[Combined case reports; renal hypertension, pyelonephritis, and acute kidney failure]

MEDICAL GRAND ROUNDS
PARKLAND MEMORIAL HOSPITAL
MAY 22, 1958

Case 1:

A 68 year old male had been a known diabetic for 10 years. Six weeks before admission he had a "stroke" followed by right sided weakness. The main complaint was weakness. The patient was oriented.

On examination the BP was 210/110 mm Hg, pulse 84, resp. 18. Fundoscopic examination revealed bilateral retinal hemorrhages, waxy exudate, arteriolar narrowing and A-V nicking. Other examination was not remarkable.

The diabetes was controlled with 10 units of regular insulin and 15 units of NPH. The urine sp. gr. was usually about 1.016, albumin was 1-2+. The urine sediment contained many WBC. Repeated urine cultures yielded A. aerogenes and E. Coli. The organisms were resistant to all antibiotic tested.

The hemoglobin was 11 gm/100 ml of blood, the WBC was 11,000 with a normal differential count. The BUN was 57 mg/100 ml, CO_2 combining power 27 mEq/L and plasma chloride 94 mEq/L. A PSP test revealed 20 per cent excretion in 2 hours. The diagnosis was that of diabetes mellitus, chronic active pyelonephritis, hypertensive cardiovascular disease.

One pint of the patient's type O ($\frac{cDe}{cde}$, MN) blood was transfused into a hematologically normal recipient of type B ($\frac{cDE}{cde}$, NN). The life span of the erythrocytes was measured in the recipient by the Ashby and radiochromium methods simultaneously. The red cell disappearance was almost linear to the base line at 33 to 40 days. The two methods gave similar results.

Case 2:

A 54 year old female was a known hypertensive subject for 3 years. Four months earlier she had a stroke which was attended by right hemiplegia.

Dysphagia was followed by considerable functional return. There were frequent falls and easy bruising. Another stroke occurred 6 months before admission. She became incontinent to urine and feces. The easy bruising became more pronounced. Before admission mental confusion, bouts of vomiting, purpura and hematuria became definite.

The BP was 260/140 mm Hg, temp. 98, pulse 90, resp. 20. The fundi were grade IV bilaterally (papilledema, etc). Cardiomegaly and hepatomegaly were observed. Bilateral Babinski reflexes were present.

During the first week the patient improved. During the second week there was mounting azotemia, acidosis, anemia and stupor. The patient succumbed 2 weeks after admission.

The urine revealed 2-4+ albumin and was loaded with RBC and WBC. The urinary sp. gr. was 1.020. On two occasions the life span of the patient's RBC was measured in hematologically normal recipients by means of the simultaneous use of the Ashby and CR^{51} methods. The patient was type O ($\frac{CDe}{cde}$, NN) and the recipients were type A ($\frac{CDe}{cde}$, NN) and type A ($\frac{cDE}{cde}$, NN).

The first red cell life span was begun shortly after admission. At this time the peripheral Hb. was 12.7 gm/100 ml, the BUN was 22, CO_2 combining power 30 mEq/L and plasma chloride 96 mEq/L. The reticulocyte count was 4.4% and the WBC was 13,000. The platelet count was 86,000/cu mm by the direct method.

The second red cell life span was begun during the second week at which time the Hb. was 7.3 gm/100 ml, the BUN was 200 mg/100 ml, CO_2 combining power was 13 mEq/L and the plasma chloride was 97 mEq/L. The reticulocyte count was 1%.

Despite the different circumstances under which the life span curves were obtained the results were comparable on the two occasions by the 2 methods. The first drop in RBC concentration in both measurements indicated a life span of about 20 to 30 days (Dornhorst reference). Thereafter the slope of RBC disappearance projected out to about 60 days.

The diagnoses were: Hypertensive cardiovascular disease with accelerated (or malignant) hypertension, thrombocytopenic purpura.

Case 3:

A 51 year old female complained mainly of headaches of 2 years duration. For 3 months the headaches had been severe. These were throbbing in character and were associated with blurred vision, tinnitus and on occasions dizziness and vomiting. She had fainted twice during one of these episodes.

Nocturia (5x) was reported. For 6 months there was shortness of breath on exertion and aches in the left chest.

The BP was 245/180 mm Hg, temp. 99°F, pulse 82 and resp. 22. The fundi revealed marked narrowing of arteries and A-V nicking, hemorrhages, exudate and bilateral papilledema (grade V). Cardiomegaly and slight edema of the feet and ankles were noted.

The hemoglobin concentration was 10 gm/100 ml. The WBC was 7,700/cu mm with a normal differential count. The urinary sp. gr. was 1.008-1.016, there was 4+ albumin, urine cultures were negative. The PSP excretion test was 15% in 2 hours. The BUN was 28-34 mg/100 ml, CO_2 combining power was 29-34 mEq/L and plasma chloride 80-91 mEq/L.

Diagnosis: Accelerated (malignant) hypertension

The life span of the RBC was determined on 2 occasions. The first time the patient's type O (Rh+MN) blood was given to a type B (Rh+MN)

recipient and both the Ashby and CR^{51} measurements were conducted. The second time the patient's RBC were tagged with CR^{51} reinjected into the patient and the disappearance of radioactivity was measured. The life span curves were similar and indicated a slight to moderate decrement in life span (Dornhorst projection about 60 days).

SUMMARY 8 CASES
RBC UREMIC DONOR INTO NORMAL RECIPIENT

Case No.	Diagnosis	BP	BUN	Hb.	Life span (Dornhorst)	Method
1	Chronic pyelonephritis (HCVD)	210/110	57	11.0	30-40 days	Ashby-CR^{51}
2	HCVD (Benign - Malignant)	210/95	244	4-6	40-50 days	" "
3	HCVD (Malignant)	245/180	22	10.3	50-60 days	" "
4	HCVD (Renal Failure)	260/140	43 200	12.7 7.3	20-30 days 20-30 days	" " " "
5	Chronic pyelonephritis HCVD	240/150	199	7.7	40 days	" "
6	Acute Renal Failure (Trauma)	160/80	83	7.9	Normal (90-120)	" "
7	HCVD (Malignant)	240/150	144	7.3	35 days 60?	" "
8	Chronic pyelonephritis	150/80	150	5.8	100 (10?) 90-100	" "

SUMMARY 5 CASES
RBC UREMIC INTO SELF AND NORMAL RBC INTO UREMIC

Case No.	Diagnosis	BP	BUN	Hb.	Life Span (Dornhorst)	Method
1	Acute Renal Failure (shock)	80/60	74	14	30	Pt-Pt CR^{51}
		200/100	18	8	50	N - Pt. Ashby
2	Chronic glomerulo-nephritis	220/120	108	10.0	60 90-120?	Pt-Pt CR^{51} N-Pt. Ashby
3	HCVD (Malignant)	208/120	168	7 4	15-20	N - Pt Ashby & CR^{51}
4	Chronic pyelonephritis	210/120	250	4	50-60	N-Pt. Ashby & CR^{51}
5	HCVD (Chronic pyelonephritis)	170/100	123	7.0	10-20	N-Pt. Ashby & CR^{51}

REFERENCES

1. Brown, G. E. and Roth, G. M.: Prognostic Value of Anemia in Chronic Glomerular Nephritis, J.A.M.A. 81:1948-1940, 1923

2. Ashe, B.: The Hemoglobin Percentage and the Red Blood Cell Count in Bright's Disease, Myocardial Insufficiency and Hypertension, Arch. Int. Med. 44:507-530, 1929

3. Townsend, S. R., Massie, E. and Lyons, R. H.: Studies on the Anemia of Chronic Glomerulonephritis and Its Relationship to Gastric Acidity, Am. J. Med. Sci. 194:636-645, 1937

4. Whipple, G. H. and Robscheidt-Robbins, F. S.: Nephritis and Its Influence Upon Hemoglobin Production in Experimental Anemia, J. Exp. Med. 69:485-498, 1939

5. Emerson, C. P.: The Pathogenesis of Anemia in Acute Glomerulonephritis. Estimation of Blood Production and Blood Destruction in a Case Receiving Massive Transfusions, Blood 3:363-372, 1948

6. Emerson, C. P. Jr. and Burrows, B. A.: The Mechanism of Anemia and Its Influence on Renal Function in Chronic Uremia, J. Clin. Invest. 28:779, 1949

References (continued)

7. Finch, C. A., Gibson, J. G., Peacock, W. C. and Fluharty, R. G.: Iron Metabolism Utilization of Intravenous Radioactive Iron, Blood, 4:905-927, 1949

8. Gardner, F. H.: Use of Cobaltous Chloride in Anemia Associated with Chronic Renal Disease, J. Lab. and Clin. Med. 41:56-64, 1953

9. Levin, W. C. and Gregory, L.: Hematological Effects of Uremia, So. Med. J. 45:121-126, 1952

10. Callen, I. R. and Limarzi, L. R.: Bone Marrow in Renal Disease, Am. J. Clin. Path. 20:3-23, 1950

11. Jacobson, L.O., Goldwasser, E., Fried, W. and Plzak, L.: Role of the Kidney in Erythropoiesis, Nature 179:633, 1957

12. Rees, S. B., Thomas, J., Guild, W. R. and Meniel, J. P.: Effect of Dialysis and Purine Ribosides Upon the Anemia of Uremia, J. Clin. Invest. 36:923, 1957

13. Loge, J. P., Lange, R. D. and Moore, C. V.: Characterization of the Anemia of Chronic Renal Insufficiency, J. Clin. Invest. 29:830-831, 1950

14. Loge, J. P., Lange, R. D. and Moore, C.V.: Characterization of the Anemia Associatedwith Chronic Renal Insufficiency, Am. J. Med. 24:4-18, 1958

15. Chaplin, H. and Mollison, P. L.: Red Cell Life Span in Nephritis and in Hepatic Cirrhosis, Clin. Sc. 12:351-360, 1953

16. Joske, R. A., McAlister, J. M. and Prankerd, T. A. J.: Isotope Investigations of Red Cell Production and Destruction in Chronic Renal Disease, Clin. Sci. 15:511-522, 1956

17. Sutherland, D. A., McCall, S., Jones, F. and Muirhead, E. E.: The Anemia of Uremia, Hemolytic State Measured by the Radiochromium Method, Am. J. Med. 19:153, 1955

18. Muirhead, E. E., Jones, F. and Sutherland, D. A.: Erythrocytes in Uremia: Survival of Erythrocytes from Nephrectomized Dogs and Uremic Patients, Fed. Proc. 14 (Pt. 1): 105, 1955

19. Muirhead, E. E. and Shields, W. F.: Erythrophagocytosis and Hemosiderosis in Lymph Nodes, Spleen and Liver in Patients Dying of Malignant Hypertension, Chronic Glomerulonephritis and Pyelonephritis and Polycystic Disease, Ann. Int. Med. 40:307-312, 1954

20. Desforges, J. F. and Dawson, J. P.: The Anemia of Renal Failure, A.M.A. Arch. Int. Med. 101:326-332, 1958

References (continued)

21. Muirhead, E. E., JOnes, Frances and Grollman, A.: The Anemia of Renal Insufficiency as Induced by Bilateral Nephrectomy of the Rabbit: With emphasis on Its Hemolytic Nature, J. Lab. and Clin. Med. 39:505-517, 1952

22. Muirhead, E. E., Jones, F., Stirman, J. A. and Lesch, W.: Hemolytic Anemia of the Dog Following Bilateral Nephrectomy, Am. J. Physiol. 173:371-378, 1953

23. Swan R. C. and Merrill, J. P.: The Clinical Course of Acute Renal Failure, Medicine 32:215-292, 1953

24. Muirhead, E. E. and Stirman, J. A.: Acute Progressive Unrelenting Renal Failure, Surgery, 32:43-57, 1952

25. Richet, G., Alagille, D. and Fournier, E.: Acute Erythroblastopenia Due to Anuria, Presse Med. 62:50-53, 1954

26. Harris, J. S., Stanley, G. D. and Poole, R. F., Jr.: Genesis of Anemia of Renal Insufficiency, Fed. Proc. 13 (pt. 1) 224-225, 1954

27. Naetes, J. P.: Erythropoiesis in Nephrectomized Dogs, Nature 181:1134-1135, 1958

28. Erslev, A. J.: Erythropoietic Factor in Uremic Rabbit, A.M.A. Arch. Int. Med. 101:407-417, 1958

29. Dornhorst, A. C.: The Interpretation of Red Cell Life Span, Blood 6: 1284-1292, 1951

Concerning References:

1,2,3 Earlier references on anemia of uremia, general view of suppression of bone marrow

4 Experimental data on hemoglobin generation in dogs with nephritis, Indication that at times Hb generation is normal thus suggesting indirectly a hemolytic component

5,6 Indication of combined mechanism of increased RBC destruction and decreased production of RBC by bone marrow

7 Decreased production of RBC as indicated by lowered rate of incorporation of radioiron into peripheral hemoglobin

8 Demonstration that bone marrow output can be increased by cobalt and anemia may be relieved

9 Demonstration of reticulocytosis in anemia of uremia

10. Demonstration of adequate cellularity of bone marrow in anemia of uremia

Concerning references (continued)

More recent data

11. Claim erythropoitin elaborated by kidneys

12 Improved life span of RBC in anemia of uremia following dialysis on an artificial kidney

13,14 Characterization of anemia of uremia as mainly due to decreased production plus extracorpuscular defect

15 Appraisal of life span of red cell in anemia of uremia by Ashby method with demonstration of normal life span in fixed low grade anemia and shortened life span in progressive anemia and renal disease

16 Study of bone marrow production in chronic renal disease with radioiron and life span with radiochromium. Emphasis on bone marrow failure

17,18 Abstract data on life span RBC in uremic patients and some RBC in normal subjects using advanced uremic as source for RBC studied

19 Demonstration erythrophagocytosis and hemosiderosis in anemia of uremia

20 Further consideration of RBC life span in anemia of renal failure

21,22 Demonstration hemolytic anemia in nephrectomized rabbit and dog

23,24,25 Anemia and bone marrow in acute renal failure

26,27 Bone marrow failure after bilateral nephrectomy of dog

28 A challenge of material in reference 11. Additional evidence for bone marrow failure in uremia (bilateral nephrectomy and ureteral ligation). Concludes that anemia of uremia is due to metabolic changes attendant on uremia rather than to the presence or absence of renal tissue. The anemia is considered associated with a decrease in production or release of erythropoietic factor and a decrease in erythropoietic response to this factor.

29 Dornhorst method of estimating average RBC life span from an Ashby survival curve