# Peri-operative Management of a Patient with Uncontrolled Polycythemia Vera for above Knee Amputation

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## Introduction

Polycythemia Rubra Vera (PV) is an abnormality of the haemopoietic stem cell characterized mainly by erythrocytosis. Granulocytosis and thrombocytosis are also common.[1] The most common serious complications in untreated patients are thrombotic events which include cerebrovascular accident, myocardial infarction, deep vein thrombosis and pulmonary embolism.[2] Bleeding is also a common complication.[1,3] Over 75% of patients with uncontrolled PV develop complications during or after major surgery because of these complications.[3] Although vast attention has been given to peri-operative management of anaemias in literature, there has been much less focus on erythrocytosis which may be an equally serious condition.[4] We report on a patient with uncontrolled PV who presented with thromboembolic gangrene of the right leg and underwent right above knee amputation under General Anaesthesia.

## Case Report

A 34 years old man with a history of Polycythemia Vera (PV) diagnosed in 1991 was admitted to our hospital with severe pain, swelling and discolouration of right lower leg. His history revealed that his usual hemoglobin (Hb) used to remain above 18g/dl. He used to get a phlebotomy done at irregular intervals. This resulted in his having this thromboembolic event leading to an ischemic lower limb. His co-morbids included hypertension for 8 years and diabetes mellitus type 1 for 3 years both of which were controlled..

His current problem started 15 days back when he was admitted to another hospital with the complaints of swelling of his legs. A renal biopsy was done. Then he developed increasing swelling and pain of the right leg which became pulseless. For this a right femoral arterial embolectomy was performed. By the next day his leg developed a compartment syndrome and a fasciotomy was done. After two days he noticed discoloration of the toes of his right foot with increasing pain. At this point he was brought to our hospital and was admitted under the care of a vascular surgeon. On admission he had a temperature of 39°C and was tachypnoeic. He showed signs of congestive cardiac failure (CCF) with sacral edema, a jugular venous pressure of +6 cms, bilateral crepitations upto the mid zones and a summation gallop. He also had a palpable spleen. His right lower limb showed necrotic tissue in the fasciotomy wounds, discolored toes and loss of sensation upto the knee. He had a Hb of 15.9, a hematocrit (Hct) of 50.2% and a markedly deranged coagulation. Atrial fibrillation was detected on the electrocardiogram and the chest radiograph showed cardiomegaly. An echocardiogram showed dilated cardiac chambers with the left ventricular ejection fraction of less than 25%. The rest of the investigations were within normal limits (Table). Intravenous antibiotics were started and hematology and cardiology consults were sought.

**Table. Laboratory results of the patient with Polycythemia Vera.**

| Laboratory variables | On Admission | Pre-operative | Normal range |
|---|---|---|---|
| **Haematology** | | | |
| Haemoglobin(gm/dL) | 15.8 | 12.1 | 13.7-16.3 |
| Haematocrit (%) | 50.2 | 38.3 | 41.9-48.7 |
| Leukocytes (x109/L) | 9.0 | 8.0 | 4.0-10.0 |
| Platelets(x103/L) | 363 | 397 | 150-400 |
| **Coagulation Profile** | | | |
| Prothrombin time(s) | 110.0 | 19.6 | 10-15 |
| Activated partial thromboplastin time(s) | 71.6 | 42.1 | Control 30s |
| INR | 7 | 1.64 | Ratio |
| D Dimer | 1.13 | | 0-0.5 |
| **Biochemistry** | | | |
| Serum Sodium (mmol/L) | 140 | 136 | 136-148 |
| Serum Potassium (mmol/L) | 3.6 | 4.0 | 3.6-5.0 |
| Glucose[fasting] (mg/dL) | 179 | 154 | 65-110 |

The patient was started on diuretics, Angiotensin Converting Enzyme Inhibitors, Digoxin, Broad Spectrum Antibiotics, Ranitidine, Insulin (sliding scale), Allopurinol, Isosorbide Mononitrates and Pethidine. The Hematologist advised a phlebotomy to decrease the Hct and a peri-operative transfusion of fresh frozen plasma to correct the coagulopathy. His right leg showed rapidly growing gangrene which needed urgent surgery with as much optimization as possible.

His CCF improved remarkably within 24 hours. His temperature also settled. The patient underwent right above knee amputation under general anaesthesia . Preoperatively he showed no signs of CCF clinically. An arterial cannula and two large bore venous cannulae were passed. Anaesthesia was induced with injection Fentanyl,

Midazolam and Propofol and a size 4 laryngeal mask airway was inserted. Monitoring included ECG, direct arterial pressure, pulse oximetry, capnography, temperature, urine output and blood glucose estimates with reflo-meter. Four units of fresh frozen plasma were transfused intraoperatively. The patient remained hemodynamically stable throughout the procedure. Postoperatively he was shifted to the Special Care Unit and then to the ward the following day. He was discharged home on the fourth postoperative day. He remains stable at home and is being followed up by a hematologist, a cardiologist and a cardiothoracic surgeon for his ongoing management.

## Discussion

Polycythemia Rubra Vera (PV) is a myeloproliferative disease in which mutation of a single cell results in increased production of erythrocytes, leukocytes and platelets.[5] Splenomegaly is also often present.[1] Hyper-viscosity of the blood leads to stasis of blood flow and an increased incidence of vascular thrombosis particularly in the cardiovascular system and the central nervous system.[1,6] Impaired platelet function leads to pathological hemorrhage[1,3,5] especially during or after surgery.[3,7] Acquired von Willibrand disease could be another cause of increased bleeding tendency especially in patients with high platelet counts.[8] Wasserman and Gilbert[3] evaluated two groups of patients undergoing major surgery and having polycythemia. Of 28 patients with uncontrolled polycythemia, 79% had complications and 36% died. Of 53 patients with controlled disease 28% had complications and 5% died. In both groups complications were related mainly to thrombosis or haemorrhage. In the light of this study it can be said that knowledge and pre-treatment of polycythemia might decrease peri-operative morbidity and mortality.

Treatment of PV includes phlebotomy and myelosuppressive therapy e.g. Hydroxyurea, alpha interferon, radioactive Phosphorus, etc.[1] In an emergency situation, viscosity of the blood can be reduced by intravenous infusions of crystalloid solutions. The role of low molecular weight dextrans has also been mentioned.[6]

Because of the risk of impaired platelet function and pathological haemorrhage neuraxial anaesthetic techniques should be considered in these patients only if the coagulation profile and the platelet function have been proved to be normal. The standard coagulation profile that is the prothrombin time (PT), activated partial thromboplastin time(aPTT) and platelet count should be normal. Platelet function should be assessed by induced platelet aggregation with collagen, ristocetin and adenosine diphosphate[9] and acquired von Willebrand disease should be excluded by determination of factor VIII activity, vWF antigen and ristocetin cofactor activity.[7] If there is any doubt of the presence of a bleeding disorder general anaesthesia (GA) should be performed.

Our patient had a history of thrombotic myocardial infarction in the past and had currently presented with thrombo-embolic gangrene of the right leg. He had a deranged PT and aPTT. This excluded the choice of regional anaesthesia for his surgery. Although he had had two surgeries elsewhere, his hematocrit (50.2) was still above the acceptable safe level for anaesthesia and surgery. Oxygen delivery is optimal at a hematocrit value of 40-45%.[10] Cerebral oxygenation improves in man when hematocrit is kept below 45%.[11] Therefore the hematologist advised a phlebotomy prior to surgery. His other major risk factor was his cardiac status on admission. As his surgery was of an urgent nature we had decided to proceed with as much optimization as possible employing full invasive monitoring including pulmonary artery pressure monitoring and intubation and ventilation. Preoperatively the patient was very well optimized and clinically showed no signs of either septicemia or CCF. Therefore, as the surgeon had assured a quick, bloodless surgery, we decided to initiate the GA with a minimally invasive technique and then proceed as required. The patient remained very stable throughout the surgical procedure and made a quick and uneventful recovery.

We recommend a multidisciplinary approach towards peri-operative optimization of a patient who has uncontrolled PV with complications. Even with controlled PV the Haematologist should be involved early in the peri-operative management. This might decrease the morbidity and mortality associated with this disease although more prospective studies are needed to prove this.[12] As with anaemias, guidelines are needed in PV regarding the safe upper limit of Hct and the assessment of coagulation profile and platelet function before proceeding with anaesthesia and surgery.

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