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PROVINCIAL STANDARDS & GUIDELINES

BEST PRACTICES IN HEMODIALYSIS CARE:
VASCULAR ACCESS CLINICS

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Executive Summary

Vascular access is a major problem for patients with end-stage-renal-disease who require hemodialysis and can contribute significantly to their morbidity and mortality.

Of the three types of vascular accesses available, the AVF is the best option for most patients. This is supported by clinical practice guidelines published by the Canadian Society of Nephrology, the National Kidney Foundation (United States) and BC's Provincial Vascular Access Services Team (PVAST). Compared to catheters and AVGs, AVFs have significantly lower rates of complications (such as infection and clotting), longer periods of patency, fewer hospitalizations, reduced patient mortality, and significantly lower costs.

The AVF prevalence and incidence rates are lower in Canada than in most other developed countries. Reported AVF prevalence rates for the 12 countries participating in the international Dialysis Outcomes and Practice Patterns Study (DOPPS) ranged from 47% (United States) to 91% (Japan). Incidence rates range from 16% (United States) to 72% (Germany).

The literature cites several *system* problems that contribute to low rates of AVF use. The literature also cites several *recommendations* for reducing these system problems. Underlying these recommendations is the need for an integrated, multidisciplinary VA program/service.

Components of an integrated, multidisciplinary VA program/service include:

- VA clinic(s) (subject of this paper)
- VA nurse(s). The FTE requirement for a VA nurse will depend upon the number and complexity of patients in the program, the number of other VA-related support positions, and the geographic spread of activities within the program.
- Renal medical director.
- Nephrologist(s) designated by the renal medical director as having a lead role to move VA-related practices forward.
- Regular VA rounds to review patients with complex access issues and to develop "access" care plans.
- Forum/committee to regularly review system-related VA issues and make improvements (nephrologist, radiologist, surgeon, VA nurse, and possibly the OR manager).
- "Protected" VA surgical and radiology time.
- Innovative strategies for fistula creation, such as:
    - Creating fixed "blocks" of time each week for fistula creations.
    - Fistula creation in an ambulatory or surgical day care setting.
    - Utilizing local anaesthesia for fistula creation in most patients.
- System-wide approach to vein preservation in patients with chronic kidney disease.
- Formalized mechanisms to work with Kidney Care Clinics to proactively identify patients and initiate education early.
- Database to enable comparisons between centres/HAs and longitudinally for each centre.

VA clinics provide a central location for multidisciplinary VA teams to practice and develop expertise, to receive and prioritize referrals for new VA creations and/or follow-up of problem accesses, to implement policies, protocols, and patient education programs promoting the use of AVFs, and to collect and analyze VA outcome-related data (especially that on non-AVF access placements and

Executive Summary

AVF and AVG failures). Access to an interventional radiologist for discussion of complex cases and participation in protocol development is an important component of the clinic.

In BC, at least one VA Clinic exists in each health authority (more in larger health authorities).

This paper uses information from the literature and from current BC experience with VA clinics to estimate the volumes and resource requirements for establishing a VA clinic for a sample HD centre serving 200 HD patients with an AVF/AVG prevalence rate of 70%. See Table 1 (pg 3).

Also included in the paper are detailed criteria for referrals to a VA clinic, goals and expected outcomes of care, and an algorithm of patient flow.

Forms and patient teaching pamphlets to support the operation of a VA clinic are available under a separate cover.

Table 1:
Estimated Volumes and Resources to Serve 200 HD Patients (AVF/AVG Prevalence Rate: 70%)

Resource	Estimate
VA clinic visit volumes	225 - 350 visits per year
VA clinic hours	2.0 - 4.0 hours per week (46 weeks per year)
VA clinic staffing	• VA nurse: 6 hours per week • Vascular surgeon: 4 hours each per week • Nephrologist specializing in VA: 4 hours per week • VA clinic clerk: 15 hours per week
Space	1 appropriately equipped consultation room (e.g., in the renal outpatient clinic)
Equipment	• Access to hospital computer (x-rays, charts, PROMIS) • Portable ultrasound machine, preferably with Doppler capability • Stethoscope and portable blood pressure machine • Tourniquet (penrose drain tubing 1 inch in diameter)
Supplies	• Patient charts • Dressing supplies
Access to radiology	• 200 - 300 procedures per year (4 - 6 procedures per week) • Includes tests/procedures arising from VA clinic plus broader VA program/service
Access to OR time	• 80 - 90 procedures per year (2 - 3 procedures per week) and 140 - 160 hours of OR time (3 - 4 hours per week) • Includes procedures arising from VA clinic plus broader VA program/service
Access to inpatient/ surgical day care beds	Not quantified but noted as a required resource

Vascular Access Clinic

1.0 Purpose of Paper

The purpose of this paper is to define vascular access (VA) clinics, describe their rationale, and outline best practices in the operation of VA clinics.

2.0 What is a Vascular Access Clinic?

A VA clinic offers a central location for a team specializing in VA creation and follow-up of VA problems to assess patients and plan access-related care. The team coordinates VA-related care centrally and consults with interventional radiologists and other professionals/diagnostic services as required.

At a minimum, the clinic team consists of a surgeon and VA nurse. In larger centres, a nephrologist with a special interest in VA is also recommended to augment the clinic team and facilitate follow-up with attending nephrologists. Access to an interventional radiologist for discussion of complex cases and participation in protocol development is an important component.

While initial assessments for new creations and problem accesses are best conducted in a clinic session with the full interdisciplinary team present, follow-up assessments of new creations and/or post interventions for problem accesses may be appropriately seen during VA "nurse only" clinic sessions.

3.0 Criteria for Referrals to Vascular Access Clinic

Recommended criteria for referral to VA clinic:

1. Patients without an existing arterial-venous fistula (AVF) or arterial-venous graft (AVG):
   a) Pre-hemodialysis (HD):
      - Patients with a GFR of approximately 15 mL/min/1.73m^2 or if GFR is 15-20 mL/min/1.73m^2 and patient is expected to require dialysis within 12-18 months.[1]
      - Patients with failing transplants or on peritoneal dialysis with plans to convert to HD.

   b) On HD but dialyzing with a catheter:
      - Refer when it is determined that patient will require chronic HD.

2. Patients who require replacement or revision of an existing access.[2]
      - May be pre-HD or on HD and have a post-creation complication and/or poorly maturing access.

3. Patients with active but non-urgent[3] AVF or AVG problems who have been reviewed by a nephrologist and/or VA coordinator but require

[1] This timeline assumes that the anticipated surgical wait time for fistula creation is consistent with the BCPRA guideline Indicators & Urgency Criteria for Surgical Hemodialysis Procedures.

[2] Timeline for referral of these patients to the VA clinic will depend on the type of access (AVF or AVG) and surgical waiting times at individual sites.

[3] These criteria were taken from the BCPRA Provincial Guidelines for VA for Patients with HD as Primary Modality (2013) when follow-up within two weeks is an acceptable time interval. Patients requiring follow-up more urgently (refer to the guideline at www.bcrenalagency.ca/node/818) are best routed directly to radiology and/or the surgeon, with the VA Nurse being notified.

a detailed VA assessment:

- Absolute access flows of 300-500 mL/min in AVF and 500- 650mL/min in AVG;
- Decrease in access flow of >20% from baseline values;
- Inability to achieve a blood pump speed on dialysis of ≥ 300 mL/min by week 3 of initiating HD or <350 mL/min for established HD (on 2 consecutive runs);
- Difficulty with cannulation and excessive bleeding post-HD otherwise unexplained;
- Arm swelling; and/or
- High machine venous pressures or low machine arterial pressures on HD.

4. Pre-HD patients with AVFs or AVGs which have not been utilized for six months and with no definitive timeline to activate.

5. Patients with unutilized AVFs or AVGs which are planned for activation within 4-6 weeks.

4.0 Rationale for Vascular Access Clinics

4.1 Literature Review

Vascular access is a major problem for patients with end stage renal disease who require hemodialysis and can contribute significantly to their morbidity and mortality. VA problems can decrease the quality of life and increase the frequency of hospitalizations.

Of the three types of vascular accesses available, the AVF is the best option for most patients. This is supported by clinical practice guidelines published by the Canadian Society of Nephrology,[4] the National Kidney Foundation (United States)[5] and BC's Provincial Vascular Access Services Team (PVAST).[6] Compared to catheters and AVGs, AVFs have significantly lower rates of complications (such as infection and clotting), longer periods of patency, fewer hospitalizations, reduced patient mortality, and significantly lower costs.[7,8,9,10]

While there is significant variation across studies in estimates of VA-related costs (different methodologies, different types of costs included, etc), the studies consistently conclude AVFs to be the most cost-effective.

[4] Canadian Society of Nephrology, (2006). 'Chapter 3: Vascular Access'. *In: Canadian Society of Nephrology Guidelines*.

[5] National Kidney Foundation, (2006, Supp 1). KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates: Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. Guidelines 1 - 8. *Am J Kidney Dis*. 48:S1-S322.

[6] BCPRA (2013). *Provincial Guidelines for VA for Patients with HD as Primary Modality*. www.bcrenalagency.ca/node/492. Accessed Dec 27, 2013.

[7] The Fistula First Breakthrough Initiative: Available at www.fistulafirst.org. Fistula First Literature Resources available at http://fistulafirst.org/Professionals/Literature.aspx. Accessed Dec 27, 2013.

[8] Goodkin, DA et al, (2010). Hemodialysis vascular access training and practices are key to improved access outcomes. *Am J Kidney Dis*. 56, p.p., 804-814.

[9] Bradbury, BD et al, (2009). Conversion of vascular access type among incidence hemodialysis patients: description and association with mortality. *Am J Kidney Dis*. 53: 804-814.

[10] Vassalotti, JA et al, (2012). Fistula First Breakthrough Initiative: Targeting Catheter Last in Fistula First. *Seminars in Dialysis*, 25: 3, p.p., 303-310.

Estimated VA-related costs per patient per year:

- US Renal Data System (USRDS): $3,194 for AVFs, $5,960 for catheters and $7,451 for AVGs (2007).[11]
- Canadian study (Lee et al[12]): $404 for AVFs, $2,191 for catheters and $3,345 for grafts.

In terms of first year costs, a Canadian study (Mann et al) estimated the cost of access care for patients in whom an AVF or AVG was attempted to be $7,989 and $11,685 respectively and for catheter-only patients to be $9,180[13]. In patients who dialyzed exclusively with a catheter, the largest cost was for hospitalization(s) for access-related complications. For patients in whom an AVF was attempted, nearly 70% of first year costs were for surgery and diagnostic imaging.

While some studies have reported that these differences can be explained through selection bias (e.g., healthier patients are more likely to be referred for AVF creation)[14,15] most have concluded that the differences persist even after adjusting for selection bias[16]. The preference for AVFs is in keeping with prominent national and international guidelines and is generally accepted to be "best practice".

The AVF prevalence and incidence rates are lower in Canada than in most other developed countries. Reported AVF prevalence rates for the 12 countries participating in the international Dialysis Outcomes and Practice Patterns Study (DOPPS) ranged from 47% (United States) to 91% (Japan). Incidence rates range from 16% (United States) to 72% (Germany).[17] Prevalence rates in the United States (US) have been slowly increasing over time as a result of the establishment of the National Vascular Access Improvement Initiative ("Fistula First") in 2003: 24% (1996 - 2001) to 31% (2002 - 2004) to 47% (2005 - 2007). While rates in Canada (including BC) are higher than in the US, they continue to be significantly lower than in other participating countries. One potential factor contributing to this difference is access to surgeons and surgery time. The typical time from referral to VA creation is 62 days in Canada, compared to 29 days in Europe and 16 days in the US. Canada has fewer VA surgeons per 100 HD patients (2.9) compared with the US (8.1) and Europe (4.6) and the median hours per week devoted to VA-related surgery is lower in Canada (0.027 hrs per 100 patients) compared with the US (0.082 hrs) and Europe (0.059 hrs).[18] See Table 2 (pg 7).

[11] US Renal Data System. (2009). Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the US. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. p.p., 266, 267, 341.

[12] Lee H et al, (Sept 2002). Cost analysis of ongoing care of patients with end-stage renal disease: The impact of dialysis modality and dialysis access, *Am J of Kidney Diseases*, 40: 3, p.p., 611 - 622.

[13] Manns, B et al, (2005). Clin J Am Soc Nephrol. 16, p.p., 201-209. doi: 10.1681/ASN.2004050355.

[14] Quinn, RR and Ravani, P., (2013). Fistula-first and catheter-last: fading certainties and growing doubts. *Nephrol Dial Transplant*; 0, p.p., 1 - 4. doi: 10.1093/ndt/gft497.

[15] Ravvani P, Palmer SC, Oliver MJ et al, (2013). Associations between hemodialysis access type and clinical outcomes: a systematic review. *J Am Soc Nephrol* 24, p.p., 465 - 473.

[16] Grubbs, V et al, (2013). Health status as a potential mediator of the association between HD VA and mortality. *Nephrol Dial Transplant*. 0, p.p., 1-8. doi: 10-1093/ndt/gft438.

[17] Ethier et al, (2008). *Nephrol Dial Transplant*. 23(10), p.p., 3,219 - 3,226.

[18] Mendelssohn, JE et al, (2006). Haemodialysis VA problems in Canada: results from the Dialysis Outcomes and Practice Patterns Study (DOPPS II). *Nephrol Dial Transplant*, 21: 721-728.

Table 2:
Prevalence and Incidence Rates, DOPPS, 1996-2007

Country	Prevalance Rate	Incidence Rate
Japan	91%	69%
Italy	83%	61%
Germany	80%	72%
France	74%	58%
Spain	70%	64%
Australia/New Zealand	77%	50%
United Kingdom	67%	37%
Belgium	57%	26%
Sweden	59%	31%
Canada	**50%**	**26%**
United States	47%	16%

The literature cites several *system problems* that contribute to low rates of AVF use, including late referrals of pre-dialysis patients, lack of awareness about the medical criteria for AVF, poor communication between care providers about expectations regarding VA, lack of training for surgeons in successful AVF placement, and patient education about the benefits of AVFs leading them to choose catheters because of the less invasive surgical procedures required and to avoid needle "sticks".[19]

The literature cites several *recommendations* to reduce system problems, including early referrals of pre-dialysis patients, referral of VA procedures to surgeons with a demonstrated interest, skill, and level of experience, routine pre-operative venous and arterial mapping, education of patients regarding the advantages of AVFs and procedures to protect the vasculature of the arm, monitoring to ensure that AVFs are functioning properly and to detect problems (infection, stenosis) early, timely intervention to correct problems, and prospective tracking of outcomes with continuous improvement. Underpinning these recommendations is the need for an integrated, multidisciplinary VA program/ service. Several examples exist in the literature demonstrating outcome improvements through such integrated, multidisciplinary VA programs/ services - for example, higher proportions of AVFs, reductions in the frequency of access thrombosis, fewer complications of surgical access procedures, improved success of AVG thrombolytic procedures, more outpatient and fewer inpatient procedures, and lower costs.[20,21,22]

Components of an integrated, multidisciplinary VA program/service include:

- VA clinic(s) (subject of this paper)
- VA nurse(s). The FTE requirement for a VA nurse will depend upon the number and complexity of patients in the program, the number of other VA-related support positions, and the geographic spread of activities within the program.
- Renal medical director.
- Nephrologist(s) designated by the renal medical director as having a lead role to move VA-related practices forward.
- Regular VA rounds to review patients with complex access issues and to develop "access" care plans.
- Forum/committee to regularly review system-related VA issues and make improvements (nephrologist, radiologist, surgeon, VA nurse, and possibly the OR manager).
- "Protected" VA surgical and radiology time.
- Innovative strategies for fistula creation, such as:
    - Creating fixed "blocks" of time each week for fistula creations.
    - Fistula creation in an ambulatory or surgical day care setting.
    - Utilizing local anaesthesia for fistula creation in most patients.

[19] Beasley, C et al, (2003). *National Vascular Access Improvement Initiative*, Institute for Healthcare Improvement.

[20] Nguyen, V, Griffith, C, and Treat, L, (June 2003). A Multidisciplinary Team Approach to Increasing AVF Creation: A Community-based Nephrology Practice Experience, *Nephrology News & Issues*, p.p., 54-57.

[21] Allon, M et al, (1998). A Multidisciplinary Approach to HD Access: Prospective Evaluation, International Society of Nephrology, *Kidney International*, 53, p.p., 473 - 479.

[22] Allon, R, (Oct 2002). Increasing AVGs in HD Patients: Problems & Solutions, *Kidney International*, p.p., 1109-24.

- System-wide approach to vein preservation in patients with chronic kidney disease.
- Formalized mechanisms to work with Kidney Care Clinics to proactively identify patients and initiate education early.
- Database to enable comparisons between centres/HAs and longitudinally for each centre.

This paper addresses one of these components, specifically the establishment of a VA clinic. Such clinics support the practice of an integrated, multidisciplinary team, provide a forum for improved coordination and communication, and enable the implementation of many of the recommendations cited in the literature that reduce system problems.

VA clinics provide a central location for a multidisciplinary VA team to practice and develop expertise, to receive and prioritize referrals for new creations and/or follow-up of problem accesses, to establish policies, protocols, and patient education programs that promote the use of AVFs, and to collect and analyze VA outcome-related data (especially that on non-AVF access placements and AVF and AVG failures). VA clinics centralize the *coordination* of VA care from multiple providers working on multiple sites to a single team of specialized care providers working at a single site (or at a limited number of sites). Several studies have demonstrated the benefits of a dedicated VA team.[23,24,25]

In the United States, the concept of VA clinics has been taken one step further with the establishment of dedicated VA centres. VA centres incorporate the concept of VA clinics but also offer VA-related diagnostic imaging and interventional procedures (radiological and/or surgical). Centres may be free-standing or based in a hospital and are staffed by interventional nephrologists, interventional radiologists and/or vascular surgeons in collaboration with a group of nephrologists and an interdisciplinary team. Data suggests that dedicated VA centres are associated with higher AVF incidence and prevalence rates, lower VA-related hospitalizations and fewer missed outpatient dialysis treatments.[26,27,28,29,30,31] Free-standing clinics are reported to be more cost-effective than hospital-based clinics.[32]

[26] Mishler, R et al, (2006). Dedicated Outpatient VA Centre Decreases Hospitalization and Missed Outpatient Treatments, *Kidney International*, 69, p.p., 393-398.

[27] Jackson, J & Litchfield, T, (March/April 2006). How a Dedicated VA Center Can Promote Increased Use of Fistulas, *Nephrology Nursing Journal*, 33: 2, p.p., 189-196.

[28] Siegel, JB, (July 2003). Beneath the Skin: The Workings of a Dedicated Dialysis Vascular Access Center. *Nephrology News & Issues*, p.p., 54-57.

[29] Beathard, GA and Litchfield, T. *Nephrology News & Issues*. Nov 2004, p.p., 44-48.

[30] Dobson, A et al. (Sept-Oct 2013). Clinical and Economic Value of Performing Dialysis VA Procedures in a Freestanding Office-based Center as Compared with the Hospital Outpatient Department among Medicare ESRD Beneficiaries. *Seminars in Dialysis*: 26:5, p.p., 624-632.

[31] Kian, K et al, (July/Aug 2007). Efficiency and Outcomes of Emergent VA Procedures Performed at a Dedicated Outpatient VA Centre, *Seminars in Dialysis*, 20: 4, p.p., 346-350.

[32] Siegel, JB, (July 2003). Beneath the Skin: The Workings of a Dedicated Dialysis Vascular Access Center. *Nephrology News & Issues*, p.p., 54-57.

4.2 Vascular Access Clinics in BC

VA clinics currently operate at the following centres in BC:

1. Kelowna General Hospital
2. Kootenay Boundary Regional Hospital (Trail)
3. Abbotsford Regional Hospital and Cancer Centre
4. Royal Columbian Hospital
5. Jim Pattison Outpatient Care and Surgery Centre (Surrey)
6. St. Paul's Hospital
7. Vancouver General Hospital
8. Royal Jubilee Hospital
9. Nanaimo Regional General Hospital
10. University of Northern British Columbia Hospital (Prince George)

5.0 Goals of VA Clinic Care

5.1 Overall Goal

The goal of a VA clinic is to facilitate the timely creation, successful ongoing use, and increased longevity of native AVFs (1st choice) and AVGs (2nd choice) for HD.

Successful ongoing use is defined as:

- Absolute access flows of >500 mL/min in AVFs and >650 mL/min in AVGs; AND
- Blood pump speeds of ≥300 mL/min by week 3 of initiating HD or >350 mL/min for established HD (in 2 consecutive runs); AND
- Readily cannulated by the majority of HD nurses.

5.2 Specific Goals & Outcomes

VA clinics provide care to renal patients in four areas:

1. Pre-operative VA patient assessment and referrals
2. Post-operative VA patient assessment and referrals
3. Follow-up of VA problems
4. VA patient readiness assessment & education re care of access

Details on specific VA clinic goals & outcomes are identified in Table 3 (pg 11).

Table 3:
VA Clinic Goals & Outcomes
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	Area	VA Clinic Goals
1	Pre-operative VA Creation Assessment & Referral Target timing of referrals to VA clinic: GFR ~15 mL/min or GFR 15-20 mL/min & pt is expected to require dialysis within 12-18 months.	Provide pre-operative VA a*ssessment and referral* services for patients requiring or on HD that do not yet have an AVF or AVG. *Assessment:* • History and physical examination. • Assess suitability of superficial veins for AVFs/AVGs. • Mapping of vessels using ultrasound. Venography may be useful to further assess the veins +/- to rule out central vein stenosis on a case-by-case basis. *Referrals:* • Provide surgical consults for access creation.
2	Post-operative VA Creation Assessment & Referral	Provide post-operative *assessment* and *referral* services for patients with newly established accesses. *Assessment*:[33] • Conduct 2 & 6 week post creation assessments. • Conduct 4 - 6 week assessment prior to start of HD. • Conduct q6 month assessments of pre-emptive AVFs/AVGs for patency. *Referrals*: • If absent thrill or bruit at 2 weeks post-op, refer to surgeon • If access not appropriately maturing at 6 weeks, initiate radiological investigations & interventions • If access not adequate for cannulation 4 - 6 weeks prior to start of HD, initiate radiological investigations and interventions
3	Follow-Up of Problem Accesses	Provide *assessment* and *coordination* of follow-up services for problem accesses. *Assessment* of problems (see referral criteria for specific indications). *Coordination* of follow-up services for problem accesses: • Angiography/angioplasty is the first option for treatment of stenosis of the AVF/AVG or central veins, unless otherwise directed by the radiologist or vascular surgeon. • Usually required within 2 weeks; but • Within 48 hours if: a) absolute access flow <300 mL/min; or b) drop from baseline of ≥50%; or c) clinical indication (severe bleeding or unable to properly dialyze) • Surgical revision of stenosed fistula/graft should be done on a more urgent basis, as per surgical priority scale.

[33] AVFs: >3 - 4 months prior to the anticipated start of HD; AVGs: 3 - 6 weeks prior to the anticipated start of HD.

Table 3:
VA Clinic Goals & Outcomes
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Area		VA Clinic Goals

4	Patient Access Readiness Assessment & Patient Education	In collaboration with KCC Clinics, provide VA related *patient education:*[34]
		Patient education:
		• Pre-operative: VA options (& pros and cons)
		• Post-operative:
		  • Care for, monitoring, & follow-up of access problems
		  • VA investigation and interventions (radiological & surgical)
		• Pre- and post-operative:
		  • Vein preservation and related strategies
		  • Reporting complications of their access

VA Clinic Outcomes		
1. AVFs/AVGs are created and successfully used for 50% of new patients requiring chronic HD & known to nephrology ≥6 mos (incidence rate) and 80% of total pts that have been on HD ≥6 months (prevalence rate). 2. AVF & AVG creations are completed within the timelines specified on BCPRAs *Urgency of Surgical Waitlist* document.[35] 3. AVF & AVG post-creation follow-up is completed as per the timelines on the BCPRA's *Provincial Recommendations for VA*. [36] 4. Follow-up of problem accesses is completed as per the timelines on BCPRA's *Urgency Criteria for Radiology and Urgency of Surgical Waitlist* documents. 5. Patients that attend VA clinics will understand basic pre and post-operative concepts, the importance of vein preservation, and their role in caring for their access.		

[34] At 2 and 6 weeks post-creation, at 4 - 6 weeks prior to the anticipated start of HD and at six month intervals in between.
[35] For out of town patients, arrangements for assessment visits may be made with their respective local community dialysis centres.
[36] Patients referred for access creation are expected to be in agreement with creation of an access prior to the referral being forwarded to the VA clinic.

6.0 Anticipated Volumes

The literature offers limited help for estimating patient volumes. The best estimate is derived from the experience of existing BC clinics.

Based on the experience in BC Vascular Access Clinics, the best estimate of VA clinic visit numbers is between 1.6 and 2.5 visits per AVF/AVG patient per year,[37] with average visit times of 20 minutes. Estimates vary depending upon several variables, including patient populations, proportion of AVFs, AVGs, and catheters, patterns of practice, and geography. Details are shown on Table 4 (pg 14).

Using the estimates provided, an HD centre serving 200 HD patients with an AVF/AVG prevalence rate of 70% (140 fistulas/grafts) can expect between 225 and 350 visits per year and require 2.0 - 4.0 hours of VA clinic time per week (assuming 20 - 25 min/pt/visit and the clinic operates 46 weeks per year).

Ideally, clinic assessments should be performed in VA clinics located on a site with an in-centre unit and full radiology and vascular surgery services. HAs with more than one in-centre site may require more than one VA clinic, particularly HAs that cover large geographic distances. Considerations to reduce travel requirements for patients include:

- Developing "first-line" access assessment expertise within community dialysis units (e.g., VA specialty nurse).
- Using telehealth for "first-line" access assessments.
- Implementing a travelling VA team to provide consultation and clinics throughout the health authority.

7.0 Resources Required

The estimates provided below assume operation of a VA clinic 2.0 - 4.0 hours per week and 46 weeks per year. This size of clinic is based on supporting an HD centre serving 200 HD patients with an AVF/AVG prevalence rate of 70% (225 - 350 VA clinic visits per year). Resources can be prorated for larger or smaller clinics. **The identified resources pertain to the VA clinic component, not to the broader requirements of a VA program/service.**

7.1 Clinic Staffing (numbers & types)

Recommended staffing requirements are as follows:

Vascular surgeon:	4 hours per week
Nephrologist specializing in VA (if available):	4 hours per week
VA nurse:	6 hours per week
VA clinic clerk:	15 hours per week

Note: Estimates of time include clinic preparation and post-clinic follow-up time.

7.2 Space, Equipment, & Supplies

Space:

- An appropriately equipped consultation room (e.g. in the renal outpatient clinic)

Equipment:

- Access to hospital computer (x-rays, charts,

[37] The number of visits per AVF/AVG patient per year is used as a proxy to provide a relative estimate of VA clinic volumes. This proxy assumes that the higher the number of AVFs/AVGs, the larger the pre-dialysis and dialysis population, and therefore the higher the number of VA clinic visits. Estimated visits include those for pre-dialysis and dialysis patients.

Table 4:
Anticipated Volumes

Health Authority	Interior HA		Fraser HA			Vancouver Coastal HA		Island HA		Northern HA
VA Clinics	**Kelowna**	**Kootenay Boundary (Trail)**	**Abbotsford Hospital**	**Royal Columbian**	**Jim Pattison Outpt Care & Surgery Centre (Surrey)**	**St Paul's (Vancouver)**	**Vancouver General**	**Royal Jubilee (Victoria)**	**Nanaimo Regional**	**University of Northern BC (Prince George)**
Clinics per wk	1/wk (surgeon + RN)	3/yr (surgeon + RN)	2/mo (surgeon + RN) + 2/mo RN f/u clinic	1 - 2/mo (surgeon + RN) + 2/mo RN f/u clinic	1/wk (surgeon + RN) + 1/wk RN f/u clinic	1/wk (nephrologist, surgeon + RN)	1/wk (nephrologist, surgeon + RN)	2/mo (surgeon + RN)	1/q2 mos (surgeon + RN)	2/mo (nephrologist, surgeon + RN)
Clinic hrs per wk	4 - 6 hrs/wk	2 days/ clinic (1 hr/wk)	2hrs/clinic (1 hr/wk)	2 hrs/clinic (0.5 hr/ wk)	3 hrs/wk	4 - 5 hrs/wk	2 hrs/wk	4 hrs/clinic (2 hrs/wk)	7 hrs/clinic (1 hr/wk)	2 - 3 hrs/ clinic (1 - 1.5 hrs/wk)
Pt visits per wk	6 - 8 pts/wk	26 pts/2-day clinic[38]	5 - 8 pts/clinic	6 - 8 pts/clinic	5 - 8 pts/wk	12 pts/wk	8 - 12 pts/wk	9 pts/clinic (4.5 pts/ wk)	20-24 pts/ one-day clinic	6 pts/clinic (3 pts/wk)
Pt visits per yr[39]	320 v/yr	80 v/yr	300 v/yr	260 v/yr	500 v/yr	550 v/yr	460 v/yr	200 v/yr	150 v/yr	140 v/yr
New fistulas/yr	IHA: 105		FHA: 324			94	128	VIHA: 129		NHA: 31
Pts with AVFs/AVGs	IHA: 188		FHA: 489			VCH: 474		VIHA: 227		NHA: 56
Visits/yr/AVF or AVG	2.1		2.1			2.1		1.6		2.5

Note: Clinic data estimated by VA RNs. New fistulas/yr estimated from Surgical Patient Registry Data, 2012/13. Estimated patients with AVFs/AVGs estimated from PROMIS Prevalence Reports (no filters) as of Sept 30, 2013.

[38] Six surgery patients plus 20 other renal patients.
[39] Assumes 46 weeks per year.

PROMIS)
- Portable ultrasound machine, preferably with Doppler capability
- Stethoscope and portable blood pressure machine
- Tourniquet (penrose drain tubing 1 inch in diameter)

Supplies:
- Patient charts
- Dressing supplies

7.3 Access to Radiology

While access to timely radiological tests and interventions is required to support a VA clinic, such resources are also required to support the overall VA service. Required radiological services include:

AVF/AVG-Related Procedures:
- Doppler ultrasound - vein mapping
- Venogram - vein mapping
- Fistulogram +/- angioplasty
- Thrombolysis

Catheter-Related Procedures:
- New permcath insertion
- Convert temporary line to permcath
- Venogram through dialysis catheter (linogram)
- Permcath change
- Fibrin sheath disruption

The number of radiology tests/procedures to support a VA clinic versus those supporting the overall VA program/service cannot be separated. The total number of radiological tests/procedures to support both functions, however, can be approximated using one of two methods:

1. Utilizing actual figures for BC extracted from the provincial renal database (PROMIS).
2. Utilizing the experience of other centres/ jurisdictions as cited in the literature (literature is limited and different studies are difficult to compare).

Regardless of the method chosen, the estimate of resource utilization for an individual centre will depend on several variables, including patient populations, proportion of AVFs, AVGs, and catheters, availability of radiological services, and geography.

Method 1: BC Experience[40]
- AVFs: 1.0 radiological procedure/patient/year (fistulogram +/- angioplasty/thrombolysis).
- AVGs: 2.2 radiological procedures/patient/year (fistulogram +/- angioplasty/thrombolysis).
- Catheters: Unable to estimate (catheter insertions are underreported in PROMIS).

Method 2: Experience at Other Centres/ Jurisdictions (as cited in the literature)

First year post-access placement (Coentrao, 2013,[41] AVFs: n=65; catheters: n=45[42])
- AVFs: 0.9 procedures/patient/year
- Catheters: 2.4 procedures/patient/year

[40] Numerator: Average number of procedures performed in 2011/12 and 2012/13. Denominator: Active HD/CKD patients on April 1, 2011 and April 1, 2012.

[41] Coentrao, L et al (2013). Cost analysis of HD and PD access in incident dialysis patients. Peritoneal Dialysis International, 33, p.p., 662-670. doi: 10.3747/pdi.2011.00309.

[42] Assignment to cohort (AVF or catheter) is based on first attempt at access placement.

Ongoing (Jackson, 2006,[43] n=207 patients, mixture of new and existing AVFs)

- AVFs: 1.5 radiological procedures/patient/year (excludes venogram only procedures).
- 46% of procedures were performed within the first six months post-creation.

Ongoing maintenance costs (Lee, H et al, 2002,[44] n=166 patients on dialysis >6 months)

- AVFs: 0.3 procedures/patient/year
- AVGs: 0.7 procedures/patient/year
- Catheters: 0.6 procedures/patient/year

For the purposes of this paper, an HD centre serving 200 HD patients could be expected to perform 200 - 300 diagnostic imaging procedures per year. This assumes:

- Prevalence rates of 65% AVFs, 5% AVGs and 30% catheters.
- 1.0 and 2.2 procedures/patient/year for AVFs and AVGs respectively (BC rates) and 1.5 procedures/patient/year for catheters (average of estimates in the literature).

7.4 Access to Surgery

Access to timely surgical resources is required to support a VA clinic and related VA programs/ services, including surgical procedures for VA creation and follow-up of problem accesses. Similar to the numbers of radiology tests/ procedures, the numbers of surgical procedures to support a VA clinic versus supporting the overall VA service cannot be separated. The total number of surgical procedures to support both functions, however, can be approximated using two methods:

1. Utilizing actual figures for BC extracted from the provincial surgical patient registry (SPR).
2. Utilizing the results of other centres/ jurisdictions as cited in the literature (literature is limited and different studies are difficult to compare).

Method 1: BC Experience[45]

- AVFs/AVGs: Estimate 0.6 AVF surgeries/year for every patient dialyzing with an AVF (this figure includes new creations and revisions for pre-HD and HD patients).
- Estimated OR time per procedure: 1.8 hours (based on 2003/04 data from the St Paul's and Vancouver General hospital OR systems). If local anaesthetics, 5 surgeries per day.

Method 2: Experience at Other Centres/ Jurisdictions (as cited in the literature)

Ongoing (Jackson, 2006,[46] n=207 patients, post-creation AVFs)

- AVFs: 0.09 surgeries/patient.

Ongoing maintenance costs (Lee, H et al, 2002,[47] n=166 patients on dialysis >6 months)

- AVFs: 0.1 procedure/patient/year
- AVGs: 1.0 procedures/patient/year

[43] Jackson, J & Litchfield, T, (March/April 2006). How a Dedicated VA Center Can Promote Increased Use of Fistulas, *Nephrology Nursing Journal*, 33: 2, p.p., 189 - 196.

[44] Lee H et al, (Sept 2002). Cost analysis of ongoing care of patients with end-stage renal disease: The impact of dialysis modality and dialysis access, *Am J of Kidney Diseases*, 40: 3, p.p., 611 - 622.

[45] Numerator: Average AVF/AVG procedures performed in 2012/13. Denominator: Active HD patients on Sept 30, 2013. 800/1,434 = 0.6 procedures/patient/year.

[46] Jackson, J & Litchfield, T, (March/April 2006). How a Dedicated VA Center Can Promote Increased Use of Fistulas, *Nephrology Nursing Journal*, 33: 2, p.p., 189 - 196.

[47] Lee H et al, (Sept 2002). Cost analysis of ongoing care of patients with end-stage renal disease: The impact of dialysis modality and dialysis access, *Am J of Kidney Diseases*, 40: 3, p.p., 611 - 622.

Using the BC estimates, a HD centre serving 200 HD patients with a prevalence rate of 70% AVFs/AVGs (140 AVFs/AVGs), could be expected to perform 80 - 90 surgical procedures per year (2 - 3 procedures per week) and utilize 140 - 160 hours of OR time (3 - 4 hours per week).

7.5 Access to Inpatient/Surgical Day Care Beds

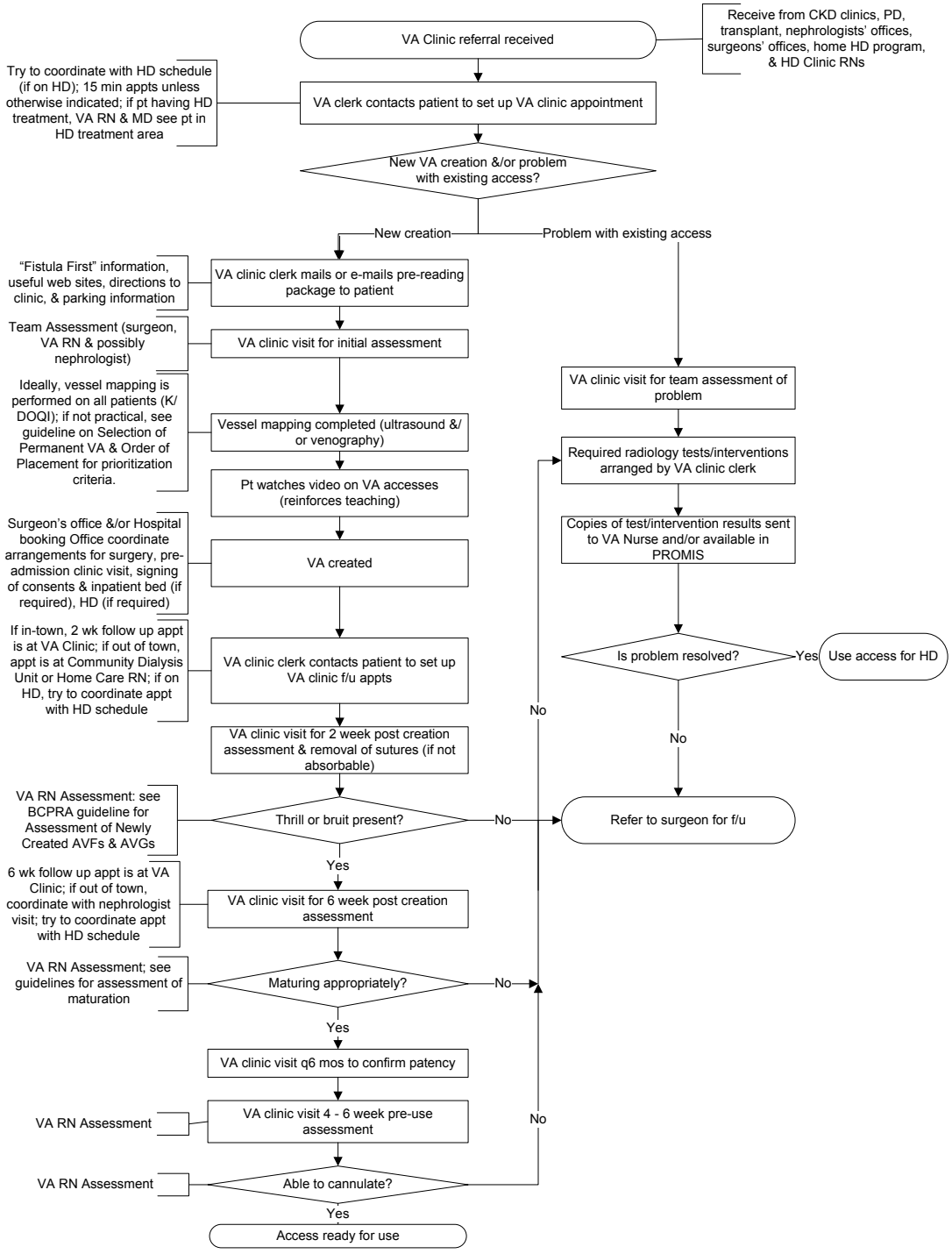
The majority of radiological and surgical VA-related tests/procedures can be done as surgical day care/outpatient procedures. A small number of patients will require access to inpatient beds for access creation (e.g., patients with multiple co-morbidities) or treatment of VA-related complications (e.g., infections).

Unfortunately no BC data is available to help estimate VA-related inpatient/surgical day care bed requirements. Also, studies in the literature are based on data which is 10 - 15 years old and no longer relevant given changes in practice patterns.

8.0 VA Clinic Flow

See Table 5 (pg 18).

Table 5:
VA Clinic Flow Chart



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