Since the first report of amphetamine-induced psychosis in 1938, \(^1\) it remained uncertain whether amphetamine or methamphetamine (MAP) could induce psychopathology the same as schizophrenia. In this study we followed 21 psychiatric inpatients with diagnosis of MAP psychosis. Schedules for affective disorders and schizophrenia (SADS), scale for assessment of negative symptoms (SANS) and global assessment scale (GAS) were used for evaluation of these patients during admission and six months after discharge.

Methods. In this study we followed 21 patients with diagnosis of MAP psychosis. Schedules for affective disorders and schizophrenia (SADS), scale for assessment of negative symptoms (SANS) and global assessment scale (GAS) were used for evaluation of these patients during admission and six months after discharge.

Results. Seventeen patients were interviewed and eight of them confessed re-use of MAP. The follow-up examinations found decreased scores of delusion and hallucination in SADS and increased GAS scores. The SANS scores of the MAP psychotic patients in this study were lower than moderate levels. No significant change could be found for most SANS subcategory scores except some items.

Conclusions. Most MAP psychotic patients followed in this study improved much in six months. The results of the SANS evaluation and the clinical course for six months indicated that the MAP psychosis is a psychotic disorder different from chronic schizophrenia.

[Chin Med J (Taipei) 2001;64:388-394]
MAP use, should still had clinical course different from chronic schizophrenics. Tomiyama used the Scale for the Assessment of Negative Symptoms (SANS) to evaluate negative symptoms and found different patterns for MAP psychotic patients and schizophrenic patients. Up to now, the relation ship between MAP psychosis and chronic schizophrenia is still vague. According to the Diagnostic and Statistical Manual-IV, 6 months is a minimum requirement for the psychotic symptoms to be diagnosed as schizophrenic disorder. Therefore, we took 6 months as a period of evaluation.

We have described the clinical course of MAP psychosis in the aspects of psychotic symptoms and negative symptoms, as well as global functions. The prognostic factors were also analyzed to compare with chronic schizophrenia.

**Methods**

Patients admitted to the psychiatric inpatient unit of Taipei Veterans General Hospital for at least one week and diagnosed as MAP psychosis were included. The diagnosis was made in case that the psychotic symptoms occurred after use of MAP and persisted at least one week after cessation of MAP use.

Totally 21 cases were included from January 1993 to April 1994. It was a group of adults of low to middle educational and occupational level and with a chronic MAP abuse history. Nine teen of them were male. The age range was 21 to 39, with the average age of 30.6 ± 5.2 years. Sixty-two per cent of them attended high school and 38% attended middle school only. Four of them were married, four were divorced and the other 13 were single. One third of them never had regular work. Others were taxi drivers, skilled workers, farm ers, and video-game store guards. Both female patients worked as bar girls. The age when MAP was first used ranged from 17 to 36, with an average age of 27.5 ± 6.1 years. At the time of admission, they had used MAP for an average age of 3.1 ± 1.6 years. The dosages used were difficult to evaluate, roughly on an average of 2.6 ± 2.4 bottles (around 1 gm/bottle) weekly. While seven patients abused MAP only, the others were also heavy drinkers or abused other drugs including narcotics, glue or sedatives. Thirty-three percent of the patients admitted using MAP within one month before admission. Urine screen tests for MAP were available from 19 patients and only 6 (31.5%) were positive.

All the patients included were evaluated at least one week after admission, and were stable enough to accept a structured interview.

In addition to basic data including personal information, drug abuse history, abstinence history, family history and diagnosis made with this admission, the following three instruments were used for structured evaluation:

**Schedule for affective disorders and schizophrenia (SADS)**

SADS was developed to assess the symptoms of affective disorders and schizophrenia. In this study only partial items including “suspiciousness”, “idea of reference”, and items of delusions, hallucinations, bizarre behavior and formal thought disorders were used to evaluate the psychotic symptoms.

**Scale for the assessment of negative symptoms (SANS)**

SANS was developed to assess negative symptoms of schizophrenia. Global assessment scale (GAS)

GAS is a single rating scale to evaluate the overall functioning of a subject from psychological or psychiatric illness to health. The second evaluation was done around six months after discharge. A face-to-face interview was arranged in which a follow-up questionnaire was used to evaluate the patient’s occupational status, daily life pattern, interpersonal relationship, and drug or alcohol abuse after discharge. The families were also approached either by telephone or in a face-to-face interview, to confirm the patients’ statements. Both first and second evaluation were done by the first author. The fourth author, a social worker, approached the families.

The results of the structured evaluations, SADS,
SANS, and GAS were computed and analyzed by the Statistical Package for the Social Science (SPSS 8.0). Wilcoxon signed rank test was used to compare the scores at follow-up and admission. Mann-Whitney-U test was used to compare the symptoms of different groups of patients, such as MAP reusers vs. abstainers, patients receiving regular treatment vs. those not. Spearman correlation coefficient was used to analyze and compare the results evaluated by different instruments.

**Results**

A total of 17 patients (81%) were interviewed at an average age of 7.1 months (S.D. 1.4 months) after discharge. One of the four patients not reached had been admitted to another psychiatric hospital, one had run away from home, and the other two refused interview. All 17 patients were male. Their average age, age when they started to abuse methamphetamine, duration of methamphetamine abuse, and average methamphetamine dosage used were not statistically different from the original 21 patients.

Eight patients (47%) confessed reusing MAP one week to four months after discharge. Actually, six of them re-used MAP within 2 months after discharge.

The mean scores of the individual SADS items were checked for all 17 cases both during hospitalization and at follow-up. During hospitalization, the most prominent symptoms rated by SADS were suspiciousness, auditory hallucination, delusion of reference, persecutory delusion, thought broadcast, and voice comment. Excerpt for the score of “delusion of reference”, the scores of all the above-mentioned prominent symptoms as well as the global severity of delusions and hallucinations decreased significantly at follow-up (Table 1).

MAP reusers and those who kept abstinent at follow-up (abstainers) were compared by SADS. No significant difference was found between both groups of patients, either in total scores or scores of SADS, during admission or at follow-up.

Among the 17 patients, 11 were followed regularly and 6 were lost or followed irregularly. The SADS scores in both groups failed to show any significant difference.

**Table 1. Schedule for affective disorders and schizophrenia scores during admission and at follow-up**

<table>
<thead>
<tr>
<th>SADS items (score range)</th>
<th>Score during admission mean (S.D.)</th>
<th>Score at follow-up mean (S.D.)</th>
<th>p values&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspiciousness (0-7)</td>
<td>4.82 (1.67)</td>
<td>2.27 (1.79)</td>
<td>0.001</td>
</tr>
<tr>
<td>Auditory hallucination (0-3)</td>
<td>2.65 (0.79)</td>
<td>1.73 (0.96)</td>
<td>0.029</td>
</tr>
<tr>
<td>Delusions of reference (0-3)</td>
<td>2.06 (0.97)</td>
<td>1.53 (0.92)</td>
<td>NS</td>
</tr>
<tr>
<td>Persecutory delusions (0-3)</td>
<td>2.47 (0.87)</td>
<td>1.33 (0.72)</td>
<td>0.005</td>
</tr>
<tr>
<td>Thought broadcasting (0-3)</td>
<td>2.35 (0.86)</td>
<td>1.47 (0.83)</td>
<td>0.006</td>
</tr>
<tr>
<td>Voice comment (0-3)</td>
<td>2.06 (0.93)</td>
<td>1.34 (0.79)</td>
<td>0.009</td>
</tr>
<tr>
<td>Delusion-severity (0-7)</td>
<td>4.59 (1.00)</td>
<td>2.40 (1.68)</td>
<td>0.005</td>
</tr>
<tr>
<td>Hallucination-severity (0-7)</td>
<td>4.29 (2.61)</td>
<td>1.80 (1.47)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

<sup>a</sup>Wilcoxon signed rank test.

**Table 2. Scale for assessment of negative symptoms global scores during admission and at follow-up**

<table>
<thead>
<tr>
<th>SANS subcategories</th>
<th>Mean global score during admission mean (S.D.)</th>
<th>Mean global score at follow-up mean (S.D.)</th>
<th>p values&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective flattening</td>
<td>1.29 (1.36)</td>
<td>0.82 (1.07)</td>
<td>NS</td>
</tr>
<tr>
<td>Alogia</td>
<td>1.24 (1.30)</td>
<td>1.00 (1.06)</td>
<td>NS</td>
</tr>
<tr>
<td>Avolition-aphth</td>
<td>2.12 (1.22)</td>
<td>1.47 (1.18)</td>
<td>NS</td>
</tr>
<tr>
<td>Anhedonia-asociality</td>
<td>2.00 (1.00)</td>
<td>1.06 (1.03)</td>
<td>0.028</td>
</tr>
<tr>
<td>Attention</td>
<td>0.53 (0.80)</td>
<td>0.18 (0.53)</td>
<td>0.084</td>
</tr>
</tbody>
</table>

<sup>a</sup>Wilcoxon signed rank test.
i cant difference on ad mis sion or through out fol low-up period. In an other word, we failed to find any treat -ment ef fects on the long-term psy chotic symp toms of this group of MAP psy chotic pa tients in 6-month fol -low-up.

There are five sub cat e go ries in SANS: af fec tive flat ten ing, alogia, avolition-apathy, anhedonia- aso -ciality and at ten tion. All of the mean global scores of the in di vid ual cat e gory were less than three, whether during ad mis sion or fol low-up period (Table 2). There was no significant difference in the mean global scores of af fec tive flat ten ing, alogia, avolition-apathy or at ten tion. The mean global scores for anhedonia- asociality de creased sig nif i cantly at fol low-up ($p < 0.05$). There was no sig nif i cant dif fer ence of SANS sub cat e go ries be tween the MAP reusers and the abstainers. Simi larly, no sig nif i cant dif fer ence of SANS sub cat e go ries was found whether pa tients were fol lowed reg u larly or not.

The GAS mean score of the 17 cases in creased sig nif i cantly from 36.5 ± 7.0 (dur ing ad mis sion) to 62.7 ± 15.2 (at fol low up) ($p < 0.001$). How ever, GAS scores showed no sig nif i cant dif fer ence be tween MAP reusers and abstainers after discharge, or be tween those pa tients who were fol lowed reg u larly and those who were not.

Only some sub categories of SANS and SADS were posi tively corre lated (Tables 3, 4). Inter est ingly, “an he donia-asociality” was neg a tively corre lated to “hal lu ci na tion-severity” at ad mis sion ($p < 0.05$). This in di cated that the more se verely the pa tient was so cially de tached, the less the se ver ity of the hal lu ci na tion he suf fered. Again, “alogia” and “at ten tion” were neg a tively corre lated to “drug abuse” at fol low-up ($p < 0.05$). Less severe drug abusers seemed to have more severe negative symp toms, especially when rated by “alogia” and “at ten tion”.

### Discussion

Though the sam ple size of this study was small, the re sults were contribu tive since the data were com -plete and struc tured, and the fol low-up rate was sat is fac tory. The rate of MAP re use in this study (47%) was com pat i ble to the results of a pre vi ous study which fol lowed 30 pa tients dis charged from the same hos pi tal for one year and found a 50% re use rate.21

The delusions and hallucinations cat e go ries of SADS as an in stru ment for struc tured in ter view ing were found valid and help ful in eval u at ing the psy -chotic symp toms of MAP psy cho sis. The ma jor symp-

### Table 3. Correlated SADS and SANS scores during admission

<table>
<thead>
<tr>
<th>SADS score</th>
<th>Correlated SANS score</th>
<th>$p$ values $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delusion-severity</td>
<td>Avolition-apathy total score ($r = 0.51$)</td>
<td>0.043</td>
</tr>
<tr>
<td>Auditory hallucination</td>
<td>Alogia total score ($r = 0.49$)</td>
<td>0.046</td>
</tr>
<tr>
<td>Hallucination-severity</td>
<td>Anhedonia-asociality total score ($r = -0.51$)</td>
<td>0.037</td>
</tr>
</tbody>
</table>

SADS = schedule for affective disorders and schizophrenia;
SANS = scale for assessment of negative symptoms. $^a$Spearman correlation coefficient.

### Table 4. Correlated SADS and SANS scores at follow-up

<table>
<thead>
<tr>
<th>SADS score</th>
<th>Correlated SANS score</th>
<th>$p$ values $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug abuse</td>
<td>Alogia global score ($r = -0.56$)</td>
<td>0.031</td>
</tr>
<tr>
<td>Persecutory delusion</td>
<td>Attention global score ($r = -0.62$)</td>
<td>0.014</td>
</tr>
<tr>
<td>Delusion-severity</td>
<td>Attention global score ($r = 0.58$)</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Avolition-apathy global score ($r = 0.52$)</td>
<td>0.046</td>
</tr>
</tbody>
</table>

SADS = schedule for affective disorders and schizophrenia;
SANS = scale for assessment of negative symptoms. $^a$Spearman correlation coefficient.
toms found were sim ilar to pre vious re ports. Most ma-
ajor symp toms found during ad mis sion got im proved
sig nif i cantly at fol low-up. Due to the small sam ple
size, we failed to find any difference in psychot ic
symptoms at fol low-up be tween MAP reusers and the
ab stain ers. Nei ther did this study pay much at ten tion
to re verse tol er ance and pre cip i tated psy chotic symp-
toms as so ci ated with MAP re use. How ever, we did
find sig nif i cantly higher psy chotic symp toms re lapse rate for
MAP reusers in the pre vi ous study done by the same
au thors.21
Tom iyama’s re port17 found quite dif fer ent mean
scores from the in di vid ual SANS sub cate gories. How-
ever, our study found even lower scores: none was
higher than three, the mod er ate level found in chron ic
schizo phrenic pa tients.19 At fol low-up, we found sig-
nificant im proved in anhedonia-asociality only. The re
sults of this study as well as To miyama’s re port
both sug gest that MAP psy cho sis were dif fer ent with
chron ic schizo phrenia while SADS eval u ate psy chotic symp toms
and schizo phrenia, ac cord ing to the SANS eval u a tion. The pres ent study also found that neg a tive
symptoms of MAP psy cho sis were not ev i dent ei ther
at ad mis sion or at 6 months fol low-up, ac cord ing to
the SANS eval u a tion. On the other hand, the pos i tive
symptoms and the global func tion were found to im-
prove much over the same pe ri od ac cord ing to the
SADS and GAS eval u a tion. The neg a tive symp toms eval u ated by SANS are pa ram e ters spe cific for schiz-
ophrenia while SADS eval u ates psy chotic symp toms
of schizophre nia as well as other psy chotic con di tions.
GAS is even less spe cific and can be ap plied to a
wide range of psy chi at ric con di tions. In this study, the
sig nif i cant im proved shown by SADS and GAS of
the MAP psy chotic pa tients but low and in con sis-
tent change of SANS sub cate gory scores sug gest dif-
fer ent clin ical course of this cat e gory of pa tients from schizo phrenic pa tients.
Be cause of the small sam ple size, the ten ta tive
con clu sion of this study failed to find the ther ape u tic
effect on the change of scores by any of the three
scales used. It is pos si ble that MAP psy cho sis is a het-
ero geneous clin ical con di tion, in which some pa tients
re cover ed well, while oth ers might need reg u lar med i-
cation to control the symp toms.
Ex cept some sub-scores, the corre la tion be tween
SANS and SADS was mostly insignifi cant in this
study. In some cases, the corre la tions were even neg a-
tive. We sus pected that the neg a tive symp toms of
alogia and anhedonia-asociality might with draw the
pa tients from their peer and re duce their chance to re-
use MAP, thus re sult in fewer psy chotic symp toms.
The re sults of this study sup port the use ful ness of
SADS and GAS in eval u ating and fol low ing the psy-
chotic symp toms and global func tion of MAP psy-
chotic pa tients. The data ob tained from SANS need
further re search to clar ify their role in the eval u a tion
of MAP psy cho sis. In fu ture study to com pare MAP
psychosis and schizophrenia, we sug gest to select
only the pa tients whose psy chotic symp toms per sist
and need con tin u ous med i ca tion. It may give dif fer ent
re sults if the neg a tive symp toms of this ho mo ge neous
group of pa tients can be closely fol lowed.

References
1. Young D, Serorille WB. Para noid psy cho sis in nar co lepsy and pos si ble dan ger s of ben z ed rine treat ment. Med Clin North
2. Breamish P, Kiloh L. Psy cho sis due to am phet amine con-
3. Hampton WH. Pro voked psy chi at ric re ac tions fol low ing use
37:167-75.
4. Ellin wood EH. Am phet amine psy cho sis: de scription of the
5. Angnst BM, Gershon S. The phe nom en ol ogy of ex per i men-
tally in duced am phet amine psy cho sis: pre limi nary ob ser va-
6. Koji ma T, Mat sush ina E, Iwama H, Ando H, Mor iya H,
Ando K, et al. Vis ual per cep tion pro cess in am phet amine psy-
7. Griffith JD. Ex per i men tal psy cho sis in duced by the ad min is-
tra tion of d-am pheta mine. In: Costa E, Gar atti ni S, eds. Am-
phetamine and Rel ated Compounds. New York: Ra ven Press,
8. Bowers MB. Acute psy cho sis in duced by psy cho to mi mietic
9. Angrist B, Lee HK, Gershon S. The an tag o nism of am phet-
amine-induced symptomatology by a nar coleptic. Am J Psy-
10. Espelin DE, Done AK. Am phet amine poi son ing- ef fec tive-


18. Endicott J, Spitzer RL. A diagnostic interview: the schedule for affective disorders and schizophrenia. *Arch Gen Psychiatry* 1978;35:837-44.

