RESULTS AND DISCUSSION

The technical conditions for surgical repair of pectus excavatum are that correction of the funnel chest should be sufficient, surgical intervention should be limited, and postoperative motility should be satisfactory. In view of these standards, many reports in the literature are critical of operative procedures using splints and methods requiring extracorporeal fixing apparatus. The sternal turnover operation developed by Wada and associates is noteworthy in that it corrects the above named weakness. Reports on a few trials of this operation have been made.

The results of our trials completely support the operative procedure developed by Wada when applied to patients under 15 years of age. In patients over the age of 15, postoperative necrosis of the bones and muscles and formation of longterm skin fistula have been experienced. There is no doubt that, for these older patients, development of a method for preserving blood flow to the sternum would be useful.

The new sternal turnover operation which we developed is judged to be useful for older children and adults, though the number so handled to date is as yet small. Important points to be observed in this operative technique are as follows: special care should be exercised in dissection of the internal mammary vessels; the dissection should be of sufficient length; and the cut end of the sternum should be tailored so that the blood flow can be maintained after crossover.

REFERENCES

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Distal Propulsion of Vena Cava Umbrella by Cardiac Massage*

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Distal propulsion of a 28 mm umbrella filter from vena cava to femoral vein occurred in a 75-year-old woman during external cardiac massage. After cardiac massage, filter position must be checked roentgenographically. Optimal management of distal migration might include placement of a second umbrella to prevent recurrent emboli and proximal migration of the dislodged umbrella.

Mobin-Uddin vena cava umbrella filters, 23 mm and the newer 28 mm size, have been used in 2,287 patients with a high degree of success in preventing recurrent pulmonary embolization, with few serious complications. Distal propulsion of the 23 mm filter has occurred in six patients after external cardiac massage. In one the undetected migration into an iliac...
vein was believed responsible for the subsequent death of the patient due to recurrent embolization. Intracaval pressures may reach 100 mm Hg during external cardiac massage, an important mechanism promoting distal propulsion.

To our knowledge this is the first recorded distal migration of the newer 28 mm umbrella filter.

CASE REPORT

A massively obese, 75-year-old white woman returned to St. Joseph’s Hospital because of shortness of breath and a rapid heart rate. Six weeks earlier she had an arthrotomy of the right knee for arthritis and had been prophylactically treated with crystalline sodium warfarin (Coumadin) for two weeks postoperation.

Her blood pressure was 105/80 mm Hg; pulse, 130 beats per minute and regular; respirations, 30 per minute; temperature, 37° C (98.6° F) rectally. Initial laboratory data were: hemoglobin, 12.3 gm/100 ml; hematocrit, 37 percent; white blood cell count (WBC), 9,700; serum potassium, 5.8 mEq/L; other electrolytes, normal; blood urea nitrogen (BUN), 30 mg/100 ml.

A radioisotopic lung scan revealed a perfusion deficit of the lower two-thirds of the left lung and the right lower lung field. Pulmonary arteriography confirmed massive bilateral pulmonary emboli (Fig 1). The pulmonary artery pressure was 50/25 mm Hg. Venography of the lower extremities revealed thrombus in the left femoral vein (Fig 2).

With fluoroscopy a 28 mm Mobin-Uddin vena cava umbrella was placed via the right internal jugular vein into the infra-renal vena cava. The post-placement flat plate roentgenogram confirmed good position of the umbrella filter (Fig 3). The patient did well until 9:00 AM the next day, when her respiratory rate rose to 44 per minute. She was intubated with an endotracheal tube, and arterial and central venous catheters were placed. The central venous pressure was 37 mm H2O. The Bennett MA-1 volume respirator was used for ventilatory assistance but her blood pressure dropped to 80/50 mm Hg. Despite resuscitative efforts with isoproterenol hydrochloride (Isuprel), epinephrine, metaraminol (Aramine) and sodium-bicarbonate a satisfactory blood pressure could not be sustained. External cardiac massage given on four occasions over the next hour was ultimately unsuccessful.
cardiac arrests were resuscitated by closed chest massage and recovered completely. Oakley has also reported a patient with massive thromboemboli who recovered completely after cardiac massage. Creation of an even larger umbrella might be rewarding. Design changes in the configuration of the umbrella should be undertaken to prevent both proximal and distal migration.

DISCUSSION

The most serious complication of the original 23 mm filter was proximal migration of the umbrella. This has occurred in 24 patients with nine deaths. The newer 28 mm umbrella filter was introduced for use in larger patients in whom the firm fixation of the 23 mm filter in a large cava might prove a problem. In 246 placements of the larger filter there have been three instances of proximal migration with three deaths.

Heimbecker recently demonstrated that closed heart massage may play a critical, previously unrecognized role in fragmenting and propelling massive emboli into more distal sites of the pulmonary arterial tree. Three of his patients who had massive emboli and who suffered cardiac arrests were resuscitated by closed chest massage and recovered completely. Oakley has also reported a patient with massive thromboemboli who recovered completely after cardiac massage. Should this promising, and universally applicable, therapy be proven of worth, then timing of umbrella placement vs the Heimbecker-Oakley maneuver will have to be considered since caval umbrellas can migrate distally after cardiac massage.

At post-mortem examination the emboli in our patient were well organized and adherent to the wall of each main branch of the pulmonary artery; fragmentation and propulsion of these emboli would have been difficult if not impossible.

The probable cause of the rather abrupt clinical downhill course the morning after caval umbrella placement was worsening right heart failure. A chest x-ray film obtained then showed very diminished pulmonary vascular markings. Cava pressure was 37 mm H2O. Re-embolization from the ovarian veins remains another possibility.

Should pulmonary embolectomy with cardiopulmonary bypass have been considered? Perhaps. Our experience indicates not, but others have had a more favorable rate of patient salvage with this operation.

Attacking the problem from a different focus, efforts should be continued to identify with laboratory tests those patients who will suffer or are suffering a thrombotic process so that optimal therapeutic anticoagulation can be instituted. Obviously the anticoagulation in our patient was stopped too soon after her first operation. Distal propulsion of the umbrella did not, in our opinion, contribute to the patient's death. However, had she lived, she would have required placement of a second umbrella to prevent recurrent emboli and proximal migration of the dislodged umbrella.

In patients with a vena cava umbrella in place, roentgenograms of the abdomen should be obtained after cardiac massage. Creation of an even larger umbrella might be rewarding. Design changes in the configuration of the umbrella should be undertaken to prevent both proximal and distal migration.

REFERENCES

5 Clinical letter, Edwards Laboratories, Santa Ana, Calif, June 1974