We conclude that a considerable cost savings and a low incidence of mortality, perioperative myocardial infarction, and prolonged intensive care unit stay can be attained in low-risk patients undergoing elective coronary artery surgery without preoperative PA catheterization. The question of whether an improvement in outcome can be achieved with PA monitoring cannot be answered from these data alone, and the large number of patients required probably precludes performing a prospective, randomized, controlled study.

REFERENCES

1. Loop FD, Christiansen EK, Lester JL, Cosgrove DM, Franco I, Golding LR: A strategy for cost containment in coronary artery surgery. JAMA 250:76–77, 1983
2. Lowenstein E, Teplic R: To (PA) catheterize or not to (PA) catheterize—that is the question (editorial). ANESTHESIOLOGY 53: 361–363, 1980
3. Keats AS: The Rovenstine Lecture, 1983: Cardiovascular anesthesia: perceptions and perspectives. ANESTHESIOLOGY 60: 467–474, 1984
4. Mangano DT: Monitoring pulmonary arterial pressure in coronary-artery disease. ANESTHESIOLOGY 53:364–370, 1980
5. Waller JL, Johnson SP, Kaplan JA: Usefulness of pulmonary artery catheters during aortocoronary bypass surgery (abstract). Anesth Analg 61:221–222, 1982
6. Kaplan JA, Wells PH: Early diagnosis of myocardial ischemia using the pulmonary artery catheter. Anesth Analg 60:789–793, 1981
7. Fleiss JL: Statistical Methods for Rates and Proportions. New York, John Wiley and Sons, 1981, pp 41–42
8. Shahian DM, Najafi H, DeLaria GA: Intraoperative placement of Swan-Ganz catheter via the left innominate vein. J Thorac Cardiovasc Surg 81:802–803, 1981
9. Feikes HL, Roberts AJ: Simplified method of intraoperative pulmonary artery flow-directed catheter insertion during cardiac surgery. Chest 81:755–756, 1982
10. McCormick JR, Dobnik DB, Mieszala BS, Berger RL: Simple method for measurement of cardiac output by thermodilution after cardiac operation. J Thorac Cardiovasc Surg 78:792–795, 1979
11. Moodie DS, Feldt RH, Kaye MP, Danielson GK, Pluth J, O'Fallon M: Measurement of postoperative cardiac output by thermodilution in pediatric and adult patients. J Thorac Cardiovasc Surg 78:796–798, 1979
12. Romano A, Niguidula FN: Technique of intraoperative placement of thermodilution catheter for cardiac output measurement in children. J Cardiovasc Surg 21:267–270, 1980
13. Kennedy JW, Kaiser GC, Fisher LD, Fritz JK, Myers W, Mudd JG, Ryan TJ: Clinical and angiographic predictors of operative mortality from the Collaborative Study in Coronary Artery Surgery (CASS). Circulation 63:793–802, 1981
14. Akins CW: Noncardioplegic myocardial preservation for coronary revascularization. J Thorac Cardiovasc Surg 88:174–181, 1984
15. Chaitman BR, Alderman EL, Sheffield LT, Tong T, Fisher L, Mock MB, Weins RD, Kaiser GC, Roitman D, Berger R, Gersh B, Hartzell S, Bourassa MG, Killip T: Use of survival analysis to determine the clinical significance of new Q waves after coronary bypass surgery. Circulation 67:302–309, 1983

Chylothorax Following Celiac Plexus Block

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Neurolytic celiac plexus block is used to relieve intractable pain in selected cases.[1,2] While major complications are rare, many risks and potential problems can occur, including paraplegia.[3] In one series[4] weakness and/or numbness in the T-10 through L-2 distribution was the most common finding (8%), followed by lower chest pain,

failure of ejaculation in men, postural hypotension, the sensation of warmth or fullness of a leg, and urinary difficulties. Additionally, aortic or inferior vena cava puncture, kidney puncture, pneumothorax, puncture of viscera, abscess or cyst, and subarachnoid or intravascular injection with attendant sequelae are recognized hazards of this technique.[5–8] We describe a previously unreported potentially serious complication of this therapy.

REPORT OF A CASE

A 75-year-old man with a history of pancreatic carcinoma was referred to our Pain Clinic for assessment and management of abdominal pain of 3 months duration. The diagnosis of adenocarcinoma of the head of the pancreas was made 18 months previously, at which time obstructive symptoms were treated surgically by roux en y choledochoenterostomy. Postoperative medical management consisted of 5-

fluorouracil, doxorubicin, and mitomycin chemotherapy. There had been no clinical evidence of recurrent disease until the onset of pain in the mid-epigastrium radiating through to the back, which was exacerbated by meals and unrelieved by antacids or an oral oxycodone preparation.

Essential hypertension was well controlled with hydrochlorothiazide and nadolol. He was chronically anemic and had a poor appetite, although body weight had been relatively steady over the prior 3 months. There were no known medical allergies and no history of tobacco or alcohol use.

On examination the patient had no external manifestations of disease except for pallor; he was not icteric. Abdominal examination revealed diffuse tenderness in the epigastric region. The liver edge was palpable four finger breadths below the right costal margin. Otherwise, general physical examination was unremarkable.

Gastroscopy revealed mild erosive gastritis. Computed axial tomography (CT) of the abdomen revealed mild enlargement of the pancreatic head. The retroperitoneal anatomy appeared normal. Measurement of serum amylase, electrolytes, hepatic enzymes, and bilirubin were normal; hemoglobin was 8.8 g/dl; platelet count was 151,000/mm^3; prothrombin time and partial thromboplastin time were normal.

A diagnostic celiac plexus nerve block was performed with the patient in the right and left lateral positions sequentially. Under image intensifier direction 12-cm 22-gauge needles with obturators were placed 7.5 cm lateral to the midline at the L-3 level and directed beneath the 12th ribs in a medial cephalad direction to rest anterior to the L-1 vertebral body; 0.5% bupivacaine with 1/200,000 epinephrine, 5 ml, was injected on each side after negative aspiration tests. There were no acute complications, and the patient had pain relief that lasted 18 h. A neurolytic celiac plexus block was subsequently performed. The same directive technique was employed with the addition of anatomic demarcation by the water-soluble contrast metrizamide before injection of 4 ml 1% lidocaine, followed by 4 ml 6.7% aqueous phenol on each side.

The patient did well with no immediate problems and obtained significant pain relief. He continued to use one to two doses of 5 mg oxycodone with 325 mg acetaminophen per day for occasional breakthrough periprandial pain upon discharge from the hospital 48 h later. Six days after discharge he presented to the emergency room with acute intermittent pain in the left shoulder and anterior chest. Evaluation revealed a pleural effusion filling one-half of the left chest for which a thoracostomy tube was placed. Analysis of the milky effusion showed cholesterol 2.89 mmol/l and triglycerides 29.28 mmol/l, consistent with chylous lymph. Culture of the effusion was negative, and there were no malignant cells seen. Chest tube drainage diminished daily, and the tube was removed after 10 days. The patient was discharged 2 days later, and to date his status remains satisfactory.

DISCUSSION

The cisterna chyli is classically described as lying anterior to the first and second vertebrae to the right of the aorta extending a length of 5–7 cm. However, the actual specific anatomy and location is quite variable.[9] In an individual, the structure may be completely absent or multilocular, or there may be multiple discreet cisternae. The thoracic duct originates from either lymphatic confluences or the cisterna(e) and ascends in proximity to the vertebral column traversing the diaphragm via the aortic hiatus posterolateral to the aorta and medial to the right crus of the diaphragm at the T-12 level. This duct continues between the azygos vein and aorta, passing to the left in the mediastinum usually around the T-5 level. Finally,

this duct empties into the left jugulosubclavian venous system. A needle passing anterior to the vertebral bodies could easily penetrate the lymphatic structures.

Perhaps such a retroperitoneal injury may lead to a subdiaphragmatic collection of lymph, which is then transported into the pleural cavity via diaphragmatic lymphatics. The flow is unidirectional consequent to valves within the lymphatic vessels. Perhaps the relatively negative intrathoracic and transpleural pressure gradiant, augmented by pulmonary excursions, serves as an abdominal-to-thoracic pump in this setting. Regardless of actual mechanisms, physiologically, such an egress definitely takes place.[10,11] Since the total flow of chyle averages 2–4 l/day leakage can result in potentially massive effusions.

The detailed anatomy of the chylous drainage system was described by Mascagni[12] in 1781, and subsequently 40 cases of chylothoraces secondary to tumor were described by Burgebuhr in 1895.[12] This process was thought to be untreatable and frequently fatal until Lampson[13] demonstrated that ligation of the thoracic duct was both feasible and effective. A convenient classification of chylothorax is as follows: congenital (in the neonatal period due to birth trauma and/or anatomic anomaly); traumatic (surgical, with reported 0.25–0.5% incidence after cardiovascular and thoracic surgery[14]; nonsurgical, with the development of chylothorax typically two to 10 days after penetrating or blunt trauma[15]); and atraumatic (usually associated with malignancy).

A tentative diagnosis is made by the usual signs, symptoms, and roentgenographic findings of pleural effusion in association with the clinical situation. The most frequently cited presenting symptom is dyspnea.[16] The specific diagnosis is made by determination of the composition of the effusion. Chylous lymph is unique in that its fat content is greater than that found in plasma and its protein content is approximately one-half that of plasma.[16]

Treatment consists of repeated thoracenteses or chest tube drainage. Concomitant medical therapy includes nutritional upkeep with a high calorie, high-protein, medium-chain triglyceride, low-fat diet supplemented with fat-soluble vitamins. This serves to replete losses and decrease lymph flow, promoting fistula closure and/or clot formation. It is the potential nutritional deficit coupled with losses of other plasma proteins, electrolytes, and lymphocytes that increases morbidity and mortality with prolonged leakage. Spontaneous closure occurs in approximately 50% of cases treated conservatively.[15] Failing this, surgical ductal ligation is indicated.

The sequence of events as outlined in our case report and the proximity of the major lymphatic conduits to the needle placement leads one to strongly suspect that the development of the chylous effusion was a direct consequence of this procedure. Review of the literature reveals

neither a report of chylothorax nor allusion to potential damage to the lymphatic system in reference to celiac plexus block.

Interestingly, the radiology literature reveals that chylothorax developing secondary to puncture of the cisterna chyli or thoracic duct is now a recognized although infrequent complication of high translumbar aortography.[17,18] The percutaneous approach for this diagnostic procedure[19] closely resembles that for performing celiac plexus block.

The possibility that the chylothorax in the case presented resulted from the patient's primary disease rather than caused iatrogenically cannot be absolutely excluded. Against this conclusion, however, is the relatively rapid resolution of the process without recurrence or other symptoms such as chylous ascites, the absence of an appreciable obstructing mass on CT scan, and the overall rarity of such a situation.[10] Another possible explanation could be erosion of the lymphatic endothelial wall by the neurolytic agent. Again, this mechanism has not been described and, without a specimen to examine, only speculation is in order.

In summary, a case of chylothorax following a neurolytic celiac plexus block is presented with a review and discussion of the possible pathophysiology and management involved. Though we are not aware of any technical measures that could be used to avoid this complication, this case report reinforces the need for follow-up of patients having such therapies and the need to include the relationships of the major lymphatic structures in anatomic descriptions of this particular procedure.

REFERENCES

1. Moore DC: Celiac plexus block with alcohol for cancer pain of the upper intra-abdominal viscera, Advances in Pain Research and Therapy, vol 2. Edited by Bonica JJ, Ventafridda V. New York, Raven Press, 1979, pp 357–371
2. Verrill P: Sympathetic ganglion lesions, Textbook of Pain. Edited by Wall PD, Melzack R. New York, Churchill Livingstone, 1984, pp 581–589
3. Galizia EJ, Lahiri SK: Paraplegia following coeliac plexus block with phenol. Br J Anaesth 46:539–540, 1974
4. Black A, Dwyer B: Coeliac plexus block. Anaesth Intensive Care 1:315–318, 1973
5. Ellis H, Feldman S: Anatomy for Anesthetists, third edition. London, Blackwell Scientific Publications, 1977, pp 266
6. Cousins MJ, Bridenbaugh PO: Neural Blockade in Clinical Anesthesia and Management of Pain. Philadelphia, JB Lippincott, 1980, pp 394–397, 551, 626, 638, 645–646
7. Orkin FK, Cooperman LH: Complications in Anesthesiology. Philadelphia, JB Lippincott, 1983, p 115
8. Bonica JJ: Sympathetic Nerve Blocks for Pain Diagnosis and Therapy, vol 2, Technical Considerations. Breon Laboratories, 1981, pp 78–90
9. Williams PL, Warwick R (eds): Gray's Anatomy, 36th edition. New York, Churchill Livingstone, 1980, pp 784–786
10. Patel RM, Purow E: Chylous ascites and chylothorax: Presenting manifestation of pancreatic carcinoma. NY State J Med 82:349–351, 1982
11. Johnston RF, Loo RV: Hepatic hydrothorax; studies to determine the source of the fluid and report of thirteen cases. Ann Intern Med 61:385–401, 1964
12. Bessone LN, Ferguson TB, Burford TH: Chylothorax. Ann Thorac Surg 12:527–550, 1971
13. Lampson RS: Traumatic chylothorax—a review of the literature and report of a case treated by mediastinal ligation of the thoracic duct. J Thorac Surg 17:778–791, 1948
14. Hesseling PB, Hoffman H: Chylothorax—a review of the literature and report of 3 cases. S Afr Med J 60:675–678, 1981
15. Hardy JD, Ewing HP: The mediastinum–chylothorax, Thoracic and Cardiovascular Surgery, fourth edition. Edited by Glenn WWL. Connecticut, Appleton-Century-Crofts, 1983, p 203
16. Nix JT, Albert M, Dugas JE, Wendt DL: Chylothorax and chylous ascites: A study of 302 selected cases. Am J Gastroenterol 28:40–55, 1957
17. Schwarz E: Puncture of the thoracic lymph duct with chylothorax: A rare complication of aortography. Radiology 75:248–250, 1960
18. Cook FE, Flaherty RA, Willmarth CL, Langelier PR: Chylothorax: A complication of translumbar aortography. Radiology 75:251–253, 1960
19. Dupont PA: Chylothorax after high translumbar aortography. Thorax 30:110–112, 1975