J Surg Med. 2023;7(2):165-169.
DOI: 10.28982/josam.7720

Research article

Journal of Surgery and Medicine
e-ISSN: 2602-2079
https://jsurgmed.com/

Preoperative advanced cardiology evaluation in adult non-cardiac surgery: A retrospective cohort study

Fatih Şimşek, Ela Erten

Department of Anesthesiology and Reanimation, Gulhane Training and Research Hospital, University of Health Sciences, Ankara, Turkey

ORCID ID of the author(s)
FŞ: 0000-0002-8774-2861
EE: 0000-0003-2820-5625

Corresponding Author
Fatih Simsek
Department of Anesthesiology and Reanimation, Gulhane Training and Research Hospital, 06010, Ankara, Turkey
E-mail: drfatihsimsek@gmail.com

Ethics Committee Approval
The study was approved by the University of Health Sciences Turkey, Gülhane Non-interventional Clinical Researches Ethics Committee (Project No: 2023/24, Date: 17.01.2023).
All procedures in this study involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments.

Conflict of Interest
No conflict of interest was declared by the authors.

Financial Disclosure
The authors declared that this study has received no financial support.

Published
2023 February 20

Abstract

Background/Aim: Advanced cardiology evaluation (ACE) is the most frequently requested consultation during preoperative medical evaluations (PMEs) performed in anesthesia outpatient clinics. However, the efficacy and results of this ACE request are unclear. We aimed to show the frequency of ACE requested during PME of patients undergoing non-cardiac surgery (NCS) and its effect on diagnosis, treatment process, and surgical time planning.

Methods: This is a single-center, retrospective cohort study of 300 patients aged 18 years and older who need ACE. Medical charts were reviewed for patient characteristics and diagnosis, planned surgery type, surgical intervention risk, revised cardiac risk index (RCRI), other consultation records, cardiology consultation indication, risk group determined by the cardiologist, metabolic equivalent (METs), and anticoagulant use were recorded.

Results: We analyzed the data of 300 patients for whom ACE was requested from 9825 patients who underwent PME. The mean age was 66 (12) years, and the most common age range was 60–79 years (62.7%). The proportion of patients with METs ≤4 was 11% (n=33). The most common additional consultation was chest disease (10%), and the most common co-morbidity was hypertension (61.6%). The most common reason for consultation was a history of ischemic heart disease (50%). According to the revised cardiac risk index, most patients were in class 2, while according to the cardiology consultation outcome grade, most patients were in the intermediate risk group. It was observed that the cardiology consultation process was mostly completed on the same day (255 patients, 85%), and the use of anticoagulant drugs was mostly left to the individual evaluation of the surgeon (143 patients, 47.7%).

Conclusion: PME should be given due care to prevent perioperative cardiac complications in patients undergoing NCS. More careful patient assessments are needed during ACEs. This would allow for more accurate risk stratifications and, if necessary, the ordering of additional testing.

Keywords: cardiac patient, perioperative risk, preoperative evaluation, cardiology consultation

How to cite: Şimşek F, Erten E. Preoperative advanced cardiology evaluation in adult non-cardiac surgery: A retrospective cohort study. J Surg Med. 2023;7(2):165-169.

Introduction

Preoperative medical assessment (PMA) aims to identify patient- and procedure-specific risks and optimize medical care before the procedure. Medical history, a physical examination, and personalized laboratory tests can be used to reveal preoperative risks [1]. However, some patients may require further examination and evaluation depending on variables such as co-morbidities, symptoms, and the type of surgical procedure. These patients can be consulted by the relevant clinical branches as needed. The cardiac assessment of patients scheduled for non-cardiac surgery (NCS) who have cardiac complaints and/or symptoms constitutes the largest part of these consultations [2].

Cardiovascular complications account for approximately 50% of perioperative deaths in non-cardiac surgery patients [3]. Most of the patients who develop complications have a disease of the cardiovascular system. Cardiologists examine patients at risk, and preoperative cardiac optimization is provided. The risk of cardiac complications in NCS is determined according to classifications, such as the revised cardiac risk index (RCRI) [4]. Moreover, additional drug treatments (e.g., beta-blockers) can be started for those with indications. Following the cardiology consultation recommendations may reduce perioperative morbidity and mortality [5].

Our study aims to show the frequency of cardiology consultations in PMA, further examination requirements, and their effect on the diagnosis, treatment process, and surgical time planning in patients with planned NCS.

Materials and methods

This is a single-center, retrospective cohort study of patients referred for cardiology consultation during preoperative medical evaluation at Ankara Health Sciences University Gülhane Training and Research Hospital Anesthesiology outpatient clinic between July 2022 and December 2022. Our study was approved by the University of Health Sciences Turkey, Gülhane Non-interventional Clinical Researches Ethics Committee (Project No: 2023/24, Date: 17.01.2023) and conducted following the ethical principles stated in the Declaration of Helsinki. As the study is retrospective, no voluntary informed consent was obtained from the patients. In our hospital, all patients ≥18 years scheduled for elective non-cardiac surgery are assessed by an anesthesiologist for the anesthesia approval process. The Anesthesia Practice Guidelines for Preoperative Assessment of the Turkish Anesthesiology and Reanimation Society (TARS) are used for the preoperative medical assessment [6]. The anesthesiologist included only the patients whose cardiology consultation requests after the preoperative anesthesia examination. A total of 9825 patients were screened preoperatively during the 6 months. It was determined that 300 patients were referred to the cardiology clinic for further cardiac evaluation and were included in this study.

In the anesthesia outpatient clinic, the basic characteristics of each patient are recorded after anamnesis, physical examination, and laboratory examination control. Patients who need additional consultation after the examination are referred to the relevant clinics. The Revised Cardiac Risk Index is routinely calculated for each patient requiring further cardiac evaluation in the anesthesia outpatient clinic [7]. In our study, age (year), gender (female/male), height (cm), weight (kg), body mass index (BMI) (kg/m^2), American Society of Anesthesiologists (ASA) physical score (I/II/III/IV), diagnosis and planned surgery type, surgical intervention risk (low/moderate/high), RCRI (class I/II/III/IV), and other non-cardiology consultation records of the patients were reviewed. Cardiology consultation indication, risk group determined by the cardiologist (low/low-moderate/moderate/medium-high/high), functional metabolic equivalent (MET) value (below 4/above 4), and anticoagulant use were recorded. The number of days the cardiology consultation request delayed the anesthesia approval process, and the recommendations after the assessment were recorded.

Statistical analysis

Data were analyzed with the SPSS (Statistical Package for Social Science) 25.0 software. All data were categorized. Categorical data were presented using numbers (n) and percentages (%). No group comparisons were made in the single cohort sample. Additional recommendations were presented using a bar chart.

Results

The data of 9825 patients who applied to the anesthesia outpatient clinic for PMA in 6 months between July 2022 and December 2022 were analyzed retrospectively. The data of 300 patients, who were requested an ACA, were analyzed. More than half (55%) of the patients were male, and 45% were female. The mean patient age was 66 (12) years, the most common age range was 60–79 years old (62.7%), and the least common age range was less than 40 years old (3%). While the ASA2 patients (n=139, 46.3%) constituted the majority of the patients in the ASA physical status classification, the rate of patients below 4 METs was 11% (n=33) (Table 1).

Table 1: Distribution of gender, age, ASA Physical status and functional capacity classifications of patients for whom cardiology consultation was requested (n=300)

	Number of patients n (%)
Gender	
Female	135 (45)
Male	165 (55)
Age distribution	
<40	9 (3)
40-59	65 (21.7)
60-79	188 (62.7)
>79	38 (12.7)
ASA physical status	
ASA I	17 (5.6)
ASA II	139 (46.3)
ASA III	127 (42.3)
ASA IV	17 (5.6)
Functional capacity	
≤4 METs	33 (11)
>4 METs	267 (89)

ASA: American Society of Anesthesiologists, METs: Metabolic Equivalents

In addition to cardiology consultations, the most frequently requested consultations were in chest diseases, endocrinology, and nephrology (10%, 7.3%, and 3.7%), respectively (Table 2). Besides the ischemic heart disease history of the patients, the most common co-morbidities were hypertension, diabetes mellitus, and COPD (61.6%, 46%, and 36%), respectively (Table 3).

Table 2: Distribution of consultations requested from other clinics (n=300)

Clinic name	Number of patients n (%)
None	223 (74.3)
Pulmonology	30 (10)
Endocrinology	22 (7.3)
Nephrology	11 (3.7)
Hematology-Oncology	4 (1.3)
Neurology	4 (1.3)
Infectious Diseases	3 (1)
Rheumatology	2 (0.6)
Cardiovascular Surgery	2 (0.6)
Head and Neck Surgery	2 (0.6)
Psychiatry	1 (0.3)
Neurosurgery	1 (0.3)

Table 3: Distribution of additional diseases of patients (n=300)

Name of disease	Number of patients n (%)
Hypertension	185 (61.6)
Ischemic Heart Disease	138 (46)
Diabetes Mellitus	108 (36)
CABG	39 (13)
Atrial Fibrillation	35 (11.6)
None	31 (10.3)
COPD	24 (8)
Heart failure	24 (8)
Hypothyroid	15 (5)
Bronchial Asthma	13 (4.3)
Chronic Kidney Disease	12 (4)
SVE	10 (3.3)
Cardiac Valve Replacement	10 (3.3)
Non-AF Arrhythmia	7 (2.3)
ICD	6 (2)
Cardiac Valve Failure	5 (1.6)
Parkinson's Disease	3 (1)
Aortic Aneurysm	2 (0,6)

CABG: Coronary Artery Bypass Grafting, COPD: Chronic Obstructive Pulmonary Disease, SVE: Cerebrovascular Events, AF: Atrial Fibrillation, ICD: Implantable Cardioverter Defibrillator

According to the risk classification of the patients by the type of surgery, 147 (49%) low-risk, 130 (43.3) medium-risk, and 23 (7.66) high-risk surgeries were planned. When the distribution of surgical procedures was examined, gastroenterological endoscopic procedures were the most common, with 67 (22.3%) patients, followed by cataract surgeries (14.3%) and inguinal hernia operations (6%) in third place (Table 4). According to the consultation indications, the history of ischemic heart disease was the most common cause of request in 150 (50%) patients, followed by general evaluation in 52 (17.3%) patients, and non-AF ECG changes in 39 (13%) patients (Table 5).

According to the RCRI calculated in the anesthesia outpatient clinic, most patients were in class 2 with 107 patients, while the least number of patients were in class 4 with 34. According to the post-examination risk assessment by cardiology physicians, the highest number of patients were in the medium-risk group, with 129 patients, while the least number of patients were in the high-risk group, with 6 patients (Table 6).

Table 4: Surgical risk estimation by type of surgical intervention and distribution of surgical procedures (n=300)

	Number of patients n (%)
Surgical risk estimation by type of surgical intervention	
Low Risk: < 1%	147 (49)
Intermediate Risk: 1–5%	130 (43.3)
High Risk: > 5%	23 (7.66)
Surgical Procedure Name	
Endoscopy-Colonoscopy-ERCP	67 (22.3)
Cataract Surgery	43 (14.3)
Herniography	18 (6)
TUR-P Cystoscopy	18 (6)
Amputation Surgery	16 (5.3)
Others	14 (4.6)
Kidney Stone Surgery	11 (3.6)
Excision-Biopsy	10 (3.3)
TAH-BSO- Myomectomy - Ovarian Cystectomy	10 (3.3)
Cholecystectomy	8 (2.6)
Thoracotomy -VATS	7 (2.3)
LDH-CDH	7 (2.3)
Anal Fissure-Fistula-Hemorrhoidectomy	6 (2)
Carpal Tunnel Syndrome.	6 (2)
Posterior Stabilization	6 (2)
Thyroidectomy	6 (2)
TOT-Adnexal Masses- Hysteroscopy	6 (2)
Unspecified	5 (1.6)
EBUS	5 (1.6)
TKA	5 (1.6)
Nephrectomy	5 (1.6)
Rhinoplasty-Septoplasty	5 (1.6)
Liver RF	4 (1.3)
Colon-Rectum CA	4 (1.3)
EVLA	3 (1)
Eye Surgery	2 (0.6)
Over CA	2 (0.6)

ERCP: Endoscopic Retrograde Cholangio Pancreatography, TUR-P: Transurethral resection of the prostate, TAH-BSO: Total abdominal hysterectomy and bilateral salpingo-oophorectomy, VATS: Video-Assisted Thoracic Surgery, LDH: Lumbar Disk Hernia, CDH: Cervical Disk Hernia, EBUS: Endobronchial Ultrasonography, TKA: Total Knee Arthroplasty, RF: Radio-Frequency, CA: Cancer, EVLA: Endovenous Laser Ablation

Table 5. Distribution of cardiology consultation reasons (n=300)

Cardiology consultation reasons	Number of patients n (%)
History of ischemic heart disease	150 (50)
General evaluation	52 (17.3)
ECG changes (non-AF arrhythmias)	39 (13)
Atrial fibrillation	26 (8.6)
Valve abnormality	17 (5.6)
Dyspnea	9 (3)
Angina pectoris	4 (1.3)
Additional disease (HT)	3 (1)

ECG: Electrocardiogram, AF: Atrial Fibrillation, HT: Hypertension

Table 6: Distribution of cardiology consultation results and revised cardiac risk index classification

		Revised Cardiac Risk Index Classification n (%)			
		Class 1	**Class 2**	**Class 3**	**Class 4**
Cardiology consultation result risk assessment (n)	**Low Risk (44)**	29 (39.7)	13 (12.1)	1 (1.2)	1 (2.9)
	Low-Intermediate Risk (88)	29 (40.2)	34 (31.8)	22 (25.5)	3 (8.8)
	Intermediate Risk (129)	14 (19.2)	53 (49.5)	52 (60.4)	10 (29.4)
	Intermediate-High Risk (33)	1 (1.4)	7 (6.5)	8 (9.3)	17 (50)
	High Risk (6)	0 (0)	0 (0)	3 (3.5)	3 (8.8)
	Total (300)	n=73 (100)	n=107 (100)	n=86 (100)	n=34 (100)

In cardiology consultation requests, it was determined that the consultations of 255 patients (85%) were completed on the same day, while the operations of nine patients (3%) were delayed due to cardiological reasons (Table 7). The most common reason for the delay in cardiology consultations that could not be completed on the same day was echocardiography in 24 patients, MPS in six patients, CAG in four patients, CT-angiography in three patients, and an exertion test in two patients.

It was observed that in patients with a history of anticoagulant and antiplatelet drug use, the drug management process was left to the discretion of the surgeon in 143 patients; it was decided to continue in 28 patients, it was recommended to interrupt it directly and start after the procedure in 23 patients,

and it was decided to apply bridge therapy in 22 patients (Table 7). It was found that five intraoperative and nine postoperative cardiology consultation requests were made from the 300 patients included in the evaluation (Table 8).

Table 7: Distribution of cardiology consultation results (n=300)

	Number of patients n (%)
Consultation time	
Ended the same day	255 (85)
Ended after 1 day	5 (1.7)
Ended in more than 1 day	31 (10.3)
Surgery delayed	9 (3)
Anticoagulant, antiplatelet drug usage recommendations	
Surgeon's decision (bleeding thrombosis balance)	143 (47.7)
It is recommended to stop	23 (7.7)
Definitely recommended to continue	28 (9.3)
Bridge Therapy recommended	22 (7.3)
Not using	84 (28)

Table 8: Distribution of intraoperative cardiac events and postoperative cardiological procedures (n=300)

	Number of patients n (%)
Intraoperative cardiac events	
None	295 (98.3)
Uncontrolled hypertension	4 (1.3)
AF with rapid ventricular response	1 (0.3)
Postoperative cardiological procedures	
None	290 (96.7)
Anticoagulant was started	4 (1.3)
Antihypertensive was started	5 (1.7)
CABG was applied	1 (0.3)

AF: Atrial Fibrillation, CABG: Coronary Artery Bypass Grafting

Discussion

Our study evaluated patients who needed advanced cardiac assessment during PMA for NCS. We found that a cardiology consultation was requested for 3.05% of the patients who applied to the anesthesia outpatient clinic. We found that further examinations and treatment were needed in 16.6% of these patients and that decisions on postponing procedures were made in 3% for cardiac reasons. While the ACA process in our hospital was mostly completed on the same day, we found that around 15% of assessments lasted more than 1 day. We believe that the requested ACA process in PMA has a minimal effect on the timing of pre-planned surgical procedures.

The mean age of the population is increasing due to improved living conditions and medical treatments. Age alone is not a risk factor for cardiological complications that may develop in the perioperative period.. However, it can be considered a risk factor along with concomitant diseases, such as hypertension, diabetes mellitus, and coronary artery disease, the incidence of which increases with advanced age [8]. The rate of undergoing surgery increases with age [9]. This increase in additional diseases and surgeries also increases the risk of morbidity and mortality, which requires more careful preoperative preparation and advanced assessment. Gündüz et al. [1] showed that ACA rates increase with age in NCS. Similarly, we found that co-morbidities, cardiac risk factors, and preoperative ACA rates increased with age.

Gender is another factor in cardiac assessment; males are at increased risk of cardiac diseases. Carrol et al. [10] showed that 19% of men and 12% of women had cardiovascular disease. Our study found that the rate of ACA was higher in males (accounting for 55%) than in females.

A preoperative medical assessment is performed to ensure that the surgical process is completed under the best conditions by choosing the most accurate anesthesia method with the fewest complications. At this stage, patients are thoroughly assessed with anamnesis, physical examination, laboratory testing, and imaging. If necessary, consultation from other clinics can be requested. ACA is the most frequently requested consultation [8]. In our study, ACA was the most frequently requested consultation, with a rate of 3.05%.

Unnecessary consultations cause loss of labor and time. That the dates for surgical procedures are planned far in advance adds to the importance of these losses. Katz et al. [11] found that few consultation outcome notes affect perioperative patient management. Our study found that the procedure was delayed in only nine patients due to ACA. Additionally, we found that the process was prolonged for more than 1 day in 31 (10.3%) patients due to additional examination and treatment. To minimize these losses, we believe that consultations should be requested according to certain guidelines and risk assessment scales [12].

The most common cause of mortality during the perioperative period in non-cardiac surgeries is complications of cardiac origin [9]. Factors such as age, gender, co-morbidity, and the urgency of the procedure play a role in triggering cardiac complications. The oxygen requirement of the myocardium increases with the addition of factors such as blood loss, hypotension, and tachycardia in the perioperative period [13]. Adding this to the coagulation system further increases the cardiovascular system's burden. The type and duration of surgery directly affect all these changes [14]. Some classifications predict surgical risks according to the type of surgical intervention. In our outpatient clinic, we use the classification that includes three risk groups (low, medium, and high) to predict the surgical risk according to the type of surgical intervention [6]. According to this classification, we determined that among the 300 patients, 147 (49%) were planned for low-risk surgery, 130 (43.3%) were planned for medium-risk surgery, and 23 (7.66%) were planned for high-risk surgery. The most frequently planned surgical procedure was a gastroenterological endoscopic procedure with 67 patients. The type of surgical intervention must be considered when requesting an ACA in PMA. We believe a routine surgical risk estimation classification according to the type of surgical intervention should be used to establish a standard.

The preoperative medical assessment is the phase in which co-morbidities, history of medication use, and functional capacity are determined through anamnesis and physical examination and surgical and anesthesia histories are assessed. Functional capacity is an index used in clinical practice and is assessed quantitatively with MET. The MET value is calculated based on the approximate value obtained from the answers to the questions asked to the patient. A value of >7 MET is a good prognosis indicator, 4–7 MET is a moderate prognosis indicator, and ≤4 MET is a poor prognosis indicator [8]. The patient's inability to climb two flights of stairs or run a short distance is one of the indicators of insufficient functional capacity. The likelihood of a perioperative cardiac event increases significantly in patients with MET ≤4 [15]. In our study, the MET value was ≤4 in 33 patients. According to the cardiology consultation score, a significant number of these patients were in the high-risk

group. Accordingly, we believe a low MET value is important for showing the possibility of perioperative cardiac events.

Various risk scores are used in the preoperative risk assessment of patients with cardiac disease. One is the RCRI classification of the American College of Cardiology/American Heart Association [7]. This classification assesses six factors: high-risk surgery, ischemic heart disease history, congestive heart failure, cerebrovascular event history, preoperative insulin use, and a preoperative creatinine value of >2 mg/dL [4]. Using these six factors, one of the four risk classes is determined. Class 1 indicates the lowest-risk class, and class 4 indicates the highest. Hulme et al. [7] examined the 90-day mortality rates of patients undergoing colon cancer surgery and found that the mortality rates increased with the increase in class, according to RCRI. Our study examined the RCRI values of 300 patients who underwent an ACA. According to the RCRI, 73 (24.3%) of patients were in class 1, 107 (35.6%) of patients were in class 2, 86 (28.6%) of patients were in class 3, and 34 (11.3%) of patients were in the class 4 risk group. We believe that the RCRI class should be determined in the PMA and that ACA should be requested in high-risk patients.

Cardiologists determine a patient's risk class due to the examination and any additional examinations they perform on patients scheduled for surgery. Using Lee's risk scoring, they often use classification with low, low-medium, medium, medium-high, and high groups [16]. The type of surgery, gender, age, co-morbidities, and risk score values are very important in recognizing perioperative cardiac events. Lee et al. [4] reported a 2.1% risk of MI and death in patients undergoing major NCS. According to the ACA results for the 300 patients we examined in our study, 44 patients were in the low-moderate risk category, 88 patients were in the low-moderate category, 129 patients were in the medium-high category, 33 patients were in the medium-high category, and six patients were in the high-risk category. It is seen that the majority of patients were in the moderate-risk group, and most of these patients were in classes 2 or 3 based on their RCRI.

One of the requests in the ACA for patients with a history of cardiological disease is a history of anticoagulant and antithrombotic drug use. Since hemorrhagic complications will increase in the perioperative period, these treatments are usually interrupted. Additionally, considering the severity of the cardiological disorder, the type and duration of the surgical procedure, and the type/amount of medication used, the medication can be continued according to the benefit/harm ratio [14]. Some patients switch to low molecular weight or non-fractionated heparin and return to drug treatment after surgery [17]. Our study recommended discontinuing anticoagulant therapy in 22 (7.3%) patients and switching to low molecular weight heparin. Moreover, the decision to discontinue the drug was left to the surgeon performing the procedure based on a benefit/harm ratio according to the procedure performed in 143 (47.7%) patients.

Limitations

There are some limitations of this study. The retrospective design of the study can be considered the first limitation. The study could be repeated prospectively. Another limitation of our study is that it is single-centered. The small sample size can also be considered a limitation. Therefore, the results may need further validated by a larger sample size test. Since our institution is a university hospital, the high number of doctors working in the anesthesia polyclinic may be one of the limitations. Also, due to the nature of our study, no firm conclusions can be drawn as to whether preoperative consultation should be omitted.

Conclusion

As a result, the contribution of the correct indications during PMA and requested consultations to perioperative processes is significant. However, unnecessary consultations cause serious loss of labor and time. Before requesting a consultation, attention should be given to preoperative risk stratification and perioperative medical management strategies. This requires good communication and teamwork between the anesthesiologist, surgeon, and consultant physician during the PMA process. More comprehensive multicenter studies are needed to reduce unnecessary consultations and costs that do not contribute to medical management.

References

1. Gündüz E, Coşkun FN, Arıcı G, Akbaş M. Effectiveness of preoperative cardiac assessment methods in patients with non-heart surgery. Akdeniz Med J. 2019;119(1):92–9.
2. Groot MW, Spronk A, Hoeks SE, Stolker RJ, Van Lier F. The preoperative cardiology consultation: Indications and risk modification. Netherlands Hear J. 2017;25(11):629–33.
3. Yıldız ŞB, Gürsoy MO. Kalp dışı cerrahi girişim uygulanacak kalp hastalarında preoperatif değerlendirme. Koşuyolu Hear J. 2015;18(1):39–44.
4. Lee TH, Marcantonio ER, Mangione CM, Thomas EJ, Carisi A, Cook EF, et al. Prediction of cardiac risk of major non-cardiac surgery. Circulation. 1999;100(10):1043-9.
5. Zambouri A. Preoperative evaluation and preparation for anesthesia and surgery. Hippokratia. 2007;11(1):13–21.
6. Preoperative Evaluation (2015). Turkish Society of Anesthesiology and Reanimation Anesthesia Practice Guidelines. https://www.tard.org.tr/assets/kilavuz/preoperatifdegerlendirme.
7. Hulme RA, Forssten MP, Pourlotfi A, Cao Y, Bass GA, Matthiessen P, et al. The Association Between Revised Cardiac Risk Index and Postoperative Mortality Following Elective Colon Cancer Surgery: A Retrospective Nationwide Cohort Study. Scand J Surg. 2022;111(1):14-21.
8. Doğu H, Doğu D. Nonkardiyak preicerrahi uygulanacak kardiyak hastalardaki peri operatif risk faktörlerinin belirlenmesi. Kartal Eğit ve Araşt Hast Tıp Derg. 2001;12(3):120-5.
9. Naughton C, Feneck RO. The impact of age on 6-month survival in patients with cardiovascular risk factors undergoing elective non-cardiac surgery. Int J Clin Pract. 2007;61(5):768-76.
10. Carroll K, Majeed A, Firth C, Gray J. Prevalence and management of coronary heart disease in primary care : population-based cross-sectional study using a disease register. J Public Health Med. 2003;25(1):29-35.
11. Katz RI, Cimino L, Vitkun SA. Preoperative medical consultations: impact on perioperative management and surgical outcome. Can J Anaesth. 2005;52(7):697-702.
12. Poldermans D, Bax JJ, Boersma E, De Hert S, Eeckhout E, Fowkes G, et al. Guidelines for preoperative cardiac risk assessment and perioperative cardiac management in non-cardiac surgery: the Task Force for Preoperative Cardiac Risk Assessment and Perioperative Cardiac Management in Non-cardiac Surgery of the European Society of Cardiology (ESC) and endorsed by the European Society of Anaesthesiology (ESA). Eur J Anaesthesiol. 2010;27(2):92-137.
13. Maggio C, Bonzano A, Conte E, Libertucci D, Panarelli M, Bobbio M, et al. Preoperative evaluation in non-cardiac surgery: Cardiac risk assessment. Int J Qual Heal Care. 1992;4(3):217–24.
14. Gündüz E. Kalp dışı cerrahide kardiyak hastaların preoperatif değerlendirilmesi [dissertation]. Akdeniz University Faculty of Medicine, Antalya; 2011.
15. Mendes DA, Silva da I, Ramires V, Reichert F, Martins R, Ferreira R, et al. Metabolic equivalent of task (METs) thresholds as an indicator of physical activity intensity. PLoS One. 2018;13(7):1–10.
16. Fleisher LA, Fleischmann KE, Auerbach AD, Barnason SA, Beckman JA, Bozkurt B, et al. Perioperative beta blockade in non-cardiac surgery: a systematic review for the 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing non-cardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. Circulation. 2014;130(24):278-333.
17. Santangelo G, Faggiano A, Toriello F, Carugo S, Natalini G, Bursi F, et al. Risk of cardiovascular complications during non-cardiac surgery and preoperative cardiac evaluation. Trends Cardiovasc Med. 2022;32(5):271-84.

The National Library of Medicine (NLM) citation style guide has been used in this paper.