Survival After Prolonged Cardiopulmonary Resuscitation

Col SP Rai*, Col RK Tripathi†, Col R Surendra#, Lt Col D Bhattacharyya**, Col RK Choudhary**

MJAFI 2007; 63 : 371-373

Key Words : Prolong cardiac arrest; Cardiopulmonary resuscitation; Defibrillation; Post resuscitation hypotension

Introduction

Cardiac arrest can be defined as abrupt cessation of cardiac pump function, which may be reversible by a prompt intervention. Ventricular fibrillation (VF) and pulse-less ventricular tachycardia (VT) are the commonest causes of non-traumatic adult cardiac arrest. VT or VF refractory to more than three defibrillations, delay in initiating cardiopulmonary resuscitation (CPR), delay in defibrillation, resuscitative efforts of longer than 15 minutes duration or end tidal carbon dioxide (ETCO₂) of less than 10 mm Hg are all associated with poor outcome [1-3]. The present report describes successful outcome after 40 minutes of cardiac arrest due to VF and six hours of post- resuscitation hypotension in a young lady who had recently undergone double valve replacement.

Case Report

A 25 year old female presented with one day history of pain abdomen and bleeding per vagina. She had undergone double valve replacement surgery for rheumatic heart disease with severe aortic stenosis, aortic regurgitation and mitral stenosis six weeks earlier. She was para one with last menstrual period three weeks earlier. On examination her pulse was 104/minute, regular and blood pressure 90/60 mm Hg. There was no pedal oedema and jugular venous pulse was not raised. Prosthetic valve sounds were normal. Lungs were clear. On internal examination, tenderness was felt in left fornix, uterus, and cervix with fresh bleeding per vagina. Her haemoglobin was 13.6gm%, total and differential leucocyte count, urinalysis, liver function tests, renal function tests and blood sugar were normal. Serum potassium was 3.8 mmol/L. Prothrombin time was 20 seconds (control 13 seconds). Gravindex test was negative. Ultrasound showed 68 x 50 x 43 mm size solid lesion in left adnexa with ill-defined margins and central cystic area. Large amount of free fluid was seen in pelvis and Morrison's pouch.

A diagnosis of ruptured ectopic gestation was made and she was planned for laparotomy. Her electrocardiograph

(ECG) showed features of digitalis toxicity in the form of downward slope of ST segment with sharp terminal rise. Proximal part of ST was also depressed and T waves were below base line (Fig.1). Digitalis and acitrome were stopped and she was given vitamin K, fresh blood and infective endocarditic prophylaxis. Her condition deteriorated over next 12 hours due to bleeding from ruptured ectopic gestation. Her haemoglobin dropped to 8 gm%, hence she was transfused blood and subjected to urgent exploratory laparotomy. She had approximately one litre of intraperitoneal blood. Left salpingo-oophorectomy was done. While skin sutures were being applied, she had sudden cardiac arrest. Cardiac monitor showed VT, which soon degenerated into VF. She was already on 100% O₂ via Boyle's apparatus. Her ETCO₂ ranged from 2-8 mm Hg during arrest period. External cardiac massage was started and she was defibrillated with 200, 300, and 360 Joules. Intravenous epinephrine 1 mg stat was given and subsequently it was repeated at every 3-4 minute interval. She was given lidocaine 50 mg intravenous (IV) bolus, which was repeated after three minutes, then she was given 10 ml of 10% calcium chloride followed by 40 ml of sodium bicarbonate. In view of persistent VF 150 mg procainamide was given IV over five minutes followed by

Fig. 1 : Preoperative ECG showing downward slope of ST with sharp terminal rise. Proximal part of ST is depressed and T waves are below the baseline suggestive of digitalis toxicity

*Senior Advisor (Medicine and Respiratory Medicine), Military Hospital (CTC), Pune - 40. *Senior Advisor (Anaesthesiology), Military Hospital Dehradun. †Classified Specialist (Gynaecology), Military Hospital Secunderabad. **Classified Specialist (Medicine and Respiratory Medicine), Army Hospital (R & R), Delhi Cantt - 10. **Commanding Officer, 324 Fd Amb, C/o 56 APO.

amiodarone 300 mg IV. Amiodarone 150 mg IV was repeated after five minutes. Patient's rhythm and pulse was assessed after every intervention. Finally 2 gm magnesium sulfate was given intravenously with which there was some improvement in arrhythmia, hence after two minutes 1 gm IV magnesium was repeated. Finally after 40 minutes of resuscitation, VF reverted to normal sinus rhythm. Her heart rate came to 136/min but pulse and blood pressure (BP) were not recordable. Her pupils were dilated, not reacting to light. She was shifted to intensive care unit (ICU) on intermittent positive pressure ventilation (IPPV) with 100% oxygen. She was managed with vasopressors (dopamine, dobutamine and mephentane) with lidocaine drip, blood and other supportive measures but she had only a weak pulse in femoral and carotid arteries. Her peripheral pulses were not palpable and her BP was not recordable for six hours. Facilities for intra-arterial BP recording and arterial blood gas studies were not available. Her hourly urine output was maintained between 25-35ml per hour. She had no pupillary reaction for four hours. She regained consciousness after seven hours. Patient was extubated in 24 hours and dobutamine and lidocaine drips were stopped. Following day her ECG showed non-specific ST depression with T inversion in inferior leads and ST elevation in anterior leads. Post-resuscitation patient developed various complications including pneumonia right lower lobe, renal failure, diarrhoea due to ischaemic colitis, severe anaemia and pelvic haematoma. She was managed conservatively for above complications. Repeat ultrasound showed evidence of rectus haematoma with hemoperitoneum. These were evacuated surgically one week later. Patient made uneventful recovery and was discharged after two weeks. She had no neurological sequelae. Prosthetic valves were functioning normally. Her renal and liver functions returned to normal. There have been no complications during one year of follow up after resuscitation.

Discussion

Defibrillation is the only effective treatment for VF and VT but chances of a successful outcome fall by about 7-10% with each minute's delay [4]. A high incidence of ventricular arrhythmia has been observed during three weeks to eight months after valve replacement [5,6]. Our patient had undergone double valve replacement six weeks earlier. Digitalis toxicity and electrolyte disturbances may precipitate potentially lethal arrhythmias and cardiac arrest [7]. Hypokalemia, hypomagnesaemia and perhaps hypocalcaemia are the electrolyte disturbances most commonly associated with cardiac arrest. Acidosis and hypoxia may potentiate the vulnerability associated with electrolyte disturbances. Early defibrillation improve the survival [8] but VT and VF as a result of digitalis toxicity can some time become refractory on defibrillation, hence it is a relative contraindication for defibrillation [7]. The ECG evidence of digitalis toxicity in our patient was borderline, so we defibrillated the patient with 200, 300 and 360 joules,

which probably made VF refractory. In patients with persistent VT or VF, electrical stability of the heart may be achieved by intravenous administration of anti arrhythmic agents during continued resuscitation [1,3]. Reversible causes of VF/VT arrest in our case were probably digitalis effect (toxicity), hypokalemia, hypomagnesaemia, hypovolemia and hypoxia. As the patient was undergoing surgery under general anaesthesia, she had secured airways. Circulation was maintained by chest compressions. The vasopressor and antiarrhythmic drugs were given sequentially as per guideline 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care [1].

Administration of magnesium suppresses digitalis-induced arrhythmias, whereas hypomagnesaemia appears to predispose to digitalis toxicity. There is some evidence that the digitalis induced potassium efflux from the myocardium is reduced by magnesium [9,10]. Retrospectively we think that since our patient had evidence of early digitalis toxicity, early administration of magnesium could have reverted VF to sinus rhythm earlier. Post-resuscitation hypotension is frequently caused by derangement in a patient's intravascular volume, heart rate, cardiac performance or a combination of these. IV amiodarone can also cause severe, prolonged hypotension. Despite replacement of intravascular volume and vasopressors, her BP was not recordable for six hours and she had feeble carotid and femoral pulsation. In the absence of invasive BP monitoring it is possible that, her BP was maintained to minimal level to keep perfusion of brain, kidney and other vital organs. The presence of unreactive dilated pupils indicate ischemic brain injury, which if lasts beyond three to five minutes indicate some degree of permanent cerebral damage. Some patients recover even after ten minutes of global cerebral ischemia. The pupillary reaction to predict central nervous system outcome may not be reliable after use of large doses of adrenaline and/or atropine as seen in our case. ETCO₂ monitoring is a useful adjunct in early detection of cardiac arrhythmias/ arrest.

The potential for successful resuscitation is a function of the setting in which cardiac arrest occurs, the mechanism of the arrest, and the underlying clinical status of the victim. The probable reasons for successful outcome in our patient were early recognition, early defibrillation, secured airway and correction of reversible causes (digitalis toxicity, hypomagnesaemia, hypokalemia and hypovolemia). The decision to terminate resuscitation should be individualised.

Conflicts of Interest

None identified

References

1. Cummins RO, Hazinski MF. The most important changes in the International ECC and CPR Guidelines. *Circulation* 2000; 102 : 371-6.
2. Denton R, Thomas AN. Cardiopulmonary resuscitation: a retrospective review. *Anesthesia* 1997; 52:324-7.
3. De Latorre F, Nolan J, Robertson C, Chamberlain D, Baskett P. European Resuscitation Council Guidelines 2000 for adult advanced life support. *Resuscitation* 2001; 48:211-21.
4. Rajaram R, Rajagopalan RE, Pai M, Mahendran S. Resuscitation in an Urban Indian Hospital. *Natl Med J India* 1999; 12: 51-5.
5. Blackstone EH, Kriklin JW. Death and other time related events after valve replacement. *Circulation* 1985; 72: 753-67.
6. Kanishi Y, Matsuda K, Nishiwaki N, et al. Ventricular arrhythmias after aortic and/or mitral valve replacement. *Jpn Cir J* 1985; 49: 576-8.
7. Haverkamp W, Shenasa M, Borggreffe M, Breitharolt G. Torsade de pointes. In : Zipes DP, Jalife J, editors. *Cardiac electrophysiology: From cell to bedside*. 2nd ed. Philadelphia: WB Saunders Company, 1995; 885.
8. Tunstall- Pedoe H, Bailly L, Chamberlain DA, Marsden AK, Ward ME, Zideman DA. Survey of 3765 cardiopulmonary resuscitations in British hospitals (the BRESUS study) methods and overall results. *BMJ* 1992; 304: 1347-51.
9. Kelly RA. Cardiac glycosides and congestive heart failure. *Am J Cardiol* 1990; 65:33-40.
10. Seelig M. Cardiovascular consequences of magnesium deficiency and loss: Pathogenesis, prevalence and manifestations: Magnesium and chloride loss in refractory potassium repletion. *Am J Cardiol* 1989; 63: 4.

Journal Scan

Hahnloser D, Pemberton JH, Wolff BG, Larson DR, Crownhart BS, Dozois RR. Results at upto 20 years after ileal pouch-anal anastomosis for chronic ulcerative colitis. *British Journal of Surgery* 2007; 94:333-40.

Ileal pouch – anal anastomosis (IPAA) has become the standard surgical procedure after proctocolectomy in patients with chronic ulcerative colitis, since the goals of eliminating disease and preserving faecal continence are achieved in most patients. Since the initial description of the procedure by Parks and Nicholls in 1978, several studies have shown that IPAA is a safe and effective operation for chronic ulcerative colitis; bowel function is acceptable and quality of life (QoL) is good. Whether these outcomes remain stable over time is unknown. Long term data seems to show a steady state or minor improvement in functional outcome with time. Some studies report contrary that function deteriorates over time. Since most patients undergoing IPAA are young and have a life expectancy of 40-50 years after operation, determining functions over long term is important.

This study conducted at Division of Colon and Rectal Surgery of Mayo Clinic at Minnesota has evaluated the success of IPAA in terms of functional outcome, QoL and durability of results. The data base consists of 1885 patients over a period of 20 years (between Jan 1988-Dec 2000) who underwent IPAA at Mayo Clinic with a preoperative diagnosis of chronic ulcerative colitis. Data base consists of all preoperative, postoperative and follow up information recorded prospectively by an independent observer. Preoperative data included stool frequency and sexual function and follow up data included stool frequency, degree of continence, ability to discriminate stool from gas, use of medication and pads and sexual and urinary abnormalities. QoL data were acquired by asking the patients to enumerate in what manner the operation affected the activity or performance in regards to sports, sexual and social activities, recreation, work around the house, family relationship and travel. Faecal incontinence during day and night were recorded

as never, occasional or frequent. Authors considered pouchitis based on presence of symptoms (watery diarrhoea, haematochezia, fatigue and fever) for 2-3 days and alleviation of such symptoms promptly (within 24 hours) on administration of ciprofloxacin or metronidazole. Nearly all patients underwent a two stage operation. The first stage consisted of abdominal colectomy, complete mobilization of small bowel mesentery and complete rectal mobilization using a close rectal resection technique. The terminal 24-30 cm of ileum was used to construct an ileal reservoir. The IPAA was completed either by excision of the anal transition zone and hand sewing the pouch to dentate line area or double stapling the pouch to dentate line and a diverting ileostomy concluded the first stage. The second stage accomplished 2-3 months later, comprised of the closure of diverting stoma. The authors analysed the results in terms of functional outcome at 1,5,10,15 and 20 years follow up. They concluded that IPAA for chronic ulcerative colitis achieves the goals of eradicating the disease, protecting the patient from future malignant disease and most importantly because patients are for the most part young, preserves reliable control of stool function and QoL. The long term results of this large study demonstrate that the clinical and functional outcomes after IPAA are excellent and stable for 20 years. IPAA has matured into a reliable and preferred operation for chronic ulcerative colitis. The study has been done exhaustively for QoL where they have included most of the relevant factors. The follow up and their protocol are both judicious and meticulous. However, it appears that the authors have worked under limitations while studying a plethora of functional outcomes and known complications of IPAA. They could have had a more objective protocol for features like faecal continence, discrimination of gases and faeces, diagnosis of pouchitis.

Contributed by

Col R Chaudhry, VSM*, Maj A Shah*

*Professor and Head, *Resident (Department of Surgery) AFMC, Pune-411 040.