The Administration of Cephalothin Sodium Through a Central Venous Catheter: Physiologic Effects*

James D. Colt, M.D., F.C.C.P.**

Cephalothin sodium was given prophylactically through a central venous catheter to patients having prosthetic graft insertions. Venous pH, Pco2, arterial pH, Pco2, PaO2, lead 2 electrocardiogram strip, and central venous pressures were recorded before and after the administration of the drug. The tests were run in an attempt to determine if there was any alteration in these parameters due to drug administration. No changes were noted in any of the blood gas, pH, ECG, or central venous pressure values. Arterial PO2 changes could not be adequately analyzed due to the wide variation in PO2. It was concluded that cephalothin sodium can be given safely through a central venous catheter, every six hours, in 2-gm doses diluted in 100 ml of 5 percent glucose in distilled water.

Among the problems complicating vascular surgery, few are more serious than an infection in the prosthetic graft. The prophylactic use of an appropriate antibiotic is a common practice. Staphylococci and gram-negative rods are the most common etiologic bacteria in graft infections. Cephalothin sodium (Keflin), because of its low toxicity and broad spectrum of effectiveness, is considered most suitable for this purpose. A serious deterrent to its use, however, is the high incidence of phlebitis following intravenous injections. We decided to administer the drug through a central venous catheter, where rapid dilution of the agent would minimize any possible irritating effect. Since a central venous catheter is present for monitoring purposes in all patients undergoing major vascular procedures, a port for the administration of cephalothin sodium is already in place. The diluent was normal saline or dextrose solution. The pH of the cephalothin sodium in distilled water was 5.1. The titrable acidity of the cephalothin sodium solution with diluent was 5 Eq/liter. One hundred ml of this solution was used. A prospective study was planned to determine whether any alterations in the venous pH, Pco2, arterial pH, Pco2, PaO2, lead 2 electrocardiogram or central venous pressure could be demonstrated when cephalothin sodium was administered using the method given above.

METHOD

The central venous catheter was used to monitor central venous pressure and as a source for blood samples to be withdrawn in the period after operation. An arterial cannula was used to monitor blood pressure and blood gas levels. In no case were these catheters inserted for the purpose of administering cephalothin sodium. All patients had 12-lead electrocardiograms and a roentgenogram of the chest before operation. Many had blood gas studies before operation because of their questionable respiratory status. Measurements of venous pH, Pco2, arterial pH, Pco2 and PaO2, and central venous pressure were made on 35 occasions in 16 patients before and 15 minutes following cephalothin sodium administration on the first day after operation. On the second day after operation 26 similar paired measurements were performed in the same 16 patients, and on the third day after operation an additional 11 measurements were performed in 7 of the patients: a total of 72 studies in 16 patients. Fourteen patients had a graft replacement of the aorta, either thoracic or abdominal, and the other two patients had major abdominal surgical problems.

Arterial and venous pH and Pco2 values, plus PaO2, lead 2 electrocardiogram strip, and central venous pressure were obtained immediately before cephalothin sodium was administered and again 15 minutes later. The drug was given in a 2-gm dose, diluted with 100 ml of 5 percent dextrose in distilled water or in normal saline in the severely diabetic patients. All injections of the drug were completed within 30 minutes. The central venous pressure was monitored with a manometer, using a fixed reference point marked on the lateral chest wall. The patient was in the same position before, during and after all drug tests. All pH and blood gases were analyzed in the same laboratory, using the Instrumentation Laboratory model 313 analyzer.

RESULTS

The average PaO2 of 60-65 mm Hg was due to chronic lung disease in 82 percent of the patients before operation. Thus, findings before administration of cephalothin sodium must be compared with values before operation, not predicted normal standards. All of the patients in whom aortic resection, either thoracic or abdominal, was performed had an endotracheal tube in place for most of the first day and sometimes until the second or third day after operation. Consequently, some of the PaO2 readings differed considerably during a single day; that is, 118 mm Hg before administration of cephalothin sodium in the morning and 68 mm Hg before cephalothin...
sodium therapy in the afternoon. The blood gas determinations before cephalothin therapy were done primarily to aid in the care of the patient.

The results, summarized as group means, are presented in Table 1 for the first, second and third days. I will furnish the original data from each patient on request. The differences between the data before and after administration of cephalothin sodium in relation to the venous pH, venous Pco₂, arterial pH and arterial Pco₂ was negligible. There were three patients in whom differences in the P_{O_2} data were possibly significant: (1) a 79-year-old man with generalized peritonitis; (2) a 52-year-old man with diabetes, emphysema and bilateral mid-thigh amputation with gangrenous ulcers of the stump; and (3) a 52-year-old patient with no complicating underlying pathology except atherosclerosis. No patient developed infection in the graft.

### Table 1—Physiologic Data Before and After Cephalothin Administration

<table>
<thead>
<tr>
<th>Day, No.</th>
<th>Mean Venous pH</th>
<th>Mean Venous Pco₂</th>
<th>Mean Arterial pH</th>
<th>Mean Arterial Pco₂</th>
<th>Mean Central Venous Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
</tr>
<tr>
<td>1</td>
<td>7.46</td>
<td>7.46</td>
<td>38</td>
<td>38</td>
<td>7.48</td>
</tr>
<tr>
<td>2</td>
<td>7.47</td>
<td>7.47</td>
<td>37</td>
<td>37</td>
<td>7.51</td>
</tr>
<tr>
<td>3</td>
<td>7.45</td>
<td>7.46</td>
<td>39</td>
<td>40</td>
<td>7.50</td>
</tr>
</tbody>
</table>

### Comment

Patients requiring vascular prostheses were selected for this study because they regularly receive cephalothin sodium prophylactically. The patients studied had predictable sources of variability: (1) Their age ranged from 29 to 81 years. Eight of the 16 patients were in the seventh decade and 6 were above 70 years of age. The mean age was 62 years. (2) The incidence of emphysema was 82 percent. (3) Seventy-one percent had cardiac disease including previous coronary occlusion, present cardiac failure and coronary insufficiency. (4) Forty-one percent were overtly diabetic or prediabetic.

Had there been any significant change in cardiac or pulmonary function the measurements made would have revealed them and provided evidence of phlebitis, had it occurred in the central veins. The chest x-ray films, compared with the films before operation, showed only those changes attributable to the surgical invasion of the pleura. The minimal or negligible changes in the venous pH, venous Pco₂, arterial pH, arterial Pco₂, central vein pressure, chest roentgenogram or electrocardiogram verify the absence of any adverse effect due to the administration of cephalothin sodium through an indwelling central vein catheter. Variations in P_{O_2} values before and after administration of cephalothin sodium occurred in three patients, only one instance of which could not be explained by pulmonary pathology before operation and/or complications after operation. Atelectasis and pneumonitis occurred after operation in three patients, including one patient with paraplegia caused by poliomyelitis. There were four patients in whom cardiac failure was difficult to correct. Septic shock was the cause of death in the one patient with peritonitis.

### Acknowledgments

I wish to express my gratitude to William P. Kleitsch, M.D., Chief of Surgery, for invaluable assistance in preparation of this manuscript. Statistical assistance was supplied by Arthur Johnson, Ph.D., Midwest Cooperative Studies Center, Hines Veterans Administration Hospital, Chicago. Statistical analysis of the P_{O_2} data was not possible because of the unanswerable question of which observations were invalid.

### References

2. Eli Lilly Company: Handbook of Cephalosporin Therapy, USA, 1968