Trained nurses can obtain satisfactory bone marrow aspirates and trephine biopsies

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Abstract

Aims—To assess the feasibility of training nurse practitioners to perform bone marrow aspiration and trephine biopsy, and to compare the quality of these samples with those obtained by medical staff.

Methods—A retrospective audit was undertaken of nurse practitioner and medical staff performance in bone marrow procedures in a busy haematology day unit.

Results—Nurse practitioners fared favourably in comparison with medical staff in performing bone marrow trephine biopsies, with mean biopsy lengths of 11 mm and 10.7 mm respectively. However, only 75% of the smears obtained by the nurses were judged technically satisfactory, compared with 91% prepared by doctors. This discrepancy was thought to be due largely to the quality of slide preparation.

Conclusions—With motivated staff and a structured educational and training programme it is possible for nurse practitioners to perform the techniques of bone marrow aspiration and biopsy, and obtain specimens of satisfactory quality, thus improving efficiency of the haematology day unit and increasing quality of patient care.

(J Clin Pathol 1999;52:154–156)

Keywords: bone marrow aspiration; trephine biopsy; nurse practitioner

In view of these changes in the roles of nurses and junior doctors we decided to re-examine tasks historically undertaken by doctors in the United Kingdom in order to establish whether some could be effectively carried out by the nursing staff on the day unit. We expanded the role of the nurse practitioner with the aim of enhancing patient care and promoting practice within the nursing team. We began this development by first teaching the techniques of venepuncture, venesection, and peripheral venous cannulation. An audit of this practice during the period of August 1996 to February 1997 showed that nurses were performing 70% of venous cannulations, 87% of venepunctures, and 90% of venesections, resulting in more efficient running of the unit. Patient waiting times were reduced and patient satisfaction increased. In view of these findings this practice was extended to bone marrow aspiration and trephine biopsy.

Methods

Two senior members of the nursing team working full time on the haematology day unit were trained to undertake bone marrow aspiration and trephine biopsy from the posterior iliac spine.

A comprehensive educational and training programme was developed and this was followed throughout training. The programme contained set competencies to ensure that the nurses undertaking training were aware of the issues of accountability and responsibility related to advanced nursing practice. These competencies included:

- anatomy of the pelvis and physiology of blood formation;
- the implications and responsibilities of bone marrow procedures;
- selection of an appropriate biopsy site;
- preparation of slides.

The nurses were trained by dedicated members of the medical staff ( registrar and senior registrar), and were supervised over a period of at least two months, until both the trainer and the nurse were confident of the operator's ability. The number of supervised procedures performed to reach satisfactory competence was five for bone marrow aspiration and seven for trephine biopsy. All patients referred for marrow aspiration/biopsy were assessed by a member of the medical team who completed a written request form identifying the required investigation as well as any ancillary tests (immunophenotyping, cytogenetics, and so on). The patients were informed that the test would be carried out by a nurse and verbal informed consent was obtained before the
procedure was undertaken; if sedation was planned, care was taken to ensure that the patient was accompanied after the test by a competent carer.

Sedation was rarely used in the case of bone marrow aspiration, but midazolam, 5–15 mg intravenously, was given to the majority of patients having a trephine biopsy. This was prescribed by the medical staff on the bone marrow request proforma, and was administered by the nurse practitioner. There was no difference between the quantity of sedation used in patients having a bone marrow test performed by doctors and those treated by nurses. A member of the medical team was required to be on the day unit or adjacent ward, and immediately available if required for the duration of the procedure and until the patient had recovered satisfactorily from the sedation. A retrospective blind audit of the quality of bone marrow aspirates and trephine biopsies taken by both nursing and medical staff (specialist registrars) was performed over an eight month period. Aspirates were assessed according to number of particles, cellularity, and spread and they were subsequently classified as either satisfactory or unsatisfactory for morphological interpretation. Trephine biopsies were assessed for quality by measuring their length after histological mounting. In a separate audit, waiting times were recorded from the time of arrival in the day unit to starting the procedure. In addition, a sample group of 30 patients completed a questionnaire about their satisfaction with the test.

Simple statistical analyses were applied to the results to assess significance (Student’s t test, χ² test).

**Results**

The total number of bone marrow aspirate and biopsy procedures performed in the day unit over the sample period was 120 and 84, respectively. The nurse practitioners carried out all bone marrow procedures unless the patient specifically requested a doctor or the nurse was otherwise busy. At the time of the audit the nurse practitioners were performing 41% of all bone marrow procedures. This low percentage mainly reflected the availability of the nurse for the procedures, as for the majority of the audit period only one had been fully trained.

Assessment of the quality of bone marrow aspirates as either satisfactory or unsatisfactory for interpretation showed that 78% of those performed by the nurse practitioner were satisfactory, compared with 91% of those performed by doctors (table 1). This difference was significant (p < 0.05, χ² test) and was largely a result of the quality of the spread of the aspirates rather than the number of particles or cellularity.

Assessment of the length of trephine biopsies showed that those taken by the nurse practitioner had a mean length of 11 mm (range 2 mm to 22 mm), and those of doctors were of mean length 10.7 mm (range 3 mm to 25 mm) (fig 1). This difference was not statistically significant (p = 0.7, Student’s t test). Patients waited longer to be treated by the nurses than by doctors (mean wait 18 minutes and 33 minutes, respectively, p < 0.05).

Few problems were encountered during the training process. Time, however, became an issue if patients arrived later than the appointed time, or if they requested sedation, when the procedure could not be carried out until a doctor became available. The nurse practitioner found the spreading of slides difficult initially, but with practice this became easier.

The results of the patient questionnaire were difficult to interpret. In the nurse practitioner group of patients, 70% would prefer a nurse to repeat the test and 30% had no preference between a nurse and a doctor. Among the patients who had the procedure carried out by a doctor, 82% favoured having a doctor again and 18% had no preference. Five patients had the test repeated at intervals by both a nurse and a doctor; of these, four had no preference and one would prefer a nurse practitioner in future.

**Discussion**

Widening the role of the nurse practitioner to incorporate tasks historically undertaken by medical staff may improve the service received by patients, particularly in the outpatient setting.

The results of our audit indicate that appropriately trained nurses can perform bone marrow biopsies and obtain specimens of a quality equal to that obtained by medical staff. With respect to bone marrow aspiration there was a significant difference in the quality of specimens obtained by medical and nursing staff, and this was due to the spreading of the aspirate. This is not surprising since the medical staff all had extensive experience and the nurses were newly trained. It is well known that satisfactory spreading of blood or bone marrow

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**Table 1 Comparison of performance between nurse practitioners and doctors in obtaining marrow aspirates and trephine biopsies**

<table>
<thead>
<tr>
<th></th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
<th>Mean length (mm)</th>
</tr>
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<tbody>
<tr>
<td><strong>Marrow aspirate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse</td>
<td>40 (78%)</td>
<td>11 (22%)</td>
<td>11 mm</td>
</tr>
<tr>
<td>Doctor</td>
<td>63 (91%)</td>
<td>6 (9%)</td>
<td>10.7 mm</td>
</tr>
<tr>
<td><strong>Trephine biopsy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
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</table>

\[ p < 0.05 \]

\[ p = 0.07 \]
films requires practice. This problem is lessen-
ing as the nurses become more experienced,
and we anticipate that it will disappear
altogether. Before the nurses had become
competent at slide preparation, problems were
easily overcome by placing a 2 ml sample of
aspirated marrow in a specimen bottle contain-
ing EDTA so that smears could also be
prepared by the medical or haematology labo-
ratory staff. If the spread is done within eight
hours this does not cause EDTA artefact, and
we have not found dilution with peripheral
blood to be a problem.

A nurse practitioner is always present on the
day unit and therefore performance of proce-
dures by them rather than by doctors, who are
often performing tasks elsewhere in the hospi-
tal, has improved the efficiency of the unit and
the quality of patient care, particularly with
regard to reduced waiting times.

The training of nurse practitioners in the
performance of bone marrow aspiration and
trephine biopsy can be achieved easily if a suit-
able training programme is drawn up, medical
and nursing staff are well motivated, and audit
is performed to assess quality. A third member
of the nursing staff is currently being trained.
We recognise that the ability of individuals to
obtain satisfactory specimens may vary and
performance is kept under review.

At present some patients ask for the
procedure to be performed by a doctor. We
suspect this reflects the traditional view of the
role of medical and nursing staff. With time
this resistance to the extended role of nurses
has been seen to lessen as the nurses gain con-
fidence and the practice is seen to be the norm.

The audit also highlighted the inadequate
length of some of the trephine biopsies
obtained by both the nurses and the medical
staff. An earlier study from Manchester has
shown that trephine biopsies shrink by 25% dur-
ing processing and that for the diagnosis of
neoplasia a minimum prefixation trephine
length of 16 mm is required. By this standard
only 40% of all the biopsies were adequate.
Clearly this needs to be addressed and we now
aim for a standard of 20 mm. The success of
this policy will be reaudited shortly.

Some haematologists may feel that accurate
reporting of bone marrow aspirates and
trephines requires that they should personally
perform the procedure as well as assess the
patient clinically. This is probably ideal but in a
busy unit it is not always practicable. Before the
nurses adopted this role in our unit, bone mar-
rows were often reported by doctors other than
those who had performed the procedure. We
feel that provided a good history, clinical
examination, and a differential diagnosis are
given to the reporting physician, interpreta-
tions are accurate and relevant.

The current service offered by nurse practi-
tioners has improved the efficiency of our unit
and we anticipate that the service will expand
as more of the staff become competent in this
procedure. A patient satisfaction survey estab-
lished that the practice is acceptable to
patients, and no patient who had had the test
performed by a nurse would rather that it had
been performed by a doctor.

With motivated medical and nursing staff
and a structured educational and training pro-
gramme, it is possible for a nurse practitioner
to perform bone marrow aspiration and biopsy
and obtain specimens of satisfactory quality,
with subsequent improved efficiency of the unit
and increased quality of patient care.

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