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Intraoperative and postoperative arrhythmias in patients undergoing non-cardiac surgery

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Διεγχειρητικές και μετεγχειρητικές αρρυθμίες σε ασθενείς υποβαλλόμενους σε μη καρδιοχειρουργικές επεμβάσεις

Abstract at the end of the article

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Introduction: Frequency of arrhythmias and especially postoperative atrial fibrillation (AF) in non-cardiothoracic surgeries is lower compared to cardiothoracic ones, ranging from 12%-19% after abdominal surgery and reaching up to 4.8% after total joint replacement. Postoperative AF develops between the 1st and 4th day after surgery and often limits patients' recovery.

The **aim** of this study was to assess the frequency and type of arrhythmia in patients undergoing gastrointestinal and orthopedic surgery.

Material and Methods: In the present cross-sectional study were enrolled 151 patients undergoing gastrointestinal and orthopedic surgery in a provincial hospital. Data were collected using the method of interview as well as were retrieved from patients' medical records and files. The significance level was set at 0.05.

Results: From 151 participants, 60% were women, 67.3% were aged>65 years, 52.7% underwent gastrointestinal surgery and 47.3% orthopedic. Regarding comorbidity, arterial hypertension was reported by 85.1%, diabetes mellitus by 27.3%, AF/other arrythmia by 26.5%, dyslipidemia by 38.8% and heart failure by7.4%. Smokers were 23.3% of participants, alcohol was consumed by 15.3% while 56.5% used to drink Greek coffee. During hospitalization arrythmia was observed in 29.3% of participants while at admission 26.5% declared AF /other arrythmia. Postoperative complications and AF were more frequent in patients aged >80 years ($p<0.001$), ($p=0.012$) respectively, patients who underwent orthopedic surgery ($p=0.001$), ($p=0.007$) respectively, those receiving anticoagulants agents ($p<0.001$), ($p=0.004$) respectively, and participants reporting a cardiac disease in their medical history ($p=0.058$), ($p=0.008$), respectively.

Conclusions: Postoperative complications and postoperative AF were

associated with age, surgery type, anticoagulants agents and medical history of cardiac disease. Prevention and treatment of both arrhythmias and complications associated with surgery requires detailed preoperative, intraoperative, and postoperative monitoring.

Key words: *Non-cardiac surgery patients, postoperative complications, arrhythmias, atrial fibrillation*

Introduction

The number of major surgical procedures performed on a global scale annually exceeds 300 million cases with the substantial majority of 85% to refer to non-cardiac surgeries.[1]

Arrhythmias are encountered postoperatively after a non-cardiac surgery.[2,3] Postoperative atrial fibrillation (POAF) is the most common arrhythmia in noncardiac surgeries which usually occurs in the first 48 hours after the procedure.[4] In perioperative period, atrial fibrillation (AF) is fluctuating from 1% to 40%[5] or from 2% to 60%.[6] This variance is mainly attributed to patients' characteristics, (age, comorbidity, presence of structural heart disease, comorbidities), type of surgery performed and inclusion or not of pre-existing AF.[5,7,8]

POAF is associated with adverse outcomes and an increased long-term risk of ischemic stroke among patients following noncardiac surgery.[5,6] More in detail, is associated with an increased 30-day and 1-year risk of stroke after noncardiac surgery. Likewise, POAF is associated with an increased risk of myocardial infarction and 30-day mortality.[4] Furthermore, POAF is associated with in-hospital morbidity, mortality, and length of hospital stay.[7] Predictors of POAF that follow non-cardiac procedures are the advanced age, male gender, colonic resections, fluid and electrolyte disorders and history of heart failure.[9]

Given the large number of non-cardiac surgeries performed in every country annually, along with patients' age which is steadily rising, POAF frequency is expected to increase over time.[5,10] Though occurrence and management of POAF after cardiac surgery are well documented, however data on arrythmias after noncardiac surgery is limited.

The purpose of the study was to assess the frequency and type of arrhythmia in patients undergoing gastrointestinal and orthopedic surgery.

Material and methods

Setting, and Period of the Study

In the present cross-sectional study were enrolled 151 individuals who underwent gastrointestinal and orthopedic surgery in a provincial hospital, from October 2021 to September 2022. Participants were selected using the method of convenience sampling.

Inclusion and Exclusion Criteria of the Sample

Criteria for inclusion in the study were as follows, patients who: i) underwent non-cardiac surgery and ii) underwent gastrointestinal and orthopedic surgery.

Data Collection and Procedure

Data were collected using the method of interview as well as were retrieved from patients' medical records and files. The process of filling out each questionnaire lasted approximately from 15 and 30 min.

Research instrument

All variables were recorded on a form designed according to purposes of the study. The independent variables were the demographic and clinical characteristics of the sample while the dependent variables were the arrhythmia and the patient outcome.

Ethical considerations

Written, informed consent for participation, was obtained from all patients after providing elaborate explanation for the purpose of the study. Participation in the study was on a voluntary basis, and anonymity was preserved. Furthermore, all participants were informed of their right to refuse or to discontinue their participation, according to the ethical standards of the Helsinki Declaration in 1983. The study was approved by the Medical Research Ethics Committee of the hospital.

Statistical analysis

Descriptive and statistical analysis were used to analyze the data. The first type aimed to describe the variables under study and the second to determine the association between the variables. Categorical data are

presented with absolute and relative (%) frequencies. The x2-test statistical test was applied and the significance level was set at 0.05. The data were analyzed with the SPSS statistical package (version 25.0).

Results

Descriptive Results

In the present study were enrolled 151 patients who underwent gastrointestinal (n=79, 52.7%) and orthopedic procedures (n=71, 47.3%). From the total sample the majority (60%) were women.

In terms of age, the majority (35.3%) were aged 65 to 79 years old.

With respect to type of admission, in 55.3% was an emergency admission.

Moreover, 80% of participants received medication before hospital admission. The category of medication is observed in Table 1.

Regarding comorbidity, arterial hypertension was reported by 85.1%, diabetes mellitus by 27.3%, atrial fibrillation/other arrythmia by 26.5%, dyslipidemia by38.8% and heart failure by7.4%.

Smokers were 23.3% of the sample, of whom 42.8% smoked more than 21 cigarettes per day. Alcohol was consumed by 15.3% while 56.5% used to drink Greek coffee.

With respect to cardiac disease, 14% had a history of cardiac disease, 8.7% heart failure and 7.3% had suffered an acute myocardial infarction (AMI) in the past.

Regarding intraoperative complications, bleeding was observed in 90.9% and atrial fibrillation in 9.1% of participants.

In terms of post-operative complications, 5.3% had bleeding, 7.3% acute renal failure, 1.3% acute respiratory failure, 15.3% atrial fibrillation and 12.6% other arrhythmia.

The duration of total hospitalization was 6.3±2.8 days and the post-operative duration was 4.7±2.0 days.

Postoperatively, arrhythmia was present in 29.3% of participants.

Regarding patients' outcome, recovery was observed in 88.7%, improvement in 8.7% and death in 2.7%. (Table 1).

Statistical Results

From the x2 test, no statistically significant differences were observed in the existence of postoperative complications within the first 48 hours in relation to gender (p=0.211). Also, no statistically significant differences were found regarding existence and type of arrhythmia in relation to gender (p=0.334).

Regarding age, patients over 80 years had more frequent postoperative complications (p<0.001). The same age group had more frequently AF (p=0.012).

Postoperative complications within the first 48 hours after surgery were not associated to the type of admission (emergency or planned) (p=0.099) and to arrhythmia category (p=0.446).

Patients who underwent orthopedic surgery had more frequently postoperative complications within 48 hours (p=0.001). Patients in the same group had more frequently AF (p=0.007).

Type of medication administered preoperatively was not found to be associated with type and frequency of complications postoperatively within the first 48 hours, except for those taking anticoagulant agents who had more frequently postoperative complications (p<0.001) with AF to be more frequent (p=0.004).

In terms of comorbidity, no postoperative complications within 48 hours were observed in participants with arterial hypertension or arrhythmias (p>0.05) as well as in those suffering from diabetes mellitus.

Fewer postoperative complications within the first 48 hours was found in smokers with a marginally statistically significant difference (p=0.054). Furthermore, alcohol consumption was not associated with postoperative complications and the type of complications (p>0.05), as coffee use. Participants who drank Greek coffee had more frequent postoperative complications within 48 hours (p=0.016) with AF to be more frequent (p=0.007).

Participants having personal history of cardiac disease had postoperative complications within 48 hours with a marginally statistically significant difference (p=0.058), while they had AF more often (p=0.008). It was not observed that patients who reported a prior acute myocardial infraction (AMI) had postoperative complications and arrhythmia (p>0.05). (Table 2, 3).

Patients who had intraoperative complications also had postoperative complications within the first 48 hours (p<0.001) and more often experienced arrhythmias (p=0.002). It was also found that postoperative complications within the first 48 hours were associated with length of hospital stay more than 8 days (p<0.001). These participants more frequently presented with AF (p=0.001) and arrhythmias (p<0.001).

Patients with a history of arrhythmia had more frequently a postoperative complication within 48

hours (p<0.001). The same group of patients had more frequently AF and arrhythmias (p<0.001).

Finally, it was found that participants having AF, also had postoperative AF more frequently (p<0.001). AF was more frequently treated with medication postoperatively (p=0.001). (Table 4,5).

Table 1. Distribution of the sample according to demographic and clinical characteristics

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS		n	%
Gender	Men	60	40,0
	Women	90	60,0
Age (years)	45-64	49	32,7
	65-79	53	35,3
	80+	48	32,0
Type of admission	Emergency	83	55,3
	Planned	67	44,7
Type of Surgery	Gastrointestinal	79	52,7
	Orthopedic	71	47,3
Medication	Antihypertensive	104	86,7
	Antidiabetic	34	28,3
	Anticoagulants	45	37,5
	Antilipidemics	47	39,2
	Diuretics	10	8,3
Comorbidity	Hypertension	103	85,1
	Diabetes mellitus	33	27,3
	Atrial Fibrillation/other arrythmia	40	26,5
	Dyslipidemia	47	38,8
	Heart Failure	9	7,4
Smoking	Yes	35	23,3
	No	67	44,7
	Former smoker	48	32
Number of cigarettes	1-20	20	57,2
	21+	15	42,8
Alcohol	Yes	23	15,3
	No	127	84,7
Coffee	Greek	69	56,5
	Espresso/filter/frappe	53	43,5
Medical history of cardiac disease	Yes	21	14
Heart Failure	Yes	13	8,7
Acute myocardial infraction	Yes	11	7,3
Intraoperative complications	Bleeding	10	90,9
	Atrial Fibrillation	1	9,1

Postoperative complications	Bleeding	8	5,3
	Acute renal failure	11	7,3
	Acute respiratory failure	2	1,3
	Atrial Fibrillation	23	15,3
	Other arrythmia	19	12,6
Total duration of hospitalization	6,3±2,8 days		
Postoperative hospitalization time	4,7±2,0 days		
Arrythmia during hospitalization	Yes	44	29,3
Outcome	Recovery	133	88,7
	Improvement	13	8,7
	Death	4	2,7

Table 2. Frequency of postoperative complications according to demographic and clinical characteristics of the sample

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS		**POSTOPERATIVE COMPLICATIONS WITHIN 48 HOURS**				
		NO		**YES**		**p**
		n	**%**	**n**	**%**	
Gender	Men	42	42,9	18	34,6	0,211
	Women	56	57,1	34	65,0	
Age (years)	45-64	44	44,9	5	9,6	<0,001
	65-79	32	32,7	21	40,4	
	80+	22	22,4	26	50,0	
Type of admission	Emergency	50	51,0	33	63,5	0,099
	Planned	48	49,0	19	36,5	
Type of Surgery	Gastrointestinal	61	62,2	18	34,6	0,001
	Orthopedic	37	37,8	34	65,4	
Medication	Antihypertensive	66	88,0	38	84.4	0,385
	Antidiabetic	21	28,0	13	28.9	0,539
	Anticoagulants	19	25,3	26	57,8	<0,001
	Antilipidemics	28	37,3	19	42,2	0,367
	Diuretics	6	8,0	4	8,9	0,558
Comorbidity	Hypertension	66	86,8	37	82,2	0,331
	Diabetes mellitus	21	27,6	12	26,7	0,541
	Atrial Fibrillation/other arrythmia	18	23,7	22	48,9	0,004
	Dyslipidemia	29	38,2	18	40,0	0,495
	Heart Failure	5	6,6	4	8,9	0,446
Smoking	Yes	27	27,6	8	15,4	0,054
	No	37	37,8	30	57,7	
	Former smoker	34	34,7	14	26,9	
Alcohol	Yes	13	13,3	10	19,2	0,231
	No	85	86,7	42	80,8	
Coffee	Greek	41	49,4	28	71,8	0,016
	Espresso/filter/frappe	42	50,6	11	28,2	
Cardiac history	Yes	10	10,2	11	21,2	0,058
AMI	Yes	6	6,1	5	9,6	0,318

Table 3. Frequency of postoperative complications according to intraoperative / postoperative variables and final outcomes of the sample

INTRAOPERATIVE / POSTOPERATIVE VARIABLES		POSTOPERATIVE COMPLICATIONS WITHIN 48 HOURS				
		NO		YES		p
		n	%	N	%	
Intraoperative Complications	No	97	99,0	42	80,8*	<0,001
	Yes	1	1,0	10	19,2	
Post-operative Complications	Bleeding	0	0	8	15,4	<0,001
	ARF	0	0	11	21,2	<0,001
	ARDS	0	0	2	3,8	0,119
Heart Failure	Yes	7	7,1	6	11,5	0,267
Total duration of hospitalization	2-4 days	46	46,9	5	9,6	<0,001
	5-7	35	35,7	18	34,6	
	8+	17	17,3	29	55,8	
Postoperative hospitalization time	1-3 days	45	45,9	6	11,5	<0,001
	4-6	48	49,0	31	59,6	
	7+	5	5,1	15	28,8	
Arrythmia at hospitalization	Yes	3	3,1	4	78,8	<0,001
Type of Arrythmia	Atrial Fibrillation	0	0,0	24	58,5	0,086
	Sinus/supraventricular/ bradycardia	3	100	17	41,5	
Outcome	Recovery	126	90,6	7	63,6	<0,001
	Improvement	12	8,6	1	9,1	
	Death	1	0,7	3	27,3	

* Negative sign

Table 4. Frequency of postoperative arrhythmias according to demographic and clinical characteristics of the sample

DEMOGRAPHIC AND CLINICAL CHARACTERISTICS		POSTOPERATIVE ARRHYTHMIAS						
		No		Atrial Fibrillation		Other arrhythmia		p
		N	%	n	%	n	%	
Gender	Men	46	42,6	6	26,1	8	42,1	0,334
	Women	62	57,4	17	73,9	11	57,9	
Age (years)	45-64	44	40,7	1	4,3	4	21,1	0,012
	65-79	34	31,5	11	47,8	8	42,1	
	80+	30	27,8	11	47,8	7	36,8	
Type of admission	Emergency	57	52,8	13	56,5	13	68,4	0,446
	Planned	51	47,2	10	43,5	6	31,6	
Type of Surgery	Gastrointestinal	65	60,2	6	26,1	8	42,1	0,007
	Orthopedic	43	39,8	17	73,9	11	57,9	
Medication	Antihypertensive	74	88.1	17	77.3	13	92.9	0,318
	Antidiabetic	24	28,6	8	36,4	2	14,3	0,357
	Anticoagulants	25	29,8	15	68,2	5	35,7	0,004
	Antilipidemics	31	36,9	9	40,9	7	50,0	0,638
	Diuretics	8	9,5	2	9,1	0	0	0,486

Comorbidity	Hypertension	74	87,1	16	72,2	13	92,9	0,167
	Diabetes mellitus	24	28,2	7	31,8	2	14,3	0,482
	Atrial Fibrillation	24	28,2	13	59,1	3	21,4	0,014
	Dyslipidemia	32	37,6	8	36,4	7	50,0	0,656
	Heart Failure	7	8,2	2	9,1	0	0	0,524
Smoking	Yes	29	26,9	2	8,7	4	21,1	0,086
	No	44	40,7	16	69,6	7	36,8	0,095
	Former smoker	35	32,4	5	21,7	8	42,1	0,985
Alcohol	Yes	16	14,8	3	13,0	4	21,1	0,743
	No	92	85,2	20	87,0	15	78,9	
Coffee	Greek	46	50,5	17	89,5	6	50,0	0,007
	Espresso/filter/ frappe	45	49,5	2	10,5	6	50,0	
Cardiac history	Yes	11	10,2	8	34,8	2	10,5	0,008
AMI	Yes	6	5,6	3	13,0	2	10,5	0,389

Table 5. Frequency of postoperative arrhythmias according to intraoperative and postoperative variables of the sample

INTRAOPERATIVE/POSTOPERATIVE VARIABLES		**POSTOPERATIVE ARRHYTHMIAS**						
		No		**Atrial Fibrillation**		**Other arrhythmia**		**p**
		n	**%**	**n**	**%**	**n**	**%**	
Intraoperative Complications	No	105	97,2	20	87,0	14	73,7	0,001
	Yes	3	2,8	3	13,0	5	26,3	
Post-operative Complications	Bleeding	4	3,7	3	13,0	1	5,3	0,194
	ARF	8	7,4	2	8,7	1	5,3	0,912
	ARDS	1	0,9	0	0	1	5,3	0,262
Heart Failure	Yes	9	8,3	4	17,4	0	0	0,133
Total duration of hospitalization	2-4 days	46	42,6	2	8,7	3	15,8	0,001
	5-7	38	35,2	8	34,8	7	36,8	
	8+	24	22,2	13	56,5	9	47,4	
Postoperative hospitalization time	1-3 days	45	41,7	3	13,0	3	15,8	0,002
	4-6	55	50,9	14	60,9	10	52,6	
	7+	8	7,4	6	26,1	6	31,6	
Arrythmia at hospitalization	Yes	2	1,9	23	100,0	19	100	<0,001
Type of Arrythmia	Atrial Fibrillation	0	0,0	23	100,0	1	5,3	<0,001
	Sinus/supraventricular/ bradycardia	2	100,0	0	0,0	18	94,7	

Discussion

According to results of the present study, 52.7% of participants underwent gastrointestinal surgeries and 47.3% orthopedic surgeries. Descriptive analysis of data demonstrated significant comorbidity in patients. Specifically, participants had arterial hypertension, diabetes mellitus, dyslipidemia and AF or other arrythmia. This was an anticipated finding for the reason that 67.3% of the sample was over 65 years old having age-related health problems. Notably, adults aged above 65 years account for 37% of all inpatient procedures in United States.[1]

Furthermore, in the present study AF or other arrythmia was found at admission in 40 participants (26.5%) while during hospitalization arrythmia had 44 participants (29.3%). Therefore, 4 patients (2.8%) developed an arrythmia of a new onset. In relevant study conducted by Leibowitz et al.,[11] among 410 elderly patients undergoing hip fracture, (mean age 80±7.8 years) the incidence of newly diagnosed AF was 3.7%. Bhave et al.,[10] showed that patients with pre-existing AF who developed POAF had similar outcomes compared to patients with new onset of POAF. Higher mortality, longer length of hospital stay and higher costs were associated with POAF and these findings did not differ by whether POAF was a pre-existing AF or a new diagnosis.[10]

Another finding of the current study concerned the postoperative complications within 48 hours and the AF presence in patients who underwent orthopedic surgery. Interestingly, orthopedic surgeries and the entailed complications represent an area of interest due to their high rise. For example, hip fracture global incidences were estimated to be 14.2 million in 2019 with most of them occurring in individuals above 70 years old.[12] Considering that characteristics of patients with hip fracture are advanced age, functional restrictions, fragility, it is easily conceivable that AF is an enormous burden.[6]

Therefore in non-cardiac surgeries, AF needs elaborate assessment in every period (pre, post and intraoperatively). In China Fu et al.,[6] among 1415 elderly patients with hip fractures demonstrated that patients with preoperative AF (7.1%) had longer delay in surgery compared to those who had not. The same researchers showed that predictors for preoperative AF were hypertension, comorbidity, low potassium and anemia as well as plasma concentrations of C-reactive protein and the inflammatory response index, at admission.[13] Gay et al.,[8] indicated that POAF incidence was related to delay in surgery mainly due to anticoagulant medicines, in preoperative medical assessment and access to the operating room among patients aged ≥ 70 years with hip fracture surgery and no history of permanent AF before admission. In Italy, Rostagno et al.,[14] in a sample of 2852 patients (mean age 83.7±8.2 years) undergoing hip fracture surgery, demonstrated POAF in 104 patients (3.6%). Time of onset was on average 2 days after surgery. Patients with POAF had longer length of hospital stay and higher mortality at 1-year follow-up in comparison to patients who maintained stable sinus rhythm. All aforementioned findings are in line with current findings showing more complications and AF in patients over 80 years old. Also, are congruent with the finding that postoperative complications, AF and arrythmia within first 48 hours were associated with hospital stay more than 8 days.

In gastrointestinal surgeries POAF is also not a rare issue with incidence to vary from 5% to 15%.[15] AF was prevalent in one in eight patients >65 years and one in four patients >85 years who underwent abdominal surgery.[16] Heywood et al.,[15] showed that among 2967 patients aged ≥65 years undergoing abdominal surgery, the 187(6.3%) developed POAF which was highest in small bowel resection (17.2%). Patients who developed POAF were older than those who did not. In Germany, Rühlmann et al.,[17] in a sample of 1210 patients who underwent surgery of upper gastrointestinal tract (esophagus, stomach) indicated postoperative arrhythmia in 100 patients (8.3%). Among procedures, esophagectomy was associated with highest POAF incidence (45.5%). In terms of surgery in lower gastrointestinal tract the post-operative arrythmia occurrence ranges from 4.4 to 13.7%. Likewise, in Germany, a recent study (2023) among 1171 patients without any history of prior arrhythmia who underwent surgery of lower gastrointestinal tract illustrated postoperative arrhythmias in 56 patients (4.8%) with highest incidence in those undergoing bowel surgeries after mesenteric ischemia.[18] Accordingly, s study in Australia documented POAF prevalence at 10.2% in a sample comprising of 461 individuals undergoing liver transplantation The median onset of POAF occurred approximately 3 days following the transplantation procedure. Furthermore, patients with POAF had elevated prevalence rate of thromboembolic events than those without (17.0% vs. 3.1%).[19] Guidelines for AF

prophylaxis among abdominal surgery patients do not exist. Appropriate interventions to prevent AF following abdominal surgery should be an area of intense investigation.[16]

During hospitalization arrythmia was observed in 29.3% of participants while at admission 26.5% declared AF /other arrythmia. Several reasons are to be held responsible for arrythmia development, such as advanced age, hypertension, diabetes mellitus, obesity, metabolic syndrome, pre-existing AF, intraoperative factors (surgical injury, atrial ischemia), and postoperative factors (volume overload, increased afterload, and hypotension).[7,20] All above factors share the common pathways of inflammation and oxidative stress.[20]

Participants who had intraoperative complications had also arrhythmias and postoperative complications within 48 hours after surgery. Several factors during surgery precipitate POAF in major, open procedures such as hypotension over 10 min, ischemia and blood transfusion. Another potential factor for post arrythmia occurrence may be the intraoperative intravenous fluid management, which is associated with cardiopulmonary complications. Intravenous fluid volumes affected secretion of N-terminal-pro-brain natriuretic peptide (NT-pro-BNP) in patients who underwent elective colorectal surgery, thus predicting cardiopulmonary complications.[16,21] Mechanically, activation of sympathetic nervous system due to surgical stress may in turn increase catecholamine release and heart rate. These factors contribute to AF onset.[1]

Patients with a history of arrhythmia had more frequently a postoperative complication within 48 hours and more frequently AF and arrhythmias. Participants having AF, also had POAF more frequently. Pre-existing AF is independently associated with increased mortality in patients undergoing non-cardiac surgery. Regardless of pre-existing AF in medical history or not, attention should focus on patients of advanced age, patients with congestive heart failure, and those undergoing high-risk procedures (thoracic or abdominal surgeries). [22]

Preoperative assessment ought to investigate the existence, severity and stability of cardiac disease, the ability of the myocardium to cope with stress, and other information for patient's intraoperative and postoperative care. Preoperative screening is the first cardiac assessment of the patient, identifying a serious cardiac problem that was not known to the patient.[23] Preoperative cardiac evaluation aims to prevent cardiac complications. The risk of intra/post-operative complications depends on overall patients' health state before surgery, comorbidities, severity, type and duration of surgical procedure.[24,25] Furthermore, diastolic dysfunction is a risk factor for the development of postoperative cardiac complications. Incidence of diastolic dysfunction is 27% as shown in echocardiographic sampling of the general population (mean age 52 years).[24] Such percentages put an emphasis on the importance of diastolic function evaluation. Monitoring the patient with electrocardiogram and cardiac enzymes especially in first 2 postoperative days, significantly assists diagnosis and management by cardiologist.[26]

A noticeable finding of the present study is that patients receiving anticoagulant agents experienced more frequent postoperative complications. According to Belli et al.,[27] the cardiopulmonary dysfunction and hemorrhage are common postoperative complications among patients receiving warfarin therapy preoperatively. High postoperative complication and mortality rates are observed in patients receiving oral anticoagulant mainly in emergency surgeries due to inability to correct coagulation parameters appropriately.[27] Time to surgery is longer in patients with hip fracture receiving direct oral anticoagulants (DOACs) in comparison to controls. Apart from increased time to surgery, oral anticoagulation is also extending hospital stay. It is with noting that oral anticoagulation involves approximately 15% of hip fracture population. [28]

Perhaps of greater concern is the present finding showing postoperative complications and AF in participants who drank Greek coffee. According to 2020 European Society of Cardiology (ESC) Guidelines for AF, the caffeine consumption does not contribute to AF development, and may even reduce the risk of AF.[29]

Last but not least, greater awareness of factors associated with AF is supposed to help clinical decision-making. Considering that AF is predominately a disease of the elderly with 70% of AF patients aged >65 years in Western Europe, Australia and North America, the need of assessment before surgery is essential. As previously articulated, this frequently encountered arrhythmia is associated with increased morbidity, mortality and health care expenditures including long hospitalizations. Optimal AF management demands a care responsive to patient's preferences, needs and values.[30-32]

Limitations of the study

The present study was of cross-sectional design and

there was no evidence of causal relationship between all dimensions under assessment. Another limitation is that the surgical procedures were performed in a provincial hospital. The method of convenience sampling was not representative of patients undergoing gastrointestinal and orthopedic surgery in Greece, thus limiting the generalizability of the results. Data were collected from the patient files and from the patients themselves during COVID-19 pandemic, where surgical procedures were limited and only emergency cases were performed, which is a serious limiting factor.

Conclusions

The current results showed the following:

More frequent postoperative complications and AF had participants over 80 years old, those who underwent orthopedic surgery, those taking anticoagulant agents, those who drank Greek coffee and those having history of cardiac disease (marginally difference).

Postoperative complications within first 48 hours and arrythmia had patients with intraoperative complications.

Postoperative complication within 48 hours, AF and arrhythmias had patients with a history of arrhythmia and those with hospital length of stay more than 8 days.

Patients who had AF, they frequently presented with postoperative AF.

Management of patients undergoing non-cardiac surgery requires the cooperation of all medical specialties involved. Based on the findings presented, it is suggested that understanding arrythmias in the context of non-cardiac surgery would raise awareness about prompt recognition and treatment, thus improving patients' safety.

ΠΕΡΙΛΗΨΗ

Διεγχειρητικές και μετεγχειρητικές αρρυθμίες σε ασθενείς που υποβάλλονται σε μη καρδιοχειρουργική επέμβαση

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Εισαγωγή: Η συχνότητα των αρρυθμιών και ιδιαίτερα της μετεγχειρητικής κολπικής μαρμαρυγής (ΚΜ) σε μη καρδιοθωρακικές χειρουργικές επεμβάσεις είναι χαμηλότερη σε σύγκριση με τις καρδιοθωρακικές. Η συχνότητα της ΚΜ κυμαίνεται από 12%-19% μετά από χειρουργική επέμβαση στην κοιλιακή χώρα και έως 4,8% μετά από ολική αρθροπλαστική. Η μετεγχειρητική ΚΜ αναπτύσσεται μεταξύ της 1ης και 4ης ημέρας μετά την επέμβαση και συχνά περιορίζει την ανάρρωση των ασθενών.

Σκοπός της παρούσας μελέτης ήταν η εκτίμηση της συχνότητας και του είδους της αρρυθμίας σε ασθενείς που υποβάλλονται σε επεμβάσεις του πεπτικού συστήματος, όπως επίσης σε ορθοπεδικές επεμβάσεις.

Υλικό και Μέθοδος: Στην παρούσα συγχρονική μελέτη συμμετείχαν 151 ασθενείς που υποβλήθηκαν σε χειρουργικές επεμβάσεις του πεπτικού συστήματος, όπως επίσης σε ορθοπεδικές επεμβάσεις σε επαρχιακό νοσοκομείο. Τα δεδομένα συλλέχθηκαν με τη μέθοδο της συνέντευξης και επιπλέον στοιχεία συλλέχθηκαν από ιατρικά αρχεία ασθενών. Το επίπεδο στατιστικής σημαντικότητας ορίστηκε στο 0,05.

Αποτελέσματα: Από 151 συμμετέχοντες, το 60% ήταν γυναίκες, το 67,3% ήταν ηλικίας >65 ετών, το 52,7% υποβλήθηκε σε επεμβάσεις του πεπτικού συστήματος και το 47,3% σε ορθοπεδικές. Αναφορικά με τη συννοσηρότητα, το 85,1% του δείγματος ανέφερε αρτηριακή υπέρταση, το 27,3% σακχαρώδη διαβήτη, το 26,5% ΚΜ και άλλες αρρυθμίες, το 38,8% δυσλιπιδαιμία και καρδιακή ανεπάρκεια το 7,4%. Καπνιστές ήταν το 23,3% των συμμετεχόντων, αλκοόλ κατανάλωνε το 15,3% ενώ το 56,5% έπινε ελληνικό καφέ. Κατά τη διάρκεια της νοσηλείας παρατηρήθηκε αρρυθμία στο 29,3% των συμμετεχόντων ενώ κατά την εισαγωγή το 26,5% δήλωσε ΚΜ/άλλη αρρυθμία. Οι μετεγχειρητικές επιπλοκές και η ΚΜ ήταν συχνότερες σε ασθενείς ηλικίας >80 ετών (p<0,001), (p=0,012) αντίστοιχα, σε ασθενείς που υποβλήθηκαν σε ορθοπεδική χειρουργική επέμβαση (p=0,001), (p=0,007) αντίστοιχα, σε όσους ελάμβαναν αντιπηκτικούς παράγοντες (p<0,001), (p=0,004) αντίστοιχα, και σε εκείνους που ανέφεραν καρδιακή νόσο στο ιατρικό τους ιστορικό (p=0,058), (p=0,008), αντίστοιχα.

Συμπεράσματα: Οι μετεγχειρητικές επιπλοκές και η μετεγχειρητική ΚΜ συσχετίστηκαν με την ηλικία, τον τύπο της επέμβασης, την λήψη αντιπηκτικών παραγόντων και το ιατρικό ιστορικό καρδιακής νόσου. Η πρόληψη και η θεραπεία τόσο των αρρυθμιών όσο και των επιπλοκών που συσχετίζονται με τη χειρουργική επέμβαση προϋποθέτει λεπτομερή προεγχειρητική, διεγχειρητική και μετεγχειρητική παρακολούθηση.

Λέξεις κλειδιά: *Μη καρδιοχειρουργικοί ασθενείς, μετεγχειρητικές επιπλοκές, αρρυθμίες, κολπική μαρμαρυγή*
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References

1 Jiang S, Liao X, Chen Y, Li B. Exploring postoperative atrial fibrillation after non-cardiac surgery: mechanisms, risk factors, and prevention strategies. *Front Cardiovasc Med.* 2023;10:1273547.
2 Hollenberg SM, Dellinger RP. Noncardiac surgery: postoperative arrhythmias. *Crit Care Med.* 2000;28(10 Suppl):N145-50.
3 Chelazzi C, Villa G, De Gaudio AR. Postoperative atrial fibrillation. *ISRN Cardiol*. 2011;2011:203179.
4 AlTurki A, Marafi M, Proietti R, Cardinale D, Blackwell R, Dorian P, Bessissow A, Vieira L, Greiss I, Essebag V, Healey JS, Huynh T. Major Adverse Cardiovascular Events Associated With Postoperative Atrial Fibrillation After Noncardiac Surgery: A Systematic Review and Meta-Analysis. *Circ Arrhythm Electrophysiol*. 2020;13(1):e007437.
5 Gialdini G, Nearing K, Bhave PD, Bonuccelli U, Iadecola C, Healey JS, Kamel H. Perioperative atrial fibrillation and the long-term risk of ischemic stroke. *JAMA*. 2014;312(6):616-622.
6 Fu M, Zhang Y, Zhao Y, Guo J, Hou Z, Zhang Y, Wang Z. Characteristics of preoperative atrial fibrillation in geriatric patients with hip fracture and construction of a clinical prediction model: a retrospective cohort study. *BMC Geriatr*. 2023;23(1):310.
7 Joshi KK, Tiru M, Chin T, Fox MT, Stefan MS. Postoperative atrial fibrillation in patients undergoing non-cardiac non-thoracic surgery: A practical approach for the hospitalist. *Hosp Pract* (1995). 2015;43(4):235-244.
8 Gay P, Genet B, Rouet A, Alkouri R, Cohen-Bittan J, Boddaert J, Zerah L. Modifiable factors associated with postoperative atrial fibrillation in older patients with hip fracture in an orthogeriatric care pathway: a nested case-control study. *BMC Geriatr*. 2022;22(1):845
9 Prince-Wright LH, Akinyemi O, Nnorom SO, Bauer ES, Cornwell Iii EE, Fullum TM. Postoperative atrial fibrillation following non-cardiac surgery: Predictors and risk of mortality. *Am J Surg*. 2022;224(4):1062-1067.
10 Bhave PD, Goldman LE, Vittinghoff E, Maselli J, Auerbach A. Incidence, predictors, and outcomes associated with postoperative atrial fibrillation after major noncardiac surgery. *Am Heart J.* 2012;164(6):918-924.
11 Leibowitz D, Abitbol C, Alcalai R, Rivkin G, Kandel L. Perioperative atrial fibrillation is associated with increased one-year mortality in elderly patients after repair of hip fracture. *Int J Cardiol.* 2017;227:58-60.
12 Dong Y, Zhang Y, Song K, Kang H, Ye D, Li F. What was the Epidemiology and Global Burden of Disease of Hip Fractures From 1990 to 2019? Results From and Additional Analysis of the Global Burden of Disease Study 2019. *Clin Orthop Relat Res.* 2023;481(6):1209-1220.
13 Bae SJ, Kwon CH, Kim TY, Chang H, Kim BS, Kim SH, Kim HJ. Predictors and prognostic impact of post-operative atrial fibrillation in patients with hip fracture surgery. *World J Clin Cases.* 2022;10(11):3379-3388.
14 Rostagno C, Cartei A, Rubbieri G, Ceccofiglio A, Polidori G, Curcio M, Civinini R, Prisco D. Postoperative atrial fibrillation is related to a worse outcome in patients undergoing surgery for hip fracture. *Intern Emerg Med*. 2021;16(2):333-338.
15 Heywood EG, Drake TM, Bradburn M, Lee J, Wilson MJ, Lee MJ. Atrial Fibrillation After Gastrointestinal Surgery: Incidence and Associated Risk Factors. *J Surg Res.* 2019;238:23-28.
16 Kazaure HS, Roman SA, Tyler D, Sosa JA. The significance of atrial fibrillation in patients aged ≥ 55 years undergoing abdominal surgery. *World J Surg*. 2015;39(1):113-120.
17 Rühlmann F, Tichelbäcker T, Mackert AF, Engelhardt D, Leha A, Bernhardt M, Ghadimi M, Perl T, Azizian A, Gaedcke J. Incidence, Associated Risk Factors, and Outcomes of Postoperative Arrhythmia After Upper Gastrointestinal Surgery. *JAMA Netw Open.* 2022;5(7):e2223225.
18 Rühlmann F, Hedicke MS, Engelhardt D, Mackert AF, Tichelbäcker T, Leha A, Bernhardt M, Ghadimi M, Perl T, Azizian A, Gaedcke J. Incidence and impact of new-onset postoperative arrhythmia after surgery of the lower gastrointestinal tract. *Sci Rep*. 2023;13(1):1284.
19 Koshy AN, Enyati A, Weinberg L, Han HC, Horrigan M, Gow PJ, Ko J, Thijs V, Testro A, Lim HS, Farouque O, Teh AW. Postoperative Atrial Fibrillation and Long-Term Risk of Stroke in Patients Undergoing Liver Transplantation. *Stroke.* 2021;52(1):111-120.
20 Costanzo S, De Curtis A, di Niro V, Olivieri M, Morena M, De Filippo CM, Caradonna E, Krogh V, Serafini M, Pellegrini N, Donati MB, de Gaetano G, Iacoviello L; Polyphemus Observational Study Investigators. Postoperative atrial fibrillation and total dietary antioxidant capacity in patients undergoing cardiac surgery: The Polyphemus Observational Study. *J Thorac Cardiovasc Surg.* 2015;149(4):1175-1182.e1.
21 Brandstrup B, Beier-Holgersen R, Iversen LH, Starup CB, Wentzel LN, Lindorff-Larsen K, Petersen TC, Tønnesen H. The Influence of Perioperative Fluid Therapy on N-terminal-pro-brain Natriuretic Peptide and the Association With

Heart and Lung Complications in Patients Undergoing Colorectal Surgery: Secondary Results of a Clinical Randomized Assessor-blinded Multicenter Trial. *Ann Surg.* 2020;272(6):941-949

22 van Diepen S, Bakal JA, McAlister FA, Ezekowitz JA. Mortality and Readmission of Patients With Heart Failure, Atrial Fibrillation, or Coronary Artery Disease Undergoing Noncardiac Surgery: An Analysis of 38047 Patients. *Circulation*. 2011;124(3):289-296.

23 Hedge J, Balajibabu P.R, Sivaraman T. The patient with ischaemic heart disease undergoing non cardiac surgery. *Indian J Anaesth.* 2017;61(9):705-711.

24 Sellers D, Srinivas C, Djaiani G. Cardiovascular complications after non-cardiac surgery. *Anaesthesia.* 2018;73 Suppl 1:34-42.

25 Lee LKK, Tsai PNW, Ip KY, Irwin MG. Pre-operative cardiac optimization: a directed review. *Anaesthesia*. 2019;74 Suppl 1:67-79.

26 Freeman WK, Gibbons RJ. Perioperative cardiovascular assessment of patients undergoing noncardiac surgery. *Mayo Clin Proc.* 2009;84(1):79-90.

27 Belli S, Aytac HO, Yabanoglu H, Karagulle E, Parlakgumus A, Nursal TZ, Yildirim S. Results of surgery in general surgical patients receiving warfarin: retrospective analysis of 61 patients. *Int Surg.* 2015;100(2):225-232.

28 Rostagno C, Cartei A, Polidori G, Civinini R, Ceccofiglio A, Rubbieri G, Curcio M, Boccaccini A, Peris A, Prisco D. Management of ongoing direct anticoagulant treatment in patients with hip fracture. *Sci Rep.* 2021;11(1):9467.

29 Hindricks G, Potpara T, Dagres N, Arbelo E, Bax JJ, Blomström-Lundqvist C, Boriani G, Castella M, Dan GA, Dilaveris PE, Fauchier L, Filippatos G, Kalman JM, La Meir M, Lane DA, Lebeau JP, Lettino M, Lip GYH, Pinto FJ, Thomas GN, Valgimigli M, Van Gelder IC, Van Putte BP, Watkins CL; ESC Scientific Document Group. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS): The Task Force for the diagnosis and management of atrial fibrillation of the European Society of Cardiology (ESC) Developed with the special contribution of the European Heart Rhythm Association (EHRA) of the ESC. *Eur Heart J.* 2021;42(5):373-498.

30 Polikandrioti M, Babatsikou F. Information to coronary disease patients. *Health Sci J.* 2013;(1):3-10.

31 Polikandrioti M. Atrial fibrillation: the impact of anxiety and depression on patients' needs. *Psychiatriki.* 2021;32(3):187-198.

32 Polikandrioti M. Patient Perceptions and Quality of Life in Pacemaker Recipients. *J Innov Card Rhythm Manag*. 2021;12(11):4769-4779.