and laboratory findings.<sup>6</sup> Using this scale, it was found that patients with a score of more than 7 points were at greater risk of developing an intestinal anastomotic leak because they required confirmatory imaging studies for subsequent surgical management, thus reducing the delay in the diagnosis of leakage, and thus being able to undergo early intervention and thus reduce the occurrence of abdominal sepsis. A shorter diagnosis of anastomotic leak was demonstrated for patients monitored with standardized postoperative surveillance (median 4.0 versus 1.5 days,  $p=0.01$ ).<sup>6</sup>

**Table 1: The Dutch leakage score.**

Variables	Scores
Fever $>38^{\circ}\text{C}^{\#}$	1
Respiratory frequency $>30/\text{min}$	1
Cardiac frequency $>100/\text{min}$	1
Oliguria ( $<30\text{ ml/hora}$ o $<700\text{ ml al día}$ )	1
Agitation or lethargy	2
Clinical impairment	2
Íleo	2
Gastric retention	2
Surgical wound dehiscence	2
Abdominal pain	2
Leukocytosis or CRP* elevation $>5\%$	1
Creatinine elevation or urea $>5\%$	1
Enteral nutrition	1
Parenteral nutrition	2

<sup>#</sup>°C: Celsius Grade, \*CRP: C-reactive protein level

The Dutch leakage score uses easily accessible clinical parameters that can be assessed daily. Patients with a high score are more likely to have anastomotic leak and to have a laparotomy; this has been shown to reduce the delay in diagnosing anastomotic leak from a median of 4 days to 1.5 days, with a concomitant reduction in mortality from 39% to 24%.<sup>6</sup> The Dutch leakage score has been shown to be a useful clinical tool in the diagnosis of anastomotic leak. These include clinical condition, abdominal pain not localized to the wound, C-reactive protein level, and respiratory rate.<sup>7</sup> The clinical manifestations of anastomotic leak can vary because they depend in part on the location and magnitude of the leak. Larger dehiscence manifest more rapidly leading to early

onset of abdominal sepsis. But small dehiscence, being contained by the omentum and intestines, may present as vague abdominal pain of lesser intensity or even as prolonged ileus.<sup>8</sup>

The objective of this work was to evaluate the diagnostic performance of the Dutch leakage score in 125 patients with intestinal anastomosis as a predictor of anastomotic leakage.

## METHODS

A retrospective, cross-sectional, analytical study of diagnostic test type where the Dutch leakage score was applied in 125 patients in hospital regional de Alta Especialidad de Oaxaca who underwent intestinal anastomosis between January 2019 and December 2019. For the development of the study, demographic data such as age, sex, type of anastomosis, fever, respiratory rate, heart rate, uresis, mental status, clinical condition, intestinal obstruction, gastric retention, wound dehiscence, abdominal pain, signs of infection, renal function, diet were obtained. The score was applied on the second and fourth postoperative day as performed in the original study.

Inclusion criteria included records of patients who underwent manual or automatic intestinal reconnection and who had the variables to be analysed. Elimination criteria excluded the files that do not contain the necessary information for the purposes of this study.

We performed a descriptive analysis of the variables with measurement of sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Dutch-leakage scale diagnostic test in a 2x2 table.

Data recording and analysis will be performed with IBM SPSS V 21 statistical software.

### Ethical responsibilities

Protection of humans and animals. The authors declare that no experiments on humans or animals have been performed for this research.

Confidentiality of data. The authors declare that they have followed their center's protocols on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

## RESULTS

We analysed 125 patients with intestinal anastomosis where The Dutch leakage score was applied on the second and fourth postoperative day 3 Regarding the

demographic variables of the 125 patients, 51.2% (64 patients) were men and 48.2% (61 patients) were women, with a mean age of 52.8 years. Regarding the type of anastomosis, 53.6% (67) were performed with stapler and 46.4% (58) were manual, the scale was negative in 76.8% (96) and anastomosis leakage was present in 19.2% (24) (Table 3). The Dutch leakage score was positive (>7 points) in 23.2% (29 patients) of which 82.75% (24) had anastomotic leakage and 17.25% (5) had no anastomotic leakage. Of this group of patients with positive test n=29, 51.72% (15) were women and 48.27% (14) were men, with a median age of 53.2 years with an interquartile range of 46-61 years. In this group 58.62% (17) were stapler anastomosis and 41.37% (12) were manual anastomosis. The median scale score on the second day was 7.5 points with an interquartile range of 7.1-8; the median scale score on the fourth day was 10.2 points with an interquartile range of 7.75-12.5. In these patients 24 (82.75%) had anastomotic leakage corroborated at re-laparotomy and 5 patients (17.25%) were managed conservatively and did not evidence leakage (Table 4).

Among the symptoms evaluated (Table 5) we found that on the second day tachycardia was present in 100% of the patients with anastomotic leak, tachypnea 53%, fever 22%, abdominal pain 12%, oliguria 13% and mental status alterations in 9%. On the fourth day, tachycardia was maintained in 100% of the patients, tachypnea 77%, fever 82%, abdominal pain 100%, oliguria 93.5% and mental status alterations in 45%.

**Table 2: The Dutch leakage score by 2x2 table.**

The Dutch leakage score	Positive	Negative	Total
<b>Positive</b>	24	5	29
<b>Negative</b>	0	69	96
<b>Total</b>	24	101	125
<b>Sensitivity (%)</b>	100		
<b>Specificity (%)</b>	95		
<b>Positive predictive value (%)</b>	82.70		
<b>Negative predictive value (%)</b>	100		
<b>Diagnostic accuracy (%)</b>	96		

**Table 3: General result, (n=125).**

Variables	Result
<b>Men (%)</b>	64 (51.2)
<b>Women (%)</b>	61 (48.2)
<b>Age (Years), media (IR*)</b>	52.8 (33-72)
<b>Anastomosis with stapler (%)</b>	67 (53.6)
<b>Manual anastomosis (%)</b>	58 (46.4)
<b>Positive score (&gt;7 points) (%)</b>	29 (23.2)
<b>Negative score (%)</b>	96 (76.8)
<b>Anastomotic leak (%)</b>	24 (19.2)

\*IR: interquartile range

**Table 4: Positive score groups, (n=29).**

Variables	Result
<b>Men (%)</b>	15 (51.72)
<b>Women (%)</b>	14 (48.27)
<b>Age (Years), media (IR)*</b>	53.2 (46-61)
<b>Anastomosis with stapler (%)</b>	17 (58.62)
<b>Manual anastomosis (%)</b>	12 (41.37)
<b>Score day 2, media (IR)</b>	7.52 (7.1-8)
<b>Score day 4, media (IR)</b>	10.2 (7.75-12.5)
<b>Anastomotic leak (%)</b>	24 (82.75)
<b>No anastomotic leak (%)</b>	5 (17.25)

\*IR: interquartile range

**Table 5: Comparison of clinical variables in patients with anastomotic leakage.**

Variables	Second day	Fourth day
<b>Tachycardia</b>	100	100
<b>Tachypnea</b>	53	77
<b>Fever</b>	22	82
<b>Abdominal pain</b>	12	100
<b>Oliguria</b>	13	93
<b>Mental confusion</b>	9	45

\*Variables expressed as a percentage

Statistical analysis showed a sensitivity of 100%, specificity of 95%, positive predictive value of 82.7%, negative predictive value of 100%, and a diagnostic accuracy of 96% (Table 2).

## DISCUSSION

As anastomotic leakage is the most feared complication after intestinal reconnection because it increases patient mortality and lengthens hospital stay, it is of utmost importance to have a clinical tool that is useful in the diagnosis of anastomotic leakage, facilitating decision making and thus having more objective arguments in the treatment of this complication and reducing mortality in patients undergoing this procedure. Diagnosis is sometimes difficult, but early detection of abdominal sepsis is decisive, as well as differentiating infections susceptible to conservative treatment from those requiring surgical management. The study by Den Dulk et al included 782 patients with colon anastomosis in which the Dulk scale was used as a tool for the early diagnosis of anastomotic leakage in which 81 patients (10.4%) had a clinically relevant anastomotic leak. The Dulk-leakage score yielded an overall sensitivity of 97% for anastomotic leakage, overall specificity of 53%, a positive predictive value (PPV) of 16% and a negative predictive value (NPV) of 99%.<sup>9</sup> A modification of the scale was used in which clinical condition, abdominal pain not localized to the wound, C-reactive protein level and respiratory rate were used. With at least one parameter present, the overall sensitivity was 97%, overall specificity 57%, PPV 17% and NPV 99.5%. With at least two points, the PPV was 41% and with three points 57%.<sup>9</sup>

In our sample of 125 patients with intestinal surgery including small and large bowel anastomosis for oncologic and benign pathology, the results indicate that the Dulk score is a tool that allows early diagnosis of anastomotic leakage with a sensitivity of 100%, specificity of 95%, NPV 100% results comparable with the original Dulk study where the results were a sensitivity of 100%, specificity of 53% and NPV 99% with the difference that in the original study 782 patients were used, we believe that using a similar number of patients the results could be even closer.

However, a retrospective study by Martin et al in France validated the Dulk scale as a diagnosis of anastomotic leak in 100 patients in which 12 developed a postoperative anastomotic leak (12%) with a specific mortality rate of 16.6% (2 patients).<sup>10</sup> A Dulk-score >3 was a good criterion for the early diagnosis of anastomotic leak with a sensitivity of 91.7%, a specificity of 55.7%, a positive predictive value of 22%, a negative predictive value of 98% and an area under the ROC curve of 0.83.<sup>10</sup>

One of the strengths of our study is that there is no other study in Mexico in which this scale has been validated, in addition to the fact that small bowel anastomosis was included, since the Dulk study had originally been performed only in colorectal surgery, thus demonstrating that this scale can also work for these patients.

The use of CRP (c-reactive protein) as a marker of anastomotic leakage has also been studied. In the study by Almeida et al, they studied 173 patients who underwent colorectal surgery with a dehiscence rate of 13.8% and found an early and persistent elevation of CRP levels after surgery, with values greater than 140 mg/dl on postoperative day 3 being the most sensitive (78%) and specific (86%).<sup>11</sup>

Within the clinical signs and laboratory values during postoperative hospitalization, to detect those clinical and laboratory abnormalities that are most related to the occurrence of anastomotic leakage, it was found that the clinical signs that occurred frequently in patients who developed leakage compared to those who did not present leakage: tachycardia, tachypnea, fever, oliguria, abdominal pain, gastric retention and ileus. These clinical manifestations of anastomotic leakage may vary because they depend in part on the location and magnitude of the leak, and whether all adjacent tissues such as the omentum or small bowel contain the leak. Large dehiscence manifest earlier, and quickly lead to sepsis, peritonitis and hemodynamic instability. But small dehiscence, being contained by the omentum and intestines, may present as vague abdominal pain of lesser intensity and prolonged ileus.<sup>12</sup>

Giving a subjective prognosis of leakage at the time of completion of an anastomosis has been shown to have limited prognostic value.<sup>13</sup> Despite minimizing risk

factors for leakage, delay in diagnosis is very common and has been described to be caused by false negatives in radiologic studies.<sup>14</sup> Two retrospective studies noted that the occurrence of respiratory and neurologic disease often precedes anastomotic leakage after colonic surgery (OR=2.8 and 5.3, respectively).<sup>15,16</sup> A prospective study indicated that cardiac disorders preceded anastomotic leak in 40% of 22 patients with anastomotic leak.<sup>17</sup> In a prospective study by Nesbakken et al the surgeon's postoperative assessment of the patient was reported to have high specificity and low sensitivity (91% and 50% respectively).<sup>18</sup> Tang et al investigated the value of digital rectal examination in the assessment of anastomotic leakage before stoma closure, and found a sensitivity of 98.4%.<sup>19</sup>

Today we must have tools that allow us to objectively estimate the risk of mortality and complications for patients. Objective risk estimations by means of this tool are very important in highly expensive and technologically demanding environments such as intensive care units.

One of the weaknesses of this study is the relatively small size of the study population, because the procedures performed were followed up over a period of 2 years; a larger number of cases would have provided a population with a wide variety of demographic and clinical characteristics. As for the strengths, being a descriptive study, it has allowed us to know the risk factors related to anastomotic leakage, as well as clinical signs related to the appearance of this, as well as the incidence of anastomotic leakage in the hospital.

## CONCLUSION

The Dutch leakage score is a versatile tool, easy to apply and available in any hospital center; capable of early diagnosis of anastomotic leakage. It can be applicable to small bowel anastomoses. High negative predictive value. It favors early re-intervention, improves prognosis and survival, decreases hospital stay and medical care costs.

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