Medical Memoranda

Cardiac Arrest associated with Bone Cement

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Two cases of cardiac arrest during the operative replacement of a femoral head with a Thompson prosthesis are reported.

CASE 1

An 81-year-old woman was admitted to hospital with a subcapital fracture of the left femur. She was febrile (100.5° F.; 38.1° C.) and had cardiomegaly and signs of congestive failure. Blood pressure was 150/90 mm. Hg. She had glycosuria and a fasting blood sugar of 160 mg./100 ml. On bed rest, Russell traction, low carbohydrate diet, and ampicillin 250 mg. six-hourly the fever, glycosuria, and basal crepitations disappeared within 36 hours.

She was operated on four days after admission. Anaesthetic management included: pethidine 50 mg., promethazine 25 mg., and atropine 0.6 mg. one hour preoperatively; preoxygenation; thiopentone 125 mg. and succinylcholine 50 mg.; endotracheal intubation; nitrous oxide 50% and halothane 1% for 15 minutes and 0.5% thereafter; and assisted ventilation with carbon dioxide absorption. Her general condition was satisfactory during the first 70 minutes of anaesthesia, systolic blood pressure remaining above 100 mm. Hg. Dextrose/saline 250 ml. and whole blood 500 ml. were given intravenously, the estimated blood loss being 350 ml.

A standard posterior approach was used. The femoral head was removed, the neck trimmed, and the shaft reamed. After trial reduction with the prosthesis of selected size, bone cement (as supplied by C.M.W. Laboratories) was mixed for about two minutes to the consistency of soft putty. This was then inserted into the shaft of the femur followed by the stem of the prosthesis, which was tapped lightly into position. The head of the prosthesis was reduced into the acetabulum after the cement had hardened. Nine minutes after the insertion of the bone cement she became acutely hypotensive and half a minute later suffered cardiac arrest. Artificial ventilation with 100% oxygen and external cardiac massage was started. Restoration of her heart beat was achieved within two minutes. The operation was then completed. The patient was fully conscious before she left the theatre and her subsequent postoperative course was uneventful. She was alive and well some six months later.

CASE 2

An 81-year-old woman with a history of angina on moderate exercise, myocardial infarction two years previously, and a recent episode of congestive heart failure was admitted to hospital with a transcervical fracture of the left femur. She was on digoxin 0.25 mg. b.d. Blood pressure was 170/100 mm. Hg. E.C.G. showed diffuse S-T and T wave changes. Other investigations showed: haemoglobin 12.6 g./100 ml.; blood urea 55 mg./100 ml.; sodium 140 mEq/l.; potassium 2.8 mEq/l.; chloride 100 mEq/l.; and bicarbonate 25.5 mEq/l.

After four days of bed rest, Russell traction, and continued digoxin she was operated on. Anaesthetic management included: pethidine 25 mg., promethazine 25 mg., and atropine 0.6 mg. one hour preoperatively; preoxygenation; thiopentone 50 mg. and alcuronium chloride 15 mg.; nitrous oxide 60%; endotracheal intubation; controlled ventilation with carbon dioxide absorption; and a second dose of alcuronium chloride (5 mg.). Her general condition was satisfactory during the first 75 minutes of anaesthesia, blood pressure remaining above 100 mm. Hg. Dextrose/saline 150 ml. was given intravenously, the estimated blood loss being 150 ml. The surgical procedure was similar to that in Case 1.

Ten to 15 minutes after the insertion of bone cement into the shaft of the femur she became acutely hypotensive and a few seconds later suffered cardiac arrest. She was given 100% oxygen and isoprenaline 0.01 mg., and external cardiac massage was

started. Heart beat returned within one minute, and an E.C.G. at this time showed sinus rhythm with occasional ventricular extrasystoles. Sodium bicarbonate 60 mEq was given intravenously. The systolic blood pressure rose to 100 mm. Hg in the immediate postarrest period and remained at this level while the surgery was completed and 1 pt. (570 ml.) of blood was transfused. After atropine 0.6 mg. and neostigmine 2.5 mg. spontaneous respiration was re-established. On transfer to the trolley an episode of ventricular fibrillation occurred; this lasted 60 seconds and was treated by artificial ventilation with oxygen and external cardiac massage. She was given 250 ml. of 20% mannitol intravenously and was mechanically ventilated for three hours until consciousness had fully returned. Thereafter she remained well for two weeks, but during the third week she developed left ventricular failure. She died on the eighteenth postoperative day.

At necropsy extensive calcific atheroma of the coronary arteries with thrombosis of the descending branch of the left coronary artery were found. There was an area of recent infarction in the anterior wall of the left ventricle, together with evidence of old myocardial infarction.

COMMENT

Both these patients were elderly and had pre-existing cardiovascular disease, which in Case 2 was severe and probably still associated with hypokalaemia. The hip in each case had been twice dislocated and once reduced without incident in the pre-cement period. Absorption of the cement monomer may have been responsible for acute hypotension leading to cardiac arrest. A fall in blood pressure in association with the use of bone cement is known to occur (personal communications from J. Charnley, A. W. Peebles, I. C. Sutherland, and J. L. E. W. Thomas), but is rare in the elective operation of total hip replacement (personal communication from J. A. Clement), where patients are often younger and fitter. A recent study on animals showed a pronounced vasodilatory action of the monomer without myocardial depression (A. W. Peebles, personal communication).

In the past 12 months at this hospital there have been 147 operations for fracture of the upper end of the femur in patients over 60 years of age. A Thompson prosthesis with bone cement was used in 42 patients, whose average age was 79.3 years, and it was in this group that the two cardiac arrests occurred.

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ADDENDUM.—Since going to press a monograph (J. Charnley, *Acrylic Cement in Orthopaedic Surgery*, Livingstone, Edinburgh and London, 1970) has been published. The author states that harm from bone cement is likely to be due to its misuse. He lays great emphasis on measures directed towards limiting absorption of the monomer. He reports, without details, four cases of operative cardiac arrest in 3,700 total hip replacements. In a further 16 operations for fracture of the femoral neck, we have met one more case of severe cardiovascular collapse. This occurred one minute after insertion of cement and lasted 20 minutes. The patient was a grossly obese, but otherwise healthy 68-year-old woman.

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