Integrated care pathways for vascular surgery: an analysis of the first 18 months

A B Sweeney, H S Flora, E J Chaloner, J Buckland, C Morrice, S G E Barker

Objective: A review of the use of previously described integrated care pathways (ICPs) established for three elective vascular surgical procedures.

Design: A retrospective analysis of information gathered prospectively over an initial 18 month period of use of vascular surgical ICPs.

Subjects: Patients admitted to a single vascular unit for "open" repair of abdominal aortic aneurysm (AAA), carotid endarterectomy, or femoropopliteal bypass grafting.

Methods: An analysis of variance data, length of stay, and costings after the use of ICPs, compared with previous clinical practice.

Results: Variance data were gathered for each of the three procedures. Variances of medication prescribing and delays in discharge were common to all procedures. In particular: (i) gastrointestinal complications were more specific to AAA repair and (ii) wound drains were removed a day later than originally proposed after femoropopliteal bypass. Overall, improved efficiency due to use of ICPs reduced the length of stay for all procedures, which was reflected in a potential cost saving of some 25%.

Conclusion: There are clear benefits to the use of ICPs, resulting in more structured, efficient, and cost effective patient care. Recommended changes to current practice based on variance analysis will require continued audit to sustain this "evidence based" approach.

Integrated care pathways (ICPs) offer a written framework for the expected management path and outcome for a patient undergoing a particular procedure involving a hospital stay. Conceptually they are not new and have been known as the integrated inpatient management model in the USA. However, their use was infrequent throughout the National Health Service until encouragement from the government white paper (Department of Health 1997). Subsequently, they have been used successfully for the management of asthma, stroke, multiple sclerosis, within paediatric oncology, and for orthopaedic patients. They are not strict guidelines per se, but represent a formalisation of what is already perceived anecdotally as "best practice". They should not be considered as a "straight jacket", restricting the usual clinical freedoms of any participatory members of the multidisciplinary team. However, changes to the first formulated ICP must be based upon peer audited review and variance analysis rather than further anecdote.

ICPs allow patients, nursing staff, doctors, and other healthcare professionals to see what the expected timeframes are for series of events throughout their hospital stay and the individual steps involved in recovery. From the patients' perspective, there is well documented evidence that ICPs promote increased confidence and an increased understanding of the procedure that they are about to undergo. At University College London Hospital we have previously published our care pathways and have already piloted a study to assess their viability in our vascular unit. In this study, deviations from what was expected have been recorded as a "variance" to allow variance analysis. This information can now be used to "complete the audit loop". Change to the ICPs only occurs when it is based on audited, real experiences, aiming ultimately towards a definitive ICP. The ICPs were found to work well for all members of the multidisciplinary team and in particular for the patients. The possibilities of further benefits both within our unit and throughout the trust are apparent. We present here the findings of our initial 18 month experience of ICPs, which we are continuing to use.

METHODS

The ICPs first laid down—based on best perceived practice before careful audit—were used on a further 59 patients over an 18 month period between 1998 and 2000. The three elective vascular surgical procedures analysed were "open" repair of abdominal aortic aneurysm (AAA), carotid endarterectomy, and femoropopliteal bypass grafting (to the above knee segment). Patients were recruited prospectively and sequentially. Not all patients were captured for this study however. In particular, patients not admitted to the vascular unit (usually because of bed availability) were excluded. In parallel with the study, a trial of endoluminal AAA repair versus "open" repair was being conducted, with approximate 50:50 randomisation to each group. Several patients due for carotid endarterectomy were entered in to a trial of angioplasty versus surgery and several patients were operated upon at another hospital within the trust's group. Patients who would have had femoropopliteal bypass grafting were frequently entered into studies for superficial femoral artery brachytherapy or superficial femoral artery subintimal angioplasty. Hence, for these reasons, the patients entering the ICP study were limited.

The main objectives were to evaluate the progress being made in adhering to the devised ICPs, to create a reasonable system for recording variances, and to analyse variances to enable changes to the ICPs. Variances were recorded, on the designated variance sheet, in the ICP by any member of the multidisciplinary team and on a daily basis. This information was fed back to the monthly group meetings, where they were categorised and assessed (by the lead clinician, senior nurse, and trial coordinator). Comparisons could then be made with a retrospectively studied group of 28 patients admitted for similar procedures from the 12 month period immediately after the ICPs were introduced.

Abbreviations: AAA, abdominal aortic aneurysm; ICP, integrated care pathway
A total of 59 patients were followed up in the study: 28 femoropopliteal bypasses, 19 carotid endarterectomies, and 12 ‘open’ repairs of AAA.

Overall there were 350 variance recordings: the 28 femoropopliteal bypass patients had 162 variances recorded (mean 5.8), for the AAA repairs there were 104 (mean 8.7), and for the carotid endarterectomies 84 variances (mean 4.4). The main categories of variances (as recorded) are shown in table 1.

The lengths of stay are shown in table 2. In all three types of surgery, these were similar to those recorded in the pilot study.

In comparison to the retrospective study group, patients were discharged approximately 10% more quickly for ‘open’ AAA repair, 13% more quickly for carotid endarterectomy, and up to 37% more quickly for femoropopliteal bypass grafts. This reduction in the length of stay was converted to ‘virtual’ savings on cost derived from the retrospective study group, as shown in table 3.

In total the inpatient episode would have cost £253 404 according to the retrospective data compared with £187 800 (55%), for the AAA repairs there were 104 (mean 8.7), and for the carotid endarterectomies 84 variances (mean 4.4). The main categories of variances (as recorded) are shown in table 1.

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In total the inpatient episode would have cost £253 404 according to the retrospective data compared with £187 800 using the ICPs, enabling an overall saving of £65 604 or 25%.

### Table 1: The main groups of variances as recorded throughout the trial

<table>
<thead>
<tr>
<th>Variance group</th>
<th>No</th>
<th>All variances (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication</td>
<td>99</td>
<td>28.0</td>
</tr>
<tr>
<td>Discharge delay</td>
<td>45</td>
<td>13.0</td>
</tr>
<tr>
<td>Wound care</td>
<td>24</td>
<td>7.0</td>
</tr>
<tr>
<td>Drain removal</td>
<td>26</td>
<td>7.0</td>
</tr>
<tr>
<td>Bowel issues</td>
<td>19</td>
<td>5.4</td>
</tr>
<tr>
<td>Intravenous fluids</td>
<td>16</td>
<td>4.5</td>
</tr>
<tr>
<td>Clip removal</td>
<td>12</td>
<td>3.4</td>
</tr>
<tr>
<td>Other</td>
<td>115</td>
<td>33.0</td>
</tr>
</tbody>
</table>

**Table 2: Length of stay data recorded, comparing patients on ICPs with the retrospective group and the pilot study patients**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>AAA</th>
<th>CE</th>
<th>FPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of patients</td>
<td>12</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Stated length of stay on ICP/days</td>
<td>11</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Actual length of stay on ICP/days</td>
<td>14.8</td>
<td>7.8</td>
<td>10.75</td>
</tr>
<tr>
<td>Retrospective group</td>
<td>16.2</td>
<td>9</td>
<td>17.0</td>
</tr>
<tr>
<td>% Reduction in overall length of stay</td>
<td>9</td>
<td>13</td>
<td>37</td>
</tr>
</tbody>
</table>

AAA, abdominal aortic aneurysm; CE, carotid endarterectomy; FPB, femoropopliteal bypass; ICP, integrated care pathway.

### Table 3: Differences in cost of cases for the different procedures using the retrospective analysis and the ICP

<table>
<thead>
<tr>
<th>Procedure</th>
<th>AAA</th>
<th>CE</th>
<th>FPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost from retrospective group</td>
<td>£58464</td>
<td>£51300</td>
<td>£143640</td>
</tr>
<tr>
<td>Total cost from ICP</td>
<td>£53100</td>
<td>£44400</td>
<td>£90300</td>
</tr>
<tr>
<td>Savings/£ per case</td>
<td>£447</td>
<td>£463</td>
<td>£1905</td>
</tr>
<tr>
<td>% Savings</td>
<td>9</td>
<td>13</td>
<td>37</td>
</tr>
</tbody>
</table>

The retrospective cost: average length of stay = cost per night ($150). AAA, abdominal aortic aneurysm; CE, carotid endarterectomy; FPB, femoropopliteal bypass; ICP, integrated care pathway.

### DISCUSSION

Preceding ICPs have been shown to represent a model for multidisciplinary, patient focused care. They provide a mechanism for the detection of variances from the standardised route of care and allow (dynamic) changes of practice based on up to date audit. Since the original pilot study, which looked at 26 patients, a further 59 patients have been analysed. Thus, these combined data on 85 patients have enabled us to better assess our original practice (by comparison with the retrospective group) and to decide whether any alterations to the ICPs need to be implemented and evaluate cost.

Although patients were admitted to a specialist vascular ward and staff were well motivated, the overall understanding and recording of variances was not good. This was in part due to the few guidelines initially offered. This meant that every conceivable variation from the defined pathways was recorded resulting in an accumulation of too much data of dubious relevance. This is illustrated well by the fact that 33% of our categories of variances were classified as “other”. Therefore, by redefining a “variance”, the different types of variances can be reduced so that focus is placed on those that do affect outcome. A possible solution would be to devise a coding/scoring system describing variance analysis. This would simplify this issue, making teaching easier and documentation accurate. This represents an ongoing issue.

Variance of medications and delayed discharge were common to all the procedures. Medications (28% of variances) covered issues such as the regimen of deep vein thrombosis prophylaxis (55%), alternative prophylactic antibiotics (25%), and delayed start of oral medications (20%). The latter was due to patients remaining “nil by mouth” longer than expected due to gastrointestinal complications. However, the former two reasons represent both the good and bad sides of our current ICPs. Issues around deep vein thrombosis prophylaxis were mainly due the difficulty in interpretation of what constituted a variance on the part of the multidisciplinary team. In addition, delays in achieving a therapeutic warfarin dose, allergy to the recommended regimen, and correct time of starting dalteparin (Fragmin; Pharmacia & Upjohn) and/or aspirin contributed to these variances. The use of alternative prophylactic antibiotics represents the flexibility within the ICP for the clinician. In these cases intravenous co-amoxiclav (Augmentin; SmithKline Beecham) was given instead of cefuroxime, this occurred mainly on the intensive care unit, where co-amoxiclav administration for routine prophylaxis is the standard practice. However, after two carotid endarterectomies, co-amoxiclav was prescribed at the request of the vascular team.

Delay in discharge (13% of variances) was a common problem, the reasons being delay in adequate provision of home care by social services (52%), referral not being made to social services (5%), transport not arranged (10%), discharge medications unavailable to be taken away by patients (5%), medical records relating to the procedure (24%), and a requirement for consultations/investigations for other quite separate problems (5%).

Certain categories of variance occurred more frequently for a specific procedure. Gastrointestinal complications (5.4% of variances), particularly constipation, occurred most often after AAA repair. Wound drain removal was originally planned for day 2 after femoropopliteal bypass. However, the majority of patients (22/28) actually had their drains removed on the third postoperative day.

Although, the length of stay was longer than set out by the ICP for each procedure by an average of three days, it was lower compared with our previous practice (as shown from the retrospective study group). The reasons for these goals not being achieved have already been discussed as discharge variances, of which 52% were attributed to failings in the
provision of social services. This group had already been referred to the social services department by the nursing staff when it was realised that some form of post-procedural support might be necessary, during the preoperative assessment. However, the failings were in organising the support packages (home help, meals on wheels, etc) as well as coordinating them to the intended date of discharge. This latter point is of interest, as the most common reason for delay on the part of the social workers was that the doctors had not set a firm discharge date. This is a plausible reason for their delay, however the ICP documents propose a timetable for discharge.

The part of the social workers was that the doctors had not set them to the intended date of discharge. This latter procedure might be necessary, during the preoperative assessment, to provide a social service. This had already been vacated earlier than usual by our use of ICPs. This efficiency leads to a greater throughput of patients to the ward, which in reality costs more but at the same time creates clear ethical and financial dilemmas for the trust.

There are obvious objective benefits of this model as shown. It should not be considered as static. Instead, it is very much dynamic. This implies that the equilibrium at which point good patient care can be delivered may be disturbed easily by factors such as pressure on beds (patients admitted to non-vascular wards), new staff (in any group of the multidisciplinary team), poorly motivated staff, general apathy, and pressure of other administrative commitments.

In addition, as patients are being entered into other research trials (particularly in the teaching hospital environment), insufficient patients are being managed by an ICP. This will have an impact on their familiarity to the staff that will be using them, as well as reduce sample sizes for meaningful analysis and audit. Thus, a review mechanism of the ICP needs to be in place at each level of the model: the trust, each specialty directorate, and ward level. Ultimately this will ensure provision of the highest standards of care to patients and avoid the perception of the ICP as an administrative burden.

The ICP is a framework to alter care in an “evidenced based” manner. As a full account of the patients’ recovery is required, each group within the multidisciplinary team is compelled to maintain good standards of documentation or “house keeping”. This is central to carrying out audit of our practice but may also be useful for other research and medicolegal issues.

It is also important to reiterate that the ICPs are a “user friendly” tool for the patients, their relatives, and the staff. There is improved communication and a better appreciation of each health professional’s role in the patients care. This has allowed also, greater nursing autonomy, with a concomitant reduction in calls to junior medical staff. More importantly, it has streamlined the overall management process by reducing the patient’s length of stay, while making the period of stay less daunting for the patient.

In conclusion, the above findings are in keeping with our ICP pilot study, particularly with regards to the types and numbers of variances. The larger numbers in the study have enabled recommendations on how our practice might be altered in an “evidence based” manner. In addition, there has been a clear demonstration of cost effectiveness in real terms as well as its potential on a trust-wide basis. Further follow up of these ICPs will be needed to see how the variance distribution, length of stay, and cost implications have been affected by the above recommendations.

**Recommendations to change our current ICPs**

- A laxative regimen has now been added and they should be prescribed routinely after AAA repair.
- Drains are removed on the third postoperative day after femoropopliteal bypass.
- The lengths of stay stated on the ICPs will be increased in all procedures by one day.
- Discharge planning will be instigated one day earlier.
- Redefinition of “variance” to promote its simplification to the users of the ICPs. This may involve devising a scoring system.
- Audit of these changes in turn.

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