Personal practice

How useful is ultrasound in the management of abdominal malignancy?

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Suspicion of abdominal malignancy in a child should lead to urgent radiological assessment. While standard radiological techniques are still important, the advent of ultrasound, computed tomography, and isotopic studies has broadened the spectrum of imaging investigations available to the clinician and diagnostic radiologist. A number of authors have reviewed the value of one or more of these investigations in the management of children with abdominal malignancy.2-4 Although computed tomography may be more accurate than ultrasound3, 5 in the diagnosis and staging of malignant tumours, it is also expensive, involves ionising radiation, and often demands sedation or anaesthesia. Because whole body computed tomography is not available in many centres including our own, and because there is no published information specifically indicating the value of abdominal ultrasound in the diagnosis and management of children presenting with newly diagnosed abdominal masses we decided to review our own experience in a consecutive series of 103 patients.

Patients

The case records of all children referred to this hospital over a four year period with a diagnosis of primary intra-abdominal malignancy were reviewed. In addition, any patients referred as having benign conditions and who were subsequently found to have a malignancy were included in the study. Wilms’ tumours (41) and neuroblastomas (45) comprised the majority of tumours. The final diagnoses are listed in Table 1.

Each of the 103 children had an ultrasound examination within a few hours of admission. Some children with advanced disease at diagnosis received chemotherapy for several months before tumour excision, and in these ultrasound scans were repeated at 6 to 12 weekly intervals until laparotomy. A Philips Sonodiagnost B scanner with 5 MHz transducers was used, with vegetable oil as a coupling agent. Ninety four children (91%) underwent intravenous urography either here or at the referring hospital and these films were reviewed independently of the ultrasound findings as part of our study.

How helpful was ultrasound in predicting the diagnosis?

Table 2 shows the preoperative diagnosis made (a) on clinical examination at the time of referral, (b) after abdominal ultrasound, and (c) after intravenous urogram, where performed.

Ultrasound yielded a diagnosis of Wilms’ tumour in 42 patients, later confirmed in 36 (86%); four others were found to have neuroblastomas, one a renal abscess, and one xanthogranulomatous pyelonephritis. Forty four patients were thought by
the ultrasonographer to have neuroblastoma and the
diagnosis was confirmed in 38 (86%): five were
found to have Wilms’ tumours and one a renal
non-Hodgkin’s lymphoma. Thus, ultrasound was no
more efficient than intravenous urography in the
diagnosis of Wilms’ tumour and neuroblastoma.
Seventeen patients were diagnosed by ultrasound as
having a lesion other than Wilms’ tumour or
neuroblastoma: in 12 the specific diagnosis was
 correct while in five patients, three of whom actually
had neuroblastoma, the diagnosis was wrong. The
higher overall diagnostic accuracy of ultrasound
(83%) compared with intravenous urography (75%)
was attributable to its superiority in the diagnosis of
tumours remote from the renal bed.

We carefully analysed the 17 cases in which the
ultrasound diagnosis was wrong. In 10 patients
specific ultrasonographic features were not charac-
teristic of the tumour eventually diagnosed and
misinterpretation was felt to be inevitable; this
group included two patients with intrarenal neuro-
blastoma. In each of the remaining seven patients
misinterpretation was felt to be avoidable and due to
inexperience. In skilled hands, therefore, we feel
that the diagnostic accuracy of ultrasound should be
around 90%, a figure comparable with the conclu-
sions of a study in which Stark et al\(^3\) found
ultrasound to have 91% diagnostic sensitivity for
neuroblastoma.

It is worth noting that the 24 hour urinary
vanillylmandelic acid excretion was significantly
raised in 42 of 45 (95%) children with neuro-
blastoma in one series,\(^4\) thus helping to establish a
preoperative diagnosis independently of the radi-
ological findings.

**Table 2 Preoperative diagnostic accuracy**

<table>
<thead>
<tr>
<th></th>
<th>No of patients</th>
<th>% (in each group) confirmed histopathologically</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Clinical diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilms’ tumour</td>
<td>47</td>
<td>77</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>38</td>
<td>85</td>
</tr>
<tr>
<td>Other diagnosis</td>
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<td>33</td>
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<tr>
<td>Total</td>
<td>103</td>
<td>72</td>
</tr>
<tr>
<td>(b) Ultrasound diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilms’ tumour</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>44</td>
<td>86</td>
</tr>
<tr>
<td>Other diagnosis</td>
<td>17</td>
<td>71</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>83</td>
</tr>
<tr>
<td>(c) Intravenous urograph diagnosis</td>
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<td></td>
</tr>
<tr>
<td>Wilms’ tumour</td>
<td>39</td>
<td>90</td>
</tr>
<tr>
<td>Neuroblastoma</td>
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<td>90</td>
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<tr>
<td>Other diagnosis</td>
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<td>0</td>
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<tr>
<td>No diagnosis</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>75</td>
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</table>

**Did ultrasound lead to precise abdominal staging of tumours?**

There was good correlation between the spread of
tumour predicted by ultrasound and the histological
findings after surgery in 30 of 41 patients with
Wilms’ tumour (73%), in 19 of the 30 children with
neuroblastoma who have so far undergone laparo-
tomy (63%), and in 10 of 12 other malignant
tumours (83%). Precise staging of abdominal dis-
ease which depends on evidence of microscopic
spread as well as macroscopic features is not always
possible with ultrasound.

Since capsular invasion, found in six patients, was
never identified (Wilms’ tumours) and local spread
(Wilms’ and neuroblastomas) was predicted by
ultrasound in only 25% of patients, we were unable,
for instance, to discriminate between stage I and II
tumours.\(^7\) A similar conclusion was reached by
Levine et al\(^8\) in a study of adults with renal tumours.
It was also very difficult to identify nodes abutting
upon a large tumour and impossible to decide if
enlarged nodes were invaded by tumour or were
reactive. This is hardly surprising since even macro-
scopically normal nodes were frequently found to
contain tumour when resected at laparotomy.

Four patients with Wilms’ tumour had renal vein
invasion, only one of these being correctly predicted
by ultrasound before operation. Renal vein invasion
should be easier to see on the left side than the right
but our numbers were clearly too small for specific
comment.

When the inferior vena cava is compressed and
displaced by a large tumour ultrasound identifica-
tion is difficult. Occasionally, altering the posture
of the child may show blood flow and, therefore,
patency of the inferior vena cava. Secondary de-
posits in the liver parenchyma should be readily
detected by ultrasound, but it is much more difficult
to visualise subcapsular metastases or direct inva-
sion from a right sided tumour. Similarly subcapsu-
lar nodules in the kidney are easily missed. The
contralateral subcapsular Wilms’ tumour included in
this series was unsuspected until the posterior aspect
of the ‘healthy’ kidney was examined at laparotomy.

**Did ultrasound correctly predict the surgical resect-
ability of the mass?**

Because the ultrasonographer cannot identify the
lower limit of pelvic tumours and is, therefore,
unable to predict their resectability, and because the
small group of ‘other’ malignant tumours is so
heterogeneous, we limited this aspect of our analysis
to the 71 patients with Wilms’ tumour and neuro-
blastoma who underwent laparotomy (Tables 3 and
These tables also indicate the number of patients who had chemotherapy before operation.

The ultrasonographer always identified correctly those tumours which could be completely resected surgically, whether at diagnosis or after chemotherapy. Of 18 tumours which proved to be incompletely resectable, however, only 10 were correctly identified as such by ultrasound, the other eight being thought by the ultrasonographer to be resectable. Resectability, which overall was accurately predicted in 63 (89%) of these 71 tumours, depends primarily on involvement of major blood vessels and other vital organs close to the tumour. The tendency of ultrasound to overestimate the likelihood of complete excision presumably results from its inaccuracy in definition of local spread.

Conclusions

Ultrasound is a safe, non-invasive, and inexpensive investigation which we have found to be acceptable to children for both isolated and repeated examination. All 103 children were examined without preparation or sedation, and wherever possible in the presence of their parents. In a few instances the child could not be calmed sufficiently at the first attempt but each examination was successfully completed later in the day. The ready acceptance of ultrasound means that response to treatment can be monitored frequently.

Clearly, ultrasound contributes more information than intravenous urography about tumours or metastases remote from the renal bed. Its main limitation—poor recognition of local tumour spread—can lead to inaccurate preoperative staging and a misleading prediction of surgical resectability.

Recommendations

In a district general hospital we should expect that most Wilms' tumours and neuroblastomas could be accurately identified by intravenous urography and 24 hour urinary vanillylmandelic acid estimations. Since children with abdominal tumours are likely to be referred to specialist units for further investigation and treatment planning it seems appropriate for the definitive ultrasound examination to be carried out at the paediatric oncology centre, where experience is likely to lead to greater diagnostic accuracy.

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References


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