system is required to enable patients to live in symbiosis with a foreign kidney and yet remain free of the risk of infection.

We thank Professor D. N. S. Kerr for his support in this project. The study was performed with ethical committee approval.

References

- Frei, P. C., Benacerraf, B., and Thorbecke, G. J., *Proceedings of the National Academy of Science*, 1965, 53, 20.
- Margarey, C. J., and Baum, N., *British Journal of Surgery*, 1970, 57, 748.

- Riggi, S. J., and DiLuzio, N. R., *Journal of the Reticuloendothelial Society*, 1964, 1, 136.
- Saba, T. M., *Archives of Internal Medicine*, 1970, 126, 1031.
- Biozzi, G., et al., *Journal of Laboratory and Clinical Medicine*, 1958, 51, 230.
- Salky, N. K., Mills, D., and DiLuzio, N. R., *Journal of Laboratory and Clinical Medicine*, 1965, 66, 952.
- Wagner, H. N., Ilio, M., and Hornick, R. B., *Journal of Laboratory and Clinical Investigation*, 1963, 42, 427.
- Wardle, E. N., *Clinical Nephrology*, 1975, 3, 31.
- Ilio, M., and Wagner, H. N., *Journal of Clinical Investigation*, 1963, 42, 417.
- Uldall, P. R., et al., *Lancet*, 1974, 2, 514.
- Berken, A., and Sherman, A. A., *Proceedings of the Society for Experimental Biology and Medicine*, 1972, 141, 656.
- Scorvill, W. A., and Saba, T. M., *Annals of Surgery*, 1973, 178, 59.

SHORT REPORTS

Risk of Acute Renal Failure Associated with Disseminated Intravascular Coagulation

The mortality rates due to acute renal failure (A.R.F.) continue to be extremely high. Early and frequent dialysis, adequate caloric intake, and intensive care have not succeeded in lowering it. Disseminated intravascular coagulation (D.I.C.) has been found to be associated with A.R.F. in many cases. The aim of this report is to determine to what extent D.I.C. modifies the prognosis of A.R.F., and whether heparin treatment is valuable.

Patients, Methods, and Results

Of the 86 patients treated in our department for A.R.F. from January 1969 to May 1974 27 had associated D.I.C. The aetiology was obstetric in 21 cases, surgical in 20, traumatic in five, medical in 37, not identified in two, and as a result of cardiac catheterization in one. The diagnosis of D.I.C. was based on three criteria: a platelet count $\leq 150 \times 10^9/l$, prothrombin time ≥ 15 seconds, and fibrinogen ≤ 1.6 g/l. Patients with hepatic disease were excluded from the study. In every patient the usual treatment for A.R.F. was followed. In 12 of 27 patients with D.I.C. intravenous sodium heparin was given. The average dose for the first 24 hours was 300 mg every four hours. The dose of heparin was considered to be correct if the thrombin time or the coagulation time were twice the control. Statistical analysis was performed by the χ^2 test.

Mortality Rates in 86 Patients With A.R.F.

	No. Dead	No. Alive	Mortality Rate (%)
Not studied haemostatically	19	13	59.4
With D.I.C.	16	11	59.2
Without D.I.C.	12	15	44.4
Total patients with A.R.F.	47	39	54.65

In 54 patients haemostatic studies were performed. The overall mortality rate was 55%. The mortality rate was higher in patients with D.I.C. than in those without, but this difference was not statistically significant ($\chi^2 = 1.21$). Mortality did not decrease (58%) in patients treated with heparin as compared with the 15 non-treated patients (60%). Excluding minor haemorrhage, there were serious therapeutic complications in 10 of the 12 treated patients. Nine patients suffered gastrointestinal haemorrhages and heparin had to be stopped. After three days of treatment one patient developed a retroperitoneal haematoma which required surgical drainage. The incidence of gastrointestinal haemorrhage was less in the non-treated patients (five out of 15). The analysis of cause of death in 27 patients with A.R.F. and D.I.C. showed that gastrointestinal haemorrhages contributed to death in eight cases (five alone, two associated with septic shock, and one associated with generalized bleeding). Septic shock alone caused four deaths, and the other four deaths were attributed to miscellaneous factors. One year after the acute episode both the five survivors of the heparin-treated group and the six survivors of the non-treated group had a glomerular filtration rate of > 60 ml.

In one patient from the latter group a renal biopsy showed patchy cortical necrosis.

Discussion

The association of A.R.F. and D.I.C. was found in 31% of the patients with A.R.F. The same frequency has been reported in Kleinknecht (28.9%),¹ while Zech found it in 5% of cases,² and Conté in 14.6%.³ These differences were due to the different causes of A.R.F. in each series and the different diagnostic criteria for D.I.C. D.I.C. is often associated with A.R.F., especially in obstetric patients.

Both Kleinknecht¹ and Zech² considered that D.I.C. worsened prognosis. In our series the mortality rate was higher for patients with D.I.C., but the difference was not significant. Conté³ suggested that D.I.C. does not influence the prognosis of A.R.F., but if only his "toxic-infectious shock" cases are considered, the results are closer to those in the other studies.

The dramatic complications of the heparin treatment must be emphasized: 10 out of 12 treated patients suffered serious haemorrhages. Gastrointestinal haemorrhages are a well established factor of morbidity and mortality in the course of A.R.F., and heparin might aggravate their evolution in patients with already critical disease.

Heparin treatment of D.I.C. has been unhesitatingly recommended by many workers, though it still remains a point of controversy. Some workers¹⁻⁴ have reported that the mortality rate has not been modified by heparin. Treatment of the primary disease is essential and early care of acidosis, sepsis, and shock checks haemostatic disturbances without anticoagulant treatment.¹⁻⁵ Cautious administration of heparin should be reserved only for selected cases, in which the catalytic mechanism of D.I.C. perpetuates the coagulation disorder, or when heparin treatment is the only possible means of diagnosis. On the other hand, it has been claimed that heparin prevents cortical necrosis,²⁻³ but we can draw no valid conclusions from our findings. In the non-treated group, however, one case of cortical necrosis was observed.

We thank Dr. J. Monasterio Asperi of the coagulation laboratory for help with the haemostatic studies.

¹ Kleinknecht, D., Kanfer, A., and Josso, F., *Revue Européenne d'Etudes Cliniques et Biologiques*, 1972, 17, 695.

² Zech, P., et al., *Journal d'Urologie et Néphrologie*, 1972, 78, 337.

³ Conté, J., et al., *Actualités Néphrologiques de l'Hôpital Necker*, p. 201, Flammarion ed., Paris, 1973.

⁴ Corrigan, J. J. jun., and Jordan, C. M., *New England Journal of Medicine*, 1970, 283, 778.

⁵ Corrigan, J. J. jun., Jordan, C. M., and Bennett, B. B., *American Journal of Diseases of Children*, 1973, 126, 629.

Department of Internal Medicine, Service of Nephrology, Ciudad Sanitaria de la Seguridad Social, Barcelona, Spain

E. ANDRÉS RIBES, M.D., Physician
J. CAMPS DOMÈNECH, M.D., Physician
J. M. MAURI NICOLÁS, M.D., Physician
M. LLORACH GASPÀR, M.D., Physician