Incidence and type of bleeding complications early and late after acute coronary syndrome admission in a New Zealand cohort (ANZACS-QI-7)

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ABSTRACT

AIMS: Use of anti-thrombotic agents has reduced ischaemic events in acute coronary syndromes (ACS), but can increase the risk of bleeding. Identifying bleeding events using a consistent methodology from routinely collected national datasets would be useful. Our aims were to describe the incidence and types of bleeding in-hospital and post-discharge in the All New Zealand Acute Coronary Syndrome Quality Improvement (ANZACS-QI) cohort.

METHODS: 3,666 consecutive patients admitted with ACS (2007–2010) were identified within the ANZACS-QI registry. A set of International Classification of Disease 10 (ICD-10) codes that identified bleeding events was developed. Anonymised linkage to national mortality and hospitalisation datasets was used to identify these bleeding events at the index admission and post-discharge.

RESULTS: Three hundred and ninety-nine (10.8%) out of 3,666 patients had at least one bleeding event during a mean follow-up of 1.94 years. One hundred and sixty-one (4.4%) had a bleeding event during their index admission, and 271 (7.4%) patients were re-hospitalised with bleeding during follow-up. Sixty-one patients (37.9%) were transfused for bleeding in the index admission cohort, and 59 patients (21.8%) at a subsequent admission. Procedural bleeding was the most common event during the index admission, whereas gastrointestinal bleeding was the most common delayed bleeding presentation.

CONCLUSION: One in ten ACS patients experienced a significant bleeding event within 2 years. The use of this ICD-10 bleeding definition in national ACS cohorts will facilitate the study of bleeding event incidence and type over time and between geographical regions, both nationally and internationally, and the impact of changes in anti-thrombotic therapy and interventional practice.

The use of antithrombotic and antiplatelet agents in conjunction with an early invasive strategy has improved ischaemic outcomes in patients presenting with acute coronary syndromes (ACS). However, the paradox of treatment lies in the increased risk of bleeding. Bleeding events and need for blood transfusion are independent predictors of mortality and adverse outcomes in ACS patients.[1-5] Minimisation of bleeding events is, therefore, an important therapeutic target.

The All New Zealand Acute Coronary Syndrome Quality Improvement (ANZACS-QI) registry captures data in all New Zealand patients with ACS undergoing revascularisation by percutaneous coronary intervention (PCI) and/or coronary artery bypass grafting (CABG). The outcomes of patients in this registry are tracked by using anonymised linkage to national datasets. With its national implementation, there is an opportunity to better understand and track the incidence of bleeding after ACS in a large contemporary cohort.

Several bleeding scores have been developed to define bleeding events in the clinical trial setting.[6-8] While these scores provide the most definitive approach to identification of bleeding events, they may be less reliable in a national registry where clinical users rather than dedicated research staff are entering data. Furthermore, to obtain information about post-discharge events requires costly and time-consuming individual patient follow-up. An alternative approach is to track bleeding events using ICD-10 codes. This methodology has been used and reported in other international studies, such as in a Danish ACS cohort.[9] In New Zealand, ICD-10 codes are recorded in national datasets using standardised definitions for every public hospital admission.

This study aims to describe the incidence and types of bleeding in-hospital and post-discharge in the ANZACS-QI cohort using ICD-10 codes.

Methods

Cohort and data collection

Consecutive patients from Middlemore, Taranaki Base and Waikato Hospitals admitted with an ACS between 2007 and 2010 were included. Data was prospectively collected and electronically recorded in the ANZACS-QI registry (formerly known as Acute PREDICT) by trained clinical staff. The ANZACS-QI registry is a web-based electronic database which captures a mandatory in-hospital dataset in ACS patients which includes patient demographics, admission ACS risk stratification using the GRACE score, cardiovascular risk factors, investigations, management, inpatient outcomes and medications at discharge.

Details of data collected have previously been reported.[10,11] Some risk factor data is incomplete as it was non-mandatory (haemoglobin, white cell count), or was sourced from the paired Cardiovascular Disease and Diabetes Mellitus (CVDDM) Predict dataset collected predominantly at Middlemore Hospital (LDL cholesterol, BMI). History of congestive heart failure prior to the index acute event was not collected in the ANZACS-QI registry, but was identified from the national hospitalisation data sets using the relevant ICD-10 codes (I110, I130, I132, I500, I501, I509). History of prior bleeding was similarly identified using the ICD-10 bleeding code set developed for this study and described below.

All New Zealander's have a unique National Health Identifier (NHI) number. We used an encrypted version of the NHI to anonymously link in-hospital ANZACS-QI patient records to subsequent outcomes captured in national public hospitalisation and mortality datasets. The encryption and linkage methodology has been described previously.[10] Ethics approval was obtained from the National Multi Region Ethics Committee (MEC/07/19/EXP).

Identification of bleeding events

Bleeding events were identified using the World Health Organization (WHO) ICD-10 codes. Relevant ICD-10 code sets used by other investigators to identify bleeding events were reviewed.[9,12-14] The process followed to derive the final set of bleeding codes is shown in Figure 1.

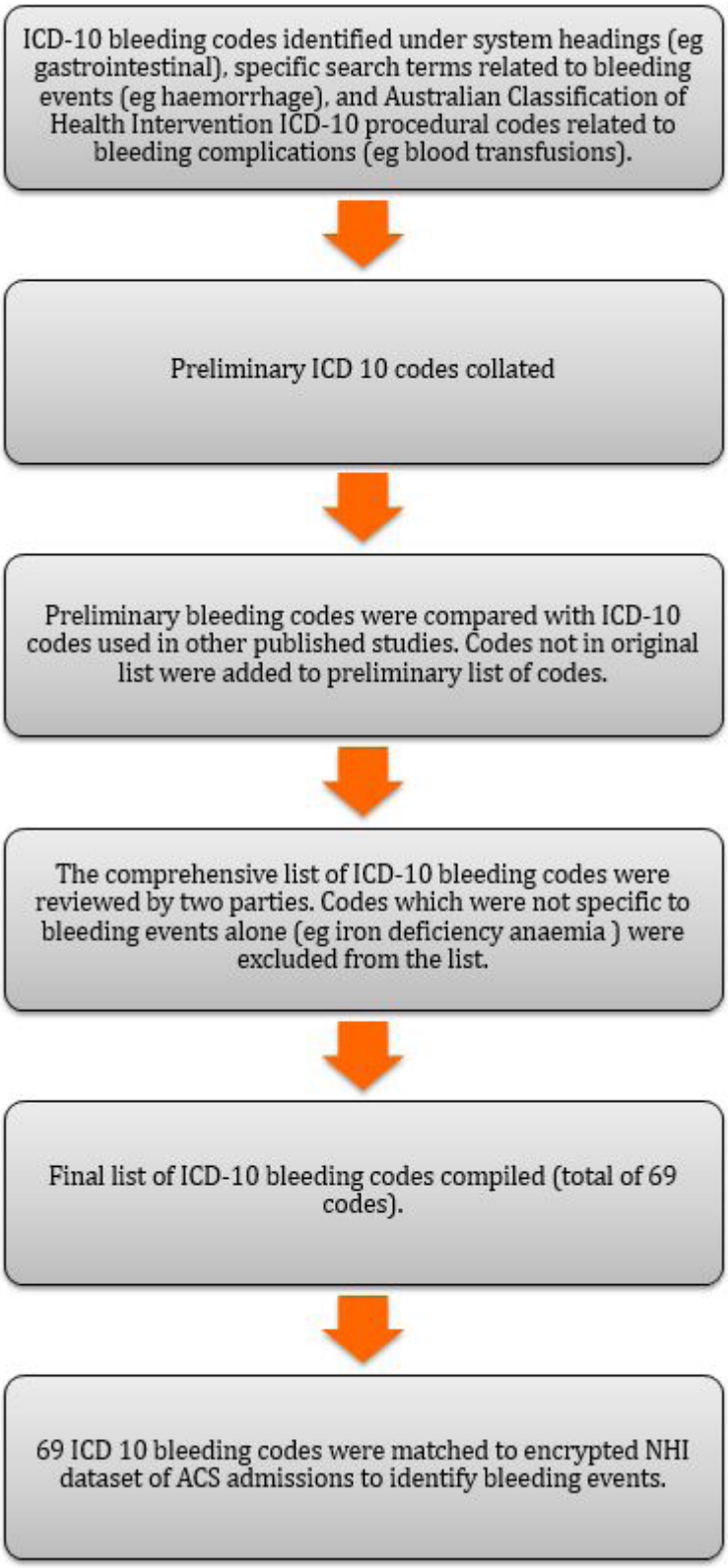
A total of 69 ICD-10 bleeding codes were selected for this study. (Appendix 1)

The encrypted linkage to national mortality and hospitalisation data sets was then used to identify patients with ICD-10 bleeding codes at the index ACS admission and after discharge. These codes were divided into bleeding sub-types: procedure related (PCI or CABG); gastrointestinal; respiratory; intra-cranial; intra-ocular; urogenital; and other. Bleeds were also divided into those associated with a fatal or a non-fatal outcome. A fatal bleeding-related outcome was any death within 28 days of admission in a patient with at least one bleeding code for that admission. Those patients with multiple bleeding codes during their index and or in subsequent hospital admissions were individually adjudicated. In these cases, the bleeding codes were prioritised and only the most serious one was reported. The prioritisation hierarchy was as follows: fatal bleed; intracerebral bleed; bleed requiring transfusion; gastrointestinal bleed; and other cause. Transfusion was only counted as a complication if it was paired with a bleeding event code.

Statistical analysis

Descriptive statistics for continuous variables were summarised as mean with

Figure 1: Process followed to derive the final set of bleeding codes.



standard deviation, and median with interquartile range. Categorical data were reported by frequency and percentage. For continuous variables, comparisons between groups were performed by the non-parametric Mann-Whitney U test due to all data being non-normally distributed. For categorical variables, the Chi-squared test or Fisher's exact test were used where appropriate. All p-values reported were two-tailed. A p-value <0.05 was considered significant. Data was analysed using SAS statistical package, version 9.4 (SAS Institute, Cary, NC).

Table 1: Cohort demographics and risk factors.

Variables	All (n=3,666)
Age (years)	
Mean ± SD	63.7 ± 13.1
Gender, n (%)	
Males	2,512 (68.5)
Females	1,154 (31.5)
Ethnicity, n (%)	
Māori	367 (10.0)
Pacific	422 (11.5)
Indian	298 (8.1)
Other Asian	80 (2.2)
European / Other	2,499 (68.2)
Current smoker, n (%)	554 (27.6)
Diabetes, n (%)	532 (26.5)
BMI	
n	1,840
Median (IQR)	28.44 (15.11–32.60)
Fasting LDL*	
n	2,011
Mean ± SD	2.7 ± 1.1
Previous CVD, n (%)	1,495 (40.8)
Previous MI, n (%)	865 (23.6)
Previous heart failure	348 (9.5)
Previous bleeding	342 (9.3)
Type of ACS, n (%)	
USA	663 (18.0)
NSTEMI	2,205 (60.2)
STEMI	798 (21.8)
Creatinine on admission	
n	3,666
Median (IQR)	89 (75–106)
Range	23–1,660
Haemoglobin (g/L)	
n	2,748
Mean ± SD	138.3 ± 18.1
WCC (x 109)	
n	3,170
Mean ± SD	9.16 ± 3.47

*Denominator = patients with complete CVDDM Predict records (n=2,011 for total, 82 for those who had bleeding and 1,929 for those who had no bleeding). CVDDM = cardiovascular disease and diabetes mellitus, LDL = low density lipoprotein, MI = myocardial infarction, USA = unstable angina, NSTEMI = non ST-elevation MI, STEMI = ST-elevation MI, WCC = white cell count

Table 2: Investigation and management.

Variables	All (n=3,666)
Heparin / Clexane, n (%)	2,689 (73.4)
GPIIbIIIa, n (%)	96 (2.6)
Angiogram, n (%)	2,729 (74.4)
PCI this admission, n (%)	1,546 (42.2)
Referral for CABG, n (%)	
Inpatient	350 (9.6)
Outpatient	92 (2.1)
None	3,224 (87.9)
Treatment at discharge alive, n (%)	
n=3,596	
Aspirin	3,520 (97.9)
Clopidogrel	2,498 (69.5)
ACE inhibitors or ARBs	2,366 (65.8)
Beta blockers	3,064 (85.3)
Statin	3,400 (94.6)

GPIIbIIIa = glycoprotein IIbIIIa, PCI = percutaneous coronary intervention, CABG = coronary artery bypass grafting

Results

Patient population and follow-up

3,666 ACS patients (2,210 from Middlemore Hospital, 1,459 from Waikato and Taranaki Base Hospitals) were identified from the ANZACS-QI registry between the years of 2007 and 2010. The mean follow-up was 1.94 years.

Demographics and clinical characteristics of patients in the ANZACS-QI registry are shown in Table 1.

In-hospital management and medications on discharge of patients in the ANZACS-QI registry are shown in Table 2.

Incidence of bleeding events and blood transfusions (Tables 3 and 4)

There were 399 (10.8%) out of 3,666 patients who had at least one bleeding event during a mean follow-up of 1.94 years. Of these, 161 (4.4%) patients bled during their index ACS admission and 271 patients (7.4%) were re-hospitalised with at least one bleeding event. Of these 271 patients, 33 patients (12.2%) had a bleeding event during their index ACS admission. The majority (n=206) had just one re-admission for a bleeding event, 51 patients had two subsequent admissions, and 14 patients had three or more admissions for bleeding events. There were 12 bleeding-related deaths at the index admission, and 51 on subsequent first readmissions.

Table 3: Types of bleeding at the index ACS admission.

Bleeding events	**Index admission**			
	Overall (n=161)	**Death = No (n=149)**	**Death = Yes (n=12)**	**Transfusion (n=61)**
Procedural n *Inpatient CABG* *PCI* *No PCI/CABG*	79 (49.1%) *28/79 (35.4%)* *44/79 (55.7%)* *7/79 (8.9%)*	77 (51.7%) *26/77 (33.8%)* *44/77 (57.1%)* *7/77 (9.1%)*	2 (16.7%) *2/2 (100%)* *0 (0%)* *0 (0%)*	34 (55.7%) *26/34 (76.5%)* *5/34 (14.7%)* *3/34 (8.8%)*
Gastrointestinal	25 (15.5%)	23 (15.4%)	2 (16.7%)	11 (18.0%)
Respiratory	19 (11.8%)	17 (11.4%)	2 (16.7%)	7 (11.5%)
Intracranial	10 (6.2%)	7 (4.7%)	3 (25.0%)	2 (3.3%)
Intraocular	5 (3.1%)	5 (3.4%)	0 (0%)	0 (0%)
Urogenital	18 (11.2%)	16 (10.7%)	2 (16.7%)	5 (8.2%)
Others	5 (3.1%)	4 (2.7%)	1 (8.3%)	2 (3.3%)

PCI = Percutaneous coronary intervention. CABG = Coronary Artery Bypass Grafts. Others = ICD-10 Codes R58 "Haemorrhage, not elsewhere classified", M25.06 "Haemarthrosis, lower leg" and K66.1 "Haemoperitoneum".

Table 4: Types of bleeding after index ACS admission.

Bleeding events	**First re-admission with associated bleeding n=271**			
	Overall (n=271)	**Death = No (n=220)**	**Death = Yes (n=51)**	**Transfusion (n=59)**
Procedural *n* *CABG*	54 (19.9%) *6/54 (11.1%)*	49 (22.3%) *5/49 (10.2%)*	5 (9.8%) *1/5 (20.0%)*	11 (18.6%) *1/11 (9.1%)*
Gastrointestinal	128 (47.2%)	100 (45.5%)	28 (54.9%)	40 (67.8%)
Respiratory	32 (11.8%)	25 (11.4%)	7 (13.7%)	4 (6.8%)
Intracranial	15 (5.5%)	11 (5.0%)	4 (7.8%)	1 (1.7%)
Intraocular	7 (2.6%)	6 (2.7%)	1 (2.0%)	1 (1.7%)
Urogenital	28 (10.3%)	23 (10.5%)	5 (9.8%)	1 (1.7%)
Others	7 (2.6%)	6 (2.7%)	1 (2.0%)	1 (1.7%)

Others = ICD 10 Codes R58 "Haemorrhage, not elsewhere classified", M25.06 "Haemarthrosis, lower leg" and K66.1 "Haemoperitoneum".

The rates of blood transfusion were higher in the group who bled during their index admission than those who bled during their subsequent admissions (37.9% vs 21.8%). This was largely accounted for by blood transfusions required for CABG and, to a lesser extent, PCI-related bleeding. Most procedures (PCI or CABG) occurred during the index admission.

Types of bleeding events (Tables 3 and 4)

The most common bleeding event during the index ACS admission was procedure related (49.1%), followed by gastrointestinal bleeding (15.5%). The reverse was seen in subsequent admissions, with gastrointestinal bleeding making up 47.2% of the bleeding events. The occurrence of respiratory, intra-cranial, intra-ocular, urogenital and other types of bleeding were similar for both index and subsequent admissions.

Discussion

In this study, we were able to describe the incidence and types of bleeding events in New Zealand ACS patients using a set of

ICD-10 bleeding codes. This study demonstrates that bleeding events in the ACS population are common, with approximately one in ten patients having a bleeding event during a mean follow-up of 1.94 years. Only 40% of the first bleeding events occurred during the index ACS admission. Transfusions were required in just over a third of those who bled during their index admission, predominantly CABG related, and in approximately a fifth of patients who bled during a subsequent admission. The most common types of bleeding events during the index ACS admission were procedure related, followed by gastrointestinal bleeding. In contrast, gastrointestinal bleeding was the most common in subsequent readmissions.

Methodological issues in identification of bleeding events and severity

Several studies have used ICD codes to define bleeding in atrial fibrillation[12,15] and PCI cohorts.[13,16] There are also prior studies using this methodology in a large cohort of ACS patients, the largest being the Danish registry studies.[9,12] There was substantial concordance between our ICD-10 bleeding codes with the two Danish studies of Sørensen et al[9] and Lamberts.[12] However, in the Danish studies, codes for intraocular and musculoskeletal bleeding were not included. Conversely, Sørensen et al[9] included the ICD-10 code for haemothorax (J94.2), which we excluded as we did not wish to include patients coded for a haemothorax from causes such as infection or malignancy. Additionally, both the Sørensen[9] and Lamberts[12] studies included codes for anaemia, whereas we excluded these codes as we were concerned that anaemia from a chronic bleed might predate the ACS event. To our knowledge, ours is the first study to outline the process in which the ICD-10 list of bleeding events was collated in the ACS population.

The incidence of 'severe' or 'major' bleeding in the context of ACS and PCI reported in prior studies range between approximately one and ten percent.[17] Comparison between studies is difficult due to a number of methodological variables. These include cohort differences, in particular registry compared with clinical trial populations, and variation in follow-up time (eg, in-hospital versus longer-term events). The bleeding definitions used have also varied widely, ranging across several clinical trial or registry and administrative dataset derived bleeding definitions.[6,9]

Clinical trial and registry bleeding definitions

The two most commonly used clinical trial bleeding definitions in ACS registries and randomised trials are the TIMI and GUSTO definitions.[7,8] These definitions were developed in the era of fibrinolysis. The TIMI and GUSTO definitions for major bleeding are well defined. However, there is only a modest concordance in grading bleeding severity between the definitions. They are also insensitive for more minor, but potentially clinically significant, bleeding and so may underestimate the true incidence of bleeding. The Bleeding Academic Research Consortium (BARC), taking into account the strengths and weaknesses of the prior bleeding definitions, recently proposed standardised definitions for bleeding end-points for use in cardiovascular clinical trials with the aim of improving uniformity in adjudicating the clinical impact of bleeding.[6] These various bleeding definitions vary in the way they record bleeding cause (eg, procedure versus non procedural related), bleeding site and severity of bleeding. Assessment of bleeding severity in these definitions also includes a combination of clinical and laboratory criteria.

Comparison of ICD-10 bleeding definition with BARC criteria

The BARC investigators identified several challenges in developing a bleeding definition, including a requirement to capture information regarding cause, site and severity of bleeding, correlation with prognosis and standardisation of the definition. They also emphasised the need for it to be practical and easy to use.

In the current study we have developed and explored the use of an ICD-10 bleeding code set as an alternative approach to using clinical trial definitions. This method has advantages and disadvantages compared with using the clinical trial derived definitions. The most important advantages relate

to these codes being routinely recorded by hospital clinical coders for all hospital admissions in New Zealand using standardised ICD-10 definitions from 2001 on. The use of ICD-10 bleeding codes have been validated against clinical records both locally[14] and internationally.[9] This means that bleeding events can be identified even in cohorts where the data needed for a specific bleeding definition (eg, BARC) is not available. It potentially facilitates the comparison of bleeding event trends both over time and between different geographical regions.

Using ICD-10 coding we are able to identify bleeding cause, for example bleeding related to CABG or PCI is captured by a specific ICD-10 code. However, this definition of procedure-related bleeding would not be as precise as the BARC definition, which requires the volume of transfusion received and chest drain loss.

The site of bleeding is also identified using ICD-10 codes and usefully divided into subtypes. The BARC definition separates out CABG and intra-cerebral/intraocular bleeding from other bleeding sites, but does not otherwise divide bleeding sites further.

Using ICD-10 codes, the severity of bleeding can be assessed by classifying into fatal versus non-fatal, intracerebral versus other, and transfusion requiring bleeding events. It is, however, not possible to identify the number of units transfused, or a drop in haemoglobin, which are included in the BARC criteria. The BARC criteria divide more minor bleeding according to whether medical intervention was required. This is not possible using the ICD-10 coding approach. While there is good evidence[17,18] that more severe TIMI and GUSTO bleeding portend a worse prognosis, a similar analysis has not been performed using an ICD derived definition of severity.

Other limitations of the ICD coding bleeding definition is that it is dependent on patients being hospitalised or dying for event ascertainment. Any more minor bleed in the community not requiring hospitalisation would be missed. A related issue is that it is not always possible to tell whether a bleeding-related admission was due to the bleeding event, or whether the bleed was an incidental problem. Use of primary versus secondary codes may be useful to distinguish these.

Incidence of bleeding

In this study, 10.8% of patients had a bleeding event during their index ACS or subsequent admissions to hospital, with 40% having their first bleed at the index admission and the remainder on a subsequent readmission. As discussed above, it is difficult to compare this figure with other studies due to methodological differences.

As a local comparison, this figure (4.4% index admission bleeding) is lower than the Dunedin group who reported TIMI bleeding in 10.5% of a 2005 ACS sub-group of non-ST elevation ACS (NSTEACS) patients exposed to enoxaparin, which excluded CABG-related bleeding.[14] In the 2005 Danish cohort[9] using a similar ICD-10 bleeding code set, the incidence of bleeding post-discharge was 4.6% in a mean follow-up period of 18 months. This compares with 7.4% post-discharge bleeding in nearly 2 years in our cohort. They did not, however, report index admission bleeding rates.

Types of bleeding

Procedure-related bleeding accounted for the majority of index admission bleeding (49%). As expected, an important proportion of the procedural bleeding events were related to CABG (35%). In some prior studies, CABG-related bleeding was excluded. Our rationale for including it was that CABG-related bleeding is common—10% of our ACS cohort underwent in-patient CABG, and 20% of the total index admission bleeds occurred in these patients. The mechanism and clinical implications of CABG-related bleeding may be different from those with non-procedural causes and depending on the research question, it may be appropriate to either include or exclude these patients.

In subsequent admissions, the most common type of bleeding was gastrointestinal bleeding (47% of readmissions). This is likely to reflect the association between long-term exposure to anti-platelet agents, and the development of gastrointestinal ulceration. Similar to our study, Ko et al also found that gastrointestinal bleeding was the most common cause for late bleeding post discharge after percutaneous coronary

intervention (56% of bleeders).[13] The higher incidence in Ko's study compared to our study may have related to the older population studied (age >65 years).

Strengths and limitations

There were several limitations in this study. As previously described, this study involved the retrospective extraction of data from a registry that was then linked to national routine health datasets, so it has the inherent limitations of such datasets. Some patients had more than one bleeding event per admission and it was necessary to prioritise severity. Furthermore, several codes appeared to code for the same bleeding event within an admission. As only one bleeding event per admission was counted, this did not affect our incidence data. However, it is possible we might have underestimated the incidence of bleeding events when more than one separate event occurred during an admission. The timing of bleeding events during a patient's admission could also be helpful in improving our understanding of those who bleed and the precipitants of bleeding. Due to the reliance on encrypted datasets, the timing of bleeding events could not be determined. For example, it was not possible to determine whether a gastrointestinal bleed occurred before or after an intervention. Furthermore, our analysis did not differentiate between a bleeding event being the primary or secondary cause for readmission.

Future directions

Further analysis on the incidence of bleeding and types of bleeding is required to reflect more current practices. This dataset includes patients between the years of 2007 and 2010. Since this time, there has been a greater move towards a radial approach to angiography, which has been associated with fewer bleeding complications than femoral access.[20,21] Additionally, the use of newer and more potent antiplatelet agents, such as ticagrelor, and novel oral anti-coagulation, may influence the incidence and types of bleeding seen in the ACS population.

Understanding the incidence and types of bleeding is only the first step in understanding those vulnerable to this complication of treatment. Our next step is to develop a multivariate bleeding risk score relevant to the real world population of ACS patients.

Conclusions

One in ten ACS patients in this New Zealand cohort experienced a significant bleeding event within 2 years. Using an ICD code-based approach to identifying bleeding events within national ACS cohorts will enable the study of bleeding event incidence and type over time, facilitate comparison between geographic regions both nationally and internationally, and allow us to assess the impact of changes in anti-thrombotic therapy and interventional practice on bleeding rates.

Appendix

System	ICD 10 AM	Description
Gastrointestinal	1850	Oesophageal varices with bleeding
	K226	Gastro-oesophageal laceration-haemorrhage syndrome (Mallory-Weiss syndrome)
	K250	Gastric ulcer, acute with haemorrhage
	K252	Gastric ulcer, acute with both haemorrhage and perforation
	K254	Gastric ulcer, chronic or unspecified with haemorrhage
	K256	Gastric ulcer, chronic or unspecified with both haemorrhage and perforation
	K260	Duodenal ulcer, acute with haemorrhage
	K262	Duodenal ulcer, acute with both haemorrhage and perforation
	K264	Duodenal ulcer, chronic or unspecified with haemorrhage
	K266	Duodenal ulcer, chronic or unspecified with both haemorrhage and perforation
	K270	Peptic ulcer, acute with haemorrhage
	K272	Peptic ulcer, acute with both haemorrhage and perforation
	K274	Peptic ulcer, chronic or unspecified with haemorrhage
	K276	Peptic ulcer, chronic or unspecified with both haemorrhage and perforation
	K280	Gastrojeju nal ulcer, acute with haemorrhage
	K282	Gastrojejunal ulcer, acute with both haemorrhage and perforation
	K284	Gastrojeju nal ulcer, chronic or unspecified with haemorrhage
	K286	Gastrojeju nal ulcer, chronic or unspecified with both haemorrhage and perforation
	K290	Acute haemorrhagic gastritis
	K625	Haemorrhage of anus and rectum
	K661	Haemoperitoneum
	K920	Haematemesis
	K921	Melaena
	K922	Gastrointestinal haemorrhage, unspecified
lntraocular	H356	Retinal haemorrhage
	H431	Vitreous haemorrhage
lntracranial	1600	Subarachnoid haemorrhage from carotid siphon and bifurcation
	1601	Subarachnoid haemorrhage from middle cerebral artery
	1602	Subarachnoid haemorrhage from anterior communicating artery
	1603	Subarachnoid haemorrhage from posterior communicating artery
	1604	Subarachnoid haemorrhage from basilar artery
	1605	Subarachnoid haemorrhage from vertebral artery
	1606	Subarachnoid haemorrhage from other intracranial arteries
	1607	Subarachnoid haemorrhage from intracranial artery, unspecified
	1608	Other subarachnoid haemorrhage
	1609	Subarachnoid haemorrhage, unspecified
	1610	Intracerebral haemorrhage in hemisphere, subcortical
	1611	Intracerebral haemorrhage in hemisphere, cortical
	1612	Intracerebral haemorrhage in hemisphere, unspecified
	1613	Intracerebral haemorrhage in brain stem
	1614	Intracerebral haemorrhage in cerebellum
	1615	Intracerebral haemorrhage, intraventricular
	1616	Intracerebral haemorrhage, multiple localised
	1618	Other intracerebral haemorrhage
	1619	Intracerebral haemorrhage, unspecified

Intracranial (cont)	1620	Subdural haemorrhage (acute)(nontraumatic)
	1621	Nontraumatic extradural haemorrhage
	1629	Intracranial haemorrhage (nontraumatic), unspecified
	S064	Epidural haemorrhage
	S065	Traumatic subdural haemorrhage
	S066	Traumatic subarachnoid haemorrhage
Respiratory	R040	Epistaxis
	R041	Haemorrhage from throat
	R042	Haemoptysis
	R048	Haemorrhage from other sitesin respiratory passages
	R049	Haemorrhage from re.spiratory passages, unspecified
Urogenital	R31	Unspecified haematuria
Procedural	T810	Haemorrhage and haematoma complicating a procedure, not elsewhere classified
Haematology (Others)	RS8	Haemorrhage, not elsewhere classified
Musculoskeletal (Others)	M2500	Haemarthrosis, multiple sites
	M2501	Haemarthrosis, shoulder region
	M2502	Haemarthrosis, upper arm
	M2503	Haemarthrosis, forearm
	M2504	Haemarthrosis, hand
	M2505	Haemarthrosis, pelvic region and thigh
	M2506	Haemarthrosis, lower leg
	M2507	Haemarthrosis, ankle and foot
	M2508	Haemarthrosis, other site
	M2509	Haemarthrosis, siteunspecified

Competing interests:
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