Short report

Direct puncture versus run up cervical myelography with iopamidol: a comparison of side effects, EEG changes and radiographic quality

P MACPHERSON, E TEASDALE, AP McGEORGE

From the Departments of Neuroradiology and Neurology, Institute of Neurological Sciences, Southern General Hospital, Glasgow, UK

SUMMARY A series of cervical myelograms performed by direct puncture resulted in almost identical incidence of side effects, more contrast within the skull, more frequent EEG abnormalities and only slightly better radiographic quality than in a comparable series of patients in whom the contrast was run up from the lumbar region.

It is generally believed that cervical myelographic by run up from the lumbar region is more likely to result in intracranial spillage of contrast than when the examination is done by direct puncture. The frequency of side effects such as headache and nausea and the occurrence of seizures are considered to be proportional to the amount of contrast entering the skull. Accordingly, it has been the practice in this institute to give prophylactic anticonvulsants when the contrast was run up but not if introduced by direct cervical puncture. As part of our evaluation of iopamidol we studied two groups of patients, 20 having direct puncture and 20 having run up cervical myelography. EEG was performed before and after the myelogram and any changes noted, the relative clinical side effects were assessed, the quantitity of contrast within the skull was estimated radiographically and by CT and the radiographic quality of the myelograms compared.

Patients

40 patients in the series gave informed consent for additional EEG and CT scan examinations. Patients with a history of seizures or of receiving potentiating drugs would have been excluded, but none presented during the trial period. When the cervical region was the site of clinical interest the investigation was done by direct puncture at the C1-2 level and where there was doubt about the site of the lesion, run up myelography was performed with the patient in the prone position. By chance, clinical presentation of 40 consecutive patients resulted in the allocation of 20 to each group: 10 male and 10 female patients in the run up, and eight male and 12 female patients in the direct puncture group. The ages are comparable in the two groups. Following upon our previous practise, run up patients were given weight-related dosage of sodium valproate; a loading dose (1500 mg for patient weight 40-55kg; 2000 mg for 56-70 kg; 2500 mg for 71-85 kg) at 8 pm on the evening before the examination and maintenance doses (700; 1000; 1200 mg respectively) at 8 am and 8 pm on the day of examination.

Method

On the day prior to examination an EEG was performed. All the myelograms were performed by either PM or ET and great care was taken to prevent the extension of contrast intracranially, though when clinically indicated (10 direct puncture and 10 run up patients) a supine view was obtained with contrast in the cisterna magna. All punctures were performed with a 20 gauge needle and 10 ml of CSF withdrawn for diagnostic purposes. The run up patients received 10 ml of iopamidol in a concentration of 300 mg/ml and direct puncture patients 7 ml of 250 mg/ml. At the end of the examination the radiologist completed a questionnaire noting details of the procedure and any immediate side effects experienced by the patient. A radiographer unaware into which category the patient had been allocated interviewed the patient and nursing staff at approximately 24 and 48 hours after the myelogram noting any complications. The patients were instructed not to lie flat until after the post-myelogram EEG.

Six to seven hours after the injection of contrast each patient had a repeat EEG while sitting, followed by a CT scan in the supine position. On the latter, the density of iopamidol in the subarachnoid spaces was measured at
three levels: ambient cisterns, Sylvian fissures, and cortical sulci.

From the myelogram, views of the cervical spine and skull base were randomised by one radiologist author and reviewed “blind” by the other. The quality of the contrast in the cervical region was scored as “satisfactory”, “good” or “excellent”: the volume which had entered the interpeduncular cistern was graded as “nil”, “slight”, “moderate” or “marked”.

Results

SIDE EFFECTS
The results are given in Table 1a, and with the exception of nausea are identical in each group.

RADIOGRAPHIC CONTRAST WITHIN THE SKULL
A lateral film of the skull taken at the end of the myelographic examination was available in 35 of the 40 patients. More contrast was present within the interpeduncular cisterns in the examinations performed by direct puncture—p ~ 0.10 (Table 1b).

CONTRAST DENSITY WITHIN THE SKULL IN HOUNSFIELD UNITS (HU)
The contrast densities in the different compartments within the skull 6½–7½ hours after the examination are shown in Table 1c. More contrast was present on average in the ambient cisterns, Sylvian fissures and cortical sulci in the direct puncture than in the run up group but the difference was significant only in the cortical sulci (p ~ 0.05).

EEG RESULTS
Post-myelographic EEG tracings showed focal sharp waves in two of the direct puncture group and in one of the run up group; generalised sharp wave discharges were present in four of the direct puncture and two of the run up patients. In three of the

Table 1  Comparison of side effects and of immediate and late contrast density within the skull in the direct puncture (N = 20) and run up (N = 20) groups.

<table>
<thead>
<tr>
<th></th>
<th>Headache grading</th>
<th>Nausea</th>
<th>Vomiting</th>
<th>Dizziness</th>
<th>Mental changes</th>
<th>Seizures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Puncture</td>
<td>1 2 3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Run Up</td>
<td>1 2 3</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(b) Radiographic density of contrast within the interpeduncular cistern at the end of the myelogram.

<table>
<thead>
<tr>
<th></th>
<th>Grading of contrast</th>
<th>Ambient cistern</th>
<th>Sylvian fissures</th>
<th>Cortical sulci</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Puncture</td>
<td>1</td>
<td>63-55 (45-118)</td>
<td>79-25 (48-111)</td>
<td>73-2 (23-118)</td>
</tr>
<tr>
<td>Run Up</td>
<td>4</td>
<td>80-50 (45-134)</td>
<td>71-85 (50-128)</td>
<td>58-7 (29-106)</td>
</tr>
</tbody>
</table>

(c) The contrast density (HU) within the skull 6½–7½ hours after the myelogram.

Fig The EEG results in relation to the contrast density (HU) within the ambient cisterns and cortical sulci.
patients with generalised discharges the pre-
myelographic tracing had shown focal sharp waves.
Two were in the direct puncture group; one suffered
from chronic bronchitis and emphysema, had inter-
mittent claudication and was hypothyroid, while the
other had a family history of epilepsy. The third
patient was in the run up group and at the time of
the examination was clinically thyrotoxic because of
thyroxin overdosage.

RELATIONSHIP OF EEG CHANGES TO THE
CONTRAST DENSITY IN THE AMBIENT CISTERN
AND CORTICAL SULCI
In the direct puncture group no changes were seen
in the five patients where the density of contrast in
the ambient cisterns was below 80HU. Of the 15
patients with higher density, six had sharp waves
(two focal and four generalised). Of the nine
patients where the density of contrast in the cortical
sulci was under 70HU only one patient developed
generalised sharp waves while of the 11 with higher
density, five had sharp waves (two focal and three
generalised). However, the above findings are not
statistically significant.

In the run up group there was no relationship in
the three patients with sharp waves (one focal and
two generalised) with the density of contrast in
either the ambient cistern or the cortical sulci.

QUALITY OF RADIOGRAPHIC EXAMINATION IN
THE CERVICAL REGION
In the direct puncture group two were graded as
“poor”, 11 as “good” and seven as “excellent”: while the corresponding figures for the run up group
were four; 12 and four.

Discussion

SIDE EFFECTS
In a survey of 120 patients undergoing direct puncture
cervical myelography with metrizamide, we
found that the incidence of headache was 60%,
nausea 33%, vomiting 26%, dizziness 32%; three
patients developed mental changes and one general-
ised seizures.8 The corresponding figures in the
direct puncture group in the present series using
iopamidol were, with the exception of headache (45%), all significantly less: nausea 5% (p < 0.01) and
vomiting 5%, dizziness 0% (p < 0.005). In the
present run up group, the incidence and grading of
headache, vomiting and dizziness was identical to
that in the direct puncture group. Mental changes
and seizures did not occur in this small series. In
an interhospital survey using iopamidol, Bassi et al8
found the complication rates of run up myelography
to average 41.5%.

CONTRAST WITHIN THE SKULL
Despite the belief mentioned in the introduction, we
found that significantly more contrast was detectable
radiographically and by CT in the direct puncture
than in the run up group. Surprisingly, there was no
direct correlation between the radiographic grading
of intracranial contrast and the subsequent HU
measurement.

EEG
Changes reported after metrizamide myelography
have been classified into two groups: (a) short slow
waves which are seen maximally 24 hours after the
injection of contrast and which are not considered to
have any clinical significance, (b) sharp waves which
are detectable some hours after the examination and
are considered to be a direct irritative effect on the
cerebral cortex.10 11 It is believed that the danger of
seizures can be minimised by preventing metrizamide
from reaching the cortex.12

Lundervold and Sortland6 found that the fre-
quency of all types of EEG changes rose from 4–5%
where the upper limit of contrast as seen on a lateral
film was in the cervical region or pontine cistern to
10% where it had reached the suprasellar cistern and
to 50% where it was visible over the frontal
cortex. Epileptiform spikes were however seen in
only 4% of their patients. Some authors have
reported that EEG changes do not occur after radiculography12 13 but Standnes et al4 reported that
epileptiform sharp waves were seen in 10% of their
radiculogram patients.

In our series using iopamidol, sharp waves were
seen in six of 20 (33%) of the direct puncture group
and in three of the 20 (16%) of the run up group.
While not of statistical significance because of the
small numbers it seems that direct puncture cervical
myelography is as likely to result in epileptiform
EEG activity as is run up myelography. It has been
found that medication with diazepam before and
after myelography was of no value in preventing
EEG abnormalities4 and apparently it is not known
if sodium valproate can protect against development
of such sharp waves. Harrington et al14 have shown
that EEG changes do not occur as a result of lumbar
puncture alone, lending proof to the belief that after
myelography such abnormalities are a reaction to
the contrast medium. However, we found no clear
 correlation between the CT attenuation and sharp
wave activity, suggesting that individual sensitivity is
an important factor.

The focal sharp wave activity occurring in three of
our patients, is consistent with cortical irritation. In
six patients generalised discharges suggest a cen-
tricphalic site of action although secondary subcor-
tical activity is not ruled out. It may, therefore, be
important to prevent contrast reaching the upper brain stem.

This study indicates that while a direct puncture cervical myelogram is likely to give marginally better quality radiographs it is more likely to result in contrast entering the subarachnoid spaces around the brain and to a greater chance of causing irritative EEG effects than a carefully performed examination carried out by running the contrast from the lumbar region. If there is a case for prophylactic anticonvulsants in the run up investigations then there must be a stronger case for their use in direct puncture myelography.

We are grateful to Dr B Whiting and Dr I Bone for their advice on the use of prophylactic anticonvulsant therapy and to Dr JP Ballantyne for advice on the EEG aspects of the study.

References

12 Gonsette RE. Biologic tolerance of the central nervous system to metrizamide. Acta Radiol [Diagn] (Stockh) 1973; Suppl 335:25–44.