Summary

The post-operative incidence of venous thromboembolism (VTE) is high for patients undergoing hip fracture surgery. Proven prophylactic measures are available although underutilized due to concern on post-operative bleeding with use of anticoagulants. This study retrospectively reviewed the clinical incidence of VTE and utilisation of thromboprophylactic protocols over an eight year period. Demographic details, mechanism of injury, VTE risk factors, prophylactic modalities (mechanical and pharmacological), operation duration, mode of anaesthesia, hospital length of stay (LOS) and post-operative complications with particular attention to suspected deep vein thrombosis (DVT) and/or pulmonary embolism (PE) were analysed. Male to female ratio was 1:2.7 with a median age of 78 years (IQR: 70–86 years) and 83 years (IQR: 77–87 years) respectively (p<0.001). Median hospital LOS was 8 days (IQR: 5–13 days) and differed with mechanism of injury. The in-hospital incidence of VTE was 1.6% (95% CI: 1.1–2.5%) with a probably underestimated three month rate of 8.2% (95% CI: 5.3–12.4%). Non fatal PE was 0.5% (95% CI: 0.2–1.0%) in-hospital and 2.6% (95% CI: 1.2–5.5%) at three months. Fatal PE was 0.5% (95% CI: 0.2–1.0%) with a three month incidence of 0.4% (95% CI: 0.1–2.4%). The in-hospital VTE incidence was kept relatively low with use of prophylactic protocols with almost all patients receiving prophylaxis by the end of the study period. Given the five-fold out of hospital increase in incidence, consideration should be given to continue prophylaxis beyond hospital discharge in this high risk group of patients.

Keywords

Aspirin, hip fractures, unfractionated heparin, low-molecular weight heparin, warfarin

Introduction

Increasing recognition of the importance of prevention and adequate treatment of venous thromboembolism (VTE) has been emphasized substantially over the last two decades. This has led to a number of consensus statements with extensive review of published evidence and specific recommendations for prophylaxis (1).

The risk of post-operative VTE is high in patients undergoing surgery for hip fracture. Without thromboprophylaxis, the rates of total and proximal deep vein thrombosis (DVT) are approximately 50% and 25% respectively (2), with fatal pulmonary embolism (PE) rates of 4% to 13% (2, 3). Failure to use prophylaxis is not only exposes patients initially to the risk of fatal PE, but, in the long term, DVT may lead to post-thrombotic venous insufficiency and leg ulceration, affecting quality of life and health care costs (1).

The American College of Chest Physicians (ACCP) 2001 consensus statement provided well-founded recommendations (2). These guidelines have recently been revised and provide a high level of evidence on routine use of fondaparinux, low molecular weight heparin (LMWH) or adjusted-dose warfarin in hip fracture surgery for at least 10 days post-operatively (4). Alternatively, low dose unfractionated heparin (UH) can also be used, while mechanical methods of graduated compression stockings (GCS) and/or intermittent pneumatic compression (IPC) devices may provide additional efficacy (2, 4–6). Aspirin alone, although inexpensive and requiring no monitoring, is not recommended due to lack of efficacy (4, 7). However, even with these currently recommended thromboprophylactic methods, the incidence of venographically detected DVT in hip fracture surgery remains as high as 24% to 34% (2, 7–11), while determining the safest and most effective prophylactic measures remains a challenge.

Several surveys (12–17) over the past few years have reported under-utilization of thromboprophylaxis in high risk patients with wide practice variations in VTE prevention. Contributing factors include concern with peri-operative bleeding associated with anticoagulant use and also the risk of spinal canal haematoma associated with spinal or epidural anaesthesia and LMWH (2, 18). More recent studies (13, 19) of current practice show that there is still much scope for improvement in prophylactic usage.
The current study was undertaken to assess the clinical incidence of VTE and the utilization of thromboprophylactic protocols for fractured neck of femur (FNOF) patients undergoing surgery at Westmead Hospital.

Materials and methods

From January 1, 1996 to December 31, 2003, 1,301 patients who underwent surgery for FNOF were identified retrospectively from Medical Records with an International Classification of Disease, Ninth Revision Code (ICD9CM) “820”. To ensure all cases were included patients were cross-checked against the Department of Surgery Orthopaedic Registry. All pathological fractures and patients on Vitamin K antagonists prior to surgery were excluded.

Suspected DVT and/or PE, mortality and readmission rates within a three-month period were recorded on all patients. The presence of symptomatic VTE was determined by documentation of positive duplex ultrasonography for DVT and ventilation perfusion lung scan for PE.

A computer generated random sample of 400 patients stratified by year (50 per year) was then selected from the total study population using the Statistical Product and Service Solutions program version 12.0.1 (SPSS Inc, Chicago, IL, USA). This was based on advice from a qualified Medical Statistician. A proforma was then developed for review that included information on age, gender, mechanism of injury, fracture type, risk factors for VTE, use of mechanical methods (GCS and IPCs) and pharmacological prophylaxis (UH, LMWH). Mode of anaesthesia (general, spinal, epidural or combined), duration of operation, hospital length of stay (LOS) and post-operative complications with particular attention to major bleeding.

Pharmacological prophylaxis was initiated pre-operatively and continued post-operatively or commenced post-operatively only. This included either UH administered at 5000IU subcutaneously twice or three times daily pre- and/or post-operatively in 12.0% of patients or LMWH in 78.5% of patients. LMWH included: (1) dalteparin (formally Pharmacia and Upjohn now Pfizer) administered at 2500IU in 0.5% of patients post-operatively or 5000IU in 3.8% of patients pre- and/or post-operatively or; (2) enoxaparin (formally Aventis Pharma now Sanofi-Aventis) administered at 20 mg in 25.8% of patients or 40mg in 45.5% subcutaneously daily pre- and/or post-operatively.

The proportion of patients commencing pre-operative administration was 43.9% for UH and 24.8% for LMWH. Combined pharmacological regimens mainly included UH starting pre-operatively followed by LMWH post-operatively in 3.0% of patients. An increased dosage regimen of LMWH was also used in 2.0% of patients. Duration for pharmacological prophylaxis was expected to be at least seven to 10 days. Major bleeding was defined as fatal bleeding, retroperitoneal, intracranial, intraspinal or bleeding that involved any other critical organ, bleeding leading to re-operation or to treatment cessation or requiring blood transfusion.

All data was entered into a Clinical Reporting System database version 1.1ma (GE Medical System Pty Ltd Australia) programmed for this study. Continuous data are presented as median and interquartile range (IQR, range from the 25th to the 75th percentile). Chi-square tests or, as appropriate, exact tests were used to compare groups of categorical data and to test for trends. The Mann Whitney U test or if appropriate the Kruskall Wallis test, were used to compare unpaired groups of continuous data. A multiple regression model with backward conditional stepwise variable selection was used for bleeding risk. For all analyses, actual P-values were reported and where possible, 95% confidence intervals (CI) presented. All tests were two tailed and differences were considered to be statistically significant at a P < 0.05 level.

Results

Patient characteristics

Median age was 82.0 years (IQR: 75.0–87.0 years). Male to female ratio was 1:2.7 with a median age of 78.0 years (IQR: 70.0–86.0 years) and 83.0 years (IQR: 77.0–87.0 years) respectively (p<0.001). Median hospital LOS was 8.0 days (IQR: 5.0–13.0 days) with no difference between genders. Risk factors for VTE included congestive cardiac failure in 7.5% followed by underlying malignancy in 9.3%, past history of VTE in 2.5% and prolonged immobility prior to admission in 3.0%.

Mechanism of injury and type of fracture

There were 59.8% of patients with American Society of Anesthesiology (ASA) score of 3 (severe systemic disease) and 22.5% with a score of 2 (mild systemic disease). Mechanism and place of injury varied with 49.0% (95% CI: 44.1–53.9%) occurring at home, followed by 41.0% (95% CI: 36.2–45.8%) in Residential Aged Care (RAC) Facilities. Median hospital LOS was significantly greater (p<0.001) for falls occurring around the home 9.0 days (IQR: 6.0–14.0 days) compared to falls occurring in RAC facilities, 6.0 days (IQR: 4.0–11.0 days). 56.5% (95% CI: 51.6–61.4%) of fracture sites were trochanteric, 38.0% (95% CI: 33.2–42.8) subcapital followed by bascervical at 3.3% (95% CI: 1.5–5.0%).

Thromboprophylaxis

On admission 12.8% of patients (95% CI: 9.5–16.0%) were on aspirin and/or clopidogrel, 1.5% (95% CI: 0.3–2.7%) on UH or LMWH on transfer from another hospital. Annual usage of GCS and pharmacological prophylaxis improved significantly (Fig. 1) from 82% in 1996 to 100% in 2002 and 2003 (p<0.001) with a small number of cases included in the pulmonary prevention (PEP) trial (7).
Median duration of pharmacological prophylaxis was 6.0 days (range: 3.0–11.0 days). UH usage significantly increased throughout the study period with maximal usage during 2000 and 2002. Median time to operation from pre-operative LMWH administration was 19.5 hours (IQR: 13.7–44.5 hours) and was 10.0 hours (IQR: 6.0–19.9 hours) from operation for post-operatively only administration. LMWH usage remained relatively constant throughout with use highest in 1997 at 96% (95% CI: 90.6–100.0%). This decreased in 2002 to 64% (95% CI: 50.7–77.3%) and increased again to 88% (95% CI: 79.0–97.0%) in 2003 (Fig. 2).

Age and duration of surgery had a significant effect on the risk of bleeding complications. For every increase in decade of age the odds of bleeding increased by a multiplicative factor of one and a half times and for every increase in hour of surgery the odds of bleeding increased by just over two times. The risk of bleeding was not increased by the use of heparin (Table 1). On hospital discharge, 1.0% (95% CI: 0.9–2.5%) of patients were documented to be on UH, 11.3% (95% CI: 8.5–14.7%) on LMWH, 14.8% (95% CI: 11.6–18.6%) on aspirin and 0.8% (95% CI: 0.3–2.2%) on warfarin.

**Anaesthesia**

Neuraxial anaesthesia was used in 20.3% (95% CI: 16.3–24.2%) of patients. This consisted of spinal anaesthesia in 19.3% (95% CI: 15.4–23.1%) and epidural in 1.3% (95% CI: 0.2–2.3%). Annual usage for spinal anaesthesia decreased (Fig. 3) from 38% (95% CI: 33.2–42.8%) in 1996 to 0% (95% CI: 0.0–7.1%) in 2002 (p<0.001). There were no reported complications of spinal canal haematoma.

**Blood transfusion and bleeding complications (Fig. 4)**

Over one-third of patients (39.0%; 95% CI: 34.2–43.8%) received a blood transfusion (median of 2.0 units, range: 1.0–10.0 units). 37.9% (95% CI: 32.7–43.2%) of patients on LMWH required a transfusion versus 21.2% (95% CI: 11.3–31.1%) on UH (p=0.01). Transfusion was required in 36.4% (95% CI: 19.7–57.0%) of patients receiving no pharmacological prophylaxis.

Gastrointestinal bleeding occurred in two patients that received either LMWH or UH prophylaxis. Three patients had multiple returns to operating theatre, one for evacuation of haematoma, debridement, lavage and repacking of the wound (this patient died from acute renal failure, cardiac arrest and cerebral infarction), the other patient for drainage of abscess and re-insertion of prosthesis, this patient died from septicemia). The third patient had an infected wound haematoma requiring debridement and wash-out and one patient had a failed hip screw with infection, requiring debridement and revision. 39.3% (95% CI: 34.5–44.0%) of patients had bleeding which was considered major or clinically significant. 36.4% of these patients received no pharmacological prophylaxis, 22.7% were on UH and 37.9% on LMWH. There was no significant difference in bleeding rates between these three groups (p=0.06). 2.5% (95% CI: 1.0–4.0%) of patients had minor bleeding.

**Table 1: Results of multiple regression defining significant factors that had an association with increase risk of bleeding.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>p-value</th>
<th>Odds ratio (OR)</th>
<th>95% CI OR Low</th>
<th>95% CI OR Upper</th>
<th>95% CI OR Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery duration (hrs)</td>
<td>0.778</td>
<td>0.25</td>
<td>0.002</td>
<td>2.18</td>
<td>1.32</td>
<td>3.58</td>
<td></td>
</tr>
<tr>
<td>Age per decade</td>
<td>0.044</td>
<td>0.01</td>
<td>0.001</td>
<td>1.55</td>
<td>1.20</td>
<td>2.01</td>
<td></td>
</tr>
<tr>
<td>UH/LMWH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UH/LMWH + aspirin</td>
<td>0.785</td>
<td>0.40</td>
<td>0.047</td>
<td>2.19</td>
<td>1.01</td>
<td>4.76</td>
<td></td>
</tr>
<tr>
<td>No pharmacological prophylaxis</td>
<td>0.453</td>
<td>0.51</td>
<td>0.373</td>
<td>1.57</td>
<td>0.58</td>
<td>4.26</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-4.926</td>
<td>1.15</td>
<td>p&lt;0.001</td>
<td></td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 2: Usage of UH, LMWH by year.](image1)

![Figure 3: Anaesthesia usage by year.](image2)
cluded one patient on UH with a small per rectal bleed, one patient with haematuria, one with nose bleed, two with thigh haematoma, one with mild haematemesis and four patients on LMWH with wound bleeding.

**Clinical outcome**

The overall in-hospital clinical incidence of VTE was 1.6% (Fig. 5 and Table 2). This ranged from 2.6% in 1996 to 0.7% in 2002. The decrease in VTE rates in 2001 and 2003 compared to previous years in relation to the increase use of combined prophylactic modalities was not significant (p=0.18). One patient in 1996 developed both a DVT and subsequently fatal PE documented as direct cause of death on post-mortem examination. Another patient in 1997 had a cardiorespiratory arrest with ongoing myocardial ischaemia and fatal PE. The overall 30-day mortality rate was 5.0%. The majority of patients (58.5%) died from cardiac complications and one patient had a massive gastointestinal bleed. Four patients died from a possible PE (not confirmed) and one from PE that also had DVT (Table 3). One patient developed asymptomatic thrombocytopenia day post-operatively with a reported platelet count of 70x10^9/L. This patient received LMWH post-operatively only.

**Readmissions**

The readmission rate within three months post discharge was 17.8% (95% CI: 15.6–19.9%). 8.2% (95% CI: 5.3–12.4%) of all readmissions were due to VTE, 6.5% (95% CI: 3.3–9.6%) to DVT and 3.0% (95% CI: 0.8–5.2%) to PE.

**Discussion**

Our cumulative clinical incidence of VTE was 9.8% in this high risk group of patients with an in-hospital incidence of 1.6% (95% CI: 1.1–2.5%) but an out of hospital incidence of 8.2% (95% CI: 5.3–12.4%). In accordance with other studies (20–22) we have demonstrated that 52.5% (95% CI: 37.0–68.0%) of all symptomatic VTE within three months of surgery occurred prior to patients being discharged from hospital. This reflects the high risk in-hospital period for post-operative VTE.

**Table 2: In-hospital incidence of VTE and 30-day mortality rates.**

<table>
<thead>
<tr>
<th>Year</th>
<th>VTE</th>
<th>95%CI</th>
<th>PE$</th>
<th>%</th>
<th>95%CI</th>
<th>30-Day Mortality</th>
<th>95%CI</th>
<th>Fatal PE$</th>
<th>%</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>5/193</td>
<td>2.6</td>
<td>1.1–5.9</td>
<td>3/193</td>
<td>1.6</td>
<td>0.5–4.5</td>
<td>12/193</td>
<td>6.2</td>
<td>3.6–10.6</td>
<td>3/193</td>
</tr>
<tr>
<td>1997</td>
<td>3/190</td>
<td>1.6</td>
<td>0.5–4.5</td>
<td>2/190</td>
<td>1.1</td>
<td>0.3–3.8</td>
<td>10/190</td>
<td>5.3</td>
<td>2.9–9.4</td>
<td>0/190</td>
</tr>
<tr>
<td>1998</td>
<td>2/171</td>
<td>1.2</td>
<td>0.9–3.6</td>
<td>1/171</td>
<td>0.6</td>
<td>0.1–3.2</td>
<td>9/171</td>
<td>5.3</td>
<td>2.8–9.7</td>
<td>0/171</td>
</tr>
<tr>
<td>1999</td>
<td>2/163</td>
<td>1.2</td>
<td>0.2–4.4</td>
<td>1/163</td>
<td>0.6</td>
<td>0.1–2.8</td>
<td>8/163</td>
<td>4.9</td>
<td>2.5–9.4</td>
<td>0/163</td>
</tr>
<tr>
<td>2000</td>
<td>4/150</td>
<td>2.7</td>
<td>1.0–6.7</td>
<td>1/150</td>
<td>0.7</td>
<td>0.1–3.7</td>
<td>9/150</td>
<td>6.0</td>
<td>3.2–11.0</td>
<td>1/150</td>
</tr>
<tr>
<td>2001</td>
<td>1/133</td>
<td>0.8</td>
<td>0.1–4.1</td>
<td>1/133</td>
<td>0.8</td>
<td>0.1–4.1</td>
<td>5/133</td>
<td>3.8</td>
<td>1.6–8.5</td>
<td>1/133</td>
</tr>
<tr>
<td>2002</td>
<td>1/138</td>
<td>0.7</td>
<td>0.1–4.0</td>
<td>1/138</td>
<td>0.7</td>
<td>0.1–4.0</td>
<td>5/138</td>
<td>3.6</td>
<td>1.6–8.2</td>
<td>0/138</td>
</tr>
<tr>
<td>2003</td>
<td>3/163</td>
<td>1.8</td>
<td>0.6–5.2</td>
<td>2/163</td>
<td>1.2</td>
<td>0.3–4.4</td>
<td>7/163</td>
<td>4.30</td>
<td>2.0–8.5</td>
<td>0/163</td>
</tr>
<tr>
<td>Total</td>
<td>21/1301</td>
<td>1.6</td>
<td>1.1–2.5</td>
<td>12/1301</td>
<td>0.9</td>
<td>0.5–1.6</td>
<td>65/1301</td>
<td>5.0</td>
<td>3.9–6.3</td>
<td>5/1301</td>
</tr>
</tbody>
</table>

$| Possible and confirmed patients, † one patient with confirmed PE, ‡ two patients with confirmed PE.
Mechanical and/or pharmacological thromboprophylaxis usage improved over the eight year study period with all patients receiving prophylaxis in 2002 and 2003. Improvements in practice patterns may possibly be reflected in increased awareness of the potential benefits of thromboprophylaxis with the combination of modalities possibly resulting in an additive or potentiating antithrombotic effect without increasing the risk of bleeding (5, 6). Although not significant this correlates with the decrease in our in-hospital clinical VTE incidence between 2001 to 2003 in comparison to previous years.

Use of LMWH only post-operatively in more than three quarters of patients together with the increased time to administration pre-operatively most likely is attributed to the concern of bleeding among our clinicians. Clinically relevant bleeding rates did not differ in patients receiving UH, LMWH or no pharmacological prophylaxis. However, age and duration of surgery had a significant effect on the incidence of bleeding complications (Table 1). Factors such as impaired renal function and delayed renal excretion in older patients on UH and LMWH may increase the risk. To date clinical trials have not directly examined the correlation between age-associated bleeding and anticoagulation with LMWH (23, 24).

Although use of LMWH and spinal anaesthesia was observed to decrease after 1997, no reported complications of spinal canal haematoma were identified. In parallel, there was an increase in usage of UH and mechanical prophylaxis. This observation possibly reflects the USA Food and Drug Administration (FDA) alert in December 1997. More than 30 cases of spinal haematoma or bleeding were reported after usage of regional anaesthesia with LMWH prophylaxis. Most patients underwent orthopaedic surgery (18) with permanent paraplegia occurring in 16 cases (25, 26). Spinal haematoma is rare after regional anaesthesia (<1 in 100,000) and its true frequency when patients are also given prophylactic doses of UH or LMWH currently remains uncertain. (25, 27).

Our 30 day all-cause mortality was 5.0% (95% CI: 3.9–6.3%) while the in-hospital fatal PE rate was at 0.5%. Almost two thirds of all deaths were due cardiac complications and 7.7% (95% CI: 1.2–14.2%) related to PE. When compared to our autopsy rate of 9.1% (95% CI: 3.7–14.5%) and fatal PE rates of 4% and 13% in other studies (2, 3) it is possible that many of our cardiac deaths were PE related. Missed deaths (e.g. occurring at home, nursing homes or other institutions) may possibly have affected our results.

Our out of hospital VTE incidence of 8.2% reflects a five-fold increase in comparison to our in-hospital incidence (1.6%). These findings illustrate that new (47.5%) DVT and PE occur post hospital discharge and that consideration should be given to continuing prophylaxis beyond hospitalization (2, 4). It is likely that the observed incidence of delayed thrombosis is an underestimation of the true three-month readmission rate. Compounding factors, including the unknown number of patients developing post-operative VTE that we may have missed due to patients readmitted to another service (e.g. haematology, respiratory), another hospital, or who may have been treated on an outpatient basis may have contributed to this.

As a quality assurance measure, DVT and PE is an accepted clinical indicator, therefore accurate diagnosis and coding is essential. However, due to the increasing trend of patients receiving outpatient treatment for VTE, even an appropriately constructed audit program for unplanned readmissions aimed at identifying every patient may prove to be difficult (28).

Traditionally thromboprophylaxis ended when the patient was discharged from hospital. However the risk extends well beyond the immediate post-operative period with hypercoagulability continuing for at least six weeks post-operatively (29). This is further influenced with shorter hospital stays. Extended prophylaxis with fondaparinux for four weeks post-operatively in the PENTasaccharide in Hp-FRActure Surgery Plus (PENTHIFRA Plus) trial was highly effective in reducing the risk of VTE by 96% without increasing clinically relevant bleeding (9, 30, 31). The Seventh ACCP guidelines recommends that patients undergoing surgery for hip fracture receive prophylaxis for up to 28 to 35 days after surgery (4).

Clinically symptomatic VTE events are rare and trials demonstrating a reduction in these are infrequently performed due to poor statistical power to demonstrate a statistically significant difference in outcome. The strength of our findings outweigh the limitations, providing additional reliable data on the late-onset of symptomatic VTE after cessation of thromboprophylaxis as well as confirmatory information that correlates with the prospectively designed PENTHIFRA Plus study.

In conclusion this study demonstrated that the incidence of VTE in a high risk group of patients treated for FNOF was able to be kept relatively low with utilization of appropriate prophylactic protocols. It also shows that by using hospital specific data practice patterns can be influenced with an increasing usage of prophylaxis demonstrated during the course of our study. An 8.2% incidence of VTE occurring in the three months after hospital discharge for FNOF reinforces that consideration should be given to out of hospital prophylaxis in this high risk group of patients.

Acknowledgments

The authors would like to thank and acknowledge Dr Karen Byth, Senior Medical Statistician for her expert advice on the statistical analysis.

### Table 3: Documented cause of 30-day mortality.

<table>
<thead>
<tr>
<th>30-Day Mortality Cause</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac complications</td>
<td>38/65</td>
<td>58.5</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>17/65</td>
<td>26.2</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>11/65</td>
<td>16.9</td>
</tr>
<tr>
<td>Sepsis/septic shock</td>
<td>11/65</td>
<td>16.9</td>
</tr>
<tr>
<td>Cerebral vascular accident</td>
<td>8/65</td>
<td>12.3</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>8/65</td>
<td>12.3</td>
</tr>
<tr>
<td>PE (suspected or confirmed)</td>
<td>5/65</td>
<td>7.7</td>
</tr>
<tr>
<td>Anaemia</td>
<td>4/65</td>
<td>6.2</td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td>1/65</td>
<td>1.5</td>
</tr>
<tr>
<td>Multorgan failure</td>
<td>1/65</td>
<td>1.5</td>
</tr>
<tr>
<td>Other</td>
<td>21/65</td>
<td>32.3</td>
</tr>
</tbody>
</table>

*A given patient may have more than one cause of death*
References


