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Management of the anti-coagulated trauma patient in the Emergency

Department: a survey of current practice in England and Wales.

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ABSTRACT

Objective: The aim of this study was to investigate current management of the anti-coagulated trauma patient in the Emergency Departments in England and Wales.

Methods: A survey exploring management strategies for anti-coagulated trauma patients presenting to the ED was developed with two patient scenarios concerning assessment of coagulation status, reversal of INR, management of hypotension and management strategies for each patient. Numerical data are presented as percentages of total respondents to that particular question.

Results: A total of 106 respondents from 166 hospitals replied to the survey, with 24% of respondents working in a major trauma unit with a specialist neurosurgical unit. Variation was reported in the assessment and management strategies of the elderly anti-coagulated polytrauma patient described in scenario one. Variation was also evident in the responses between the neurosurgical and non-neurosurgical units for the head-injured, anti-coagulated trauma patient in scenario two.

Conclusions: The results of this study highlight the similarities and variation in the management strategies used in the Emergency Departments in England and Wales for the elderly, anti-coagulated trauma patient. The variations in practice reported may be due to the differences evident in the available guidelines for these patients.

What this study adds.

What is already known?

There is conflicting evidence regarding the effect of pre-injury warfarin and as a result, no internationally accepted, validated guidelines exist for the management of this patient group.

What this study adds.

A case-based questionnaire of 64% of Trusts in England and Wales participating in the Trauma Audit and Research Network, found variation in management strategies particularly with regard to the elderly, anti-coagulated trauma patient. This study provides important evidence that fully validated guidelines are required, in order to ensure a high level of standardised care and optimal patient outcomes.

INTRODUCTION

Major trauma accounts for over five million deaths worldwide each year and this number is predicted to increase to over eight million by 2010.[1] In the UK alone, trauma accounts for approximately 16,000 deaths and costs the NHS between £0.3 and £0.4 billion in immediate treatment.[2,3] It has been reported that approximately one third of bleeding trauma patients present with a coagulopathy.[1,4] Research has demonstrated that coagulation defects that occur in trauma patients are complex and these abnormalities are caused by a number of interrelated factors including; pre-existing conditions, pre-injury oral anti-coagulant use, dilution of haemostatic factors by fluid resuscitation or blood transfusion, severe hypothermia, hypoperfusion and acidosis due to tissue damage from trauma.[5-7]

It is reported that approximately 1% of the UK population are currently using anticoagulant therapy and it is predicted that this figure will continue to rise as the size of the elderly population increases.[8] Controversy exists in trauma research regarding the impact of pre-injury anti-coagulant use on trauma patients. Pre-injury warfarin has been reported to be an independent predictor of mortality in trauma patients.[9,10]

There is conflicting evidence regarding the effect of pre-injury warfarin and as a result, no internationally accepted, validated guidelines exist for the management of this group.[5,10-13] One of the key recommendations in the National Audit Office

Report “Major Trauma Care in England” (2010) stated that there is a need for Strategic Health Authorities to develop protocols for the effective delivery of major trauma care against the standards set out in national clinical guidelines.[14] In the absence of such guidelines, there is a risk that patients receive a standard of care that is “less than good standard”, as previously reported in 60% of major trauma cases in England.[15] The aim of this study was to investigate variation in current management of the anti-coagulated trauma patient in the Emergency Departments in England and Wales, thus highlighting the need and providing evidence for inclusion of this complex subgroup of patients, in future national trauma guidelines.

METHODS

A survey exploring management strategies for anti-coagulated trauma patients presenting to the ED was developed. Two patient scenarios were presented, which included a combination of closed and open-ended questions, with space provided to offer comments as required. A number of questions were open-ended in order not to lead the respondent into providing specific responses and to reduce the risk of introducing response bias. The survey was pre-tested by a number of non-participating clinicians in Morriston Hospital, Swansea and was subsequently revised based on feedback received.

Using a purposive sample, the survey was administered using a web-based form to one of the trauma leads in each of the hospitals participating in the Trauma Audit and Research Network (TARN) in England and Wales. The respondents were therefore asked to discuss their own practice in the survey. To improve initial response rate, a follow-up round of surveys was sent to the trauma leads after three months via email and repeated after another eight weeks. TARN currently receives

patient data from all trauma receiving hospitals in England and Wales. Ethical approval was not required as all responses were anonymous.

Numerical data are presented as percentages of total respondents to that particular question. Results are reported comparing responses for the neurosurgical centres (major trauma units) with the non-neurosurgical centres (non-major trauma centres) for both scenarios.

RESULTS

Characteristics of respondents

A total of 106 respondents from 166 hospitals replied to the survey. This was a 64% response rate from the hospitals participating in TARN. Of these hospitals, 25 out of the 27 neurosurgical centres in England and Wales responded, with the remainder being from non-neurosurgical centres. Six of the included questionnaires had not completed scenario two.

Scenario One

Scenario 1: A polytrauma patient has been admitted to your ED. The patient is 70 years old and known to use warfarin for atrial fibrillation. On initial examination, the patient appears to have a closed abdominal injury with signs of shock. The patient's has a respiratory rate of 25, heart rate of 130, blood pressure of 90/70 and a normal GCS. INR is 2.8. The patient has received one litre of normal saline during pre-hospital care. Assuming the trauma team is giving Tranexamic Acid and initiating imaging requests:

1) How would you assess this patient's coagulation status?

2) Would you reverse the patient's INR? YES / NO *(Please circle)*

Comments:

3) If yes, how would you reverse the INR? *(Please circle all applicable)*

- a) Vitamin K
- b) Fresh frozen plasma
- c) Pro-thrombin complements

Comments:

4) What INR range are you aiming to achieve through reversal?

5) Would you treat the patient's hypotension? YES / NO *(Please circle)*

6a) If yes, what would be your initial treatment for the hypotension?

Type of treatment: Volume: Rate of infusion:

6b) What is your target BP?

6c) If yes, what would be your on-going treatment for the hypotension?

Type of treatment: Volume:

7) Would you treat the hypotension differently due to the pre-injury warfarin use (compared to a patient not using warfarin pre-injury)? YES / NO *(Please circle)*

Comments:

Table 1 outlines how the respondents would assess the patient's coagulation status.

Table 1: Methods used to assess patient's coagulation status

| Method of assessment | Number (%) n=102 | Neurosurgical unit number (%) n=25 | Non-neurosurgical unit number (%) n=77 |
|---------------------------------------|---------------------|--|--|
| INR / near patient INR | 67 (65.7%) | 12 (48%) | 55 (71%) |
| Coagulation / clotting screen | 48 (47.1%) | 9 (36%) | 39 (51%) |
| Liver function tests | 3 (2.9%) | 1 (4%) | 2 (3%) |
| Laboratory tests (not specified) | 8 (7.8%) | 2 (8%) | 6 (8%) |
| ROTEM or TEG | 11 (10.8%) | 7 (28%) | 4 (5%) |
| Full blood count | 15 (14.7%) | 3 (12%) | 12 (16%) |
| Clinical findings | 8 (7.8%) | 2 (8%) | 6 (8%) |
| Platelets | 6 (5.9%) | 2(8%) | 4 (5%) |
| Fibrinogen / FDP | 16 (15.7%) | 3(12%) | 13 (17%) |
| Activated partial thromboplastin time | 16 (15.7%) | 2 (8%) | 14 (18%) |
| Prothrombin Time | 6 (5.9%) | 2 (8%) | 4 (5%) |
| Other | 6 (5.9%) | 4 (16%) | 2 (3%) |
| Liaise with haematology | 2 (2.0%) | 0 (0%) | 2 (3%) |

*INR: International normalised ratio; TEG: Thromboelastography; ROTEM: thromboelastometry
Other: haemoglobin, thrombin time, intracellular calcium, arterial and venous blood gases, D Dimer
and U&Es.*

Free text box used so any number of responses permitted. Total respondents=102

A total of 105 (99%) respondents stated that they would reverse the patient's INR, demonstrating a consensus in management between the respondents from both neurosurgical and non-neurosurgical centres. Figure 1 highlights the products used

by the respondents to reverse the patient’s INR. Respondents may have used either one or any combination of the products.

Figure 1: Products used to reverse the patient’s INR

For the target INR range that respondents were aiming to achieve with their reversal strategies, a total of 21 different values / ranges of values were reported by the respondents, all ranging between the values of 1 and 2. The most commonly reported target INR (32%) in the neurosurgical centres was a ‘normal’ INR, compared to the non-neurosurgical units where the most commonly reported value (23%) was 1.5 or less.

A total of 53% of respondents from the non-neurosurgical units stated they would treat the patient’s hypotension, compared with 80% of respondents from neurosurgical centres. The strategies used by the respondents for the on-going treatment of the patient’s hypotension have been grouped into “blood products” (including red cells, platelets, fresh frozen plasma and cryoprecipitate) or “fluids” (including crystalloids, normal saline, plasmalyte and hartmanns. Table 2 highlights the treatment strategy for on-going hypotension in the patient in Scenario 1.

Table 2: Treatment strategies for on-going hypotension (if hypotension being treated)

| | Number (%) n=95 | Neurosurgical unit, number (%) n=18 | Non-neurosurgical unit, number (%) n=77 |
|------------------------------|----------------------------|--|--|
| Blood products | 83 (87%) | 14 (78%) | 69 (90%) |
| Fluids | 23 (24%) | 2 (11%) | 21 (27%) |
| Massive haemorrhage protocol | 5 (5%) | 2 (11%) | 3 (4%) |

A total of 31% of respondents (from both neurosurgical and non-neurosurgical centres) stressed that the most important definitive treatment would be early CT imaging and surgery to identify and address the bleeding source. The volume and rate of each of the products that would be given by the respondents to treat the patient's hypotension are described in Appendix A as a supplemental file.

A total of 58% of respondents stated their target systolic blood pressure would be between 90 and 100, 32% stressed that they wouldn't use blood pressure at all to assess the patient, and 7% stated that it would depend on whether the patient had a head injury or not. This was the general consensus from respondents in both neurosurgical and non-neurosurgical centres.

A total of 32% of respondents from the non-neurosurgical centres stated that they would manage this trauma patient differently (compared to other trauma patients) as a result of their pre-injury anti-coagulant use. In the neurosurgical centres, a total of 44% of respondents stated they would manage the patient differently. The main comments made by respondents from both neurosurgical and non-neurosurgical centres regarding the difference in management concerned the need for early reversal of the INR, the need for a higher threshold for suspicion of bleeding, in addition to greater aggressiveness in the correction of clotting abnormalities in the anti-coagulated trauma patient.

Scenario 2

Scenario 2: An elderly patient with an isolated head injury has been admitted to your ED. On examination, the patient is normotensive has no clinical signs of haemorrhage. The patient is known to use warfarin for AF and has an INR of 2.8. The patient has a GCS of 8. The patient has a small frontal contusion and a sub-dural haematoma on CT scan. Assuming the trauma team is considering CRASH 3:

1) Is your ED in a hospital with a specialist neurosurgical unit? YES / NO (please circle)

2) What guidelines would you use to treat this patient?

3) How would you assess this patient's coagulation status?

4) Would you reverse the patient's INR? YES / NO (Please circle)

Comments:

5) If yes, how would you reverse the INR? (Please circle all applicable)

- a) Vitamin K
- b) Fresh frozen plasma
- c) Pro-thrombin complements

Comments:

6) What INR range are you aiming to achieve through reversal?

A total of 100 responses (60% response rate) were received for the second scenario, with 25% of the respondents working in a specialist neurosurgical unit. Table 3 highlights the guidelines that would be followed by respondents when managing the patient.

Table 3: Guidelines used in the management of anti-coagulated trauma patient

| Guideline | Number (%) n=94 | Neurosurgical unit number (%) n=24 | Non-neurosurgical unit number (%) n=70 |
|----------------------------------|--------------------|---------------------------------------|---|
| NICE Head Injury Guidelines | 33 (35%) | 8 (33%) | 25 (36%) |
| Local Trust Guidelines | 30 (32%) | 10 (42%) | 20 (29%) |
| Advanced Trauma Life Support | 3 (3%) | 0 (0%) | 3 (4%) |
| CRASH-3 on Tranexamic Acid | 4 (4%) | 0 (0%) | 4 (6%) |
| British Society of Haematology | 7 (7%) | 2 (8%) | 5 (7%) |
| Regional Trauma or Neurosurgical | 12 (13%) | 2 (8%) | 10 (14%) |
| None needed | 5 (5%) | 0 (0%) | 5 (7%) |
| On-call neurologist | 7 (7%) | 1 (4%) | 6 (9%) |
| Other | 5 (5%) | 0 (0%) | 5 (7%) |

*CRASH-3: Clinical randomisation of Antifibrinolytic in significant head injury (Trial acronym)
Free text box used so any number of responses permitted*

Table 4 highlights the methods the respondents would use to assess the patient's coagulation status. There was a consensus between the two groups that a

coagulation screen was the best method for assessing the patient's coagulation status however, a greater number of respondents from the non-neurosurgical centres relied on INR. Fibrinogen was reported to be used in a higher percentage of respondents from the neurosurgical centres.

Table 4: Methods used to assess patient's coagulation status

| Method of assessment | Number of responses (%) n=98 | Neurosurgical unit number (%) n=25 | Non-neurosurgical unit number (%) n=73 |
|---------------------------------------|---------------------------------|---------------------------------------|---|
| INR / near patient INR | 57 (58%) | 10 (40%) | 47 (64%) |
| Coagulation screen | 46 (47%) | 12 (48%) | 34 (47%) |
| Liver function tests | 4 (4%) | 2 (8%) | 2 (3%) |
| ROTEM or TEG | 4 (4%) | 2 (8%) | 2 (3%) |
| Full blood count | 8 (8%) | 2 (8%) | 6 (8%) |
| Clinical findings | 2 (2%) | 2 (8%) | 0 (0%) |
| Platelets | 7 (7%) | 1 (4%) | 6 (8%) |
| Fibrinogen / FDP | 10 (10%) | 7 (28%) | 2 (3%) |
| Activated partial thromboplastin time | 11 (11%) | 1 (4%) | 10 (14%) |
| Partial Prothrombin time | 2 (2%) | 0 (0%) | 2 (3%) |
| Prothrombin Time | 6 (6%) | 2 (8%) | 4 (5%) |
| Other | 4 (4%) | 1 (4%) | 3 (4%) |
| No further assessment required | 8 (8%) | 4 (16%) | 4 (5%) |

*INR: International normalised ratio; TEG: Thromboelastography; ROTEM: thromboelastometry
Other: haemoglobin, liaise with the on-call haematologist, intracellular calcium and arterial / venous blood gases.*

Free text box used so any number of responses permitted. Total respondents=98

A total of 97% of respondents stated that they would reverse the patient's INR in this scenario, with the 3% who wouldn't reverse it, working in a non-neurosurgical centre.

Figure 2 highlights the products used by the respondents to reverse the patient's INR.

Figure 2: Products used to reverse the patient's INR

The INR value or range that respondents were aiming to achieve for the patient in scenario two with their reversal strategies ranged between 1 and 2, with a total of 19 different responses given. The most commonly reported target INR value (33%) for the neurosurgical centres was an INR of 1, compared to the non-neurosurgical centres where the most commonly reported value (20%) was 1.5 or less.

DISCUSSION

This study has identified the similarities and differences in treatment strategies used in England and Wales, to manage the elderly, anti-coagulated trauma patient presenting to the ED. Hanley (2004) commented that pronounced differences exist in the recommendations within guidelines regarding management of an elderly anti-coagulated trauma patient.[16] The results of this study have highlighted that a number of different guidelines are used by the respondents in current practice. Furthermore, a number of respondents who work at non-neurosurgical centres suggested that they did not use any guidelines to manage such patients.

The most commonly used guideline (NICE Head Injury Guidelines) only discusses the use of CT scan in this specific patient group and contains no recommendation regarding reversal of anti-coagulant therapy.[17] The British Society of Haematology guidelines recommends the use of IV or oral Vitamin K in combination with PCC or FFP (if PCC not available) for the reversal of warfarin in the bleeding major trauma patient.[18] It is beyond the scope of this study to comment on similarities or variations in the content of each individual regional or local guidelines. It is evident however that there are no national guidelines that focus solely on the elderly, anti-coagulated trauma patient, that consider all aspects of management.

When considering both scenarios presented in the survey, there was an overall consensus that the patients' INR should be reversed. The methods used to assess the patient's coagulation status varied between the respondents. The most commonly used methods to assess coagulation status were INR and a clotting / coagulation screen, in both neurosurgical and non-neurosurgical centres. Recent research has suggested however that these tests monitor only the initiation phase of

blood coagulation therefore it is possible that the conventional coagulation screen appears normal, while the overall state of blood coagulation (clot stability, lysis or platelet function) is abnormal.[4,19] It is suggested that in addition to routine coagulation tests, viscoelastic methods also be performed to assist in characterising the coagulopathy and in guiding haemostatic therapy, however further research is needed.[4,19] A number of respondents commented that they would like to use such methods, but the equipment was not available at their ED. This lack of access to equipment invariably contributes to obvious differences in management of this patient group.

The products used to reverse the patient's INR varied between respondents. Current available guidelines recommend the use of PCC for the reversal of vitamin K-dependent oral anticoagulants in bleeding trauma patients and this was the most commonly reported product used by the respondents.[1,20,21] It is evident that there is a lack of consensus in the guidelines regarding the use of other products for the reversal of INR in a bleeding trauma patient.

Permissive hypotension for bleeding trauma patients is a relatively new concept in the management of bleeding and coagulopathy in major trauma patients. This approach avoids the adverse effects of early aggressive fluid resuscitation while maintaining an adequate level of tissue perfusion.[1,6,7] Current research recommends that good quality evidence underpinning permissive hypotension is limited and this may explain the fact that over half of the respondents would treat the hypotension of the patient in scenario one.

There are a number of potential limitations in this study. One of the inherent problems with a survey study is achieving a sufficient response rate. In this study,

65% of hospitals contacted to complete the survey were represented therefore non-response bias may have occurred. Similarly, there was a number of missing data fields in the completed surveys which may have introduced an element of bias. Misinterpretation of questions within the survey should be considered, however the survey was piloted and subsequently adapted, which should have reduced this inaccuracy.

CONCLUSIONS

Despite the inherent potential biases in an investigation using a survey for data collection, the results of this study highlight the similarities and variation in the management strategies used in the Emergency Departments in England and Wales for the elderly, anti-coagulated trauma patient. The variations in practice reported may be due to the differences evident in the available guidelines for these patients. In the absence of fully validated, national clinical guidelines, there is a risk of sub-optimal care and outcomes for the elderly, anti-coagulated major trauma patients. As a result of the variation in current practice reported in this study, the need for the specific inclusion of this complex, subgroup of major trauma patients, in future national guidelines has been highlighted.

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Figure legends:

Figure 1: Products used to reverse the patient's INR

Respondents asked to tick which of the three products listed they would use (more than one response therefore permitted)

Figure 2: Products used to reverse the patient's INR

Respondents asked to tick which of the three products listed they would use (more than one response therefore permitted)