Progress in the Application of Preoperative Cardiac Risk Assessment in Patients with Non-Cardiac Surgery

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Abstract: Collecting relevant literature in recent five years by means of literature review, To review the application of preoperative cardiac risk assessment in non - cardiac surgery patients. Extract the key parts of each assessment method, And to provide reference for anesthesiologists to do the preoperative cardiac risk assessment more conveniently and quickly.

1. Introduction

With the aging of China's population and the change of living environment, The number of patients requiring non-cardiac surgery is increasing,And the number is increasing year by year, Not like heart surgery,Non-cardiac surgery doesn't monitor heart function directly, There is no timely support for cardiopulmonary bypass too, This is a greater potential risk for patients with cardiovascular disease.And that easy to induce cardiovascular complications[1]. Cardiovascular complications mainly refer to the major adverse events occurring in perioperative period(major adverse cardiac event,MACE), Including perioperative new atrial fibrillation, heart failure and myocardial infarction, The time periods involved are mainly intraoperative and postoperative 30 days[2], In worldwide, About 200 million patients were undergoing major non-cardiac surgery each year, 30 percent of these had cardiovascular disease,The 30 days postoperative mortality was 0.5%-2% ,that the main cause of death was MACE[3]. So accurate preoperative assessment is important for predicting surgical risk, Studies have shown that effective preoperative assessment reduces complications and mortality from anesthesia[4]. Accurate assessment of perioperative cardiovascular risk can better identify high-risk patients. The influence even determines the anesthesiologist's anesthesia management strategies and preparation of contingency plans.In this article,The purpose is to reviewe the methods of preoperative cardiac risk assessment in patients with non-cardiac surgery .

2. Summary of Guidelines for the American Heart Society/American Heart Association (Acc/Aha): Cardiac Risk Classification for Non-Cardiac Surgery

Guidelines stipulate that the high-risk surgery with major adverse cardiovascular events MACE is greater than 5% include aortic and major vascular Surgery, The moderate risk surgery that MACE is between1%-5% include Carotid endarterectomy;Head and neck surgery;Intraperitoneal and intrathoracic surgery;Orthopaedic surgery;Prostate surgery. The low risk surgery that MACE is less-than 1% include Outpatient surgery;Endoscopic surgery;Superficial surgery ;Cataract surgery ;Breast surgery. But,For patients with cardiovascular disease, the risk of MACE increased even with fewer risk factors[5].

3. Preoperative Cardiac Risk Assessment of the European Society of Cardiology (Esc)/European Institute of Anesthesia (Esa) :Assessment of Patient Functional Capacity

The guide is often not used as a tool for individual cardiac risk assessment,It is a supplement to perioperative risk assessment of cardiovascular events,If the patient has a higher risk of MACE,we need to evaluate with FC,When FC≥4METs,Surgery is undergoed without further evaluation.If the

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patient's heart function is poor(FC< 4METs) or unknown, we can carriy out Drug or exercise load test.Based on the trial results, we should consider coronary angiography and revascularization[6].

4. Goldman Index

The model weighted 9 independent predictors of perioperative cardiovascular events,According to the total score,The mode could be divided into I ~ IV 4 grades, In level III and IV,the surgery risk is high, In level IV,the patients can only do first aid surgery, The incidence of PCE from grade I 0 to 5 points was 0.7% ,Cardiogenic mortality was 0.2% , The incidence of PCE from grade II 6 to 12 points was 5% ,Cardiogenic mortality was 2%,The level III was 13-25 points,The incidence of PCE was 11%, Cardiogenic mortality was 2%,When the level IV score ≥25points ,The incidence of PCE was 22%,Cardiogenic mortality was 56%,Its suitable for getting rid of high-risk population[7].

5. Detsky Index

The model mainly includes 8 major projects: Arteria coronaria disease;Pneumonedema;Valvular heart disease; Arhythmia;More than 5 ventricular premature contractions;Poor physique; Age >70 ;Emergency operation.The main end events were Myocardial infarction,Pneumonedema,Cardiac death.The model also classifies the risk of surgery according to the type of surgery,The incidence of PCE in vascular surgery and orthopedic surgery was 13.2%,The Intrathoracic and intraperitoneal surgery was 8.0%,The Head and neck surgery 2.6%,The incidence of PCE in transurethral and prostatectomy was 1.6%,In patients with a score of 0 to 5, the risk probability of PCE occurrence will be lower than the above probability,In patients with a score of more than 10, the risk probability of PCE occurrence would be higher than the above probability,If we need to get the specific PCE risk probability according to the Detsky index score, we can further use the likelihood ratio graph to make the assessment of PCE risk more intuitive[8].

6. The Revised Cardiac Risk Index(Rcri)

The model has good predictive effect, It was widely used as a guide by multiple countries[9-11], It included 6 major PCE-related projects:Ischemic heart disease;Cerebrovascular disease;Congestive heart-failure;Treatment of diabetes with insulin;Serum creatinine levels >177μmol/L and High-risk surgery,Each item give 1 point,The model that monitored end events was Myocardial Infarction;Acute Left Ventricular Failure;Ventricular Fibrillation;Cardiac Arrest;Complete bundle branch block;When the total score was 0,1,2 and≥3, the incidence of PCE was 0.5%,1.3%,3.6% and 9.1% respectively[12]. However, RCRI is mainly applicable to the assessment of PCE risk in non-emergency surgery,But not suitable for emergency surgery[13].

7. Brain Natriuretic Peptide(Bnp)

As an evaluation index of left ventricular systolic dysfunction, BNP can also predict the occurrence of MACE[14], ESC/ESA guidelines recommend BNP monitoring as a preoperative risk assessment for non-cardiac surgery patients, Studies have shown that BNP concentrations >189pg/mL were selected as cutoff points,When Choosing BNP concentration >300pg/mL as high-risk patients,81% of high-risk patients had MACE,The incidence of MACE is 6%[15],BNP also predicts postoperative cardiovascular events,Patients with postoperative detection of BNP ≥245pg/mL had a significantly higher postoperative mortality rate of 30 days and the risk of non-fatal myocardial infarction and heart failure were higher too[16].

8. Other

In addition to the above methods for assessing the incidence of MACE, these methods can also be used to predict, For example: Troponin content; Hemoglobin content ; hematocrit; preoperative C-reactive protein levels ; presepsin levels; and so on. And using NSQIP surgical risk calculator, physiological status and surgical grading to assess mortality and morbidity scoring system, Preoperative score to predict postoperative mortality POSPOM, and Vascular Events In Non-cardiac Surgery Patients cohort Evalution VISION, MICA risk calculator and other tools for risk assessment.

With the development of medicine, The MACE assessment of patients with non-cardiac surgery is becoming more and more perfect, Individual assessment methods need to be selected according to the patient's physical condition, However, the manner of anesthesia and the management of anesthesia during the operation will also affect the final outcome, Therefore, it is necessary to use effective monitoring methods to monitor circulatory function, finding out the change of hemodynamics in time, and dealing with it effectively, so as to avoid and prevent the further deterioration of the patient's condition, reducing the risk of perioperative cardiovascular complications and ensuring the safety and stability of the patient through the perioperative period.

References

[1] Xu Mengqian(2019).An overview of intraoperative circulatory monitoring techniques for non-cardiac surgery in patients with heart disease. Chinese Journal of Thoracic Cardiovascular Surgery.Vol.26, No.10,pp.1026-1030.

[2] SELLERS D,SRINIVAS C,DJAIANI G.(2018).Cardiovascular complications after non-cardiac surgery.Anaesthesia,Vol.73, No.1,pp.34-42.

[3] Cai Bin et al(2019). Cardiac risk factor assessment system for perioperative period of major non-cardiac surgery in patients with cardiovascular disease. International journal of anesthesiology and resuscitation. Vol.40, No.1,pp.58-61.

[4] Wang Xuezhan(2007).Interpretation of digital assessment methods for anesthetic and surgical risk. Journal of Clinical Anesthesiology,Vol.23, No.11,pp.947-949.

[5] Xiong Lize, Deng Xiaoming(2017). China anesthesiology guide and expert consensus 2017 edition. People's Health Publishing House,Vol.11, No.1,pp.1-350.

[6] Lu Chengzhi(2017).Perioperative cardiovascular risk assessment and management in noncardiac surgery patients. Electronic Journal of Practical Organ Transplantation,Vol.5, No.4,pp.363.

[7] Ridley S(2015).Cardiac scoring systems--what is their value.Anaesthesia,Vol.58, No.10,pp.985-991.

[8] Zhao Menglin, Zu Lingyun, Gao Wei.(2019).Advances in perioperative cardiovascular event risk prediction models for noncardiac surgery, Chinese Journal of Frontiers in Medicine (Electronic Edition),Vol.11, No.3,pp.14-18.

[9] Duceppe E, Parlow J, MacDonald P, et al(2017). Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery. Can J Cardiol, Vol.33, No.1,pp.17-32.

[10] Kyo S, Imanaka K, Masuda M, et al(2017).Guidelines for Perioperative Cardiovascular Evaluation and Management for Noncardiac Surgery (JCS 2014). Circ J, Vol.81, NO.2,pp.245-267.

[11] Ranc N, Palin-Luc T, Paris PC, et al(2014).2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery: Executive Summary. J Am Coll Cardiol, Vol.64, NO.22,pp.2373-2405.

[12] Lee TH, Marcantonio ER, Mangione CM, et al(1999).Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. Circulation, Vol.100, NO.10,pp.1043-1049.

[13] Biccard B(2015).Proposed Research Plan for the Derivation of a New Cardiac Risk Index. Anesth Analg, Vol.120,No.3,pp.543-553.

[14] Rodseth RN,Biccard BM,le Manach Y,et al(2014).The prognostic value of pre-operative and post-operative B-type natriuretic peptides in patients undergoing noncardiac surgery: B-type natriuretic peptide and N-terminal fragment of pro-Btype natriuretic peptide: a systematic review and individual patient data meta-analysis.J Am Coll Cardiol,Vol.63,No.2,pp.170-180.

[15] Goldman L,Caldera DL,Nussbaum SR,et al(1977). Multifactorial index of cardiac risk in noncardiac surgical procedures. N Engl J Med,Vol.297, NO.16,pp. 845- 850.

[16] Wang Hongyan, Ding Wengang(2019). Type B natriuretic peptide predicts cardiovascular events in patients with noncardiac surgery. Progress in Cardiovascular Diseases,Vol.40, NO.2,pp.219-221.