10-2012

Duration of CPR: How Long is Too Long? A Positive Outcome After 90 Minutes of CPR

Laura Cohen
University of Massachusetts Medical School, laura.cohen@umassmemorial.org

Shubjeet Kaur
University of Massachusetts Medical School, shubjeet.kaur@umassmemorial.org

Duration of CPR: How Long is Too Long?

A Positive Outcome After 90 Minutes of CPR

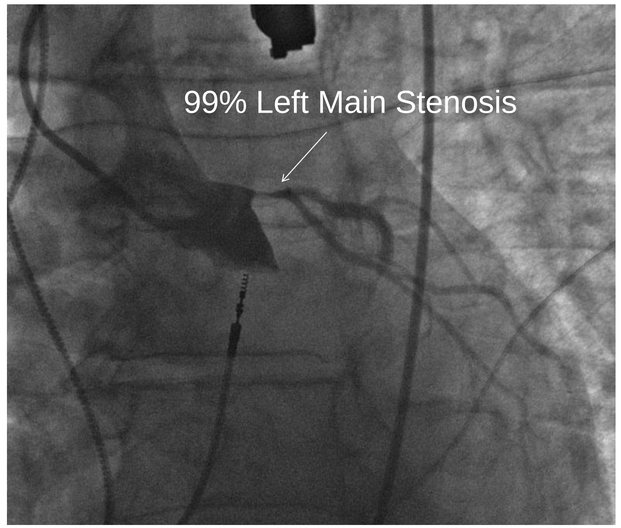
Laura Cohen, D.O., Shubjeet Kaur, M.D.
Department of Anesthesiology, University of Massachusetts Medical School, Worcester, MA

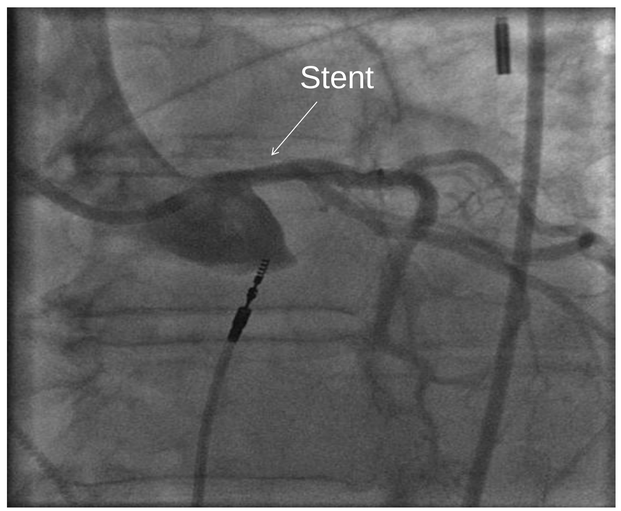
INTRODUCTION

Survival and neurologic function following prolonged cardiopulmonary resuscitation (CPR) are often poor and currently there lacks a formal recommendation for the maximum duration of resuscitative efforts. However, there have been multiple case reports of positive neurological outcomes following prolonged CPR. This case presentation helps to support and encourage the continuation of CPR in the appropriate setting and with available resources including intra-arrest percutaneous intervention (PCI) and extracorporeal membrane oxygenation (ECMO).

CASE REPORT

- A 73 year-old male presented for elective coronary angiography to evaluate exertional dyspnea for the preceding two months.
- The coronary angiogram found an ejection fraction of 50%, a 70% diffuse stenosis of the left main coronary artery and 100% occlusion of the mid right coronary artery.
- The patient was admitted and scheduled for coronary artery bypass grafting (CABG).
- Approximately 15 minutes after an uneventful induction of general anesthesia, the patient became acutely hypotensive and then pulseless.
- CPR was initiated and an intra-aortic balloon pump (IABP) was placed. CPR was continued for approximately 90 minutes during which time the patient was brought emergently to the cardiac catheterization lab.
- Coronary angiography was performed revealing an acute 99% tubular stenosis of the left main coronary artery. A drug eluding stent was placed which restored flow. The patient was then placed on ECMO.
- Within 24 hours ECMO was weaned and the patient was able to move all extremities. Later, sedation was also weaned, at which point the patient was able to follow simple commands. At follow up three months later, he was able to follow all commands and communicate verbally.





DISCUSSION

There is conflicting literature when it comes to the benefits of performing prolonged CPR. One meta-analysis of over 14,720 all-cause cardiac arrests has shown that the probability of survival decreases significantly if CPR continues longer than 10 minutes[1]. However another review of 64,339 patients with in-hospital cardiac arrests demonstrated that patients with longer median resuscitation times had greater chance of return of spontaneous circulation and survival to discharge[2]. This same study also showed that the length of CPR duration did not affect the rate of favorable neurologic outcomes. Multiple additional case reviews report durations of CPR in excess of 100 minutes in patients whom suffered no neurologic deficits[1]. Our patient survived approximately 90 minutes of resuscitative efforts which included CPR, IABP placement, intra-arrest PCI and ECMO.

Timely initiation of effective CPR plays a significant role in patient outcomes. Within 4 minutes of cardiac arrest, cerebral ischemia begins. If the delay in initiating CPR increases from 0 to 6 minutes, the ability to regenerate cerebral ATP becomes severely impaired and cerebral blood flow at a given perfusion pressure begins to decline[3]. CPR was initiated within seconds of detection of hypotension in our patient. Effective chest compressions provide forward blood flow preserving cerebral perfusion, while chest recoil increases coronary blood flow[4]. By this mechanism we were able to provide circulatory support to our patient until ECMO was started.

Our case supports the findings of Kagawa, et al who concluded that ECMO and intra-arrest PCI could improve survival in patients with cardiac arrest refractory to conventional CPR[5]. These interventions are thought to provide the higher coronary perfusion pressure and total circulatory support required for the heart to regain function. Although a fibrillating heart consumes approximately 75% of the amount of oxygen than that of the normal beating heart at normothermia, the fibrillating state has been shown to induce more ischemia secondary to increased coronary resistance[6]. Our patient's myocardial ischemia was likely worsened by refractory fibrillation. Therefore, prompt PCI and initiation of ECMO may have contributed to our patient's survival.

CONCLUSION

Prolonged CPR can result in favorable patient outcomes if done promptly and effectively, utilizing all available resources including intra-arrest PCI and ECMO.

REFERENCES

1. Charapov I, Eipe N. Cardiac arrest in the operating room requiring prolonged resuscitation. *Can J Anesth*. 2012;59:578-585.
2. Goldberger ZD, Chan PS, Berg RA, et al. Duration of resuscitation efforts and survival after in-hospital cardiac arrest: an observational study. *Lancet*. Published online September 5, 2012.
3. Kagawa E, Dote K, Kato M, et al. Should We Emergently Revascularize Occluded Coronaries for Cardiac Arrest?: Rapid-Response Extracorporeal Membrane Oxygenation and Intra-Arrest Percutaneous Coronary Intervention. *Circulation*. Published online August 16, 2012.
4. Estafanous, FG, Barash PG, Reves JG. *Cardiac Anesthesia: Principles and Clinical Practice*. 394. Second Edition, 2001.
5. Alpert, JS, Ewy, GA. *Manual of Cardiovascular Diagnosis and Therapy*. 2002. 5th edition. Pg 132.
Paradis, NA, Halperin, HR, et al. *Cardiac Arrest: The Science and Practice of Resuscitation Medicine*. 2nd edition. Pages 241-243