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Impact of nosocomial infections in patients with diabetes mellitus and SARS-CoV-2 in a respiratory care unit

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Abstract

Background: In Mexico, 29% of mortality resulting from SARS-CoV-2 was associated with one or more comorbidities. Diabetes mellitus was one of the most frequently increasing in-hospital mortality. **Objective:** This study was aimed at determining the impact of nosocomial infections in diabetic patients diagnosed with COVID-19. **Materials and methods:** An analysis of 930 patients with SARS-CoV-2 was performed, grouping data from April 2020 to December 2021. Survival, hospital stay, causative agents, antimicrobial resistance, and comorbidities were the variables of interest. **Results:** About 30% of patients had diabetes mellitus, which presented a greater number of concomitant comorbidities such as arterial hypertension in 50%, and chronic kidney disease in 13%. The survival function was higher in patients without diabetes mellitus. **Conclusions:** The association between nosocomial infections and diabetes mellitus increased hospital length of stay and mortality, which is why multidisciplinary teams are important to carry out prevention programs and establish hospital sanitation measures.

Keywords: COVID-19. Nosocomial infections. Diabetes mellitus.

Introduction

Worldwide, there have been 763 million positive cases of SARS-CoV-2 and 6.9 million deaths. In Mexico, 7,595,635 positive cases and 333,961 deaths were reported until 2023, being predominantly males in their seventies^{1,2}.

In Mexico, 29% of fatalities from COVID-19 were associated with the presence of comorbidities, such as systemic arterial hypertension (SAH) 51%, diabetes mellitus (DM) 40%, and obesity 18%. The prevalence of DM in patients with COVID-19 is 18%³.

Worldwide, 463 million people suffer from DM and it will increase to 578 million by the year 2030. In Mexico, 10.32% of people over 20 years of age had a diagnosis

of DM, equivalent to 8,542,718 people. By the year 2020, 151,019 deaths were reported due to this disease, representing 14% of the total deaths in the country⁴.

DM is associated with a state of chronic inflammation, hyperglycemia, and decreased innate and humoral immunity. Likewise, in patients infected with SARS-CoV-2, increased IL-6, IL-10, sFas, granulysin, and IP-10 have been identified as biomarkers of disease progression and mortality, favoring the development of acute respiratory distress syndrome (ARDS)⁵.

Occurring 48 h after hospitalization among non-previously infected patients, nosocomial infection (NI) prevalence in developed countries varies between 5.1% and 11.6%, and between 5.7%-19.1% in low- and middle-income countries⁶⁻⁸.

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NIs could complicate pulmonary viral infections such as COVID-19, playing an important role in the evolution and prognosis of patients during the pandemic, mainly when associated risk factors such as advanced age, cardiac disease, DM, and chronic kidney disease (CKD) were present. The prevalence of co-infection in COVID-19 varies between 4-22% and can exceed 45% in those patients requiring admission to the intensive care unit (ICU). The average occurrence length varies between 1 and 2 weeks on admission⁹.

Perhaps, concentration hospitals account for the most NIs in Mexico, having a mortality rate of 4.8%. The most common NI pathogens include Gram-negative bacteria such as *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, followed by Gram-positive bacteria such as *Enterococcus faecalis*, *Enterococcus faecium*, and *Staphylococcus aureus*⁶. A well-defined epidemiology, prevalence, etiology, antimicrobial resistance, and associated risk factors are paramount for NI control programs to be effective¹⁰.

This study aims at knowing the impact that NI had on patients admitted for COVID-19 and DM in a respiratory care unit in Mexico City.

Materials and methods

Observational, cross-sectional, and retrospective study including patients older than 18 years, having SARS-CoV-2 confirmed by PCR-RT, hospitalized in a tertiary care hospital respiratory care unit from April 2020 to December 2021. NI was defined as the presence of any of the following criteria: fever after 72 h of admission, new pulmonary infiltrate, not present at the time of admission, abnormal urine test in patients with normal urine tests at admission, bloodstream catheter-related infection during hospitalization or laboratory analysis suggestive of infection not present at admission.

Statistical analysis was performed using the Student's t-test for independent samples to analyze the bivariate association between variables and DM status. Chi-square test was used to analyze the bivariate association between variables and having or not DM. Kaplan-Meier graphs were used to show the survival function according to having or not DM and having or not NI. The statistical software SPSS® version 29 was used.

Results

Nine hundred and thirty records of patients hospitalized for COVID-19 were analyzed, 275 patients had Type 2 DM. The average age was 54.0 ± 15.4 years.

Regarding DM status, after performing a Student's t-test, statistically significant differences were observed in age, 58.6 ± 12.2 years in diabetic versus 52.0 ± 16.2 years in non-diabetic patients. Among patients having DM, 50.2% had SAH while only 17.9% had SAH in non-diabetic patients. Patients with CKD represented 13.1% of DM patients and 8.1% of non-diabetic patients. Mortality was higher in DM patients representing 42.9%, compared to 33.5% in non-diabetic patients. All differences were statistically significant with a $p < 0.05$ (Table 1). The most frequent site of culture with growth was urine culture, followed by bronchial secretion culture and blood culture, with no difference between patients with diabetes mellitus and those without diabetes mellitus (Table 2).

In the Kaplan-Meier graph for survival function, we observed that survival was higher in non-diabetic patients (Fig. 1A). Similarly, the survival function was slightly higher in non-diabetic patients having superinfection (Fig. 1B).

Discussion

NIs, as a global public health problem, constitutes a permanent threat in the care of patients in respiratory care units, affecting hospital stay, and costs. In Mexico, a high prevalence of NIs is commonly observed in internal medicine, pediatrics, and surgery floors. Knowing the associated risk factors help us to prevent up to a third of NIs¹¹.

Well-known macro-and microvascular complications of DM affect patient survival. The association between diabetes and associated infections is also well known; however, evidence is controversial regarding whether DM itself increases susceptibility to infection, or whether cardiovascular and renal comorbidities that are frequently associated with DM are the main responsible factors¹².

The prevalence of DM in patients with COVID-19 in our study (29%) was higher compared to other series where only 5.9% of patients outside the ICU had DM⁹. Our findings are in agreement with other studies reporting that the risk of contagion of COVID-19 in DM patients is similar to the general population; nonetheless, DM patients are more prone to complications carrying higher rates of morbidity and mortality¹³.

No differences were observed in NIs and mortality between diabetic and non-diabetic patients (18.2% vs. 17.4%), which is similar to the 15% mortality rate found in a Dutch series and the 16% rate in a systematic review of 48 studies in 16 countries, supporting the rationale use of antibiotics on admission. About 40% of patients with DM and NIs developed ARDS. Lowering the incidence of bacterial superinfection, even in populations at risk, could be attributed to reinforcing the

Table 1. Sociodemographic and clinical characteristics of people with COVID-19, according to Type 2 diabetes mellitus status

Variable	Total (n = 930)	Non-diabetic (n = 655)	Diabetic (n = 275)	p-value
Age, y, mean (SD)	54.0 (15.4)	52.0 (16.2)	58.6 (12.2)	0.001 ^a
Hospital LOS, mean (SD)	11.8 (9.0)	11.8 (9.2)	11.9 (8.5)	0.778 ^a
SpO ₂ , mean (SD)	86.4 (14.0)	86.7 (14.0)	85.8 (13.9)	0.409 ^a
CRP, mean (SD)	155.7 (124.4)	151.5 (124.7)	165.3 (123.7)	0.233 ^a
Ferritin, mean (SD)	1339.5 (1224.3)	1362.2 (1259.9)	1285.3 (1135.9)	0.442 ^a
D dimer, mean (SD)	4254.6 (8579.8)	4076.4 (8404.8)	4667.1 (8976.3)	0.375 ^a
Procalcitonin, mean (SD)	1.2 (4.8)	1.1 (4.2)	1.5 (6.0)	0.234 ^a
Gender, n (%)				
Female	399 (42.9)	274 (41.8)	125 (45.5)	0.308 ^b
Male	531 (57.1)	381 (58.2)	150 (54.5)	
Comorbidities				
SAH, n (%)	255 (27.4)	117 (17.9)	138 (50.2)	0.001 ^b
CKD, n (%)	89 (9.6)	53 (8.1)	36 (13.1)	0.018 ^b
Cancer, n (%)	37 (4.0)	34 (5.2)	3 (1.1)	0.003 ^c
Cardiac disease, n (%)	25 (2.7)	17 (2.6)	8 (2.9)	0.025 ^b
COPD, n (%)	12 (1.3)	10 (1.5)	2 (0.7)	0.526 ^c
OSA, n (%)	2 (0.2)	0 (0.0)	2 (0.7)	0.086 ^c
Deaths, total, n (%)	334 (36.3)	217 (33.5)	117 (42.9)	0.007 ^b
Deaths plus superinfection, n (%)	164 (17.6)	114 (17.4)	50 (18.2)	0.081 ^b
Deaths w/o superinfection, n (%)	766 (82.4)	541 (82.6)	225 (81.8)	0.081 ^b
Causative agents				
<i>E. coli</i> , n (%)	38 (23.2)	27 (23.7)	11 (22.0)	0.223 ^c
<i>Staphylococcus</i> spp., n (%)	40 (24.4)	29 (25.4)	11 (22.0)	
Enterobacterias, n (%)	28 (17.1)	22 (19.3)	6 (12.0)	
<i>Candida</i> spp., n (%)	23 (14.0)	15 (13.2)	8 (16.0)	
<i>Klebsiella</i> spp., n (%)	15 (9.1)	10 (8.8)	5 (10.0)	
<i>Pseudomonas</i> , n (%)	1 (0.6)	1 (0.9)	0 (0.0)	
<i>Acinetobacter</i> , n (%)	6 (3.7)	1 (0.9)	5 (10.0)	
Other, n (%)	13 (7.9)	9 (7.9)	4 (8.0)	
Antibiotic resistance				
Carbapenems, n (%)	13 (18.1)	6 (12.8)	7 (28.0)	0.110 ^b
No carbapenems, n (%)	133 (81.1)	95 (83.3)	38 (76.0)	0.269 ^b
Lincosamides, n (%)	3 (4.8)	1 (2.1)	2 (12.5)	0.156 ^c

SD: standard deviation; LOS: length of stay; SpO₂: oxygen saturation; CRP: C reactive protein; SAH: systemic arterial hypertension; CKD: Chronic kidney disease; COPD: chronic obstructive pulmonary disease; OSA: Obstructive sleep apnea/hypopnea syndrome.

^aStudent t test for independent samples.

^bChi-Square test.

^cFisher's exact test.

correct use of personal protective equipment and hand hygiene during and after patient examination^{14,15}.

No significant differences were observed when comparing the isolated infectious agents between diabetic and non-diabetic patients; although, when comparing our results with those of a recent systematic review, large differences in isolated pathogens exist: *Escherichia coli* (23.2% vs. 3.1%), *Staphylococcus aureus* (24.4% vs. 10.4%), *Klebsiella pneumoniae* (15% vs. 13.5%), *Pseudomonas aeruginosa* (0.6% vs. 17.2%), and *Acinetobacter baumannii* (3.7% vs. 25%)³.

Antimicrobial resistance increased during the COVID-19 pandemic, according to a meta-analysis, the prevalence of coinfection plus antimicrobial resistance was 24%. In our study, antimicrobial resistance was 18.1% for non-carbapenems, 81.1% for carbapenems, and 4.8% for lincosamides, without finding a difference between diabetic and non-diabetic patients. Antibiotic prescription is of paramount complexity among large concentrating hospitals, hence the importance of having committees that regulate its use and limit its abuse^{16,17}.

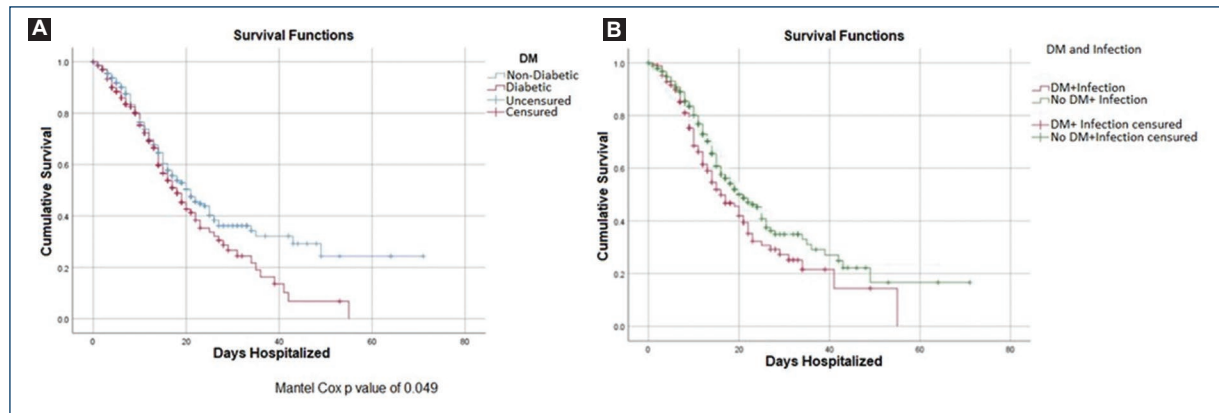


Figure 1. A: Kaplan-Meier survival curve in diabetic and non-diabetic patients. **B:** Kaplan-Meier survival curve in patients with bacterial superinfection.

Table 2. Positive culture site in diabetic and non-diabetic patients

Site	Total (n) (n = 930)	Non-diabetic (n) (n = 655)	Diabetic (n) (n = 275)
Blood culture	112 (12.04%)	75 (11.45%)	37 (13.45%)
Urine culture	226 (24.30%)	156 (23.82%)	70 (25.45%)
Bronchial secretions	166 (17.85%)	119 (18.17%)	47 (17.09%)
Catherter tip	16 (1.72%)	14 (2.14%)	2 (0.73%)
Wound	6 (0.65%)	4 (0.61%)	2 (0.73%)
Sputum	8 (0.86%)	6 (0.92%)	2 (0.73%)
Pleural fluid	7 (0.75%)	5 (0.76%)	2 (0.73%)
Peritoneal fluid	1 (0.11%)	0	1 (0.36%)
Secretions	4 (0.43%)	2 (0.31%)	2 (0.73%)
Cerebrospinal fluid	1 (0.11%)	1 (0.15%)	0

Hospital stay is another factor favoring the onset of NIs. A prolonged hospital stay results from more than 9 days of hospitalization¹⁸. In our study, no significant differences were observed in hospital length of stay between diabetic and non-diabetic patients ($p = 0.778$). Diabetic patients presented more associated comorbidities such as SAH, CKD, cancer, and cardiac disease, similar to other studies where a higher prevalence of obesity and COPD was also found¹⁴.

In our cohort, 20% of patients had metabolic dyscontrol, 15% had sepsis, 10% had acute kidney injury, and 1% had pulmonary thromboembolism. The main nosocomial complications were respiratory tract infection, urinary

tract infection, and central venous catheter-related infection in that order. Similar to what was published by Alnimr et al., who reported a preponderance of respiratory and bloodstream infections with a prevalence of 57.4 and 25%, respectively¹⁹.

NIs represent a threat in immunocompromised patients with invasive devices, the main ones called ventilator-associated pneumonia, urinary tract infection, and bloodstream catheter-related infection, in our study corresponding to 60%, 20%, and 10%, respectively. Its frequency and severity made it imperative to implement actions, which included detection of causative agents, hand hygiene reinforcement, limitation of insertion of invasive devices, and rational use of antibiotics, which decreased NI incidence in our unit during the COVID-19 pandemic.

Conclusions

NIs continue to be a public health problem that requires preventive action by multidisciplinary teams. DM is a risk factor for the development of severe COVID-19 bacterial superinfection, and increased hospital length of stay, favoring the appearance of ARDS and increasing mortality rates.

Data availability

The authors declare that the data used to support the findings of this study are available from the corresponding author on request.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

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Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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References

1. Pan American Health Organization. PAHO Biweekly COVID-19 Epidemiological Update; 2023. Available from: <https://www.paho.org/en/documents/paho-biweekly-covid-19-epidemiological-update-19-april-2023> [Last accessed on 2023 May 08].
2. Góbernet de México. COVID-19 México, General Información; 2023. Available from: <https://datos.covid-19.conacyt.mx> [Last accessed on 2023 May 08].
3. Bello-Chavolla OY, Bahena-López JP, Antonio-Villa NE, Vargas-Vázquez A, González-Díaz A, Márquez-Salinas A, et al. Predicting mortality due to SARS-CoV-2: a mechanistic score relating obesity and diabetes to COVID-19 outcomes in Mexico. *J Clin Endocrinol Metab*. 2020;105:dga346.
4. INEGI. Statistics about World Diabetes Day; 2021. Available from: https://www.inegi.org.mx/contenidos/saladeprensa/aproposito/2021/EAP_Diabetes2021.pdf [Last accessed on 2023 May 08].
5. Hernández-Solís A, Güemes-González AM, Ruiz-Gómez X, Álvarez-Maldonado P, Castañeda-Casimiro J, Flores-López A, et al. IL-6, IL-10, sFas, granulysin and indicators of intestinal permeability as early biomarkers for a fatal outcome in COVID-19. *Immunobiology*. 2022;227:152288.
6. World Health Organization. Prevention of Hospital-Acquired Infections. A Practical Guide. Geneva: World Health Organization; 2002. Available from: https://apps.who.int/iris/bitstream/handle/10665/67350/WHO_CDS_CSR_EPH_2002.12.pdf?sequence=1&isallowed=y [Last accessed on 2023 May 08].
7. World Health Organization. Report on the Burden of Endemic Health Care-Associated Infection Worldwide. Geneva: World Health Organization; 2011. Available from: https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf [Last accessed on 2023 May 08].
8. World Health Organization. Health Care-associated Infections Fact Sheet. Available from: https://www.convatec.at/media/1286/gpsc_ccisc_fact_sheet_en.pdf [Last accessed on 2023 May 08].
9. Ruiz-Garabosa P, Cantón R. Covid-19: impact on prescribing and antimicrobial resistance. *Rev Esp Quimioter*. 2021;34:63-8.
10. García-Cenoz M, Chamorro J, Vidán J, Lanzeta I, Lameiro F, Urtasun JM, et al. Prevalencia de la infección nosocomial en Navarra: resultados agregados del estudio EPINE 2005. *Anales Sist Sanit Navarra*. 2007;30:89-99.
11. García H, Martínez-Muñoz AN, Peregrino-Bejarano L. Epidemiología de las infecciones nosocomiales en una unidad de cuidados intensivos neonatales. *Rev Med Inst Mex Seguro Soc*. 2014;52(Suppl 2):30-7.
12. Hussain A, Bhowmik B, do Vale-Moreira NC. COVID-19 and diabetes: knowledge in progress. *Diabetes Res Clin Pract*. 2020;162:108142.
13. Hernández-Solís A, Reding-Bernal A, Cantú-Torres VP. Clinical behavior of SARS-CoV-2 infection (COVID-19) in patients with type-2 diabetes mellitus in a respiratory care unit. *Med Clin (Barc)*. 2023;161:37-8.
14. Sieswerda E, de Boer MG, Bonten MM, Boersma WG, Jonkers RE, Alea RM, et al. Recommendations for antibacterial therapy in adults with COVID-19 - an evidence based guideline. *Clin Microbiol Infect*. 2021;27(1):61-6.
15. Chong WH, Saha BK, Ramani A, Chopra A. State-of-the-art review of secondary pulmonary infections in patients with COVID-19 pneumonia. *Infection*. 2021;49:591-605.
16. Sulayyim HJ, Ismail R, Hamid AA, Ghafar NA. Antibiotic resistance during COVID-19: a systematic review. *Int J Environ Res Public Health*. 2022;19:11931.
17. Kariyawasam RM, Julien DA, Jelinski DC, Larose SL, Rennett-May E, Conly JM, et al. Antimicrobial resistance (AMR) in COVID-19 patients: a systematic review and meta-analysis (November 2019-June 2021). *Antimicrob Resist Infect Control*. 2022;11:45.
18. Stranieri M, Silva I, García J, García L, Gómez C, Fajardo A, et al. Infecciones nosocomiales en la unidad de cuidados intensivos del hospital universitario Dr. Ángel Larralde. *Inform Méd*. 2008;10:171-7.
19. Alnimer AM, Alshahrani MS, Alwarthan S, AlQahtani SY, Hassan AA, BuMurah NN, et al. Bacterial and fungal coinfection in critically ill COVID-19 cases and predictive role of procalcitonin during the first wave at an academic health center. *J Epidemiol Glob Health*. 2022;12:188-95.

Evaluation of a social intervention program for transplant patients: a qualitative study

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Abstract

Introduction: The intervention of social work (SW) promotes the social well-being of the patient. At the Hospital General de México “Dr. Eduardo Liceaga” (HGM), SW has implemented the Social Intervention Program in Transplants (PRIST) throughout pre-, during, and post-transplant stages in several dimensions. The objective of this study was to evaluate the PRIST by identifying the supports perceived by patients. **Methods and materials:** This was a descriptive and qualitative study using semi-structured interviews, following an interview guide for evaluation and a thematic analysis. **Results:** Thirteen patients participated in this study, with a mean age of 36 years, 6 (46.1%) women, a mean schooling of 13 years, 5 (38.4%) with a living donor transplant, and an average age of 4.9 years after the transplant. Six themes were identified: informational support, orientation, and institutional efforts, social evaluation and educational intervention, monitoring of the process, emotional support, and leadership-empathy of SW. **Conclusions:** PRIST is positively evaluated by patients, responding to their needs. The specialized preparation of SW and the person-family-centered care contribute to a better intervention. It is suggested to implement the PRIST in other hospital contexts.

Keywords: Social work. Qualitative assessment. Social intervention. Kidney transplant. Public hospital.

Introduction

The process of receiving a kidney transplant (KT) is complex and requires the participation of a multidisciplinary team working together with the patients and their families. Social work (SW) plays a key role in assessing and supporting patients in the socioeconomic aspects that affect their entire health-care process. SW takes action across three stages of the process: before, during, and after the transplant, with the objectives of assessment, support, and follow-up¹.

In some health-care systems, SW has developed specific intervention programs to work along with the

patients and their families, both regarding organ donation and the entire transplant process²⁻⁶. In Mexico, general transplant protocols have been implemented in the public sector, including SW tasks associated with patient assessment and administrative support^{7,8}. However, specific social intervention programs with this population have not been reported and evaluated to this date.

SW practices are based on theoretical and methodological models rooted in psychological, social, and administrative perspectives^{9,10} (Fig. 1). These models can be applied to various levels of care related to the user: individual, group, and community¹¹, guiding the

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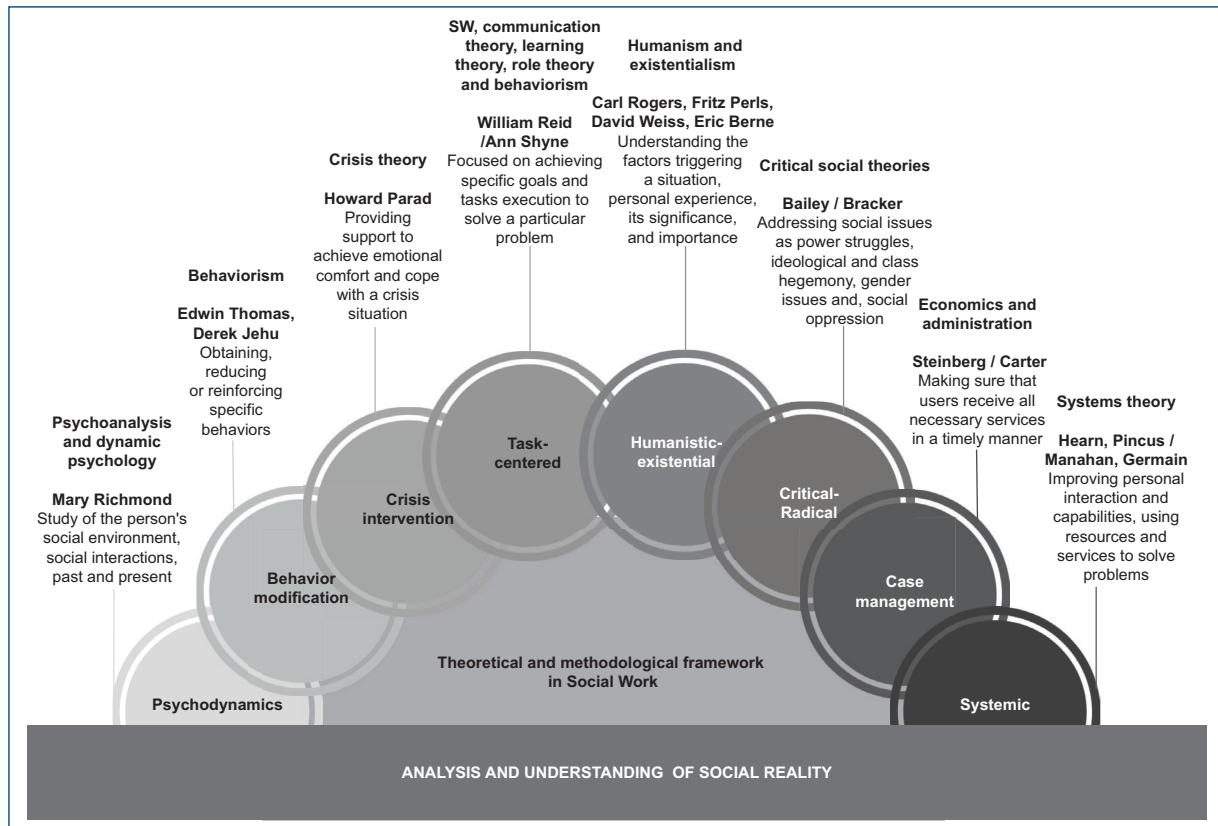


Figure 1. Traditional models of social work interventions. Developed based on Viscarret-Garro¹¹.

functions of social diagnosis and intervention in settings such as the hospital one¹². Starting in 2012, Hospital General de México “Dr. Eduardo Liceaga” (HGM) initiated the implementation of the Social Intervention Program in Transplant (PRIST, by its Spanish acronym) by the Department of Social Work and Public Relations built on SW intervention models, the needs of the hospital population, and the experiences of social workers.

PRIST is developed with the purpose of assessing, educating, and supporting the patients and their families across the different stages of the transplant process under a person- and family-focused health-care approach, including the role their families have played in their lives, and the support provided by these families to facilitate a health recovery¹³. The program includes specific and cross-cutting actions in each one of the dimensions: socioeconomic family conditions, organization, commitment, and compliance, support networks, housing conditions, and administrative and legal aspects across the entire intervention process. In the pre-transplant stage, actions involve assessment, intervention planning, and guidance to prepare the patients

and their families for transplantation. During the transplant stage, the SW provides guidance and accompaniment during surgery and post-operative care, manages support, and assists in hospital administrative procedures. After the transplant, the SW guides the process of adaptation and care plan for the isolation and gradual reinsertion into everyday life (Fig. 2).

Given that PRIST has been implemented in the HGM for over 10 years and that various studies have shown that KT recipients have psychosocial needs of emotional support, acceptance, guidance, and equitable health-care, most of which remain unmet due to the lack of interventions, or methodology limitations¹⁴, the objective of this study was to qualitatively evaluate this program in KT recipients treated at the organ donation and transplantation unit by identifying and describing the support perceived by them during their health-care process in the SW setting.

Materials and methods

This was a qualitative and descriptive study that used theoretical assumptions from the systems theory, which

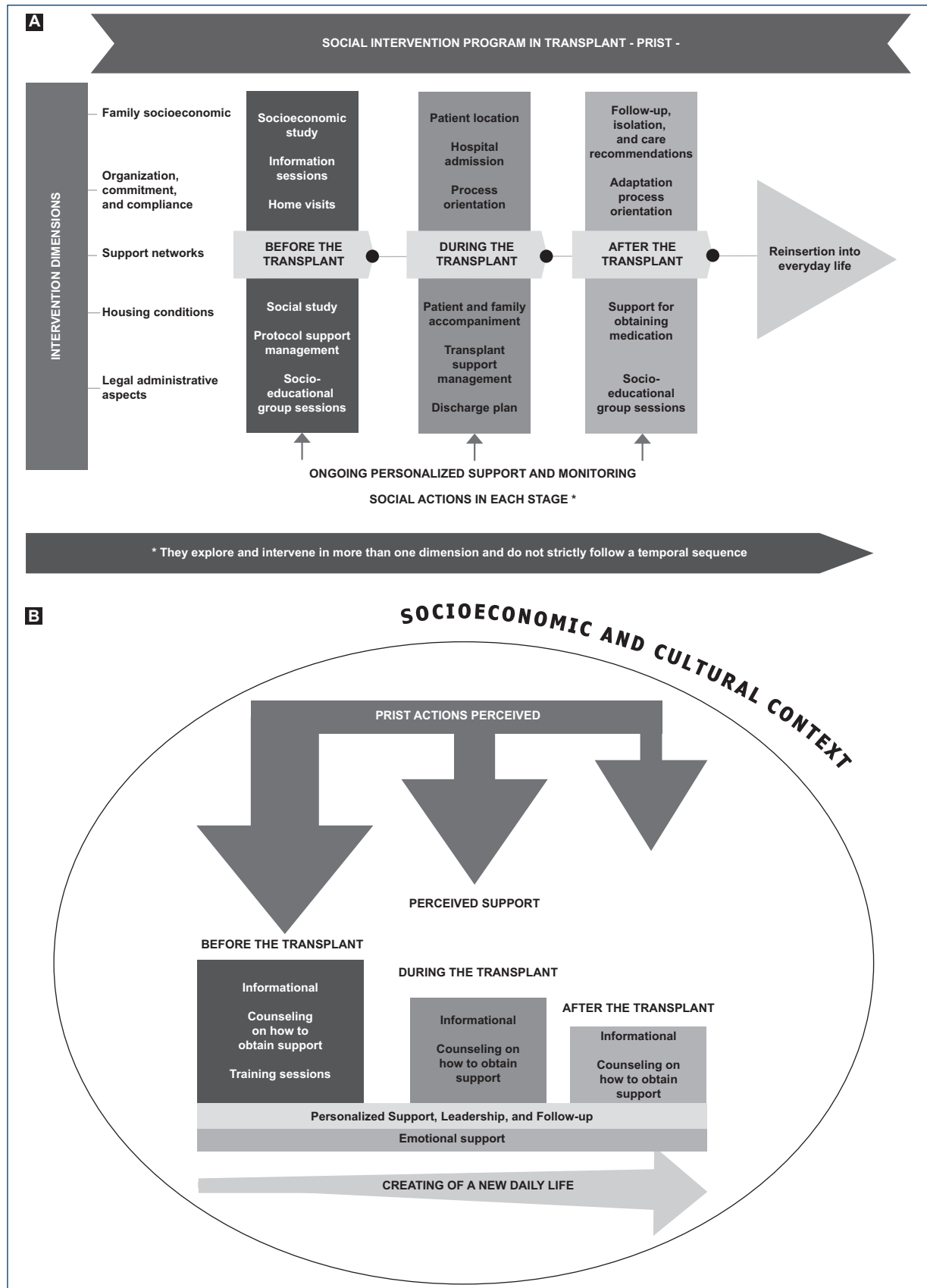


Figure 2. A: Social Intervention Program in Transplant -PRIST-. **B:** Representation of how PRIST works in the actual social work practice.

Table 1. Interview guide for PRIST assessment

Instructions	<p>The following topics are a guide for conducting semi-structured interviews with kidney transplant recipients. The aim is to encourage recipients to express freely on the proposed topics, allowing for the addition of information, or further exploration based on each interviewee's experiences and personal history.</p> <p>Notes for the interviewer:</p> <p>It is not necessary to ask all the questions. Select from the prompts if the information has not been addressed during the interview.</p> <p>The order of the interview can be adjusted based on topics raised by the participant. You may revisit a previous topic, or move on to a different one to go on with the conversation.</p> <p>Inform the interviewee that we want to learn from him/her and know more about his/her experiences. There are no right or wrong answers.</p> <p>Clearly explain the purpose of the study to the participant and obtain his/her consent before starting the interview.</p> <p>Take notes after the interview on the interview setting (e.g., interruptions, other people present, disturbances, any issues that may have arisen). Transcribe the audio recording as soon as possible.</p>
Sociodemographic Data	<p>Interview date</p> <p>Name</p> <p>Age</p> <p>Place of birth</p> <p>Place of residence</p> <p>Education level</p> <p>Marital status</p> <p>Occupation</p> <p>Medical diagnosis</p> <p>Languages</p> <p>Ethnic group</p> <p>Phone number</p>
Themes	<p>History with the illness and transplant</p> <p>Journey through health-care services and experiences in each service</p> <p>Relationship with health-care professionals</p> <p>Understanding of the illness</p> <p>Actions and decision-making regarding diagnosis and medical treatment</p> <p>Limitations associated with the illness and the transplant</p> <p>Description of family structure and dynamics</p> <p>Social support networks, and description of perceived support</p> <p>Religion, beliefs, and customs</p> <p>Family, social, occupational, economic, and emotional effects of illness and transplant</p> <p>Everyday life before and after the transplant</p> <p>Future plans</p>

recognizes a system as an entity that interacts with others and mutually feeds back to maintain its functioning. In the social context, individuals are part of social systems and subsystems that interrelate and can affect the responses that lead to social behaviors¹⁵.

Semi-structured interviews were held, following an interview guide (Table 1) to evaluate PRIST across different transplantation stages. The interview guide was developed using a transdisciplinary approach involving SW, medicine, and medical anthropology. The interviews were conducted over 7 months (from 2022 through 2023). Adult KT recipients at HGM from 2015 through 2022 were invited to participate and selected through convenience sampling¹⁶. Interviews were conducted at a private location inside the hospital, with a mean duration of one and a half hours. Furthermore, the interviews were audio-recorded for transcription and analysis. The number of interviews was

determined based on the criterion of information saturation and richness¹⁶, which was applied to the interviews of the target participants (those who received a KT from 2015 through 2022 and were directly assisted by social workers).

A thematic analysis followed, involving the blind coding of information by the researchers, followed by the creation of categories and themes to organize and prioritize information to guide the interpretative process, using the ATLAS.ti 23 software¹⁷. The results were triangulated to verify concordance with the categories and enrich the interpretation.

Ethical disclosures

This work is part of a larger research project approved by HGM research and ethics committees with registration no. DI/22/310/03/51. The overall objective

Table 2. Sociodemographic data of participants

Patient no.	Age	Gender	Civil status	Education	Residence	Occupation	Ethnic group	Type of transplant	Transplant time
1	27	Man	Single	High school	Estado de México	Administrative assistant worker	Non-indigenous	DDKT	2 years
2	40	Man	Single	Primary	Estado de México	Elementary activities and support staff	Náhuatl	DDKT	7 years
3	52	Woman	Single	University	Mexico City	Professional-technician	Non-indigenous	LDKT	6 years
4	24	Man	Single	Postgraduate	Estado de México	Student	Non-indigenous	LDKT	2 years
5	39	Man	Married	High school	Mexico City	Merchant, sales employee, and sales agent	Non-indigenous	DDKT	6 years
6	34	Woman	Single	University	Estado de México	Professional-technician	Non-indigenous	DDKT/DDKT	4 years/1 year
7	39	Woman	Cohabitation	High school	Mexico City	Stylist	Non-indigenous	LDKT	2 years
8	29	Woman	Single	High school	Mexico City	Elementary activities and support staff	Non-indigenous	LDKT	3 years
9	29	Man	Single	High school	Estado de México	Merchant, sales employee, and sales agent	Non-indigenous	LDKT/DDKT	6 years/3 years
10	31	Man	Single	University	Estado de México	Civil worker, CEO, and manager	Non-indigenous	LDKT	5 years
11	49	Man	Cohabitation	Primary	Mexico City	Agricultural, livestock, forestry, hunting, and fishing worker	Náhuatl	DDKT	7 years
12	32	Woman	Single	High school	Estado de México	Housewife	Non-indigenous	DDKT	7 years
13	44	Woman	Single	High school	Mexico City	Student/Seamstress	Non-indigenous	DDKT	7 years

DDKT: Deceased donor kidney transplant; LDKT: Living donor kidney transplant.

of the project is to explore resilience, coping, and social support in KT recipients. Patients voluntarily agreed to participate in the research after reading and signing the informed consent forms. The corresponding biosecurity measures were observed.

Results

A total of 13 individuals participated, with a mean age of 36 years, including six women (46.1%), and a

mean of 13 years of education. Five (38.4%) received transplants from living donors, while two received re-transplants (Table 2). A total of six themes associated with perceived support during the three intervention phases were identified: 1. Informational support; 2. Guidance and institutional management; 3. Social evaluation and educational intervention; 4. Monitoring of the preparation and adaptation process; 5. Emotional support; and 6. SW leadership based on empathy.

Table 3. Participants' narratives on perceived support

Stage/Theme	Before the transplant	During the transplant	After the transplant
1. Informational support	<i>Certainly, it was tough at the beginning, but with the help and guidance from the hospital, all those doubts started to clear up. So, we followed what they recommended for us here, and you know, we said, "Let's go" (Patient #1).</i>	<i>Sometimes I would say, "I'll ask the social worker all questions I may have because the doctors were driving me nuts due to how they'd talk to me, or because they'd explain things to me so quickly that I couldn't understand" (Patient #12).</i>	<i>First, I went to postoperative care in the Morelos neighborhood, but when they told us that there would be a home visit, and I didn't qualify, they changed my address to San Antonio Abad, and that's where I received the home visit. [The SW] asked, "What medicines were you on?" (Patient #5).</i>
2. Guidance and institutional management	<i>- How did you find out about this place? - Because they gave us information here, and then my dad went searching, and they were going to support us there too (Patient #2).</i>	<i>We also had to write letters to aid organisations, and they also helped us, as well as the hospital (Patient #8).</i>	<i>At the beginning of the surgery, it was the aid organisation, but after the transplant and everything, they helped with the medicines, and I've been in contact with them ever since (Patient #4).</i>
3. Social evaluation and educational intervention	<i>I wasn't at home because at that time, the social worker came to my house, and said that my home didn't qualify for home care, so a family uncle of my mom had several rooms available, and the social worker said I could stay there (Patient #1).</i>	<i>In social work, they obviously talked to us a lot, and all that information clears up a lot of things, many doubts (Patient #1).</i>	<i>During the pandemic, I lost my job and, as a result, I was selling a everything. So, I approached social work to update the socioeconomic assessment and request assistance with free healthcare coverage by the Federal Government. For me, it was really helpful because I had no money at all (Patient #13).</i>
4. Monitoring of the preparation and adaptation process	<i>That's when they referred me to social work.. we talked about my situation, which was quite unique. We had nothing, no job, no papers, nothing. So, I had to start the process of getting my immigration documents ready to be able to receive treatment legally. They also explained in that conversation that the transplant had a significant legal component. So, that's where I rushed to get my documents, or try to obtain Mexican documents (Patient #10).</i>	<i>- When you were nearing your transplant, did you make any appointments with the social worker? - Yes, I did; but very few of them. It was when we were dealing with the paperwork for the transplant. But yes, I mean, I've been grateful to this hospital because they have been very supportive (Patient #11).</i>	<i>Thank God, I'm doing well, I'm at 100%. We continue coming to regular appointments because it's part of the entire transplant process. We continue with treatments, medicines, and remain diligent. (Patient #4).</i>
5. Emotional support	<i>Yes, I received support from social work since the first transplant. At that time, there was a social worker there, and for me personally, it was an essential part of the transplant process because she really meant a lot to me (Patient #6).</i>	<i>Social work motivated me. It's a path where I ended up. It gave me the opportunity to join a TV station, so a lot of people heard my story (Patient #5).</i>	<i>After the transplant, though, I'm not saying you're going to have a happy life just because you had a transplant, no, because there are other factors that should be considered. But if you've already received the transplant, it's like motivation to get rid of all those things that used to bring you down (Patient #6).</i>
6. SW leadership based on empathy	<i>She also gave me information on the transplant. In my case, I did find empathy in that regard, a lot of follow-up, and things were very clear to me (Patient #6).</i>	<i>The social worker and all, she's a person whose way of being I like because she's very straightforward. She tells you something, and you're going to do it for your own good. Why are you going to do it? Because it's for your own good, not because you want to. If you don't want to be OK, go ahead, do as you please. But I crossed paths with the social worker, and I saw how she explained things to me, the way she told me things (Patient #5).</i>	<i>She (the social worker) has a way of connecting with patients right from the first time she sees you. It's like she remembers your name because she already knows who you are (Patient #6).</i>

1. Informational support: This support is highly valued by the patients and their families to make informed decisions on the transplant and the implications associated with each stage of the process. Its importance is emphasized due to the lack of knowledge on the entire preparation and transplant process (Table 3).
2. Guidance and institutional management: Guidance and management, particularly associated with material support, are essential for patients, facilitating access to aid organisations and ongoing transplant process (Table 3).
3. Social evaluation and educational intervention: The assessment of socioeconomic and housing conditions favors preparation for transplantation and access to treatment. Individual and group sessions are positive to receive informational and emotional support (Table 3).
4. Monitoring of the preparation and adaptation process: Direct, clear, and respectful interaction in monitoring the process activates the patients' commitment and responsibility toward the entire process and its outcomes (Table 3).
5. Emotional support: Some participants acknowledge that SW provides emotional support with which to motivate and cope with the entire process. However, this support is perceived in contrasting ways. One patient reports that SW encouraged him to promote transplantation and its benefits, while another participant recognizes the lack of emotional support from the healthcare team involved (Table 3).
6. SW leadership based on empathy: Participants recognize SW as a constant presence that understands their particular situation and suggests, and motivates continuity during the entire process, despite obstacles (Table 3).

Discussion

The analysis conducted describes that the SW-PRIST interaction has a positive impact regarding coping with KT for transplant recipients. The actions conducted within PRIST are perceived as support, and these supports have been identified as useful in overcoming family, social, and economic barriers across the entire process.

Patients perceive more support in the pre-transplant phase because this is the time when SW evaluates and activates personal, family, and social mechanisms for transplant preparation. Each patient perceives more or less support based on their individual socioeconomic

and family characteristics at the beginning of the process. For example, Indigenous and migrant patients report receiving more support from SW, which stresses the relationship among the vulnerability of certain social groups, the various barriers they face in accessing healthcare, and the need for support across the entire process¹⁸.

Participants say that they have received guidance from SW to manage institutional material support across all stages of the transplant process. This guidance helps alleviate the financial burden on their families, which can be significant due to the precarious economic conditions of the population served by HGM. Despite the implementation of free health care, economic barriers and out-of-pocket expenses for post-transplant maintenance therapies still persist. These economic barriers are documented in the medical literature currently available and are associated with worse health outcomes, which suggest the existence of an inverse relationship between socioeconomic status and health measures¹⁹. This underlines the importance of continuing to implement actions to counteract these effects for this group of people.

The research describes that the emotional support provided by SW through the implementation of PRIST leads to well-being through constant accompaniment and motivation, making patients feel that the professional "is actually there". In other countries, psychosocial approaches by SW in the organ donation and the entire transplant process are highly relevant^{1-4,6} maybe because socioeconomic aspects are addressed by health-care systems with more resources. In the Mexican context, significant socioeconomic inequalities demand greater intervention strategies in this regard.

The reported supports for monitoring and leadership by SW are interrelated since the program is implemented through a personalized relationship with constant, empathetic, and direct communication to make sure that actions are actually carried out. This SW leadership in providing support reflects the vision of Person-centred health-care approaches^{20,21} and person and Person-and Family-Centred Care¹³. Fig. 2B provides a graphic summary of the analysis presented so far.

The positive evaluation of PRIST suggests that specific interventions should be designed for transplantation care in other hospital settings, customizing actions to the specific needs and characteristics of the population, and to the complexity of the Person-and Family-Centred Care approach.

Based on this evaluation, areas for program improvement can be identified as beneficial for this population:

1. Include sociocultural aspects in the intervention dimensions to develop sensitive actions that should take into account the perspective and experiences of individuals within their context. This means developing cultural competencies by SW; 2. Addition of emotional aspect as a dimension of intervention to strengthen activities related to emotional support and personal and family accompaniment across the entire transplant process; 3. Consider the limitations that institutional dynamics impose on the full implementation of the program.

In conclusion, evaluating PRIST through semi-structured interviews with the patients allowed for a deeper understanding of how each participant perceives and values the social work intervention, while taking into account their socioeconomic context and experience with the transplant. This stresses the importance of conducting qualitative evaluations of health-care interventions.

Conclusion

The PRIST was evaluated positively by the participants. The design across the different phases and dimensions responds to the patients' needs and characteristics. The specialized training of SW, and the implementation of programs focused on the individual and his/her family contribute to a better intervention. The implementation of the PRIST in other Mexican hospitals settings should be customized to the needs of the populations served.

Limitations

This study has several limitations: 1. Individuals with graft loss who had to come back to replacement therapy were not included; these experiences could provide information on the role of PRIST in these cases; 2. The perceptions of the transplant health-care team on the value of the SW intervention were not explored; this could help guide intervention lines, or emphasis during program implementation; 3. The working conditions of SW at the hospital setting that could impact the execution of PRIST were not analyzed.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

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

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript nor for the creation of images, graphics, tables, or their corresponding captions.

References

1. Beder J. Organ transplant social work. In: Hospital Social Work: the Interface of Medicine and Caring. Ch. 6. Milton Park: Routledge Taylor and Francis Group; 2006.
2. Arricivita Amo AL. El trabajo social sanitario en otros ámbitos. In: Abreu Velázquez MC, Ballester Albarracín M, Colom-Masfret D, Juan Germán ML, Napal Lecumberri C, editors. Intervención Según Ámbitos Sanitarios. Spain: Oberta UOC Publishing, SL; 2014. p. 1-56.
3. DePasquale N, Hill-Briggs F, Darrell L, Boyer LL, Ephraim P, Boulware LE. Feasibility and acceptability of the TALK social worker intervention to improve live kidney transplantation. *Health Soc Work.* 2012;37:234-49.
4. DePasquale N, Hill-Briggs F, Darrell L, Ephraim P, Falcone B, Shafer C, et al. The talking about live kidney donation (TALK) social worker intervention: putting it into practice. *J Nephrol Soc Work.* 2013;37:13-8.
5. Kumar M. Role of social worker in cadaver organ donation and transplant coordination-a single centre experience. *Int J Soc Work Hum Serv Pract.* 2013;1:101-4.
6. Morales MA, Le Maitre Noda MD, Escuela IM, Afonso Pérez LC. El trabajador social sanitario en trasplante: como técnico del servicio de la coordinación autonómica de trasplante de órganos y tejidos. Documentos de trabajo social: Revista de Trabajo y Acción Social. 2009;45:197-207.

7. Liceaga E. Manual de Procedimientos del Servicio de Trasplante de Órganos. Mexico: Hospital General de México; 2020.
8. Zubirán S. Protocolo de Trasplante Renal. México: Instituto Nacional de Ciencias Médicas y Nutrición; 2015.
9. Hill R. Caso individual: modelos Actuales de Práctica. Pia a Presei Libere: Editorial Humanitas; 1986.
10. Du Ranquet M. Los Modelos en Trabajo Social. Intervención con Personas y Familias. Madrid: Siglo XX de España Editores S.A.; 1996.
11. Viscarret-Garro JJ. Modelos y Métodos de Intervención en Trabajo Social. Madrid: Difusora Larousse-Alianza Editorial; 2014.
12. García-Longoria y Serrano MP, Sánchez Urios A, Pastor Seller E. Introducción al Trabajo Social Aplicado. Murcia: Isabor; 2002.
13. Registered Nurses' Association of Ontario. Person-and Family-Centred Care. Ontario: Registered Nurses' Association of Ontario; 2015.
14. Wurm F, McKeaveney C, Corr M, Wilson A, Noble H. The psychosocial needs of adolescent and young adult kidney transplant recipients, and associated interventions: a scoping review. BMC Psychol. 2022; 10:186.
15. Payne M. Teorías Contemporáneas del Trabajo Social. Una Introducción Crítica. 1st ed. España: Ediciones Paidós Ibérica; 1995.
16. Martínez-Salgado C. El muestreo en investigación cualitativa. Principios básicos y algunas controversias. Ciên Saúde Colet. 2012;17:613-19.
17. Nowell LS, Norris JM, White DE, Moules NJ. Thematic analysis: striving to meet the trustworthiness criteria. Int J Qual Methods. 2017; 16:1-13.
18. Colmenares-Roa T, Figueroa-Perea JG, Pelcastre-Villafuerte B, Cervantes-Molina L, Juárez-Ramírez C, Guadarrama J, et al. Vulnerability as a palimpsest: practices and public policy in a Mexican hospital setting. Health (London). 2022;26:753-76.
19. Venkataraman S, Kendrick J. Barriers to kidney transplantation in ESKD. Semin Dial. 2020;33:523-32.
20. Bamford T. The team approach in person-centred health care: the social work perspective. Int J Pers Cent Med. 2011;1:23-6.
21. Washburn AM, Grossman M. Being with a person in our care: person-centered social work practice that is authentically person-centered. J Gerontol Soc Work. 2017;60:408-23.

History of the Infectology Service

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Abstract

Historical evolution of Infectious Diseases Service since the inauguration of the General Hospital of México, the development of Infectious Diseases and the Infectious Diseases Service of this Hospital; The main facts in 118 years are highlighted, the figures of doctors who have stood out, the infectious pathologies and how the care of the infectious –contagious patient has been faced, especially in epidemic outbreaks and pandemics in México.

Keywords: Hospital General de México. Infectious diseases. Infectious diseases service. History of infectious diseases. Mexico.

First period

In 1905, Hospital General de México, Mexico City, Mexico began its activities with 32 wards for the management of various medical conditions (Table 1). The areas dedicated to infected patients and their caregivers are presented in table 2. The wards were physically large horizontal galleries aligned one after the other, with clean water extracted from artesian wells, and built from stainless steel, or porcelain sinks^{1,2}.

In the early years, there was a significant flow of patients, and research activities were initiated. Among these, the research conducted back in 1907 on avitaminosis and chronic intestinal self-intoxication by Dr. Ernesto Ulrich, a pathologist who worked at this center from 1907 through 1934. He was also a professor of Histology, became the director of the Medical School in 1934, and was a member of the National Academy of Medicine since 1906. In 1910, Dr. Eduardo Liceaga's work with Salvarsan for the management of syphilis drew everyone's attention. Dr. Eduardo Liceaga, born in 1839 in Guanajuato, Mexico died in January 1920, had distinguished himself as a medical student

by consistently ranking first in all the courses he attended to. In addition to his medical pursuits, he also had an interest in music and served as the secretary of the Philharmonic Society, taught physics and natural history, acoustics, and phonography in music. In the field of medicine, he played a significant role delving into the medical field of Infectology and working on various diseases such as tuberculosis, syphilis, leprosy, smallpox, laryngotracheitis, yellow fever, and rabies. He brought the rabies vaccine to Mexico in 1888 and used it in a 12-year-old boy bitten by a dog. This vaccine was originally developed by Pasteur in 1885, who gave it personally to Dr. Liceaga. Dr. Liceaga was also involved in the 1886 typhus epidemic and the bubonic plague outbreak reported in Mazatlán, Mexico. He established systems for isolating contagious patients, directed the Pediatrics department at Hospital San Andrés, served as the head of the Typhus Campaign, was President of the National Academy of Medicine, also President of the Superior Council of Health, and Director of the National School of Medicine. He proposed and published the Personal Hygiene Manual. Along

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Table 1. Type of patients and no. of wards out of the starting 32

Type of patients	No. of wards
Non-infectious patients	21
Maternity	2
Puerperal fever	1
Infectious-contagious	5
Gynecology	1
Retirees	1
Observation	1

with engineer Roberto Gayol Soto, he became the Medical Director in charge of the construction of Hospital General in June 1896, with the financial resources provided by the Lottery for Public Charity^{2,3}.

Howard Taylor Ricketts dies at the American Hospital of Mexico on May 3, 1910. He had contracted typhus from the patients' blood and developed the disease that led to his death. General Porfirio Díaz declared 3 days of mourning, and honors and recognitions were bestowed on him. Dr. Ricketts was born in 1871 in Finlay, OH, United States. He codiscovered the bacteria responsible for the Rocky Mountain spotted fever and Mexican typhus (1909) with Wilder. He demonstrated the transmission of these diseases through tick, louse, and flea bites. Back in Mexico, he conducted a research at Hospital General. Later, in Mexico too, Hermann Mooser established the difference between exanthematic typhus and murine typhus due to *Rickettsia typhi* (mooseri). The definitive work on *Rickettsia prowasecki* as the causative agent of exanthematic typhus was published back in 1928 in *Gaceta Médica de México* by Herman Mooser^{2,4}.

During the Mexican Revolution, the hospital did not stop its activities but experienced significant instability, common changes of directors, and the come-and-go of medical personnel. In those years, an epidemic of typhus broke out that flooded the hospital with patients. Up to 600 people with the disease were treated at one time or another. This situation led to dedicating five wards exclusively for these cases. In 1919, the Central Commission for the Study of Typhus was established at Hospital General de México, with Dr. José Terrés serving as its president.

In 1918, the Spanish Flu broke out, and many became ill, many of whom were treated at the hospital with a very high mortality rate (25%). The treatments

used at the time for these patients included quinine, creosote, guaiacol, eucalyptol, phenol, iodoform, sodium benzoate, ipecacuanha, and colloidal gold. During these years, and due to the need to treat so many patients, the Infectology Unit actively participated in the management and research associated with typhus, brucellosis, and influenza. After the armed conflict, the hospital evolved and stabilized.

Infectology ward

Several wards were dedicated to the management of infectious patients. Ward #27 was dedicated to the management of multiple infectious diseases and later evolved into Infectology to eventually merge with ward #27 Bis, becoming ward #28 (Infectology). The individuals responsible for ward #28 (from 1914 through 1937) are listed in Table 3. Dr. Arturo Iturriaga is mentioned in some references as the head of the Infectology Unit at the opening of the Hospital General. However, we should mention that he was the head of ward #28, which was dedicated to the management of puerperal fever, according to the records from the hospital. Dr. José Martínez, Dr. Arturo Iturriaga, and Dr. Manuel Cañas worked in ward #27 only.

We should mention that during this period, various centers in the country were dedicated to the management of infectious patients. These included ward #28 from Hospital General, ward #10 from the Spanish Hospital, an Isolation Unit at the French Hospital, a ward for the management of polio patients at the English Hospital, and the clinical unit of the Institute of Tropical Diseases.

Dr. Cayetano Andrade López, born in 1890 in Morelón, Guanajuato, graduated in 1914 at Michoacana Medical School. He was a professor, writer, poet, and journalist who contributed to magazines such as *Policromía*, *Semanario Político*, *El Girondino*, *El Renovador*, and *El Combate*, some of which he also directed. He was involved with organizations such as Ateneo de Ciencias y Artes, Ateneo Nezahualcóyotl, and Vanguardia Nicolaíta. During the Mexican Revolution, he participated in the conflict, but in 1918, he joined Hospital General where he pursued a career as a medical intern, medical extern, and service manager. He also worked at the La Castañeda Psychiatric Hospital, served as a deputy for Guanajuato in 1924, and held positions as the Director of Information for the Ministry of the Interior and directed the Official Gazette. He is the author of "Lumbre Falsa," "Anecdotario Nicolaíta," "Antología de escritores nicolaítas," and "Estudio sobre la literatura Nicolaíta." He passed away in 1962^{2,4-6}.

Table 2. Wards and directors

Type of infected patients	Director of the ward	No. assigned to each ward
Multiple infections	Ignacio López	27
Leper in children and adults	Federico Bustamante	27 bis
Observation	Marco Antonio Barranco	22
Men with venereal diseases	Juan Nepomuceno Castellanos	10
Venereal diseases as well	Francisco Aguirre	11
Typhus-related	Alfonso Altamirano	12
Typhus-related as well	Manuel Cañas	13
Women with venereal diseases	Lamberto Barreda	20
TB patients	Manuel González de la Vega	26
Puerperal fever	Arturo Iturriaga	28
Infected children	Manuel Izaguirre	29
Patients with typhus	Francisco Bulman	30
Lab	S. Morales Pereira, bacteriologist	

Table 3. Heads of infectology from 1914 through 1937

Heads	Period
Ignacio López	Until 1914
Alejandro Martínez Rojas	1914-1916
Carlos Glass	1917
Lamberto Barreda	1918
Salvador Quevedo y Zubieta for a few months, then, Pablo Mendizábal	1919
Gabriel Suzán	1920
Luis Martínez	1921
Germán Troconis Aragón	1922-1924
Cayetano Andrade	1925
Pablo Barrueta	1927-1928
Salvador Ugalde y Cayetano Andrade López	1929-1930
Cayetano Andrade López	1930-June 1937

Back in 1937, Dr. Maximiliano Ruíz Castañeda discovered the vaccine for typhus, and established the Experimental Immunology Laboratory at Hospital General. He conducted research on typhus and brucellosis and created the National Center for Brucellosis. Dr. Ruíz Castañeda was born in Acambay, Mexico, and got his medical degree in 1923. He studied Microbiology at the

University of Paris and the Pasteur Institute, France in 1924 and 1925, respectively. In 1931, he collaborated with Dr. Hans Zinzer in Harvard to develop the typhus vaccine. He administered this vaccine to several individuals in Mexico, and the “Castañeda Vaccine” was also used by the allies in Europe during World War II. His contributions to brucellosis were highly significant and recognized by the World Health Organization. He received numerous recognitions, including the National Science Award in 1948, the National Order of Merit in Ecuador, the Luis Pasteur Medal in Cuba, the Scientific Merit Award in the State of Mexico, the title of “Beloved Son of the State of Mexico,” and the Research Medical Council Award from the Mexican President. He gained recognition from the Phi Sigma Society, the American Society of Immunology, the New York Academy of Medicine, the Society of Exotic Pathology, and the Mexican Society of Geography and Statistics. He served as a Senator for the State of Mexico from 1958 to 1964 and passed away in Mexico City at the end of 1992^{2,4,5}.

Starting September 1, 1937, Dr. Samuel Morones Alba (Fig. 1) was appointed head of the Infectious Diseases Department at Hospital General. Dr. Samuel Morones was born in Aguascalientes in 1907. He graduated as a medical surgeon from the National Medical School in February 8, 1930. In 1935, he continued his education at the Institute of Tropical Diseases in Hamburg, Germany, and later graduated as a malaria

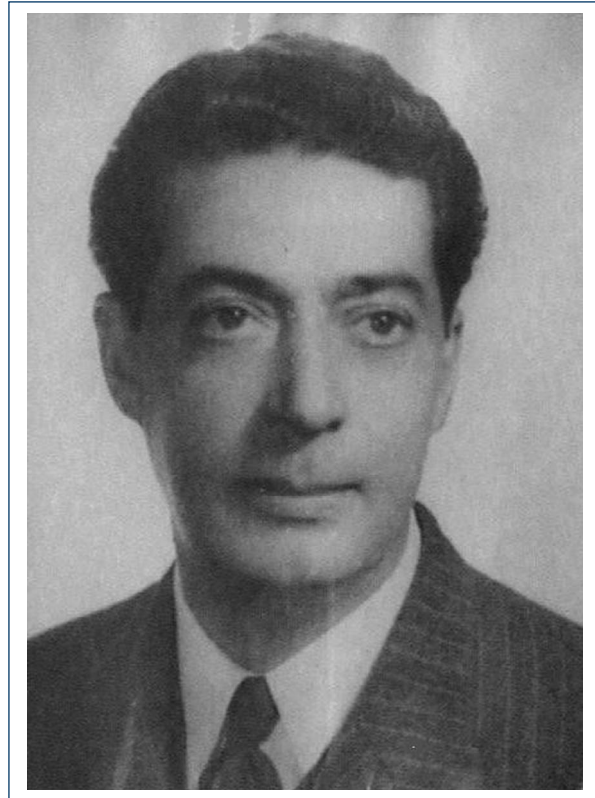


Figure 1. Dr. Samuel Morones Alba.

specialist doctor in Paris. Back in Mexico, he founded the Clinic for Parasitic Diseases. In 1939, he became a member of the National Academy of Medicine, and in 1957, he served as the president of Hospital General Medical Society. He also ran the Contagion Unit at the Spanish Hospital and the Clinical Unit at the Institute of Health and Tropical Diseases. Along with Prof. Joseph Smadel from the Army Medical Center, he successfully treated the world's first cases of exanthematic typhus with chloramphenicol in the infectious disease ward. Dr. Morones could also speak several languages such as Spanish, French, German, English, Italian, Portuguese, Latin, and Greek. His approach to medicine emphasized studying at the patient's bedside with reference books in hand, considering clinical work as the best method to gain knowledge on the patients.

A year after Dr. Morones took office, in 1938, the Infectious Diseases Center was refurbished, resulting in a three-story building. Dr. Samuel Morones Alba designed, developed, and implemented new methods and procedures, initiating anti-infectious therapy, and changing the old concept of infectious procedures.

Dr. Samuel Morones unveiled a commemorative plaque honoring Dr. Ricketts, who contracted the

disease while conducting typhus studies from the blood of patients at the Infectious Disease Unit of Hospital General, subsequently succumbing to the same illness.

In 1942, following instructions from the then-director of Hospital General, Dr. Abraham Ayala González, and the Infectious Disease Unit changed to Ward #28 for Infectious and Contagious Diseases.

Triggered by Dr. Morones, Dr. Daniel Méndez, and Dr. Álvaro Díaz Muñoz created the Infectious Disease Hospital of the Mexican Social Security Institute, which was initially located at the Medical Center (Avenida Cuauhtémoc) and then at the "La Raza" Medical Center. In its early days, this hospital was made possible thanks to the selfless support (without commission, payment, or appointments) of the nursing staff who worked in ward #28 of Hospital General after having been trained on the management of contagious patients.

In the following years, the Infectious Disease Unit stood out for holding extraordinary clinical and medical sessions, with significant participation from doctors such as Samuel Morones Alba, Francisco Higuera Ballesteros, Arturo Orozco Barajas, Roberto Flores Guerrero, Jesús Olvera Vázquez, Carlos Ledezma Zubieta, Carlos Lataban Morales, and guests from other academies and attending physicians. From 1944 to 1968, both Prof. Morones and Dr. Gerardo Varela, Dr. Luis Mazzotti, and Dr. Jorge Olarte served as honorary advisors to the Mexican Social Security Institute.

Unexpectedly, Dr. Samuel Morones passed away on September 23, 1968. On this day, the medical world lost the man who revolutionized medical therapy for the management of infectious and contagious patients turning ward #28 into a cutting-edge unit in Mexican Infectious Diseases. Thanks to his forward-thinking, he gave it identity, organization, continuity, and coherence until the very last day. Dr. Daniel Méndez published an *In Memoriam*, where he emphasized, and I quote: "those of us who were close to Maestro Morones know that he never accepted flattery or praise; that's why these words spoken in his honor are devoid of hyperbole".^{4,6-8}

Academic projection

Dr. Francisco Higuera Ballesteros (Fig. 2) took over ward #28 from 1969 through 1972, overseeing the clinical and educational activities of the unit, and initiating formal and methodological research. He was born in Oaxaca on December 20, 1916. In Mexico City, he

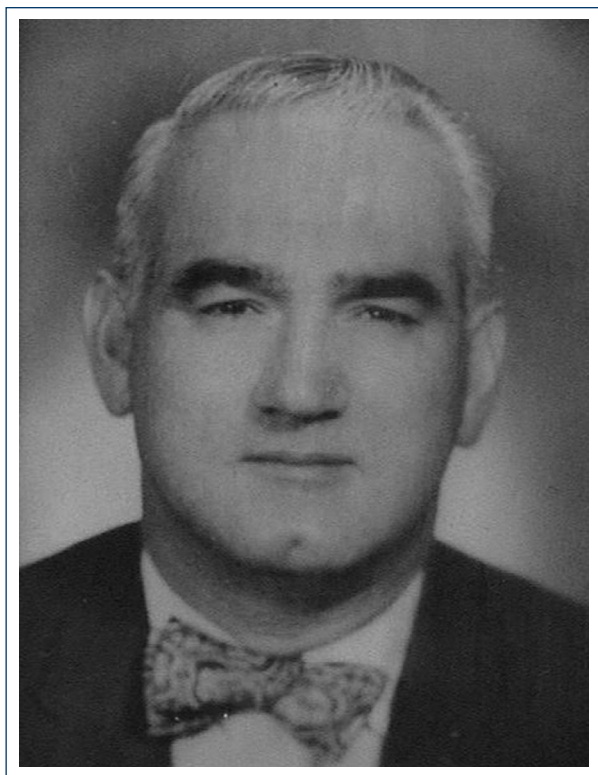


Figure 2. Dr. Francisco Higuera Ballesteros.

completed his Bachelor's degree in Biological Sciences at the National Preparatory School. He studied law for two years at the National Autonomous University of Mexico (UNAM) School of Law, and joined the Medical School in 1940, graduating as a medical surgeon in 1946. As a student, he arrived at Hospital General in 1942. In 1944, he became head of trainees and continued his career as a physician, medical associate, and assistant after passing his exam in Internal Medicine, then becoming an associate physician in Infectiology, to eventually become the Head of the Infectiology Unit. In 1959, he was appointed President of the Medical Society of Hospital General, and in 1972, he became the medical deputy director. In 1974, he eventually became the director of the hospital. He also served as the President of the National Association of Doctors of the ISSSTE and was a founding member of the National Association of Infectiology, member of the Academy of Sciences and Arts in New York, and the author of 53 scientific papers published in national and international journals. Dr. Higuera Ballesteros, Dr. Ernesto Calderón Jaimes, Dr. Jesús Kumate Rodríguez, Dr. José Ruiloba, Dr. Roberto Flores Guerrero, Dr. Miguel Ángel Peredo López Velarde, Dr. Emilio Escárzaga Tapia, and Dr. Pablo Mendoza Hernández founded the Mexican Association of

Infectiology back in 1973, with Dr. Pablo Mendoza Hernández serving as its first president. Dr. Francisco Higuera Ballesteros passed away in Mexico City, in the Infectious Disease Unit of Hospital General in 2002.

In 1972, Dr. Arturo Orozco Barajas took over the Infectious Disease Department until 1980, continuing with activities already going on there. In 1976, ward #28 changed its name to Unit of Internal Medicine and Infectiology #405.

In 1981, Dr. Roberto Flores Guerrero was appointed Head of the Infectious Disease Department, a position he held until 1982. Dr. Flores Guerrero was born in September 8, 1936, in Mexico City. He earned his medical surgeon degree from UNAM Medical School in 1960. In 1966, he completed his training in Infectiology at the University of Berkeley, CA, United States before returning to the Infectious Disease Department. During Dr. Flores's tenure, research was conducted on amebic hepatic abscesses, rabies, tetanus, meningitis, and exanthematous diseases. He served as the President of the Mexican Association of Infectiology, published 48 specialty articles, and, along with Dr. Francisco Higuera Ballesteros, Dr. Jesús Kumate Rodríguez, Dr. Ernesto Calderón Jaimes, and Dr. Miguel Ángel Peredo López Velarde, founded and initiated the work of the Mexican Certification Council in Infectiology^{2,7,9}.

In 1982, the Infectious Diseases Unit was entrusted to Dr. Francisco José Higuera Ramírez who continued the activities devoted to the management of patients, teaching, and research. Starting in 1987, a University Residency in Infectiology was initiated. In 1987, Dr. José Kuthy Porter—director of the hospital—changed the name from Infectious Diseases Unit to Infectious Diseases Department in full compliance with the existing regulations at the time.

Under the helm of Dr. Higuera Ramírez until 1995, the Infectious Diseases Department established an infectious disease intensive care unit (1980), a septic operating room (1985), a radiology unit, and a microbiological and clinical lab.

Dr. Francisco José Higuera Ramírez was born in Mexico City in 1945. He pursued his medical career at UNAM School of Medicine and specialized in internal medicine at the Mexican Social Security Institute. He also earned a master's degree in medical sciences from UNAM. His research focused on tuberculous meningitis, immunosuppression, tetanus, and the beneficial effects of IV emetine. He conducted studies on glycated hemoglobin and on the various clinical uses of antimicrobial drugs.

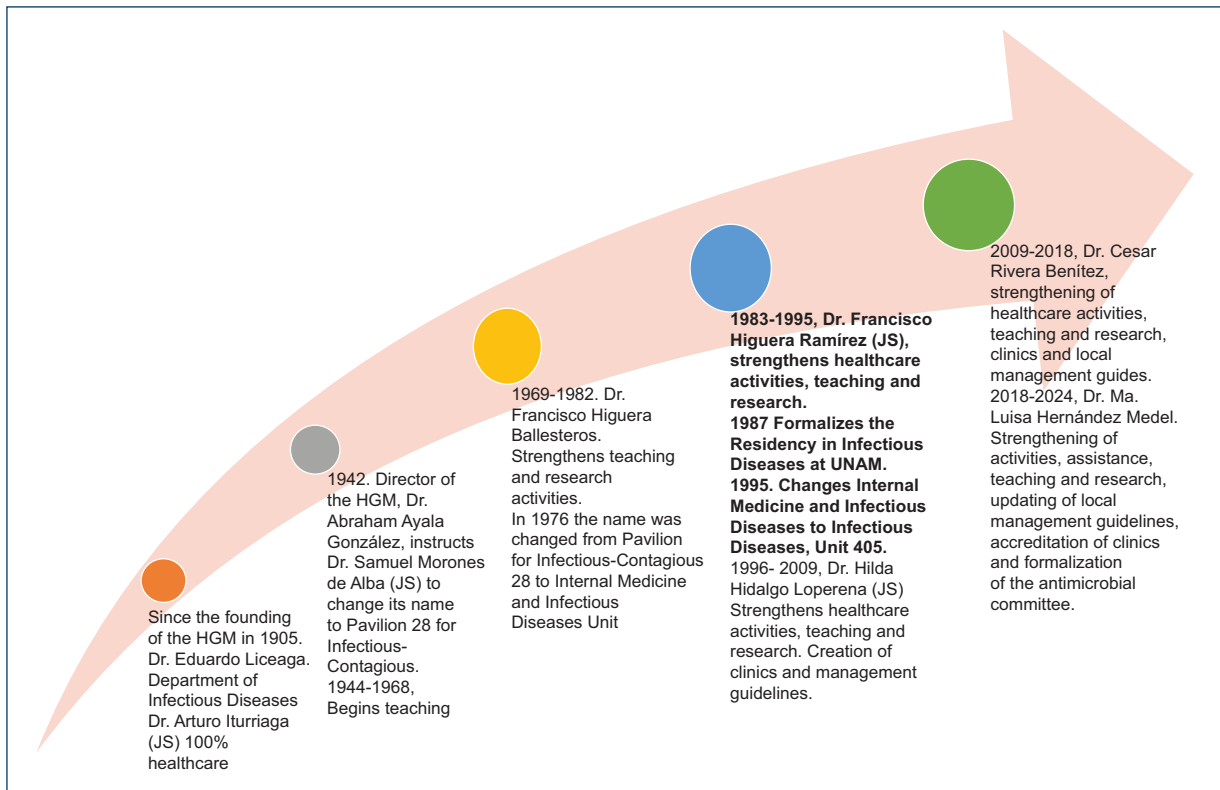


Figure 3. History of the infectious diseases service.

We should mention that as a routine practice since the hospital inception until the 1950s, all patients entering the infectious disease wards would have their heads shaved, body bathed, and their clothing incinerated (delousing for typhus prevention). This practice eventually became occasional until the 1980s when they would be shaved occasionally.

In 1995, Dr. Hilda Hidalgo Loperena took over the Infectious Diseases Department, where she oversaw various activities including patient care, teaching, and research. She reorganized the department, including the outpatient services, inpatient care, Intensive Medical Therapy, Respiratory Therapy, Isolation Units, Surgery, Radiology, Education, and Research. This included in-hospital consultations, the management of nosocomial infections, high-value biological antimicrobials, clinics for conditions such as acquired immunodeficiency syndrome (AIDS) and hepatitis, catheter applications, diabetic foot care, and soft-tissue management. The department also treated transplants cases, emerging diseases, and epidemic outbreaks.

Dr. Hilda Hidalgo Loperena was born in Mexico City in 1947. She completed her training at the Medical School

and graduated as a medical surgeon with honors in 1972. She later specialized in internal medicine at the IMSS and pursued training on infectious diseases at the MD Anderson Cancer Center at the University of Texas and the University of California, Sacramento, CA, United States.

In 2009, Dr. César Rivera Benítez was appointed Head of the Infectious Diseases Department, a position he held until early 2018.^{2,7} Dr. Rivera was born in Mexico City in 1950. He earned his degree from UNAM Medical School in 1975 and completed his internal medicine specialization at Hospital General de México. During his tenure, Dr. Rivera established specialized clinics for the management of hepatitis and human immunodeficiency virus/AIDS, implemented the SALVAR program for patients with AIDS, and restructured the infectious diseases specialization program.

In February 2018, Dr. María Luisa Hernández Medel took over the role of Head of the Infectious Diseases Department. She started her leadership with various actions aimed at creating a positive working environment and maintaining the continuity of the programs that were already running. We should mention that during her tenure, the department treated patients during the COVID-19 pandemic.

Dr. Hernández was born in Pinotepa Nacional, Oaxaca, in 1966. She graduated from the Medical School at the University of Morelos, Toluca, México. She completed her specialization in internal medicine and infectious diseases at Hospital General de México and earned her master's degree in Health Sciences at the National Polytechnic Institute (Fig. 3).

At present, the Infectious Diseases Department is housed on one floor for clinical work, with an additional area on the first floor dedicated to the offices of the medical staff. In the early 1960s, the department underwent renovations that ended in 1963, featuring 72 beds. Toward the end of the 20th century, under the leadership of Dr. Hidalgo and being the hospital directed by Dr. Higuera Ramírez, a remodeling project reduced the size of the Infectious Diseases Department, resulting in 30 inpatient bed, two outpatient consultation cubicles, one intensive care unit, one operating room, and an area for resident physicians.

Conclusion

Over the course of 118 years, Hospital General, along with the country itself, has evolved, much like Medicine and Infectology. The service, with its medical staff, has excelled in academics, providing care to countless individuals, educating numerous generations of doctors and specialists, and conducting extensive research with numerous publications, book chapters, and books being published. All these achievements have elevated the Infectology department at Hospital General to a prominent position in Mexican medicine. Our center has transitioned from dealing with major infectious epidemics to the epidemiological transition, where chronic and degenerative diseases are becoming increasingly prominent. Infectology today and in the future must remain vigilant trying to understand and manage the infections of the past, always with the potential of resurfacing today. It must also be prepared to address diseases associated with immunosuppression and those due to chronic and degenerative conditions. This includes remaining vigilant about emerging infectious diseases and vector-borne illnesses, which currently pose significant morbidity and mortality issues. We must also be prepared for the imminent problem of bacterial resistance and nosocomial infections, along with present epidemic outbreaks such as the H1N1 influenza virus of 2009 and the COVID-19 pandemic

(beginning of 2020). The Infectology Service at Hospital General de México has responded effectively to these recent major infectious challenges from typhoid to COVID-19^{2,4,6,10,11}.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

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

Data confidentiality. The authors declare that no patient data appears in this article.

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

References

- García GM, Vela RN. Los primeros médicos que laboraron en el hospital general de México 1905-1931. *Visión*. 2014;9:5-149.
- Díaz de Kuri M, Treviño CV. Historia del Hospital General de México 1905-2010. México: Creatividad y Diseño, S.A. de C.V.; 2010.
- Baeza-Bacab MA. El doctor Eduardo Liceaga, pediatra. *Gac Med Mex*. 2018;154:398-408.
- Fajardo G, León-Portilla M, Martín-Abreu L, Martínez M, Vela RN, Palencia JS. Centenario del Hospital General. Historia de la Medicina Mexicana. Barcelona, España: Lunwerg Editores; 2004.
- Fajardo OG. La academia nacional de medicina en el México posrevolucionario: 1917-1946. In: Treviño CV, Fajardo OG, García PE, Lifshitz GA, Martínez BX, Martínez CF, et al. La Academia Nacional de Medicina de México, 150 Años de Actividad Ininterrumpida. Colección Aniversario. México: Intersistemas S.A. De C.V.; 2014. p. 105-22.
- Treviño CV. La academia durante el porfiriato y la revolución. In: Treviño CV, Fajardo OG, García PE, Lifshitz GA, Martínez BX, Martínez CF, et al. La Academia Nacional de Medicina de México, 150 Años de Actividad Ininterrumpida. Colección Aniversario. México: Intersistemas S.A. De C.V.; 2014. p. 77-104.
- Sánchez-Rosales G. El Hospital general de México: una historia iconográfica. *Bol Mex Hist Filos Med*. 2002;5:16-24.
- Méndez D. Samuel morones alba. In memoriam. *Gac Med Mex*. 1968;98:1480-1.
- Peredo LV. XXVII aniversario de la fundación de la AMIMC semblanza histórica de la asociación Mexicana de infectología y microbiología clínica (AMIMC). *Enferm Infect Microbiol*. 2000;20:223-30.
- Villalobos JA, Gómez JL, de León Rosales SP. La epidemia de influenza A/H1N1 en México. México. Médica Panamericana; 2010.
- Romero-Cabello R, Medel ML, Martínez-Jiménez SN, Zavala-Pineda M. Infection in history by an infinitely small being. *Rev Med Hosp Gen Mex*. 2020;83:97-9.

Total lap. hysterectomy with prior bilateral kidney transplant. Experience in Hospital General de México

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Abstract

Uterine myomatosis is the main cause of abnormal uterine bleeding in women. The diagnosis approach is a challenge to the gynecologist; they must provide the ideal treatment to improve the quality of life of the patient. Laparoscopic hysterectomy is emerging as one of the elected procedures for such pathology. In previous renal transplants, it has been reported that minimal invasion is a useful alternative as opposed to a surgical approach when it comes to uterine pathology; however, there are very few cases reported in the literature with a bilateral renal transplant.

Keywords: Hysterectomy. Laparoscopic surgery. Kidney transplantation. Uterine fibroids.

Introduction

Total laparoscopic hysterectomy

Surgical procedures, which include total hysterectomy as management for benign and malignant pathology of the uterus and adnexa, are abdominal and vaginal approaches. The vaginal approach compared to the abdominal approach has better results in terms of invasion; however, it is limited by the size of the tumor as well as vaginal elasticity and the patient's surgical history¹. In some reviews, the procedure is found as laparoscopic-assisted vaginal hysterectomy, where important steps of the hysterectomy are performed laparoscopically, mainly vascular ligations on superior pedicles. To reduce the incidence of urinary tract injuries, bladder retraction is proposed as well as vaginal ligation of the uterine arteries and cardinal ligaments, leaving only the laparoscopic approach to verify the integrity of the abdominal structures and hemostasis².

The implementation of the laparoscopic approach (minimally invasive surgery) has increased in recent years along with the indications for its application³. The benefits of minimally invasive surgery are reflected in shorter surgical time, less bleeding, lower rate of postoperative infections, and decreased hospital stay and convalescence⁴.

The challenges and limitations of minimally invasive surgery for benign pathology lie mainly in the training of gynecologists in this tool, as well as in the limited availability of the procedure at all levels of care. Even with this, the increase in the use of minimally invasive surgery in procedures such as hysterectomy, even in malignant pathologies of the uterus and adnexa, is notable in the past 20 years, revolutionizing gynecological surgery⁴.

Here, we present the case of a patient with benign gynecological pathology, with multiple comorbidities, highlighting the history of a double kidney transplant, as well as previous peritoneal dialysis on multiple occasions; this represented a challenge in the surgical approach for the

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gynecology service. Together with the patient, we opted for the minimally invasive approach, despite expecting the presence of multiple abdominal adhesions. It is vitally important to highlight the participation of the transplant service of this hospital unit since in this way we ensure the integrity of both kidney grafts and their valuable support in the surgical approach. It is important to mention that trans- and post-surgical surveillance by the anesthesiology and intensive care service set the tone to ensure that renal function was preserved, corroborated at discharge and in outpatient surveillance by nitrogen levels and urinary index.

Despite the therapeutic success in this case, we do not have a wide range of cases to issue recommendations regarding the management of this type of patient, but we highlight multidisciplinary management, which undoubtedly improved the result.

Case report

A 45-year-old patient presents with systemic arterial hypertension for 1 year, Type 2 diabetes mellitus for 2 years, both under treatment, and Hepatitis C due to transfusion without treatment or follow-up since 2013. She underwent a double kidney transplant secondary to congenital renal hypoplasia and first implant dysfunction (1996, 2011) in this hospital, under management with immunomodular drugs, with adequate function at the time of the protocol (Fig. 1). The patient presented uterine artery embolization in 2018 and had multiple transfusions (last on 05/29/21) due to anemic syndrome.

The patient began her current condition 2 years before the surgical protocol with abnormal uterine bleeding characterized by an increase in the amount and duration of bleeding (approximately 400-600 ml of bleeding per day) as well as occasional intermenstrual bleeding, with abundant clots, despite multiple pharmacological treatments with NSAIDs, antifibrinolytics and combined oral contraceptives for 1 year; in addition to placement of a levonorgestrel-releasing intrauterine device in January 2021, expelled 1 month later without symptom control. The patient was hospitalized in May 2021 for anemic syndrome due to uterine myomatosis of small and medium-sized FIGO 2-4 elements. For this reason, total laparoscopic hysterectomy is performed.

Extensive adhesiolysis was performed with meticulous hemostasis, releasing them, revealing a uterus measuring 12 × 8 × 5 cm, with irregular edges due to multiple fibroids, both ovaries measuring 2 × 2 cm, and

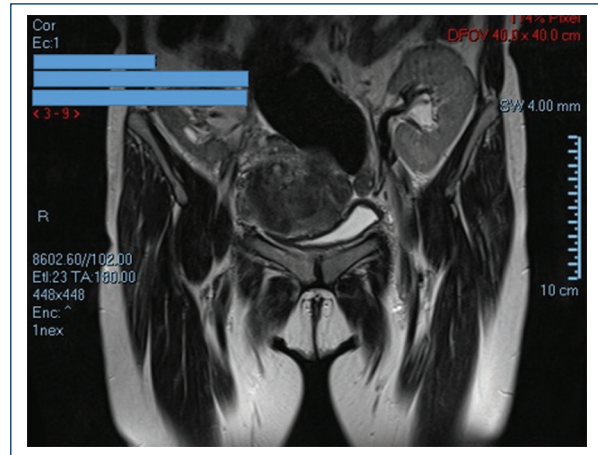


Figure 1. Abdominal magnetic resonance imaging with evidence of two kidney grafts in the pelvic location.

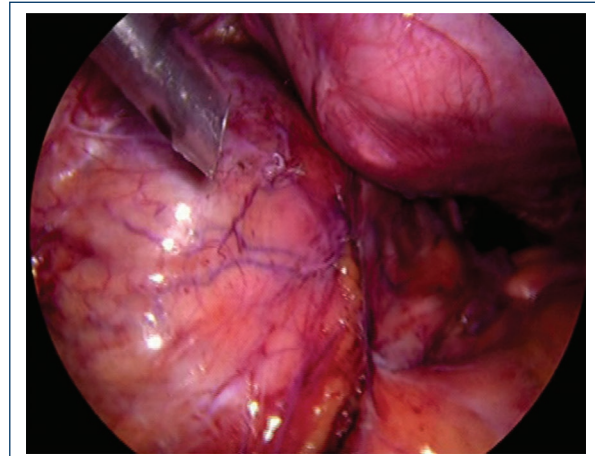


Figure 2. Left kidney graft in relation to the uterus and left annex.

salpinges without macroscopic alterations (Fig. 2). Hysterectomy with bilateral salpingectomy was performed without complications, the specimen was extracted vaginally, total closure of the dome was performed (Fig. 3), and subsequently, cystoscopy was performed showing urine ejection through both ureters, with which we terminated the procedure with a total bleeding of 150 ml. During the procedure, the transplant service verifies the integrity of the kidney grafts as well as the ureteral tract, without identifying any alterations.

Subsequently, during surveillance in the recovery area, the patient presented a decrease in the urinary index, so it was decided to admit her to the intensive care unit, where she remained under surveillance for

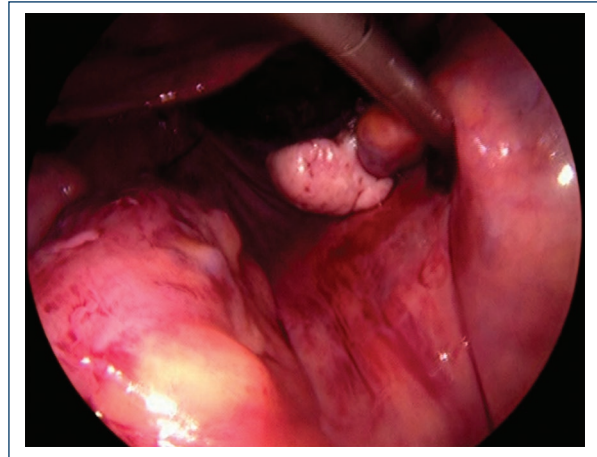


Figure 3. Closed vaginal dome with preservation of adnexa.

24 h with discharge due to improvement in condition after replacement of fluids and volume expanders. She was discharged with total laparoscopic hysterectomy and bilateral salpingectomy secondary to uterine myomatosis and adhesiolysis chronic kidney disease KDIGO II, kidney transplant secondary to renal hypoplasia (1996) and renal implant dysfunction (2011), systemic arterial hypertension under treatment, Type 2 diabetes mellitus in treatment and post-transfusion Hepatitis C infection (2013) without treatment.

The patient presented an adequate evolution and gynecological examination without alterations. The histopathology report indicates predominantly intramural and submucosal myoma measuring 8x8 cm.

Conclusions

Only one case has been reported of a patient with the same characteristics with a satisfactory evolution and discharge after the surgical event, so the report of this case is very important to, in this way, share our experience and work for the management of patients with these types of comorbidities⁵.

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Ethical disclosures

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

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

References

1. Walker JL, Piedmonte MR, Spirtos NM, Eisenkop SM, Schlaerth JB, Mannel RS, et al. Laparoscopy compared with laparotomy for comprehensive surgical staging of uterine cancer: Gynecologic Oncology Group Study LAP2. *J Clin Oncol*. 2009;Nov 10;27(32):5331-6.
2. Drahonovsky J, Haakova L, Otcenasek M, Krofta L, Kucera E, Feyereisl J. A prospective randomized comparison of vaginal hysterectomy, laparoscopically assisted vaginal hysterectomy, and total laparoscopic hysterectomy in women with benign uterine disease. *Eur J Obstet Gynecol Reprod Biol*. 2010;148(24):172-6.
3. Wattiez A, Cohen SB, Selvaggi L. Laparoscopic hysterectomy. *Curr Opin Obstet Gynecol*. 2002;14(5):417-22.
4. Levy L, Tsaltas J. Recent advances in benign gynecological laparoscopic surgery. *Fac Rev*. 2021;26(50):10:60.
5. Tamhane N, Al Sawah E, Mikhail E. Total laparoscopic hysterectomy in the setting of prior bilateral renal transplant, a case report and review of the literature. *Surg Technol Int*. 2018;32(4):139-143.

Aspergillus otomastoiditis: a case report and review of the literature

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Abstract

Otomycosis is an infection in the external ear canal, which involves the inner ear. The genus *Aspergillus* is the most frequent causal agent, can present with otorrhea, otalgia, pruritus, and tinnitus and is more frequent in patients with predisposing factors such as immunocompromise or living in humid and/or warm climates. We present the case of a 61-year-old woman, a merchant, who was considered immune-competent on entry and had a history of storing brick and cement fragments in her home, in those who have been found to have fungal-induced otic and mastoid infection with adequate clinical response to treatment.

Keywords: Otomycosis. Aspergillosis. *Aspergillus*. Otitis. Voriconazole. Mycosis.

Introduction

Otomycosis is an infection in the external ear canal and the inner ear. It can occur *de novo* in a patient with predisposing factors or appear as a complication of the use of broad-spectrum antibiotics. This is caused by different types of fungi, mainly *Candida* and *Aspergillus*, highlighting the species *Aspergillus niger* (the most common in this condition), *Aspergillus alliaceus*, *Aspergillus candidus*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus terreus*, and *Aspergillus versicolor*¹. A rare and potentially fatal complication is otomastoiditis².

This disease can present clinically with otorrhea, otalgia, pruritus, and tinnitus and is more common in patients with predisposing factors such as immunocompromise, living in tropical or subtropical climates, insulin resistance and a history of storing brick and cement fragments in the home; important data to support the suspicion of the final diagnosis³.

Case report

A 61-year-old woman, resident of Mexico City, presented with left otalgia of 7 days of evolution, of insidious onset, associated with fetid seropurulent otorrhea and progressive hearing loss. Her personal history included prediabetes, systemic arterial hypertension, previous hospitalization for hypokalemic paralysis, storage of brick, and cement fragments in her home. On physical examination, bone fragments were observed in the left external auditory canal, foul-smelling purulent discharge, and loss of integrity of the tympanic membrane. Plain and contrast-enhanced computed tomography of the skull showed left mastoid destruction, with no evidence of neuroinfection (Fig. 1).

A left mastoidectomy with tissue debridement was performed. The histopathological study reported fungal structures compatible with *Aspergillus* spp. (Fig. 2), later identified as *Aspergillus terreus* by

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Figure 1. Cranial CT in contrast-enhanced phase, axial section: loss of pneumatization of the left mastoid cells associated with bone destruction is observed.

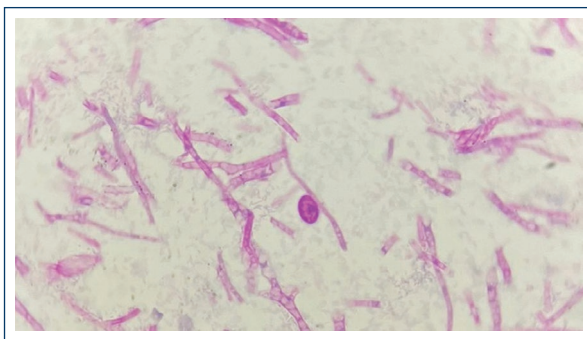


Figure 2. Periodic acid-Schiff stain in mastoid bone biopsy sample: hyaline, septate, thin-walled hyphae are observed, with dichotomous branches at 45 degrees.

genetic sequencing. Treatment with oral voriconazole was started for 6 weeks, with adequate clinical and imaging response, without subsequent neurological alterations, and with complete resolution of the condition.

Discussion

A case was presented with the diagnosis of *Aspergillus* otomastoiditis confirmed by histopathological report and genetic sequencing. This was treated satisfactorily with a medical and surgical approach, with favorable evolution. The diagnosis requires a high level of suspicion according to risk factors and epidemiological context since the prognosis worsens exponentially when these are delayed and the initial clinical course

can be insidious. In the case presented here, timely detection prevented additional complications.

The diagnosis can be made by identifying hyphae in a debridement sample of the lesions. During the approach, soft-tissue involvement, bone destruction, or intracranial extension must be evaluated. Skull tomography with simple and contrasted phases is the best study to evaluate bone tissue and data of possible infection in the central nervous system; among the findings, bone erosion, decreased density of the skull base, abscesses, and mastoid involvement should be looked for. To assess whether there is intracranial extension, magnetic resonance imaging is more appropriate. The definitive laboratory diagnosis is by mycological culture, direct microscopy, or histopathology with samples taken directly from the external auditory canal and secretions. In the case presented, the diagnosis could be established by histopathological study of a sample taken directly from the mastoid bone^{3,4}.

One of the most feared, but rarest complications of otomycosis is otomastoiditis, described in a small series of cases⁵, where the prolonged use of antibiotics and topical steroids is common. Fungal disease of the temporal bone has been classified into three types: type 1 or non-invasive, Type 2 or with bone invasion (especially in immunocompetent patients), and Type 3 or fulminant angio-invasive (more common in immunosuppressed patients)⁶; The case presented here corresponds to Type 2.

There is no consensus on the most effective agent for the treatment of otomycosis; there are a few publications on its treatment with topical antifungals. It is important to note that some of these studies do not report clinical or mycological details cure rates, or routes of administration. However, everyone agrees on the importance of local mechanical debridement of visible fungal elements and the use of topical or systemic antifungals. Systemic antifungals are reserved for fungal cases of mastoiditis or cerebral extension⁷.

For extrapulmonary forms of aspergillosis, the first treatment option is triazoles, among which the preferred is voriconazole, or alternatively, posaconazole or isavuconazole. If it is not available, or if the patient is intolerant or refractory to such treatments, Amphotericin B is considered the next therapeutic option⁸. New antifungals are in development, such as fosmanogepix, ibrexafungerp, olorofim, and rezafungin, which could be good therapeutic options in the near future⁹.

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Ethical disclosures

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

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References

1. Opperman CJ, Copelyn J. *Aspergillus niger* otomycosis in a child with chronic otitis externa. S Afr J Infect Dis. 2020 Jun 25;35(1):1281.
2. Kirschner R, Sun PL, Huang SL, Chen CL, Yang CP. A case of bilateral otomycosis associated with *Aspergillus flavus* and *A. terreus* in Taiwan. J Mycol Med. 2017 Sep;27(3):412-416.
3. Zhang L, Wang X, Houbraken J, Mei H, Liao W, Hasimu H, et al. Molecular identification and *in vitro* antifungal susceptibility of *Aspergillus* isolates recovered from otomycosis patients in Western China. Mycopathologia. 2020 Jun;185(3):527-535.
4. Vennwald I, Klemm E. Otomycosis: diagnosis and treatment. Clin Dermatol. 2010 Mar 4;28(2):202-11.
5. Varghese R, Nair RM, Kavalakkat FJ. Fungal otomastoiditis: a case series in immunocompetent adults. Indian J Otolaryngol Head Neck Surg. 2014 Jan;66(1):110-3.
6. Hall PJ, Farrior JB. *Aspergillus mastoiditis*. Otolaryngol Head Neck Surg. 1993 Feb;108(2):167-70.
7. Kiakojori K, Bagherpour Jamnani N, Khafri S, Mahdavi Omran S. Assessment of response to treatment in patients with otomycosis. Iran J Otorhinolaryngol. 2018 Jan;30(96):41-47.
8. Patterson TF, Thompson GR, Denning DW, Fishman JA, Hadley S, Herbrecht R, et al. Practice guidelines for the diagnosis and management of aspergillosis: 2016 Update by the infectious diseases society of America. Clin Infect Dis. 2016 Aug 15;63(4):e1-e60.
9. Koehler P, Bassetti M, Chakrabarti A, Chen SCA, Colombo AL, Hoenigl M, et al. Defining and managing COVID-19-associated pulmonary aspergillosis: the 2020 ECMM/ISHAM consensus criteria for research and clinical guidance. Lancet Infect Dis. 2021 Jun;21(6):e149-e162.

Recurrent laryngeal nerve palsy after left-sided supraclavicular ultrasound-guided perivascular brachial plexus block. A unique case

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Abstract

Supraclavicular brachial plexus nerve block is ideal for surgical procedures of the upper limb. Ultrasound guidance continues to grow in popularity as a method of nerve localization, significantly improves the quality of nerve block with a lesser number of complications, it has the advantage of allowing real-time visualization of the plexus, pleura, and vessels along with the needle and local anesthetic spread, although complications cannot be eliminated completely. Ipsilateral recurrent laryngeal nerve (RLN) palsy is a rare complication associated with supraclavicular approach. The incidence of the RLN block occurring with supraclavicular approach is 1.3% of patients, but incidence of block with ultrasound-guided supraclavicular block is not known. There are two cases reported in the world literature, in Mexico there is no evidence in this regard. We discuss the first case report in Mexico and the third in the world of this rare complication which occurred while performing a left supraclavicular perivascular block performed under ultrasound guidance.

Keywords: Left recurrent laryngeal nerve palsy. Left supraclavicular brachial plexus block. Ultrasound guidance.

Introduction

Described as the “spinal of the arm,” a supraclavicular brachial plexus nerve block (SCB) is performed at the level of plexus trunks formed by C5-T1 nerve roots, where almost the entire sensory, motor, and sympathetic innervations of the upper extremity are carried in just three nerve structures confined to a very small surface area, it is ideal for upper limb surgical procedures¹. Intravascular injection, pneumothorax, hemidiaphragmatic paresis, cervical sympathetic block, and nerve injury are the common complications with this approach. Recurrent laryngeal nerve (RLN) palsy is a rare complication associated with this approach (1.3% incidence)². Ultrasound (USG) guidance helps in performing nerve blocks with accuracy and has reduced the rates of complications.

However, experience and acquaintance with the anatomy is highly required. RLN block and hoarseness of voice is a rare complication of this block and has been reported in case of right-sided block³. There are two cases reported in the world literature, the first case of left RLN palsy using USG for SCB plexus nerve block was reported by Naaz et al.⁴, and the second by Lakhe et al.⁵. We discuss the first case report in Mexico and the third in the world of this rare complication which occurred while performing a left supraclavicular perivascular block performed under USG guidance.

Clinical case

A 49-year-old male patient with American Society of Anesthesiologists (ASA) Grade III had to undergo corrective

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surgery for a left radioulnar fracture (open reduction with internal fixation). Pre-operative investigations were found within normal limit. We planned to conduct the case under SCB plexus block supplemented with sedation. After explaining the procedure and taking consent he was taken inside the operation room. The standard ASA monitors were attached and baseline parameters were recorded. Taking all aseptic precautions, supraclavicular block was performed under USG guidance using high-frequency convex transducer just above the clavicle at approximately its midpoint. By in-plane technique, a 50-mm, 22-G needle was passed posterolateral to the brachial plexus in a lateral-to-medial direction. Being convinced with the location of needle, 20 mL of 0.75% ropivacaine plain and 10 mL of 1% lidocaine with epinephrine were instilled after repeated negative aspiration. The block was effective and the patient's left upper limb was anesthetized. Within 5 min, he also complained of difficulty in speech and there was hoarseness in his voice which was not there before. In next 15 min, hoarseness and cough became more severe. The patient became very anxious because of this. He had no other problems like breathlessness or drop in oxygen saturation. His hemodynamic parameters were unaltered and there were no electrocardiogram changes. As the patient became very anxious, we decided to sedate and ventilate him. A gentle laryngoscopy was done under sedation (propofol 50 milligrams, fentanyl 100 micrograms), as RLN involvement was suspected. On laryngoscopy, the left vocal cord was found immobile and abducted. Oxygen supplementation was continued (facial mask) and maintenance with sevoflurane. Surgery was started. The symptoms did not worsen, and vitals remained stable. Vigilant monitoring was continued. After the surgery, the patient was assessed and definitive finding of hoarseness of voice was confirmed with no difficulty in breathing. The patient was shifted to post-anesthesia care unit for observation. Oxygen supplementation was continued. The patient was observed for next 2 h before shifting to the floor. Her voice recovered completely after approximately 48 h.

Discussion

The SCB also referred to as “spinal of the arm” is popular for surgeries of the upper limb. USG has gained popularity in regional anesthesia as it is safe, reliable, and precise⁶. The sensitivity of ultrasound to guide administration of local anesthetic (LA) is ranged from 85% to 92%, and the specificity around 90% to 95%⁷. In developing countries like Mexico, due to the unavailability of resource, we continue to rely on the blind surface

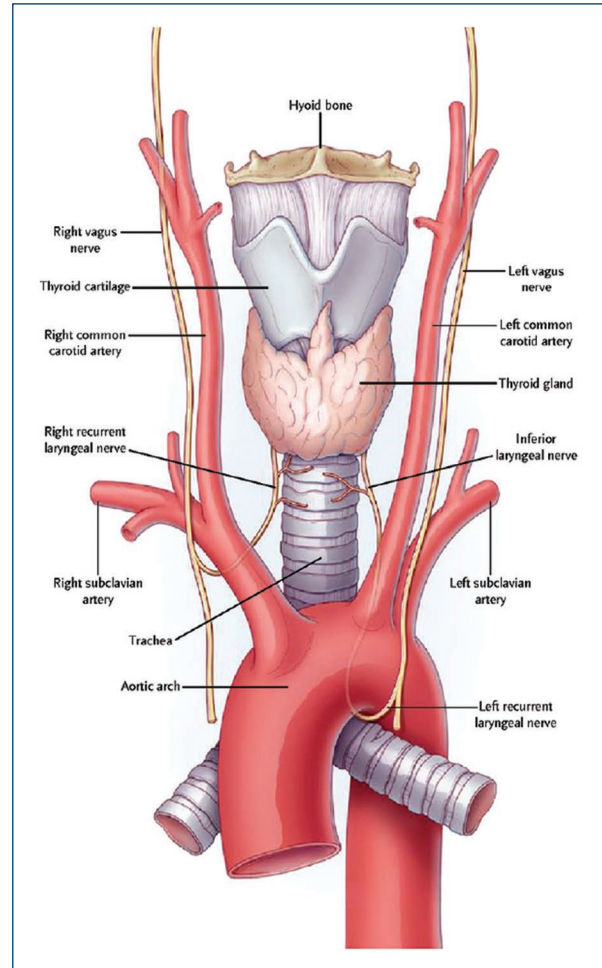


Figure 1. Anatomical relationship of recurrent laryngeal nerve right and left. Downloaded from nejm.org.

landmark technique. The most feared complication of this technique is pneumothorax with a prevalence of 0.5-6%⁸. With an ultrasound-guided supraclavicular approach, the risk of pneumothorax is significantly reduced. However, nerve injury and vascular puncture are possible with all approaches. It is true that the risk of pneumothorax has decreased dramatically, but it has not been eliminated. When a supraclavicular block is performed, a phrenic nerve block can occur at a rate of up to 60% depending on the technique and the volume of LA used. The supraclavicular approach is contraindicated in patients at risk of contralateral phrenic nerve damage or with severe lung disease. In the supraclavicular approach, the needle must always be well-visualized because the injection site is close to the pleura. This technique requires strong ultrasound experience⁹. The incidence of complications related to peripheral nerve blocks is reported to be low, approximately 3%

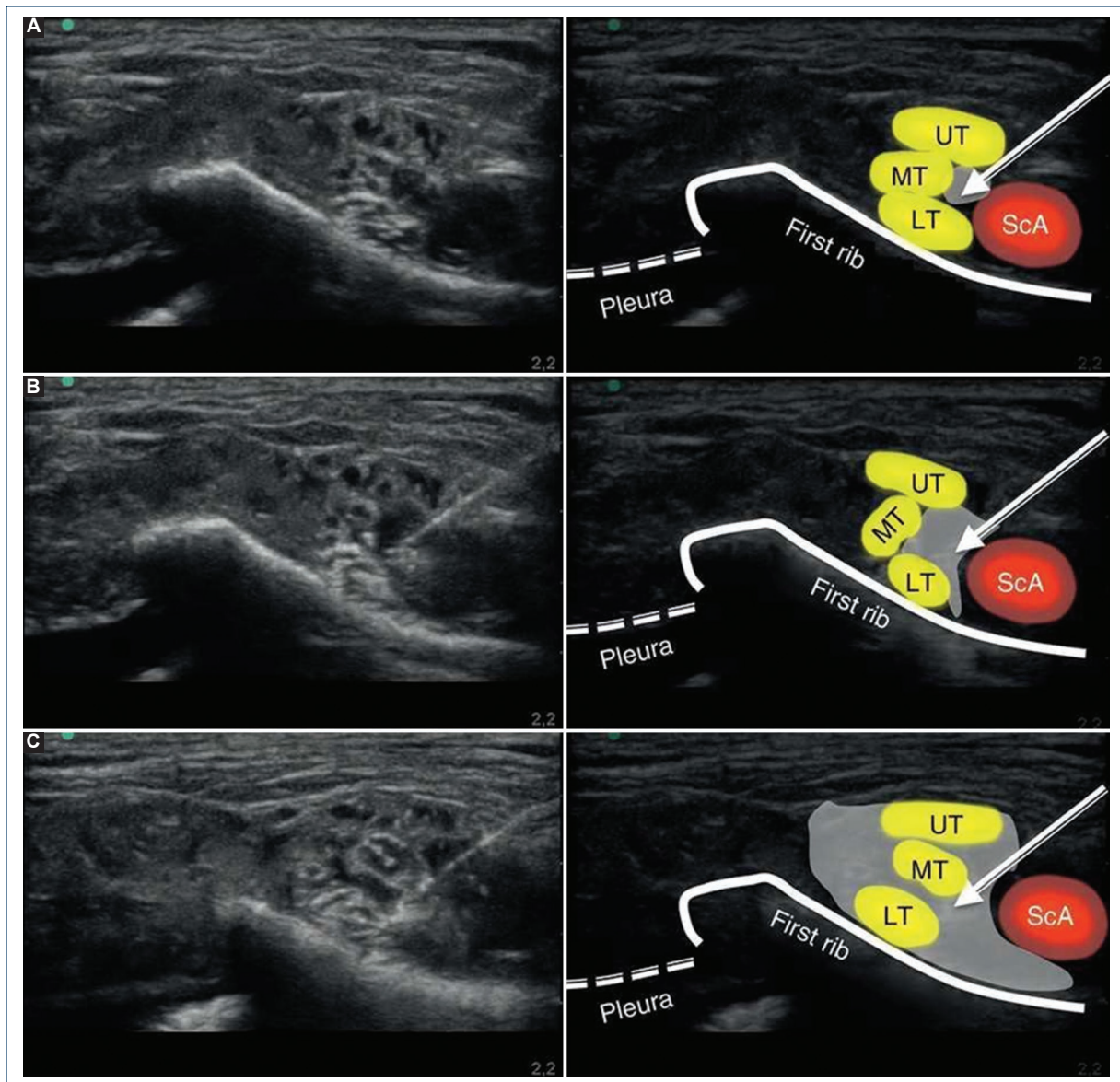


Figure 2. Ultrasound image captured during the administration of the supraclavicular block using a medial approach on the anatomic specimen. **A:** position of the needle at the injection site. **B:** ultrasound image during the 10 ml injection. **C:** ultrasound image after completing the 20 ml injection.

ScA: subclavian artery; UT: upper trunk; MT: middle trunk; LT: lower trunk. The arrow points toward the position of the neurostimulation needle. The gray shade shows the distribution of the volume injected at the injection site evaluated with ultrasound. From Herrera AE. et al 2017¹⁰.

within 4-6 weeks after surgery, approximately 2-4/10,000 within 1 year. In addition, recent reports suggest that most neurological complications detected postoperatively may be related to surgery, rather than regional anesthesia, and that many regional anesthesia-related neurological injuries tend to be reversible. However, our patient had permanent neurologic injury associated with a SCB plexus block, suggesting that developments in peripheral nerve blocks such as ultrasound and improvements

have not completely eliminated the possibility of serious complications¹¹. Safety is closely related to a range of professional competencies, including operator knowledge, attitudes, and skill. A key skill includes keeping the needle in the plane of the ultrasound beam and identifying important structures such as the first rib, pleura, and blood vessels¹².

Although rare, RLN palsy has been documented in 1.3% of cases of classical SCB¹³. It has mostly been

reported in the right-sided block which is well explained by its relationship with the right subclavian artery (SCA). The right and left RLNs follow different courses¹⁴ (Fig. 1). The right RLN encircles the right SCA and is in its close proximity. Hence, there are chances of its involvement in rare cases when a large amount of LA is deposited near the artery where the RLN is located. Hence, when the drug is deposited near SCA, there remains the possibility of involvement of RLN due to close proximity of the neurovascular structure, and more so when a large volume of the drug has been deposited¹⁵. However, the left RLN is much medial in relation to the left SCA running closer to trachea and esophagus. It is the left vagus nerve which runs near the SCA. The mechanism by which the nerve block occurred in our case was the exclusive block of the fibers of RLN present in the vagus nerve or unilateral vagus nerve as the drug deposited moved medial to the SCA and since the RLN is located farther. Visualization of the tip of the needle throughout the procedure is of utmost importance as this prevents the puncture of unwanted structures preventing complications and increases the chances of success of the procedure by deposition of LA at exact location¹⁶⁻¹⁸ (Fig. 2). The fascial sheath surrounding the brachial plexus is a determinant for the spread of LA. The sheath is a derivative of the deep cervical fascia and terminates by merging with the medial intermuscular septum of the arm. The LA injected spreads up and down the nerves in a longitudinal manner and circumferential spread are limited by the fascial sheath. When the large volume of LA is injected, there is a possibility of proximal spread of excessive drug involving RLN and attributing the hoarseness of voice¹⁹. As it happened with our patient the volume of the drug used might have been an additional contributing factor for the excessive spread. There is a remote possibility of aberrant left RLN (incident 0.04%) when it is known as non-recurrent inferior laryngeal nerve, it runs closer to the SCA and is always associated with aberrant vessels such as arteria lusoria, right aortic arch, and situs inversus²⁰. Cases have been reported of respiratory obstruction as a result of unilateral SCB plexus block. In our case, it was self-limited; it only caused a feeling of discomfort in the patient. For similar reason, interscalene brachial plexus block should be avoided^{21,22}. Various techniques have been described to limit the spread of injected LA into the brachial plexus²³. These include the use of tourniquet position of the arm, use of massage of the area for around 5-10 min, multiple injection techniques, digital pressure proven by Gupta et al.⁸, and elevated the

head end of the bed by 30°. Based on the radiological evidence, digital pressure has been touted as an effective method to halt progression of LA into areas of the brachial or cervical plexus during brachial plexus block²⁴.

The mechanism by which the nerve block occurred in our case was the exclusive block of the fibers of RLN present in the vagus nerve or unilateral vagus nerve as the drug deposited moved medial to the SCA and since the RLN is located farther. This case can be explained as a case of block of medial fibers of vagus nerve, that is, fibers of left RLN present in vagus nerve or unilateral vagus nerve block. In our patient, digital pressure was not applied after SCB as we were using USG-guided technique. We propose that digital pressure would have prevented the excessive spread proximally which would have prevented the involvement of RLN.

Conclusion

The left RLN palsy is a unique complication of the supraclavicular block. It is temporary and self-limiting most of the time but it is distressing for the patient for being unable to phonate. When performing nerve blocks, care should be taken to inject lesser dose of LA because these days nerve blocks are performed using ultrasound and the location where the drug is deposited is more accurate. The tip of the needle should be visualized right from introduction till the whole of the drug is injected so that drugs may not be deposited elsewhere and chances of complications are minimized. Specific training strategies are recommended, including techniques to optimize needle visualization. The digital pressure, the elevation of the head end of the bed 30°, using a lower volume of drugs and use of USG might mitigate the complication. The basic rules of safe practice remain very important, training, anatomical knowledge, and meticulous technique, including slow injection of LA with regular syringe aspiration and maintenance of verbal contact with the patient.

Further studies are required to determine the incidence of the discomforting and extremely rare complication, this being the third case reported in the world literature and the first in Mexico.

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article. Furthermore, they have acknowledged and followed the recommendations as per the SAGER guidelines depending on the type and nature of the study.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript, nor for the creation of images, graphics, tables, or their corresponding captions.

References

1. La Grange P, Foster PA, Pretorius LK. Application of the Doppler ultrasound bloodflow detector in supraclavicular brachial plexus block. *Br J Anaesth.* 1978;50:965-7.
2. Neal JM. Upper extremity blocks. In: Rathmell JP, editor. *Regional Anesthesia: the Requisites in Anesthesiology.* 1st ed. Philadelphia, PA: Elsevier Mosby; 2004. p. 59-72.
3. Finucane BT, Tsui BC. Complications of brachial plexus anesthesia. In: *complications of Regional Anesthesia.* New York: Springer; 2007. p. 121-48.
4. Naaz S, Asghar A, Jha NK, Ozair E. A unique case of hoarseness of voice following left supraclavicular brachial plexus block. *Saudi J Anaesth.* 2020;14:109-11.
5. Lakhe G, Poudel H, Pradhan S, Dhakal S. A unique case of hoarseness of voice following left sided supraclavicular block: a case report. *Nep J Med Sci.* 2020;5:39-41.
6. D'Souza RS, Johnson RL. Supraclavicular block. In: *statPearls.* Treasure Island, FL: StatPearls Publishing; 2022.
7. McCartney CJ, Dickinson V, Dubrowski A, Riaz S, McHardy P, Awad IT. Ultrasound provides a reliable test of local anesthetic spread. *Reg Anesth Pain Med.* 2010;35:361-3.
8. Raghoe P, Singh K, Taxak S, Ahlawat M, Hooda S. Comparison of ultrasound guided technique with conventional landmark technique for supraclavicular brachial plexus nerve block in patients undergoing upper limb surgery. *Int J Pharmacol Clin Sci.* 2016;5:1-4.
9. Nadeua MJ, Lévesque S, Dion N. Ultrasound-guided regional anesthesia for upper limb surgery. *Can J Anesth.* 2013;60:304-20.
10. Herrera AE, Mojica V, Nieuwveld D, Prats-Galino A, López AM. Ultrasound guided supraclavicular perivascular block. Anatomical, technical medial approach description and changes in regional perfusion. *Colomb J Anesthesiol.* 2017;45(4):272-9.
11. Reiss W, Kurapati S, Shariat A, Hadzic A. Nerve injury complicating ultrasound/electrostimulation-guided supraclavicular brachial plexus block. *Reg Anesth Pain Med.* 2010;35:400-1.
12. Abell DJ, Barrington MJ. Pneumothorax after ultrasound-guided supraclavicular block. *Reg Anesth Pain Med.* 2014;39:164-7.
13. Gupta M, Jain P, Bhalla S, Upadhyay N. Hoarseness of voice after supraclavicular ultrasound-guided subclavian perivascular brachial plexus block. *Indian Anaesth Forum.* 2017;18:86-8.
14. Andersen DK, Raphael EP, Billiar T, Dunn D, Hunter J, Matthews J. In: *Brunicaudi FC, editor. Schwartz's Principles of Surgery.* 9th ed. United States: McGraw Hill Professional; 2009.
15. Park HS, Kim HJ, Ro YJ, Yang HS, Koh WU. Delayed bilateral vocal cord paresis after a continuous interscalene brachial plexus block and endotracheal intubation: a lesson why we should use low concentrated local anesthetics for continuous blocks. *Medicine (Baltimore).* 2017;96:e6598.
16. Vade Boncouer TR, Weinberg GL, Oswald S, Angelov F. Early detection of intravascular injection during ultrasound-guided supraclavicular brachial plexus block. *Reg Anesth Pain Med.* 2008;33:278-9.
17. Loubert C, Williams SR, Hélie F, Arcand G. Complication during ultrasound-guided regional block: accidental intravascular injection of local anesthetic. *Anesthesiology.* 2008;108:759-60.
18. Schaffhalter-Zoppoth I, Zeitz ID, Gray AT. Inadvertent femoral nerve impalement and intraneural injection visualized by ultrasound. *Anesth Analg.* 2004;99:627-8.
19. Thompson GE, Rorie DK. Functional anatomy of the brachial plexus sheaths. *Anesthesiology.* 1983;59:117-22.
20. Kamath S, Rathnakar P, Shetty K. Nonrecurrent laryngeal nerve: rare entity. *NUJHS* 2012;2:42-4.
21. Rollins M, McKay WR, Eshima RE. Airway difficulty after subclavian perivascular block. *Anesth Analg.* 2003;96:1191-2.
22. Plit ML, Chhajed PN, MacDonald P, Cole IE, Harrison GA. Bilateral vocal cord palsy following interscalene brachial plexus block. *Anaesth Intensive Care.* 2002;30:499-501.
23. Winnie AP, Radonjic R, Akkineni SR, Durrani Z. Factors influencing distribution of local anesthetic injected into the brachial plexus sheath. *Anesth Analg.* 1979;58:225-34.
24. Urme WF, Grossi P, Sharrock NE, Stanton J, Gloeggler PJ. Digital pressure during interscalene block is clinically ineffective in preventing anesthetic spread to the cervical plexus. *Anesth Analg.* 1996;83:366-70.

Acute complicated diverticulitis treated by laparoscopy: case report and literature review

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Abstract

The term diverticular disease or diverticulosis is used to describe the presence of diverticula that do not exhibit inflammation or any other complications. Diverticular disease is a growing problem in developing countries mainly by changes in diet becoming more like industrialized countries. The management of diverticulitis has evolved in recent years toward more conservative strategies or minimally invasive techniques. This review focuses in minimally invasive management of perforated diverticulitis and purulent peritonitis. In appropriately selected and classified patients, this alternative reduces morbidity and mortality of laparotomy and allows management of complications.

Keywords: Laparoscopy. Diverticulitis. Peritonitis.

Introduction

Colonic diverticula are the most common structural abnormality of the intestine¹. Its prevalence has increased in relation to the greater longevity of the population and its detection. The spectrum of presentation is very varied, and treatment has evolved to more conservative strategies¹.

The presence of diverticula is directly related to age, with a prevalence of 5% in those under 40 years of age and increasing to 60% in those over 80 years of age. The risk of developing acute diverticulitis is 10 to 25% and one in five will present some type of complication such as abscess or obstruction. Less than 1%, only 1-2% of acute diverticulitis present as a free intestinal perforation. About 80% of patients with acute

diverticulitis are over 50 years of age and only 2-5% is under 40. The most common location is the sigmoid colon in up to 90% of cases².

Diverticula are small sacculations of mucosa that protrude through the muscular layer of the colon (pseudodiverticula), they occur due to genetic predisposition as well as environmental factors, mainly diets low in dietary fiber and chronic constipation, which consequently lead to increased intestinal pressure, mainly in the sigmoid colon, a phenomenon known as compartmentalization, which leads to the formation of pseudo-diverticula found more frequently in areas of weakness of the intestinal wall caused by the entry of circulation to the mucosa³.

The pathophysiology of diverticulitis is not yet fully understood, but it is postulated that the neck is the site

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of obstruction of the diverticulum by fecal matter, which induces ischemia of the mucosa and bacterial overgrowth, initiating an inflammatory process that can occur from microperforations that they produce a localized inflammatory process (phlegmon) until free fecal perforation into the cavity with the subsequent inflammatory response and sepsis¹.

Diverticular disease has a wide spectrum of clinical presentation from asymptomatic until one of its complications occurs; inflammation, bleeding, abscess, perforation, or obstruction. The classic presentation of diverticulitis is the triad of left lower quadrant pain associated with fever and leukocytosis. These findings occur together in a portion of patients diagnosed with computed tomography (CT)-confirmed acute diverticulitis depending on the setting, ranging from 47% in outpatients to 93% of those seen in the emergency department. Diverticular bleeding can occur in 30-50% of patients without involving inflammation of the diverticula. On examination, the rebound in CII with guard is the most guiding sign toward the diagnosis, being able to find masses in relation to the presence of abscesses or frank data of peritoneal irritation in case of perforation. If the patient presents data of systemic inflammatory response such as associated hypotension, tachycardia, dehydration or oliguria, an abdominal sepsis process originating from the acute diverticular process complicated with abscess, fistula or free perforation is evident⁴.

The spectrum of differential diagnoses includes gynecological conditions, urinary tract diseases, colon carcinoma, Chron, ischemic colitis, and acute appendicitis in cases in which the sigmoid is very redundant, among the most common².

The study of choice is computed axial tomography, which has come to replace contrast radiographic studies with a sensitivity of 95% and specificity of 100%. The presence of diverticula associated with fat stratification as well as thickening of the colon wall are the most frequently found findings in 70-100% of cases⁴. It also allows establishing the extension of the inflammatory process as well as identifying possible complications as well as ruling out other differential diagnoses.

The classification of diverticular disease encompasses a spectrum of presentations from pericolic inflammation to perforation and fecal peritonitis². Depending on clinical parameters such as laboratory and imaging, it is classified as complicated and uncomplicated. The most used classification for prognosis and treatment is the Hinchey classification, which classifies it into four stages⁴ (Table 1).

Table 1. Hinchey classification

1a	Pericolic phlegmon and inflammation, no fluid collection
1b	Pericolic abscess < 4 cm
2	Pelvic or inter-loop abscess or abscess > 4 cm
3	Purulent peritonitis
4	Feculent peritonitis

As with other classifications, there are modifications in which some of the stages are subdivided; IIa, and IIb depending on the size of the abscess. Mortality for stages II and III is less than 5%, increasing from 13% in III to 43% in HIV. It is worth mentioning that this classification does not take into account comorbidities or pre-existing factors in patients⁴.

Case presentation

This is a 57-year-old male patient with no pathological history relevant to the case, who began his condition 8 h before going to the hospital with pain in the left iliac fossa as well as little tolerance to oral administration. On arrival, laboratories and CT scans are obtained, reporting Hinchey IIA diverticulitis, for which he is treated with conservative management based on antibiotics, to which the patient shows unfavorable evolution. In a second tomography study, the diagnosis of intestinal obstruction secondary to an acute diverticular inflammatory process was made (Fig. 1). The obstructive process did not progress favorably for 24 h, so it was decided to operate on the patient. In this case, a laparoscopic approach is chosen.

Pneumoperitoneum was established with a direct vision trocar. On entering the peritoneal cavity, multiple adhesions of the omentum to the peritoneal and visceral surface were found, which were released with blunt dissection using a grasper. At the moment of separating the greater omentum from the intestine, multiple interloop abscesses were found, which opened with the traction of the omentum, some of them already open to the cavity (Fig. 2). Blunt dissection of the omentum was continued with suction irrigation which allowed drainage and lavage of the numerous small abscesses between the loops of small intestine. The round ligament was divided to allow superior mobilization of the greater omentum out of the work area. As the separation of the omentum continued, more abscesses were found and drained with blunt dissection and suction irrigation. The dissection of the loops of the small intestine was carefully performed at the same time.

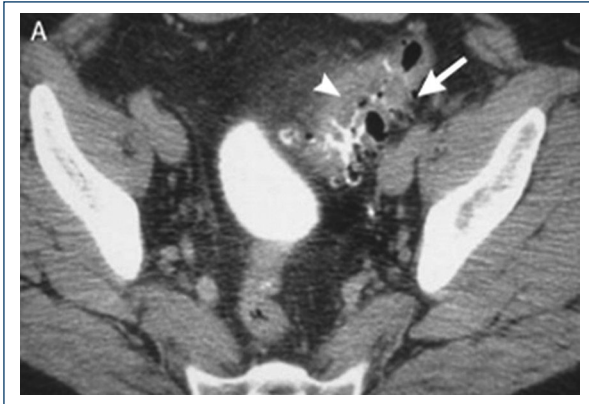


Figure 1. Axial cut of abdominal tomography with oral contrast at the level of the pelvis. Multiple saccular defects are observed at the level of sigmoid colon associated with mural thickening and edema of adjacent mesenteric fat. Findings consistent with diverticulitis.

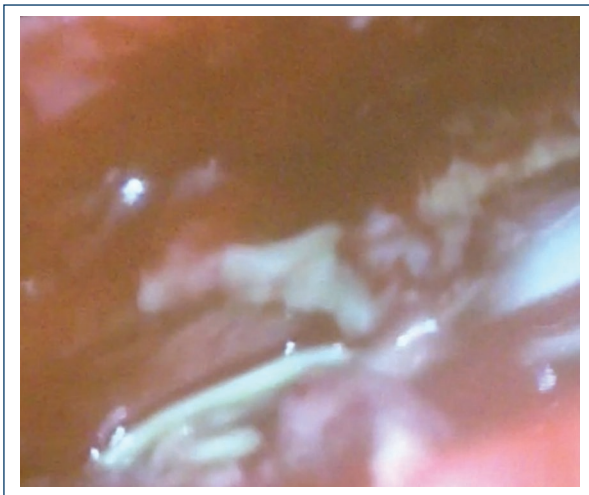


Figure 2. Multiple abscesses some of them already open to the peritoneal cavity.

With the separation of the omentum and the drainage of the abscesses, an area was identified in which the loops of the small intestine were adhered to the inflammatory plastron caused by the acute diverticular process adjacent to the thickened walls of the sigmoid colon, which conditioned the obstruction of the ileum with distension of the loops before this transition zone and subsequently without content (Fig. 3).

The release of the small intestine was performed using blunt dissection and hydrodissection in the same way until the release of the ileum loops, which were carefully examined, as well as the sigmoid, without finding leaks or perforations. Intraoperative colonoscopy

was also performed. The colonoscope was advanced to the site of acute inflammation where the only finding was a decrease in the lumen without being significant and without evidence of perforation. An exhaustive lavage of the peritoneal cavity was performed with 4 L of physiological solution with a 0.5% dilution of iodine before the placement of 2 suction drains.

In this case, the selection of the patient was made according to the CT findings, which initially classified it as acute Hinchey II diverticulitis. At the time of surgery, generalized purulent peritonitis was evidenced, which did not correlate with what was reported by the radiology department.

The patient's clinical conditions were initially those of a patient with sepsis of abdominal origin with criteria for systemic inflammatory response but who responded adequately to initial resuscitation as well as to antibiotic management. The unfavorable evolution was due to the intestinal obstructive process secondary to the diverticular inflammatory process.

In the particular case of this patient, the minimally invasive management allowed the release of adhesions, drainage of the abscesses caused by the diverticular inflammatory process, and mobilization of the small intestine, which was folded by the inflammatory process.

Access to the abdominal cavity in a patient with dilated loops of the small intestine is a relative contraindication for laparoscopy given the reduced visual and working field. With an adequate technique of entering the cavity, in this case, under direct vision it is possible to access, keeping aside the risk of perforation, to any of the loops of the small intestine that are dilated, so far there is no evidence on what the modality is. to establish the pneumoperitoneum in this class of patients, however, the particular observation is that the Veress needle is the least reliable alternative, on the other hand, open access (Hasson) or with a trocar with direct vision are the safest methods to access to the peritoneal cavity with the least number of complications, of which the most important would be to perforate a pressurized intestine due to an obstructive process.

Discussion

Perforated diverticulitis with leakage of pus or feces into the peritoneal cavity is considered a complicated diverticulitis that corresponds to Stages III or IV according to Hinchey's classification⁴. Historically, surgical procedures begin in 1907 by Mayo who described the three-stage surgery. Later, with the introduction of perioperative antibiotics, the Hartman procedure or

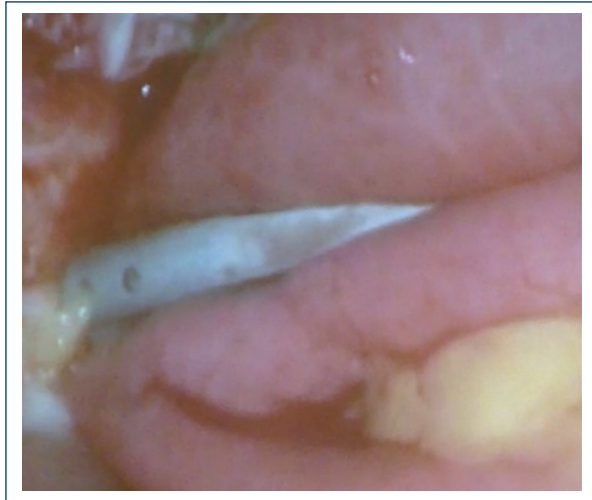


Figure 3. Obstruction of the ileum with distension of the loops before the transition zone.

two-stage surgery became the standard of care initially described by Henri Hartman as a surgical treatment for colon cancer). This showed lower mortality as well as morbidity, mainly with a significant decrease in the number of fistulas generated in three-stage procedures in which the affected colon segment was not resected¹. The Hartman procedure is a two-stage surgery in which the affected segment is resected during the acute inflammatory process, lavage, end colostomy and closed distal loop for subsequent reconnection in the next 6 months.

Primary resection and anastomosis are another of options available for the surgical management of perforated diverticulitis, with a mortality very similar to PH (14% vs. 14.4%), in addition to the fact that in properly selected patients an anastomotic leak rate of 6% is achieved. One of the most important aspects to consider is the rate of stoma reversal, since up to 60% of patients with terminal colostomy by Hartman procedure; remain with colostomy without reversal of it; against 85% stoma reversal in case of ileostomy by resection and primary anastomosis².

In recent years, minimally invasive techniques have been postulated with the advent of laparoscopy; including laparoscopic lavage and drainage (LLD) strictly in patients with diverticulitis complicated by purulent peritonitis (Hinchey III). The approximately 3% mortality compared to 14% for the Harman procedure placed the LLD as a promising option for the management of perforated diverticulitis⁵.

The correct classification of patients according to the Hinchey stage is vital for the selection of the procedure

to be performed. In the case of laparoscopic lavage, it is the procedure of choice for infection control caused by purulent diverticulitis. In the scenario in which a free fecal perforation is identified, a different technique should be selected, either HP or resection with primary anastomosis with or without a protective ileostomy, since LLD is not a means of controlling the source of infection in patients in the case of leakage of fecal matter from the colon. Reports of series with primary closure of the perforation with washing are scarce and with inconclusive results; Therefore, there is currently not enough evidence in favor or finding of this technique^{6,7}.

According to the pathophysiology of purulent diverticulitis, it is caused by the rupture of an abscess, whereas peritonitis is caused by the outflow of pus into the peritoneal cavity. Based on this, it is postulated that laparoscopic lavage is effective in controlling the source of infection, as well as continuous drainage of the cavity^{6,7}.

In this way, the LLD with the inherent advantages of minimally invasive surgery is an alternative to reduce the number of emergency laparotomies, resections, and stomas, reducing the morbidity associated with the urgent management of Hinchey III diverticulitis, with a reduction in surgical times and a shorter stay in the hospital⁷.

The present case was initially diagnosed as uncomplicated diverticulitis, for which management guidelines with bowel rest, broad-spectrum antibiotics and hydration were initiated. The evolution of the patient was not favorable, subsequently presenting symptoms of intestinal obstruction, so after 72 h of conservative management, surgical management was decided.

At the time of defining what the approach would be, it was decided to perform a diagnostic laparoscopy and, if necessary, proceeds to open surgery. Given the already suspected conditions of the patient, it was possible to start the laparoscopic procedure in which the stage of Hinchey 3 diverticulitis could be defined due to the presence of multiple abscesses that conditioned a purulent diverticulitis but without evidence of direct leakage of intestinal material. Due to the inflammatory process, loops of the adjacent small intestine were folded in the inflammatory plastron, which conditioned a transition zone or obstruction to the passage of intestinal material. Through laparoscopic surgery, the correct dissection of the adhesional process was achieved, as well as the washing and drainage of the abdominal cavity. The patient evolves satisfactorily, never presents data of systemic inflammation, tolerates the oral route satisfactorily, and presents bowel movements of satisfactory consistency. The patient is discharged home on the third

postoperative day. In the outpatient follow-up, I did not present complications.

Conclusions

Management will depend on the degree of severity of the diverticulitis picture. In general, uncomplicated diverticulitis included in Grades I and II responds adequately to medical management based on bowel rest or a low-residue liquid diet, depending on tolerance to the oral route and the general conditions of the patient. Broad-spectrum antibiotics should be started with coverage for anaerobes and gram negatives. Patients in good general condition and without data of systemic inflammatory response can be managed as outpatients in selected cases. Patients who present severity data; oral intolerance, poor general condition, severe pain, or SIRS; requiring therapeutic interventions (e.g., percutaneous drainage) should be hospitalized.

On the other hand, complicated diverticulitis, usually Hinchey Stages II with large abscesses, III and IV, must be hospitalized, start management with bowel rest; broad-spectrum antibiotics, analgesia, and resuscitation in case of SIRS data or management of sepsis and septic shock depending on the severity of the presentation.

In cases of uncomplicated diverticular disease, management will be based on broad-spectrum antibiotics, bowel rest, analgesia, and general measures, without requiring therapeutic or surgical intervention in most cases. Patients with uncomplicated diverticulitis will have a favorable evolution with this management, even in some series the use of antibiotics in mild cases of diverticulitis is questioned^{8,9}.

In stage II with large abscesses (> 4 cm), the most effective and least invasive intervention is image-guided drainage by CT or sonography.

Stages III and IV cover cases of diverticulitis complicated with purulent or fecal peritonitis, for which they must necessarily be hospitalized patients who will require urgent surgical intervention in addition to management of sepsis, severe sepsis, and septic shock depending on the degree of severity and the evolution of the patient.

As the incidence of diverticulitis increases in our environment, our knowledge regarding its treatment advances. A case is shown in which with the appropriate conditions a minimally invasive approach shows satisfactory results. More research should be done regarding this type of approach and its results in diverticulitis.

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Conflicts of interest

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

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

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript nor for the creation of images, graphics, tables, or their corresponding captions.

References

- McDermot FD, Collins D, Heeney A, Winter DC. Minimally invasive and surgical management strategies tailored to the severity of acute diverticulitis. *Br J Surg.* 2014;101:90-9.
- Jacobs DO. Clinical practice. Diverticulitis. *N Engl J Med.* 2007;357:2057-66.
- Medina-Fernandez MJ, Díaz-Jiménez N, Gallardo Herrera AB, Gómez-Luke I, Garcilazo-Arsimendi DJ, Gómez-Barbadillo J. New trends in the management of diverticulitis and colonic diverticular disease. *Rev Esp Enferm Dig.* 2015;107:162-70.
- Bridoux V, Antor M, Schwarz L, Cahais J, Khalil H, Michot F. Elective operation after acute complicated diverticulitis: is it still mandatory? *World J Gastroenterol.* 2014;20:8166-72.
- Alecha JS, Pais SA, Marin XB, Martinez BO, Ribera EB, Irazabal CY. Safety of non operative management after acute diverticulitis. *Ann Coloproctol.* 2014;30:216-21.
- Myers E, Hurley M, O'Sullivan G, Kavanagh D, Willson I, Winter D. Laparoscopic peritoneal lavage for generalized peritonitis due to perforated diverticulitis. *Br J Surg.* 2008;95:97-101.
- Wiegand N, Geltzeiler CB, Tsikitis VL. Trends in the surgical management of diverticulitis. *Ann Gastroenterol.* 2015;28:25-30.
- Iyer R, Longstreth GF, Chu L, Chen W, Yen L, Hodgkins P, et al. Acute colonic diverticulitis: diagnostic evidence, demographic and clinical features in three practice settings. *J Gastrointest Liver Dis.* 2014;23:379-86.
- Moore FA, Catena F, Moore EE, Leppaniemi A, Peitzmann AB. Position paper: management of perforated sigmoid diverticulitis. *World J Emerg Surg.* 2013;8:55.