An Audit of Out of Hours Interventional Vascular Radiology


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Background: in 1996 the Royal College of Radiologists established a set of guidelines for out of hours radiology. Part of the recommendations determined that all units should regularly assess their own out of hours workload. In light of these guidelines we have audited our units interventional radiology activity.

Methods: this was a retrospective study looking at the number of emergency angiograms and procedures performed over a 1-year period. Patients were identified from a vascular radiology database and case notes reviewed.

Results: a total of 1902 patients had angiograms with 686 having further procedures. Of these, 1093 patients (57%) having 380 procedures (55%) were under the care of a consultant vascular surgeon. Of the vascular surgical patients only 17 patients (1.6%) were actually investigated out of hours (1700±0800 weekdays and at weekends). 5/17 (29%) patients received thrombolysis and 7/17 (41%) had either an angioplasty or stent. Despite being a major vascular unit only 2/17 (12%) were patients referred from outside the units own trust. Following diagnostic angiography, 13/17 (76%) of patients had an intervention performed within the first 24 h.

Conclusion: in a unit performing a large number of angiograms only a small number of patients require out of hours emergency angiography and interventional vascular procedures. Our impression is that this is the result of a flexible and responsive in house’s service. At the present time extra-hospital referrals do not appear to generate large amounts of out of hours work. This level of out of hours activity has implications in the provision of vascular radiological services in the future.

Key Words: Interventional radiology; Vascular surgery; Patient management.

Introduction

In 1996, The Royal College of Radiologists produced a report1 outlining for departments the best use of resources for emergency radiology. The report highlighted that workload for many radiology departments had increased over the last few years due to a number of factors. The increasing complexity of radiological investigations and interventions had been coupled with a greater clinical demand, which was putting increasing pressures on radiology departments.2,3 In response, the report stated that the need to investigate patients out of hours must be based on the appropriateness of the request and only those patients whose situation was judged sufficiently urgent could justify specialist investigations outside normal working hours.

A report by the Vascular Surgical Society4 has outlined the provision of vascular services dependent upon unit size. In our centre there are three full time Consultant Vascular Radiologists who staff two angiography suites for the equivalent of 15 half days per week. For the remaining 5 half days one of the suites is used for cardiac catheterisation although can be used for non-cardiac work when available. The vascular radiologists together with four other consultant colleagues operate a one in seven on call rota for interventional radiology, providing a full range of diagnostic and therapeutic options. In concert with the four Consultant Vascular Surgeons (two maximum part time and two full time) they serve a population of approximately 400 000 people and in addition tertiary referrals are accepted from all over North and West Yorkshire.

Recommendations by the Royal College for Radiology departments first required the collection of the actual amount of work being undertaken out of hours.5-7 Up until now, little published data has been available addressing the question of workload and on call radiological activity. Our study provides some preliminary information about patient numbers and time spent performing emergency out of hours interventional vascular radiology at St James’s University Hospital, Leeds.
Methods

The time period of study was 1 year (1st Aug 1999 to 31st July 2000). Data was extracted from a dedicated Interventional Radiology database of all those cases (vascular and non-vascular) that were booked in and out of hours. From this data, time sheets that are kept in the department were sorted by hand to identify those patients under the care of a Consultant Vascular Surgeon and those procedures that were actually performed out of hours (times 1700 to 0800 next working day, and any procedures at weekends and bank holidays\(^4\)). Only those patients who required an interventional radiologist to come in from home outside these hours qualified to be included in this audit. This does not include any occasions when the list overran or indeed when cases were started after 1700, as long as the radiology staff had not left the hospital.

The length of time that each procedure took was also available from the time sheets and then case notes were used to identify procedures, intervention, and outcome as well as referral source and complications. It is clear from the Royal College of Radiologists report\(^1\) that an important consideration for any on call personnel is whether they are being used effectively and appropriately. This is a difficult judgement to make objectively, however, by auditing the time from diagnostic investigation to time of first intervention we can arrive at a surrogate marker of case urgency.

Patients who required the vascular radiology service had been assessed by a senior vascular trainee or consultant vascular surgeon and discussed directly with the interventional consultant on call. The diagnostic, and if appropriate therapeutic procedure, was then arranged and performed by the radiology consultant in a dedicated angiography suite with the help of two members of the vascular radiology support staff who also provide an on call service.

Results

Over the one-year period, a total of 1902 patients had angiography at St James’s Vascular Radiology Department, with 686 having a further vascular interventional procedure. Of these patients 1093 (57%) were identified as having their angiography requested by the vascular surgical team, 380 (55%) of whom had a further endovascular procedure. The remainder were under the care of non-vascular consultants, undergoing angiography and intervention for a range of indications. Specialities such as renal and oncology both requested some 7% each of this workload. Urology and neurology 2% each, and haematology 3%. General Surgery and Medicine each requested 7% of this workload, with 2% by other specialities.

Looking more closely at this number only 17 patients had their investigation requested by the vascular surgical team and performed out of hours. Of these, 16 were for lower limb and one for upper limb angiography. This amounts to 0.89% of the total number of angiograms performed in the 12-month period or 1.6% of the vascular surgical angiograms requested.

Interventions

Two main types of intervention were identified; those who required an endovascular procedure as part of their management (Group 1) (Table 1) and those who underwent surgical treatment alone (Group 2) (Table 2).

### Group 1

In group 1 there were 10 patients who required an endovascular procedure, of which five who were suitable for intra-arterial recombinant tissue-Plasminogen activator (rt-PA) thrombolysis. Of these five, two patients underwent a superficial femoral artery (SFA) angioplasty.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Radiology procedure</th>
<th>Surgery</th>
<th>Complication</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>83</td>
<td>rt-PA</td>
<td></td>
<td>Above knee amputation</td>
<td>Alive</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>rt-PA</td>
<td></td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>rt-PA and SFA angioplasty</td>
<td></td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>37</td>
<td>rt-PA and SFA angioplasty</td>
<td></td>
<td>Below knee amputation</td>
<td>Alive</td>
</tr>
<tr>
<td>5</td>
<td>68</td>
<td>rt-PA and CIA stent</td>
<td></td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>78</td>
<td>SFA angioplasty</td>
<td></td>
<td>Myocardial infarct</td>
<td>Dead</td>
</tr>
<tr>
<td>7</td>
<td>70</td>
<td>EIA stent</td>
<td>CFA endarterectomy and fem-pop thrombectomy</td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>44</td>
<td>PT embolisation</td>
<td></td>
<td>Myocardial infarct</td>
<td>Alive</td>
</tr>
<tr>
<td>9</td>
<td>61</td>
<td>Popliteal angioplasty</td>
<td></td>
<td>Alive</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>40</td>
<td>Subclavian stent</td>
<td></td>
<td>Alive</td>
<td></td>
</tr>
</tbody>
</table>


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angioplasty, and one had a common iliac artery angioplasty and stent following rt-PA therapy. The remaining two patients did not have any subsequent radiological intervention. One had clinical and angiographic resolution of the clot and the other had irreversible ischaemia and proceeded to an above knee amputation.

The remaining five patients in group 1 underwent endovascular procedures; one had an SFA angioplasty, one a popliteal angioplasty, one an external iliac angioplasty and stent, one a subclavian artery angioplasty and stent, and finally one a posterior tibial artery branch embolisation. Of interest is that of the ten patients who received an interventional procedure, only one, had an additional surgical reconstruction, although two other patients required major amputation.

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Group 2 consisted of seven patients who underwent arterial graft surgery. The operations performed were varied and are set out in Table 2. Most notable perhaps is the fact that only one required simple femoral embolectomy.

Timing of intervention

Thirteen patients (76%) had an intervention within 24 h of their admission. During the following 24 h period one patient had an intervention. Finally 3/17 patients (18%) had procedures over 48 h following admission.

Complications

Three patients of the 17 (18%) had post procedural myocardial infarcts, two of whom died. Both the major amputations were performed in the group who initially received thrombolysis. One patient had a thrombosed popliteal aneurysm and the other had occluded posterior tibial and peroneal arteries with no option for reconstruction. The 30-day limb and patient survival rates were 15/17 (88%) and 15/17 (88%) respectively.

Source of referrals

Acute admissions via the Accident and Emergency Department constituted the commonest source of patient referral 13/17 (76%). In-hospital referrals accounted for 2/17 (12%).

Referrals from outside St James’s hospital amounted to only two out of the 17 patients that needed out of hours vascular radiology (12%).

Interventional out of hours activity

Within the period of study the total time spent performing diagnostic or interventional procedures amounted to 66 h 15 min. This represents the total amount of time the patients spent in the department undergoing angiography with, or without an endovascular procedure. The median time spent on each procedure was 3 h (interquartile range 2–3.25 h). The longest period spent in the department was 4 h and 15 min on a patient requiring thrombolysis.

Total out of hours activity

Within our 12-month study period this amounts to 6712 h available. This takes into account time before 0800 and after 1700 on weekdays as well as weekends and bank holidays. Using our conservative criteria for out of hours procedures (i.e., only if the consultant radiologist was called in from home) the time spent performing these procedures (66 h 15 min) as a proportion of the total time available amounts to 0.987%. Note that this represents only those procedures

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Table 2. Patients receiving surgical interventions.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Surgery</th>
<th>Complication</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>79</td>
<td>Iliac artery aneurysm repair</td>
<td></td>
<td>Alive</td>
</tr>
<tr>
<td>12</td>
<td>53</td>
<td>Femoro-distal RVG</td>
<td></td>
<td>Alive</td>
</tr>
<tr>
<td>13</td>
<td>53</td>
<td>Femoro-popliteal RVG</td>
<td></td>
<td>Alive</td>
</tr>
<tr>
<td>14</td>
<td>74</td>
<td>CFA SFA thrombectomy, and patch</td>
<td>Myocardial infarct</td>
<td>Dead</td>
</tr>
<tr>
<td>15</td>
<td>65</td>
<td>Aorta bi-profundal, Right profunda BK pop RVG</td>
<td></td>
<td>Alive</td>
</tr>
<tr>
<td>16</td>
<td>88</td>
<td>Femoro-popliteal embolectomy</td>
<td></td>
<td>Alive</td>
</tr>
<tr>
<td>17</td>
<td>63</td>
<td>L. CFA endarterectomy, fem-fem cross-over, Right.fem-dist RVG 4-C fasciotomies</td>
<td></td>
<td>Alive</td>
</tr>
</tbody>
</table>

performed on patients under the care of a vascular surgeon and does not include the hepatic, renal, gastrointestinal and cardiac procedures also performed by the department on call.

Discussion

Although the Royal College of Radiologists issued its report 6 years ago, there is little or no published data on department's workload across the country. Our particular interest is in the provision of on call diagnostic and interventional vascular radiology, however, increasing demands within the health service mean that all radiology subspecialties and units are likely to benefit from internal audit of elective and emergency caseload.

For the purposes of this study we used extremely strict criteria for what was termed out of hours radiology. Only if the radiologist had to be called back to the hospital having left the building was it deemed to have been an on call procedure. This ignores all those urgent procedures that were fitted into the normal working day as well as those studies that finished or in some cases were started after 5 p.m. Our reason for this was that we considered a working session to be of a flexible length and as long as they were “accommodated” into this period or added to the end then the extra work could be accepted as part of the day job. Criticisms of overruns due to juniors training, department inefficiencies and avoidable delays can therefore not be leveled at this study. However it does underestimate the inconvenience to staff of being a central referral unit for vascular radiology.

In our hospital angiography and skilled endovascular radiologists are available throughout any given 24h period. Of course, only those patients deemed to require imaging, or an endovascular procedure were referred, i.e., those patients who were taken to theatre without imaging, e.g., brachial embolectomy, are not included.

Furthermore, the total number of referrals who had angiography out of hours does not represent the total number of vascular surgery patients who were accepted by the vascular surgical consultants from other trusts. Only those deemed to require the urgent service would have undergone out of hours investigation and treatment. This excludes those referrals that were accepted and discussed with radiologists out of hours but had their procedure within the next working day. This discussion involved the surgical consultant or senior trainee reviewing the patient on transfer arrival and deciding on the urgency of the case.

Of the patients included in this study the majority (10/17) needed specialist radiology intervention as well as a diagnostic angiogram. This has implications for service provision within district general hospitals where on call staff may not be familiar with therapies such as angioplasty, stenting, and thrombolysis. It may be argued that most ischaemic problems can be adequately managed by either radiology or surgery as local skills allow. Our view is that to provide a modern vascular service it is necessary to be able to call upon the full range of surgical and radiological options allowing discussion of what is best management solely in the light of the patient and pathology presented.

St James’s hospital provides a vascular surgical and radiology service to nearly half a million people and we would expect the amount of time spent performing out of hours procedures in surrounding hospitals to be less than that declared here. Moreover, when peripherally placed hospitals have staffing or equipment difficulties then their referrals are accepted here as well as our own work.

We think that from this data there is a case for all patients to be transferred to a single major unit with an out of hours interventional radiology service to make the best use of available resources. However before this can be discussed it will be necessary for other hospitals to audit their own workload. Clearly when dealing with emergency cases there is an argument in favour of local services close to the point of need. An appropriate vascular service must provide out of hours access to both surgical and radiological expertise within easy reach otherwise any potential benefit may be lost. Even if some time is saved by a local radiology department then this gain must be balanced against the cost implications of providing a service which is rarely called upon and can be provided within one or two hours ambulance ride.

At this stage it is, however, crucial to determine how many patients need to be provided for and where the greatest need lies before sensible provisions can be made. The concept that some central well organised units will accept referrals ad hoc depending on availability of on call staff in district general hospitals appears to be becoming less popular.

The question of whether the service is used appropriately is extremely difficult to answer objectively. If large numbers of investigations were being performed out of hours but receiving no subsequent early treatment, then it would imply that the cases were not considered urgent enough for emergency intervention and were inappropriately referred for emergency angiography. On balance we feel the organisation of the service with a consultant vascular surgeon deciding in conjunction with the consultant radiologist...
provides an ideal environment in which appropriate
decisions can be made about urgency of case.2,5,9

In conclusion, the data presented here indicates that
even in a major vascular unit performing a large num-
ber of angiograms only a small number of patients
need out of hours emergency angiography and inter-
ventional vascular procedures. We suspect that for
most intermediate/remote vascular units the cost of
providing the necessary interventional radiology
equipment as well as sufficient radiologists to cover
a comprehensive on call service may prove uneco-
nomic. This draws us back to the original “hub and
spoke” concept of centralising vascular services.

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