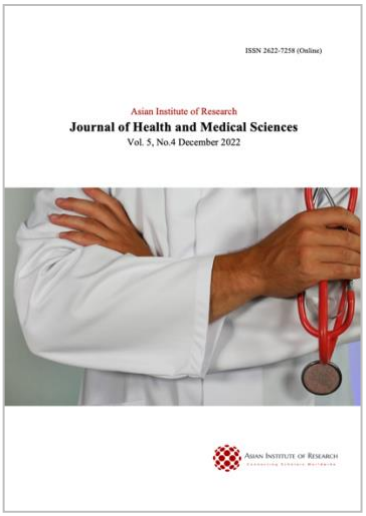

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Anaesthetic Management of Patient with Left Atrial Myxoma, Coronary Artery Disease 3 Vessels Disease, and Parkinson's Disease

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Abstract
Myxomas are the most common primary benign intracavitatory tumour with the incidence of 0.5 per million populations. Myxomas account for 0.3% of all cardiac surgeries performed. Clinically, they are characterized by a triad of embolisation, obstruction of blood flow, and constitutional symptoms (Goodwin's triad). Meanwhile Parkinson's disease is a degenerative neurologic disorder caused by degeneration of nerve cells in the substantia nigra causing weakness motor coordination. Symptoms include tremor, bradykinesia, rigidity, and postural instability. Achieving a satisfactory hemodynamic performance is the primary objective in the management of cardiac surgery patient. Optimal cardiac function ensures adequate perfusion and oxygenation of other organ systems (in particular vital organs) and improves the chances for an uneventful recovery from surgery. A 61-year old female diagnosed with Coronary Artery Disease 3 Vessel Disease (CAD 3 VD), Parkinson's disease, and left atrial myxoma was brought to the emergency department with dyspnea. The patient has undergone angiography and the echocardiography result was LVEF 59% with global normokinetic, LA myxoma causing non-significant mitral flow. LA myxoma excision under general anaesthesia on CPB was planned. Balanced general anaesthesia on cardiopulmonary bypass forms the basis of Anaesthetic management of Cardiac myxomas. However specific individual considerations will have to be made regarding drugs, doses, regional anaesthetic choices, anticoagulation and post-operative management. There is no simple anesthetic technique for patients with Parkinson'. Therefore, careful preoperative assessment, administration of drugs during and after anesthesia, as well as avoiding agents that are known to trigger Parkinson's symptoms is a major factor in reducing postoperative morbidity and mortality.

Keywords: Anesthetic Management, CAD 3VD, Cardiopulmonary Bypass, Myxoma, Parkinson's Disease

1. Introduction

Myxomas are commonest primary benign intracavitarytumorss with the incidence of 0.5 per million population (MacGowan et al.,1993). Myxomas account for 0.3% of all cardiac surgeries performed (Castells et al.,1993). Myxomas are twice more common in females than in males and the mean yearof occurrence is 55 years (Godwin.,1963). Myxomas commonly arisefrom the left atrium but 25% occurs in the right atrium or ventricles. (Godwin.,1963). Clinically, they are characterized by triad of embolisation, obstruction of blood flow, and constitutional symptoms (Goodwin's triad) (Feng et al., 1990). About 17-59% of patients with myxomas present as an embolic event, while cerebral embolisation occurs in up to 45%, and this commonly occurs in the middle cerebral artery territory as in our case (Feng et al., 1990).

Parkinson's disease is a degenerative neurologic disorder caused by degeneration of nerve cells in the substantia nigra causing weakness in motor coordination. These nerve cells die or become damaged because they loose the ability to produce dobutamine. Symptoms include tremor, bradykinesia, rigidity, and postural instability (Feng et al 1990).

Patients undergoing cardiac surgical procedures are extensively monitored. Hemodynamic alterations and myocardial ischemia that occurs during the induction of anesthesia, in the prebypass period, during CPB, and following resumption of cardiac activity can have significant adverse effects on myocardial function and recovery (Feng et al., 1990).

It should be noted that even though both hypertension and tachycardia can increase myocardial oxygen demand, an increase in heart rate results in more myocardial ischemia at an equivalent increase in oxygen demand. Standard monitoring in the operating room consists of a five-lead ECG, central venous catheter (CVC), a radial arterial line, pulse oximetry, an end-tidal CO2 measurement, a Swan-Ganz pulmonary artery (PA) catheter, cerebral oximetry, and a urinary Foley catheter to measure urine output, core body temperature and intraoperative transesophageal echocardiography (TEE) should be obtained (Feng et al.,1990).

Anesthetic management must be individualized, taking into consideration the patient's age, comorbidities, the nature and extent of coronary or valvular disease, the degree of left ventricular dysfunction, and plans for early extubation. These factors will determine which medications should be selected to avoid myocardial depression, tachycardia, or bradycardia, or to counteract changes in vasomotor tone. Generally, a balanced anesthetic technique using a combination of narcotics and potent inhalational agents is used for all open-heart surgery to minimize myocardial depression (Feng et al.,1990).

2. Case

A 61-year old female diagnosed with Coronary Artery Disease 3 Vessel Disease (CAD 3 VD), Parkinson's disease, and left atrial myxoma was brought to the emergency department with dyspnea. She had a past history of hypertension for over 2 years. She was diagnosed with CAD since 2021 and was on medical therapies furosemide 1x40 mg, bisoprolol 1x2,5 mg, candesartan 1x8 mg, nitroglycerin 1x2,5, amlodipine 1x10 mg, allopurinol 1x100 mg, Clobazam 1x10, Clopidogrel 1x75 mg, levodopa 1x125 mg, Trihexylphenidyl 1x1 mg. She weighs 42 kg.

The patient had undergone angiography for preoperative indications. The echocardiography result was global normokinetic with LVEF 59%, LA myxoma causing non-significant mitral flow. The patient has hypertension as coexisting disease. LA myxoma excision under general anaesthesia on CPB was planned.

Angiography results show a codominant system. The left main artery appears fine. The left anterior descending vessel showed moderate stenosis in the mid, severe stenosis in the distal and in the ostial branches of diagonal 1 and diagonal 2. The intermediate ramus showed severe stenosis in the ostial. The left circumflex artery showed severe stenosis distally and ostium OM 1. The right coronary artery showed mild stenosis proximally.

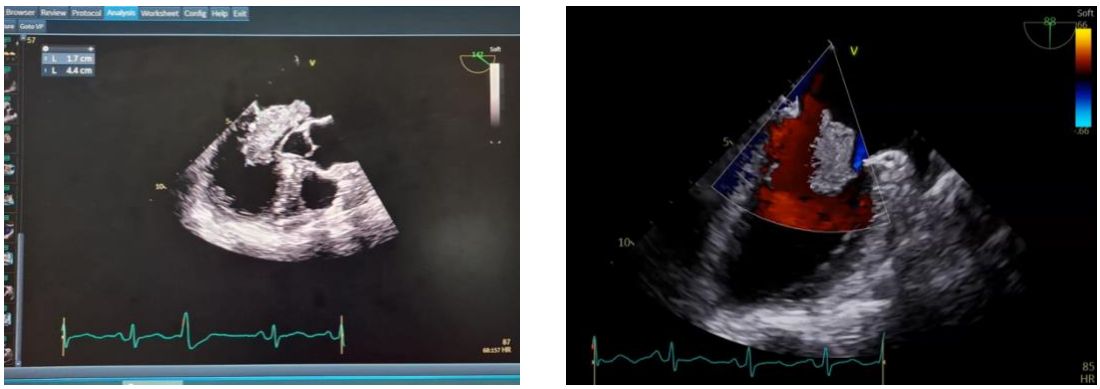

Figure 1: Echocardiography showing mass in the Left atrium (arrow)

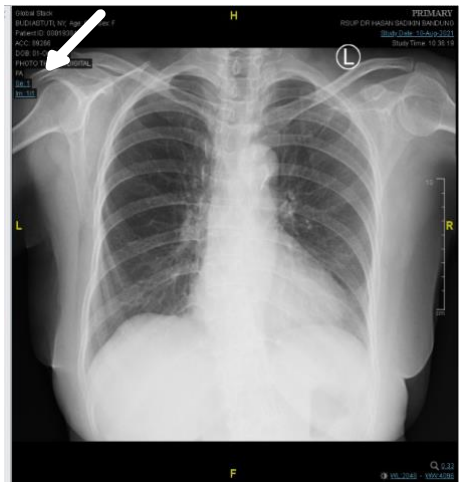

Figure 2: Photo thorax show cardiomegaly without swelling, atheroclerosis of aorta, scoliosis of the thoracic vertebrae

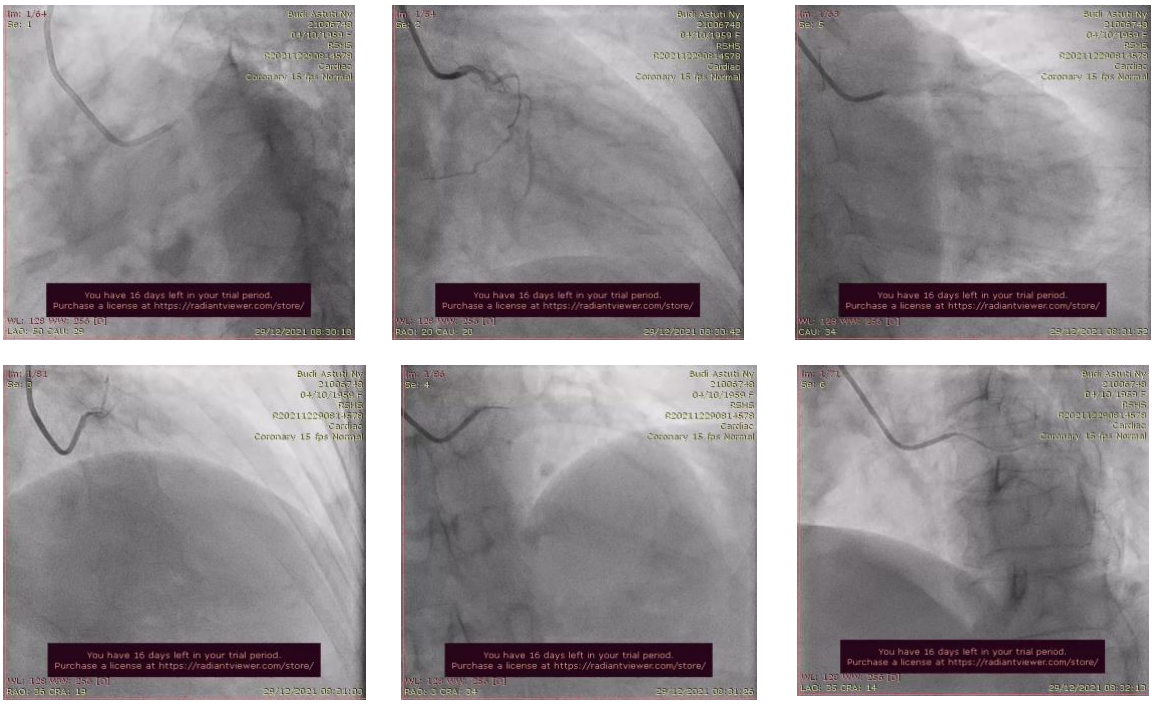

Figure 3: Angiography show CAD 3 VD

All the routine preoperative investigations were within normal limits. Patient was taken into operating room and arterial line was secured in right radial artery under local anaesthesia. Before the induction of anesthesia, the patient was preoxygenated for 3-5 minutes, then given midazolam 3 mg, fentanyl 150 mcg, propofol 40 mg, and rocuronium 40 mg intravenously. Intubation was done with cuffed endo-tracheal tube size 8. Anaesthesia was maintained with sevoflurane. A 7 Fr triple lumen central venous catheter was inserted through left subclavian vein. Baseline ACT (activated clotting time) was 150sec. Patient was heparinized with 16000 IU of IV Heparin and ACT was maintained > 8 minutes and the patient went into cardiopulmonary bypass. Total Cross clamp time was 40 minutes and total bypass time was 44 minutes. During the bypass period, anesthesia was maintained using continous propofol infusion.

Intraoperative, a LA Myxoma sized 2 x 1,4 cm was excised, with a stalk attached to the interatrial septum (IAS). Excision of LA Myxoma was done including part of the IAS to which the myxoma was attached and the created ASD was closed with pericardial patch.

Intraoperative investigations of arterial blood gas analysis, hemoglobin level, blood sugar, and electrolytes were within normal limits. Intravenous protamine 160 mg was givenfor reversal of heparin effect. ACT was 120 seconds after protamine injection. Total duration of anaesthesia was 4 hours and 25 minutes and total duration of surgery was 4 hours. The patient received 1.5L of Ringers Lactate, 500ml of Gelofusine (Gelatine 3.5%) and two pints (700ml) of packed red cells were also transfused intraoperatively.

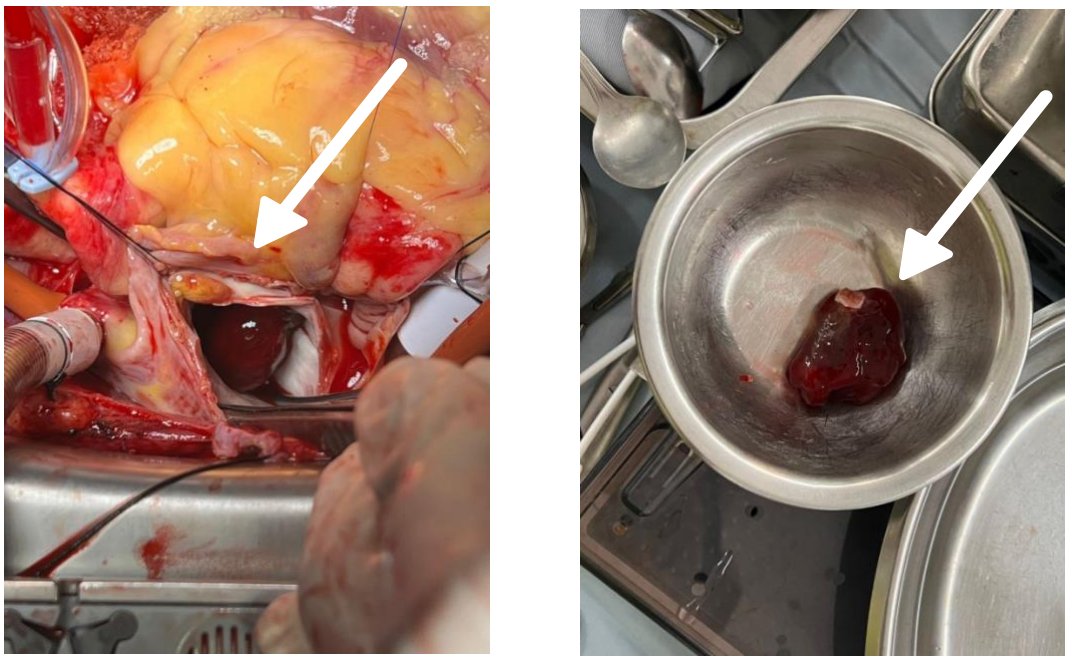

Figure 4: LA myxoma, just after excision (arrow)

The patient was transferred to the ICU, still intubated and sedated with propofol infusion. The patient's heart rate was 90 bpm and BP 118/78 mmHg, on dobutamine infusion 5µg/kg/min. Patient was extubated in the ICU after a few minutes and was kept on non-rebreathing mask with oxygen 15 lpm, RR 20/min and SpO_2 97%. For analgesia, the patient received continuous intravenous morphine 1mg/hour. At the early postoperative period, the chest drain production was about 130ml/hour, intravenous traneksamic acid 1 gram was given. Levodopa as the medication for Parkinson's was continued immediately after surgery through a nasogastric tube. As the blood pressure was maintained, the dobutamine infusion was decreased and stopped at the same day. Postoperative laboratory investigations were within normal limits.

On the third postoperative day, all routine investigations were normal. Urine catheter and central venous catheter were removed. The patient was then shifted to the ward where she was observed for three more days whilst the chest and limb physiotherapy was continued. LMWH was stoppedon seventh post- operative day and the

patient was discharged. She was then advised to follow up after one week and continue physiotherapy.

3. Discussion

Myxomas are commonest primary benign intracavitatory tumors with the incidence of 0.5 per million populations (Castells et al.,1993). Clinically, they are characterized by triad of embolisation, obstruction of blood flow, and constitutional symptoms (Goodwin's triad) (Feng et al., 1990). About 17-59% of patient with myxoma present as embolic event, while cerebral embolisation occurs in up to 45%, and this commonly occurs in the middle cerebral artery territory as in our case (Feng et al.,1990).

Three things must be considered when starting the induction are oxygenation, fluid status, and selection of drugs that does not make the heart work harder. Pre-oxygenation is needed to optimize blood oxygen levels. In addition, CVC placement should be done to ensure the patient remains in a normovolemic state. The combination of fentanyl, midazolam, and sevoflurane is the drug of choice used for induction, because it can minimize the cardiac depressant effect. However, the beneficial effects on the heart are still obtained.

Obstruction to blood flow can present with heart failure or syncope in 41 – 79% of cases (Mac Giwan et al., 1993). Left ventricular outflow tract obstruction because of the mass can mimic mitral stenosis and can cause pulmonary hypertension and even congestive heartfailure (Mac Gowan et al.,1993). Right sided myxoma can also be associated with obstruction and can present as cardiovascular collapse during induction of anaesthesia (Mac Gowan et al., 1993).

Fever, malaise, weight loss, fatigue, anemia, andraised erythrocyte sedimentation rate are common constitutional symptoms which occur in around 90% patients with myxomas.(Feng et al.,1990) These features resolve immediately after surgery and are believed to be due to release of inflammatory mediators from tumour cells (Namboodiri et al., 2004).

Structurally, there are two types of myxomas, one withround, non-mobile surface, and another polypoid type with irregular shape, mobile surface and this latter type has the higher incidence of embolism and this is the commonest type to prolapse into the ventricles (Swenson et al., 2005).

Surgical management is the treatment of choice for myxomas but open-heart surgery immediately after cerebral embolisation is considered contraindicateddue to problems of hemorrhagic, infarction or progressive cerebral oedema (Swenson et al., 2005). Another school of thought considers immediate surgery as the treatment, as recurrent embolisation can be fatal (Peters et al., 1974). The recurrence of myxoma has been reported to be less than 2% on most series (Mac Gowan et al., 1993).

Anaesthetic considerations include the consideration for patient undergoing open-heart surgery. A detail history and a meticulous clinical examination is a must. Risk factors for cardiovascular diseases, other comorbid conditions, NYHA classification for functional status of the patient should also be assessed properly (Disesa et al., 1988). Preoperative evidence of heart failure, pulmonary hypertension and evidence of outflow obstruction should be obtained (Moritz et al., 1989). Patient with history of embolism should be properly treated with anticoagulants according to guidelines and then planned for surgery (Bateman et al., 1983). Apart from routine blood and urine investigations, chest roentgenogram, electrocardiography, and echocardiography is essential. Echocardiography not only gives information about the size of the tumour, but can also locate the origin of the myxoma (Knepper et al., 1988). In this regard, trans-esophageal echocardiography (TEE) is superior to transthoracal echocardiography (TTE) (Mac Gowan et al., 1993).

Even though arrhythmias are uncommon, atrialarrhythmias –if present— should be treated either pharmacological or with electric cardioversion as indicated (Knepper et al., 1988). In patients with evidence of embolism, other investigations are required depending on the site of embolism. CT scan and MRI are helpful in embolic stroke while Doppler studies are helpful in cases of peripheral vessel involvement, e.g. carotid or femoral arteries (Moritz et al.,1989).

Adequate premedication helps in allaying anxiety, and avoids detrimental haemodynamic changes due to it (Disesa et al., 1988). Apart from basic monitoring; invasive arterial pressure monitoring and central venous line placement is a must in patient undergoing myxoma excision (Disesa et al., 1988). Pulmonary artery catheterization is not necessary unless there are specific indications for it. The use of TEE has now been considered a useful tool for intraoperative diagnosis, localization of the tumour, and also for confirmation of adequateremoval (Mac Gowan et al., 1993). The anaesthetic regimen for conducting anaesthesia for myxoma excision is not different from any other cardiac surgery, but a balanced anaesthetic approach is now the preferred method (Bateman et al., 1983). Opiates, along with volatile anaesthetic agents, which have additional advantage of inducing ischemic preconditioning (in patients likely to have ischemic myocardial insults), and any of the commonly used muscle relaxants can be combined for the balanced approach (Bateman et al., 1983). Benzodiazepines, forms a core component of the balanced approach and midazolam in particular is preferred for minimal effect on coronary blood flow autoregulation. After the aortic cross clamping and the patient on CPB, anaesthesia can be maintained with the volatile agent through the CPB or can be maintained on low dose propofol infusion for sedation (Disesa et al., 1988). However, induction with propofol is not advised because of action causingsignificant depression of myocardium, and hypotension owing to decrease systemic vascular resistance (Disesa et al., 1988).

After the excision of tumour and repair of the opening site, weaning from CPB and reversal of heparin with protamine, checking regular blood gas parameters and activated clotting time are similar to any other cardiac surgery (Peters et al., 1974). Fast track cardiacanaesthesia or early extubation following surgery is the goal and shall be preferred unless any complications or contraindications occur (Bateman et al., 1983).

Regional anaesthetics, intrathecal or epidural haveadvantages because of their desirable effects on stressresponse, haemodynamics, coronary perfusion pressure, myocardial blood flow redistribution and chances of early extubation, but their use is not common, maybe because of concerns foranticoagulation, and potential to cause haematomaand its neurological consequences (Bateman et al., 1983).

Post-operatively, the patient should be monitored in an intensive care unit or other high dependency units,where constant supervision, monitoring and vigilance are available (Peters et al., 1974). Anticoagulation should be resumed postoperatively in patients with history of embolism, and in those who were on anticoagulation preoperatively.(Disesa et al.,1988) High incidence of arrhythmias and conduction disturbances have been reported both in early and late post-operative periods (Knepper et al., 1988).

Myocardial ischemia occurs when the oxygen supply to the heart is insufficient to meet metabolic needs. This mismatch can result from a decrease in oxygen supply, a rise in demand, or both. The most common underlying cause of myocardial ischemia is obstruction of coronary arteries by atherosclerosis. In the presence of such obstruction, transient ischemic episodes are usually precipitated by an increase in oxygen demand as a result of physical exertion. Ventricular hypertrophy due to hypertension can predispose the myocardium to ischemia because of impaired penetration of blood flow from epicardial coronary arteries to the endocardium (Ha J.W et al., 1999).

A low cardiac output state in patients with a history of CAD may result from abnormal preload, contractility, heart rate, or afterload. It may also be noted in patients with satisfactory systolic function but marked left ventricular hypertrophy and diastolic dysfunction. The principal management of this condition are: 1. Ensure satisfactory oxygenation and ventilation; 2. Treat ischemia or coronary spasm if suspected to be present –myocardial ischemia often responds to intravenous nitroglycerin (NTG) but may require further investigation if it persists; 3. Optimize preload by raising filling pressure with volume infusion; 4. Stabilize the heart rate and rhythm; 5. Improve contractility with inotropic agents –this should be based on an understanding of the α, β or nonadrenergic hemodynamic effects of vasoactive medications and their anticipated effects on preload, afterload, heart rate, andcontractility; 6. Reduce afterload; 7. Maintain blood pressure (Ha J.W et al., 1999).

The main perioperative concern in our patient was the past history of hypertension for over 2 years, CAD (CTO in LAD and RCA, 89-90% stenosis in LCX), low EF (27%), extensive myocard infarction (from apical to basal) with hypertrophy as well as global function impairment of the left ventricle. Providing safe anesthesia to these

patient who are posted for CABG has always been challenging. Hemodynamic alterations and myocardial ischemia that occur during the induction of anesthesia, in the prebypass period, during CPB, and following resumption of cardiac activity can have significant adverse effects on myocardial function and recovery. It should be noted that even though both hypertension and tachycardia can increase myocardial oxygen demand, an increase in heart rate results in more myocardial ischemia at an equivalent increase in oxygen demand (Ha J.W et al.,1999).

Perioperative management of Parkinson's patients is a challenge for an anesthesiologist. Attention must be focused on three things, the administration of anti-Parkinson's drugs in the perioperative period, the possibility of adverse interactions from anesthetic drugs with antiparkinsonian drugs, as well as physiological disturbances caused by Parkinson's disease.

If it is decided to perform general anesthesia, it needs to be done with anticipation of the possibility of a difficult airway, hyperreactive airway and aspiration due to excessive secretions. The possibility of postoperative mechanical ventilation should also be considered. In patients undergoing general anesthesia, rigidity following high or low doses of fentanyl may be observed in normal patients. However, people with Parkinson's are more likely to have postoperative confusion and hallucinations (Kumar et al., 2004) (Morganet al., 2006).

Furthermore, it is important to ensure that patients receive treatment in the postoperative period. Routine doses of anti-Parkinson's drugs should be continued as soon as possible after surgery to prevent exacerbation symptoms. Stopping levodopa suddenly can cause exacerbations symptoms, especially dysphagia and rigidity of the chest wall skeletal muscles affecting ventilation ability and disturbance of respiration, or neuroleptic malignant syndrome (NMS) may occur (Nicholson et al., 2002).

In the use of inhaled anesthetic agents, one thing that must be avoided is the possibility of tachyarrhythmias due to the use of halothane in Parkinson's patients treated with levodopa, because halothane can sensitize the heart to catecholamines. There have been no reports of adverse effects with isoflurane, sevoflurane, or desflurane in Parkinson's patients. Isoflurane and sevoflurane are the inhaled agents of choice although they may cause hypotension, especially in patients with autonomic neuropathy and in those with autonomic neuropathy (Robert.,2011).

4. Conclusion

Achieving a satisfactory hemodynamic performance is the primary objective in the management of cardiac surgical patient. Optimal cardiac function ensures adequate perfusion and oxygenation of other organ systems (in particular vital organs) and improves the chances for an uneventful recovery from surgery. Balanced general anaesthesia on Cardiopulmonary Bypass forms the basis of anaesthetic managementof cardiac myxomas. However specific individual considerations will have to be made regarding drugs, doses, regional anaesthetic choices, anticoagulationand post-operative management. There is no simple anesthetic technique for selecting anesthesia Parkinson's patient. Therefore, careful preoperative assessment, administration of during and after anesthesia, as well as avoiding agents that known to trigger Parkinson's symptoms is a major factor in reduce postoperative morbidity and mortality.

References

MacGowan, S. W., Sidhu, P., Aherne, T., Luke, D., Wood, A. E., Neligan, M. C., & McGovern, E. (1993). Atrial myxoma: national incidence, diagnosis and surgical management. *_Irish journal of medical science, 162(6),*_223–226. https://doi.org/10.1007/BF02945200.

Castells, E., Ferran, V., Octavio de Toledo, M. C., Calbet, J. M., Benito, M., Fontanillas, C., Granados, J., Obi, C. L., & Saura, E. (1993). Cardiac myxomas: surgical treatment, long-term results and recurrence. *_The Journal of cardiovascular surgery, 34(1),*_49–53. https://pubmed.ncbi.nlm.nih.gov/8482704/

Goodwin J. F. (1963). Diagnosis of left atrial myxoma. *_Lancet (London, England), 1(7279),* 464–468. https://doi.org/10.1016/s0140-6736(63)92359-6.

Fang, B. R., Chiang, C. W., Hung, J. S., Lee, Y. S., & Chang, C. S. (1990). Cardiac myxoma—clinical experience in 24 patients. *_International journal of cardiology, 29(3),* 335–341. https://doi.org/10.1016/0167-5273(90)90123-m.

Namboodiri, K. K., Chaliha, M. S., Manoj, R. K., & Grover, A. (2004). Central nervous embolism as an usual presentation of left atrial myxoma. *_Journal of postgraduate medicine, 50(2),*151. http://www.bioline.org.br/pdf?jp04047

Swenson, J. D., Balley, P. L. (2005). Intraoperataive diagnosis of atrial myxoma by TEE. *_Miller's Anaesthesia. Churcill Livingstone.*

Disesa, V. J., Collins, J. J., Jr, & Cohn, L. H. (1988). Considerations in the surgical management of left atrial myxoma. *_Journal of cardiac surgery, 3(1),*_15–22. https://doi.org/10.1111/j.1540-8191.1988.tb00213.x.

Peters, M. N., Hall, R. J., Cooley, D. A., Leachman, R. D., & Garcia, E. (1974). The clinical syndrome of atrial myxoma. *_JAMA, 230(5),*_695–701. https://pubmed.ncbi.nlm.nih.gov/4479298/

Moritz, H. A., & Azad, S. S. (1989). Right atrial myxoma: case report and anaesthetic considerations. *_Canadian journal of anaesthesia = Journal canadien d'anesthesie, 36(2),* 212–214. https://doi.org/10.1007/BF03011447.

Bateman, T. M., Gray, R. J., Raymond, M. J., Chaux, A., Czer, L. S., & Matloff, J. M. (1983). Arrhythmias and conduction disturbances following cardiac operation for the removal of left atrial myxomas. *_The Journal of thoracic and cardiovascular surgery, 86(4),*_601–607. https://pubmed.ncbi.nlm.nih.gov/6621088/

Knepper, L. E., Biller, J., Adams, H. P., Jr, & Bruno, A. (1988). Neurologic manifestations of atrial
myxoma. A 12-year experience and review. _Stroke, 19(11),_ 1435–1440.
https://doi.org/10.1161/01.str.19.11.1435.

Ha, J. W., Kang, W. C., Chung, N., Chang, B. C., Rim, S. J., Kwon, J. W., Jang, Y., Shim, W. H., Cho, S. Y., Kim, S. S., & Cho, S. H. (1999). Echocardiographic and morphologic characteristics of left atrial myxoma and their relation to systemic embolism. *_The American journal of cardiology, 83(11),*_1579–A8. https://doi.org/10.1016/s0002-9149(99)00156-3.

Kumar, T.K.S., Ali, M., & Hirakannawar, A. (2004). Clinical experience and surgical considerations in the management of cardiac myxomas. *_Indian Journal Thoracic Cardiovascular Surgery, 20,*_ 77–82. https://doi.org/10.1007/s12055-004-0046-3

Morgan, G.E., Mikhail, M.S., & Murray M.J. (2006). _Anesthesia for patients with neurologic & psychiatric disease in Clinical anesthesiology._ *Lange Medical Book/McGraw-Hill Medical Publishing Division.*

Nicholson, G., Pereira, A. C., & Hall, G. M. (2002). Parkinson's disease and anaesthesia. *_British journal of anaesthesia, 89(6),*_904–916. https://doi.org/10.1093/bja/aef268.

Robert, M.B. (2011). *_Cardiovascular management: Manual of perioperative in adult cardiac surgery._* Blackwell's publishing.