An Audit of the Post-Operative Management of Patients taking Warfarin

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Introduction
It is of vital importance to manage the anticoagulation of surgical patients who take warfarin appropriately in order to minimise the risk of bleeding and clot formation.

Objectives
The aim of this audit was to assess the post-operative management of patients taking warfarin against standards taken from the recently revised Salisbury NHS Foundation Trust policy "Dalteparin Bridging for Patients taking Warfarin".

Audit Standards
6 standards covering the post-operative management of patients taking warfarin were taken from the current "Dalteparin Bridging for Patients taking Warfarin" policy, and set at 100%.

Method
Patients were identified by ward pharmacists and Medicines Management Technicians (MMTs). 24 patients’ medical records were reviewed retrospectively and assessed for compliance with the 6 standards.

Results
43% of patients received dalteparin 5000 units at an appropriate time on the day of surgery, 70% of high risk and 43% of low risk patients received an appropriate dose of dalteparin on day 1 post surgery. Warfarin was restarted at an appropriate time in 43% of patients and at an appropriate dose in 71% of patients. 60% of patients had dalteparin continued until the INR was within the therapeutic range, and then stopped.

Discussion
This audit identified some issues with compliance with the policy in relation to dalteparin prescribing and administration post-operatively. In some cases dalteparin was prescribed at the wrong dose, omitted without documented reasoning or not prescribed at all. The reloading of warfarin was often delayed or patients did not restart warfarin as inpatients. In several cases this was due to doctors not being aware the patient was on warfarin and/or not documenting the plan for restarting warfarin. Some patients were not prescribed dalteparin on discharge to continue until INR was therapeutic. There were some limitations to the audit such as the small sample size and the audit was carried out retrospectively.

Conclusion
None of the 6 standards achieved the target set at 100%. Three standards including administration of dalteparin on the day of surgery, on day 1 of surgery for low risk patients and restarting warfarin at an appropriate time were met in less than half of cases. The dose of warfarin and prescribing of dalteparin while the INR was sub-therapeutic achieved better compliance, however this is likely because many patients were excluded from this standard as warfarin was not restarted as an inpatient.

Recommendations
Increasing awareness of the guidelines, education of doctors regarding how to reload warfarin after surgery and the introduction of a bridging clinic could improve the management of anticoagulation in surgical patients taking warfarin. Improved documentation is needed in various areas identified in this audit.
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Introduction

The temporary interruption of warfarin therapy in patients undergoing surgical and interventional procedures poses an increased risk of thromboembolic events, however the continuation of these agents increases the risk of bleeding. The appropriate peri-operative management of patients taking warfarin is therefore necessary in order to balance these risks.

The optimal approach to manage patients who require temporary interruption of oral anticoagulation therapy due to surgery has not been determined by large randomised controlled trials and further research is necessary to determine this. Two randomised controlled trials are currently being undertaken in this area in order to evaluate the safety and efficacy of peri-procedural bridging of warfarin using LMWH: PERIOP-2 (A Double Blind Randomized Control Trial of Post-Operative Low Molecular Weight Heparin Bridging Therapy Versus Placebo Bridging Therapy for Patients Who Are at High Risk for Arterial Thromboembolism) and BRIDGE (Bridging Anticoagulation in Patients Who Require Temporary Interruption of Warfarin Therapy for an Elective Invasive Procedure or Surgery).

Current best practice recommendations from the British Committee for Standards in Haematology (BCSH) and American College of Chest Physicians (ACCP) are to bridge patients who are at high risk of thrombosis on withdrawal of anticoagulation with low molecular weight heparin (LMWH) or heparin during the interruption of oral anticoagulation. The Trust policy uses similar risk classification to the BCSH and ACCP guidelines to determine whether the patient is at high or low risk of withdrawal of anticoagulation and therefore how to manage their anticoagulation. This is outlined in appendix 1.

Background

The Salisbury NHS Foundation Trust "Dalteparin Bridging for Patients taking Warfarin" policy has recently been updated in September 2013. A number of clinical incidents have been recorded on the Trusts' Clinical Incident reporting system relating to the management of surgical patients who take warfarin. For example, in September 2013 four separate incidents were reported. One patient was not prescribed dalteparin on their TTO after orthopaedic surgery despite their INR being sub-therapeutic, two patients were given dalteparin and warfarin even though the INR was therapeutic, and in a fourth incident an orthopaedic patient at high risk of VTE had stopped warfarin 13 days prior to their operation and had not received dalteparin bridging (even though the pre-operative assessment unit had advised the GP to prescribe this).

A similar audit was carried out in 2012 entitled "An Audit of the Management of Peri-Operative Anticoagulation", however the policy has since been changed and the standards used were different to those used in this audit. The previous audit also looked at both pre and post-operative management of anticoagulation, whereas this audit focussed only on the post-operative management of anticoagulation.

Objectives

The aim of this audit was to assess the post-operative management of patients taking warfarin against standards taken from the recently revised policy "Dalteparin Bridging for Patients taking Warfarin".
Audit Standards

All standards were based on the current "Dalteparin Bridging for Patients taking Warfarin" policy (appendix 1), and set at 100%.

Standards:

1. All patients receive dalteparin 5000 units on the day of surgery (day 0), by 6pm for morning surgery or 10pm for afternoon surgery, unless there is a documented contraindication.

2. Patients at high risk of withdrawal of anticoagulation receive therapeutic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication.

3. Patients at low risk of withdrawal of anticoagulation receive prophylactic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication.

4. Warfarin is restarted on day 1 or 2 post surgery for patients at low risk of withdrawal of anticoagulation and on day 2 or 3 post surgery for patients at high risk of withdrawal of anticoagulation, unless there is a documented contraindication.

5. Warfarin is restarted at an appropriate dose

6. Dalteparin is continued until INR is within the therapeutic range, and then stopped.
**Method**

The audit was first approved by the Clinical Audit Department via the Online System for Clinical Audit (OSCA) form.

Adult patients undergoing surgical and interventional procedures and who take warfarin were identified by ward pharmacists and Medicines Management Technicians (MMTs) from 4th November 2013 - 28th January 2014 across the surgical wards: Britford, Downton, Amesbury, Chilmark and Laverstock.

Patients' medical notes were requested and reviewed retrospectively after discharge. A data collection form (appendix 2) was designed and used to collect the following information:

- the indication for warfarin (plus the CHADS<sub>2</sub> score if AF)
- the risk of withdrawal of anticoagulation
- the dose, timing and duration of dalteparin administration
- information on the reloading of warfarin including the INR post surgery, when warfarin was reloaded and the dose in relation to the patients usual dose.

All identifiable information was anonymised.

An initial pilot of the data collection form was carried out using the first four patients, this was then improved and used for the remaining patients in the audit.

The data was then analysed and assessed for compliance with the aforementioned standards, taken from the "Dalteparin Bridging for Patients taking Warfarin" policy. Appropriate recommendations were made, based on the results of the audit.
Results

A total of 24 patients were included in this audit, of which 20 (83%) underwent elective surgery or interventional procedures and 4 (17%) underwent emergency surgery. Patients were from the general surgical wards Britford (17%) and Downton (46%); orthopaedic wards Amesbury (13%) and Chilmark (13%), and Laverstock (13%), the plastics ward. Table 1 summarises the adherence to the standards used in this audit.

Table 1: Percentage of patients achieving each of the six standards audited

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Standard</th>
<th>Percentage Aim</th>
<th>Percentage Achieved</th>
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<tbody>
<tr>
<td>1</td>
<td>All patients receive dalteparin 5000 units on the day of surgery (day 0), by 6pm for morning surgery or 10pm for afternoon surgery, unless there is a documented contraindication</td>
<td>100%</td>
<td>43%</td>
</tr>
<tr>
<td>2</td>
<td>Patients at high risk of withdrawal of anticoagulation receive therapeutic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication</td>
<td>100%</td>
<td>70%</td>
</tr>
<tr>
<td>3</td>
<td>Patients at low risk of withdrawal of anticoagulation receive prophylactic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication</td>
<td>100%</td>
<td>43%</td>
</tr>
<tr>
<td>4</td>
<td>Warfarin is restarted on day 1 or 2 post surgery for patients at low risk of withdrawal of anticoagulation and on day 2 or 3 post surgery for patients at high risk of withdrawal of anticoagulation, unless there is a documented contraindication</td>
<td>100%</td>
<td>43%</td>
</tr>
<tr>
<td>5</td>
<td>Warfarin is restarted at an appropriate dose</td>
<td>100%</td>
<td>71%</td>
</tr>
<tr>
<td>6</td>
<td>Dalteparin is continued until INR is within the therapeutic range, and then stopped</td>
<td>100%</td>
<td>60%</td>
</tr>
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</table>

12 patients (50%) were classified as being at high risk from withdrawal of anticoagulation and 12 patients (50%) as being at low risk from withdrawal of anticoagulation, according to the "Dalteparin Bridging for Patients taking Warfarin" policy.
Discussion

Standard 1: All patients receive dalteparin 5000 units on the day of surgery (day 0), by 6pm for morning surgery or 10pm for afternoon surgery, unless there is a documented contraindication

43% of patients (10) in this audit received dalteparin 5000 units by the appropriate time on the day of surgery, or had a documented contraindication. One patient was omitted from this standard as the drug chart was not present in the medical notes, and therefore this standard could not be assessed.

In two cases, patients received dalteparin 5000 units but this was delayed, being given at 00:00 and 01:00 hours, and in another two patients treatment dose dalteparin was given, which is not in accordance with the protocol. In two cases, there was no documented reason for omission of dalteparin, however in the clinical notes both patients had haematuria which could explain the reason for the omission. One patient was prescribed dalteparin which was omitted on the drug chart with the code 4 (clinical reasoning), although the reason was not documented in the notes and therefore failed this standard. The dose of dalteparin for one patient was unclear as it had been written originally as 5000 units and subsequently changed to 18000, although it is not clear when this change was made and what dose the patient received, therefore failed this standard.

Standard 2: Patients at high risk of withdrawal of anticoagulation receive therapeutic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication

This standard is regarding patients classified as being at high risk of withdrawal of anticoagulation and therefore the 12 patients in the low risk category were excluded from this standard. Two high risk patients were also excluded, one as the drug chart was missing and therefore this standard could not be assessed and another because they were prescribed a heparin infusion in place of dalteparin.

70% of patients (7) achieved this standard. Of the three patients which failed this standard, one received prophylactic dalteparin, another received 5000 units BD and the third received treatment dose dalteparin but there was no documented weight of the patient in the notes at all and therefore it was not possible to confirm if the patient received an appropriate dose, since treatment dose dalteparin is dosed based on weight.

Standard 3: Patients at low risk of withdrawal of anticoagulation receive prophylactic dalteparin at an appropriate dose on day 1 post surgery, unless there is a documented contraindication

This standard is regarding patients classified as being at low risk of withdrawal of anticoagulation and therefore the 12 patients in the high risk category were excluded from this standard. 3 further patients were excluded as they were discharged before dalteparin was given on day 1 post-operatively.

67% of patients (6) received prophylactic dose dalteparin and achieved this standard. One patient was not prescribed any dalteparin, although it was documented in the medical notes that the plan was to give treatment dose dalteparin. Another patient received no dalteparin and although the reason for omission was not explicitly documented, it is likely this was due to haematuria.
Standard 4: Warfarin is restarted on day 1 or 2 post surgery for patients at low risk of withdrawal of anticoagulation and on day 2 or 3 post surgery for patients at high risk of withdrawal of anticoagulation, unless there is a documented contraindication

43% of patients (10) restarted warfarin at an appropriate time post surgery or had a documented contraindication. This standard was considered to have been achieved if the patient was discharged on the day warfarin had been prescribed to be restarted; this was the case in two patients. One patient was excluded from this standard as the individual was at low risk of withdrawal of anticoagulation and did not wish to continue with warfarin, she was then referred on discharge to be reviewed by her GP for consideration of a new oral anticoagulant.

In line with the policy, high risk patients must receive at least one dose of treatment dose dalteparin prior to restarting warfarin. One high risk patient was restarted on warfarin on the day of surgery. A second high risk patient was restarted on day 1 post surgery, however his INR was 2.4 and therefore this was considered appropriate.

In the case of two patients, an initial decision was made to delay restarting warfarin for a clinical reason. However, in both cases this was not reviewed regularly and warfarin was only restarted on day 6 post-operatively for one patient despite no further bleeding documented; and warfarin was only restarted on discharge (day 16) for a second patient despite a plan to restart on day 3 and no further documentation as to why this was not done.

In several cases, there was no documentation either in the notes or the TTO regarding warfarin. This was the case for two patients discharged on day 1 and day 3 post-operatively (although the TTO was not present in one of these patients notes). There were several more cases where the pharmacist identified to the doctor that the patient was on warfarin. In one case, despite the pharmacist identifying on day 1 post surgery that the individual was normally on warfarin, the patient was not restarted on warfarin as an inpatient and they were discharged on day 2 post surgery, the TTO stated no changes to regular medication. The pharmacist identified and discussed with the doctor regarding warfarin on discharge in three other cases, for patient discharged on days 1 (two patients) and 4.

Standard 5: Warfarin is restarted at an appropriate dose

71% of patients (10) achieved this standard. As with the previous standard, this standard was considered to have been achieved if the patient was discharged but warfarin had been prescribed. This was the case for two patients. 10 patients were excluded from this standard because warfarin was not restarted as an inpatient. In 6 of these cases (as discussed above) warfarin was not restarted and there was no documentation in the notes regarding warfarin, or the pharmacist needed to identify on discharge that the patients took warfarin. Exclusion of these patients may have lead to the compliance with this standard being skewed positively.

For the patients which were included in this standard and did not achieve it, this was usually because warfarin was prescribed at their normal maintenance dose despite their INR being less than 1.5, whereas the policy states that warfarin should be reloaded by giving double the maintenance dose for one day and then returning to the patient normal daily maintenance dose. In one case the patient received their normal dose on day 1, followed by double the maintenance on day 2. In the final case which did not achieve this standard, the patient was prescribed 6mg, followed by 10mg when their usual dose was 3.5mg.
Standard 6: Dalteparin is continued until INR is within the therapeutic range, and then stopped

60% of patients achieved this standard (9), including 6 which were discharged with dalteparin which was documented to continue until INR therapeutic. Several patients were excluded from this standard: one was excluded because the INR was 2.4 post surgery, 6 patients were excluded either because the drug chart or TTO was missing, or it was unclear if the patient was discharged with dalteparin and this information was needed and two patients were excluded because it was decided the patient would not recommence warfarin (one patient was discharged with dalteparin to continue long term, and the second was referred to their GP for initiation of a new oral anticoagulant).

For the patients which did not meet this standard, this was due to not prescribing dalteparin on discharge despite their INR being sub-therapeutic in three cases, no documented plan regarding warfarin or dalteparin in two cases and continuing for 3 days after the INR was therapeutic in one case.

Limitations of the Audit

There were several limitations in the design of the audit. Firstly, ward pharmacists and Medicines Management Technicians (MMTs) were involved in identifying patients for inclusion in the audit which may have resulted in some patients being missed if they were not identified by the pharmacist or MMT. Additionally, as the pharmacists were aware that these patients were being included in an audit, this may have affected the interventions they made, and potentially could have skewed the results in a positive manner.

Unfortunately the sample size for this audit was relatively small, partly due to many patients' medical records not being available for retrieval. Additionally, many patients were excluded from particular standards which further reduced the sample size. A larger sample size would have given a more accurate representation of the management of these patients across the surgical wards.

There were many more patients from the general surgical wards (Britford and Downton) compared to orthopaedic wards (Amesbury and Chilmark) and plastics (Laverstock). Therefore, it was not possible to separate the results based on individual wards. A larger sample size would have enabled this distinction to be made.

On several occasions there was information missing from the medical notes such as missing TTOs, drug charts and warfarin charts which were needed to assess compliance with the standards. This resulted in some patients being excluded from certain standards as it was not possible to confirm if it had been achieved or not. Since the audit was retrospective, this was unavoidable and could have only been overcome if the audit was completed prospectively. This was not done due to the ethical implication of needing to intervene with the patients' management if it was not according to the policy.

Poor documentation was one of the main limitations of the audit. Deviation from the policy may have been intentional and appropriate, however due to poor documentation this was not known and therefore was assumed not to meet the specified standard. For example, dalteparin was marked on the drug chart with a "4" which indicates clinical reasoning for omission, however this reason was not documented clearly in the notes.
One of the criteria for classifying individuals into high or low risk of withdrawal from anticoagulation is the calculation of the CHADS2 score if the patient has atrial fibrillation. If the score is more than 4, or more than 2 if the patient has had a previous stroke, then the patient is classified as high risk. The actual score was not specifically documented in any case and therefore the score was often based on the documented history and may not have been completely accurate due to incomplete information which was gained from multiple sources. Similarly, it is unlikely that doctors used this scoring system to classify individual patients into high or low risk as it was difficult to find the necessary history.

In patients at high risk of withdrawal from anticoagulation, dalteparin 5000 units should be prescribed on the day of surgery and then changed to treatment dose dalteparin on subsequent doses. On a couple of patients' drug charts the change in dose was done over the original 5000 units prescription, and it was not possible to identify when this change occurred.

This audit focussed only on the post-operative management of patients taking warfarin and not on the management pre-operatively. This was not carried out due to significant limitations of trying to collect this data retrospectively. This could be included in a future audit.
Conclusion

None of the 6 standards assessed in this audit achieved the target, set at 100%. The administration of dalteparin both on the day of surgery and on day 1 post-operatively was often omitted without a documented contraindication which resulted in poor compliance with standards 1-3. The administration of treatment dose dalteparin to high risk patients on day 1 (standard 2) was better, with 70% achieving this standard compared with 43% of low risk patients receiving prophylactic dose dalteparin (standard 3). It is likely that in many cases a clinical judgement not to give dalteparin was made, but was not recorded and therefore contributed to the low percentage of patient which achieved these standards.

The timing of restarting warfarin was often delayed, occurring later than recommended in the Trust guidelines without documented reason or was not restarted as an inpatient at all. In several cases this was due to the doctors not being aware that the patient took warfarin at all, until this was identified by the pharmacist and is therefore an important point to address.

In patients where warfarin was reloaded as an inpatient, this achieved better compliance with 71% being prescribed the correct dose according the policy.

When patients were fully reloaded with warfarin as inpatients, standard 6 was done well. However, where patients were discharged before their INR was therapeutic, they were not always discharged with dalteparin to continue until INR therapeutic and in some cases there was no plan documented at all.
**Recommendations**

Increasing awareness of the guidelines would improve the prescribing of the appropriate doses of dalteparin for high and low risk groups.

The introduction of a bridging clinic which patients would attend prior to surgery may improve the management of these patients and would provide clear guidance documented in the patients’ notes for ward staff to manage patients anticoagulation post-operatively.

To reduce the possibility of ward staff not being aware the patient takes warfarin, it should be written on the drug chart along with the patients other regular medication even though warfarin will not be initiated straight away.

Improved documentation in many areas would improve the management of surgical patients taking warfarin. It would be of benefit to encourage documentation in the medical notes if the patient was at classified as either at high or low risk of withdrawal of anticoagulation to aid in following the appropriate part of the dalteparin bridging policy. Additionally, the clinical reasoning for any deviations from the policy should be documented in the medical notes and the plan to manage warfarin reloading should be documented if it has not been done as an inpatient, as a record for both the patient and their GP.

The timing and dosing of warfarin when reloading could be improved. Education of doctors regarding how to reload warfarin after surgery, and involvement of the anticoagulation nurses may help to improve this.
References


