Uric Acid Excretion in Patients with Malignant Lymphomas

By N. Primikirios, L. Stutzman and A. A. Sandberg

It has been established that effective therapeutic agents used in the treatment of Hodgkin's disease and lymphosarcoma can produce, in certain cases, excessive and rapid breakdown of nucleoproteins, resulting in an acute uremic picture and death. Uric acid is one of the chief end products of purine catabolism in human subjects and is eliminated in the urine. Massive liberation of uric acid as a result of tissue destruction can be accompanied by precipitation of urates and uric acid crystals in collecting tubules of the kidneys or in the ureters, resulting in obstructive uropathy.

In the acute leukemias, chronic myelocytic leukemia, and other myeloproliferative disorders, an elevation of serum uric acid and an increased urinary excretion of uric acid may occur before therapy. From the findings of Weisberger and Persky it appears that some degree of hyperuricemia may exist among untreated lymphoma patients. These authors also reported a high incidence of uric acid renal calculi among such cases. However, data available in the literature are insufficient to indicate whether or not, in cases of lymphoma, there is correlation between the urinary uric acid excretion and either the size of the tumor mass or its sensitivity to therapy.

This paper presents the results of studies of the blood levels and urinary excretion of uric acid before, during and after therapy in 12 cases of malignant lymphoma. These data are correlated with the size and responsiveness to therapy of the tumor masses.

Material and Methods

Uric acid studies were carried out in seven cases of Hodgkin's disease and in five cases of lymphosarcoma before, during and after therapy. The diagnosis in all cases was confirmed by lymph node biopsy. Six patients were previously untreated, whereas six had received therapy in the past, but not within the month preceding the study. The most obvious lesions were chosen for serial measurements by the same observer during the study period.

Twenty-four hour urine specimens were collected without preservative. Each patient was placed on an 1800 to 3200 calorie, low purine diet containing 100-120 mg. of purines for at least 48 hours prior to collection of urine, and this diet was continued throughout the entire period of observation. Patients who failed to cooperate in urine collections or dietary restrictions were deleted from the study. All except one had a normal blood urea nitrogen (BUN) initially. To avoid their influence upon uric acid excretion, drugs such as salicylates, probenecid and phenylbutazone were not given.

Uric acid was measured by the differential spectrophotometric method of Kalckar, as modified by Praetorius. This has been found to be a highly reproducible method in our laboratory. The enzymatic methods employed in this study were previously used by one of us for the determination of uric acid levels in a group of normal subjects on similar low purine diets, and these values are shown in Table 1.
Table 1.—Serum and Urinary Uric Acid Levels in Normal Subjects and Before Treatment in Patients with Lymphomas

<table>
<thead>
<tr>
<th></th>
<th>Serum Uric Acid</th>
<th>Urinary Uric Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg./100 ml.</td>
<td>mg./24 hr.</td>
</tr>
<tr>
<td>Normal subjects*</td>
<td>5.4 3.4–8.3</td>
<td>399 276–460</td>
</tr>
<tr>
<td>Patients</td>
<td>6.6 3.3–10.7</td>
<td>693 606–845</td>
</tr>
</tbody>
</table>

*Data for normals from Sandberg et al.12

RESULTS

The cases have been divided empirically into two groups according to estimates of their objective response to therapy (table 2):

**Group I—Poor Response to Therapy.** Cases 1 through 7. These patients had measurable reduction in their tumor mass of 0–20 per cent. Figures 1 through 5 show representative cases.

**Group II—Good Response to Therapy.** Cases 8 through 12. These 5 patients had 70 per cent or more reduction in size of their measurable tumor mass as a result of therapy. Figures 6–9 show representative cases in this group.

In view of several interesting features, Case 8 will be presented in detail:

Case 8. A 33 year old white male with lymphosarcoma, lymphocytic type, of 3 months duration, was admitted with fever, a large left pleural effusion, mediastinal adenopathy, generalized peripheral lymphadenopathy, multiple cutaneous nodules and hepatosplenomegaly. Bone marrow aspiration revealed hypercellularity with over 50 per cent of the cells being immature lymphocytes.

The patient received nitrogen mustard therapy (0.2 mg. Kg. body weight on each of 3 days) with dramatic clinical response, except for persistence of lymphocytic infiltration in the bone marrow. Uremia and hyperuricemia were accompanied by a sharp increase in the urinary uric acid (fig. 7). A large volume of orally administered fluids resulted in a daily urinary output of 3,000–5,000 ml. and rapid improvement of uremia.

Two weeks later cutaneous nodules had reappeared, and a sudden left facial palsy appeared without clinical evidence of progression of the disease elsewhere. The liver and spleen remained barely palpable. Spinal fluid was under increased pressure and contained 58 WBC's per cu. mm. and 126 mg. per cent protein. A course of nitrogen mustard was given (0.1 mg. Kg. on two successive days) followed by radiation to the left lateral skull and cervical areas. During the first 3 days of therapy, prednisone, 80 mg. per day, was given. The treatment resulted in relief of neurological signs but was complicated by a second and more dramatic rise of urinary and serum uric acid levels associated with progressive oliguria. During this phase, serum levels of uric acid reached 37 mg. per cent, BUN 147 mg. per cent and serum potassium 7 mEq. L. The urine was of low specific gravity, with traces of albumin and upon microscopic examination was shown to contain many uric acid crystals, leukocytes and erythrocytes.

Hemodialysis was performed with a MacNeill-designed dialyzer, by the method described by Anthone et al.31 resulting in the removal of 4.5 Gm. of uric acid.

Artificial hemodialysis was performed, with removal of 4.5 Gm. of uric acid. The serum uric acid dropped from 29.5 mg. per cent to 15 mg. per cent; BUN from 147 mg. per cent to 78 mg. per cent; and potassium from 7 to 3.8 mEq./L. Satisfactory diuresis followed the dialysis, and the patient was discharged two weeks later with normal BUN, serum uric acid and potassium values.

One month later, the patient was readmitted with progressive azotemia and recurrence of cutaneous nodules, lymphadenopathy and hepatomegaly. Death occurred five days later.
Table 2.—Response of Blood and Urine Uric Acid Levels to Treatment and Clinical Result

<table>
<thead>
<tr>
<th>Group</th>
<th>Diagnosis</th>
<th>Duration Disease (Mo.)</th>
<th>Age &amp; Sex</th>
<th>Tumor size (o+++o)</th>
<th>Systemic Manifestations (o+++o)</th>
<th>Treatment</th>
<th>Highest Urine Uric Acid (mg/24 hr.)</th>
<th>Highest Serum Uric Acid (mg.%)</th>
<th>% Decrease in Tumor Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A</td>
<td>Lymphatic Lymphosarcoma</td>
<td>36</td>
<td>55 M</td>
<td>+++</td>
<td>None</td>
<td>HN₂</td>
<td>774</td>
<td>812</td>
<td>3.2</td>
</tr>
<tr>
<td>1 B</td>
<td>Lymphatic Lymphosarcoma</td>
<td>36</td>
<td>55 M</td>
<td>+++</td>
<td>None</td>
<td>X-ray, abdomen and prednisone</td>
<td>—</td>
<td>614</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>Hodgkin’s Disease</td>
<td>60</td>
<td>33 F</td>
<td>+++</td>
<td>++</td>
<td>HN₂</td>
<td>820</td>
<td>780</td>
<td>5.6</td>
</tr>
<tr>
<td>I</td>
<td>Poor Response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 A</td>
<td>Retic. Cell Sarcoma</td>
<td>102</td>
<td>65 M</td>
<td>+++</td>
<td>None</td>
<td>X-ray, bilat. inguinal</td>
<td>776</td>
<td>915</td>
<td>10.7</td>
</tr>
<tr>
<td>3 B</td>
<td>Retic. Cell Sarcoma</td>
<td>106</td>
<td>65 M</td>
<td>+++</td>
<td>None</td>
<td>HN₂</td>
<td>598</td>
<td>1140</td>
<td>10.7</td>
</tr>
<tr>
<td>4</td>
<td>Retic. Cell Sarcoma</td>
<td>8</td>
<td>40 M</td>
<td>++</td>
<td>None</td>
<td>HN₂</td>
<td>661</td>
<td>858</td>
<td>7.2</td>
</tr>
<tr>
<td>5</td>
<td>Hodgkin’s Disease</td>
<td>12</td>
<td>43 F</td>
<td>++</td>
<td>+++</td>
<td>Chlorambucil</td>
<td>750</td>
<td>920</td>
<td>7.6</td>
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<tr>
<td>6</td>
<td>Hodgkin’s Disease</td>
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<td>59 M</td>
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<td>++</td>
<td>HN₂</td>
<td>800</td>
<td>1344</td>
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</tr>
<tr>
<td>7</td>
<td>Hodgkin’s Disease</td>
<td>12</td>
<td>44 F</td>
<td>++</td>
<td>++</td>
<td>HN₂</td>
<td>569</td>
<td>650</td>
<td>3.9</td>
</tr>
<tr>
<td>II</td>
<td>Good Response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 A</td>
<td>Lymphatic Lymphosarcoma</td>
<td>3</td>
<td>33 M</td>
<td>+++</td>
<td>++</td>
<td>HN₂</td>
<td>723</td>
<td>5486</td>
<td>7.6</td>
</tr>
<tr>
<td>8 B</td>
<td>Lymphatic Lymphosarcoma</td>
<td>4</td>
<td>33 M</td>
<td>++</td>
<td>+</td>
<td>HN₂, prednisone, X-ray, skull</td>
<td>730</td>
<td>2800</td>
<td>5.0</td>
</tr>
<tr>
<td>9</td>
<td>Giant Follicular Lymphoma</td>
<td>24</td>
<td>47 M</td>
<td>+++++</td>
<td>None</td>
<td>X-ray, abdomen</td>
<td>922</td>
<td>2600</td>
<td>8.3</td>
</tr>
<tr>
<td>10</td>
<td>Hodgkin’s Disease</td>
<td>5</td>
<td>37 M</td>
<td>+</td>
<td>None</td>
<td>X-ray, neck and axilla</td>
<td>881</td>
<td>792</td>
<td>6.2</td>
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<tr>
<td>11</td>
<td>Hodgkin’s Disease</td>
<td>1</td>
<td>58 M</td>
<td>+</td>
<td>None</td>
<td>X-ray, mediastinum</td>
<td>558</td>
<td>812</td>
<td>9.0</td>
</tr>
<tr>
<td>12</td>
<td>Hodgkin’s Disease</td>
<td>96</td>
<td>36 M</td>
<td>++</td>
<td>++</td>
<td>HN₂</td>
<td>1000</td>
<td>1250</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Fig. 1.—Case #1, 55 year old white male. Lymphosarcoma, lymphocytic type, with large inguinal masses, moderate axillary lymphadenopathy and liver enlarged to 4 cm. below costal margin. There was no response to nitrogen mustard, prednisone or radiation therapy to both inguinal masses and death occurred on the 37th day. Autopsy revealed terminal uremia to have been due to chronic pyelonephritis. There was no increase in urinary uric acid during therapy.
Fig. 2.—Case #2, 33 year old white female. Hodgkin's disease. Fever, night sweats, weakness, hepatosplenomegaly, generalized lymphadenopathy of minor size, left mediastinal enlargement, and an abdominal mass, 6 cm. in diameter, were present on admission. Nitrogen mustard relieved symptoms, but physical findings remained unchanged. No increase in urinary uric acid was observed.
Fig. 3.—Case #3, first treatment (A), 65 year old white male. Lymphosarcoma, reticulum cell type, with large masses in the right inguinal and femoral areas, and hepatomegaly. Radiation therapy resulted in limited response of the masses, which was not reflected as a peak in urinary uric acid excretion during radiation therapy.
Fig. 4.—Case #3, second treatment (B), same patient as shown in figure 3 during another course of therapy 4 months later. A large abdominal mass had appeared in addition to the former findings. Nitrogen mustard therapy was clinically ineffective, with progressive increase of tumor during and after therapy. A temporary spike in urinary uric acid is noted in relation to therapy.
Fig. 5—Case #4, 40 year old white male with lymphosarcoma. Nitrogen mustard therapy. A slight increase in uric acid excretion is noted on the two days following completion of therapy.
Table 3.—Serum Uric Acids Before and After Therapy

<table>
<thead>
<tr>
<th>Case</th>
<th>Before therapy</th>
<th>Post-treatment</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>I 1</td>
<td>3.2-3.9</td>
<td>3.4</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>5.6-7.5</td>
<td>6.5</td>
<td>4.3-5.7</td>
</tr>
<tr>
<td>3 A</td>
<td>7.6-10.3</td>
<td>8.5</td>
<td>3.6-5.4</td>
</tr>
<tr>
<td>B</td>
<td>8.5-10.7</td>
<td>9.9</td>
<td>6.1-6.8</td>
</tr>
<tr>
<td>4</td>
<td>7.2-7.4</td>
<td>7.4</td>
<td>4.6-4.7</td>
</tr>
<tr>
<td>5</td>
<td>5.6-7.6</td>
<td>6.5</td>
<td>2.8-4.9</td>
</tr>
<tr>
<td>6</td>
<td>7.6-8.3</td>
<td>8.0</td>
<td>2.5-3.5</td>
</tr>
<tr>
<td>7</td>
<td>3.3-3.9</td>
<td>3.7</td>
<td>1.7-3.0</td>
</tr>
<tr>
<td>II 8</td>
<td>4.4-7.6</td>
<td>6.0</td>
<td>2.8-4.9</td>
</tr>
<tr>
<td>9</td>
<td>7.4-8.3</td>
<td>7.7</td>
<td>4.9-5.7</td>
</tr>
<tr>
<td>10</td>
<td>5.6-8.9</td>
<td>6.9</td>
<td>4.7-5.8</td>
</tr>
<tr>
<td>11</td>
<td>4.6-9.0</td>
<td>7.5</td>
<td>7.2-7.9</td>
</tr>
<tr>
<td>12</td>
<td>3.3-4.6</td>
<td>3.9</td>
<td>2.4-2.6</td>
</tr>
</tbody>
</table>

No studies of uric acid excretion were made during the terminal phase. Post mortem findings revealed generalized lymphosarcoma (lymphocytic type). The kidneys showed massive and diffuse interstitial infiltration by lymphosarcoma, as well as invasion of Bowman's capsule and the adventitia of some tubules. No evidence of obstructive uropathy was found.

COMMENTS

Our results are compared to those of normal subjects of both sexes on similar low purine diets, since there are no adequate uric acid metabolic studies in patients with varied diseases, and who were as ill as these lymphoma patients, to serve as comparisons. Many of our patients were febrile and had lost weight, particularly muscle tissue. During such catabolic periods, the uric acid excretion might be expected to be elevated. However, Leon, while finding increased blood uric acid levels in starved subjects, found the urinary uric acid excretion significantly decreased.7 All of these 12 patients with lymphoma manifested increased urinary uric acid excretion during the pretreatment period when compared to normal subjects, whether such excretion was calculated as total 24-hour urinary output of uric acid or as mg. of uric acid per Kg. of body weight. These data are shown in table 1. There was no overlap between the patient group and the group of normal subjects in this respect. However, only 2 patients (Patients 3 and 11) had serum uric acid levels above the normal range (table 2). Obviously the rate of urinary excretion of uric acid is a much more sensitive indication of changes of nucleoprotein metabolism than is the serum uric acid level. The hyperuricuria seen prior to treatment may be due to (1) an increased body pool of purines correlated with mass of the tumor or (2) a higher purine turnover by the lymphoma tissue or elsewhere within the body of a patient with lymphoma. Since there was poor correlation between the estimated tumor size and the uric acid excretion, the latter would seem more important. There was no relation between the degree of elevation of the pretreatment uric acid output and the response of the tumor to treatment.

In addition to the increased output observed during the baseline period, several patients developed transiently higher outputs of urinary uric acid in rela-
Fig. 6.—Case #6, 59 year old white male with Hodgkin's disease, was admitted with fever and marked symptoms of activity, but hepatomegaly, 4 cm. below costal margin, was the only objective evidence of disease. Nitrogen mustard therapy gave a good symptomatic response, but there was no regression of the hepatomegaly. A definite, but transient, increase in urinary uric acid is seen on the last day of therapy. Note the decrease in serum uric acid after completion of treatment.
Fig. 8.—Case #9, 47 year old white male with giant follicular lymphosarcoma. Generalized lymphadenopathy, hepatosplenomegaly and a 23 x 18 cm. abdominal mass. Abdominal radiation caused rapid and nearly complete dissolution of the abdominal mass. High levels of urinary uric acid were seen after initiation of therapy followed by rapid regression of the tumor mass.
Fig. 9.—Case #12, 36 year old white male with Hodgkin’s disease with systemic manifestations, splenomegaly (5 cm. below costal margin), a 2 cm. in diameter node in the left axilla and a 3.5 cm. in diameter node in the left inguinal area. Chest x-ray revealed bilateral pulmonary infiltration. Nitrogen mustard gave a good subjective response and improvement in all areas of measurable disease. Note the transient increase in urinary uric acid on the three days following completion of therapy and its eventual diminution to levels below the pretreatment period.
tion to cytotoxic therapy. None of the 7 patients with poor response (Group I) had a marked rise in urinary uric acid excretion in relation to therapy, but 5 (Patients 3B, 4, 5, 6, and 7) showed minor increases during this time, while 3 showed no increase.

Two (Patients 8 and 9) of the 5 patients with good response developed a marked increase in urinary uric acid excretion in association with therapy. Two other cases (Patients 11 and 12) showed minor increases, while no rise was seen in the remaining case.

Gerbrandy et al. have also noted the abnormally high excretion of uric acid during control periods in patients with Hodgkin's disease and related this to the presence of fever. No such correlation was observed among our patients when systemic symptoms, including fever, are compared to the uric acid excretion (table 2).

In the period of stabilization following completion of cytotoxic therapy, in only one case (patient 12) did the urinary uric acid excretion decrease to levels below the pretreatment levels, while in the remaining eleven cases, no clear diminution of the increased output appeared.

Increased uric acid excretion, when seen during therapy, occurred in the past when three- to four-week courses of radiation therapy were given, and during or immediately following the administration of nitrogen mustard. In no case did elevations appear for the first time late in the course of x-ray therapy.

Good symptomatic responses were obtained with nitrogen mustard treatment in three patients with Hodgkin's disease associated with little or no objective response in measurable tumors. Two of these courses of treatment (Patients 2 and 7) were not accompanied by rises in uric acid excretion, while a definite transient rise was observed in the third (Patient 6). In this last case, this may have been a manifestation of breakdown in deep abdominal tumor masses which were not appreciable clinically. (Widespread retroperitoneal disease was found later at autopsy.) A less likely explanation is that the increase in uric acid excretion was due to destruction of leukocytes, since the peripheral white blood count fell from 19,000 to 8,000 per cu. mm. during the four days of therapy. The symptomatic response in the other two patients is consistent with the hypothesis that the improvement was not due to the destruction of significant amounts of tumor, but might reflect an “anti-inflammatory” effect of nitrogen mustard. Such an effect might be due to inhibition of the elaboration of a toxic substance by diseased tissue, or by inactivation of such a substance.

Nitrogen mustard did not result in rise of either serum or urine uric acid levels in three of these cases (1, 2 and 7), and there was no clinical evidence of tumor response. In an additional patient, not included in this series, whose diagnosis was ultimately established at autopsy as retroperitoneal abscess without lymphoma and in whom uric acid metabolic studies were performed, there was only a slight increase in normal pretreatment urine and blood levels following nitrogen mustard. Similarly, there was no appreciable rise in urinary uric acid excretion in Patient 3 (treatment A) during or after radiation through large femoral and pelvic ports. It would therefore appear that these cytotoxic
agents do not mobilize significant amounts of uric acid from normal tissue or resistant tumors. On the other hand, in Cases 8 and 9, there were prompt rises in urinary uric acid excretion soon after the institution of cytotoxic therapy, associated with reduction in the size of tumor masses.

Therefore, further increase of urinary uric acid above baseline levels appearing in association with cytotoxic therapy appeared to have been derived from the breakdown of lymphoma tissue and, when it appeared in marked degrees early in the course of treatment, was a more sensitive indicator of such breakdown than clinical measurements. This observation is in agreement with those of Spencer et al., who stated that increased uric acid excretion is an early and sensitive indicator of radiation effect. However, in the present study, small increases in excretion seen in several patients were inconsistently associated with objective clinical evidence of improvement.

No relationship was seen between the urinary excretion and the blood levels of uric acid. Three patients (6, 9 and 12) were able to excrete over 1000 mg. of uric acid per day while maintaining blood levels of uric acid which were normal or only slightly elevated (table 2). On the other hand, higher serum levels were observed in Cases 1 (treatment B) and 3 (treatment A) with lower urinary values. Such differences may reflect natural variation in renal clearances, or may be due to low renal reserve, as in Patients 1 and 8. These cases developed oliguria and rises in BUN in association with severe renal disease which had been present prior to the institution of therapy.

There was a decrease in the average serum uric acid level in the post-treatment as compared to the pretreatment period in 10 of the 11 surviving patients (table 3). The standard deviation of the individual observations is 1.03 mg. per cent which means that 95 per cent of the time the individual observation is within 2.06 mg. per cent of the correct value. The average difference between the pretreatment mean and the post-treatment mean was -2.4 mg. per cent with a standard error of 0.20. Hence, the confidence interval on $\bar{Z}$ is -2.0 to -2.8 mg. per cent, which definitely does not include zero, indicating a statistically significant change in the before and after average. No correlation was observed among the amplitude of the decrease and the size of tumor or response to therapy. This fall in blood level was not reflected by a demonstrable fall in urinary uric acid output, except in one case (12).

Oliguria as a complication of anti-lymphoma or anti-leukemia therapy has been well documented. It is attributed to an obstructive uropathy due to precipitation and deposition of uric acid crystals in the collecting tubules of the kidneys or ureter. Precipitation of uric acid occurs when its solubility in the urine is exceeded because of inadequate volume or low pH. Patients with previously diseased kidneys, due to malignant infiltration or chronic infection, appear more liable to develop renal complications during therapy. Clinical manifestations include renal colic, hematuria, oliguria, vomiting, drowsiness, and the passage of cloudy urine. When potentially dangerous hyperuricemia, unusually high urinary excretion of uric acid, or unusual sensitivity of tumor to therapy are noted, large amounts of fluid should be given. Urinary alkalization may increase the solubility of uric acid within the tubules and ureters. Large doses of sodium bicarbonate may be used for this purpose in
patients with good renal function. However, many lymphoma patients cannot tolerate such a high solute load, and this medication should not be given during periods of oliguria or to patients with significant underlying renal disease. Acetazolamide will raise the urinary pH values for a period of several days following its introduction, and may be of use during critical periods of hyperuricuria. The urinary alkalinizing effect of this drug disappears after a few days, so that no reliance can be placed upon it for longer periods. Local x-ray irradiation of the kidneys prior to other therapy has been suggested if parenchymal renal involvement by tumor is suspected. Abstinence from uricosuric agents is indicated. In cases of anuria, cystoscopic manipulations, with operative removal of stones or crystal depositions from ureters or renal pelvis may be of value. That uric acid can be removed from the blood by hemodialysis with an artificial kidney was shown by Goldberg et al., who were able to remove between 1.3 and 3.9 Gm. of uric acid from patients with acute renal failure from various causes. Firmat et al. recently reported success in use of the artificial kidney in treatment of renal failure and hyperuricemia in patients with lymphoma and leukemia. These authors emphasized the presence of a low BUN to uric acid ratio in the acute renal failure of lymphomas as compared to the acute renal failure associated with other diseases. This concept seems a valuable one and can be utilized in comparing the renal failure of Case 8 (fig. 7) ascribed to uric acid nephropathy to that of Case 1 (fig. 1), in which renal failure seemed primarily due to underlying pyelonephritis.

Conclusions

Uric acid blood and urine studies were performed in 12 patients with lymphomas while on a measured low purine diet before, during and after cytotoxic therapy.

Before treatment, urinary uric acid excretion in these patients was significantly higher than in normal subjects, although only 2 patients had clearly elevated blood uric acid levels. There was no correlation between the estimated size of the tumor masses and pretreatment uric acid excretion. The response to treatment could not have been predicted by measurement of the pretreatment uric acid excretion.

In one patient with extensive tumor infiltration of the kidneys, dangerous renal failure, preceded by marked hyperuricemia, developed during therapy. Mechanical hemodialysis resulted in clinical improvement and marked reduction in the blood levels of uric acid and urea.

The finding of a large increase in uric acid excretion during the early days of treatment of a patient with lymphoma is indicative of a responsive tumor. Such data also serve as warning of potential obstructive uric acid nephropathy or uropathy before major increases in serum uric acid appear. Small increases of uric acid excretion in association with treatment could not be correlated with objective clinical response.
URIC ACID EXCRETION IN MALIGNANCY

SUMMARIO IN INTERLINGUA

Esseva effectuate studios del acido uric in le sanguine e le urina de 12 patientes con lymphoma recipiente—durante e post therapia cytotoxic—un dieta a basse mesurate contento de purina.

Ante le tractamento, le excretion urinari de acido uric in iste patientes esseva significativemente plus alte que in subjectos normal, sed solmente duo del patientes monstrava nettemente elevate nivellos de acido uric in le sanguine. Esseva trovate nulle correlation inter le estimate magnitude del massa del tumor e le excretion de acido uric ante le tractamento. Il non haberea essite possibile predicere le responsa therapeutic per mesurar le excretion pre-tractamental de acido uric.

In un del patientes con extense infiltration tumoric del renes, un periculo disfallimento renal—precedite per marcate hyperuricemia—se disveloppava durante le therapia. Hemodialyse mechanic resultava in melioration clinic e marcate reductiones del nivellos sanguinee de acido uric e de urea.

Le constatation de un marcate augmento del excretion de acido uric durante le prime dies del tractamento de un patiente con lymphoma indica que le tumor es responsive. Tal datos etiam servi como signal de alarma indicante le possibilitate potential de obstructive nephropathia a acido uric o de uropathia ante le apparition de major augmentos del acido uric in le sero. Micre augmentos del excretion de acido uric in association con le therapia non poteva esser correlate con un objective responsa clinic.

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Uric Acid Excretion in Patients with Malignant Lymphomas

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