Despite pharmacological treatment, advanced surgical techniques, and the introduction of mechanical hemodynamic support, mortality rate following cardiogenic shock remains high. At the Cleveland Clinic Foundation, from 1992 to 1996, a retrospective study involving 108 patients who met the institutional criteria for cardiogenic shock as an acute event post-myocardial infarction or post-cardiovascular intervention was conducted to determine the best treatment modality. The effects of coronary revascularization (coronary artery bypass graft [CABO] or percutaneous transluminal coronary angioplasty [PTCA]), heart transplantation, or conservative treatment (inotropes and intra-aortic balloon pump) on inhospital survival were evaluated. Of the 108 patients, 25 were treated conservatively and 8 survived (survival rate, 32%); 28 patients were treated with salvage PTCA and 13 survived (46.4%); 33 patients had emergency CABO and 20 survived (60.6%); 13 patients had cardiac transplantation and 11 survived (84.6%); and 9 patients were treated with other cardiac surgery and 3 survived (33.3%). We conclude that surgical intervention, especially cardiac transplant, when available, improves survival.

CARDIOGENIC SHOCK (CS) remains a leading cause of mortality in patients who have myocardial ischemia, infarction, or in patients who undergo cardiovascular intervention. The conservative treatment, including inotropic pharmacologic agents and mechanical support with intra-aortic balloon pump counterpulsation, did not dramatically improve survival. It may help to stabilize patients until more aggressive intervention is available. Our five year-experience at the Cleveland Clinic Foundation with aggressive intervention for CS is outlined in this paper to define the best form of therapy for CS.

Methods

Selection of Patients
A retrospective analysis of all patients diagnosed with CS at the Cleveland Clinic Foundation between 1992 to 1996 was conducted.

Inclusion Criteria
CS was defined by the following criteria: (1) arterial systolic blood pressure < 90 mm Hg or mean BP < 60 mm Hg in the absence of hypovolemia or inotropic support; (2) signs of pulmonary congestion or pulmonary capillary wedge pressure (PCWP) ~ 18 mm Hg; (3) cardiac index (CI) :::; 2.0 L/min/m²; and (4) evidence of tissue hypoperfusion, oliguria, cool clammy skin, and depressed mentation.

Study Population
A total of 108 patients who satisfied the above criteria were studied. Of these, 65 patients presented with CS, complicating acute myocardial infarction or unstable angina and 43 patients suffered CS after various cardiovascular interventions or cardiac catheterization. Sixty-two (57.5%) patients were males and 46 (42.5%) were females. Of the 108 patients, 67 (62%) had history of hypertension, 33 (30.5%) had history of diabetes mellitus, 53 (49%) had history of hyperlipidemia, 86 (79.6%) had history of smoking, 59 (54.6%) had family history of coronary artery disease, 66 (61.1%) had history of coronary artery disease, and 27 (25%) had prior coronary artery bypass graft (CABG) surgery.

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Results

Of the 15 patients who had CS after percutaneous trans luminal coronary angioplasty (PTCA): (1) 8 patients had emergency CABG and five survived (62.5%); (2) 2 patients had heart transplantation and both survived; (3) 4 patients were treated conservatively and two survived (50%); and (4) 1 patient had salvage PTCA and survived. The overall survival rate for this group of patients was 66.6% (10/15 patients).

Of the 6 patients who had CS after diagnostic cardiac catheterization: (1) 4 patients had emergency CABG and all survived (100%); and (2) 2 patients were treated conservatively and one survived (50%). The overall survival rate for this group was 83.3% (5/6 patients).

Of the 13 patients who had CS after CABG: (1) 2 patients had heart transplantation and both survived (100%); and (2) 11 patients received conservative therapy and two survived (18.2%). The overall survival rate for this group was 30.8% (4/13 patients).

Of the 2 patients who had CS after heart transplantation, both patients were treated conservatively and both expired.

Of the 7 patients who had CS after valvular surgeries: (1) three had mitral valve replacement (MVR); (2) two had aortic valve replacement with CABG; (3) one had aortic valve replacement (AVR); and (4) one had aortic valve repair. Of this group, 6 patients were treated conservatively and three survived (50%). The patient who had redo surgery (MVR) expired. The overall survival rate for this group of patients was 42.8% (3/7 patients).

There were 65 patients who had CS after acute myocardial infarction. All were treated aggressively with PTCA, CABG, heart transplant, or different open heart surgeries. A total of: (1) 27 patients were treated with salvage PTCA and 12 survived (44.4%); (2) 21 patients were treated with emergency CABG and 11 survived (52.4%); 9 patients had heart transplants and seven survived (77.7%); (4) 8 patients were treated with emergency different open heart surgeries that included MVR, ventricular septal defect (VSD) repair, left ventricular aneurysmectomy, and only three survived (37.5%). The overall survival rate in this group of patients with CS after acute myocardial infarction was 50.7% (33/65 patients). The results of the modes of treatment are seen in Table 1.

The survival rates of different treatment modalities are shown in Table 2. Of 108 patients: (1) 25 were treated conservatively and eight survived (32%); (2) 28 were treated with PTCA and 13 survived (46.4%); (3) 33 were treated with CABG and 20 survived (60.6%); (4) 13 had heart transplants and 11 survived (84.6%); and (5) 9 were treated with different open heart surgeries and three survived (33.3%).

The overall survival of patients who received aggressive treatment (PTCA, CABG, or heart transplant) was 44/74 (59.4%). For patients who received conservative therapy or different open heart surgeries, the overall survival was 11/34 (32.3%). The overall survival of all patients with CS was 55/108 (50.9%).

Discussion

CS remains an extremely lethal condition when only conservative pharmacologic treatment and hemodynamic support are used. The inhospital survival rate for this group of patients is reported at 17%.1,2 The best temporary and palliative treatments with intra-aortic balloon pump and inotropic and vasopressor agents did not significantly improve the survival rate.3-6 In our study, similar conservative therapy produced a survival rate of 32%.
PTCA was introduced in 1985 as a form of treatment for CS. Since then, 16 studies with PTCA as a treatment for CS were reported. The successful reperfusion rate was around 69%. In our study, 28 patients had salvage PTCA after CS. Successful reperfusion was achieved in 22/28 patients (78%). The total survival rate in patients with PTCA after CS was 46%.

In 1973, emergency CABG was attempted as a treatment for CS, and since then, several studies have been reported. Of these, 15 studies were reported between 1973 to 1989 that showed emergency CABG results with an inhospital mortality rate that ranged between 0% to 67%. In our study, patients who underwent emergency CABG after CS had an inhospital survival rate of 60.6%, which is significantly higher than the survival rate with conservative treatment.

Other surgical procedures such as VSD repair, MVR, and left ventricular aneurysmectomy did not produce good results as emergency CABG. The survival rate of these surgical procedures was close to that with the conservative treatment (Table 3).

Finally, heart transplantation, when available, was attempted as a salvage procedure in patients with CS who did not qualify for PTCA or CABG. In our series, 13 patients who had heart transplantation as a treatment for CS had the best survival rate of 84.6%.

Conclusions

CS continues to have high mortality rate. Although its etiology is varied, the most frequent cause is an acute myocardial infarction. Early treatment with inotropic, vasopressor drugs, and intra-aortic balloon pump tend to stabilize the condition of the patient. However, they do not significantly reduce the mortality rate.

Aggressive intervention did significantly improve the survival rate in our series. Our study shows that, whenever feasible, early aggressive therapy is superior to conservative treatment. Further research should continue to investigate different modalities of treatment that would reduce the mortality rate even further.

References


Table 3. Treatment outcome: 108 patients.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. case</th>
<th>Survival no.</th>
<th>Survival %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative</td>
<td>25</td>
<td>8</td>
<td>32.0</td>
</tr>
<tr>
<td>Aggressive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PTCA, CABG, cardiac transplant)</td>
<td>74</td>
<td>44</td>
<td>59.4</td>
</tr>
<tr>
<td>Other OHS</td>
<td>0</td>
<td>3</td>
<td>33.3</td>
</tr>
</tbody>
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PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft; OHS = open heart surgery.