Renal Failure after Radiological Contrast Media

J. MCEVOY,* M.D., M.R.C.P. ; M. G. MCGEOWN,† M.D., PH.D., F.R.C.P.ED. ; R. KUMAR,‡ M.D.

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Summary: Over a 12-month period four patients developed acute renal failure after undergoing radiological investigations using contrast media. Though the incidence of serious complications is low, the possibility of adverse side effects must be weighed against the usefulness of the information provided by these techniques.

Introduction

In normal circumstances diagnostic radiocontrast media are safe and cause little if any upset to the patients under investigation. In recent years there has been a tendency to advocate ever-increasing doses of these contrast media to obtain adequate pictures when the renal or hepatic excretory mechanisms are impaired (Schwartz *et al.*, 1963; Kelsey Fry and Cattell, 1970). However, in the presence either of pre-existing renal insufficiency or of jaundice with its known tendency to potentiate nephrotoxic agents they may precipitate an acute or acute on chronic episode of renal failure. We report four such cases seen in the period March 1969 to April 1970. Two arose as a complication of renal arteriography, while the other two resulted from attempts at intravenous cholangiography in the presence of jaundice.

Case 1

A 74-year-old man was first seen at another hospital on 28 March 1969 complaining of thirst and polyuria. His urine did not contain sugar, but a blood pressure of 290/160 mm. Hg was noted along with papilloedema, exudates, and haemorrhages in both optic fundi. Blood urea on admission was 69 mg./100 ml., with a normal electrolyte block. An intravenous pyelogram on 1 April showed a right kidney measuring 10.5 cm. along its bipolar axis, and on the left side a large rounded mass expanding the upper pole of the kidney and extending as far as the inferior diaphragmatic surface. The appearances were thought consistent with either hypernephroma or simple cyst of the kidney, and arteriography was advocated to differentiate between those two lesions. On 8 April the blood urea was 67 mg./100 ml. An aortogram and selective left renal arteriogram carried out on 22 April showed the lesion of the left upper pole to be a large simple cyst. A pronounced stenosis of the right renal artery was also noted, and the flow through both kidneys was very slow. Blood urea on 23 April was 110 mg./100 ml., rising to 280 mg. on 2 May despite conservative measures for the treatment of acute renal failure. Urinary output on 2 May was down to 270 ml./24 hours.

He was admitted to this unit on 2 May and treated by peritoneal dialysis, intravenous fluids, and a 20-g. protein acute renal failure diet. Within five days his urinary output had increased to over 1,500 ml./24 hours, and he was able to reduce his blood urea without further dialysis. He was discharged to continue convalescence in the hospital which he first attended.

Case 2

A 67-year-old man was seen at the outpatient department of another hospital complaining of haematuria. His blood urea was 25 mg./100 ml. on 18 March 1970. An intravenous pyelogram on 20 March indicated a lesion on the right side. On 23 March the urea was 30 mg./100 ml. A selective right renal arteriogram on 24 March showed a hypernephroma in the right kidney, which

was removed the following day. The tumour was well encapsulated and measured 1 in. (2.5 cm.) in diameter. Postoperatively the urea rose progressively to a maximum of 380 mg./100 ml. on 8 April and then fell gradually to 64 mg. by the 24th. Only conservative measures were needed to manage the renal failure and dialysis was not required. Subsequent investigation in the postoperative period showed that he was suffering from unsuspected myelomatosis, with Bence-Jones proteinuria, lucid areas in the vault of the skull, and IgG greater than 3,000 mg./100 ml. The sternal marrow showed a pronounced infiltration with small plasma cells but no evidence of carcinomatous infiltration. He was alive and reasonably well in September 1970 with a blood urea of 56 mg./100 ml.

Case 3

A 46-year-old man had been extensively investigated in another hospital over the previous five years for jaundice. The origin of this remains obscure, though the laboratory findings suggest an obstructive type of lesion. Several other members of his family are also said to have developed jaundice at about the same age as he did. On 14 February 1969 his blood urea was 27 mg./100 ml., total bilirubin 7.1 mg./100 ml., direct 7.0 mg. An intravenous cholangiogram was attempted on 2 June, but the liver failed to excrete the dye, so a second attempt with 200 ml. of Biligrafin in 1,000 ml. of 5% dextrose was made on 24 June. This was also unsuccessful. A third attempt with still larger volumes of contrast medium was under consideration, but was frustrated by the patient, who developed malaise, vomiting, and epigastric discomfort 24 hours after the second examination. By 26 June his blood urea was 146 mg./100 ml., rising to 375 mg. on 30 June, the date of his transfer to this unit. He was anuric.

Treatment was started with peritoneal dialysis, appropriate fluid and electrolyte replacement, and a 20-g. protein acute renal failure diet. Over the next three weeks his urinary output rose gradually to 3,870 ml./24 hours; and his blood urea decreased spontaneously without further dialysis. At an outpatient review on 8 August he had returned to normal health except for the jaundice, and his blood urea was 38 mg./100 ml. on a normal diet.

Case 4

A 38-year-old woman with Down's syndrome was known to have had stones in a non-functioning gall bladder for some years. Repeated episodes of acute cholecystitis led to operative removal of the gall bladder in this hospital in March 1969, from which she made a good recovery. Her blood urea at this time was within normal limits. On 5 September 1969 she was admitted to another hospital with a history of prolonged vomiting, and on examination was found to be dehydrated and deeply jaundiced—total bilirubin 9.8 mg./100 ml., direct 9.2 mg. On 6 September her blood urea was 90 mg./100 ml. with the following serum electrolyte block: sodium 136, potassium 3.1, chloride 98, CO₂ combining power 20 mEq/l. and plasma S.G. 1029. The findings in the blood and in the urine indicated that the jaundice was obstructive in origin, and a presumptive diagnosis of stone in the common bile duct was made. She was treated with intravenous fluids and electrolytes and the blood urea dropped to 20 mg./100 ml. On 9 September an intravenous cholangiogram was carried out. This was unhelpful in that the liver failed to excrete the contrast medium and no opaque calculi were seen. On 13 September her blood urea had risen to 356 mg./100 ml. and she was then transferred to this unit, where she was found to be hypotensive, the blood pressure 80/60 mm. Hg, and she had a tachycardia which was at times uncountable even on auscultation.

Electrocardiography showed sinus tachycardia with anterolateral ischaemia but no definite infarction. Peritoneal dialysis was begun and the appropriate intravenous fluids were continued. The urinary output over the first 24 hours was 960 ml. and by the fourth day here it had risen to 2,190 ml., but the blood urea remained at almost the same level. Peritoneal dialysis was tech-

* Consultant Nephrologist, Belfast and South Belfast Hospital Groups, Belfast BT9 7AB.

† Consultant Medical Urologist, Belfast and South Belfast Hospital Groups.

‡ Registrar, Renal Unit, Belfast City Hospital

nically unsatisfactory, partly because of her mental state, and haemodialysis could not be undertaken because of her low blood pressure and general condition, which failed to improve despite appropriate supportive treatment. She deteriorated further and died on 24 September. Unfortunately necropsy was not carried out. We cannot, therefore, rule out the possibility that the second episode of renal failure may have been due to something other than the contrast medium—for example, septicaemia or rupture of the common bile duct. There was, however, no clinical evidence pointing specifically towards any such complication; she was provided with broad-spectrum antibiotic cover, and the peritoneal effluent was not suggestive of perforation of any viscus.

Discussion

Intravenous and intra-arterial contrast media are so widely and safely used, as to be regarded as virtually non-toxic. Schwartz *et al.* (1963) first advocated using a larger than normal dosage to improve the intravenous pyelogram in renal failure. The drip infusion technique was introduced by Schencker (1964). Since then there have been numerous published reports of successful visualization of the urinary tracts when using high-dose urography, and these have continued right up to the present time (Kelsey Fry and Cattell, 1970).

Various authors, however, have drawn attention to the risks involved. Manitz and Matthes (1967) and Ansell (1968) reported temporary anuria as a complication of intravenous pyelography in patients with renal failure. Chamberlain and Gleeson (1965) concluded that the morbidity and mortality of renal angiography are such as to make it unjustified in the investigation of hypertension. Renal failure is not listed among their complications but clearly needs to be taken into account. The danger of acute renal failure after pyelography in myeloma is well known, though Lasser *et al.* (1966) produced clinical and experimental evidence that this is less likely with the newer contrast media. The fact that Case 2 survived his I.V.P. without any rise in blood urea is in keeping with their findings. Whether the subsequent deterioration after the arteriogram was due to precipitation of myeloma protein as a result of the contrast arriving in the kidney at a higher concentration than is achieved during pyelography, or whether it represents a direct toxic effect on the kidney similar to what must have occurred in Case 1 is open to speculation. These cases were all radiographed in other hospitals and only transferred to the regional dialysis unit when renal failure became apparent. Exact details of the dosage and radiological techniques used are therefore not available.

It has been pointed out in standard texts that patients suffering from pre-existing renal insufficiency may be pre-

cipitated into acute renal failure by disturbances which in the normal person cause only minor changes in renal function (De Wardener, 1967). These include radiological contrast media, especially if used for aortography or in the presence of jaundice (Milne, 1967). Becker *et al.* (1968) advised that extra care be taken if renal failure is accompanied by jaundice.

Some advocates of high-dose radiology are reluctant to accept that the injected contrast media could have been responsible for the exacerbations of renal failure cited in the literature. Kelsey Fry and Cattell (1970) imply that some other factor—for example, dehydration—may have been responsible for the cases reported. Certainly the patient reported by Bergman *et al.* (1968) was inadvertently dehydrated, but this cannot be said of all the other instances in the literature to date. Even the oral administration of contrast media may not be without risk. Canales *et al.* (1969) have reported four cases of renal failure where the agent was iopanoic acid taken by mouth prior to cholecystography, and they make it clear that in their patients there was no clinical or laboratory evidence of parenchymatous hepatic dysfunction. Fortunately the incidence of serious complications is low, but our experience of four cases in a 12-month period should underline that it is not negligible, and we fear that ever-increasing doses of contrast media may increase the frequency and severity of cases unless great care is taken in the selection of patients to be examined in this way. The possibility of adverse side effects in any diagnostic procedure must be weighed against the usefulness of the information it may provide. In the presence of renal disease or deep jaundice the complications of using contrast media may be very serious; an intravenous cholangiogram in particular is unlikely to be informative if the serum bilirubin is high.

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