

# Utility of the Vascular Quality Initiative in improving quality of care in Canadian patients undergoing vascular surgery

Elizabeth Liao, BSc  
 Naomi Eisenberg, PT, MEd  
 Anish Kaushal, BSc  
 Janice Montbriand, PhD  
 Kong-Teng Tan, MD  
 Graham Roche-Nagle, MD, MBA

Accepted Apr. 16, 2018; Early-released  
 Dec. 1, 2018

## Correspondence to:

G. Roche-Nagle  
 Division of Vascular Surgery  
 Eaton North 6-218  
 Toronto General Hospital  
 200 Elizabeth St  
 Toronto ON M5G 2C4  
 graham.roche-nagle@uhn.ca

DOI: 10.1503/cjs.002218

The Vascular Quality Initiative (VQI) is a national cooperative quality-improvement initiative designed to evaluate processes of care and outcomes in vascular surgery. The purpose of this report is to show the utility of such a database to provide insight into the standard of care provided, to highlight areas of local quality improvement, to benchmark our data against local, regional and national trends, and to ultimately improve safety in Canadian patients undergoing vascular surgery. We present the history of the database, its spread in the Canadian health care system and examples of quality improvements achieved from analyses of data recorded and retrieved from the VQI. Using the VQI, our institution was able to decrease the length of stay after endovascular aneurysm repair, decrease the contrast volume in endovascular aneurysm repair, save on costs, and provide medium-term outcome data on peripheral vascular interventions and smoking cessation strategies. The VQI is a powerful tool to improve patient safety and quality in vascular surgery. Its ability to create local regional improvement groups fosters a quality-focused culture and is important for Canadian patients.

La Vascular Quality Initiative (VQI) est une initiative de collaboration nationale axée sur l'amélioration de la qualité, conçue pour évaluer les processus de soins et les résultats en chirurgie vasculaire. Le but du présent rapport est de montrer l'utilité d'une telle base de données pour situer les normes de soins actuelles, mettre en lumière les secteurs d'amélioration de la qualité locale, évaluer nos données à la lumière des tendances locales, régionales et nationales et ultimement, améliorer la sécurité des patients canadiens de chirurgie vasculaire. Nous retraçons l'historique de cette base de données, son adoption par le système de santé canadien et donnons des exemples d'améliorations de la qualité obtenues grâce à l'analyse des données enregistrées et récupérées à partir de la base VQI. Cette base de données nous a permis d'abrégier les séjours hospitaliers après la réparation endovasculaire des anévrismes, d'épargner sur les coûts et de compiler les résultats à moyen terme des interventions vasculaires périphériques et des stratégies d'abandon du tabagisme. La VQI est un outil puissant pour améliorer la sécurité des patients et la qualité de la chirurgie vasculaire. Sa capacité de créer des groupes loco-régionaux d'amélioration de la qualité favorise une culture axée sur la qualité et est importante pour les patients canadiens.

In the age of advanced surgical procedures for complex diseases, patient safety and quality improvement are at the forefront of effective patient-centred care. In the United States and Canada, 2 independently maintained quality-improvement databases have emerged as the primary vascular surgery quality-measurement tools with the purpose of evaluating perioperative outcomes and assessing hospital and physician quality: the Society for Vascular Surgery Vascular Quality Initiative (VQI) and the American College of Surgeons National Surgical Quality Improvement Program (NSQIP). The former is a national cooperative quality-improvement initiative designed to evaluate processes of care and outcomes in vascular surgery.<sup>1</sup> It has 100% capture for 11 major vascular surgery procedures. Additional follow-up data are collected 1 year after the procedure. The NSQIP is a national database to collect data from the preoperative period through to 30 days postoperatively. Surgical cases are sampled on the basis of institution program options, with a minimal requirement of cases analyzed annually.<sup>2</sup>

The VQI has grown rapidly in the US since its inception, with over 400 participating centres. Currently, there are 5 centres in Canada registered with the VQI — Grey Nuns Community Hospital, Edmonton, Thunder Bay Regional Health Sciences Centre, Thunder Bay, Ont., Toronto General Hospital and St. Michael's Hospital, Toronto, and the Centre intégré de santé et de services sociaux de l'Outaouais, Gatineau, Que.) — with more in the process of joining (Nova Scotia Health Authority and Centre hospitalier de l'Université de Montréal). The Department of Vascular Surgery at the Toronto General Hospital has employed the VQI since August 2010.

## HISTORY

The Vascular Study Group of New England was founded in 2001 as a voluntary cooperative group of clinicians and hospital administrators whose aim was to continuously improve the quality, safety, effectiveness and cost of caring for patients with vascular disease. The group used aggregated data to recognize patterns of outcomes and their associated causes. Through regular meetings, the group defined processes that affect outcome improvement in numerous areas in vascular surgery and allow individual hospitals and physicians to understand their results in the context of regional benchmarks.<sup>3</sup> Within a decade after the inception of the group, numerous similar regional quality initiatives had been developed as part of what is now a national and international movement sponsored by the Society of Vascular Surgery as the VQI. The VQI continues to expand nationally and internationally. Today there are over 430 participating centres in 46 US states and Canada with more than 3200 physicians of varying specialties. There are 18 regional quality groups, including Canada, which hold semiannual meetings focused on quality improvement.

Currently, the VQI collects data on a variety of vascular procedures ranging from aortic aneurysm repair (open and endovascular), arterial bypass and peripheral vascular interventions for aneurysmal and inclusive disease, lower extremity amputations and cerebrovascular disease, to arteriovenous access, varicose vein surgery and inferior vena cava filter removal. The size and power of the database have enabled it to work on postmarket device evaluation in partnership with the US Food and Drug Administration. There are several active projects, 1 of which involves the use of thoracic endografts following type B aortic dissection.<sup>4</sup>

## HOW HAS OUR INSTITUTION USED THE VASCULAR QUALITY INITIATIVE?

Our institution has been recording data on several commonly performed vascular procedures in the VQI since 2010. These data have been used in our local institution to identify, review and resolve quality issues.

The VQI has developed powerful tools for quality improvement. Two examples are the Center Opportunity Profile for Improvement reports and the Analytics and Reporting Engine. The former, which are prepared by the Society for Vascular Surgery Patient Safety Organization, focus on a specific procedure and present an analysis of variables according to centre, region and VQI as a whole. Centres are presented with tables identifying where the opportunities lie (Appendix 1, available at [canjsurg.ca/002218-a1](http://canjsurg.ca/002218-a1)). Other tools include a free app and online clinical risk calculators (<https://www.qxmd.com/calculate-online/vascular-surgery>). The Analytics and Reporting Engine allows the individual user to generate custom reports in real time for a single procedure or across procedures, depending on the variables selected. Filters can be applied to narrow the population of interest, and reports are produced that can incorporate benchmarking for the centre, region and/or the rest of the VQI. An example of this type of report incorporating all of the VQI is provided in Appendix 1.

We highlight a few procedures studied at our institution and how we leveraged data from the VQI to improve patient safety and quality of services.

### *Shortening length of stay after endovascular aneurysm repair*

The VQI provides risk-adjusted benchmarking expectations. Early on in our institution's experience, a Center Opportunity Profile for Improvement report identified that our group had a longer than expected length of stay following elective endovascular aneurysm repair. Following analysis, we instituted some changes including reduction in opioid and catheter use, early mobilization, and management of patient and family expectations. Within 6 months, our risk-adjusted length of stay had reversed and become statistically significantly shorter than expected. We repeated the study 2 years later and found that, not only had we sustained the change in practice, we were able to save 34 hospital days in the second cohort. The unadjusted average costs declined from \$27 191 to \$26 275, a decrease of 3.4%. These data are easily accessible in real time, unlike most hospital administrative databases, and offer the potential for cost savings.<sup>5</sup>

### *Reducing iodinated contrast volume in endovascular aneurysm repair*

A query of the Analytics and Reporting Engine identified that, on average, our iodinated contrast volume per endovascular aneurysm repair case was higher than for other VQI sites. We reduced contrast volume by diluting it while maintaining the same image quality. This enabled us to match nationally benchmarked contrast volumes.

### *Predicting outcomes and assessing risk of peripheral vascular interventions*

In addition to using analytic functions built into the VQI, users can download raw data from the VQI, combine them and run additional statistics. We wanted to analyze the population undergoing percutaneous transluminal angioplasty to assess risk and identify characteristics that significantly affect outcome. We found that consistent predictors of worse patency outcome were female sex, high Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) classification,<sup>6</sup> prior major amputation, younger age and cigarette smoking.<sup>7</sup> Our outcomes were comparable to those reported in the literature.

### *Smoking cessation rates among patients undergoing vascular surgery*

Smoking is associated with both the development and the progression of occlusive peripheral arterial disease and aneurysmal disease. Although smoking cessation is a key priority in vascular surgical practice, there has been substantial variability in the efficacy of cessation treatment among patients at our institution. The framework of the VQI allows institutions to track the success or failure of targeted interventions. We performed a study to determine the prevalence of smoking and cessation rates among patients undergoing vascular surgery using VQI data.<sup>8</sup> We found a smoking prevalence of 33.5% and a 1-year cessation rate of 41.6%.

## DISCUSSION

The VQI has been shown to be an important tool in quality improvement in the United States and now in Canada.<sup>9,10</sup> It allows real-time benchmarking of individual physicians and centres against local, regional and national trends. The VQI is a powerful tool for vascular surgeons as it was engineered specifically for vascular surgery. It uses self-reported data to capture a continuous data sample on all vascular procedures, since all eligible procedures are entered.

In contrast to the VQI, the NSQIP employs nurse abstractors to record samples of procedures instead of all procedures. Because of the different data collection methods, the 2 registries capture different patient outcomes.<sup>11</sup> When this factor is eliminated by using identical collection periods, differences in variable definition and variable collection result in discordance in postoperative variables and outcomes.<sup>12</sup> The unique continuous data-collection method employed by the VQI and the 1-year follow-up data allow for a more complete review of procedural and long-term-outcome activity at each institution.

A key question for any clinical registry is how to translate information into system change to improve quality.

Many registries gather clinical data and produce comparative reports for distribution among its members. The VQI is unique because it allows the collaboration of centres in regional quality groups. It offers the opportunity of comparing processes and learning from the ideas, successes and techniques of others. There is now a Canada-specific regional quality group meeting twice a year, which allows the comparison of Canadian data, as these can vary substantially from US data and hospital practices.

Institutions participating in the VQI have more patients using appropriate preoperative risk-factor-modifying medications and have better long-term outcomes.<sup>13</sup> Centres registered with the VQI are encouraged to participate in regional quality groups to tackle focused small or large projects. One such group in southern California was able to significantly increase the use of both preoperative statin and antiplatelet use and discharge statin and antiplatelet use in patients with peripheral arterial disease over 3 years.<sup>14</sup> Involvement in the VQI and its regional quality groups increases accountability and, in turn, positively affects patient outcomes. An added benefit of VQI-based quality improvement is the cost savings for institutions, as shown in our experience with length of stay after endovascular aneurysm repair.

Importantly, with the advent of Quality-Based Procedures, using a quality database can assist in identifying centres that use best practices for quality improvement. In Ontario, the Ministry of Health and Long-Term Care has implemented several Quality-Based Procedures programs, with more in development.<sup>15</sup> The VQI has given us the tools to examine and improve quality of care and show this to our local hospital and provincial counterparts. It is expected that future funding will be based on quality results, and VQI will allow centres to focus on quality and show their positive outcomes.

## CONCLUSION

The VQI is a powerful tool to improve patient safety and quality in vascular surgery. It highlights opportunities for quality improvement and allows institutions to deliver patient-centred care while also being economically advantageous. In each of the 4 examples highlighted in this report, we were able to study and improve the quality of vascular procedures performed at our institution by analyzing self-reported VQI data. Identifying shortcomings is an important first step to achieving long-term sustained quality improvement. Understanding the patient population receiving procedures and predictors of outcome is important in preoperative prevention and risk stratification, and in patient selection for procedures. Reflecting on current practices improves future care and surveillance. By participating in the VQI, our institution increases its accountability, develops better practices and improves patient outcomes.

**Affiliations:** From the Faculty of Medicine, University of Toronto, Toronto, Ont. (Liao); the Division of Vascular Surgery, University Health Network, Toronto, Ont. (Eisenberg, Roche-Nagle); the Faculty of Medicine, University of Edinburgh, Edinburgh, Scotland (Kaushal); the Pain Research Unit, Department of Anesthesia and Pain Management, University Health Network (Montbriand); and the Division of Vascular and Interventional Radiology, University Health Network, Toronto, Ont. (Tan, Roche-Nagle).

**Competing interests:** None declared.

**Contributors:** E. Liao, N. Eisenberg, J. Montbriand, K.-T. Tan and G. Roche-Nagle designed the study. E. Liao, N. Eisenberg, A. Kaushal and G. Roche-Nagle acquired the data, which E. Liao, N. Eisenberg, J. Montbriand and G. Roche-Nagle analyzed. E. Liao, N. Eisenberg, J. Montbriand and G. Roche-Nagle wrote the article, which all authors reviewed and approved for publication.

## References

1. Vascular Quality Initiative. Improving vascular care. West Lebanon (NH): Society of Vascular Surgery; 2018. Available: <https://www.vqi.org/> (accessed 2017 Dec. 14).
2. ACS National Surgical Quality Improvement Program. Chicago: American College of Surgeons; 2018. Available: <https://www.facs.org/quality-programs/acs-nsqip> (accessed 2017 Dec. 14).
3. Cronenwett JL, Likosky DS, Russell MT, et al. A regional registry for quality assurance and improvement: the Vascular Study Group of Northern New England (VSGNNE). *J Vasc Surg* 2007;46:1093-101.
4. Beck AW, Lombardi JV, Abel DB, et al. Innovative postmarket device evaluation using a quality registry to monitor thoracic endovascular aortic repair in the treatment of aortic dissection. *J Vasc Surg* 2017;65:1280-6.
5. Eisenberg N, Lindsay T, Oreopoulos G, et al. Quality improvement in elective endovascular aneurysm repair length of stay using risk-adjusted Vascular Quality Initiative comparisons: a local study. *J Vasc Surg* 2016;64:1539.
6. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *J Vasc Surg* 2007;45:S5-67.
7. Liao E, Eisenberg N, Tan KT, et al. Patient profile and peripheral vascular interventions in consecutive patients treated at a single academic center. *J Vasc Surg* 2016;64:1549.
8. McHugh SM, Eisenberg N, Montbriand J, et al. Smoking cessation rates among patients undergoing vascular surgery in a Canadian center. *Ann Vasc Surg* 2017;45:138-43.
9. Scali ST, Runge SJ, Feezor RJ, et al. Outcomes after endovascular aneurysm repair conversion and primary aortic repair for urgent and emergency indications in the Society for Vascular Surgery Vascular Quality Initiative. *J Vasc Surg* 2016;64:338-47.
10. Bertges DJ, Neal D, Schanzer A, et al. The Vascular Quality Initiative Cardiac Risk Index for prediction of myocardial infarction after vascular surgery. *J Vasc Surg* 2016;64:1411-21.
11. Johnston LE, Robinson WP, Tracci MC, et al. Vascular Quality Initiative and National Surgical Quality Improvement Program registries capture different populations and outcomes in open infrainguinal bypass. *J Vasc Surg* 2016;64:629-37.
12. Aiello FA, Shue B, Kini N, et al. Outcomes reported by the Vascular Quality Initiative and the National Surgical Quality Improvement Program are not comparable. *J Vasc Surg* 2014;60:152-9.
13. De Martino RR, Hoel AW, Beck AW, et al. Participation in the Vascular Quality Initiative is associated with improved perioperative medication use, which is associated with longer patient survival. *J Vasc Surg* 2015;61:1010-9.
14. Agha RA, Camm CF, Edison E, et al. Improving compliance with statins in patients with peripheral arterial disease: a quality improvement study. *Ann Med Surg (Lond)* 2012;1:30-3.
15. Ontario Ministry of Health and Long-Term Care. Health system funding reform. Toronto: Queen's Printer for Ontario; 2017. Available: [www.health.gov.on.ca/en/pro/programs/ecfa/funding/hs\\_funding\\_qbp.aspx](http://www.health.gov.on.ca/en/pro/programs/ecfa/funding/hs_funding_qbp.aspx) (accessed 2017 Dec. 16).