straight as possible, a plaster jacket is applied over
stockings, the prominences being padded with felt. Two
metal bows with studs and two hinges are incorporated
in the plaster (fig. 1). When the plaster has set, the
jacket is divided into two by cutting out a narrow
region, the jacket can be taken up under the chin (fig. 2)
and the turnbuckle at home a few more turns every day, but
has been applied and inspected in the clinic, give the
patient controls the extending force acting on
the spine. When the curve reaches the upper thoracic
region, the jacket can be taken up under the chin (fig. 2)
so that the fulcrum is situated at a higher level in the
column. And with the plaster jacket as a model, the
correction jacket can be made out of strong leather.
By measuring the increase in height and the alteration of
the vision, it is possible to express the results
numerically. During treatment the patient
should have small frequent meals, as gastric over-
distension causes a feeling of oppression. During the
day he is up and about as usual and can, after the jacket
has been applied and inspected in the clinic, give the
turnbuckle at home a few more turns every day, but
under regular observation.

ILLUSTRATIVE CASE-RECORD
A man, aged 24, was first seen in 1940 with a 5-year history of symptoms. A typical ankylosing spondylitis had developed with much spinal deformity, stiffness of the neck, and
restriction of movement in the left hip; thoracic excursion very slight.
Pain and stiffness were severe, in spite of his taking
'Pyramidon' gr. 2 daily. There have been 8 attacks of iritis and scleritis. Sedimentation-rate 21 (Westergren).
Radiography showed a "bamboo spine," obliteratior of the sacro-iliac joints, and a secondary arthritis of the left hip.
The patient received X-ray therapy according to the usual
programme, and after the first course the pain considerably
lessened, ankylosis were no longer necessary, and the stiffness
somewhat diminished. Sedimentation-rate 25 mm. in 1 hr.
After an interval of a few weeks another course of X-ray therapy
was administered, after which the pain disappeared com-
pletely, except in the left hip, which responded, however,
to short-wave diathermy and massage.
After 6 months the patient was bicycling again, and able
to continue the university courses. Sedimentation-rate 13.
During 1941 there was slight pain in muscle-groups, which
responded favourably to lumination and a single short-
wave diathermy treatment; sedimentation-rate unchanged. In the
middle of 1942 there had been pain in neck and hips, which
reacted well to a short course of X-ray therapy. In 1943
there were no special features, and the monthly sedimenta-
tion-rate remained at 10.

When the first jacket was removed, the muscles of the loin
were very painful, and the patient was ordered a week's rest.
The pains were relieved with mustard plasters in a few days,
and the second jacket was applied. The maximal extension
possible of the spine was accomplished by turnbuckle in a
march, and the patient was left in this position for another
fortnight. He was 3 cm. taller, and his visual axis was raised
by 12°, values which remained unchanged after removal of the
jacket (fig. 3c).

During the last few days of wearing the jacket, after having
had only a week's respite in 23 months, there was considerable
fatigue; and the flank muscles were painful and weak after its
removal. After massage and mobilisation the patient
was symptom-free after 3 weeks, and a month later he started
work. Sedimentation-rate constant at 10.

A follow-up 6 months after application of the jacket, during which time he had to do much walking in connexion with his work, trans and bicycles not being available in war-
time, showed an increase in height of 2 cm., and a raising of
visual axis by 9° (fig. 3d). The results were not so good as before (fig. 3c) is probably due to fatigue.

It is our opinion that, even in this long-standing case with obvious secondary structural adaptation, it
then the treatment could not be improved by another
method to correct still further the present spinal deformity,
as the turnbuckles of the first two had been opened up
to their maximum.

LOUSE-BORNE RELAPSING FEVER
TREATED WITH CALCIUM GOLD KERATINATE
M. WOLMAN, CAPTAIN RAMC
CENTRAL PATHOLOGICAL LABORATORY, MF
M. OMAR, M B, D B
M. ABU-TALEB, M B
IMBABA FEVER HOSPITAL, CAIRO

The treatment of spirochetal diseases with gold preparations was apparently introduced simultaneously
by Levaditi and Nicolau (1925) and by Feldt (1941).
Their results were confirmed and amplified by subsequent
experimenters. Thus, Steiner and Fischl (1929) found two
gold compounds, 'Solganal' and 'A. 69,' more effective than 'Neosalvarsan' and of a higher chemo-
therapeutic index. Rothermundt and Wichmann (1932)
found that, whereas certain strains of spirochetes were
more sensitive to gold treatment, others were more
sensitive to arsenicals. Feldt (1941) reported that gold
treatment was therefore preferable to arsenical,
as their chemotherapeutic index was higher: calcium-
gold keratinate ('Neosolganal') was said to be the
best in the series, because of the anti-allergic action of the Ca.

The action of solganal and neosolganal in curing labora-
tory infections with relapsing fever spirochetes was
studied further at the National Institute for Medical
A strain of Treponema recurrentis from the Liverpool
School of Tropical Medicine was used. Mice were treated
on the first day of patent infection, a single dose being
given intraperitoneally in 0-8-1-0 c.c.m. water. The
response was judged by the presence or absence of spiro-
chetes in the blood one day later. Results were as follows:

<table>
<thead>
<tr>
<th>Dose clearing</th>
<th>Dose killing</th>
<th>Chemotherapeutic index*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neosolganal</td>
<td>0-5</td>
<td>26</td>
</tr>
<tr>
<td>Solganal B</td>
<td>1-3</td>
<td>&gt; 80</td>
</tr>
<tr>
<td>Neosarsphenamine</td>
<td>1-0</td>
<td>8-5 or less</td>
</tr>
</tbody>
</table>

*Lethal dose
Therapeutic dose.

The neosolganal was taken from two samples prepared
in this country. These results indicated that neosol-
ganal had a much more favourable chemotherapeutic
index than neosarsphenamine. Larger batches of neosol-
ganal were accordingly prepared by Dr. D. H. Hey, of
British Schering, Ltd., who devised new methods of
synthesis, since the original process of manufacture had
been kept secret in (Germany). The material and bio-
logical results were forwarded by the Medical Research
Council to the Director of Pathology, War Office, who
encouraged the clinical trials here described. No
clinical trials of neosolganal at an epidemic of relapsing fever have previously been reported.

It has been our combined experience (Wolman 1944, Dr. Ramly—of the Imbaba Hospital—not yet published)
that the treatment of louse-borne relapsing fever with arsenicals is rather disappointing. The testing of other
chemotherapeutic agents in this disease was therefore
very desirable.
MATERIAL AND METHODS

The experiment was conducted at the Imbaba Fever Hospital in Cairo. The patients were all Egyptians, usually villagers living near to Cairo, and belonging to a low social-economic class. The epidemic was a rather mild one of louse-borne relapsing fever, occurring in a number of villages in the vicinity of Cairo. Lice were occasionally found to harbour spirochetes. The mortality of this epidemic in consecutive groups of 100 varied between 0% and 9%, and averaged 2.6% (private communication by Dr. A. M. Ramli).

Patients were usually admitted in the evening. A thick film was taken on admission, stained with Giemsa, and examined next morning. Only patients who had pyrexia at the time and whose blood was positive for spirochetes were included in the experiment and were given a serial number. Even numbers (experimental group) were given intravenous injections of 0.5 g. neosolganal (British Schering) in 5 c.c.m. of distilled water. Odd numbers (control group) were not given any drug. Each of these series consisted of 80 patients.

Besides these two series, there were two other smaller series of 20 patients each, one of which was given 1 g. of neosolganal in 5 c.c.m. of water, and the other 1 g. of neosolganal dissolved in 5 c.c.m. of 'Ametox' (10% solution of calcium-thiosulphate, May and Baker). These last two groups are too small to be of any statistical significance, and a full record of them would therefore be superfluous, although they will be mentioned later.

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TABLE I—DISTRIBUTION OF PATIENTS BY SEX, AGE, AND DURATION OF ILLNESS BEFORE ADMISSION

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of patients</th>
<th>Duration of illness before admission (days)</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental group</td>
<td>Control group</td>
<td>Experimental group</td>
</tr>
<tr>
<td>Male</td>
<td>43</td>
<td>48</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>37</td>
<td>32</td>
<td>4</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–10</td>
<td>9</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>11–30</td>
<td>23</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>31–40</td>
<td>13</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>41–60</td>
<td>3</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>61–70</td>
<td>2</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

Patients were put into one group or the other according to their serial number, no attention being paid to their condition, age, or sex. Children below the age of 4 years were excluded altogether owing to the difficulties of intravenous therapy in small children. Those above this age were given a dose of neosolganal of approximately 0.01 g. per kg. of body-weight.

All patients had as little as possible symptomatic treatment, which was standardised and parallel in all groups. Patients were also given 2 lemons daily to keep a good level of vitamin C in their blood, a point recommended by the makers of neosolganal.

Slides were taken and examined twice daily for almost the whole duration of the experiment. Towards the end, technical difficulties forbade us to continue this routine, and slides were then examined near the beginning and end of each attack.

The age- and sex-distribution of the patients in both groups, and the duration of sickness before admission to hospital are shown in Table I.

Some patients had a history of possible, or probable, former attacks at home. There were 7 patients in each group who had had a recent previous period of illness, with which they probably had an attack of relapsing fever. There were 3 patients in the experimental group, and 4 in the control group who had had a former period of illness which most probably was the first attack of the disease. Since these numbers are almost equal, they do not affect our results.

Some patients had intermittent diseases and complications as shown in Table II.

TABLE II—INTERCURRENT DISEASES (EXCLUDING BILHARZIASIS)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchitis</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pneumonia or pleurisy</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Parotitis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pernicious anemia</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Abseceses</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Malaria</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Smallpox</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

TOXIC EFFECTS OF NEOSolGANAL

We were on the lookout for toxic reactions due to the drug. This entailed observation of the patient after the injection was given, and repeated examinations of the urine and white-cell counts.

(1) 60% of the patients had no ill effects from the injections. The other 40% had reactions as follows.

Immediate reactions (within 1 hour of the injection):
15 patients had rigor and/or sweating, possibly due to the rapid destruction of the spirochetes.
6 patients vomited.
7 patients had rigor and sweating and vomited.
1 patient had a severe reaction with loss of consciousness, delirium, and incontinence of urine and faeces. This patient had malignant tertian malaria at the same time, and the reaction might well have been due to the malaria, or to the effect of the drug on it, or to the combination of both diseases.

Delayed reactions:
3 patients had late reactions, vomiting within 6–12 hr after the injection.

(2) Toxic effects of the drug, as expressed in changes of the white-cell count and urine, have been estimated in comparison with the control group. Table III shows that there was no significant difference between the two groups. In compiling this table two facts had to be considered: (a) the albuminuria, hematuria, and high leucocyte count might possibly be caused by the disease itself; and (b) the fact that more than half our patients had a bilharzial infection.

TABLE III—CHANGES IN URINE AND WHITE-CELL COUNTS 7–10 DAYS LATER COMPARED WITH STATE ON ADMISSION

<table>
<thead>
<tr>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
</tr>
<tr>
<td>Urine</td>
</tr>
<tr>
<td>Alummin same or decreased</td>
</tr>
<tr>
<td>Alummin increased</td>
</tr>
<tr>
<td>Sediment same or improved</td>
</tr>
<tr>
<td>Sediment deteriorated</td>
</tr>
<tr>
<td>White-cell count</td>
</tr>
<tr>
<td>Same or more than half original value</td>
</tr>
<tr>
<td>Less than half original value</td>
</tr>
<tr>
<td>Less than 4000 per c.mm.</td>
</tr>
</tbody>
</table>

This table does not include all the patients, because certain investigations were omitted in some cases.

There was no statistically significant difference between the toxic reactions to the drug in the experimental group, who were given neosolganal 0.5 g. in water, and the other two groups, who were given neosolganal 1 g. in water and neosolganal 1 g. in calcium thiosulphate, although these showed slightly more immediate toxic reactions.

The last two groups did not differ in the number or severity of toxic effects. It seems, therefore, that calcium thiosulphate does not reduce the incidence of toxic effects from neosolganal.

We conclude that the therapeutic administration of neosolganal does not constitute a hazard to the patient.
RESULTS

**Duration of first attack.**—The injection of the drug caused the disappearance of spirochætes from the patient's blood within 24 hours in all cases; therefore, the earlier treatment was initiated the shorter was the attack. This was always accompanied by a rise in temperature above normal (37°C), although in one case a relapse lasting one day had a maximum recorded temperature of 37°C only.

A number of cases had rises of temperature after the end of the first attack, with no spirochætes found in the blood, but in a few cases the temperature came down first. The accompanying figure shows the difference between the average duration of the first attack in the hospital and in the experiment, which the average was calculated can be seen in Table I. It will be seen from the figure that there is an apparent relationship between the average duration of the attack (total, in hospital, and at home) and the day of the disease on which the patient was admitted. This is really a fallacy, because patients admitted in the later stages of the attack do not represent a random sample of those affected. Patients arriving after 7 days' illness, for example, are not a random sample, and the average duration of the attack in these cases must, of course, exceed 7 days.

**Relapses and non-specific rises of temperature.**—We defined a relapse as the reappearance of spirochætes in the peripheral blood-stream after the end of the first attack. This was always accompanied by a rise in temperature above normal (37°C), although in one case a relapse lasting one day had a maximum recorded temperature of 37°C only.

TABLE IV—INFLUENCE OF NEO SOLGANAL ON RELAPSE-RATE, RELAPSE LENGTH, INTERVAL, AND NON-SPECIFIC RISES OF TEMPERATURE

<table>
<thead>
<tr>
<th></th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>Difference in Percentage</th>
<th>SE of both groups considered together</th>
<th>SE of difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relapses</td>
<td>No. N%</td>
<td>No. N%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 14</td>
<td>17.5</td>
<td>32.6</td>
<td>8.9</td>
<td>4.0</td>
<td>1.5 (n.s.)</td>
</tr>
<tr>
<td>Relapse</td>
<td>5</td>
<td>9</td>
<td>4.2</td>
<td>3.4</td>
<td>1.3 (n.s.)</td>
</tr>
<tr>
<td>Both</td>
<td>51</td>
<td>43</td>
<td>8.2</td>
<td>6.4</td>
<td>2.5 (n.s.)</td>
</tr>
</tbody>
</table>

**DISCUSSION**

We have obviously in our hands a potent non-dangerous chemotherapeutic agent. Its administration seems to be safe, and the immediate effects good. As a rule the spirochætes disappear from the blood and the temperature falls within a day (usually less) of the drug being given. It seems clear that the drug is more useful when given early, simply because the disease will be shortened.

**REFERENCES**

Steiner, G., Fischl, V. (1929) klin. Wschr. 8, 582.