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Case Series

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Supraventricular Tachycardia and Anaesthetic Management- A Case Series

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ABSTRACT

Cardiac arrhythmias are commonly encountered in the peri-operative period, out of which atrial fibrillation has a relatively higher prevalence. Tachyarrhythmias are associated with various underlying factors like hypertension, heart disease, long-standing chronic obstructive pulmonary disease, hyperthyroidism, electrolyte abnormalities, and diabetes. Hence, understanding the pathophysiology and the management of cardiac arrhythmias is paramount for the anesthesiologist. This series would focus on managing peri-operative cardiac arrhythmias in non-cardiac surgeries, with a particular emphasis on atrial fibrillation.

Key-words: Supraventricular tachycardia, Atrial fibrillation, Atrial flutter, Combined spinal epidural

INTRODUCTION

Atrial fibrillation (AF) is one of the most common arrhythmias.[1] Atrial fibrillation may occur in patients admitted for anaesthesia before surgery, during anaesthesia, or in the postoperative phase. The prevalence of AF increases with age in the general population. It ranges from 0.12–0.16% among individuals under 49 to 1.7–4.0% in individuals 60–70 years old and up to 13.5–17.8% in individuals over 80.[2-4]

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Patients undergoing surgery may experience paroxysmal, new onset, or established atrial fibrillation.[5] Atrial fibrillation engenders multiple effects on cardiopulmonary hemodynamics, which can lead to hypotension, heart failure, and myocardial infarction. These patients have an increased risk of thrombosis and stroke due to decreased atrial flow.[6]

For an anaesthesiologist, managing peri-operative AF is crucial. To prevent peri-operative complications, it is vital to identify and eliminate all potential triggering factors along with adequate treatment of arrhythmias.

Case 1: Atrial Fibrillation with Hyperthyroidism

A 75-year-old female weighing 48 kg was posted for closed reduction internal fixation with PFN for a left comminuted IT femur fracture. She was a known hypertensive for 10 years on Tab Amlo 5 mg OD and a

known case of Atrial Fibrillation on Tab Amiodarone 100 mg. She was incidentally diagnosed with hyperthyroidism and was started on Tab Carbimazole 5 mg BD and Tab Propranolol 20 mg BD and Tab Amiodarone was tapered.

On examination, she had an irregular heart rate of 84/min, non-invasive blood pressure of 160/100 mm Hg, respiratory rate of 18/min, and O_2 saturation of 97% on room air. Airway examination showed MPC Class 2 and limited neck extension. Spine examination showed narrow intervertebral spaces. Systemic examination revealed normal heart sounds and pan systolic murmur.

Investigation revealed normal CBC, INR of 1.02, Free T3-4.94, Free T4-3.54, TSH-<0.01 and other blood investigations within normal limits. CXR revealed cardiomegaly. ECG showed an irregular rhythm with LVH with a strain pattern. Echocardiography showed Severe MR, TR, Moderate Pulmonary Hypertension, Atrial Fibrillation, Degenerative mitral valve, all 4 chambers dilated, EF-52%, PASP- 50 mm Hg.

For anticoagulation coverage, Inj LMWH 0.4 mg s.c was started five days before surgery and omitted 12 hr before surgery. High-risk consent was taken. Standard ASA Monitors defibrillator ECG leads were attached. Heart rate was 84/min irregularly irregular with atrial fibrillation. 18 G cannula was established.

Under all aseptic precautions and USG guidance, the right-sided IJV was cannulated with a 7 Fr triple-lumen catheter. The right radial artery was cannulated for invasive BP monitoring. Under all aseptic precautions, the combined spinal epidural was performed. Spinal anaesthesia was administered with Inj Bupivacaine 0.5% heavy 1.5 cc+ 25 mcg fentanyl citrate. Adequate analgesia was achieved. Intraoperatively, heart rate was in the range of 80-90/min and O_2 saturation 98-100% and the patient was hemodynamically stable.

CVP-guided IV fluids were given to the patient intraoperatively. The surgery lasted for 1½ hours with blood loss of 250 ml. Post-operatively, the patient was shifted to MICU for further management. Inj LMWH 0.6 mg s.c was started 12 hrs post-op, epidural top-ups were continued post-operatively and removal of the catheter was planned according to ASRA Guidelines. The postoperative period was uneventful.

Case 2: Atrial Flutter with COPD

An 85-year-old female weighing 50 kg was scheduled for left bipolar hemiarthroplasty for an intertrochanteric femur fracture. She had a known case of hypertension and COPD on Tab Telma H 40 OD, Tab MetXL 25 mg BD and Tab Orciprenaline 10 mg TDS. On examination, she had an irregularly irregular heart rate 78 beats per min, non-invasive blood pressure (NIBP) of 170/86mmhg, respiratory rate of 20/min and oxygen saturation of 98% on room air. Airway examination showed MPC class II, and limited neck extension. A spine examination showed a calcified spine.

Blood investigations were within normal limits. Chest X-ray showed pleuro-parenchymal lesions for which HRCT chest and ABG were done, which were within normal limits and pre-operative nebulization with Duolin and Budecort was given.

ECG showed sawtooth waves suggestive of Atrial Flutter. Echocardiography showed no RWMA, 55% Ejection Fraction, concentric LVH, mild MR, grade 1 diastolic dysfunction, fluttering of mitral leaflet, sclero-calcific aortic valve.

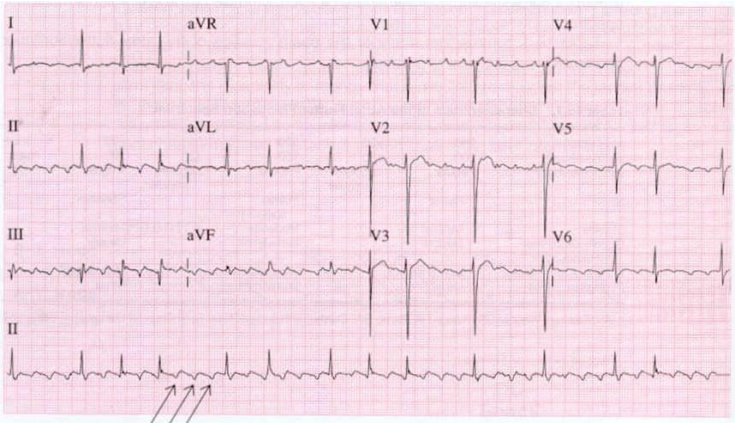

Fig. 1: ECG showing atrial flutter

For anticoagulation coverage, Inj. Heparin 2500 units (unfractionated) subcutaneous TDS was started 2 days before surgery and Tab Amiodarone 200 mg BD was started. High-risk consent was taken. Standard ASA monitors defibrillator ECG leads were attached. Heart rate was 76 beats per min with atrial flutter. Two 18 G cannula were established. The left radial artery was cannulated for invasive BP monitoring. Under all aseptic precautions, combined spinal epidural anaesthesia was performed. Spinal anaesthesia was administered with Inj Bupivacaine 0.5% heavy 1.5 cc with 25 mcg fentanyl citrate. Adequate analgesia was achieved, and the patient was hemodynamically stable.

After proper positioning of the patient, half an hour post-induction, a transient episode of atrial fibrillation was

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noted, which reverted by itself. As a precautionary measure, Inj Amiodarone infusion (300mg in 50 cc NS) at 10ml/hour was started to prevent further Tachyarrhythmias. Inj Magnesium Sulphate 1 gm IV was given for cardiac stabilization.

Intraoperatively, heart rate was 60-65/min and oxygen saturation were 98-100%. Inj Noradrenaline was started to maintain adequate mean arterial BP. The surgery lasted for 3 hours with a blood loss of 700ml. 1 PRC (packed red cell) was transfused intraoperatively. Inj amiodarone infusion was stopped and the patient was shifted to cardiac ICU with ongoing noradrenaline infusion. Inj LMWH 0.6 mg s.c was started 12 hrs post-op, epidural top-ups were continued post-operatively and removal of the catheter was planned according to ASRA Guidelines. The postoperative period was uneventful.

Case 3: Atrial Fibrillation with Transposition of Great Vessels

An 18-year-old male, weighing 45 kg, diagnosed with osteomyelitis of the left femur and tibia, was posted for debridement and drainage. The patient complained of high-grade fever with left lower limb pain. Upon examination, the patient exhibited pallor, central cyanosis, digital clubbing, irregularly irregular pulse rate of 110/min, non-invasive blood pressure of 98/66mm Hg, oxygen saturation of 86% with oxygen being delivered at a rate of 10 lit/min via non-rebreathing mask, and a respiratory rate of 33 per minute. TLC 21,000/cu.mm, Hb 13.8 mg/dl, platelets 90,000/cu.mm, and C-reactive protein 230 mg/L were revealed.

ECG showed absent P waves suggestive of atrial fibrillation. Chest X-ray revealed dextrocardia. His 2D echo was representative of situs-inversus with transposition of great vessels, a significant ventricular septal defect (VSD), a large atrium with a stump of interatrial septum close to roof, and a large ostium-primum with severe pulmonary hypertension. Pre-operative ABG (pH 7.46, pCO_2 19 mm Hg, pO_2 43 mm Hg, $sO_2$79.8%, HCO_3 24 mmol/lit).

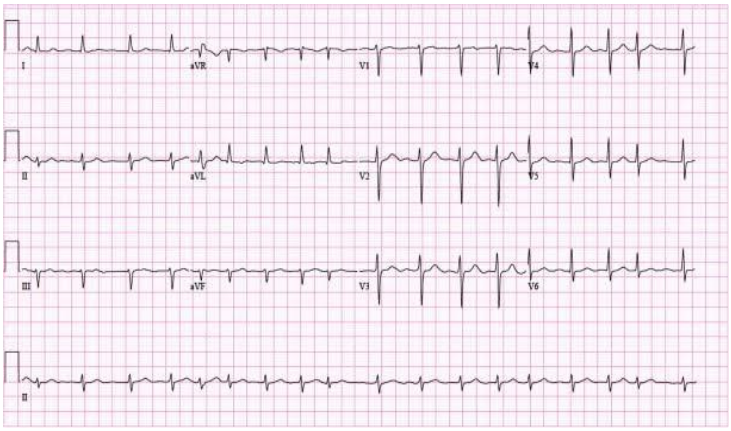

Fig. 2: ECG showing atrial fibrillation

Therapy was initiated with Inj. Low Molecular Weight Heparin 0.4 mg SC, Tab Amiodarone 200 mg, Tab Bisoprolol 2.5 mg & Inj. Furosemide 20 mg IV. High-risk consent was taken. Standard ASA monitors and defibrillator ECG leads were attached. Pre-operative vitals were HR- 96/min and irregular, BP 88/56 mm Hg with vasopressor support, SpO_2 81% with oxygen by NRM@10 lit/min. Under all aseptic precautions, under USG guidance, right, right-sided IJV was cannulated with 7 Fr Triple lumen catheter. The left radial artery was cannulated for invasive BP monitoring. After generous use of opioids as premedication, the patient was induced with Inj. Etomidate and Inj. Vecuronium and mechanically ventilated.

Sevoflurane was used as the inhalational agent of choice. Inj Amiodarone infusion (300 mg in 50 cc NS) at 10ml/hour was started with Inj Noradrenaline infusion to maintain baseline hemodynamic. Intraoperative ABGs after induction and at the end of surgery were (pH 7.277, pCO_2 50.6 mm Hg, pO_2 72.3 mm Hg, sO_2 89.4%, HCO_3 21 mmol/lit) (pH 7.279, pCO_2 47.9 mm Hg, pO_2 77.2 mm Hg, SO_2 92%, HCO_3 19.4 mmol/lit) respectively. Blood loss was more than 600 ml and more than 1.5litre of pus was drained from a linear incision from mid-thigh to below knee. Total intake was 1300ml with urine output of 200 ml.

Elective mechanical ventilation was planned post-operatively in ICU with an assist control mode of ventilation (TV 350 ml, RR 20/min, FiO_2 50%, PEEP 4 cm H_2O). Elective ventilation was continued for 48 hours. Amiodarone infusion was stopped after 24 hours and noradrenaline was gradually tapered. Extubation was uneventful.

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Case 4: Atrial Fibrillation with Chronic Kidney Disease

A 55-year-old male weighing 60 kgs was posted for right DJ stent exchange. The patient was a known case of hypertension, diabetes and CKD on Tab. Nicardia 20 mg OD. He was on maintenance haemodialysis for 6 months. The patient underwent right-sided DJ stenting 2 months back, which was followed by twice-weekly maintenance haemodialysis. He was a chronic smoker and a chronic alcoholic. Now, the patient came with complaints of generalized anasarca for 15 days and breathlessness for one day. Tab. Nicardia 20 mg was stopped, and the patient was put on Tab. Clinidipine 5mg OD for hypertension. ECG was suggestive of supraventricular tachycardia with features of atrial fibrillation, for which he was started on a tab Amiodarone 100 mg BD.

On general examination, the patient had an irregular heart rate of 100/min, non-invasive BP of 150/100 mm of hg, RR of 18/min, and saturation of 99% on room air. Airway examination showed MPC class II and spine examination was normal. Systemic examination revealed normal heart sounds. Air entry decreased at bilateral bases with crepts.

Investigations revealed Hb of 9.5gm% with normal TLC and platelets, normal INR, and KFT values of urea 96, creatinine, and 2.8. 2D echo revealed bi-atrial enlargement global hypokinesia with EF 30% with mild MR, mild TR, mild PH. ECG showed irregular rhythm with ectopic beats. A bilateral carotid doppler study revealed a plaque of size 0.3x1.8cm at the bulb of the right common carotid artery extending into right external carotid. An echogenic material of 4x0.2cm is noted within IJV on the right side causing near total occlusion of its lumen s/o near total thrombus.

The patient was on Tab. Nitrofurantoin 100mg TDS, Inj. Lasix 40mg TDS, Tab. Clinidipine 5mg od, Tab. Urimax 0.4mg HS, Tab. Amiodarone 100mg TDS, duolin nebulisation TDS, tab febuxostat 40mg od, Tab. Sobiosis Forte 1gm TDS.

For anticoagulation coverage inj. LMWH 0.4mg subcutaneous was started 5 days before surgery and omitted 12 hours before. High-risk consent was taken. Standard ASA monitors defibrillator ECG leads were attached. Heart rate was 100/min irregularly irregular; two 18 G cannula were established. Left radial artery was cannulated for invasive BP monitoring.

Under all aseptic precautions, spinal anaesthesia was administered with Bupivacaine 0.5% heavy 1cc with 25mcg fentanyl citrate. Adequate analgesia was achieved. The patient was hemodynamically stable. Intraoperatively heart rate was 90-100/min and O_2 saturation was 97-99%. Mean arterial BP was maintained in the range of 80-90mmhg throughout the procedure. The surgery lasted for 15 min. Post-operatively, the patient was shifted to MICU for further management. Inj LMWH 0.6mg subcutaneous was started 12 hours post-operatively.

Case 5: Atrial fibrillation with COPD

65 years male weighing 80 kg was posted for right lower limb fasciotomy for necrotizing fasciitis. The patient gives a history of breathlessness at rest for the last 1 year. The patient has a history of working in an iron factory for 30 years. The patient presents a history of fever with chills, cough & cold for 2-3 days. The patient had an irregular heart rate of 98/min on examination. NIBP was 130/90 mm of hg, RR was 30/min, and SpO_2 97% on room air.

Airway examination showed MPC grade- II, with a short neck. Spine examination showed narrowed intervertebral spaces. Systemic examination and blood investigations were normal. CXR was suggestive of a hyper-inflated lung with a flattened diaphragm. D-dimer was significantly elevated at 6727ng/ml, and ECG showed an irregular rhythm with VPCs. 2DECHO revealed no RWMA, 50% Ejection Fraction, Concentric LVH, dilated cardiomyopathy, mild MR, grade 1 diastolic dysfunction. To control heart rate Inj. Dilzem 5 mg iv STAT was given and the patient was observed for the same. Anticoagulation coverage was not given since the patient was taken as an emergency.

High-risk consent was taken, and standard ASA monitor defibrillator ECG leads were attached. HR was 100/min, irregularly irregular with atrial fibrillation alternating with flutter. 18G cannula for intravenous access was established. Under all aseptic precautions, under USG guidance, right, right-sided IJV was cannulated with 7 Fr Triple lumen catheter. The right radial artery was cannulated for invasive BP monitoring.

Under all aseptic precautions, spinal anaesthesia was administered in the right lateral position with 1cc Inj 0.5% Bupivacaine with Inj. Fentanyl 25mcg. Adequate analgesia was achieved. The patient was intraoperatively hemodynamically stable. Intra Op- HR was in range of 60-170/min and O2 saturation was 97-99%. IV fluids were given in titrated doses. Surgery lasted for 1 hour

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with a blood loss of 250ml. Post-operatively, the patient was shifted to MICU for further management. Inj LMWH 0.6 mg s.c was started 12 hrs postoperatively.

DISCUSSION

Perioperative AF was once thought to be benign and self-limiting. New research indicates that it is linked to significant morbidity and mortality and may, in some instances, predict long-term AF and stroke risk. Atrial fibrillation (AF) is the most common cause of unanticipated complications during the peri-operative period, especially after non-cardiac surgery, even with known risk factors.[7] To depolarize both ventricles, cardiac electrical impulses originate at the SA node. In atrial fibrillation (AF), impulses do not begin at the SA node but originate throughout the atria.[8,9] The Heart Rhythm Society distinguishes between three forms of atrial fibrillation (AF): paroxysmal, which can happen and end on its own. Persistent, which requires treatment to end, and permanent, which cannot be treated even with medication or electrical therapy. The most prevalent subtype of AF in the peri-operative period is paroxysmal AF, typically caused by localized ectopic firing.[10,11]

Perioperative risk reduction therapies focus on proactively controlling patient and surgery-related variables that may induce arrhythmogenic episodes and avoiding potential arrhythmogenic triggers. Anaesthesiologist must treat both the AF itself and the hemodynamic abnormalities it causes to prevent end-organ damage. Peri-operative management of AF includes pharmacological or electrical methods to restore sinus rhythm, regulation of the ventricular rate in those with chronic AF and paroxysmal or persistent AF, prevention of paroxysmal or chronic atrial fibrillation once sinus rhythm is successfully restored, thromboembolic phenomenon prevention.[12]

When it comes to treating patients with ventricular dysfunction and ischemic heart disease, amiodarone is the recommended medication of choice. Aside from its anti-arrhythmic properties, amiodarone also provides the added benefit of rapid rate regulation. After intravenous loading, this rate-controlling impact (beta-blockade and calcium channel blockade capabilities) is shown early. To avoid sympathetic activation, hypoxia, sudden electrolyte imbalance and hyper or hypovolemia, specific peri-operative therapies should be implemented. During surgery, hypotension may increase the risk of AF.

There is potential hemodynamic instability when using intravenous induction agents to administer general anaesthesia to these individuals. Because of its cardio-stable characteristics, etomidate has been a commonly employed induction agent of choice. Although ketamine hasn't been linked to peri-operative AF, its intraoperative use in multimodal pain management may put patients at risk for peri-operative AF since it increases sympathetic activity even at sub-anaesthetic doses. Consequently, it could be wise to avoid giving ketamine to older adults. As an anticholinergic drug that reverses neuromuscular blockade when used with neostigmine, glycopyrrolate can cause tachycardia and dysarrhythmias.[13]

Sympathetic stimulation during laryngoscopy and intubation may lead to pulmonary oedema. Regarding AF, among the volatile anesthetics, desflurane is associated with increased sympathetic activation and arrhythmia risk.[14] In addition to its propensity for dysrhythmias, halothane has the drawback of myocardial depression. [15] Vecuronium can be safely used in cardiac patients as it provides steady hemodynamics.[16,17]

Reduction in preload is observed with positive pressure ventilation. Considering the risks and the lack of coagulopathy, a regional anaesthetic technique should be chosen. Spinal anaesthesia alone would result in abrupt, severe hypotension; in contrast, CSE offers the combined advantages of immediate dense blockade, with a low dose spinal, to start the surgical procedure, and the gradual increase in the height of the block with epidural if necessary. If the procedure could be completed under the regional block, cardiac patients would benefit from regional anesthesia's perspective and a well-established advantage over general anaesthesia. [18]

During surgery, transoesophageal echocardiography (TEE) can help rule out AMI and manage fluid in high-risk patients.[19,20] Hence, a patient with SVT can be successfully handled with a multidisciplinary approach and sufficient hemodynamic monitoring, considering all peri-operative considerations.

CONCLUSIONS

To conclude, the documented cases provide valuable insights into successful management strategies. Continuing research in this area holds promise for refining protocols, enhancing patient outcomes, and advancing our understanding of the complex interplay

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between anaesthesia and supraventricular tachycardia. This case series sheds light on the crucial anaesthetic considerations in patients presenting with supraventricular tachycardias (SVTs). The diverse array of SVTs poses unique challenges in peri-operative management. Tailoring anaesthetic strategies based on the specific SVT subtype and individual patient characteristics is paramount to optimize peri-operative outcomes. Close collaboration between anaesthesiologists, cardiologists, and surgeons is essential to ensure a multidisciplinary approach addressing care's cardiac and anaesthetic aspects.

Further exploration of innovative technologies and collaborative efforts between anaesthesiologists and cardiologists will contribute to the evolution of more tailored and practical approaches in the future.

SUMMARY

Our findings emphasize the need for a personalized and vigilant approach when managing patients with SVTs undergoing various surgical procedures.

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Data collection- Dr. Madhushree Shah, Dr. Ayush Bhatnangar, Dr. Rangoli Sao, Dr. Ajinkya Kalbande

Data analysis and Interpretation- Dr. Madhushree Shah, Dr. Ajeet Jyotipurkar, Dr. Ayush Bhatnagar, Dr. Ajinkya Kalbande

Literature search- Dr. Madhushree Shah, Dr. Ajeet Jyotipurkar, Dr. Rangoli Sao

Writing article- Dr. Madhushree Shah, Dr. Heena Pahuja, Dr. Ayush Bhatnagar, Dr. Rangoli Sao

Critical review- Dr. Madhushree Shah, Dr. Heena Pahuja, Dr. Ajeet Jyotipurkar, Dr. Anjali Bhure Dr. Ayush Bhatnagar, Dr. Rangoli Sao, Dr. Ajinkya Kalbande

Article editing- Dr. Madhushree Shah, Dr. Heena Pahuja

Final Approval- Dr. Madhushree Shah, Dr. Heena Pahuja, Dr. Ajeet Jyotipurkar, Dr. Anjali Bhure

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