

Validity of vascular trauma codes at major trauma centres

Abdulmajeed Altoijry, MD^{*‡}
 Mohammed Al-Omran, MD, MSc^{*‡}
 Thomas F. Lindsay, MDCM, MSc[†]
 K. Wayne Johnston, MD[†]
 Magda Melo, BScPharm, MSc^{*}
 Muhammad Mamdani, PharmD,
 MA, MPH^{*}

From the ^{*}Li Ka Shing Knowledge Institute, St. Michael's Hospital, University of Toronto, Toronto, Ont., [†]Division of Vascular Surgery, Toronto General Hospital, University of Toronto, Toronto, Ont., [‡]Division of Vascular Surgery, Department of Surgery, King Saud University, Riyadh, Saudi Arabia

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Correspondence to:

A. Altoijry
 Li Ka Shing Knowledge Institute
 St. Michael's Hospital
 30 Bond St.
 Toronto ON M5B 1W8
 altoijrya@smh.ca

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Background: The use of administrative databases in vascular injury research has been increasing, but the validity of the diagnosis codes used in this research is uncertain. We assessed the positive predictive value (PPV) of International Classification of Diseases, tenth revision (ICD-10), vascular injury codes in administrative claims data in Ontario.

Methods: We conducted a retrospective validation study using the Canadian Institute for Health Information Discharge Abstract Database, an administrative database that records all hospital admissions in Canada. We evaluated 380 randomly selected hospital discharge abstracts from the 2 main trauma centres in Toronto, Ont., St. Michael's Hospital and Sunnybrook Health Sciences Centre, between Apr. 1, 2002, and Mar. 31, 2010. We then compared these records with the corresponding patients' hospital charts to assess the level of agreement for procedure coding. We calculated the PPV and sensitivity to estimate the validity of vascular injury diagnosis coding.

Results: The overall PPV for vascular injury coding was estimated to be 95% (95% confidence interval [CI] 92.3–96.8). The PPV among code groups for neck, thorax, abdomen, upper extremity and lower extremity injuries ranged from 90.8 (95% CI 82.2–95.5) to 97.4 (95% CI 91.0–99.3), whereas sensitivity ranged from 90% (95% CI 81.5–94.8) to 98.7% (95% CI 92.9–99.8).

Conclusion: Administrative claims hospital discharge data based on ICD-10 diagnosis codes have a high level of validity when identifying cases of vascular injury.

Level of evidence: Observational Study Level III.

Contexte : L'utilisation des bases de données administratives pour la recherche sur les lésions vasculaires est en hausse, mais la validité des codes diagnostiques utilisés dans ces recherches est incertaine. Nous avons évalué la valeur prédictive positive (VPP) des codes de lésions vasculaires de la dixième édition de la Classification internationale des maladies (CIM-10) qui figurent dans une base de données administrative ontarienne.

Méthodes : Nous avons réalisé une étude de validation rétrospective à partir de la base de données de l'Institut canadien d'information sur la santé (ICIS) sur les congés des patients, une base de données administrative qui enregistre toutes les hospitalisations au Canada. Nous avons évalué 380 congés hospitaliers de 2 grands centres de traumatologie de Toronto, en Ontario, soit l'Hôpital St. Michael's et le Centre des sciences de la santé Sunnybrook, entre le 1er avril 2002 et le 31 mars 2010. Nous avons ensuite comparé ces dossiers aux dossiers hospitaliers des patients correspondants pour vérifier la concordance des codes attribués aux interventions. Nous avons calculé la VPP et la sensibilité pour estimer la validité des codes diagnostiques appliqués aux lésions vasculaires.

Résultats : La VPP globale pour les codes de lésions vasculaires a été estimée à 95 % (intervalle de confiance [IC] de 95 % 92,3–96,8). Parmi les groupes de codes attribués aux lésions affectant le cou, le thorax, l'abdomen, les membres supérieurs et inférieurs, la VPP a varié de 90,8 (IC de 95 % 82,2–95,5) à 97,4 (IC de 95 % 91,0–99,3), tandis que la sensibilité a varié de 90 % (IC de 95 % 81,5–94,8) à 98,7 % (IC de 95 % 92,9–99,8).

Conclusion : Les données administratives sur les congés hospitaliers basées sur les codes diagnostiques de la CIM 10 ont un degré de validité élevé pour ce qui est des lésions vasculaires.

Niveau de preuve : Étude d'observation Niveau III.

Administrative claims databases are an important source of data for epidemiological research. These databases are often large and contain information on patient hospital admissions, emergency department visits, clinic visits and medication use. With respect to diagnostic information in these databases, the International Classification of Diseases (ICD) is the international standard commonly used to classify diagnoses.

Given their growing use in health research, much attention has been given to the validity of diagnostic coding in these databases. The validity of numerous clinical diagnoses, complications and procedures in administrative databases has been assessed.¹⁻⁶

While high levels of agreement are often found with specific surgical procedure codes, diagnosis codes (both primary and secondary) vary in completeness and accuracy.^{7,8} The use of administrative databases in vascular injury research has been increasing, but the validity of the diagnosis codes used in this research is uncertain. Our primary objective for this study was to assess the positive predictive value (PPV) of vascular injury coding in administrative claims data in the province of Ontario.

METHODS

We conducted a retrospective validation study using the Canadian Institute for Health Information Discharge Abstract Database (DAD), an administrative database that records all hospital admissions in Canada. We assessed 380 randomly selected hospital discharge abstracts from the 2 main trauma centres in Toronto, Ont., St. Michael's Hospital and Sunnybrook Health Sciences Centre, between Apr. 1, 2002, and Mar. 31, 2010. These charts were randomly selected from a pool of patients with codes for vascular injuries. Both hospitals used ICD-10 codes during the study period. Health record coders in each of the 2 centres, as in other hospitals, routinely read through the patients' medical charts to code up to 16 diagnoses; these data were then transmitted to the DAD.

We compared the DAD records with the corresponding patient charts from the 2 centres to assess the level of agreement for procedure coding. Hospital charts were located using the patient chart number, month and year of birth, and dates of admission and discharge captured in the administrative data records. For validation, we used 8 vascular injury codes collapsed into 5 categories according to the injured body region (Table 1). The manner in which records were selected ensured even distribution of records based on the injured body region. A clinically trained reviewer (A.A.) blinded to the hospitals' original diagnosis coding reviewed the charts and examined the discharge summary, physician notes, operation notes and radiology reports. The reviewer used clinical definitions and guidelines from the ICD-10 coding manual to record the presence of relevant injuries for each chart.⁹ Chart confirmation of vascular injury was considered the gold standard

Table 1. Vascular trauma codes (ICD-10)

Code	Description
S15	Injury of the neck vessels
S25	Injury of thoracic vessels
S35	Injury of abdominal and pelvic vessels
S45, S55 or S65	Injury of upper limb vessels
S75, S85	Injury of lower limb vessels
ICD-10 = International Classification of Diseases, tenth revision.	

reference. The reviewer abstracted the vascular injuries and assigned them according to the body region. Vascular injuries for each group or body region (e.g., neck S15) include any venous (e.g., jugular) or arterial (e.g., carotid) injuries, regardless of the physiologic value of the vessel (e.g., internal or external jugular) or the mechanism of injury (e.g., penetrating or blunt).

We calculated the PPV and sensitivity to describe the validity of the vascular injury diagnosis coding. We defined PPV as the proportion of any diagnostic code for vascular injury in the DAD that matched the corresponding vascular injury recorded in the patient's chart.¹⁰ An overall PPV and PPVs for each injured body region were calculated. Sensitivity within each group was defined as the proportion of vascular injury diagnoses recorded in the patients' charts having a positive DAD recording within the same group.¹⁰

This study was approved by the research ethics boards of both St. Michael's Hospital and Sunnybrook Health Sciences Centre.

RESULTS

We selected 190 records from each centre. Of the charts from St. Michael's Hospital, we reviewed 189; the remaining chart was missing. The diagnoses listed in 174 of these charts matched those in the administrative data, whereas the diagnoses listed in the other 15 charts were for other vascular injuries (different codes within the administrative data). All 190 charts from Sunnybrook Health Sciences Centre were reviewed. The diagnoses listed in 186 of these charts matched those in the administrative data. The diagnoses listed in 3 charts were for other vascular injuries, and 1 patient chart suggested no evidence of vascular injury (Fig. 1). Using chart review as the gold standard, the overall PPV for the entire study sample was 95% (95% confidence interval [CI] 92.3-96.8; Table 2) and ranged from 90.8% to 97.4% for individual code groups. Sensitivity ranged from 90.0% to 98.7% for individual code groups (Table 2).

DISCUSSION

Given the importance of administrative databases as a source of data for epidemiological, prospective and evidence-based medicine studies, examining the validity of diagnostic codes

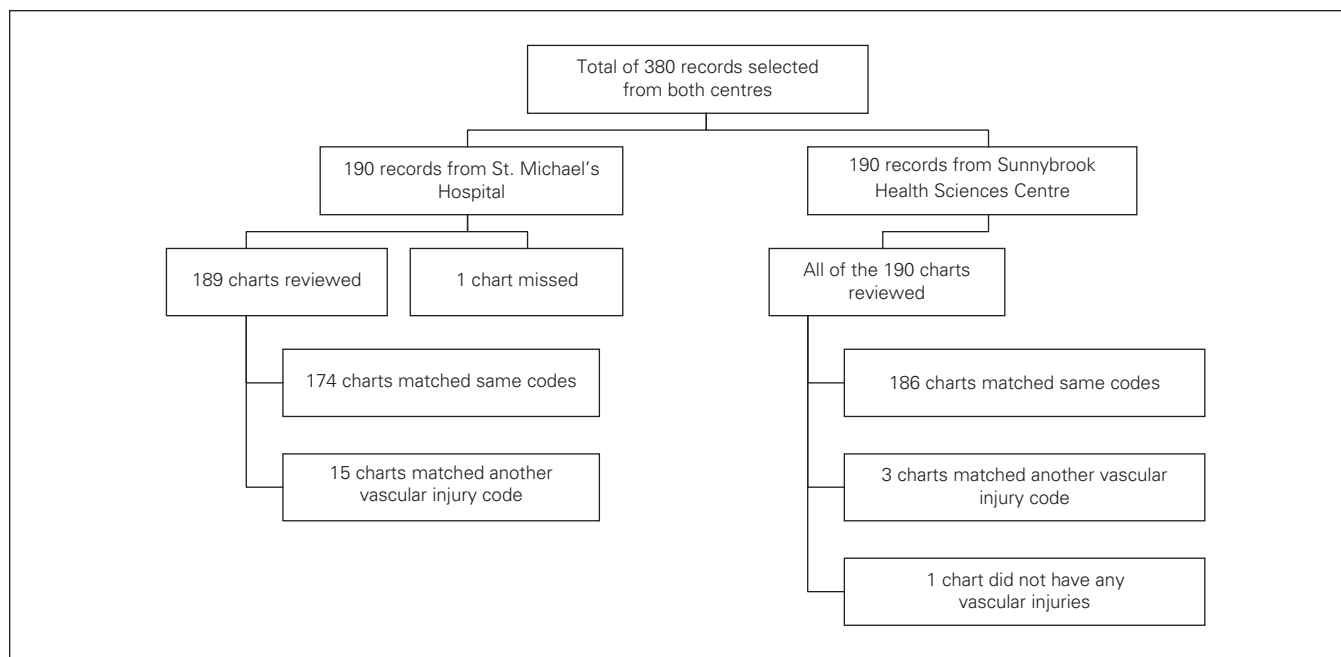


Fig. 1. Records selection and chart review.

Table 2. Positive predictive value and sensitivity of vascular injury diagnosis coding, by anatomical region

Region	PPV		Sensitivity	
	%	95% CI*	%	95% CI*
All	95.0	92.3–96.8		
Neck	97.4	91.0–99.3	98.7	92.9–99.8
Thorax	90.8	82.2–95.5	94.5	86.7–97.8
Abdomen	96.0	88.9–98.6	90.0	81.5–94.8
Upper extremity	97.3	90.8–99.3	97.3	90.8–99.3
Lower extremity	93.4	85.5–97.2	95.9	88.7–98.6

CI = confidence interval; PPV = positive predictive value.
*Calculated according to Centre for Evidence-based Medicine Toronto, Stat Calculator.¹¹

in administrative databases highlights how the accuracy of these codes is important and has a significant effect on the study results.

To our knowledge, our study is the first to assess the validity of diagnosis (ICD-10) codes for vascular injury in administrative claims data. Our findings suggest an overall PPV of 95% (95% CI 92.3–96.8) and a sensitivity ranging from 90.0% to 98.7% for individual code groups.

Limitations

Our study was limited to only 2 trauma centres in Toronto, Ont., which may limit the generalizability of our findings. In addition, vascular injury subcodes, which differentiate between arterial and venous injuries and among anatomic regions, were not identified in this validation study.

CONCLUSION

Despite its limitations, our study suggests that administrative claims hospital discharge data have a high level of validity when identifying cases of vascular injury. Given that our results showed such a high level of accuracy, we anticipate that the number of vascular injury cases we may have missed by using those 8 major vascular trauma ICD-10 codes would be low. As such, usage of a particular database becomes further feasible and valuable, even for advanced retrospective vascular injury studies.

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Competing interests: None declared.

Contributors: A. Altojiry, M. Melo and M. Mamdani designed the study. A. Altojiry and M. Melo acquired the data, which A. Altojiry, M. Al-Omran, T.F. Lindsay, K.W. Johnston and M. Mamdani analyzed. A. Altojiry wrote the article, which all authors reviewed and approved for publication.

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