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Title:

Biventricular Mechanical Heart Support in the Clinical Setting of Cardiogenic Shock: A Nursing Case Report

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ACCEPTED

Session Title:

Rising Stars of Research and Scholarship Invited Student Posters

Slot:

RS PST1: Sunday, 17 November 2019: 11:45 AM-12:15 PM

Applicable Category:

Clinical, Academic, Students

Keywords:

Cardiogenic Shock, Critical Care and Mechanical Circulatory Support

References:

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From: Dittman BK. Percutaneous biventricular mechanical heart support in cardiogenic shock: a nursing case report. Crit Care Nurse. 2019;39(2):15-28.

Abstract Summary:

Critical care nurses play a pivotal role in the maintenance and optimization of care for patients in cardiogenic shock who have mechanical heart pumps in place

Content Outline:

Introduction

Only a few cases of biventricular cardiogenic shock have been treated with Impella circulatory assist devices in the United States.

Clinical Findings

A 29-year-old man came to the emergency department because of cough, shortness of breath, fever, and chills. Initial assessment revealed hypotension; an elevated creatinine level of 2.1 mg/dL; and markedly elevated results on liver function tests, with alanine transaminase 5228 IU/L and aspartate aminotransferase 6200 IU/L. The patient's signs and symptoms met criteria for New York Heart Association class IV heart failure and associated poor prognosis for recovery.

Diagnosis

Echocardiography revealed dilated cardiomyopathy and biventricular failure with an ejection fraction of 15%. Results of an endomyocardial biopsy confirmed the diagnosis of myocarditis.

Interventions

After unsuccessful treatment with inotropes, biventricular support was started with an Impella CP device in the left ventricle and an Impella RP device in the pulmonary artery.

Nursing Considerations

Nursing considerations and interventions indicated in the effective management of Impella devices (Figure 1)

Nursing considerations for care of a patient with an Impella device (Figure 2)

Outcomes

The patient was maintained on support for 8 days and was discharged to home from the hospital after 27 days. Repeat echocardiography 90 days after discharge indicated improvement in ejection fraction to 40%. At follow-up 16 weeks after discharge, all signs and symptoms of heart failure had resolved. The patient has not had any inpatient readmissions to the hospital to date.

Conclusion

This case presents an opportunity for analysis of care activities and role responsibilities of bedside nurses in caring for this patient. Discussion of this case expands the literature describing nursing activities associated with caring for patients with Impella devices.

Topic Selection:

Rising Stars of Research and Scholarship Invited Student Posters (25201)

Abstract Text:

Presented in this report is one of the first cases of biventricular cardiogenic shock treated with Impella circulatory assist devices in the United States. The patient presented to the emergency room with complaints of cough, shortness of breath, fever, and chills. The initial assessment was relevant for hypotension, elevated creatinine of 2.1 mg/dL, significantly elevated liver function tests (LFT) with an alanine transaminase (ALT) of 5228 IU/L, and aspartate aminotransferase (AST) of 6200 IU/L. The patient's presentation met criteria for New York Heart Association class IV failure and associated poor prognosis for recovery. Echocardiography revealed dilated cardiomyopathy and biventricular failure with an ejection fraction of 15%. Endomyocardial biopsy confirmed the diagnosis of myocarditis. After failing to respond to inotropes, biventricular support was initiated with Impella Cardiac Power in the left ventricle and Impella RP in the pulmonary artery. The patient was maintained on support for eight days and discharged to home from the hospital after 27 days. Repeat echocardiography 90 days after discharge revealed improvement in ejection fraction to 40%. At follow up, 16 weeks after discharge, all signs and symptoms of heart failure had resolved. The patient has not had any inpatient readmissions to the hospital to date. The case presents an opportunity for analysis of care activities and role responsibilities of bedside nurses in caring for this patient. Discussion of this case expands the literature describing nursing activities associated with caring for patients with Impella devices.

Nursing Considerations: Patient Care	**Rationale**	**Interventions**
Fluid and electrolyte balance	● Adequate volume is essential to maintaining Impella flow and systemic perfusion ● Prevent air emboli ● Prevent suction events	● Maintain CVP greater than 14cmH20 ● Monitor I/O closely for signs of dehydration ● Monitor and replenish electrolytes
Impaired cardiac output	● Hemodynamic support is achieved by the devices and medical therapies	● Maintain MAP>60mmHG and MAP<90mmHG ● Titrate/wean vasopressors as ordered ● Trend MV02 and ABG results

	● Hemodynamic targets ensure optimal device performance and systemic perfusion ● Maintaining higher flows L> R prevents device induced pulmonary edema	● Monitor HgB ● Maintain P level and flows higher on left sided CP device than on Right sided RP device throughout therapy and weaning
Impaired mobility	● Femoral approach restricts patient's mobility ● implementation of interventions to promote comfort ● Implementation of interventions to prevent device migration	● Restrict patient to bed when femoral approach utilized ● Log roll patients ● Utilize knee immobilizers ● HOB< 30 ● Educate patient on strategies to prevent migration ● Max assistance with skin care and ADL's Q2h
Knowledge Deficit	● Patients must learn about the treatment plan and expected outcomes to optimize therapy ● Patients must verbalize understanding of education to adhere to plan and long term goals	Educate patient on: ● Plan of care ● Migration prevention strategies ● Activity limitations ● Invasive line care ● Heart failure management ● Medications: Long term therapy ● Procedures: ECHO, device weaning

Nursing Considerations: Device Management	**Rationale**	**Interventions**
Monitoring Device Placement	Impella devices can only provide optimal hemodynamic support if they are placed and maintained in proper position with the inlet and outlet across the cardiac valve. Migration decreases	● Monitor external placement marker ● monitor placement and motor current waveforms for pulsatility ● Monitor flows

	the flow the device can generate, and puts the patient at risk for injury	● Echocardiogram for suspected device movement ● hemodynamic monitoring ● ABG/ MVO2 monitoring ● monitor urine output for changes in color ● monitor plasma free HGB and haptoglobin for suspected hemolysis
Maintaining Device Performance (Flow/Support)	Impella devices are set at a performance level (P- Level) that generates a rate of flow to support cardiac output. This level can be increased (titrated)if the patient requires more support, or decreased (weaned) as the patient begins to recover.	● Collaborate with primary team for plan of care ● assist with patient evaluation by decreasing support to P2 during ECHO ● monitor and evaluate end organ perfusion (urine output, neurovascular status, ABG/ MV02, lactic acid) ● titrate/wean performance levels as prescribed by primary team ● evaluate patient tolerance of changes in support ● communicate all findings to primary team
Maintaining Therapeutic Anticoagulation	Impella devices require anticoagulation, most commonly with heparin, to prevent clotting and fibrin buildup on device elements	● Initiate heparin as ordered by primary team ● monitor ACT every 2 hours until ACT is 160-180 sec ● monitor for bleeding at insertion site ● monitor for hematuria ● monitor CBC every 4 hours
Maintaining Purge System	Impella devices have a small motor component that spins at a high rate of	● Maintain purge system with dextrose and Heparin solution as

	speed to generate flow. This component must be lubricated and protected from clot or fibrin to ensure continued device function. This is accomplished through a specialized system called the purge system that infuses a viscous solution of dextrose and heparin into the motor and creates a spray that diverts blood from entering the motor.	ordered by primary team (generally 5-10% dextrose in water with 6.25-50 units/ml heparin) ● change specialized purge cassette every day or as per institutional policy on dextrose infusions ● monitor purge pressure and infusion rate