Initiation of a Multidisciplinary, Rapid Response Team to Massive and Submassive Pulmonary Embolism

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Pulmonary embolism (PE) can result in rapid clinical decompensation in many patients. With increasing patient complexity and advanced treatment options for PE, multidisciplinary, rapid response teams can optimize risk stratification and expedite management strategies. The Massive And Submassive Clot On-call Team (MASCOT) was created at our institution, which comprised specialists from cardiology, pulmonology, hematology, interventional radiology, and cardiac surgery. MASCOT offers rapid consultation 24 hours a day with a web-based conference call to review patient data and discuss management of patients with high-risk PE. We reviewed patient data collected from MASCOT's registry to analyze patient clinical characteristics and outcomes and describe the composition and operation of the team. Between August 2015 and September 2016, MASCOT evaluated 72 patients. Seventy of the 72 patients were admitted to our institution, accounting for 32% of all patients discharged with a primary diagnosis of PE. Average age was 62 ± 17 years with a female predominance (63%). Active malignancy (31%), recent surgery or trauma (21%), and recent hospitalization (24%) were common. PE clinical severity was massive in 16% and submassive in 83%. Patients were managed with anticoagulation alone in 65% (n = 46), systemic fibrinolysis in 11% (n = 8), catheter-directed therapy in 18% (n = 13), extracorporeal membrane oxygenation in 3% (n = 2), and an inferior vena cava filter was placed in 15% (n = 11). Thirteen percent (n = 9) experienced a major bleed with no intracranial hemorrhage. Survival to discharge was 89% (64% with massive PE and 93% with submassive PE). In conclusion, multidisciplinary, rapid response PE teams offer a unique coordinated approach to patient care. **(Am J Cardiol 2017;120:1393–1398)**

Pulmonary embolism (PE) is a common cause of cardiovascular death and its incidence is increasing.[1–3] Patients presenting with PE frequently have multiple co-morbidities, including advanced age, a high rate of malignancy, and concomitant cardiac or pulmonary disease.[4–6] Traditionally, treatment included anticoagulation with rare utilization of advanced therapies such as fibrinolysis.[1,7] Recent PE treatment options offer the potential for improved safety and have broadened the use of advanced therapies, including catheter-based fibrinolysis in a greater proportion of high-risk patients.[8,9] Advances in extracorporeal membrane oxygenation (ECMO) have made it a feasible option for salvage therapy in unstable patients.[10] Management of patients with submassive and massive PE is logistically complex, given the heterogeneous nature of the disorder and patients. There is a lack of consensus regarding management consequently.[11,12] Overall short-term mortality ranges from 5% to 11% and can be as high as 32% in hemodynamically unstable patients, with approximately 50% of deaths occurring within the first 72 hours of presentation.[1,13–15] Rapid response teams were initially developed to evaluate patients with acute clinical deterioration while on an inpatient general medical or surgical floor.[16] A recent meta-analysis demonstrated an odds ratio of 0.62 for in-hospital cardiac arrest and odds ratio of 0.88 for in-hospital mortality when a rapid response team is available.[17] Multidisciplinary PE response teams can coordinate and expedite risk assessment, management decisions, and implementation of treatment.[18–20] We describe our initial experience after creating and deploying a multidisciplinary, rapid response PE team, the Massive And Submassive Clot On-call Team (MASCOT), focused on patients with high-risk PE.

Methods

MASCOT was formed at Beth Israel Deaconess Medical Center (BIDMC) to include experts in thrombosis, critical care, cardiogenic shock, and catheter-based interventions employed in acute massive and submassive PE. The team comprised subspecialists from cardiology, pulmonology, hematology, interventional radiology, and cardiac surgery. A virtual pager was created that can be accessed through the

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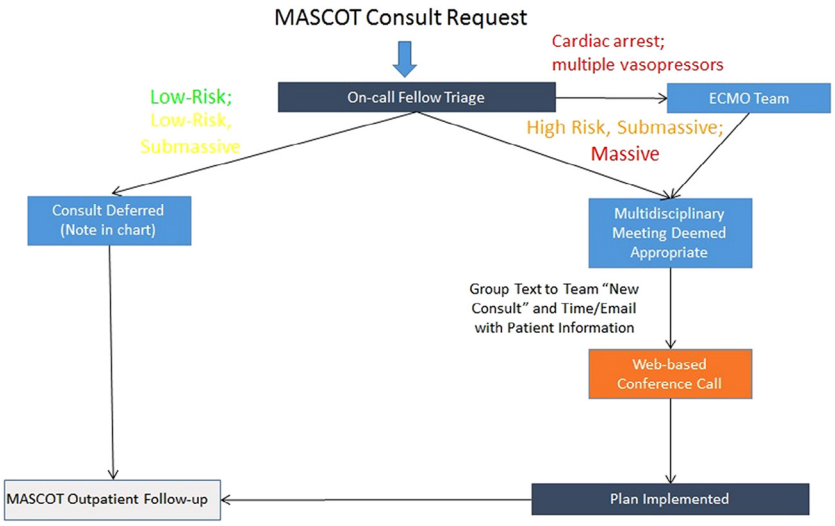

Figure 1. To publicize the formation of a new consultative team, MASCOT was promoted through informational presentations at numerous departmental and divisional meetings, case presentations, and conferences, and featured on the hospital intranet, along with a 1-page informational document e-mailed throughout the BIDMC network.

paging directory throughout the BIDMC and affiliated hospital network and is integrated into the BIDMC emergency department (ED) communication dashboard to facilitate rapid activation. The page is received by the cardiology fellow on-call who assesses the patient (Figure 1). If the patient's presentation is deemed of sufficient complexity to activate the team or a clinical management question requiring discussion is identified, a group text message is sent alerting the team of a new consult with a concurrent e-mail sent with the patient's medical record number and a brief summary of the presentation. A web-based conference call is initiated by the on-call fellow that allows for screen sharing to review pertinent patient data and imaging. A consensus on further diagnostic evaluation, treatment, triage or disposition, and contingency plans is formulated and implemented by the end of each call. A template note is left in the chart describing the recommendations made by the MASCOT team. The patient is followed in the hospital by the cardiology service, and the team is reconvened on an as-needed basis including if there is any change in clinical condition. In cases where there is concern for imminent or ongoing cardiac arrest, the team is bypassed, and the case is discussed with the ECMO team with incorporation of MASCOT once a decision regarding ECMO has been made. MASCOT consultation is deferred if a patient demonstrates low-risk features that do not warrant activation of the full team. Physicians managing any patient with a PE can request outpatient follow-up consultation with a member of MASCOT by way of a dedicated e-mail address.

The BIDMC Institutional Review Board approved the formation of a MASCOT patient registry. All patients who were evaluated by MASCOT were included in the registry at the time of initial consultation. A review of each patient's online medical record was completed at a later time to populate the data parameters included in the registry. The registry was created to capture patient demographics, co-morbidities, risk factors for venous thromboembolism, clinical presentation, PE characteristics, including laboratory and imaging findings, and treatments and outcomes. PE severity was defined as massive if there was demonstration of hypotension, shock, or vasopressors were instituted; submassive if shock and hemodynamic compromise were absent but imaging or cardiac biomarker evidence of right ventricular strain were present; and low risk if none of the above were present.[21] Outcomes included bleeding, length of stay, survival to discharge, and 30-day mortality. Major bleeding was defined as GUSTO (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) severe or moderate bleeding, bleeding requiring blood transfusion, an intervention, hemodynamic compromise, or intracranial hemorrhage.[22] Systemic fibrinolysis, catheter-directed therapy, and ECMO were considered advanced therapies. A search was performed for International Classification of Diseases Medical Diagnosis Codes of a primary diagnosis of PE in both the ED and inpatient discharges during the time MASCOT was active.

Data were collected utilizing MS Excel. Means and standard deviations were used to summarize continuous variables and frequency with proportion to summarize categorical variables. Fisher's exact test was used to compare mortality in those with massive versus submassive PE.

Results

MASCOT was formed in August 2015 and formally evaluated 72 patients through September 2016. Virtual consultation occurred in 2 patients who were at an outside facility and were successfully managed at the referring institution by mutual agreement. Of the remaining 70 patients whom we evaluated at our institution, 37 (53%) had been transferred from an outside facility with a known or presumed diagnosis of PE. Consult requests originated from the ED in 49%, with the remainder from inpatient services (Figure 2).

The ED requested a MASCOT consultation in a total of 80 patients, which accounted for 45% of the 177 patients with a primary diagnosis of PE evaluated in the ED (Figure 3). Of the 80 consultation requests from the ED, formal MASCOT