

Technique of reinforcement for the abdominal wall with longitudinal suture lateral to the incision (reinforced tension line-RTL) for midline closure in order to prevent evisceration

Técnica de refuerzo de la pared abdominal con sutura longitudinal lateral a la incisión (reinforced tension line - RTL) para el cierre de la línea media como prevención de evisceración

Cuenca Osmar* , Ferreira Rosa** , Ferreira Jesús *** , Sosa Ever**** , Agüero Angel ***** , Cano Cristhian***** , Ruíz Díaz Jorge*****

Hospital de Clínicas San Lorenzo, Paraguay

ABSTRACT

Introduction: Evisceration is a complication after a laparotomy, the RTL technique can prevent it. **Objective:** To describe results using the RTL technique for the prevention of evisceration in at-risk patients. **Material and method:** Prospective, observational, descriptive, cross-sectional study in a patient with risk factors for evisceration with a score greater than 6 on the Van Ramshorst scale using RTL technique for midline closure from March 2023 to February 2024, at the IICCQ Hospital de Clínicas FCM-UNA. **Results:** 30 patients with 6 or more risk factors for evisceration according to the Van Ramshorst scale were studied. **Risk factors found:** age, type of surgery, anemia, ascites, cough. Mean age was 55.2 ± 10.3 years, incision greater than 18 cm (63%) of patients, surgical time was 180 ± 165 minutes (50%), surgical site infection (20%), 1 (3.3%) death due to abdominal sepsis. 2 (6.7%) **Conclusion:** The RTL technique is a safe, fast, easy to perform technique, it can prevent eviscerations.

Palabras claves: Evisceration, midline closure.

RESUMEN

Introducción: La evisceración es una complicación posterior a una laparotomía la técnica de RTL puede prevenirla. **Objetivo:** Describir resultados utilizando la técnica de RTL para prevención de evisceración en pacientes de riesgo. **Material y método:** Estudio prospectivo, observacional descriptivo, de corte transversal en paciente con factores de riesgo de evisceración con puntaje mayor a 6 de la escala Van Ramshorst utilizando técnica de RTL para cierre de la línea media de marzo de 2023 a febrero de 2024, en la IICCQ Hospital de Clínicas FCM-UNA. **Resultados:** se estudiaron 30 pacientes con 6 o más factores de riesgo para evisceración según escala de Van Ramshorst. **Factores de riesgo encontrados:** edad, tipo de cirugía, anemia, ascitis, tos. Edad promedio fue $55,2 \pm 10,3$ años, incisión mayor a 18 cm (63%) de

los pacientes, tiempo quirúrgico fue de 180 ± 165 minutos(50%), infección del sitio quirúrgico (20%) , 1(3,3%) óbito por sepsis abdominal .Se presentaron 2 (6,7%) **Conclusión:** La técnica RTL es una técnica segura, rápida, fácil de realizar, puede prevenir evisceraciones.

Palabras claves: Evisceración, cierre de línea media.

INTRODUCTION

A midline laparotomy is a procedure commonly used by surgeons to access the peritoneal cavity in various surgical specialties (digestive surgery, vascular surgery, gynecology, and urology). This technique can present significant complications in the presence of various factors that may trigger a local complication of different types, such as wound infection, dehiscence-evisceration, and incisional hernia.¹

Acute parietal dehiscence, or evisceration, is defined as the opening of the previously closed musculoaponeurotic layers following a laparotomy. Its incidence varies widely depending on the type of surgery: 12–15% in elective laparotomies and up to 40% in emergency surgeries and in high-risk patients.^{1,2} Diagnosis is generally clinical in the early postoperative days, around the ninth day after laparotomy. It is considered a serious complication due to its morbidity and mortality (44%) and may progress to a subsequent incisional hernia. The costs of its treatment and the prolonged hospital stay are high, thus also generating an economic impact that must be taken into account.^{3,4} Despite the multiple suture techniques employed, the different types of suture materials used, and consideration of the general factors that may affect healing, the rate of complications associated with this type of surgical approach has not been

*Chief of Service of Surgical Clinic's 2nd Course

**Chief of Staff of Surgical Clinic's 2nd Course email: rferreirapederezoli@gmail.com

***Resident Chief of Surgical Clinic's 2nd Course

****On-call Chief

*****Teaching Aid of Surgical Clinic's 2nd Course

*****Surgical Clinic's 2nd Course Resident

WINNING PAPER- 21° PARAGUAYAN CONGRESS OF SURGERY (September 2024)

Corresponding Author: Rosa Ferreira Email: rferreirapederezoli@gmail.com

Received: 26/01/2025 - Revised: 8/02/2025 - Accepted: 24/02/2025

Revisor: Carlos Arce Aranda Facultad de Ciencias Médicas. UNA

Editor: Eduardo González Miltos Universidad Nacional de Asunción; San Lorenzo, Paraguay

 Este es un artículo publicado en acceso abierto bajo una Licencia Creative Commons

reduced. Even studies conducted, including meta-analyses, have not demonstrated significant improvements in the outcomes of laparotomy closures.^{1,5}

The multifactorial origin makes it relevant to identify predictive factors for evisceration and to prevent them by correcting systemic factors and using an optimal closure technique.^{5,6}

The prophylactic use of prosthetic mesh has been shown to be effective in preventing evisceration in patients both with and without risk factors. However, there is no scientific evidence defining which patients would benefit most from this approach or the optimal anatomical plane for its placement.^{7,8}

In 2010, Van Ramshorst et al.⁹ proposed a scoring system (Table 1) to identify high-risk patients. Their findings showed that patients with a score greater than 6 have a 40% risk of evisceration^{9,10}. However, they concluded that its predictive power is limited due to the multifactorial nature of the problem. Even so, the scale remains useful for identifying high-risk patients in whom it is necessary to apply optimal techniques or prophylactic measures to reduce the incidence of evisceration.¹¹

Table 1: Van Ramshorst Score

Variable	Scoring
Age (years)	
40-49	0,4
50-59	0,9
60-69	0,9
>70	1,1
Sex: male	0,7
Chronic, obstructive, pulmonary disease	0,7
Ascites	1,5
Jaundice	0,5
Anemia	0,7
Emergency surgery	0,6
Surgery type	
Gallbladder or bile duct	0,7
Esophagus	1,5
Gastroduodenal	1,4
Small intestine	0,9
Colon	1,4
Vascular	1,3
Cough	1,4
Surgical site's infection	1,9

Source: Van Ramshorst GH et al. Abdominal wound dehiscence in adults: Development and validation of a risk model. *World J Surg*.2010

Evisceration risk: Less than 2 points: 5,6%; 2-3,99 points: 12%; 4-5,99 points: 16%; 6 or more points: 40%.

OBJECTIVES

Describe the results of applying the midline closure technique using the RTL method for the prevention of evisceration in at-risk patients.

Describe risk factors for evisceration

Describe factors associated with the surgical act: size of the incision, surgical time, hospital stay, local complications.

Describe morbidity and mortality

MATERIAL Y MÉTODOS

Prospective, observational, descriptive, cross-sectional study,

non-probabilistic purposive sampling, from March 2023 to February 2024, in patients identified as having risk factors for evisceration according to the Van Ramshorst Scale, in whom the midline closure technique using the RTL method was applied for the prevention of evisceration in at-risk patients, at the 2nd Course of Surgical Clinic, Faculty of Medical Sciences, FCM. UNA. Patients were selected in whom risk factors were identified using the Van Ramshorst predictive scale, with a score of 6 or higher in each patient, thus determining the risk of postoperative evisceration. Patients over 18 years of age undergoing midline laparotomy were included, regardless of diagnosis and type of surgery, whether elective or emergency. The technique used for the prevention of evisceration was the midline closure technique described by Hollinsky^{12,13}, known as RTL for its acronym in English (reinforced tension line), which consists of placing two suture lines, each along the aponeurotic edge of the surgical wound. It begins with a strand of suture thread (synthetic, slow-absorption suture material, polydioxanone 2-0) at one end of the aponeurotic wound, where the suture runs longitudinally and parallel to the aponeurotic edge. The needle should enter and exit at 1 cm intervals, always taking 0.5 cm from the edge of the aponeurosis. Upon reaching the opposite corner of the wound, another strand of suture is used, repeating the same process along the opposite aponeurotic edge. The ends of the two suture strands are tied at the aponeurotic corners.

In this way, the aponeurotic wound is left with two suture lines reinforcing its edges. The wound is then closed with PDS 1, at 0.8 cm from the wound edge and 0.8 cm from one stitch to the next; the suture must include and anchor to the two longitudinal reinforcing strands.

STUDY VARIABLES

Evisceration, risk factors, incision size, types of surgery, surgical time, local complications, mortality.

DATA ANALYSIS AND MANAGEMENT

The data were coded and logged into an electronic template (Excel, Microsoft) and analyzed in the Epi Info program using descriptive statistics.

ETHICS

The study complied with the Belmont ethical principles; as it was a prospective study, secondary data were used. During data collection, the principle of patient confidentiality was respected.

RESULTS

Sample: 30 patients were selected with predictive criteria for evisceration of 6 points or more, 20 women and 10 men. Mean age was 55.2 ± 10.3 years.

The types of surgery to which the selected patients were subjected were: emergency surgery: n=15 (50%), oncologic surgery: n=10 (33.3%), and n=5 (16.7%) patients underwent abdominal wall repair surgery.

According to the Van Ramshorst scale applied to the patients, the following risk factors were identified: incision size greater than 18 cm: n=19 (63.3%), surgical time of 180 minutes or more: n=15 (50%), hospital stay of more than 5 days: n=10 (50%), pulmonary disease: n=10 (33.3%), ascites: n=4 (13.3%), anemia: n=10 (33.3%), cough: n=10 (33.3%), surgical site infection: n=6 (20%), seroma: n=2 (6.7%), and hematoma: n=3 (3.3%).

Table 2: Risk factors n: 30

Variable	Patients	Frequency
Incision size greater than 18 cm	19	63,3%
Surgical time of 180 minutes or more	15	50%
Hospital stay of more than 5 days	10	33,3%
Pulmonary disease	10	33,3%
Ascites	4	13,3%
Jaundice	-	
Anemia	10	33,3%
Cough	10	33,3%
Surgical site's complications		
Surgical site infection	6	20%
Seroma	2	6,7%
Hematoma	3	3,3%

Source: Archivos de la Segunda Cátedra de Cirugía. Hosp.Clinicas FCM-UNA

Of the 30 patients, we had 2 (6.7%) eviscerations that occurred between the 5th and 10th postoperative day. We reported 1 (3.3%) death due to sepsis originating from the abdomen.

DISCUSSION

Evisceration is an acute complication of abdominal wall closure, with significant morbidity and mortality, which prolongs hospital stay and increases costs.^{1,2,3}

The use of predictive scales for evisceration, such as that of Van Ramshorst⁹, to assess the risk of complications in patients would make it possible to identify those who could potentially develop this complication and to apply preventive measures: modified closure techniques or the use of prophylactic mesh.^{6,7,8}

Among the known techniques for midline closure, the RTL technique constitutes an interesting alternative.

Mayagoitia, Lozada Hernández et al¹ in León, Guanajuato (Mexico) conducted a double-blind randomized clinical trial of 100 patients during the period 2014–2015 to compare the use of the RTL technique with conventional closure in patients at high risk of postoperative evisceration. Patients over 18 years of age who underwent midline laparotomy were included, regardless of diagnosis, whether emergency (42.7%) or elective, with a score of 6 or higher according to the Van Ramshorst predictive scale. Two groups were formed: 1) control with conventional closure, and 2) experimental with the RTL technique.

There were no significant differences in the preoperative score between the two groups. Among the main results: 89 patients (89%) completed the study—45 in the control group and 44 in the experimental group; 11 patients (12.35%) experienced evisceration: 9 (20%) in the control group and 2 (4.5%) in the experimental group, with a significant difference in favor of the RTL technique.¹

In this series, it was concluded that the application of the RTL technique reduces the incidence of postoperative evisceration to 4.5%, does not increase the cost or the postoperative complications associated with this type of closure, can be used in contaminated surgery without prolonging surgical time since it only uses two additional sutures in the closure of the incision, and is an appropriate option compared to mesh placement,

which carries a high risk of infection. In our series, an incidence of evisceration of 6.7% was reported.

Lozada Hernández et al¹ again conducted a double-blind randomized clinical trial on the prevention of incisional hernia using the RTL technique versus primary suture in midline laparotomy, in a study with patient follow-up at 3 years after laparotomy, involving a group of 124 patients over 18 years of age who underwent midline laparotomy in either elective or emergency surgery, of whom 51 patients underwent RTL and 53 underwent primary suture. After 3 years of follow-up, the incidence of incisional hernia was higher in the primary suture group (15/53, 28.3%) than in the RTL group (5/51, 9.8%) ($p = 0.016$, OR 0.35, 95% CI 0.14–0.88, $p = 0.017$). In addition, the groups had similar results regarding surgical site infection, hematoma, seroma, and postoperative pain. This means that the RTL technique is also useful for preventing long-term complications and is not associated with an increase in early complications.

Akhilesh Agarwal et al¹⁵, in a randomized clinical trial on reinforced tension line suture closure after midline laparotomy in emergency surgery published in 2011, during the period from 2007 to 2009, studied 190 patients who underwent emergency laparotomy, comparing a group treated with RTL and another with continuous suture. A significant difference was found ($P = 0.0026$), in which none of the 90 patients treated with RTL presented evisceration, while 13 of the 100 treated with continuous suture did present evisceration.

The RTL technique is a procedure that adds only 1 to 2 more minutes, increases the force required for closure disruption, can be combined with other techniques such as the Small Bites method for wall closure or with mesh placement for defect closure, reduces the frequency of early eviscerations and incisional hernias, and constitutes an alternative to the use of prophylactic meshes.

CONCLUSION

After applying the midline closure technique with lateral reinforcement in patients with risk factors for evisceration, evisceration was observed in 2 cases (6.7%).

The most frequently found risk factors were: pulmonary disease, cough, anemia, emergency surgery, and, less frequently, ascites and abdominal wall repair surgery.

Among the factors associated with the surgical act, the most frequent was an incision size greater than 18 cm in 63.3% of cases, surgical time of 180 minutes or more in 50% of cases, and hospital stay of more than 5 days (33.3%), while the main local complication found was surgical site infection in 20% of cases. Mortality was 3.3%.

AUTHOR CONTRIBUTIONS

All authors actively participated in the various stages of the work. The conception and design of the study, as well as the collection, analysis, and interpretation of the data, were carried out jointly. The manuscript was written and critically reviewed with the participation and agreement of all authors. All authors approved the final version of the article and are responsible for its content.

CONFLICTS OF INTEREST

There are no conflicts of interest.

FUNDING

The authors funded the production of this article.

BIBLIOGRAPHY

- Mayagoitia JC, Lozada E, Smolinski R, Álvarez J, Hinojosa J, Hernández L. Comparación de dos técnicas de sutura para cierre aponeurótico en laparotomía media en pacientes con alto riesgo de evisceración posquirúrgica. *Rev Hispanoam Hernia* 2016;4(4):137-143.
- E. Gili Ortiz, R. González Guerrero, L. Bejar Prado, G. Ramírez Ramírez, J. López Méndez. Dehiscencia de la laparotomía y su impacto en la mortalidad, la estancia y los costes hospitalarios. *Ciresp*.2015;93(7):444-449.
- de Hernia, A. M. (2015). Guías de práctica clínica para Hernias de la Pared Abdominal. México: Asociacion Mexicana de Hernia.Disponible en: [www. http://amhernia.org/wp-content/themes/amhernia/files/guias2015.pdf](http://amhernia.org/wp-content/themes/amhernia/files/guias2015.pdf) [Ago 2015].
- Rodríguez Hermosa J, Codina Cazador A, Ruiz B, Roig J, Girones J, Pujadas M, et al. Factores de riesgo de dehiscencia aguda de la pared abdominal tras laparotomía en adultos. *Cir Esp*. 2005; 77:280-286. Medline
- M. Bellón, H.J. Durán. Factores biológicos implicados en la génesis de la hernia incisional. *Cir Esp*.2008; 83:3-7. Medline
- N. Argudo Aguirre, J. Sancho Insenser, J.A. Pereira Rodríguez. a. Malas profilácticas en laparotomía urgente. Resultados a largo plazo en un estudio retrospectivo.(2013) Disponible en: <http://hdl.handle.net/2072/213764>
- Caro Tarrago A, Olona Casas C, Jiménez Salido A, Duque Guilera E, Moreno Fernández F, Vicente Guillén V. Prevención de la hernia incisional en laparotomía de la línea media con una malla superpuesta: un ensayo clínico aleatorizado.a.*World J Surg*. 2014; 38:2223-2230 b. <http://dx.doi.org/10.1007/s00268-014-2510-6> | Medline
- Bhangu A, Fitzgerald JE, Singh P, Battersby N, Marriott P, Pinkney T. a.Revisión sistémica y metanálisis de la colocación de malla profiláctica para la prevención de la hernia incisional después de laparotomía de la línea media. b.*Hernia*. 2013;17: 445-455 c.<http://dx.doi.org/10.1007/s10029-013-1119-2> | Medline
- Van Ramshorst GH, Nieuwenhuizen J, Hop WC, Arends P, Boom J, Jeekel J, et al. a.Dehiscencia de herida abdominal en adultos: desarrollo y validación de un modelo de riesgo.*World J Surg*. 2010; 34:20-27 b.<http://dx.doi.org/10.1007/s00268-009-0277-y> | Medline
- Pereira JA, López Cano M, Marsa FI, Feliu X. a. Resultados de una encuesta nacional sobre el cierre de la pared abdominal. b. *Cir Esp*. 2013; 91:645-650 c. <http://dx.doi.org/10.1016/j.ciresp.2013.02.001> | Medline
- CJ Gómez Díaz, P. Rebasa Cladera, S. Navarro Soto, JM Hidalgo Rosas, A. Luna Aufroy, S. Montmany Vioque, et al. a.Validación de un modelo de riesgo de evisceración. b. *Cir Esp*.2014; 92:114-119 c. <http://dx.doi.org/10.1016/j.ciresp.2012.12.008> | Medline
- C Hollinsky, S Sandberg. biomechanical study of the reinforced tension line (RTL)—a technique for abdominal wall closure and incisional hernias *Eur Surg*. 2007; 39:122-127
- C. Hollinsky, S. Sandberg, R. Kocijan. Preliminary results with the reinforced tension line: a new technique for patients with hernias of the ventral abdominal wall.*Am J Surg*. 2007; 194:234-239 a. <http://dx.doi.org/10.1016/j.amjsurg.2006.09.045> | Medline
- Lozada E, Escamilla E. Prevención de hernia incisional comparando la técnica RTL vs cierre primario en laparotomía por línea media: 3 años de seguimiento ensayo clínico controlado. *CIR ESP*. 2021;99(Espec Congr 2):727
- Alas Sola F, Callejas Colato A. Cierre de pared abdominal: técnica quirúrgica, tipos de sutura y recomendaciones para cierre de pared abdominal en pacientes con laparotomía línea media y alto riesgo de evisceración. 2024. Tesis Doctoral. Universidad de El Salvador.