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# Bioethical dilemmas in pandemics by COVID

## *Dilemas bioéticos en pandemia por COVID*

Abilene Cirenia Escamilla-Ortiz,* Alejandra Martínez Osorio‡

In 1529, in the surgical "lessons" of the Hôtel-Dieu Hospital, Ambroise Pare said that leafing through books and chatting or chattering in the operating room is useless if the hands do not practice what reason dictates. Since then, the practice of surgery has been based on technical skills (techne), knowledge (episteme), and the capacity for judgment (phronesis).[1]

Surgeons face ethical difficulties and choice questions of moral issues. Surgery does harm before it heals, it is invasive and penetrates the patient's body, and the surgical decision is usually made in uncertain circumstances.[1]

Decisions in surgery must have relevance; the surgeon needs to be virtuous with modest qualities, e.g., punctuality, perseverance, teamwork, and equanimity.[1]

The surgeon should not be obstinate, especially when he or she knows that the procedure will be futile or disproportionate, the latter being defined as performing acts that appear unnecessary.[1]

In this pandemic, surgeons have faced bioethical dilemmas; the surgeon asks the patient for testing before a scheduled or emergency procedure. However, the patient does not ask the surgeon for testing. How does the surgeon proceed if the patient refuses to test, accepts, or declines the procedure?

Most of the time, surgeons and patients are vaccinated, but what if neither is vaccinated? Hence, all suspected patients must enter with personal protective equipment, use operating rooms with good ventilation, or have less staff in the operating room for COVID patients to reduce contagion. These are some of the recommendations the American College of Surgeons issued at the end of 2020.

For the surgeon, when faced with patients with COVID, the first thing is not to harm; he/she must perform procedures that have been shown to give good results and with less damage.[2] A surgical procedure increases risks if the patient has COVID-19 or has already had it.[2]

The risks should be weighed against the benefits, and each case should be judged individually to see if it is scheduled or urgent and if there is space in the Intensive Care Unit in case it is needed. Informed consent should be obtained with each case's risks and benefits, including the risk of death due to COVID.[2] In cases where there is doubt or difficulty, collegiate decisions should be made.

This pandemic has led us to make decisions that we did not expect and with ethical implications. We can continue to make interventions as long as we guarantee benefits to the patient and do so ethically.[2]

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# Preliminary analysis of the effectiveness of the Spatz-3® balloon in a sample of female patients in Ciudad Juarez, Mexico

## *Análisis preliminar de la efectividad del balón Spatz-3® en una muestra de pacientes femeninos en Ciudad Juárez, México*

Óscar I Ortiz-Ruvalcaba,[*] Juan de Dios Díaz-Rosales,[‡] Gabriel Galván-Araiza,[*] Julio César Naranjo-Chávez,[*] Ana Luisa Márquez-Morales,[*] Dante Deras-Ramos,[‡] Raúl Luna-Lugo[‡]

**Keywords:**
gastric balloon, stomach, obesity, obesity management, women.

***Palabras clave:***
*balón gástrico, estómago, obesidad, manejo de la obesidad, mujeres.*

**ABSTRACT**

**Introduction:** obesity is a high-mortality pandemic. Its treatment is multidisciplinary and is based on lifestyle changes with limited benefit. Intragastric devices (IGD) are a treatment for weight loss, especially when the patient is unfit or denies surgery. **Objective:** to evaluate treatment results with the intragastric device Spatz-3® over 12 months. **Material and methods:** a longitudinal study was carried out to evaluate the efficacy of the intragastric device Spatz-3® in a private endoscopic center in northern Mexico; 27 female patients were analyzed between January 2019 and December 2021. **Results:** an average decrease in total weight of 14.2 kg (14.6% of total body weight and 37.6% of excess weight lost) was observed at 12 months. Despite lower effectiveness than that reported in surgical treatment, IGDs are more effective than conservative interventions based on changing the patient's lifestyle. **Conclusion:** the intragastric device Spatz-3® showed a considerable reduction in total weight, being also a method with a lower rate of complications and completely reversible.

***RESUMEN***

***Introducción:*** *la obesidad es una pandemia de alta mortalidad. Su tratamiento es multidisciplinario y tiene como base el cambio del estilo de vida con un beneficio limitado, por lo que en la mayoría de los casos es necesario realizar otras intervenciones. El uso de dispositivos intragástricos colocados por endoscopia es un método en el tratamiento para la pérdida de peso, principalmente cuando el paciente no es apto o no acepta una intervención quirúrgica.* ***Objetivo:*** *evaluar los resultados del tratamiento con el dispositivo intragástrico Spatz-3® en un periodo de cuatro a 12 meses.* ***Material y métodos:*** *se analizaron los resultados de un estudio longitudinal para evaluar la eficacia del dispositivo intragástrico Spatz-3® en un centro endoscópico privado en el norte de México. Se analizaron 27 pacientes del género femenino en un periodo comprendido entre enero de 2019 y diciembre de 2021, a quienes se les colocó el dispositivo Spatz-3®.* ***Resultados:*** *se observó una disminución del peso total en promedio de 14.2 kg (14.6% del peso total corporal y 37.6% del exceso de peso perdido) a los 12 meses. Aunque estos resultados están por debajo de lo reportado por otros estudios con tratamiento quirúrgico (manga gástrica, bypass gástrico), el dispositivo intragástrico tiene una efectividad más alta comparada con las intervenciones conservadoras basadas en el cambio del estilo de vida del paciente.* ***Conclusión:*** *el dispositivo intragástrico Spatz-3® mostró una reducción considerable del peso total, siendo además un método con menor tasa de complicaciones y completamente reversible.*

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## INTRODUCTION

Obesity is the disease that generates the most deaths worldwide (up to 12.3% in 2016). Its mortality is related to its comorbidities, mainly: diabetes, hypertension, and dyslipidemia.1 In Mexico, it is considered a public health problem; regardless of socioeconomic level or region, the prevalence of obesity continues to increase. Currently, in Mexico, the prevalence of overweight is 39.1%, obesity 36.1%, and abdominal adiposity 81.6%.[1]

Morbid obesity is a condition that requires structured attention and specific capacity. Unfortunately, these conditions are not available in most of Mexico.[1] The management of obesity includes conservative measures such as lifestyle modification (diet and exercise). This measure needs more patient adherence and is of limited and reversible efficacy. The discrete success of the initial measures against obesity forces us to look for other alternatives, where bariatric surgery procedures are one of the preferred measures for the treatment of obesity; however, only 1% of obese patients (with criteria for bariatric surgery) will have access to these procedures.[2] Therefore, non-surgical interventional procedures are alternatives for the treatment, and their popularity is increasing due to the safety they project and their proven effectiveness.[3]

Balloon intragastric devices (IGDs) are considered a safe alternative with a better success rate than conservative measures. This fast-acting, minimally invasive IGDs are restriction therapies that limit food intake, induce early satiety, increase gastric emptying time, and reduce caloric intake (with subsequent weight loss).[4] IGDs have also been documented to decrease ghrelin secretion, aiding in managing comorbidities such as diabetes, dyslipidemia, and non-alcoholic fatty liver disease (NAFLD).[5]

Balloon IGDs have been continuously redesigned to increase weight loss, improve patient tolerance, and decrease complications. The ideal balloon IGD should have specific characteristics: it should be made of soft and durable material, has a low ulcerogenic potential, has a radiopaque marking for tracking and identification, and be size adjustability and of simple removal.[3] There are several devices of this type, such as Orbera®, Obalon®, ReShape®, Elipse®, and Spatz-3®, among others. They are made of silicone and are filled with air or liquid (stained with methylene blue) with volumes ranging from 500 to 900 ml. The time this therapy can last inside the stomach ranges from six to 12 months.[2]

Bariatric procedures, regardless of the technique performed, are considered of good quality if they meet the following objectives: reduce pathological weight, maintain it over time, improve or cure comorbidities that reduce the life span of the obese patient, improve quality of life, and induce a minimum number of sequelae.[6] this study aimed to measure the effect of the DIG Spatz-3® (Medical Great, Neck NY.) in a sample of women in a private endoscopic medical center in northern Mexico.

## MATERIAL AND METHODS

A longitudinal and analytical study was conducted on a sample of female patients undergoing therapy with the DIG Spatz-3® in a private bariatric unit in Ciudad Juarez, Chihuahua (OrmaMed-International Surgical Services) from January 2019 to December 2021.

The selection criteria were female gender, over 18 years of age, compliance with balloon adjustment at four months, and balloon removal at 12 months of treatment. Exclusion criteria were patients who did not authorize control lab tests, active or recent gastric ulcer, previous gastric surgery, esophageal or gastric varicose veins, hiatal hernia > 5 cm, and the use of anticoagulants. Elimination criteria: patients who underwent adjustments or balloon removal in another unit.

The following variables were evaluated: age, ideal weight, height, current weight, body mass index (BMI), total excess body weight, excess body weight lost (BWL), percentage of BWL (%BWL), body weight lost, fasting glucose, triglycerides, high-density lipoproteins (HDL), aspartate aminotransferase (AST), alanine aminotransferase (ALT), and glycated hemoglobin (HbA1c).

The ideal weight was calculated using the formula: ideal weight = ideal BMI × height.[2]

In the case of women, the ideal BMI is 21.5 kg/m$^2$. The formula was used to calculate excess body weight: excess body weight = actual weight - ideal weight. The formula used for the calculation of %EPP was %BWL = (BWL × 100)/excess weight.

For the placement procedure of the IGD Spatz-3®, the informed consent form was signed. Under sedation, the gastric cavity was evaluated with Fujinon EPX-4400® endoscopy equipment in the left lateral decubitus position. Then, the balloon DIG Spatz-3® was introduced, verifying that it was in place in the gastric cavity. Then an initial volume of 500 cm$^3$ (saline solution stained with methylene blue) was instilled, and after a few hours of observation, the patient was discharged and monitored by telephone. Subsequently, after four months of treatment, an appointment was made to adjust the balloon (until 900 ml of saline solution stained with methylene blue was completed). At the end of 12 months of treatment, the patient was again seen, the variables were remeasured, and the balloon was removed.

IBM SPSS® version 24 (Chicago, IL) software was used; averages as a measure of central tendency and standard deviation (SD) as a measure of dispersion were calculated. Averages were compared using Student's t-test for variables with normal behavior in related samples and the Wilcoxon test for variables with non-normal behavior in related samples. It was considered statistically significant when the p-value result was $< 0.05$. The Kolmogorov-Smirnov test was used to define the behavior of each quantitative variable.

## RESULTS

Twenty-seven female patients were included with an average age of 45.4 ± 10.6 years, height of 1.63 ± 4 cm, and BMI of 36.5 ± 2.7 kg/m$^2$. An ideal weight of 57.4 ± 2.9 kg and an average excess weight of 40.1 ± 7.1 kg were calculated. *Table 1* shows the differences in the variables at balloon placement, during the adjustment (four months), and at device removal at 12 months. *Figure 1* shows the average evolution of the patients concerning initial weight, weight at adjustment, and weight at the end of therapy, and shows the initial excess weight (in kg), excess weight at adjustment, and excess weight at the end of therapy.

*Table 2* shows how the variables were modified at four months of treatment compared to the pre-treatment state. A decrease in total body weight on average of 8.9 ± 5.7 kg ($p \leq 0.001$) was observed, representing a loss of 9.1% of the patient's % of total body weight lost, a decrease in %BWL of 23.1% ± 14.6%,

**Table 1: Changes in variables during Spatz-3® balloon treatment.**

| Variable | Baseline | SD | Adjustment | SD | Removal | SD |
|---|---|---|---|---|---|---|
| Weight (kg) | 97.5 | 7.9 | 88.6 | 8.3 | 83.3 | 11.9 |
| BMI (kg/m$^2$) | 36.5 | 2.7 | 33.2 | 3.4 | 31.2 | 4.4 |
| Weight excess (kg) | 40.1 | 7.1 | 31.2 | 8.5 | 25.9 | 11.7 |
| Glucose (mg/dl) | 98.0 | 21.4 | 90.3 | 22.9 | 99.7 | 41.7 |
| Triglycerides (mg/dl) | 148.6 | 54.3 | 125.6 | 67.9 | 139.0 | 84.9 |
| HDL (mg/dl) | 65.8 | 46.8 | 48.4 | 9.5 | 52.1 | 12.5 |
| AST (U/l) | 27.7 | 8.2 | 29.8 | 13.8 | 22.8 | 6.7 |
| ALT (U/l) | 30.8 | 10.2 | 26.7 | 10.5 | 23.6 | 9.9 |
| HbA1c (%) | 6.4 | 1.3 | 6.5 | 1.2 | 6.3 | 1.8 |

SD = standard deviation. BMI = body mass index. HDL = high-density lipoproteins. AST = aspartate aminotransferase. ALT = alanine aminotransferase. HbA1c = glycated hemoglobin,
Source: electronic file OrmaMed.

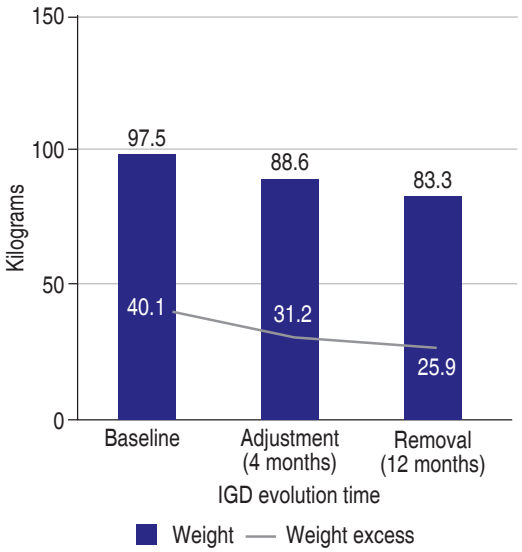


***Figure 1:*** *Graphic representation of total and excess weight loss during therapy at baseline, four months, and 12 months with the intragastric device (IGD).*

and a decrease in BMI of 3.3 kg/m$^2$ ($p \leq 0.001$). Glucose and triglyceride levels were also significantly reduced at four months of treatment. However, HDL levels, liver enzymes, and HbA1c showed no significant changes.

*Table 3* describes the patients at the end of DIG therapy (12 months). On average, a decrease in total weight of 14.2 ± 8.5 kg ($p < 0.001$) was observed, representing 14.6% total weight loss and accounting for 37.6% ± 26.2% of %BWL. BMI had a statistically significant decrease of 5.3 kg/m$^2$ ($p < 0.001$). AST and ALT levels also decreased statistically significantly, while glucose, triglycerides, HDL, and HbA1c showed no significant reductions.

## DISCUSSION

Obesity is a complex disease to treat, and we must remember that medical treatment (conservative, endoscopic, or surgical) will have a high failure rate if it is considered the only therapy. It is of utmost importance that a multidisciplinary team strictly follows up with the patient to foresee the anxiety mechanisms that will provoke new habits that limit weight loss and condition the failure of even the most radical bariatric therapies.

Although %BWL does not translate into a proportional patient weight loss, it has been documented. Klingler reports that patients undergoing an IGD placement (from four to 12 months) usually have an average of %BWL of 6 to 15%.[7] In this sense, the %BWL better represents that weight loss, and in general, the American Society of Gastrointestinal Endoscopy (ASGE) recommends that IGDs have an average %BWL of 25% at six months.[8] With these numbers and recommendations, we can analyze the results.

Although international studies show that IGDs effectively reduce up to 58% of %BWL at six months,[2] our results reveal the likely reality in most centers where IGDs are frequently used. Our analysis shows that during treatment with the IGD Spatz-3®, an average weight loss of 14.2 kg is achieved at 12 months of treatment, which is 14.6% of total body weight and 37.6% of %BWL, according to Klingler's publication and ASGE.[7] In our sample of patients, this weight loss represents a reduction in average BMI from grade II obesity to grade I obesity (36.5 versus 31.2 kg/m$^2$, $p < 0.001$).

In a study performed with the Orbera® balloon, the average weight loss at six months was 14.7 kg,[2] compared to our lower results at four months (8.9 kg), while after adjustment, the threshold of 14 kg was reached at 12 months of treatment. However, the 14.7 kg lost at six months (with Orbera®) represented 32.1% of %WBL versus 14.2 kg at 12 months (in our study), which represented 37.6% of %WBL. This difference was 5.5% in favor of the 12-month therapy. Another study performed with the ReShape® device showed a %BWL of 15.4%,[2] slightly higher than the 14.6% total body weight loss obtained in our study. In another study conducted in Mexico, the average weight loss was 10.7 kg after an eight-month therapy with an IGD,[8] a slightly lower average than our group's.

In more extensive samples of patients (1,523 patients), the efficacy of different DIGs has been evaluated, where a %BWL of 17.9% and a %EPP of 4.4% were observed.[9] These results reveal lower averages than those shown in our study (%EPP 37.6% and %EPP 14.6%, respectively). The higher averages in our study may be because the sample was small

compared to the more than 1,500 patients evaluated. When the study sample is larger, the statistical power stabilizes. However, our study is preliminary, and we will continue documenting it until we obtain more stable and reliable results.

In another study conducted by Nucci in Italy with the Spatz-3® balloon, the average weight loss in 138 patients at 12 months was 24.8 kg,[10] of which was almost double that shown in our analysis (14.2 kg at 12 months). In other studies, with the Spatz-3® balloon, it was observed that the %BWL at 12 months ranged from 45.8 to 56.7%.[3] These excellent results reveal how great the benefit can be at the individual level. In our study, one patient had a %BWL of 67%. As such, this result cannot be inferred, but it demonstrates that some patients will respond better.

Although fasting glucose levels were significantly reduced at four months, this result could not be corroborated at 12 months of treatment with the IGD Spatz-3® balloon. There was no significant reduction in glycated hemoglobin levels, so we could not show improvement in the metabolic profile of the patients at the end of treatment. However, we must remember that this preliminary study should consolidate the results once we have an adequate sample.

Few complications are reported concerning IGDs, such as early removal of the IGD due to intolerance or pain (4 to 7%), nausea and vomiting (30 to 50%), and balloon rupture (4.1 to 15.8%).[3] Serious complications (0.84%) are rare; most resolve with endoscopic treatment. Surgery has been required in 0.07% of patients, with no apparent related mortality.[11] Major complications include bleeding, ulceration, gastric perforation,[12] esophageal perforation due to tearing,[11] and gastric outlet obstruction syndrome.[13] In general, complications during medium-term therapy are based on loss of patient follow-up (both by the service provider and the patient's carelessness). In our study, post-placement pain was observed in 10% of patients (which did not warrant removal), nausea and vomiting in 60% of patients (managed with antiemetic drugs), and esophagitis in up to 40% of patients (probably related to poor adherence to proton pump inhibitor therapy).

These results for %EPP show actual numbers from a bariatric center in northern Mexico. These results are less satisfactory than those presented in other research papers; however, these numbers provide ethical information obtained in a specific population and do not evoke false results.

**Table 2: Evolution of patients at four months after Spatz-3® balloon adjustment.**

| Variable | Baseline | SD | Adjustment | SD | Difference | p |
|---|---|---|---|---|---|---|
| Weight (kg) | 97.5 | 7.9 | 88.6 | 8.3 | 8.9 | < 0.001 |
| BMI (kg/m$^2$) | 36.5 | 2.7 | 33.2 | 3.4 | 3.3 | < 0.001 |
| Weight excess (kg) | 40.1 | 7.1 | 31.2 | 8.5 | 8.9 | < 0.001 |
| Glucose (mg/dl) | 98.0 | 21.4 | 90.3 | 22.9 | 7.7 | 0.002 |
| Triglycerides (mg/dl) | 148.6 | 54.3 | 125.6 | 67.9 | 23.0 | 0.002 |
| HDL (mg/dl) | 65.8 | 46.8 | 48.4 | 9.5 | 17.4 | 0.070 |
| AST (U/l) | 27.7 | 8.2 | 29.8 | 13.8 | -2.1 | 0.180 |
| ALT (U/l) | 30.8 | 10.2 | 26.7 | 10.5 | 4.1 | 0.080 |
| HbA1c (%) | 6.4 | 1.3 | 6.5 | 1.2 | -0.1 | 0.300 |

SD = standard deviation. BMI = body mass index. HDL = high-density lipoproteins. AST = aspartate aminotransferase. ALT = alanine aminotransferase. HbA1c = glycated hemoglobin.
Source: electronic file OrmaMed.

**Table 3: Final result at the end of the 12-month treatment with the Spatz-3® balloon.**

| Variable | Baseline | SD | Removal | SD | Difference | p |
|---|---|---|---|---|---|---|
| Weight (kg) | 97.5 | 7.9 | 83.3 | 11.9 | 14.2 | < 0.001 |
| BMI (kg/m$^2$) | 36.5 | 2.7 | 31.2 | 4.4 | 5.3 | < 0.001 |
| Weight excess (kg) | 40.1 | 7.1 | 25.9 | 11.7 | 14.2 | < 0.001 |
| Glucose (mg/dl) | 98.0 | 21.4 | 99.7 | 41.7 | -1.7 | 0.300 |
| Triglycerides (mg/dl) | 148.6 | 54.3 | 139.0 | 84.9 | 9.6 | 0.200 |
| HDL (mg/dl) | 65.8 | 46.8 | 52.1 | 12.5 | 13.7 | 0.700 |
| AST (U/l) | 27.7 | 8.2 | 22.8 | 6.7 | 4.9 | 0.009 |
| ALT (U/l) | 30.8 | 10.2 | 23.6 | 9.9 | 7.2 | 0.002 |
| HbA1c (%) | 6.4 | 1.3 | 6.3 | 1.8 | 0.1 | 0.200 |

SD = standard deviation. BMI = body mass index. HDL = high-density lipoproteins. AST = aspartate aminotransferase. ALT = alanine aminotransferase. HbA1c = glycated hemoglobin.
Source: electronic file OrmaMed.

We are aware of the limitations of the use of BMI as an indicator of obesity or risk of associated comorbidities since it is not very accurate for assessing adiposity at the individual level and for specifying its location;[14] nevertheless, it continues to be a valid marker, albeit with a subjective tinge. Waist circumference is an index that allows us to evaluate visceral fat and better characterize this area.[15] Unfortunately, we did not have this variable at the time of the study, but it will be included in future reports.

Predictors of treatment success with DIGs go hand in hand with weight reduction, classifying it as %TPP and %EPP; however, these two measures focus on different areas of study. The %TPP in a 5-15% range reduces weight-related morbidity.[6] In comparison, the %EPP determines the success or failure of the therapy and classifies it as < 20% unsatisfactory result, from 20 to 50% as a good result, and > 50% as an excellent result.[16,17] In our study, the decrease in %TPP was 14.6% and a %EPP of 37.6%. Within the classifications mentioned above, the results obtained in this study are defined as successful, as they comply with the established ranges.[6]

The importance of the success of these two criteria varies depending on the objective of the study, taking into account the surgical point of view in case the use of DIG therapy is a predecessor of some other surgical intervention, the range of success based on %EPP is mainly used, while those patients who reject some other intervention and the therapeutic objective is to improve the prognosis of life and reduce morbidity and mortality, the decrease in total weight is considered as an expected predictive value.[18]

## CONCLUSIONS

Significant weight reduction using the DIG Spatz-3® is documented in this preliminary study. Although the reduction is not dramatic as in surgical bariatric procedures, the DIG Spatz-3® represents a safe and reversible option for patients who are bridging prior to a surgical procedure, patients who do not desire a surgical procedure, or patients with obesity who wish to decrease their weight and BMI without undergoing the risks and morbidity and mortality that other definitive procedures may have.

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# Bariatric surgery in Mexico. Characteristics of the practice in 2019

## *Cirugía bariátrica en México. Características de la práctica en 2019*

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**Keywords:**
bariatric surgery, practice patterns, gastric bypass, Latin America.

***Palabras clave:***
*cirugía bariátrica, patrones de práctica, bypass gástrico, Latinoamérica.*

**ABSTRACT**

**Introduction:** Mexico has a long history in bariatric surgery and is one of the pioneer countries in Latin America. The characteristics of the bariatric surgery practice in Mexico have yet to be analyzed. **Material and methods:** an online survey was sent to all active members of the Mexican College of Obesity Surgery and Metabolic Diseases (CMCOEM) to analyze the surgical practice for one year. **Results:** most bariatric surgeons were male, with a mean age of 48.7 years. Regarding surgical volume, between 100 to 500 procedures in private practice were more frequently reported. Most procedures were performed in the northern part of Mexico. The surgical procedures more frequently performed were gastric sleeve, followed by gastric bypass and one anastomosis gastric bypass. There was also an important number of bariatric endoscopic procedures. The total number of procedures performed in one year was 8,887, and 1,033 endoscopic procedures. **Conclusions:** this study helps us to know that bariatric procedures are commonly performed in private institutions in the northern zone of Mexico. Considering the high prevalence of obesity in our country, we can see that increasing the surgical offer in public and private institutions is necessary.

***RESUMEN***

***Introducción:*** *México cuenta con una larga historia en la práctica de la cirugía bariátrica, siendo uno de los países pioneros dentro de América Latina; sin embargo, las características de la práctica de cirugía bariátrica no han sido analizadas.* ***Material y métodos:*** *se realiza una encuesta entre socios del Colegio Mexicano de Cirugía para la Obesidad y Enfermedades Metabólicas con el fin de analizar la práctica quirúrgica en el transcurso de un año.* ***Resultados:*** *la mayoría de los cirujanos bariatras son del género masculino, con un promedio de edad de 48.7 años. En cuanto al número de intervenciones, el grupo más frecuente fue el de los cirujanos que realizaron entre 100 y 500 procedimientos en el sector privado. El mayor porcentaje de cirugías se efectuaron en la frontera norte del país. Los procedimientos que se realizaron con mayor frecuencia fueron manga gástrica, bypass gástrico y bypass gástrico de una anastomosis, así como un considerable número de procedimientos endoscópicos bariátricos. El número total de procedimientos quirúrgicos en un año fue de 8,887 y de procedimientos endoscópicos de 1,033.* ***Conclusiones:*** *considerando la alta frecuencia de obesidad, es necesario incrementar la oferta quirúrgica tanto a nivel público como privado.*

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## INTRODUCTION

Obesity is a worldwide pandemic, and Mexico is found among the first places.

Mexico has a long history in bariatric surgery, one of Latin America's pioneer countries.[1]

Since 2014 there has been official certification in bariatric surgery in the country. Since 2010 there have been university training programs in various hospitals, which translates into a more significant number of surgeons with training to perform bariatric surgical procedures safely and with a greater number of bariatric surgical centers.

In Mexico, bariatric surgery is performed in public and private hospitals, and considering its geographic location, there are centers dedicated to medical tourism.

Due to the lack of a national registry, the number of bariatric surgical/endoscopic

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procedures performed in the country and their distribution is still being determined.

The present study aims to investigate the number and distribution of interventions using a survey analyzing the practice during 2019.

## MATERIAL AND METHODS

A structured digital survey was sent through the SurveyMonkey® platform to all active members of the Mexican College of Surgery for Obesity and Metabolic Diseases (CMCOEM). The survey included questions on the volume, type of procedure, and its primary or revision nature for surgical and endoscopic procedures. Once the data were obtained, they were grouped and sorted for analysis (complications were not asked since this was not the study's objective).

The territorial classification was used to define the corresponding region within the interior of the Mexican Republic *(Figure 1)*.

## RESULTS

Of a total of 257 requests, 64 responded (24.9%). A total of 60 (93.8%) were male, two (3.1%) were female, and two (3.1%) did not specify gender. The average age was 48.7 years, ranging between 35 and 71 years.

Regarding total experience, eight surgeons (12.5%) reported having performed less than 100 procedures, 42 (65.6%) between 100 and 500 procedures, nine (14.1%) between 501 and 1,000, and five (7.8%) more than 1,000 procedures.

According to the geographical distribution within the Mexican Republic, 22 surgeons (34.3%) live in the central zone, 14 (21.9%) in the northern zone, nine (14.1%) in the western zone, four (6.3%) in the southern zone, two (3.1%) in the eastern zone, one in more than one region and two did not specify the region. Regarding the public or private nature of care, 40 surgeons (62.5%) worked exclusively in the private sector, four (6.3%) exclusively in the


***Figure 1:*** *Geographic distribution by zones.*
*Available in: https://images.app.goo.gl/RxLjCiMaxvAiXVEf8*

**Table 1: Distribution of bariatric surgical procedures according to type and their primary nature or revision surgery.**

| | Primary surgeries | Revision surgeries* | Total | % |
|---|---|---|---|---|
| AGB | 327 | 172 | 499 | 5.6 |
| RYGB | 1,957 | 429 | 2,386 | 26.9 |
| GS | 4,428 | 284 | 4,712 | 53.1 |
| OAGB | 737 | 199 | 936 | 10.5 |
| BPD | 71 | 57 | 128 | 1.4 |
| SADI-S/SIPS | 56 | 34 | 90 | 1.0 |
| Other | 106 | 30 | 136 | 1.5 |
| Total | 7,682 | 1,205 | 8,887 | 100.0 |

* Surgeries performed after a previous surgical procedure.
AGB = adjustable gastric banding. RYGB = Roux-en-Y gastric bypass. GS = gastric sleeve. OAGB = One Anastomosis Gastric Bypass (represents all types of one-anastomosis gastric bypass). BPD = biliopancreatic diversion. SADI-S = single anastomosis duodenum-ileal and sleeve. SIPS = stomach intestinal pylorus-sparing surgery.

public sector, ten (15.6%) in both sectors, and ten did not specify.

A total of 8,887 surgical procedures were performed; their distribution is shown in *Table 1*, and 1,033 endoscopic procedures are shown in *Table 2*.

A total of 2,810 surgical/endoscopic procedures were performed in the northern zone (28.3%), of which 2,706 were surgical procedures (30.4%) and 104 endoscopic procedures (10.1%).

## DISCUSSION

According to the National Institute of Statistics and Geography (INEGI) and the National Survey of Demographic Dynamics 2018 (SNIEG) database, the population in Mexico is 125,000,000 people, 51.1% women and 48.9% men.1 For its part, the Organization for Economic Cooperation and Development (OECD) highlights that Mexico has the first place in overweight and obesity in Latin America,[2] stating that 75.2% of adults over 20 years of age have some degree of overweight or obesity, so the number of people with obesity would be approximately 94,000,000 people.

As of March 18, 2019, 42 years after the founding of the Mexican Board of General Surgery (CMCG), a total of 10,232 general surgeons from different parts of the country have been certified, of which 1,164 (11.4%) are women, and 4,356 are in force in total.[3]

In 2013, the certification process for bariatric surgeons began, first before the Mexican College of Surgery for Obesity and Metabolic Diseases (CMCOEM) and currently by the Mexican Board of Surgery. So far, 171 have completed the procedure, and 58 are in the process. Of the total, 23 are women (10%), and 206 are men (90%).[4] With these figures, we can see very few surgeons with the training and credentialing to attend to the population with obesity requiring surgery.

It is essential to highlight that 2,706 (30.4%) of the procedures in this study were performed in the northern part of the country, mainly corresponding to foreign patients seen as part of medical tourism, which highlights that the Mexican population in need of obesity surgery is underserved.

Given the lack of a registry of bariatric surgery in the country, an attempt was made to explore the characteristics of the practice using a survey. We observed that the most significant

number of bariatric surgeons are male, working predominantly in private hospitals in the country's central region, followed by the northern border region.

It was also observed that many surgeons work in both the public and private sectors. According to the number of surgical procedures, most bariatric surgeons have performed between 100 and 500 procedures annually.

Regarding the type of procedures, the most performed bariatric surgery in Mexico, as reported in other countries, is the gastric sleeve, followed by gastric bypass, and third place one-anastomosis gastric bypass (OAGB).[5] Although adjustable gastric banding has decreased over time, a significant volume of this type of intervention is still observed within the surgeries performed in 2019. Likewise, many endoscopic procedures for treating complications in bariatric surgery and a few primary procedures are also observed.

The mission of having a national registry lies in improving the efficiency, effectiveness, and safety of bariatric and metabolic surgery. Establishing high-quality tools and standards is necessary to accomplish this task. Collecting core data from patients undergoing surgery is essential to evaluate the quality of our protocols, carry out improvement actions, and perform multicenter studies. We have an excellent example from the American College of Surgeons and the American Society for Metabolic and Bariatric Surgery (ASMBS), who have created the MBSAQIP (Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program). This program states, "MBSAQIP works to advance safe, high-quality patient care through the accreditation of bariatric surgical centers".[5-8] A bariatric surgical center achieves accreditation after a rigorous review process demonstrating that it is equipped with physical resources, human resources, and activity standards, and all accredited centers report their results to the MBSAQIP registry.

**Table 2: Distribution of endoscopic procedures.**

| | n |
|---|---|
| Transoral gastroplasty | 50 |
| Gastric bypass revision | 182 |
| Intragastric balloon | 746 |
| Other | 55 |

On the other hand, standardizing a surgical procedure is complex due to the diversity of preferences among surgeons, the choice of different suture materials, stapling, drains, and others. However, it is necessary to homogenize the main characteristics of the procedures that could have the most significant impact on weight loss and metabolic outcomes.[9-12]

CMCOEM is actively working to standardize the various bariatric/metabolic interventions as much as possible and to collect data to compare outcomes, improve training opportunities, facilitate feedback, reduce errors, and increase surgical quality.

## CONCLUSIONS

The present survey revealed that in Mexico, most bariatric procedures are performed privately in the northern region of the Mexican Republic. The most frequently performed procedures were gastric sleeve followed by gastric bypass and in third place single anastomosis gastric bypass (SAGB). Considering the high frequency of obesity, increasing the surgical offer at both public and private levels is necessary.

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# Safety and efficacy of antimicrobial versus surgical treatment in uncomplicated acute appendicitis in adults

## *Seguridad y eficacia del tratamiento antimicrobiano versus quirúrgico en apendicitis aguda no complicada en adultos*

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**Keywords:** acute appendicitis uncomplicated, non-operative treatment, adult, evidence review.

***Palabras clave:*** *apendicitis aguda no complicada, tratamiento no operativo, adultos, revisión de evidencia.*

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**ABSTRACT**

**Introduction:** antibiotic therapy for acute uncomplicated appendicitis in adult patients has been proposed as a safe and effective alternative. **Objective:** to review the available evidence to assess the safety and efficacy of antibiotic treatment. **Material and methods:** a literature search in databases comparing antibiotic therapy and appendectomy was made to identify the most recent systematic reviews and meta-analyses with the results on the safety and efficacy of the intervention. **Results:** four systematic reviews with meta-analyses met the inclusion criteria. The antibiotic treatment group had a lower success rate, overall effectiveness, and complication rate. The rates of complicated appendicitis with peritonitis identified at the time of operation and surgical complications were equivalent in both groups. The appendectomy group had a higher success rate and treatment efficacy at 1-year follow-up. **Conclusions:** appendectomy is still the most effective treatment than antibiotic therapy for a definitive cure of acute uncomplicated appendicitis. Antibiotic therapy can be an alternative for those patients who wish to avoid surgery and do not have predictors of treatment failure.

***RESUMEN***

***Introducción:*** *el tratamiento conservador para la apendicitis aguda no complicada en el adulto se ha propuesto como una alternativa segura y eficaz.* ***Objetivo:*** *revisar la evidencia disponible para evaluar la seguridad y eficacia del tratamiento antibiótico.* ***Material y métodos:*** *mediante una investigación bibliográfica en bases de datos se identificaron las revisiones sistemáticas y metaanálisis más recientes que incluyen los resultados de la seguridad y eficacia de la intervención.* ***Resultados:*** *cuatro revisiones sistemáticas con metaanálisis cumplen con los criterios de inclusión. La evidencia muestra que el éxito del tratamiento conservador es significativamente menor, la eficacia del tratamiento en seguimiento a un año es mayor en el grupo control con menor cifra de recurrencia. La apendicitis complicada es similar entre grupos y las complicaciones postintervención son significativamente mayores en el grupo control. Las complicaciones quirúrgicas son similares entre grupos, al igual que el absceso postoperatorio, infección del sitio quirúrgico, obstrucción intestinal y hernia ventral.* ***Conclusiones:*** *la apendicectomía es un tratamiento invasivo sujeto a eventos adversos con un perfil de riesgo conocido, por lo que continúa como tratamiento estándar. La terapia con antibióticos puede considerarse como alternativa para los pacientes que desean evitar la cirugía y no tienen predictores de falla al tratamiento.*

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## INTRODUCTION

Acute appendicitis (AA) is among the most common causes of acute abdomen. Worldwide, it affects 151 people per 100,000 inhabitants per year, mainly during adolescence, after which the incidence decreases as age increases. In older adults, it affects between 5 and 10%. The lifetime risk of the disease in men is estimated at 8.6 and 6.7% in women.[1]

Disease severity is based on clinical presentation, imaging, and transoperative findings and is helpful for perioperative management. The World Association for Emergency Surgery (WSES) classifies it as uncomplicated and complicated, characterized by necrosis, phlegmon, perforation, and abscess formation.[2,3] Distinctive histopathologic findings of simple AA include edema in the early stage and suppuration in the late stage. Appendiceal phlegmon, which is the formation of an inflammatory mass with peri appendicular pus, is considered by some authors to be complicated appendicitis.[4,5] In complex or perforated AA, evidence of gangrene, perforation, localized or disseminated abscess, and extraluminal fecalith are recognized.[6,7]

Appendectomy has been considered the mainstay of treatment for more than a century since Charles McBurney assumed that in the absence of surgery, the uncomplicated disease progresses to a complicated disease. Currently, it is a routine procedure; each year, more than 60,000 appendectomies are performed in our country, 50,000 in the United Kingdom and 300,000 in the United States, of which between 15 and 36% are negative or also called white,[8] with a known risk profile: low mortality in uncomplicated AA that increases three to four times in the presence of complication.[9] In the elderly patient, it can reach up to 8%.[10] Postoperative morbidity varies between 2 and 23%.[11]

It has been questioned whether the traditional treatment approach is appropriate given the number of negative appendectomies, surgical morbidity, and costs.[12] With this argument and others, antibiotic treatment (ABTx) has been proposed for patients with early and uncomplicated AA, similar to the management of other intra-abdominal inflammatory processes such as colonic diverticulitis, acute cholecystitis, salpingitis, and, in children, enterocolitis.[13] Recently, many clinical trials (RCT) have been published, with diverse methodologies and variable quality, comparing ABTx with appendectomy or surgical treatment (STx) and suggesting conservative management as a safe and effective alternative.[14] This treatment modality is a matter of controversy in general surgery since it is a treatment modality that is not widely accepted. The objective is to review the best quality evidence available to answer the following question: what is the safety and efficacy of antibiotic treatment and appendectomy for uncomplicated AA in adults?

## MATERIAL AND METHODS

Systematic reviews (SR), meta-analyses (MA), and systematic reviews with meta-analyses (SR/MA) comparing ABTx with STx in uncomplicated AA published in the period from 1999 to 2020 are identified through a bibliographic search in the Medline, ScienceDirect, Scopus, Google Scholar, and Cochrane Library databases, restricted to publications in Spanish and English. In both languages, the keywords in the search strategy are appendicitis / acute/ uncomplicated / treatment/antibiotic/adults. The selection criteria of publications for this work are the most recent ones that include the analysis of the primary and secondary results of the randomized clinical trials (RCTs) submitted for review in a complete way to extract the data of interest and document the evidence, which is helpful in the evaluation of the safety and efficacy of the intervention; i.e., success, failure and efficacy of treatment at one-year follow-up, recurrent appendicitis, complicated appendicitis, postoperative complications, mortality, postoperative complications, surgical site infection and postoperative abscess, bowel obstruction, and incisional hernia.

## RESULTS

### Bibliographic research

The database screening process for publication selection is shown in *Figure 1* and identifies

1,644 articles and 87 additional articles. The full texts of 48 SRs, MAs, and SR/MAs are reviewed after assessing the titles and abstract of the publications, and four SRs and SR/MAs published in 2019 met the inclusion criteria and are the evidence review material.[15-18] They include 45 investigations, 31 practiced in adults, 12 in children, and two in a mixed population with majority adults; 27 are RCTs, 24 in adults; one quasi-RCT study in adults; seven retrospective studies, four in adults; and ten prospective cohort studies, four in adults. Each SR/MA assesses the risk of bias in each trial and is variable by variable criteria used for its qualification and different category. Five different intravenous (IV) and six oral (OV) ABTx schedules were used in the intervention, both for varying periods.

## Characteristics of the publications selected for review

1. The study by Prechal et al.[15] is an SR/MA that includes five RCTs performed in adults, selected for having a higher level of evidence, arguing that in previously published studies, the results and the level of possible bias differ. The heterogeneity among the studies is considerable, and in general, the risk of selection bias is considered low, the risk of performance bias is unclear in all the studies, the risk of attrition bias is low, and the risk of reporting bias is high.
2. The publication by Poprom et al.[16] is a double SR/MA, the traditional and one in a network, that evaluated treatment outcomes and risks and benefits of intervention by direct and indirect, individual or combined comparison of antibiotics with STx that examined the effects of treatments in a complete way, allowing to assess for each treatment the probability of being the best or having a range that can be derived from the posterior distributions of all treatments (surface under the curve). It includes nine RCTs, six in adults, one in a mixed population, and two in children. Overall, the risk of selection, outcome, and reporting bias is assessed as low. The table results correspond to the direct MA described in the RCTs.
3. The MA of Yang et al.[17] compared the intervention results in managing complicated and uncomplicated AA. It included 11 studies, five RCTs, three retrospective, and three prospective, all rated with good methodological quality according to the Cochrane bias assessment tool. The data shown in the

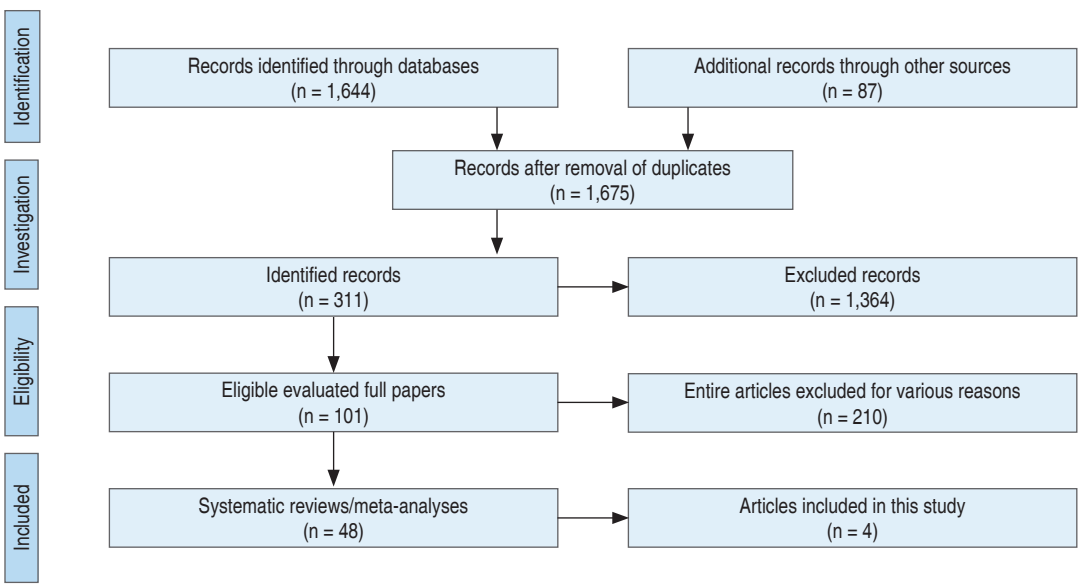


***Figure 1:*** *Flow chart of research and study selection.*

**Table 1: Efficacy of antimicrobial therapy versus appendectomy in uncomplicated acute appendicitis in adults.**

| | Prechal D, et al.[15] | | Poprom N, et al.[16] | | Yang Z, et al.[17] | | Podda M, et al.[18] | |
|---|---|---|---|---|---|---|---|---|
| **Treatment efficacy** | **ABTx (%)** | **STx (%)** | **ABTx (%)** | **STx (%)** | **ABTx (%)** | **STx (%)** | **ABTx (%)** | **STx (%)** |
| Treatment success | NR | NR | 0.68-0.88 | NR | 82.8 | 96.6 | 68.7 | 80.9 |
| | | | NS, similar in groups* | | Signif. lower in ABTx* | | NS, similar in groups* | |
| Treatment efficacy (1 year) | 62.5 | 96.3 | NR | NR | NR | NR | 73.6 | 91.9 |
| | Signif. higher in STx* | | | | | | NS, similar in groups* | |
| Treatment failure | NR | NR | NR | NR | NR | NR | 8.5 | NR |
| | | | | | | | No comment | |
| Recurrent appendicitis | NR | NR | 18.2 | NR | 5.6 | NR | 19.2 | NR |
| | | | Signif. higher in ABTx* | | Signif. lower in STx* | | No comment | |
| Complicated appendicitis | NR | NR | 2.7-35 | NR | NR | NR | 21.8 | 12.7 |
| | | | No comment | | | | NS, in groups | |
| Post-intervention complications | 17.9 | 10.2 | NR | NR | 10.3 | NR | 6.6 | 14.5 |
| | Signif. lower in ABTx* | | | | Signif. higher in STx* | | Signif. higher in STx* | |

* Commentary of the publication when comparing the results.
ABTx = intervention group, treatment with antibiotics. STx = control group, appendectomy. NR = No report. NS = Non significant.

tables reflect the results obtained in uncomplicated AA.

4. Podda et al.[18] published the most recent SR/MA, and its objective was to summarize the most current available evidence on non-operative management derived from 20 studies to have more sensitive results. It included ten studies practiced in adults, and ten in children, seven RCTs, one quasi-randomized study, eight prospective cohort studies, and four retrospective studies. The heterogeneity between studies was high, and the risk of bias was generally low; the risk is high in non-randomized trials. The results of this publication in the tables correspond to the adult group.

### Treatment efficacy and safety results

*Table 1* shows the results of treatment efficacy. Conservative treatment success was significantly lower in ABTx in one publication, not reported in another, and similar between research groups in the two. Treatment efficacy at 1-year follow-up was significantly higher in the control group in one publication, was like groups in another publication, and was not described in two. Failure of conservative treatment, that is, during the initial hospitalization and within the first month of follow-up, is reported in only one publication and is 8.5%, an eventuality that does not occur in STx. Recurrent appendicitis was significantly higher in ABTx than in the control group. The finding of complicated appendicitis was similar between groups; one publication does not comment on this. The incidence of postoperative complications was significantly higher in STx in three publications.

*Table 2* summarizes the results of treatment safety. None of the publications report mortality. Surgical complications were similar between groups and without significant difference in two publications, without comment in one, and not reported in another. A postoperative abscess was similar between groups, only described in one publication. Surgical site infection in the ABTx did not differ from the control group according to the report in one publication, no comment in another, and no description in two. Intestinal obstruction in the conservative group was similar to the surgical group, with no significant difference. The ventral hernia had a similar frequency between groups.

## DISCUSSION

When evaluating the safety and efficacy of ABTx versus STx in uncomplicated AA, it is convenient to consider that two treatment strategies of different nature and not different surgical techniques are compared. Surgery is an invasive treatment subject to adverse events of various kinds that do not occur with conservative treatment.[19] Furthermore, to determine the validity of the conclusions of RCTs, it is necessary to know their methodological quality since the benefits of treatment can be overestimated, and in SR/MA, the risk of bias increases when few RCTs are included.[20] Methodological inconsistencies include diagnostic and inclusion criteria variability, high crossover rates between research groups, small study populations that limit generalization to large populations, lack of standardized definitions of treatment success or failure, and recurrent disease. Heterogeneity between studies is noted in each SR/MA using various antimicrobial regimens, including drugs for varying periods, different routes, and a lack of comparative RCTs of antibiotics used as an intervention.[4,13]

If the figure for treatment failure during the initial hospitalization and in the first month, which is 8.5%, we add the recurrence during the first year of surveillance, estimated between 5.6 and 19.2%, the risk of experiencing a new episode of AA can be between 26.4 and 47.5%; of these patients, up to 42% will require surgery, which increases hospital readmission and the costs of care.[13,21]

Most of the surgical procedures in the RCTs were performed with open surgery, more susceptible to infectious complications in whom postoperative antibiotics are not used in the presence of contamination. The studies do not report wound protection measures, peritoneal contamination control, drains use, and abdominal wall closure. Antimicrobial prophylaxis reduces the risk of surgical infection by 5 to 15%, not using it as a possible outcome bias in favor of conservative management.[22]

The total cost of conservative management is approximately 5.5% higher than STx if one considers the extra expenses imposed on the conservative treatment group: follow-up consultations, repeated hospitalizations, additional surveillance procedures such as control computerized tomography (CT) scans, and colonoscopy in patients over 40 years of age, treatment of recurrence, and appendiceal neoplasia.[23] The rate of negative or non-

**Table 2: Safety of antimicrobial therapy versus appendectomy in uncomplicated acute appendicitis in adults.**

| Safety of treatment | Prechal D, et al.[15] | | Poprom N, et al.[16] | | Yang Z, et al.[17] | | Podda M, et al.[18] | |
|---|---|---|---|---|---|---|---|---|
| | ABTx (%) | STx (%) | ABTx (%) | STx (%) | ABTx (%) | STx (%) | ABTx (%) | STx (%) |
| Mortality | NR | NR | NR | NR | NR | NR | NR | NR |
| Surgical complications | 13.3 | 14.4 | NR | NR | NR | 18.4 | 14.0 | 14.5 |
| | NS, similar in groups* | | | | No comment* | | NS, similar in groups* | |
| Post-operative abscess | NR | NR | NR | NR | NR | NR | 0.9 | 1.9 |
| | | | | | | | NS, similar in groups* | |
| Surgical site infection | 5.8 | 6.6 | NR | NR | NR | NR | 4.2 | 6.9 |
| | No comment* | | | | | | NS, similar in groups* | |
| Intestinal obstruction | NR | NR | NR | NR | NR | NR | 3.2 | 3.9 |
| | | | | | | | NS, similar in groups* | |
| Incisional hernia | NR | NR | NR | NR | NR | NR | 0 | 0.6 |
| | | | | | | | NS, similar in groups* | |

* Commentary of the publication when comparing the results.
ABTx = intervention group, treatment with antibiotics. STx = control group, appendectomy. NR = No report. NS = Non significant.

curative appendectomies is currently between 3 and 6%, attributed to the implementation of clinical practice guidelines incorporating imaging studies (ultrasound and CT scans) as part of the standard evaluation process and the routine use of laparoscopy.[24]

A missing component in the safety profile of non-operative management is the risk of not recognizing other diseases, such as Crohn's disease or neoplasms. Appendiceal cancer comprises less than 1% of neoplasms of the gastrointestinal tract and is found in less than 2% of surgical specimens. Between 2000 and 2009, the incidence increased by 54%; a retrospective review of cases in one institution found 28% of incidental neoplasms in patients undergoing interval appendectomy.[25] Conservative treatment has been proposed as a valid short-term option for elderly patients with high surgical risk due to comorbidity.[10] Although AA is rare in the elderly, patients over 65 are more likely than any other age group to have complicated appendicitis ranging from 18 to 70%,[9] higher rates of postoperative complications such as surgical site infection and prolonged ileus, and prolonged hospital stay.[26]

The antibiotics used in the RCTs are the subject of observations, criticisms, and risk signals we try to avoid. Among the most important observations are the low susceptibility and resistance of *E. coli* to amoxicillin and clavulanic acid, which make the scheme ineffective for treating gastrointestinal bacteria.[13,27] The same observation is made for ampicillin/sulbactam, piperacillin/tazobactam and fluoroquinolones. Among the criticisms is the inappropriate use of antibiotics, especially carbapenems, due to widespread use and overprescribing, qualified as overtreatment, which promotes bacterial resistance and more incredible difficulty in controlling severe infections when they occur in patients with intra-abdominal infections and neutropenia.[12] The main risk to be avoided is bacterial resistance to multiple antibiotics, which the World Health Organization (WHO) has warned about due to the worldwide increase in infections caused by multidrug-resistant bacteria.[4]

The promoters of ABTx in uncomplicated AA have identified the predictors of treatment failure: age older than 45 years, symptoms of more than 48 hours of evolution, mainly fever, the elevation of biochemical markers of inflammation such as C-reactive protein (CRP) and in a CT scan, demonstration of appendicular diameter greater than 15 mm, presence of fecalith, fluid or extraluminal air.[28,29]

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# Acute appendicitis secondary to appendiceal endometriosis: A case report and literature review

## *Apendicitis aguda secundaria a endometriosis apendicular: reporte de caso y revisión de literatura*

Óscar Cervantes-Gutiérrez,* David De León-Ángeles,* Alberto Pérez-Cantú,* Marcos Jafif-Cojab,* Andrew Michael Sorsby-Vargas*

**Keywords:**
appendicitis, endometriosis, laparoscopy.

***Palabras clave:***
*apendicitis, endometriosis, laparoscopia.*

**ABSTRACT**

Endometriosis is a common gynecological disorder that affects 6 to 10% of women of reproductive age. Endometriosis implants can be located within the gastrointestinal tract, mainly in the rectum and sigmoid colon, with rare appendicular involvement. We present a patient experiencing clinical symptoms of acute appendicitis, incidentally diagnosed with appendicular endometriosis during laparoscopic appendectomy.

***RESUMEN***

*La endometriosis es un trastorno ginecológico frecuente que afecta de 6 a 10% de las mujeres en edad reproductiva. Los focos de endometriosis se pueden localizar dentro del tracto gastrointestinal, principalmente en recto y colon sigmoides, siendo poco frecuente la afectación apendicular. Presentamos el caso clínico de una paciente que cursa un cuadro clínico de apendicitis aguda, la cual fue diagnosticada de manera incidental con endometriosis apendicular durante la apendicetomía laparoscópica.*

## INTRODUCTION

Endometriosis is a gynecological disorder in which endometrial tissue is outside the uterine cavity. Foci of endometriosis can be found in various organs (extragenital endometriosis), the most frequent gastrointestinal.[1] Gastrointestinal involvement is rare, while acute appendicitis secondary to endometriosis lesions is even less frequent.[2] Appendiceal endometriosis is generally asymptomatic; however, it may develop clinical manifestations such as chronic pelvic pain, lower gastrointestinal bleeding, intussusception, or appendicitis.[1] In 1952, the first patient with a preoperative diagnosis of acute appendicitis and postoperative diagnosis of appendiceal endometriosis was reported.[2]

## CASE PRESENTATION

A 32-year-old female patient came to the emergency department with abdominal pain of 12 hours of evolution, located in the epigastrium and with posterior migration to the right iliac fossa. The picture was accompanied by nausea and fever (38.2 ºC) as well as anorexia and general malaise. On physical examination, the abdomen had decreased intensity and frequency peristalsis, muscle resistance in the right hemiabdomen, and pain on superficial and medial palpation at McBurney's point. Von Blumberg, psoas, obturator, and Rovsing signs were also positive.

Laboratory tests were performed, which reported the presence of leukocytosis in 18.5 × $10^3$/µL, neutrophilia 88%, bands 8%, and PCR of 3.8 mg/dl.

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Due to the high clinical suspicion of acute appendicitis (score eight on the Alvarado scale), it was decided to perform a laparoscopic appendectomy. During the surgical procedure, appendicular inflammatory data equivalent to the diagnosis of acute appendicitis in the suppurative phase were found, as well as the presence of multiple endometriosis implants in the cecal appendix *(Figure 1)*, ovaries, fallopian tubes, and sigmoid colon. Samples of these implants were taken and sent for histopathological studies and the cecal appendix. The appendectomy was performed without complications with a satisfactory evolution and hospital discharge the following day. The histopathological report highlighted the presence of endometrial glands and stroma in the excised appendix.

## DISCUSSION

The leading cause of acute appendicitis is secondary to obstruction of the appendiceal lumen.[2] Such obstruction is usually due to fecaliths, lymphoid hyperplasia, plant debris, parasites, or neoplasms; however, approximately one-third of cases of acute appendicitis occur without the obstruction of the appendiceal lumen.[2] Endometriosis is described as a common benign gynecological disorder divided into internal and external, depending on the location of the endometrial tissue.[3] It affects 6 to 10% of women of reproductive age and can develop equally in premenopausal and postmenopausal women.[4] In internal endometriosis, the endometrial tissue is within the uterine layers. In contrast, in the external form, the endometrial tissue can be in genital organs, pelvic peritoneum, gastrointestinal tract, greater omentum, mesentery, and liver, among others.[3]

***Figure 1:*** *Laparoscopic image showing cecal appendix with inflammatory data and presence of endometriosis implants.*

It has been estimated that 10% of patients with endometriosis have intestinal endometriosis, which is more frequent in the rectum and sigmoid colon.[5] The incidence of appendicular endometriosis is close to 3% of all cases of intestinal endometriosis.[4] Collins reported 355 cases of appendiceal endometriosis in 71,000 postoperative appendectomy patients (0.05%).[6] Appendiceal endometriosis is usually asymptomatic, although it may manifest as appendicitis, perforation, intussusception, and lower gastrointestinal bleeding.[5] Hakoda et al. described the case of a patient with appendiceal intussusception to the cecum, subsequently diagnosed with appendiceal endometriosis.[7] A relationship between appendiceal endometriosis and the presence of uterine leiomyomatosis and menstrual cycle abnormalities has also been demonstrated.[4]

In the case of our patient, the clinical picture manifested severe abdominal pain in the right iliac fossa; a history of menstrual abnormalities was denied, and the presence of uterine leiomyomas was ruled out at the surgery. Since the clinical picture was compatible with a classic picture of acute appendicitis (score of eight on the Alvarado scale), imaging studies were not requested for economic reasons. The diagnosis of preoperative appendiceal endometriosis is complex since endometriosis can manifest itself in many ways without pathognomonic signs.

Endometriosis is diagnosed through a detailed anamnesis, pelvic examination, biomarkers, imaging studies, and laparoscopically.[8] Within the anamnesis, it should be suspected when data such as cyclic pelvic pain, dysmenorrhea, periovulatory pain, dyspareunia, dyschezia, and dysuria are manifested.[7] Pelvic examination (in skilled hands) is considered an effective clinical maneuver for diagnosing endometriosis.[8] Extreme pain on bimanual palpation of the utero-vesical cul-de-sac and the cul-de-sac of Douglas is considered suspicious for endometriosis, as is the painful mobilization of the uterus itself.[8] No biomarkers have been validated to diagnose endometriosis, but the

CA-125 marker has been reported to be helpful in postoperative follow-up as a marker of possible recurrence.[8] Transvaginal ultrasound is the first choice of imaging study to visualize ovarian endometriomas. It has the advantage of being low-cost, while a computerized axial tomography scan is reserved for a few cases.[8] The gold standard for diagnosing endometriosis is laparoscopy, which verifies lesions' presence and extent.[8]

The treatment strategy consists mainly of surgery and hormonal therapy (the application is determined depending on the patient's age and symptomatology).[5] Surgical treatment is preferably performed laparoscopically since its use allows exploration of the entire peritoneal cavity.[5] In 2001, using laparoscopy, Nezhat described the first intestinal resection for endometriosis.[9] Rodriguez-Wong and Rodriguez-Medina reported the case of a patient with appendicular endometriosis, managed by infraumbilical right paramedian laparotomy and appendectomy with the Ochsner technique. The patient had a favorable clinical course and received six-month complementary hormonal therapy.[10]

## CONCLUSIONS

Appendicular endometriosis is a rare pathology and challenging to diagnose preoperatively, so initiating the suspicion using a detailed anamnesis is essential. The diagnosis is made by laparoscopy, and if appendicular endometriosis is found to cause acute abdomen, it is suggested to intervene by laparoscopic appendectomy.

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# Laparoendoscopic cystogastric bypass of pancreatic necrosis. A case report

## *Derivación cistogástrica laparoendoscópica de una necrosis pancreática. Reporte de caso*

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**Keywords:**
pancreatitis, cystogastric bypass, minimally invasive.

***Palabras clave:***
*pancreatitis, derivación cistogástrica, mínima invasión.*

**ABSTRACT**

The incidence of acute pancreatitis (AP) is increasing by up to 0.7 hospitalizations per 1,000 population in the U.S. In 80% of patients, AP is mild and self-limited, but up to 20% may present with a severe necrotizing course, responsible for substantial morbidity and a mortality rate of up to 27%. The leading cause of death is necrotizing infection, associated with a poor prognosis and a 15-39% mortality. Until recently, the gold standard for treating infected necrosis was surgical necrosectomy by laparotomy. This procedure provides broad access to infected necrosis but is highly invasive and is associated with morbidity rates of 34 to 95% and a mortality of 11 to 39%. Alternative methods primarily involve debridement by retroperitoneal, laparoscopic, endoscopic, or combinations of these approaches. They share the common goal of avoiding laparotomy and are collectively called "minimally invasive necrosectomy". These techniques continue to evolve and undergo refinement. To date, no evidence or randomized trials comparing these techniques with traditional "open" necrosectomy or, equally importantly, comparing the different minimally invasive necrosectomy techniques with each other. These options present a problem for surgeons treating patients with pancreatic necrosis, as they need to consult the available evidence to guide their treatment selection. This case provides a general but concise description of a minimally invasive approach with reference to technique and outcome.

***RESUMEN***

*La incidencia de pancreatitis aguda (PA) está aumentando hasta en 0.7 hospitalizaciones por cada 1,000 habitantes en los EE. UU. En 80% de los pacientes, la PA es leve y autolimitada, pero hasta 20% de los pacientes puede presentar un curso necrotizante grave, responsable de una morbilidad sustancial y una tasa de mortalidad de hasta 27%. La principal causa de muerte es la infección de la necrosis, que se asocia con un mal pronóstico con una mortalidad de 15 a 39%. Hasta hace muy poco el estándar de oro para el tratamiento de la necrosis infectada solía ser la necrosectomía quirúrgica mediante laparotomía. Este procedimiento proporciona un acceso amplio a la necrosis infectada, pero es muy invasivo y se asocia con tasas de morbilidad de 34 a 95% y una mortalidad de 11 a 39%. Los métodos alternativos implican principalmente el desbridamiento mediante abordajes retroperitoneales, laparoscópicos, endoscópicos o combinaciones de éstos. Comparten el objetivo común de evitar la laparotomía y en conjunto se conocen como "necrosectomía por mínima invasión". Estas técnicas continúan evolucionando y sometiéndose a refinamiento. Hasta la fecha no hay pruebas o ensayos aleatorizados que comparen estas técnicas con la necrosectomía "abierta" tradicional o, lo que es igualmente importante, que comparen las diferentes técnicas de necrosectomía por mínima invasión entre sí. Esto representa un problema para los cirujanos que tratan a pacientes con necrosis pancreática, ya que necesitan consultar la evidencia disponible para guiar la selección de su tratamiento. Este caso proporciona una descripción general, pero concisa de un abordaje por mínima invasión con especial referencia en la técnica y el resultado.*

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## INTRODUCTION

With the emergence of minimally invasive surgical procedures, the aim has been to minimize the impact on the patient, these methods being the treatment of choice in various pathologies, as in this case, the drainage of pancreatic collections. Historically, several terms have been used to describe fluid accumulations around and inside the pancreas; depending on their chronicity and characteristics, they are divided into four groups: acute peripancreatic fluid collections, necrotic fluid collections, pancreatic pseudocyst and walled-off pancreatic necrosis (WON). Pancreatic necrosis with collection formation is susceptible to infection, making it challenging due to the added morbidity of open drainage. Recently the percutaneous and endoscopic approaches have gained tremendous popularity due to their minimally invasive nature;[1,2] however, the laparoscopic technique has demonstrated good therapeutic results and more significant benefits to the patient, such as shorter hospital stay and less recovery time.[2]

## PRESENTATION OF THE CASE

A 48-year-old male patient with a history of smoking (TI of 23), intense alcoholism, marijuana use, hepatitis C, and a history of two events of mild acute pancreatitis of alcoholic origin resolved without apparent complications. Two and a half months later, he came to the emergency department for abdominal pain, presenting hyporexia, nausea, and vomiting after two days of evolution, finding on physical examination pain and increased volume on palpation at the epigastric level located at deep planes, with no evidence of peritoneal irritation. The diagnostic protocol was completed documenting moderately severe acute alcoholic pancreatitis. A computed axial tomography (CT) scan showed evidence of hypodense and irregular image measuring 13.47 × 12.41 × 8.53 cm, with a defined

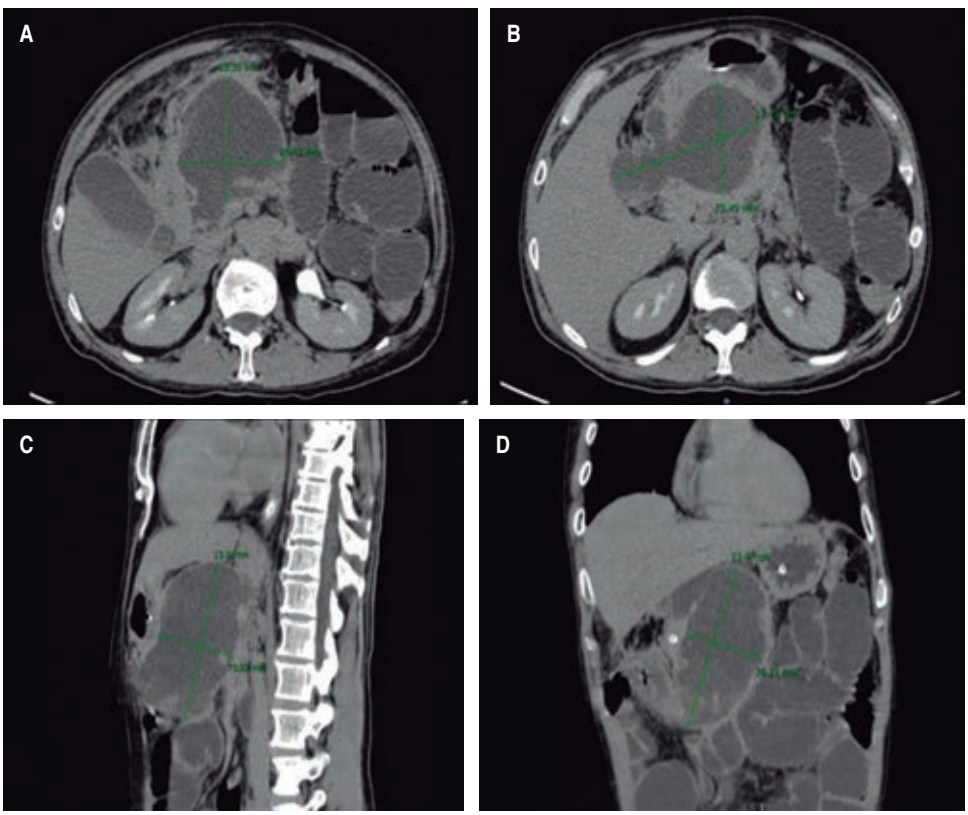


***Figure 1:***

*Computerized axial tomography scan. **A** and **B)** Axial section. **C)** Sagittal section. **D)** Coronal section.*

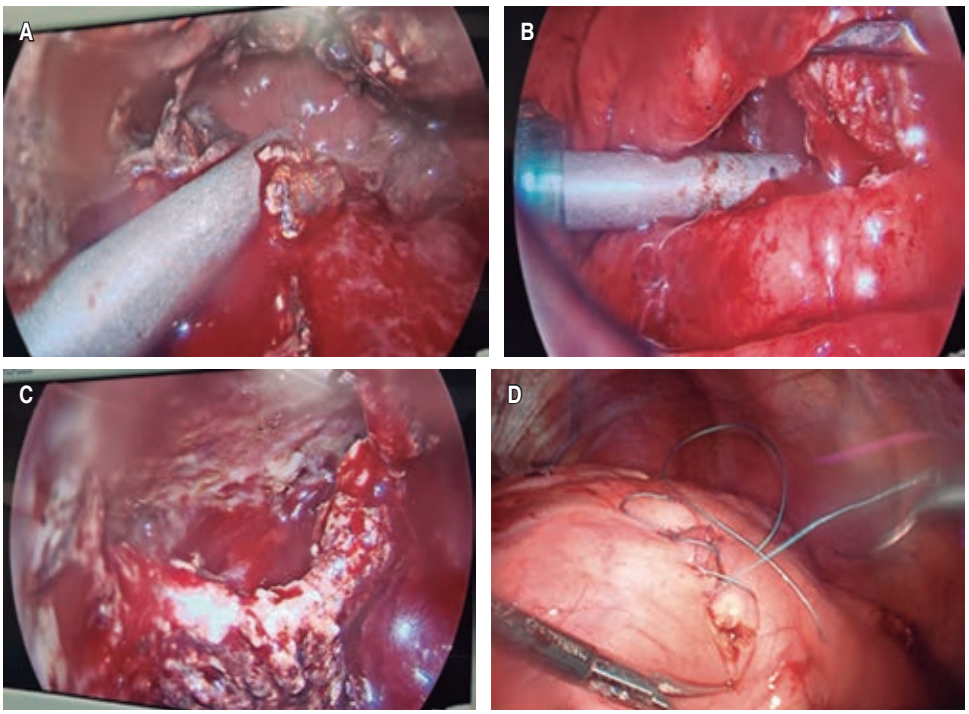


***Figure 2:***

*Drainage sequence.* ***A)*** *Opening towards the pseudocyst in the posterior wall of the stomach.* ***B)*** *Debridement of pancreatic necrosis.* ***C)*** *Drained cavity.* ***D)*** *Closure of the stomach wall in two planes.*

wall and heterogeneous content corresponding to a pancreatic pseudocyst of 746 ml of volume *(Figure 1)*. He started with supportive management until the remission of acute pancreatitis. Laparoendoscopic cystogastric bypass was performed, with findings of a pancreatic pseudocyst with septated necrotic content, which displaced the stomach, obtaining a total of 700 mL of cloudy liquid and detritus *(Figure 2)*. A triple lumen nasojejunal tube was placed for immediate enteral feeding and gastric decompression. The patient was discharged in two days from the General Surgery Service of the Centenario Hospital "Miguel Hidalgo" with a nasojejunal tube and outpatient control, which was removed three weeks after the surgical event, adequately tolerating the oral route.

## DISCUSSION

Surgical treatment of severe acute pancreatitis has evolved significantly in the last two decades with the emergence of minimally invasive surgery.[3] For its resolution, there are several therapeutic options: percutaneous drainage, endoscopic management, either

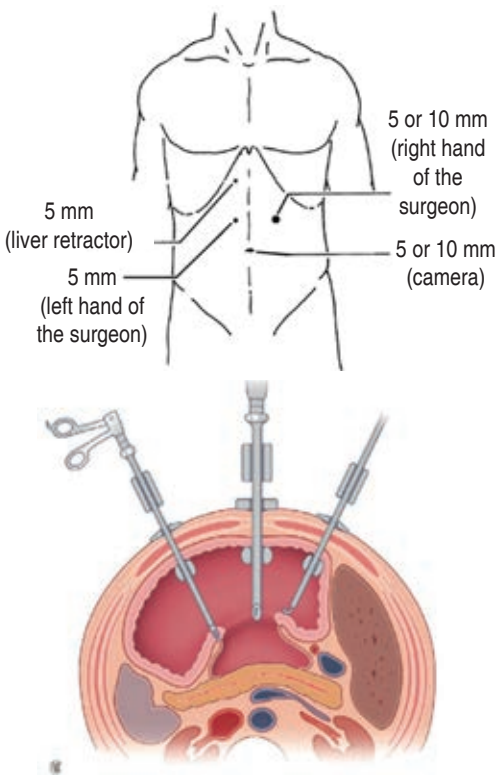


***Figure 3:*** *Schematic drawing showing port locations and dissection approach.*

transpapillary or transmural, laparoscopic, and open technique.[2,4,5]

The main indication for drainage is persistent symptomatology (food intolerance, persistent discomfort, poor quality of life, and continuous pain), infection, or other complications. In our case, the patient presented with oral intolerance and persistent symptomatology. Given the weight of literature over the past three decades, it is clear that deferred surgical intervention of up to four weeks has proven to be safer and advantageous concerning almost all measurable outcomes.[6-10]

The standard treatment consists of an open necrosectomy to remove the affected tissue completely.[7] However, this "gold standard" approach is associated with significant morbidity, especially high rates of pancreatic fistulas (40%), enteric fistulas (20%), and incisional hernias (25%), as well as mortality rates ranging from 11-39%, coupled with the risk of long-term pancreatic insufficiency.[6,11,12]

Thus, we are facing the rise of minimally invasive surgery;[4] it has recently been shown that combining different approaches could significantly optimize clinical management in critically ill patients affected by complicated necrotizing pancreatitis.[10,11] Recent literature supports that minimally invasive approaches are associated with better outcomes than early open necrosectomy.[10]

Surgical transgastric necrosectomy (TGN) is a procedure with little discussion.[9] The retrospective study by Driedger et al.[9] represents the most extensive experience of TGN within the current literature, which exposed a series of 178 patients at three hospital centers and concluded that TGN is an excellent one-step surgical option for symptomatic walled pancreatic necrosis, as it limits the risk of possibly inadequate pancreatic debridement and subsequent occurrence of a pancreatic-cutaneous fistula after traditional necrosectomy.[9,12]

Tan et al.[3], in a retrospective study, which was the first comparison between the laparoscopic and open surgical treatment of infected pancreatic necrosis, showed that the complication rate, estimated blood loss, and mean postoperative hospital stay was significantly higher in the open approach group. However, the mean operative time was longer in laparoscopy.[3]

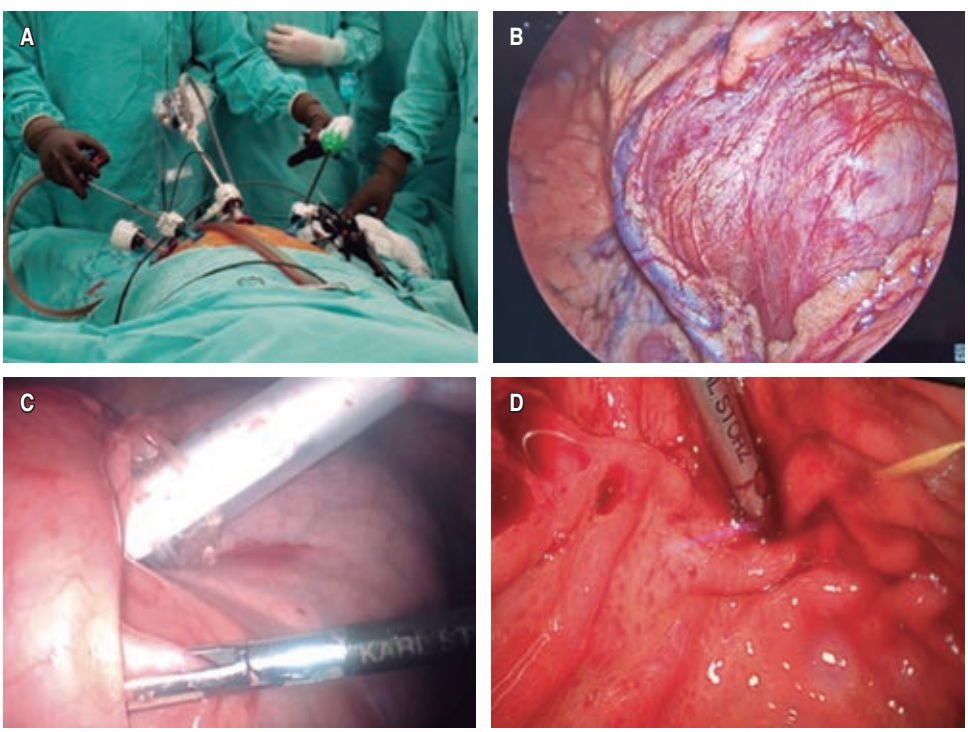


***Figure 4:***

*Initial approach.* ***A)*** *Use three 5 mm and one 10 mm trocars (optical).* ***B)*** *Increased stomach volume due to extrinsic compression of the pseudocyst.* ***C)*** *Gastrotomy and introduction of the trocar to the stomach.* ***D)*** *Identification of the most swollen area.*

### Surgical technique

In the present case, the surgical plan consisted of a laparoscopic procedure with an endoscopic variant, internal drainage, and transgastric pancreatic necrosectomy *(Figure 3)*: a 10 mm transumbilical optical trocar was placed under the Hasson technique, followed by a pneumoperitoneum at 12 mmHg and two working ports in the subcostal region: right 10 mm and left 5 mm. If the left lobe of the liver is very prominent, a 5 mm trocar can be used in the epigastric region with a hepatic retractor *(Figure 4)*. Anterior gastrotomies were performed for the introduction of transgastric trocars, insufflation of the gastric chamber with $CO_2$ for endoscopic vision, a 6 cm posterior gastrotomy at the site of contact with the pancreatic cyst for the performance of cystogastric bypass was performed, ending with curettage and aspiration of the cystic cavity for the extraction of necrotic tissue and detritus. In the end, trocars were removed to the peritoneal cavity for gastrorrhaphy with 2-0 vicryl cross stitches *(Figure 2)*; a soft drainage of the Penrose type was placed towards the surgical bed, and trocars were removed for subsequent closure of the abdominal wall in the usual way.

## CONCLUSION

Currently, minimally invasive procedures are the gold standard for the treatment of pancreatic pseudocyst and associated necrosis, given the low rate of complications, lower incidence of pancreatic fistula, no contamination of the peritoneal cavity, thus reducing associated morbidity, a shorter hospital stay, and a favorable evolution with rapid incorporation to the routine activities of each patient.

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# Spontaneous pneumoperitoneum secondary to intestinal pneumatosis: an uncommon cause of acute abdomen

## *Neumoperitoneo espontáneo secundario a neumatosis intestinal: una causa poco frecuente de abdomen agudo*

Jonathan Salgado-Vives,* Enrique Chávez-Serna,* Guadalupe Grisel Yáñez-Herrera‡

**Keywords:**
intestinal pneumatosis, pneumoperitoneum, acute abdomen, systemic sclerosis.

***Palabras clave:***
*neumatosis intestinal, neumoperitoneo, abdomen agudo, esclerosis sistémica.*

**ABSTRACT**

Intestinal pneumatosis is a rare entity characterized by the gas accumulation in the submucosa or subserosa of the walls of the digestive tract, usually associated with other diseases; primary presentation is rare. In most cases, the clinical manifestations are asymptomatic, infrequent the presentation as acute abdomen, secondary to spontaneous pneumoperitoneum. We report the case of a female patient with systemic sclerosis who presented a clinical picture of abdominal pain in the emergency department, with failure to conservative treatment and progression to the acute abdomen, for which surgical treatment was offered, resolving the spontaneous pneumoperitoneum secondary to intestinal pneumatosis involving the entire small intestine, by exploratory laparotomy and intestinal rest with excellent results.

***RESUMEN***

*La neumatosis intestinal es una entidad poco frecuente que se caracteriza por mostrar acumulación de gas en la submucosa o subserosa de las paredes del tracto digestivo, por lo general se asocia con otras enfermedades, la presentación primaria es rara. Las manifestaciones clínicas en la mayoría de los casos son asintomáticas, siendo poco frecuente la presentación como abdomen agudo, secundario a neumoperitoneo espontáneo. Reportamos el caso de una paciente con esclerosis sistémica, la cual evidenció cuadro clínico de dolor abdominal en el servicio de urgencias, con falla al tratamiento conservador y con progresión a abdomen agudo, por lo cual se ofreció tratamiento quirúrgico, con lo que se resolvió el neumoperitoneo espontáneo secundario a neumatosis intestinal que comprometía todo el intestino delgado, mediante laparotomía exploratoria y reposo intestinal con excelente resultado.*

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## INTRODUCTION

Intestinal pneumatosis represents a rare clinical entity characterized by the gas accumulation in the submucosa or subserosa, forming cystic lesions within the gastrointestinal tract.[1] This pathology was first reported in 1730 by Du Vernoi and subsequently subcategorized by Koss in 1952.[2,3] The incidence of intestinal pneumatosis is still not precisely known. However, it is increasingly reported as a finding due to the frequent use of computed tomography in abdominal pathologies.[4] It can occur in any age group, from neonates to geriatrics,[3] with a slight male predominance and peak presentation between 30 and 50.[5,6] One autopsy series reported an incidence of 0.03% in the general population.[3] Intestinal pneumatosis can affect any segment of the digestive tract from the esophagus to the rectum, but most frequently occurs in the small intestine (42%) (60% in jejunum, 30% in duodenum, and 10% in ileum), followed by the colon (36%) or both (22%), according to reports in the literature.[3-5] These cysts contain a mixture in variable amounts of nitrogen,

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hydrogen, oxygen, carbon dioxide, butane, propane, methane, ethane, and argon.[5] In approximately 85% of patients, the pneumatosis is associated with chronic pulmonary pathology, rheumatologic diseases, immunosuppression, or gastrointestinal diseases, being classified as secondary intestinal pneumatosis; the remaining 15% have no underlying pathology, its etiology being idiopathic, so it is classified as primary pneumatosis.[7] Most cases are asymptomatic, although up to 30% may manifest as acute abdomen secondary to spontaneous pneumoperitoneum due to rupture of the bullae.[5]

## PRESENTATION OF THE CASE

We present the case of a 61-year-old female patient who came to the emergency department with distension, intense and diffuse abdominal pain, intolerance to oral intake, and nausea leading to vomiting with food characteristics of a week's evolution with sudden exacerbation in the last day. As important personal history, she was diagnosed with systemic sclerosis in treatment with immunomodulators, primary hypothyroidism, and chronic liver disease under study, which required therapeutic paracentesis a year ago. The physical examination revealed an afebrile and conscious patient with a globose abdomen tympanic to percussion, decreased peristalsis, pain on deep palpation in the four quadrants, without evidence of peritoneal irritation; no masses or tumors were palpated, there was no ascites fluid under tension, and rectal examination showed no alterations. Laboratory studies were requested on admission without significant alterations, and an ultrasound did not show conclusive changes, with little perihepatic ascites fluid. Conservative management was started with fasting, antibiotic therapy with a double scheme (ciprofloxacin plus metronidazole), and placement of nasogastric tube without exit of food or fecal material through it, without data of improvement, with diaphoresis and progression of abdominal pain, so it was decided to perform a contrasted computerized tomography scan of the abdomen, where air and free liquid in the cavity with high suspicion of intestinal perforation was visualized *(Figures 1 and 2)*. The surgical findings were free air in the abdominal cavity with cystic intestinal pneumatosis of benign origin in the entire small intestine, scarce ascites fluid, and no associated intestinal perforation data *(Figure 3)*. Given this situation, the diagnosis of intestinal pneumatosis was proposed. The evolution was favorable after the three-day intervention with analgesic treatment, antibiotic therapy, and intestinal rest. After six days of remission of the clinical picture, without complications, the patient was discharged and sent to the general surgery outpatient clinic for continued monitoring.

## DISCUSSION

Intestinal pneumatosis is rare in which gas-containing cysts form under the intestinal

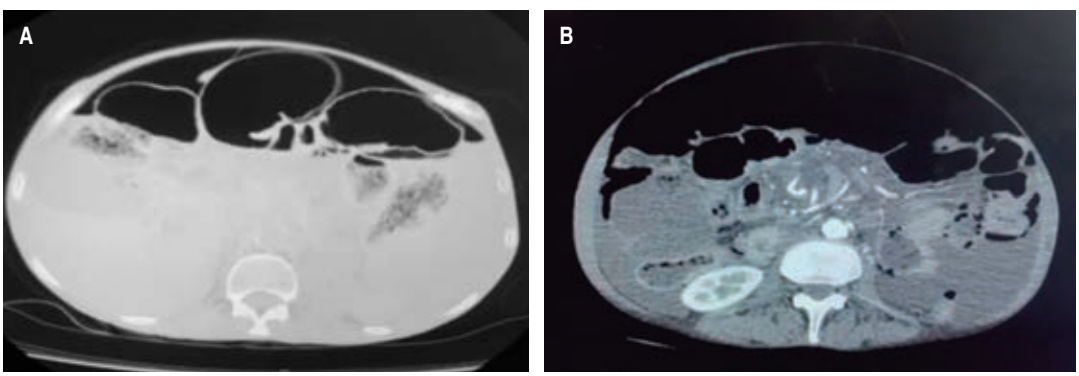


***Figure 1: A)*** *Axial section at a hepatic level showing intestinal loops with significant dilatation, free air, and perihepatic fluid.* ***B)*** *Axial section at a renal level showing significant free air.*

mucosa and serosa. The exact pathophysiology of this disease is currently unknown, although several theories have been put forward.[7] Multiple pathologies are associated with this condition; the most common are those related to gastrointestinal, pulmonary, rheumatologic, infectious diseases, immunosuppressive treatments, and trauma secondary to endoscopic or laparoscopic processes. In our case, the patient presented rheumatologic pathology, possibly associated with a secondary cause.[2,3,5] Three theories have been described to explain etiopathogenesis: the mechanical theory, which attributes the presence of transmural air to a state of increased intraluminal pressure and mucosal damage, which causes gas to escape to the wall; the bacterial theory, which suggests that the air originates from the presence of gas-producing anaerobic bacteria (*Clostridium difficile* and *Clostridium perfringens*), and the pulmonary theory, in which the increase in intrathoracic pressure in patients with pulmonary pathology (asthma, COPD) causes rupture of the alveoli and gas extravasation reaching the mediastinum, the retroperitoneal space, the mesentery and finally, the intestinal serosa.[6]

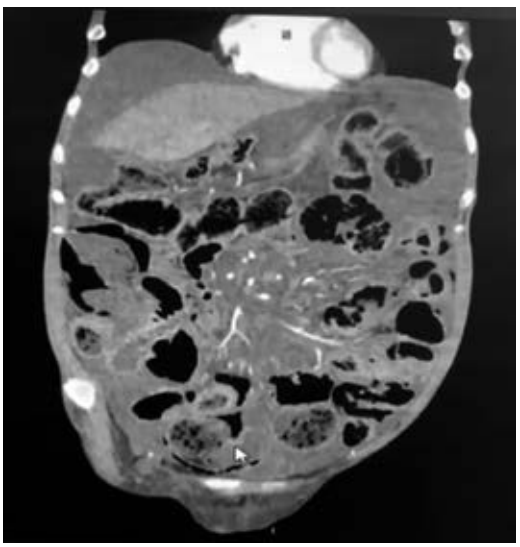

***Figure 2:*** *Coronal section showing perihepatic and perisplenic fluid and diffuse intestinal involvement of intestinal pneumatosis.*

Most patients are asymptomatic, but when there are clinical manifestations in intestinal pneumatosis, they are nonspecific, such as abdominal pain (59%), diarrhea (53%), nausea and vomiting (14%), mucus in the stool (12%) and hematochezia (12%). Complications are infrequent but occur in approximately 30% of patients, with spontaneous pneumoperitoneum, volvulus, obstruction, and intestinal ischemia being frequent.[2,3,5,6]

The diagnosis of intestinal pneumatosis is made by exclusion, having ruled out other causes of abdominal pain, in general, by a computerized tomography scan or simple abdominal radiography. However, abdominal

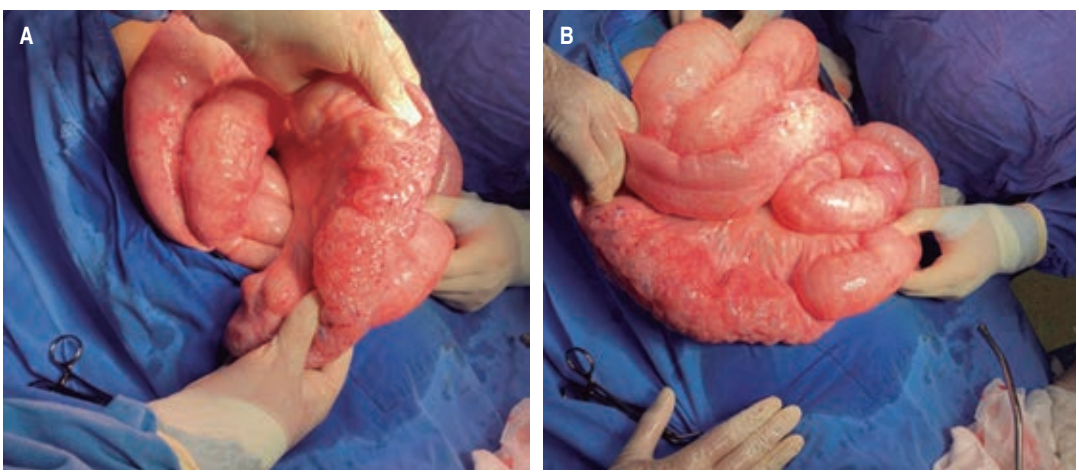


***Figure 3:*** *Transoperative images showing intestinal pneumatosis affecting mainly the jejunum and ileum but involving the entire small intestine.*

CT scan is the most sensitive and is considered the study of choice. In our case, the patient presented with tension abdomen, but without frank data of acute abdomen on admission, and due to the history of chronic liver disease, the CT scan helped rule out other more frequent causes of abdominal pain.[4] Cysts can be described as linear, circular, or bubbly, with no direct relation to the severity of the pathology.[7] However, confusing them with intestinal polyps, cancer, inflammatory bowel disease, and necrotizing enterocolitis is easy.[2]

The differential diagnosis includes mainly visceral perforation when it starts with spontaneous pneumoperitoneum, which occurs in 30% of patients with this pathology.[7]

Laboratory abnormalities are usually the result of the underlying disease causing intestinal pneumatosis. The main clinical predictors of intestinal necrosis and mortality in patients with intestinal pneumatosis include the following: pH less than 7.3, bicarbonate level of less than 20 mEq/l, lactate level of more than two mmol/l, amylase level of more than 200 U/l, and laboratory test results consistent with disseminated intravascular coagulation (prolonged prothrombin time, decreased fibrinogen level, elevated fibrinogen degradation products, and elevated D-dimer level).[3,8,9]

The treatment of intestinal pneumatosis must be individualized according to the patient's clinical conditions. Asymptomatic patients do not require any specific treatment; to indicate conservative treatment, we must have a high diagnostic suspicion of this disease,[6,7] while in patients with mild symptoms, conservative treatment can be initiated with intravenous antibiotic therapy (metronidazole is considered the antibiotic of choice, and is used for intraluminal bacteria, thus reducing anaerobic gas production), nasogastric decompression, sclerotherapy and bowel rest (decreases the availability of substrates for bacteria) with a success rate of up to 93%.[3,6,10]

In patients with severe symptoms, with suspicion of related complications (perforation, obstruction, hemorrhage, intestinal volvulus, or portal pneumatosis) and if there are predictors of mortality in the laboratory results, emergency surgical intervention will be indicated, with exploratory laparotomy being successful in most of these cases. In this case, we opted for surgical treatment due to the progression of the patient's symptoms, the poor response to conservative treatment in the first hours, and the findings obtained from the tomographic study, where there was a high suspicion of perforation due to air and free fluid.[1,3,6]

High-flow oxygen therapy and hyperbaric oxygen have long been recognized as effective therapy for intestinal pneumatosis, leading to cyst regression on imaging and resolution of symptoms. It is currently an alternative to conservative treatment that has shown excellent results.[3] The accumulation of oxygen in the cysts increases the partial pressure of hydrogen in the cysts, which causes high-pressure diffusion of hydrogen out of the cyst into the bloodstream; cyst resolution follows with oxygen reabsorption for use in cellular metabolism. Increased oxygenation at the tissue level may facilitate phagocytic activity and directly target gas-producing organisms. To date, no complications have been reported with the use of this therapy, with a reported improvement of symptoms in 89% of patients.[3,9]

## CONCLUSION

Intestinal pneumatosis is a rare entity; in most cases, it is associated with other pathologies, it is usually asymptomatic, and it is diagnosed as a finding with imaging studies; however, it can manifest as acute abdomen secondary to spontaneous pneumoperitoneum, where the presence of perforation of the hollow viscera should be ruled out as a first option. Intestinal pneumatosis should be considered a differential diagnosis causing acute abdomen, mainly when the patient has associated pathologies such as rheumatologic diseases. Currently, there is no standardized regimen for treating this pathology within conservative management; oxygen therapy seems to be an alternative with promising results that should be considered; however, each patient should be individualized to avoid complications. Surgical treatment is reserved for cases presenting acute abdomen, high suspicion of complications, and failure of conservative treatment.

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# Extrapulmonary tuberculosis presents as a groin abscess

## *Tuberculosis extrapulmonar que se presenta como un absceso inguinal*

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Andrés Hernández-Avitia,‡ Juan de Dios Díaz-Rosales§

**Keywords:**
abscess, inguinal canal, drainage, groin, suppuration, tuberculosis.

***Palabras clave:***
*absceso, conducto inguinal, drenaje, ingle, supuración, tuberculosis.*

**ABSTRACT**

Extrapulmonary tuberculosis is a complex pathological entity that manifests in up to 25% of cases with a primary pulmonary focus. We present the case of a 53-year-old male patient who attended the surgery department for an inguinal abscess, whose drainage revealed a retroperitoneal collection of mycobacterial origin. Recognizing these cases and suspecting the diagnosis is a pending task in the region of the Americas, where it continues to be a public health problem. This problem is coupled with the lack of applicable protocols due to the wide pathogenic variety of the extrapulmonary presentation of tuberculosis, so it is vital to expand the information about this pathological entity.

***RESUMEN***

*La tuberculosis extrapulmonar es una entidad patológica compleja que se manifiesta hasta en 25% de los casos con foco primario pulmonar. Se presenta el caso de paciente masculino de 53 años que acudió a consulta de cirugía por un absceso inguinal, cuyo drenaje reveló una colección retroperitoneal de origen micobacteriano. Reconocer estos casos y sospechar el diagnóstico es una tarea pendiente en la región de las Américas, donde continúa siendo un problema de salud pública. Esta problemática está aunada a la carencia de protocolos aplicables debido a la amplia variedad patogénica de la presentación extrapulmonar de la tuberculosis, por lo que es de vital importancia expandir la información acerca de esta entidad patológica.*

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## INTRODUCTION

Tuberculosis (TB) is a public health problem in Mexico (related to conditions in the country) and one of the leading causes of death from a single infectious agent.[1] The states of Guerrero, Tabasco, and Veracruz (south of the country) have more cases of tuberculosis, while the state of Chihuahua (north) is in 13th place in registered cases of pulmonary TB.[2]

Evidence shows that up to 25% of TB cases have extrapulmonary involvement.[3] The extrapulmonary manifestation can affect virtually all organs and has various clinical manifestations that can generate difficulty and delay diagnosis.[4]

Several mechanisms have been proposed by which TB spreads to other regions; it is accepted that a primary pulmonary focus can produce contiguous spread by lymphatic or hematogenous routes, the latter being the most likely cause of extrapulmonary infection.[5]

This article aims to present a case of extrapulmonary TB with an atypical presentation in the form of an inguinal abscess. This case represents a fundamental challenge for healthcare personnel to diagnose and manage complications.

## PRESENTATION OF THE CASE

A 53-year-old male patient came to the surgery department with a mass in the right inguinal region with a probable diagnosis of an inguinal hernia of two weeks of evolution. The patient had a history of type 2 diabetes (DM2) of a long evolution, in treatment with oral hypoglycemic

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agents (glibenclamide/metformin 2.5 mg and 500 mg, twice a day), surgery for a complicated diverticular disease where a colostomy was performed and a bowel reconnection surgery, without knowledge of a history of infectious diseases; he denied fever, cough, or was in poor general condition.

On examination, the patient was afebrile, with normal peristalsis, a fluctuant erythematous mass, and pain in the right inguinal region. Lab tests showed glucose 230 mg/dl, creatinine 0.9 mg/dl, hemoglobin 14.3 g/dl, hematocrit 36%, leukocytosis 18,000/mm$^3$, and platelets 450,000/mm$^3$. With these findings, an abscess of the inguinal region was suspected. An abdominopelvic tomography (CT) scan was performed, in which it was corroborated that the mass corresponded to a right iliac abscess with extension to the ipsilateral inguinal ligament. In addition, it was observed that the left side had a perirenal abscess, involvement of the psoas, and ipsilateral perineum *(Figure 1)*.

With the diagnoses established, drainage of the enlarged right inguinal region was performed (Gibson type incision), from which purulent yellowish-brown material was obtained in the first instance and well-formed caseous material later (during the same drainage). The entire collection was drained; it extended towards the retroperitoneal region in zone 3. The wound was irrigated with saline solution, closed with 1-0 caliber polyglecaprone 25, and a Jackson-Pratt drain was left. This material was sent for cytology (hematoxylin and eosin [H&E]), which reported abundant detritus and few non-specific bacterial colonies *(Figure 2)*, so Ziehl-Neelsen (ZN) staining was performed, showing the presence of acid-fast

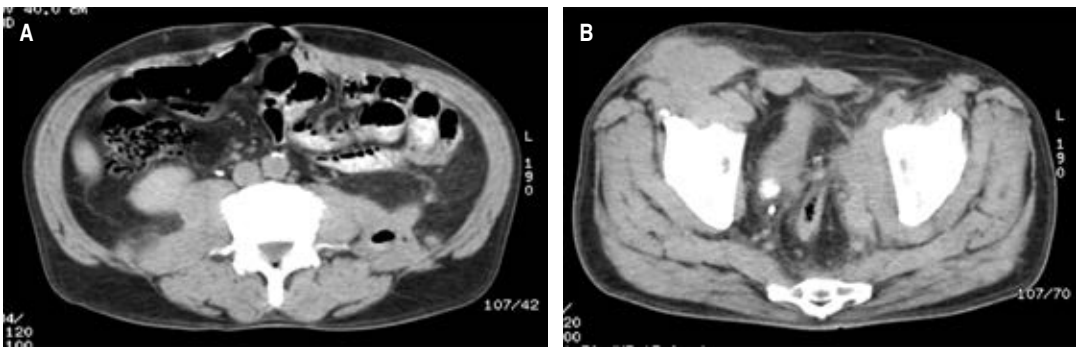


***Figure 1:*** *Abdominopelvic tomography scan, axial view.* ***A)*** *A collection over the right psoas and inflammatory tissue is seen.* ***B)*** *The collection is observed in the right inguinal region draining towards the abdominal wall.*

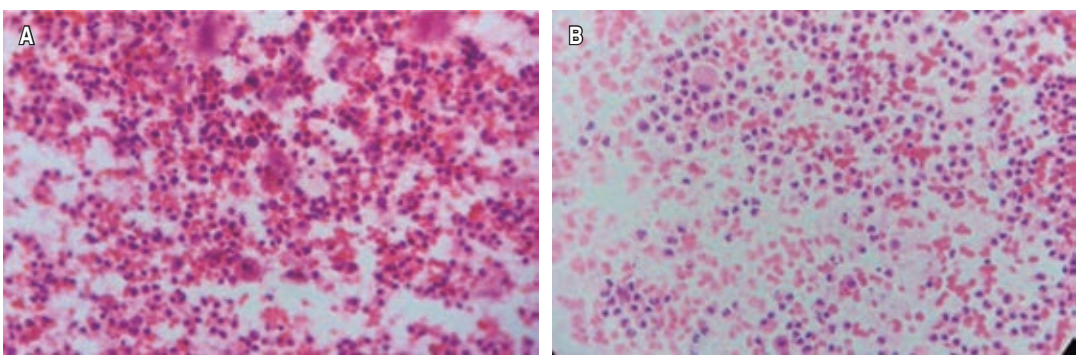


***Figure 2:*** *Cytologic smears stained with H&E showing abundant mixed inflammatory cells and activated macrophages on a proteinaceous background, erythrocytes, and abundant cellular detritus with few non-specific bacterial colonies.*

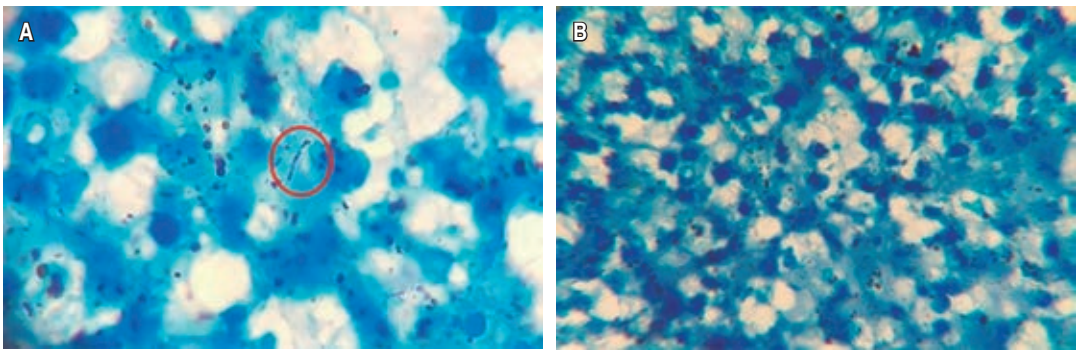


***Figure 3:*** *Cytology smears and cell block stained with Ziehl-Neelsen showing sparse, slightly curved long bacilli associated with the previously described elements on routine staining with hemosiderin present.*

bacilli *(Figure 3)*. At the same time, the culture confirmed the isolation of *Mycobacterium tuberculosis*.

After drainage, the patient was administered antibiotics empirically with ceftriaxone (1 g IV every 12 hours) and metronidazole (500 mg IV every eight hours). He was discharged due to improvement on the fourth postoperative day and sent to the infectious disease service, where he was administered strictly supervised shortened treatment (SSST). The patient showed improvement and periods of distension and mild abdominal pain during evolution. Currently, the patient completed the SSST (one year after his drainage) with evident clinical improvement, no purulent material coming out of the wound, and no collections in the retroperitoneum.

## DISCUSSION

Pulmonary and extrapulmonary TB has an essential dependence on its development with some conditions such as low socioeconomic status, immunosuppression (HIV-AIDS, T2D), alcoholism, and drug addiction.[6] We present the case of a patient with a history of immunosuppression secondary to T2D. This situation is an independent risk factor for the development of resistant TB.[7]

Extrapulmonary TB is an underestimated and often complex diagnostic entity because there are no fast and effective confirmatory tests. When extrapulmonary TB is suspected, it is because the clinical picture is florid and sometimes with complications that could have mortality. When faced with TB in the peritoneal or retroperitoneal region, obtaining a specimen (puncture, open surgery, or laparoscopy) for pathology analysis and clarifying the diagnosis by Ziehl-Neelsen staining, culture, or polymerase chain reaction (PCR) will lead to the diagnosis.[6-8] In the case presented, H&E examination of tissue sections showed extensive granulomatous inflammation with focal necrosis, while ZN staining revealed organisms compatible with mycobacteria.

Tuberculosis abscesses have been described as "cold" abscesses because they do not have a "classic" inflammatory process since they have a lower glycogenic metabolism.[9,10] They can occur anywhere there are lymph nodes; however, cervical, mediastinal, and inguinal locations are the most reported.[11] Cases of inguinal abscesses due to TB have been described as isolated abscesses originating from lymph node involvement; however, in the present case, the inguinal abscess was a means for the outflow of a retroperitoneal collection that drained to the right inguinal region.[9,12]

Abscesses coming from the lumbar region follow the psoas sheath through the retroperitoneum to the iliac fossa, which can fill with fluid and purulent material collecting in Scarpa's triangle and the inguinal ligament,[13] as shown in this patient. A psoas abscess can originate due to its proximity to retroperitoneal organs that may be affected by TB and can cause multiple complications due to the ease of generalized dissemination originated by its vasculature; this psoas abscess can have a bony

origin.[12,14] In the case presented, the origin of the abscess could not be corroborated.

A computerized tomography scan is the gold standard for diagnosing retroperitoneal abscesses. However, microbiological isolation and visualization of the microorganism are required to diagnose certainty in the case of TB. PET-Scan is a tool that differentiates active masses (neoplasms) from TB abscesses, at least in a couple of published cases, and could work in places where the technological resource is available.[10]

Without an initial pulmonary picture, extrapulmonary forms are of complex diagnosis (lymph nodes, genitourinary, and osteoarticular system).[5] The non-specific clinical presentation and the atypical evolution of this patient, who developed an inguinal abscess secondary to extrapulmonary TB, leads us to think that when faced with a diagnostic challenge such as this one, this condition should be suspected as a diagnostic possibility and the SSST cycle should be started as soon as possible to avoid the risk of complications that could generate an unfavorable evolution for the patient.

## CONCLUSION

It is essential to know all the diagnostic aids available to help refine the approach to a complex and unusual condition, which should always be considered in populations with a high incidence of this disease. This case represents the diagnostic difficulty of this condition. It exposes the problem of undiagnosed patients, who must go through a long and tortuous path until they reach the appropriate treatment.

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# Use of transverse abdominal plane block for drainage of intra-abdominal abscess: a case report

## *Uso del bloqueo del plano transverso del abdomen para drenaje de absceso intraabdominal: reporte de caso*

Alan Gutiérrez-Ramírez,* José Luis Bizueto-Monroy,‡ Said Cuéllar Valencia*

**Keywords:**
block, transverse abdominal plane, abdominal surgery.

***Palabras clave:***
*bloqueo, plano transverso abdominal, cirugía abdominal.*

**ABSTRACT**

Transverse abdominal plane block (TAPB) is a local anesthetic technique involving infiltration of the fascial plane between the transverse and internal oblique abdominal muscles and the nerve segments from T6 to L1. The first applications in the surgical context were made in the first decade of the century, described during cesarean sections and colorectal surgery as an adjuvant in the control of post-surgical pain. However, cases have been described in which it was used as the only analgesic therapy. We present the case of a 40-year-old female patient with a history of aortic valve stenosis treated with valve prosthesis and antithrombotic drugs, who underwent a fourth gestation complicated with preeclampsia, requiring surgical resolution of the pregnancy. Her post-surgical period was complicated by an intra-abdominal abscess, requiring surgical treatment. However, the patient's clinical condition contraindicated the neuroaxial blockade as an anesthetic, so it was decided to perform a bilateral TAPB and sedation for later surgery. She presented good postoperative evolution with no new complications. TAPB is a practical alternative in patients who need abdominal surgery and in whom it is considered risky to undergo general, epidural, or spinal anesthesia due to the possibility of aggravating their conditions.

***RESUMEN***

*El bloqueo del plano transverso del abdomen (TAPB) es una técnica de anestesia local que implica la infiltración del plano fascial localizado entre los músculos transverso y oblicuo interno del abdomen e involucra los segmentos nerviosos de T6 a L1. Las primeras aplicaciones en el contexto quirúrgico se hicieron en la primera década del siglo, descritas durante cesáreas y cirugía colorrectal como adyuvante en el control del dolor postquirúrgico, aunque se han descrito casos en los que se usó como terapia analgésica única. Se presenta el caso de paciente femenino de 40 años con antecedente de estenosis valvular aórtica tratada con prótesis valvular y antitrombóticos, quien cursó cuarta gesta complicada con preeclampsia, por lo que requirió resolución quirúrgica del embarazo. Su periodo postquirúrgico se complicó con absceso intraabdominal, con lo cual ameritó tratamiento quirúrgico. No obstante, el estado clínico de la paciente contraindicó el uso del bloqueo neuroaxial como anestésico, por lo que se optó por realizar un TAPB bilateral y sedación para luego ser intervenida. Presentó buena evolución postquirúrgica sin nuevas complicaciones. El TAPB es una alternativa útil en pacientes que necesitan cirugía abdominal y en quienes se considera riesgoso ser sometidos a anestesia general, epidural o espinal por la posibilidad de agravar sus condiciones.*

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## INTRODUCTION

The transverse abdominal plane block (TAPB), first described in 2001 by Dr. Rafi,[1] is a local anesthetic technique involving infiltration of the fascial plane superficial to the transverse abdominis muscle and deep to the internal oblique muscle, the basis of which is the peripheral blockade of the T6 to L1 segments running through it.[2,3] Techniques based on anatomical landmarks and ultrasound-guided techniques have been described.

The technique by anatomical references consists of delimiting Petit's lumbar triangle in whose vertex and in parallel form, the needle is introduced without imaging support with the double pop technique or "loss of resistance" (pauses produced by the passage

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of the needle through the fasciae of the external and internal oblique).[3,4]

With the introduction of imaging technologies to support the application of local anesthetics, different ultrasound-guided approaches have been developed: the lateral approach, the oblique subcostal approach, and the posterior approach. The lateral approach is performed with the injection of the local anesthetic in the plane between the internal oblique and transverse abdominis in the mid-axillary line between the costal margin and the iliac crest; its disadvantage lies in a poorer cephalic block compared to the technique using anatomical references. The oblique subcostal approach was developed to improve the cephalic block, provides analgesia of the T6-T9 segments, and is performed by inserting the needle near the midline and xiphoid appendix, advancing inferolateral parallel to the costal ridge with the injection of the anesthetic between the transversus abdominis and the anterior rectus, or between the rectus muscle and the posterior leaflet of the rectus sheath. When this technique is performed in conjunction with the lateral approach, they are called dual TAPB.[3,5] As for the posterior approaches, the transducer is placed in the same manner as the lateral approach and projected posteriorly to the quadratus lumborum area, injecting the anesthetic into the fascial plane between the transverse aponeurosis and the most anterolateral portion of the quadratus lumborum. Variations of this technique involve injecting the quadratus lumborum or the plane deeper.[2-4]

The literature reports different posology, drugs, and routes of administration; however, there is still no consensus as to which drug and dose is the most effective, although there is evidence that the posterior approach is the best technique in terms of reduced opioid consumption, lower scores on resting pain scales, as well as dynamic and longer duration of the anesthetic effect.[5]

Subsequently, a trans-surgical variant of this technique was proposed that provides good analgesia. Its primary use is in patients not candidates for the rachi-medullary blockade. The first applications in the surgical context date back to the first decade of the century and were described during cesarean sections[6] and colorectal surgery.[7] Its advantage lies in eliminating the risks of intraperitoneal or abdominal viscera puncture.

Complications of TAPB are infrequent and are mainly related to the increase in plasma levels of the anesthetic used that generates symptoms of toxicity; however, there are also visceral lesions reported in the literature, mainly liver lacerations during techniques by anatomical reference.[5]

## PRESENTATION OF THE CASE

A 40-year-old female patient had four gestations, three deliveries, and a history of aortic valve stenosis since 2017 with surgical management based on valve prosthesis placement and use of acenocoumarin until the diagnosis of her last pregnancy, during which oral the anticoagulant drug was suspended, and enoxaparin was started. She started her current condition when she was admitted to the obstetrics service with a gestational age report of 28.5 weeks of gestation (SDG) by the last menstrual period and 29.4 by fetometry. Preeclampsia was diagnosed with severe data, so it was decided to perform a Kerr cesarean section and bilateral tubal occlusion with Kroener technique, reporting 350 $cm^3$ of bleeding, obtaining a single live male product of 31.5 weeks by Capurro, with an Apgar score of 7/8, and with cleft lip and palate. She was discharged on the fifth day, requiring a transfusion of blood products in her immediate postoperative period. Twenty-one days later, she was readmitted due to abundant and fetid bleeding through the surgical approach; wound healing was performed, and an abdominal wall defect was evidenced, so it was decided to perform an ultrasound, with findings of a defect in the anterior abdominal wall in the cephalic portion of the wound through which intestinal loops protrude *(Figures 1 and 2)*. In an abdominal computerized tomography scan, a heterogeneous non-measurable collection was identified in the middle and caudal third of the wound at the level of the subcutaneous plane, as well as a thick-walled collection in the pelvic cavity and left iliac fossa *(Figure 3)*.

In addition, a transesophageal echocardiogram was performed, which showed

adequate aortic valve prosthesis function, moderate mitral and tricuspid regurgitation, with preserved left ventricular ejection fraction.

Laboratory studies reported hemoglobin of 9.1 g/dl, hematocrit of 32.6%, thrombocytosis of 492,000, leukocytosis of 18,340 with neutrophilia of 92%, prothrombin time of 30 s, and INR of 2.53. The need for urgent surgical intervention was determined; however, since the patient did not achieve the target International Normalized Ratio (INR) and given the potential cardiovascular clinical deterioration of the patient, an immediate intervention was decided with the support of the anesthesiology service and the application of ultrasound-guided TAPB by lateral approach bilaterally, infiltrating 75 mg of ropivacaine + 50 mg of bupivacaine gauged at 20 $cm^3$ with 0.9% saline solution in each hemiabdomen, in addition to administering sedation with midazolam and fentanyl, after which the suture material from the previous surgery was removed with the finding of approximately 200 $cm^3$ of hemato purulent material from subcutaneous tissue with extension to the left side of the mesogastrium; aponeurotic dehiscence in the cephalic portion of the wound with slight retraction of the edges was seen. Dissection was performed by planes up to the cavity, with evidence of a well-defined pelvic hollow abscess of approximately 50 $cm^3$; the cavity was cleaned with 1,000 $cm^3$ of sterile solutions, and finally, the aponeurotic wall and skin were closed. Finally, a vacuum-assisted suction system is placed.

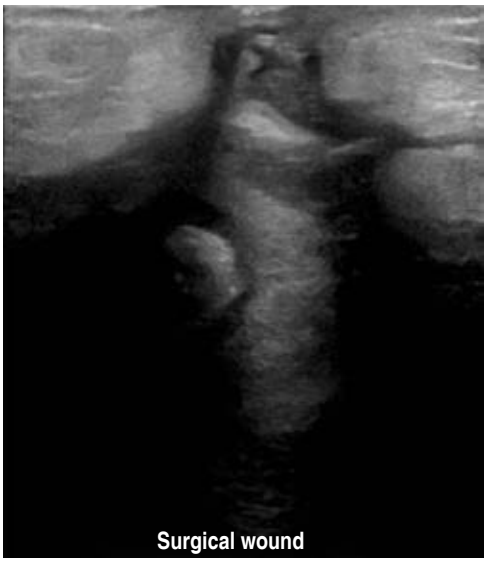


***Figure 1:***

*Ultrasound image of the cephalic third of the wound showing an aponeurotic defect through which small bowel loops protrude, covered by subcutaneous tissue and skin.*

## RESULTS

The postoperative course improved, with adequate pain control referenced by an analog pain scale of 2/10 at rest. The suction system was removed after the fourth day as there was no clinical evidence of collections. She remained hospitalized and under surveillance until overlapping parenteral with oral antithrombotic drugs, with uncomplicated discharge. She attended a control appointment to remove stitches one week after discharge. She found no evidence of dehiscence at any wall level,

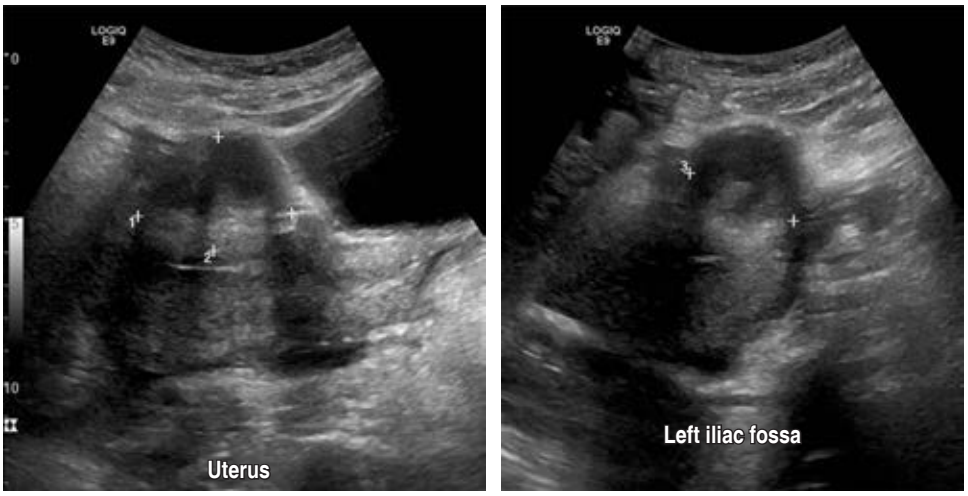


***Figure 2:***

*Ultrasound image at the level of the left iliac fossa showing a capsulated collection of heterogeneous content concerning the left uterine horn.*

without hematomas, and with wound healing according to expectations.

## DISCUSSION

Since its first description in the early 21st century, the transverse abdominal plane blockade has been effective in postoperative pain management as part of multimodal therapy because adequate analgesia reduces the metabolic response to trauma and postoperative morbidity and accelerates postoperative recovery. It should be one of the issues of importance to the surgeon. Although the anesthesiology service almost exclusively provided its initial description and use, surgical practitioners can also use transverse plane blocks.[3,5-8] Although the trans surgical uses reported and mainly studied have been during elective surgery, the use of TAPB is essential in patients admitted to the intensive care unit after emergency abdominal surgery since they usually have poor pain control, mainly because they are not candidates for epidural analgesia due to coagulopathy associated with sepsis. There are reports in the literature of cases of post-surgical patients with peritonitis hospitalized in the intensive care unit, in whom the use of TAPB reduced their need for opiates, improved their pain at rest and during movement (cough maneuver) and allowed them to undergo pulmonary physiotherapy, which led to early discharge from that service.[9] The use of TAPB has even been reported as the only anesthetic technique in patients with acute abdomen, a septic shock of abdominal focus, and need for emergency laparotomy qualified with ASA IV, with chronic obstructive pulmonary disease and coagulopathy due to sepsis, in whom it was preferred to avoid general, epidural or spinal anesthesia. In that case report, a bilateral dual TAPB was administered with the injection of 20 ml of 0.25% bupivacaine, 20 ml of 1% lidocaine, and 0.2 mg of adrenaline on each side of the abdominal wall, which allowed the slow and accident-free performance of a laparotomy with primary closure of ileum perforation and placement of omental patch. Furthermore, the patient recovered postoperatively without incident and was discharged two weeks later.[10]

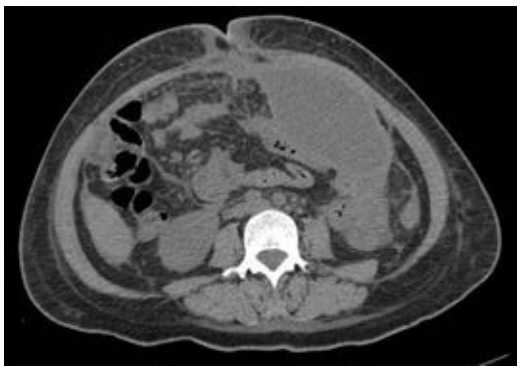

***Figure 3:*** *Tomography image: transversal section of the abdomen at L2 level showing encapsulated collection with densities between 33 and 47 Hounsefield units.*

The above shows that, as in our case, in patients in an unstable clinical condition with significant comorbidities in whom emergent surgical-anesthetic management in the abdominal cavity is required but who are prone to deterioration or complication with conventional maneuvers, TAPB is a useful alternative, with fewer risks compared to the usual approaches and that, properly administered, provides levels of analgesia comparable to epidural anesthesia.[11]

## CONCLUSION

Although there is no consensus as to the ideal drug or weight dose for TAPB, and there is a lack of scientifically valid studies in the literature to support its use, TAPB is a valuable alternative in patients requiring urgent abdominal surgery, in whom it is considered risky to undergo general, epidural, or spinal anesthesia due to the possibility of complications.

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Manuscripts inadequately prepared or not accompanied by the checklist will be accepted with being submitted for review.

The requirements are shown in the checklist. The format is available at www.medigraphic.com/pdfs/cirgen/cg-instr.pdf (PDF). Authors should download it and check each section as each publication requirement is fulfilled.

## CHECKLIST

### GENERAL ASPECTS

☐ Articles should be submitted in electronic format. Authors should have a copy for reference.

☐ The manuscript should be typed in Arial 12-point font, double-spaced, in letter size, with 2.5 cm margins on each side. The standard page comprises 30 lines, 60 characters each (1,800 per page). Words in another language should be presented in italics.

☐ The text should be presented as follows: 1) title page, 2) abstract and keywords [in Spanish and English], 3) introduction, 4) material and methods, 5) results, 6) discussion, 7) acknowledgments, 8) references, 9) appendices, 10) text of tables, and 11) figure captions. Each section should start on a separate sheet. The format can be modified in review articles and clinical cases if necessary.

☐ Consecutive numbering of each page, starting with the title page.

☐ Write down the name, address, and telephone number of three probable reviewers not belonging to the working group to whom the article can be sent for review.

### TEXT

#### Title page

☐ Includes:

1) Title in Spanish and English, maximum 15 words and short title of no more than 40 characters,
2) Name(s) of the authors in the order in which they will be published; if the paternal and maternal surnames are noted, they may appear linked with a short hyphen,
3) Credits to each of the authors,
4) Institution(s) where the work was performed.
5) Address for correspondence: complete address, telephone, fax, and e-mail address of the responsible author.

#### Summary

☐ In Spanish and English, with a maximum length of 200 words.

☐ Structured according to the order of information in the text:

1) Introduction,

2) Objectives,
3) Material and methods,
4) Results and
5) Conclusions.

☐ Avoid using abbreviations, but if their use is indispensable, their meaning should be specified the first time they are cited. Symbols and abbreviations of units of measurement in international use do not require specification of their meaning.

☐ Keywords in Spanish and English, without abbreviations, with a minimum of three and a maximum of six. They must correspond to those accepted by PubMed in its MeSH section.

### Text

☐ Manuscript not exceeding ten pages, divided into subtitles to facilitate reading.

☐ The names, initials, or file numbers of the patients studied should be omitted.

☐ Abbreviations are accepted but must be preceded by what they mean the first time they are cited and the units of measurement of international use to which the Mexican government is subject.

☐ Drugs, medicines, and chemical substances should be named by their generic name, and the dosage and routes of administration should be indicated according to the international nomenclature.

☐ The statistical methods used should be described at the end of the Material and Methods section.

### Acknowledgments

☐ Acknowledgments and details of support, drug(s), and equipment(s) provided should be cited before references. Send written permission from the persons to be cited by name.

### References

☐ From 25 to 30 in original articles, 25 to 35 in review articles, and 10 to 15 in clinical cases. They are identified in the text with Arabic numerals and in progressive order according to the sequence in which they appear in the text.

☐ References cited only in tables or figure captions should be numbered according to the sequence in which the identification of the table or figure first appears in the text.

☐ Personal communications and unpublished data will be cited without footnote numbering.

☐ The title of periodicals should be abbreviated according to the recommendations of the INTERNATIONAL COMMITTEE OF MEDICAL JOURNAL EDITORS (ICMJE) http://www.icmje.org/recommendations/browse/manuscript-preparation/preparing-for-submission.html#g. Complete information should be provided for each reference, including the article's title, abbreviated journal title, year, volume, and initial and final pages. When there are more than six authors, the first six should be listed, and the abbreviation et al. should be added.

Examples of articles from periodicals with up to six authors:

Ohlsson J, Wranne B. Noninvasive assessment of valve area in patients with aortic stenosis. J Am Coll Cardiol. 1986;7:501-508.

Seven or more authors:

San-Luis R, Munayer J, Aldana T, Acosta JL, Ramirez H, Campos A et al. Total anomalous pulmonary venous anomalous connection. Five years of experience. Rev Mex Cardiol. 1995; 6: 109-116.

Books, note edition when it is not the first one:

Myerowitz PD. Heart transplantation. 2nd ed. New York: Futura Publishing; 1987.

Book chapters:

Hardesty R, Griffith B. Combined heart-lung transplantation. In: Myerowitz PD. Heart transplantation. 2nd ed. New York: Futura Publishing; 1987. p. 125-140.

For more examples of reference formats, authors should consult:

www.nlm.nih.gov/bsd/uniform_requirements.html
www.icmje.org

Authors should avoid citing articles from predatory or pseudo-review journals.

### Tables

☐ It does not have.

☐ Yes, it does.
Number (with a letter): _____

☐ The information they contain is not repeated in the text or figures. A maximum of 50 percent plus one of the total number of pages of text is accepted.

☐ They will be headed by the title and progressively marked with Roman numerals according to their appearance in the text.

☐ The title of each table alone will explain its contents and allow correlation with the dimensioned text.

☐ Articles citing "predatory" journals will not be accepted.

### Figures

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☐ Yes, it does
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☐ The information they contain is not repeated in the text or tables.
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☐ The images appear in black and white in the printed version of the magazine. However, if the images submitted are in color, they will appear as such (in color) in the electronic version on the Internet. If the author wishes to have them also published in color in the printed version, he/she must pay the corresponding fee according to the publishing house.

### Photographs

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Number (with a letter): _____

In color:

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☐ Photographs showing identifiable patients must be accompanied by written permission for publication from the patient. If such permission is not possible, a portion of the patient's face should be covered in the photograph.

☐ Each photograph will be numbered according to the number assigned to it in the text of the article.

### Figure feet

☐ It does not have.

☐ Yes, it does.
Number (with a letter): _____

☐ They are marked with Arabic numerals corresponding to them according to the global sequence.

### Ethical aspects

☐ The procedures in humans must comply with the principles established in the Declaration of Helsinki of the World Medical Association (WMA) and with the provisions of the General Health Law Title Five and Regulations of the General Health Law on Health Research, and NOM-012-SSA3-2012, which establishes the criteria for the execution of health research projects in humans, as well as with the rules of the Research Ethics Committee of the institution where they are carried out. In case of having a registration number, please provide it.

☐ Experiments on animals shall comply with the National Research Council's standards, NOM-062-ZOO-1999, technical specifications for the production, care, and use of laboratory animals and those of the institution where they are performed.

☐ Any other situation considered of interest should be notified in writing to the editors.

☐ Disclosure of financial and non-financial relationships and activities, formerly known as conflict of interest.

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