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Postoperative atrial fibrillation after cesarean delivery

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Abstract

Background and Aims. Atrial fibrillation (AF) is the most common arrhythmia seen clinically. Due to the lack of literature and guidelines on maternal AF as a postoperative complication following cesarean delivery (CD), we undertook a study to characterize parturients who developed AF following CD and to evaluate arrhythmia management and outcomes in this patient population.

Methods. After receiving ethics committee approval, a retrospective chart review was performed to determine the incidence, possible risk factors, treatment, and outcome of women who developed AF following CD performed between 2003 and 2012 at New York Methodist Hospital in Brooklyn, New York.

Results. A total of 17,039 CDs were performed at New York Methodist Hospital from 2003 to 2012. Of these, seven parturients developed AF after CD. The incidence of AF following CD in this patient population was 1:2,434 (0.04%). The age range was 26-41 years, with a median of 33 years. All 7 parturients were at term or postterm. Two deliveries were elective and five were emergent. Two of the seven parturients had prior history of paroxysmal AF. One patient was identified as having mitral regurgitation. All seven had low levels of serum magnesium postoperatively. Out of the seven, two parturients had spontaneous conversion to normal sinus rhythm, one required electrical cardioversion and four required pharmacologic cardioversion.

Conclusions. Postoperative AF (POAF) exists as a rare complication in women who undergo CD with an incidence of 0.04% in our patient population. All parturients in our study were noted to have hypomagnesemia in the postoperative period. Occurrence of AF increased length of hospital stay and utilization of hospital resources.

Keywords: postoperative atrial fibrillation, cesarean delivery

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Introduction

Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation. Diagnosed by electrocardiogram, AF presents with absent P waves that are replaced by fibrillatory waves with an irregular ventricular response [1]. The estimated prevalence of AF is 0.4% in the general population and increases with age [2]. AF occurs in less than 1% of adults under age 60 and more than 6% in adults older than 80 years of age [3-5]. As the most frequently seen rhythm disturbance in the medical field, AF is associated with significant morbidity and mortality [6]. For example, AF is associated with heart failure and more rapid decline in cognitive function in dementia, and also increases stroke risk up to fivefold and is responsible for over a fifth of all strokes [7].

Cesarean delivery (CD) is the most common major abdominal surgery performed in the United States [8]. The current CD rate in the United States is over 30% of deliveries and has been increasing over the past several decades [9]. Rates of CD vary widely between countries and even regions, in part due to varying customs and healthcare budgets [10]. New York Methodist Hospital (NYMH) delivers more than 5,000 babies on average each year, with approximately 1 out of 3 babies delivered by CD. With the increased utilization of CDs,

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it is assumed that incidence of postoperative complications is also similarly increasing. One meta analysis found a maternal complication rate of 23.3% in elective CS and 55.2% in emergency CS [10]. Some of the most common maternal complications seen following CD include hemorrhage, infections (including peritonitis, endometritis and septicemia), deep vein thrombosis, adhesions, and postoperative ileus [11].

AF is a very frequent complication of cardiothoracic surgery with a reported incidence of 30-50% [12, 13]. Predictors of postoperative AF (POAF) following cardiothoracic surgery include age, extent of pulmonary resection, cardiac history, brain natriuretic peptide (BNP) levels, and poor six minute walk test [14]. Medical prophylaxis against POAF after thoracic surgery is recommended, and while angiotensin-converting enzyme inhibitors, amiodarone, calcium channel blockers, and magnesium have all been shown to be effective, beta blockers have demonstrated the greatest efficacy at decreasing the rate of POAF when used prophylactically after thoracic surgery [15]. Although less common in non-cardiothoracic surgeries with an incidence of approximately 5-10%, AF can be a serious postoperative problem that causes increased length of hospitalization, greater cost and higher risk of postoperative complications including pneumonia and congestive heart failure [13, 16]. The mechanism of development of AF following non-cardiothoracic surgeries is likely multifactorial, including increased sympathetic tone, electrolyte imbalances, hypervolemia, autonomic stimulation, intraoperative hypotension, and hypoxia [17]. Predictors of POAF in non-cardiothoracic surgery patients include age, male sex, hypertension, history of cardiac disease, and abdominal surgery [14]. Rate control is the most common treatment strategy used for patients with POAF, though rhythm control is considered when patients remain symptomatic despite rate control or cannot tolerate rate control [17]. Direct current cardioversion is used in patients with POAF experiencing hemodynamic compromise or symptoms including chest pain, pulmonary edema, or loss of consciousness [17].

The pregnancy state itself may be pro-dysrhythmic, due to the cardiovascular, hemodynamic, autonomic, and hormonal changes it involves [18]. This may suggest increased risk for POAF in patients following CD, relative to other types of non-cardiothoracic surgery. Because the FDA classifies most antiarrhythmic drugs as category C during pregnancy, it is recommended that medication use be limited in pregnant or lactating women with AF and that the lowest effective dose of the safest known medications be used [19].

To our knowledge, AF as a postoperative complication in women who undergo CD has never been directly studied. Due to the potential complications of arrhythmias in the postoperative period and the lack of data currently available on AF after CD, our objectives were to evaluate the incidence of AF following CD and to determine the risk factors for maternal AF in the postoperative period, and to evaluate arrhythmia management and outcomes in these patients.

Methods

After receiving ethics committee approval, a retrospective chart review was conducted analyzing CDs at New York Methodist Hospital (NYMH) in Brooklyn, New York, between November 1, 2003 and October 31, 2012. A total of 17,039 CDs performed within this time period were identified, and all were included in the study. Patients who developed AF in the first 48 hours following CD were identified from the hospital database using the International Classification of Diseases, 10th revision (ICD-10). Incidence of POAF in cesarean patients was calculated for the 9-year study period. Each confirmed case of AF in the postoperative period was analyzed for patient demographics, prior medical history, intraoperative course, postoperative course, treatment received, and outcome. These data were manually tabulated. The patients were contacted to determine the current status of their AF, including recurrent AF episodes and requirement for prolonged medical treatment for arrhythmia.

Results

There were a total of 17,039 CDs performed at NYMH between November 1, 2003 and October 31, 2012, which were all included in this study (Fig. 1). Seven out of the 17,039 cesarean patients had POAF.

Incidence of POAF following CD was found to be 1 in 2,434 (0.04%), or 4 per 10,000 CDs.The age range of CD patients who developed POAF was 26-41 years with a median of 33 years (Table 1). Five of the seven parturients were African American, one was Hispanic and one was Caucasian. All parturients were multigravid and delivered at term or postterm. Four patients were undergoing a repeat CD and three were primary CDs. Two of the seven deliveries were elective CDs and the rest were emergent. In all cases, the anesthetic administered was neuraxial (combined spinal epidural or spinal alone). None of the 7 parturients underwent general anesthesia for CD. The average duration of surgery was 57.3 minutes. The estimated intraoperative blood loss was on average higher than normal at 986 mL.

Postoperatively, all patients had mild hypomagnesemia with serum magnesium levels between 1.1-1.3

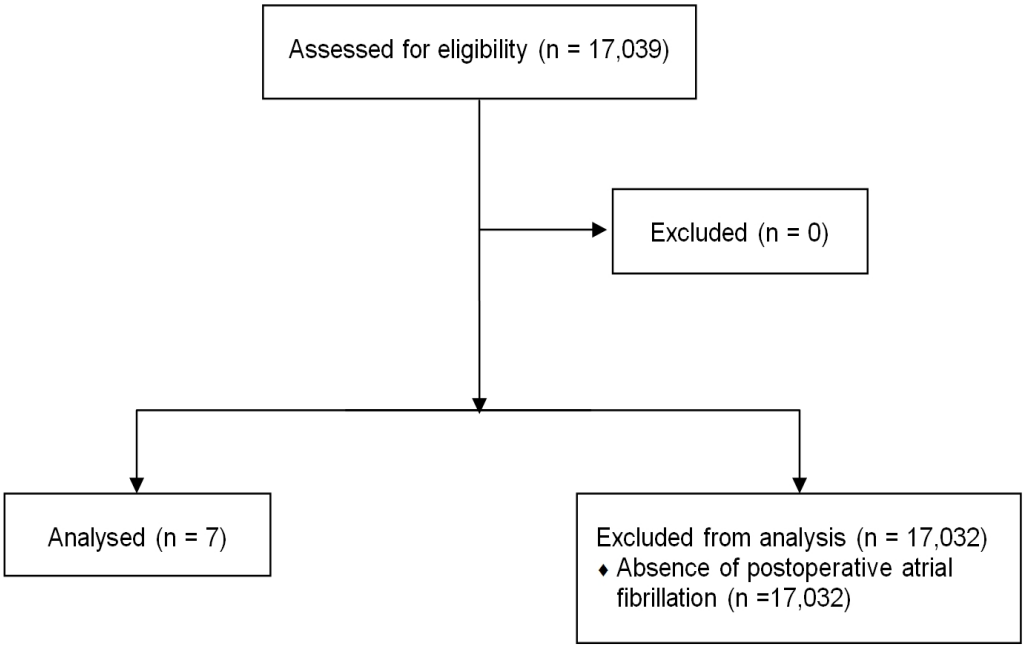

Fig. 1. Flowchart of participants included in this descriptive study

Table 1. Preoperative and intraoperative variables

Parturient	Age/Race	PMH	Gravidity/Parity	Indication for CD	EBL (mL)
1	26/AA	Asthma, cerebral palsy	G2P0101	Arrest of dilatation, failed TOLAC	1000
2	29/AA	Asthma, mitral regurgitation	G2P1001	Postdatism	800
3	35/Hispanic	Asthma	G5P1031	Breech	800
4	37/AA	Paroxysmal AF	G2P0101	Repeat CD	800
5	41/Caucasian	Factor V deficiency	G4P2012	Postdatism, failed TOLAC	1500
6	32/AA	None	G5P2022	Non-reassuring fetal heart rate	800
7	34/AA	Chronic hypertension	G2P1001	Breech	2000

AA: African American; TOLAC: trial of labor after cesarean; CD: cesarean delivery; EBL: estimated blood loss; PMH: past medical history

mEq/L, while the normal range is 1.6-2.4 mEq/L (Fig.2). All other electrolytes and thyroid function tests were normal (Table 2). None were diagnosed with pulmonary embolism or amniotic fluid embolism. All 2D echocardiograms were essentially normal, except for Parturient 2 who had mitral regurgitation and Parturient 4 who had a dilated left atrium. Out of the seven, 2 parturients had spontaneous conversion to normal sinus rhythm, 1 required electrical cardioversion and 4 required pharmacologic cardioversion. The average length of stay was 4.6 days. All patients were contacted at the time of this study to determine their AF history following discharge, but all were lost to follow-up.

Discussion

Arrhythmias are a well-documented complication after cardiothoracic surgery with an incidence of 30% to 40%, with AF being the most commonly seen arrhythmia [12]. The reported incidence of AF after non-cardiothoracic surgery is as low as 0.37% in some analyses [20]. In this study, the majority of the patients who developed AF after CD required medical intervention, either pharmacologic or electrical cardioversion therapy. Although AF was witnessed infrequently in CDs, the presence of this arrhythmia caused increased length of hospital stay compared to the average of 3.1 days following a non-complicated CD and increased utilization of hospital resources [21]. Half of the patients who developed AF had some form of preexisting cardiac disease including hypertension, paroxysmal AF or valvular disease. All parturients who developed POAF had postoperative hypomagnesemia. Whether or not hypomagnesemia was present preoperatively is unknown, as preoperative serum magnesium levels were not measured in these patients.

The physiological stresses of pregnancy may predispose parturients to cardiac arrhythmias. During pregnancy the maternal heart is affected by the combination of direct physiological effects of the hormonal state of pregnancy, alterations in autonomic tone,

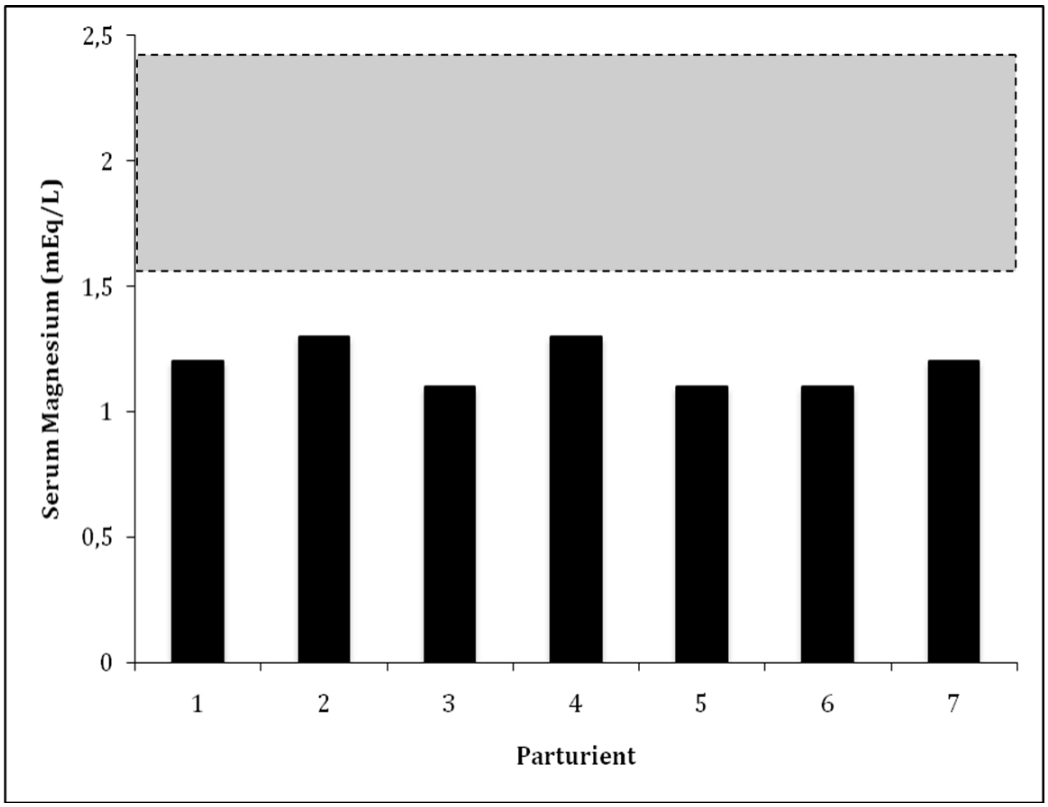

Fig. 2. Postoperative serum magnesium levels for parturients who developed atrial fibrillation following cesarean delivery. The normal range for serum magnesium (1.6-2.4 mEq/L) is indicated by the grey bar with dotted outline

Table 2. Postoperative variables

Parturient	Serum magnesium (mEq/L)	Serum potassium (mEq/L)	Serum phosphate (mg/dL)	Serum calcium (mg/dL)	Mode of cardioversion	Length of stay (days)
1	1.2	4.3	4.4	8.2	Pharmacologic	3
2	1.3	4.6	3.9	9.7	Spontaneous	4
3	1.1	4.4	4.3	9	Pharmacologic	3
4	1.3	4.4	3.2	8.6	Electrical	7
5	1.1	3.6	3.2	8.6	Pharmacologic	5
6	1.1	3.6	3.5	8.4	Spontaneous	5
7	1.2	3.8	5.3	8	Pharmacologic	4

Normal serum magnesium: 1.6-2.4 mEq/L; Normal serum potassium: 3.5-5.0 mEq/L; Normal serum phosphate: 2.5-4.5 mg/dL; Normal serum calcium: 8.8-10.3 mg/dL

hemodynamic changes, and electrolyte imbalances [22]. Women undergoing CD may also be at higher risk for postoperative arrhythmias due to increased vagal tone seen during certain surgical maneuvers or nausea or vomiting that may be present during the CD [1, 23]. Operative and psychological stress can lead to an increase in sympathetic output [16, 24, 25], which may contribute to the development of POAF.

Hypomagnesemia is commonly seen in pregnancy and may predispose a patient to arrhythmias [16, 26]. A 2012 Framingham Heart Study reported that the age- and sex-adjusted incidence of AF was 9.4 per 1000 person-years among individuals with serum magnesium < 1.77 mg/dL and 6.3 per 1000 person-years among those with levels > 1.99 mg/dL [27]. Compared with individuals in the highest quartile for serum magnesium, those with levels < 1.77 mg/dL had a 54% increased risk of developing AF ($p = 0.02$). Similar associations between electrolyte level and AF have not been observed with potassium or calcium [27]. Other proposed risk factors for the development of AF in the postoperative period are hypovolemia from significant blood loss, hemodynamic instability, hypoxia, inflammation, hypoglycemia and hyperglycemia [16].

Management of AF in the postoperative period initially depends on the hemodynamic and clinical status of the patient. Potential inciting agents for the arrhythmia should first be identified and corrected, including

correction of electrolyte disturbances, optimization of intravascular fluid status, correction of hypoxia, and optimization of pain management in order to decrease sympathetic output [16]. Management of AF generally involves rate control or rhythm control and anticoagulation. In general, rate control is used to stabilize the patient's hemodynamic status and promote better ventricular filling, while rhythm control is often used for acute management in a patient who is hemodynamically unstable or symptomatic. For rate control, beta-blockers (esmolol, metoprolol, propranolol), nondihydropyridine calcium channel blockers (diltiazem, verapamil) or digoxin are widely used. Beta-blockers are the most effective agent and most commonly used. The target heart rate in patients with AF is not a set range, but guided by patient's hemodynamic status and comfort level. For acute management of patients with AF who have hemodynamic instability or are symptomatic, guidelines recommend rhythm control or direct current cardioversion. In the case of patients without structural heart disease and when avoiding general anesthesia is desirable, pharmacologic cardioversion is preferred. Otherwise electrical cardioversion, especially in life-threatening hemodynamic instability, is generally recommended. Class 1C (flecainide, propafenone) or Class III (amiodarone, ibutilide, dofetilide) antiarrhythmics are effective for pharmacologic cardioversion with an average a success rate of 70%-80%for restoration of sinus rhythm [16]. Restoration of sinus rhythm is indicated in any patient with life-threatening hemodynamic instability, regardless of the duration of arrhythmia, but otherwise should only be attempted in patients whose AF lasts more than 24 hours, but less than 48 hours in effort to avoid the need for anticoagulation. Definitive data for anticoagulation in POAF is not well established. Due to the risk of bleeding in the days following major surgery, and because perioperative AF is typically transient and not recurrent, anticoagulation is generally not recommended in these patients [16].

The main limitations of our study were its retrospective design and the relatively small number of cases that were available for study. Larger, multi-site studies should be performed to better characterize the patients at highest risk for AF following CD. Ideally these studies ought to be prospective in nature, to mitigate risk of potential confounding or bias.

Conclusions

With the rate of CDs on the rise, it is important to consider all complications that parturients may experience intraoperatively as well as postoperatively, including maternal AF. POAF is a rare complication after CD and seems to be most common in multi-gravid, African American parturients with postoperative hypomagnesemia and preexisting cardiac disease who undergo emergent CD under neuraxial anesthesia. In order to improve maternal outcomes following CD, further studies should be performed to characterize patients at risk for AF following CD and optimize arrhythmia management in this population.

Conflict of interest

Nothing to declare

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