Predictive factors for reintervention after abdominal surgery

Factores predictivos de reintervención tras cirugía abdominal

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Abstract

Unplanned reintervention (UR) occurs across a broad spectrum of general surgical procedures; and it is considered to be the postoperative complication that confers the highest risk of mortality. As a result, the ability to predict such events can significantly improve the general outcomes of patients. Available evidence concerning risk factors for UR in abdominal surgery is far-reaching but highly segmented. Some risk factors can be applied to many procedures, but others are highly bound to specific procedures. Considering the above, designing a predictive model for all abdominal surgeries is a formidable task. Nevertheless, a general predictive model should be developed to reach as many procedures as possible, and then arranged and segmented to fit specific procedures. This review aims to investigate risk factors associated with UR and available models concerning reoperation decision-making.

Keywords: Unplanned reintervention, postoperative complications, abdominal surgery, predictive factors, postoperative complications.

Resumen

La reintervención quirúrgica no programada (RQNP) ocurre en un amplio espectro de procedimientos quirúrgicos generales; y se considera que es la complicación postoperatoria que confiere mayor riesgo de mortalidad. Como resultado, la capacidad de predecir dichos eventos puede mejorar significativamente los resultados generales de los pacientes. La evidencia disponible sobre los factores de riesgo de RQNP en la cirugía abdominal es amplia pero muy segmentada. Algunos factores de riesgo pueden aplicarse a muchos procedimientos, pero otros están muy ligados a procedimientos específicos. Teniendo en cuenta lo anterior, diseñar un modelo predictivo para todas las cirugías abdominales es una tarea formidable. Sin embargo, se debe desarrollar un modelo predictivo general para llegar a tantos procedimientos como sea posible, y luego organizarlo y segmentarlo para que se ajuste a procedimientos específicos. Esta revisión tiene como objetivo investigar los factores de riesgo asociados con la RQNP y los modelos disponibles relacionados con la toma de decisiones de reintervención.

Palabras clave: Reintervención no planificada, complicaciones postoperatorias, cirugía abdominal, factores predictivos, complicaciones postoperatorias.

An objective approach towards measuring surgical efficacy is the analysis of its complications[1]. For simplicity, complications are defined as a negative outcome that implies an unexpected detrimental situation, failure to cure the underlying disease, and sequelae[2]. A classification was developed and later revised to provide a validated tool to classify complications and objectivize their analysis. This revised "Classification of Surgical Complications" (CSC) contemplates five levels of outcomes, going from harmless at grade I, to death of a patient at grade V[3].

Statistical analyses have shown that grade I complications are expected to be present in nearly 10% of all surgeries, while grade V complications have an incidence of under 2%. It would be expected to find a decreasing trend going from grade I to grade V; however, grade IIIb complications, defined as the need for a new intervention (reintervention), are nearly as frequent as grade I complications, with an incidence of 8% in abdominal surgery[4]. Recent protocols have been implemented to decrease reintervention rates. Nonetheless, reintervention remains a significant burden of increased hospital length of stay, morbidity, and mortality. Evidence shows that mortality following reintervention is significantly higher compared to that of the initial procedure alone[5].

Considering the impact of reinterventions on patients' outcomes, a proper risk assessment must be performed to decrease reintervention rates. Modifiable and unmodifiable risk factors have been described for reintervention in abdominal procedures. Likewise, these risk factors have been segmented into preoperative, intraoperative, and postoperative factors for analysis purposes[6]. Unplanned reintervention (UR) occurs across a broad spectrum of general surgical procedures; however, it has been stated that this complication is more related to the procedure than the patients' variables. As a result, reintervention rates might be a useful quality monitoring tool to identify opportunities for quality improvement[7]. This review aims to investigate risk factors associated with UR and available models concerning reoperation decision-making.

UNPLANNED REINTERVENTION: CAN WE PREDICT IT?

Depending on several variables, UR may occur after almost any surgical procedure. Current evidence suggests that UR rates are highly variable, ranging between 0.8-7%[8]. Evaluating and tracking UR represents an objective path to assessing the quality of surgical procedures. However, data gathering has been proven to improperly identify postsurgical events and lack the precision to isolate underlying factors. Likewise, postsurgical complications are often too procedure-specific, making it difficult to develop a single model that can be used across the heterogeneous range of general surgical procedures[7]. In order to improve surgery outcomes, the physician must be able to predict complications according to the patient's profile. For that reason, it is important to be able to identify relevant predictive factors and apply them accordingly[9].

An investigation by Li et al.[10] performed a retrospective analysis of 3200 patients who underwent general surgery procedures, where the incidence of UR was 4.3%. Likewise, nearly 60% of the UR were classified as a result of an error in surgical technique, and 20% were classified as a result of an error in postoperative management. Furthermore, after multivariate analysis, it was reported that higher initial surgery-related risk, measured by the NNIS score, and surgeries performed outside working hours increased the risk of UR. Similarly, Rama-Maceiras et al.[11] reported an incidence of 3.3% for UR in over 11,000 noncardiac surgical patients. The main indication for UR was postsurgical bleeding and infections. Reoperation of the abdominal cavity was the most prevalent type of UR, compared to other body regions, suggesting that abdominal surgery itself is a predictive factor for UR.

When analyzing surgical procedures, a distinction must be made between elective and emergency surgical procedures, mainly because of their differing nature. Guevara et al.[12] performed a prospective study in the general surgery service of a tertiary hospital between 2007 and 2008. After multivariate analysis, it was reported that patients that underwent emergency surgery had nearly twice the risk of UR compared to elective surgery (Relative risk (RR) 1.79, 95% CI; 1.15-2.78). After adjusting for age, gender, body mass index, American Society of Anesthesiology (ASA) classification, and operation complexity, the risk for UR increased, suggesting that these could also be risk factors to consider.

A more recent investigation further confirmed that patients undergoing emergency surgery had 4.5 times higher risk of needing UR than primarily elective surgeries. Similarly, the incidence of UR was significantly higher in males than in males; however, no logistic regression was performed, so no causality was demonstrated. Moreover, an ASA score ≥3 correlated significantly more with UR than lower scores[13]. Several studies have reported that postsurgical bleeding and infection are the most common indication for reintervention[10,11,14]. As a result, conditions that increase the risk of bleeding and infections should be considered in this matter. Kao et al.[15] reported that bleeding and surgical errors were the most common cause of UR. Along these lines, it was reported that a history of liver disease, smoking, low platelet count in preoperative screening, and adminis-

tration of antiplatelet or anticoagulant drugs before the intervention increased the risk of UR.

Regarding comorbidities, diabetes mellitus (DM) has the most available evidence concerning postoperative complications. It has been previously stated that bleeding and infections are the main indications for reoperation, only followed by surgical errors[11,15]. DM has been independently associated with postoperative complications (odds ratio (OR)= 1.65, 95% CI), especially infections (OR=1.55), wound healing disorders (OR=2.01), and hematomas (1.36). Furthermore, after adjusting for confounders and excluding other postoperative complications, DM was still associated with an overall increase in reoperations (OR=1.56)[16]. It is advised for clinicians to develop strategies in the perioperative period to minimize surgical risks attributed to DM by optimizing glucose control[17].

Since postsurgical complications are highly procedure-specific, available data is usually linked to specific procedures. For example, van Westreenen et al.[18] executed a retrospective analysis of negative outcomes in elective colorectal surgery. According to univariate analysis, ASA class, older age, Charlson comorbidity index, and stage of disease (when cancer was the cause of intervention) were significantly associated with reoperation. Similarly, an observational study reported the factors associated with reoperation rates in colorectal resection patients: Diagnosis of inflammatory bowel disease, multiple comorbidities, male sex, and emergency admission showed the strongest correlation. Likewise, rectal resection was significantly more associated with UR than other anatomical regions[19].

On the other hand, Gangl et al.[20] determined the incidence and associated risk factors of UR after pancreatic resection. It was reported that over 12% of the patients had a UR, making this procedure highly likely to require reintervention compared to other procedures. Bleeding and pancreatic fistula were the main indication for reintervention. However, patient or procedure-related factors did not influence reoperation rates. Another study by Qiu et al.[21] further analyzed pancreatoduodenectomy and reoperation rates. Multivariate analysis showed that DM (OR=3.70; 95 CI), intraoperative blood loss ≥400 mL (OR=4.06; 95 CI), and occurrence of postoperative complications in the form of pancreatoenteric anastomotic leak and postoperative hemorrhage were independent risk factors for UR. Similarly, reoperation in other retroperitoneal procedures has been associated with identical risk factors, like bleeding, intestinal perforation, and wound dehiscence[22].

Lyu et al.[23] analyzed the risk factors associated with UR in hepatectomy procedures. Firstly, right hepatectomy and trisectionectomy had the highest reoperation rates. Furthermore, logistic regression models demonstrated that male sex and ASA class 4 were independent reoperation predictors. Likewise, the reoperation group had higher rates of postoperative transfusions, wound complications, and increased operative duration, but these variables had no predictive power for UR. In addition, Ford et al.[24] analyzed patients undergoing liver transplantation. After multivariate analysis, only obesity showed significant positive predictive power regarding UR (OR= 2, 95% CI). Likewise, obesity was correlated with prolonged operative time, which was previously associated with postoperative complications and, therefore, with UR[25].

While there are predictive scores designed to guide the decision-making of reoperation, these models are only useful in postoperative patients, especially those with complications[26]. These models have been extensively validated and have good predictive power, as demonstrated by statistical analyses[27]. However, no available models consider the possibility of predicting the need for reintervention in patients prior to their first intervention. Some factors like DM and obesity can be applied to a wide range of procedures, but the procedure-specific variations make it difficult to develop a feasible general predictive model[28].

In addition to developing predictive models, evidence suggests that local improvements must be made within the general surgery service. UR can happen virtually in any procedure, but variations in incidence across different regions can be explained by divergence in education and nonadherence to international protocols[7]. One of the most prevalent causes of reoperation is surgical technique errors, accounting for nearly 70% of the cases. However, a well-defined registry is essential to ensure an accurate assessment of the quality of care provided[29]. An extensive amount of evidence has determined that evaluation of postoperative complications, including UR, is the strongest predictor of quality of care, as well as the most objectively measurable factor[8,13,30-35].

Conclusions

Postoperative complications represent a veritable risk concerning any surgical procedure. In most scenarios, this risk is significantly surpassed by the surgery's benefits, making the surgical approach the optimal one. UR is the postoperative complication that confers the highest risk of mortality. As a result, the ability to predict such events can significantly improve the general outcomes of patients. Available evidence concerning risk factors for UR in abdominal surgery is far-reaching but highly segmented. Some risk factors can be applied to many procedures, but other risk factors are highly bound to specific procedures. Considering the above, designing a predictive model for all abdominal surgeries is a formidable task. Neverthe-

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