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Routine coagulation tests during elective abdominal surgery to predict the risk of bleeding

Pruebas de coagulación de rutina en cirugía abdominal electiva para predecir riesgo de hemorragia

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Keywords:
Coagulation tests, bleeding, elective surgery, cholecystectomy, hernia repair.

Palabras clave:
Pruebas de coagulación, sangrado, cirugía electiva, colecistectomía, reparación de hernia.

ABSTRACT

Introduction: Many hospitals in Mexico perform routine coagulation tests prior to an elective surgery to prevent intra- or postoperative bleeding. However, in the surgical literature, some authors do not approve this practice. **Objective:** To analyze the utility of coagulation tests for elective surgeries and the possibility for intra or postoperative bleeding. **Material and methods:** A retrospective comparative study was performed; it included 263 patients who underwent elective abdominal surgeries from a single institution. Coagulation tests were compared with sex, age groups, intra- or postoperative bleeding, surgical time and length of hospital stay. **Results:** A total of 2 (0.76%) intra or postoperative bleeding cases were found. Abnormal tests were reported in agreement with the International Normalized Ratio (INR) with minimal risk of bleeding (10/3.8%), INR with the maximal risk of bleeding (3/1.1%), PTT (66/25.1%) and PT (25/9.5%). There was no significant difference when coagulation tests were compared with sex, intra- or postoperative bleeding or surgical time. Abnormal INR with maximal risk of bleeding was more common in patients ≥ 60 years of age (p = 0.002). Surgical time and length of hospital stay were longer in patients with abnormal INR with maximal (p = 0.003) and minimal risk of bleeding (p = 0.005), respectively. **Conclusions:** Routine use of coagulation tests prior to elective abdominal surgery has no justification. It should be avoided.

RESUMEN

Introducción: *Muchas instituciones en México realizan pruebas de coagulación (CTS, por sus siglas en inglés) de rutina, previas a una cirugía electiva para prevenir hemorragia intra- o postoperatoria. Sin embargo, algunas publicaciones no aprueban esta práctica.* ***Objetivo:*** *Evaluar la utilidad de las pruebas de coagulación previas a cirugías abdominales electivas para predecir el riesgo de hemorragia intra- o postoperatoria.* ***Material y métodos:*** *Se llevó a cabo un estudio retrospectivo comparativo. Se incluyeron 263 pacientes a quienes se les realizó cirugía abdominal electiva. Las pruebas de coagulación se compararon con variables de género, grupos de edad, presencia de hemorragia intraoperatoria o postoperatoria, tiempo quirúrgico y tiempo de estancia intrahospitalaria.* ***Resultados:*** *Se informó un total de dos (0.76%) hemorragias intraoperatorias o postoperatorias. Se observaron resultados anormales en 10 (3.8%) pacientes con International Normalized Ratio (INR) con riesgo mínimo de sangrado, en tres (1.1%) con INR con riesgo máximo de sangrado, 66 (25.1%) con tiempo parcial de tromboplastina y 25 (9.5%) con tiempo de protrombina. No hubo diferencia significativa cuando las CTS se compararon con género, presencia de hemorragia intraoperatoria o postoperatoria o tiempo quirúrgico. International normalized ratio anormal con riesgo máximo de sangrado fue significativamente más común en pacientes ≥ 60 años (p = 0.002). El tiempo quirúrgico y el tiempo de estancia intrahospitalaria fueron más prolongados en pacientes con INR anormal con riesgo máximo (p = 0.003) y mínimo de sangrado (p = 0.005), respectivamente.* ***Conclusiones:*** *La práctica de solicitar pruebas de coagulación de rutina previa a cirugías abdominales electivas no tiene justificación y debería evitarse.*

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INTRODUCTION

Most institutions in Mexico perform routine preoperative tests; however, evidence has reported that such tests should be done only in patients whose clinical condition requires it.[1-3] In the case of coagulation tests (CTs) this practice is no exception, and in many institutions it is almost mandatory to request prothrombin time (PT), partial thromboplastin time (PTT) and the international normalized ratio (INR) prior to elective surgery. The reason for requesting CTs is to prevent intraoperative or postoperative hemorrhage (IPH) or, in many cases, to avoid legal problems.

In Mexico, the *Official Mexican Standard for the practice of anesthesia* of 2011[4] *(Norma Oficial Mexicana, NOM)* defines as "pre-anesthetic tests, the studies performed on patients who require it before anesthesia to assess the physical condition and risk."

The purpose of this study is to assess the need for routine CTs in elective abdominal surgery, to analyze the risk of bleeding and the cost-benefit ratio.

MATERIAL AND METHODS

A retrospective study was performed between February 2015 and July 2016. It was reported online according to the criteria of the STROCSS Group[5] and a research record was obtained. A total of 344 patient records from a single public hospital in Mexico were reviewed. All patients who underwent elective cholecystectomy or elective ventral or inguinal hernia repairs were included. Non-elective surgeries (such as for acute cholecystitis or incarcerated hernias) were excluded. All procedures were carried out by three graduate surgeons. The cholecystectomies were performed by either open or laparoscopic approach; the hernia repairs were performed only by an open approach. Of the 344 cases, 81 were excluded because their file was incomplete, such that a total of 263 cases were considered suitable for analysis. PT, PTT and INR were analyzed, and such variables were compared with gender, age (divided by groups), presence of IPH, surgical time and length of hospital stay. IPH was defined as the presence of bleeding with hemodynamic instability, bleeding that required reoperation, or bleeding that required blood transfusion for control. INR was defined as minimum risk of bleeding (the range in which the risk of bleeding exists, but is low) and maximum risk of bleeding (range in which the risk of bleeding is high).[6] The Statistical analysis was performed by a Student's t-test and ANOVA for quantitative variables and χ^2 for qualitative variables with the use of SPSS® Statistics. A p value ≤ 0.05 was considered statistically significant.

RESULTS

Of the 263 cases, 191 (72.6%) were women and 72 (27.4%) men. The average age was 45.3 ± 16.88 years. Of the total cases, 120 (45.6%) had at least one comorbidity and 143 (54.3%) did not *(Table 1)*. Surgery was performed in 137 patients with regional anesthesia (52.1%) and in 126 with general anesthesia (47.9%). There were a total of 40 (15.2%) complications, of which 25 (9.5%) were intraoperative and 15 (5.7%) postoperative. Two (0.76%) IPH were present, the first case was a 29-year-old woman with a body mass index (BMI) of 25.1 kg/m^2 and a history of tubal-ovarian obstruction as a family planning method. Her preoperative coagulation tests (INR, PT, and PTT) were normal. She underwent an open cholecystectomy and had to be reoperated due to bleeding from the cystic artery. The second case was a 27-year-old woman with a BMI of 33.2 kg/m^2 and a history of three caesarean sections. Her preoperative coagulation tests were normal, except for a PTT of 12.6 seconds (normal range considered between 24 and 32). A cholecystectomy was performed and she had to be reoperated for

Table 1: Comorbidities in 263 cases.

Comorbidities	Number of patients (%)
Diabetes	25 (9.5)
Thyroid diseases	2 (0.8)
Epilepsy	2 (0.8)
Hypertension	47 (17.9)
Other comorbidities	44 (16.7)
No comorbidities	143 (54.3)

intraoperative bleeding secondary to hepatic laceration. The surgical time was 69.8 ± 34.8 minutes and the average hospital stay was and 1.3 ± 1.2 days. Of the 263 cases studied, 250 (95.1%) had normal INR, 10 (3.8%) an abnormal INR with minimal risk of bleeding and three (1.1%) an abnormal INR with maximum risk of bleeding. Sixty-six (25.1%) cases had abnormal PTT and 25 (9.5%) abnormal PT.

Table 2 shows that there was no statistical difference when CTs were compared with gender variables. In *Table 3* the CTs are compared with three age groups. In this comparison the presence of abnormal INR with maximum risk of bleeding was found to be significantly more frequent in patients ≥ 60 years (p = 0.002); for the rest of the CTs no significant differences were found when compared with the three age groups. In *Table 4*, CTs were compared with dependent variables (surgical time, presence of IPH and time of hospital stay). Surgical time was significantly longer in patients with abnormal INR and maximum risk of bleeding than in those with normal or abnormal INR with minimal risk of bleeding (p = 0.003). In addition, the time of hospital stay was significantly longer in

Table 2: Comparison between gender and coagulation tests.

	Total n (%)	Men n (%)	Women n (%)	p
Number of cases	263	72 (27.4)	191 (72.6)	
INR, normal	250 (95.1)	69 (95.8)	181 (94.8)	0.733
INR with minimum risk of bleeding	10 (3.8)	2 (2.8)	8 (4.2)	0.595
INR with maximum risk of bleeding	3 (1.1)	1 (1.4)	2 (1.0)	0.832
PTT, normal	197 (74.9)	53 (73.6)	144 (75.4)	0.758
PTT, abnormal	66 (25.1)	19 (26.4)	47 (24.6)	
PT, normal	238 (90.5)	66 (91.7)	172 (90.1)	0.693
PT, abnormal	25 (9.5)	6 (8.3)	19 (9.9)	

INR considered normal ≤ 1.3, INR considered with minimum risk of bleeding 1.31-1.5, INR considered with maximum risk of bleeding ≥ 1.51.
PTT normal value, 24-32 seconds, PT normal value 11.3-13 seconds.
INR = international normalized ratio; PTT = partial thromboplastin time; PT = prothrombin time.

Table 3: Comparison between age groups and coagulation tests.

	< 40 years n (%)	Between 40 y 60 years n (%)	> 60 years n (%)	p
Number of cases	111 (42.2)	96 (36.5)	56 (21.3)	0.280
INR, normal	107 (96.4)	92 (95.8)	51 (91.1)	0.002*
INR with minimum risk of bleeding	4 (3.6)	4 (4.2)	2 (3.6)	
INR with maximum risk of bleeding	0	0	3 (5.3)	
PTT, normal	77 (69.4)	76 (79.2)	44 (78.6)	0.209
PTT, anormal	34 (30.6)	20 (20.8)	12 (21.4)	
PT normal	103 (92.8)	84 (87.5)	51 (91.1)	0.428
PT anormal	8 (7.2)	12 (12.5)	5 (8.9)	

INR considered normal ≤ 1.3, INR considered with minimum risk of bleeding 1.31-1.5, INR considered with maximum risk of bleeding ≥ 1.51.
PTT normal value, 24-32 seconds, PT normal value 11.3-13 seconds.
INR = international normalized ratio; PTT = partial thromboplastin time; PT = prothrombin time.

Table 4: Comparison between IPH, surgical time, hospital stay and coagulation tests.

	IPH n (%)	p	Surgical time (minutes)	p	Hospital stay (days)	p
Total	2 (0.8)		69.8 ± 34.8		1.3 ± 1.2	
INR normal	2 (0.8)	0.730	68.6 ± 33.3	0.003	1.2 ± 1.1	0.005*
INR with minimum risk of bleeding	0		78.4 ± 31.2		1.8 ± 1.0	
INR with maximum risk of bleeding	0		135.0 ± 96.5		1.0 ± 1.22	
PTT normal	1 (0.4)	1.0	69.3 ± 35.6	0.701	1.3 ± 1.2	0.636
PTT anormal	1 (0.4)		70.6 ± 32.3		1.3 ± 1.2	
PT normal	2 (0.8)	0.643	68.8 ± 33.9	0.253	1.2 ± 1.1	0.053
PT anormal	0		79.3 ± 42.3		2.0 ± 1.8	

INR considered normal ≤ 1.3, INR considered with minimum risk of bleeding 1.31-1.5, INR considered with maximum risk of bleeding ≥ 1.51. PTT normal value, 24-32 seconds, PT normal value 11.3-13 seconds. INR = international normalized ratio; PTT = partial thromboplastin time; PT = prothrombin time; IPH = intraoperative or postoperative hemorrhage. * Statistically significant.

patients with abnormal INR with minimal risk of bleeding than in those with normal or abnormal INR with maximum risk of bleeding (p = 0.005). There was no significant difference in surgical time or in-hospital stay time when compared to the remaining CTs. Finally, the presence of IPH showed no statistical difference with any of the CTs with which it was compared.

DISCUSSION

In this study, the percentage of CTs with abnormal results varied between 1.1% (abnormal INR with maximum risk of bleeding) and 25.1% (PTT), without this modifying neither the preoperative plan nor the postoperative results. These data are similar to those reported by others, where the percentage of abnormal CTs systematically requested in patients without risk factors for IPH varies between 2.4% and 15.6%, and these results did not change the preoperative plan nor the postoperative evolution.[7-9] This study also evaluated the possibility of abnormal results when CTs were compared to gender and age groups, in which it was observed that patients ≥ 60 years were significantly more likely to have abnormal INR values with maximum risk of bleeding. This finding could be related to the physiological changes characteristic of older people or to statistical biases, due to the small number of patients evaluated with abnormal INR with maximum risk of bleeding.

The reasons for having abnormal CTs are probably the presence of undiagnosed coagulation diseases or factors directly associated to CTs (inadequate calibration, laboratory values of limited comparability, skin temperature or technique used to obtain the sample), since in other publications these factors have been associated to irregularities in the CTS.[10,11]

This study also revealed that patients with abnormal INR and maximum risk of bleeding had significantly longer surgical time and patients with abnormal INR with minimum risk of bleeding had significantly longer hospital stay. These results show that abnormal CTs (specifically INR) can influence surgical time and length of hospital stay[6] although not necessarily for the presence of bleeding. However, these results are not conclusive, because the number of patients with abnormal INR was very low (13 cases) when compared to the bulk of the sample with normal INR (250 cases).

The guidelines of the Committee of the European Society of Anesthesiology (ESA) do not recommend routine request for CTs

unless there are specific risk factors (level of evidence D).[12] Other authors have reached similar conclusions, such as Barrio et al., who concluded that CTs should not be requested without a specific cause,[13] or Eisenberg et al. who did not find differences between PT and PTT values and the risk of IPH.[14] Some studies have even detected a higher percentage of IPH with normal CTs than with abnormal ones.[15] A study carried out in Mexico at the "Gea González" Hospital evaluated the cost of routine preoperative studies, including CTs and they found that the cost required to detect an abnormality in a test is about $ 22,000.00 Mexican Pesos, approximately $ 1,163.00 US dollars (current exchange rate). In addition, they also mentioned a similar number of complications among patients with normal and abnormal preoperative studies.[16] Other series from the National Medical Center in Mérida found that the probability of intraoperative bleeding is not different among patients with normal or abnormal CTs.[17]

In our series we focused only on elective abdominal surgeries (specifically cholecystectomies and hernia repairs) and the results were similar to those described by Trumbull et al., who reported that CTs in elective cholecystectomies provided little preoperative information.[18] These findings have been observed not only in abdominal and adult surgeries, but in other non-abdominal, as well as in pediatric procedures.[19,20]

This study was conducted at the General Hospital of Boca del Rio in Veracruz, Mexico, where approximately 450 CTs are performed each month for various types of elective surgeries. In our institution the cost of such tests (PT, PTT, INR and activation percentage), taking into account only the cost of reagents, is $ 110.00 Mexican pesos or $ 5.82 US dollars (current exchange rate). However, because in many cases CTs are repeated in the same patient and these tests require not only reagents, but laboratory equipment, electrical energy and laboratory personnel, it is possible that the costs per patient are higher.

CONCLUSIONS

Considering the limitations of this study (the retrospective design and the small sample to detect an episode of HPI), we can conclude that it is necessary to implement evidence-based medical regulations for each institution, to avoid practices based on isolated events, but also to recur to legal institutions that support those regulations, since the fear of the legal consequences of not requesting CTs often limits physicians and hospitals to act according to scientific evidence.

In our country routine CTs have become an almost indispensable study prior to elective surgery, this practice does not have a clear justification and should be avoided, especially in countries where resources could be used in areas of greater demand.

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