TRENDS IN VASCULAR SURGERY

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There is a general trend to endovascular management in both aortic and peripheral vascular surgery. Carotid intervention has moved back to surgical intervention for symptomatic lesions with less intervention for asymptomatic lesions. There is more emphasis on medical management, risk factor modification and selective non-operative treatment. Combined surgical and endovascular intervention has led to the development of the endovascular or hybrid theatre which is useful in both aneurysmal disease (thoracic and abdominal), peripheral arterial occlusive disease (PAOD) and trauma.

Aortic Aneurysm

There is a trend to endovascular AAA repair with most units offering stent graft repair in preference to open repair. Approximately 50-80% of aneurysms will be treated with stent grafts. Relative indications include "hostile abdomen" and increased medical risk especially respiratory disease. Relative contra-indications include "good" medical risk and young age. All randomised studies show a 50% reduction in 30 day mortality. The mortality advantage is not sustained at 2-3 years, with most of the advantage lost due to late re-intervention (DREAM and OVER). Quality of life advantages are also degraded with on-going surveillance and re-intervention. A number of devices are now available commercially. Improvements include lower profile delivery systems, more flexible limbs and re-positionable devices. Promising results have been seen with the Nellix sac anchoring prosthesis, which fills the aneurysm sac with a polymer filled gel, and has an extremely low incidence of type 2 endoleaks (residual aneurysm sac perfusion).

Figure 6. Endologix's Nellix AAA device.

The use of truly percutaneous repair has been increasing. Large-hole closure techniques (pre-close) have allowed this. Not all femoral arteries are suitable though, with femoral calcification, re-operative groins and ectatic femoral arteries a problem.

Iliac aneurysms remain a problem for endovascular treatment. Acute occlusion of IIA is a persisting problem with a 20-40% incidence of buttock claudication. Iliac aneurysms can be treated with preservation of internal iliac perfusion using Iliac Bifurcation devices. These are mini-branch devices with a short covered stent being introduced into the IIA usually from the other femoral.

Challenges also remain in the treatment of aneurysms with a juxtarenal and thoracic aneurysms. Juxtarenal aneurysms can be treated with fenestrated devices, using covered stents into the renal and visceral vessels. There is additional renal artery risk with both open and endovascular repair. Only one company (COOK Medical) manufactures these and currently 6-8 weeks is needed to manufacture and sterilise. Off-the-shelf fenestrated devices have been proposed (COOK p-branch, Endologix Ventana) but these remain under research protocols. Branches, as opposed to fenestrated devices are also available, extending treatment to thoraco-abdominal aneurysms. These are used when the stent graft does not oppose the wall of the aorta at the level of the branch intended to be re-perfused. Again covered stents are used, with access from the axillary or brachial artery. Long sheaths are required from the upper body with multiple sheaths and two endovascular teams working from above and below often simultaneously. Multiple covered stents are required. These branches have had a pleasing short and medium term patency with 5-year freedom from branch intervention of 84%.

There is additional risk of spinal cord ischemia (SCI) with these extensive repairs. Techniques to reduce the risk of SCI include preservation of the left subclavian artery and the internal iliac artery, the use of CSF drains and peri-procedural blood pressure manipulation to avoid hypotension. Additional risk factors include previous aortic repair, long lengths of coverage and coverage of the T8-L1 region (artery of Adamkiewitz).

The proximal extent of thoracic endovascular repair can be limited by the head and neck vessels but increasingly arch de-branching can be used, including de-branching from the ascending aorta.

Arch repair requires increasing co-operation between cardiac and vascular services although most are still done with Vascular Surgery lead due to endovascular expertise. There is additional cerebral risk, both anterior and posterior circulation, with arch manipulation. Parallel grafts (snorkel, chimney, and periscope) can be used when fenestrated technology is not available.

New Zealand runs a prospective audit of thoracic endovascular techniques, under the auspices of the Vascular Society of New Zealand.

Medical therapy and indications for aneurysm repair remains unchanged at 5-5.5cm for AAA and 6cm for thoracic aneurysms. The UKSAT and ADAM showed that among patients with a small abdominal aortic aneurysm there was no long-term difference in mean survival between the early-surgery and surveillance groups. Non-intervention for high-risk patients remains very valid.

Aortic Dissection

Urgent intervention for Acute Type A Dissection remains mandatory to prevent tamponade, aortic valve disruption and coronary artery ischaemia. This remains the preserve of cardiac surgery.

Acute type B thoracic aortic dissection is an important pathology often requiring repair. Intervention for complication is usually advised (branch vessel ischaemia, rupture and acute false lumen dilatation). Aims of intervention with proximal stent grafting include cover of the proximal fenestration, re-expansion of the true lumen and branch vessel stenting (STABLE trial). Uncovered bare metal stents distal to the covered stent can be used to help true lumen re-expansion. Intervention in “uncomplicated” dissection remains under investigation (INSTEAD trial).

There is limited ability to intervene in Chronic Type B Thoracic Aortic Dissection with late aneurysm formation being treated mostly with open surgery. Stent grafts have a much smaller role.

Vascular Trauma

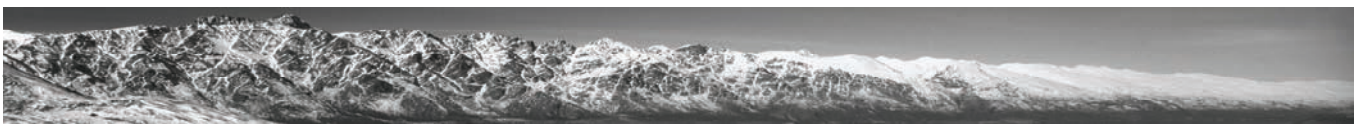
Virtually all blunt aortic trauma is treated with stent grafting. Endovascular techniques can also be used to treat difficult to access bleeding for both blunt and penetrating trauma (pelvis, abdominal, subclavian, renal).

Genetics

High-level genetic research is being done in Australasia (Dunedin and Cairns) to determine genetic inheritance and risk profiles. Millions of data analysis points using Genome Wide Association Screening (GWAS) can identify previously unknown correlation to genes and specific phenotypes.

Peripheral Artery Occlusive Disease (PAOD)

There is much time spent in diagnosis of PAOD helped with specific Vascular Laboratories. Non-invasive testing (pulse volume recording, plethysmography, ankle brachial indices, exercise testing) and ultrasound form the backbone for this.



Most centres will look towards investigation of PAOD in Rutherford class 3-6, although diagnostic dilemmas, young age and the suggestion of iliac disease (better results with intervention as compared with infra-inguinal) may be investigated earlier.

Symptoms	Rutherford classification
Asymptomatic	0
Mild claudication	1
Moderate claudication	2
Severe claudication	3
Rest pain	4
Minor tissue loss/ulcer	5
Major tissue loss	6

Risk factor modification has become vastly more important with smoking cessation, anti-platelet therapy, statin therapy, exercise regimes and medical treatment of diabetes and hypertension featuring. Statin therapy appears to have pleotropic advantages over and above its cholesterol lowering effects, leading to most vascular patients being prescribed therapy regardless of lipid profile.

Ideal Lipid Profile – New Zealand Heart Foundation Guidelines	
Total cholesterol	Less than 4 mmol/L
LDL cholesterol (bad)	Less than 2.0 mmol/L
HDL cholesterol (good)	Greater than 1.0 mmol/L
TC / HDL ratio	Less than 4
Triglycerides	Less than 1.7 mmol/L

PAOD Intervention

Most intervention is endovascular as a first line if there is felt to be advantage over open therapy (shorter lesions, stenosis rather than occlusion, not involving branches, more proximal lesions especially iliac). Plain Old Balloon Angioplasty (POBA) still remains the mainstay. Stents have found favour recently in the SFA with the BASIL trial suggesting that “In patients presenting with severe limb ischaemia due to infra-inguinal disease and who are suitable for surgery and angioplasty, a bypass-surgery-first and a balloon-angioplasty-first strategy are associated with broadly similar outcomes in terms of amputation-free survival, and in the short-term, surgery is more expensive than angioplasty.”

Options for leg endovascular intervention –

- Plain Old Balloon Angioplasty (POBA)
- Stents
- Drug eluting balloons
- Cutting balloons
- Drug eluting stents
- Covered stents
- Bio-absorbable stents

Mid and late re-stenosis has hampered intervention in the lower leg with SFA and popliteal lesions struggling to achieve less than 50% re-stenosis rates at 2 years. For critical limb ischaemia particularly with tissue loss this is thought to be less important as short-term healing with mid-late re-stenosis less important ie re-stenosis doesn’t matter if the foot has healed.

Equipment which is available through smaller sheaths is very helpful with much femoral work being able to be done through 5Fr and even 4Fr sheaths. Groin closure devices have significantly helped the groin complications and early ambulation.

Tibial intervention has markedly increased with major advances in inventory and technique. Included in this is the angiosome concept where specific parts of the foot are supplied by specific tibial arteries and endovascular intervention should be guided somewhat by this –

- Low profile balloons
- Tibial / CTO wires (0.014/0.018 gauge rather than 0.035)
- Smaller access sheaths
- Longer balloons
- Dedicated stents with and without drug coating
- Retrograde and safari access
- Angiosome concept

Bypass surgery has reduced significantly although remains the mainstay for longer lesions and failed endovascular intervention. Combined procedures in hybrid theatres are increasingly common in this area particularly as management of the common femoral artery disease remains mostly surgical. There is no advantage for Dacron over PTFE but there has been a vast reduction in prosthetic graft use. Vein confers a 10-50% advantage over prosthetic (TASC) more marked the more distal (tibial) the bypass. The use of alternative sources of vein (contralateral great saphenous vein, small saphenous vein, arm vein) and the use of spliced vein (multiple vein segments of vein) can make these procedures more challenging and lengthy form a surgical point of view. There is no clear benefit of reversed vs non-reversed vein.

Rigorous surveillance of bypass and endovascular repair is useful. However there is less utility in US surveillance of iliac intervention (surgical or endovascular) and tibial endovascular intervention (due to calcification.

Renal Artery

There has been a significant decline in surgical renal intervention in the last 10 years. Almost all intervention is endovascular with surgery being limited to failed endovascular intervention and some procedure in combination with open aortic surgery.

There has also been a decline in renal angioplasty and stenting for ostial atherosclerotic disease. Both ASTRAL and CORAL have shown mixed results with only sub-group benefit. However there are a number of people with hypertension and some with ischaemic nephropathy who may benefit. There may be benefits in endovascular advances with low profile wires (0.014) and stents, the use of “no touch” vessel cannulation and covered stents to minimise the risk of athero-embolisation.

Renal angioplasty without stenting is the mainstay for fibro-muscular disease which is a smaller subset of hypertension patients typically the younger female.

Renal artery denervation has been trialled with promising results in the non-atherosclerotic hypertensive patients. This requires direct renal artery cannulation and then delivery of a noxious stimulus such as radio-frequency ablation to both renal arteries (SIMPLICITY). Early results are promising with results showing "Catheter-based renal denervation can safely be used to substantially reduce blood pressure in treatment-resistant hypertensive patients." These are similar to older surgical techniques of renal artery denervation, which was abandoned due to procedural morbidity and some mortality.

Carotid

Some changes have occurred. There is increasing evidence for the use of medical services to detect patients at high risk of recurrent stroke after a cerebral event. This has been led by the Oxford Group who has championed the ABCD2 scoring system but also re-analysis of older studies (NASCET and ECST), which randomised medical therapy vs carotid endarterectomy (CEA). Early intervention will reduce the recurrent event rate although there is still some debate about the timing. Most units aim to have intervention within 2-3 weeks of the sentinel event. This often requires hospitalisation to achieve. No-referral or open access stroke clinics may assist. Significant advantages exist for CEA in symptomatic carotid stenosis with NNT about 5.

There have been major changes with the type of intervention for symptomatic carotid stenosis with a retrenchment for carotid angioplasty and stenting (CAS). Several trials including ICSS have shown a doubling in stroke rate after CAS. Many of these have been smaller strokes. MRI sub-studies have shown and even higher incidence of cerebral infarcts after CAS when compared with CEA.

High-risk patients may still be referred for CAS and results in this group are encouraging (SAPPHIRE). Specific indications include anatomic variants with high bifurcation, previous surgery or radiotherapy and possibly high medical risk. Some reservations exist in the post-radiotherapy group with a much higher incidence of common carotid lesions, which can be longer, more fibrotic and prone to embolisation. The radiation "arteritis" in the low neck can also be treated with bypass such as subclavian-to-carotid bypass. The major option with the higher risk patients is local anaesthetic CEA. This was shown in GALA to be equivalent and some enthusiasts use this routinely. A slick procedure, both anaesthetically and surgically, is required. A co-operative patient who is able to lie quietly for several hours is required. The incidence of shunt dependence is much lower than with other indirect methods of measuring cerebral perfusion (between 4-10%).

Intervention for lower grade stenosis (50-69%) is beneficial in some case but patients much have a greater life expectancy. Stroke rate is reduced from 11% to 5% over 5 years for those with a 50-69% stenosis, compared with 26% to 9% over 2 years for those with >70% stenosis.

Mesenteric Revascularisation

Chronic gut ischaemia remains a challenge with most intervention using endovascular attempts first. Success and longer-term results are limited with a high re-intervention rate, poorer results in the coeliac artery and those with heavily calcified vessel origins. Surgical revascularisation has excellent patency (>90% at 5 years) but is more lethal with an 8-10% 30-day mortality. There remain diagnostic challenges in this area. There is also a small subset of young patients (almost exclusively female) with coeliac artery compression syndrome, some of which respond to surgical intervention. These should not have endovascular intervention due to poor results and stent compression.

Acute mesenteric ischaemia is a true surgical emergency and most are treated surgically, although catheter directed thrombolysis has been used. A laparotomy to determine gut integrity is useful.

Imaging

There is a major swing to non-invasive diagnostic imaging and few diagnostic catheter studies are done. There are advantages for and against each modality including Nephrogenic Systemic Fibrosis (NSF) and contrast-induced nephropathy (CIN). Most of the non-invasive studies allow interventional planning with marked reductions in contrast dose.

Modality	Advantages	Disadvantages
Ultrasound	Safe, no radiation, repeatable, reliable, excellent for surveillance, able to be done with anti-coagulated patient	Operator dependent, still has difficulties with calcification, especially tibial, time consuming
MRA	Safe, no radiation, able to do dynamic studies, edits out calcium, able to be done with anti-coagulated patient	Operator dependent, Some risk of NSF. Limited in patients unable to co-operate, claustrophobic and those with pacemakers, Not reimbursed in Australia
CTA	Safe, available, excellent for aorto-iliac pathology and aneurysms (lumen, wall and peri-arterial information), able to be done with anti-coagulated patient	Some risk of CIN, radiation, operator dependent with significant time periods of post processing time, difficulties with calcium
Catheter angiography	Remains gold standard, ability to intervene	Involves arterial puncture, radiation, risk of CIN, problems with hypertension, anti-coagulated patients and calcified femoral arteries

NSF – “Nephrogenic systemic fibrosis is a new disease whose incidence has peaked and receded over the past decade. It occurs in the presence of significant renal impairment, either acute or chronic (MDRD creatinine clearance of <30 mL/min/1.73m^2), and is associated with the administration of gadolinium-based contrast (GBC). Since 2006, the incidence of this disease has decreased markedly in patients with renal impairment, mainly owing to protocols that have not administered GBC to patients with creatinine clearances of less than 30 mL/min/1.73m^2, and in some cases with the use of less toxic and lower doses of GBC.”

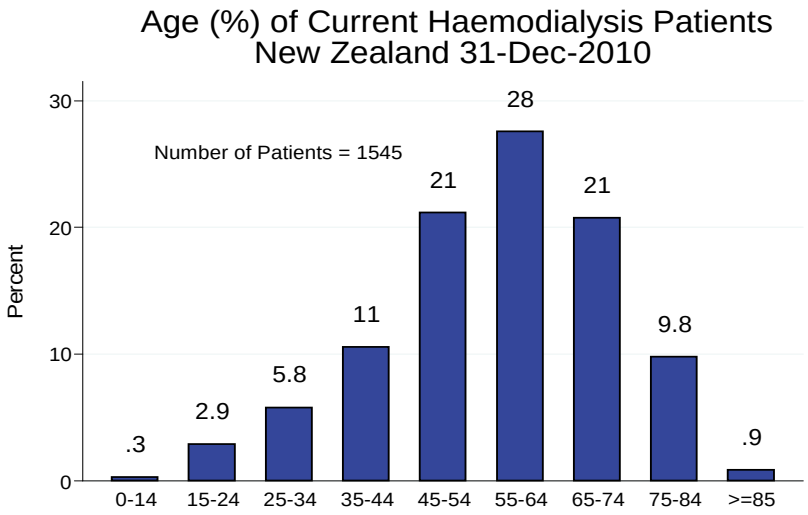
CIN prevention has focused on consideration of alternate imaging modality, normovolaemia, discontinuation of nephrotoxic agents (such as NSAIDS), contrast dose reduction, use of low-osmolal contrast media or iso-osmolal contrast media, IV fluids and N-acetylcysteine. “Over the past half-decade, clinical trials have compared the efficacy of IV sodium bicarbonate (bicarbonate) with IV sodium chloride (saline). Although several trials showed bicarbonate to be more effective than saline for the prevention of CIAKI, other trials reported no difference between these two IV fluids. Clinical trials investigating the efficacy of N-acetylcysteine also have been inconsistent in their results. Consequently, there remains clinical equipoise regarding the superiority of bicarbonate (compared with saline) and the role of N-acetylcysteine.”

Newer intervention fusing the pre-procedural CT or MR with the angio table looks promising. The ability to do on-table angio-CT (360° spin) allows greater precision with angio-intervention (eg fenestrated stent grafting, neuro-intervention) and body intervention (liver, renal, aortic).

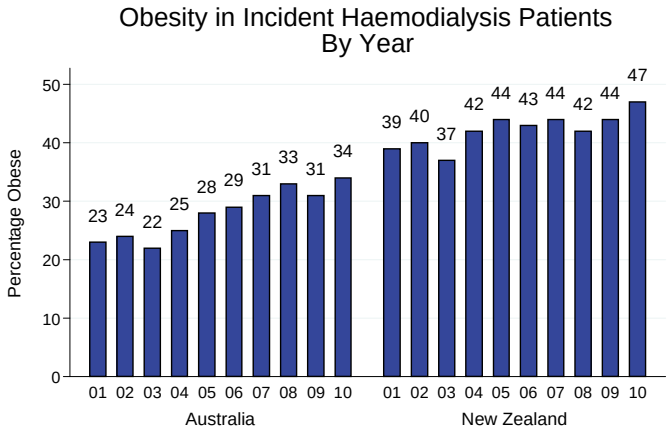
Dialysis Access

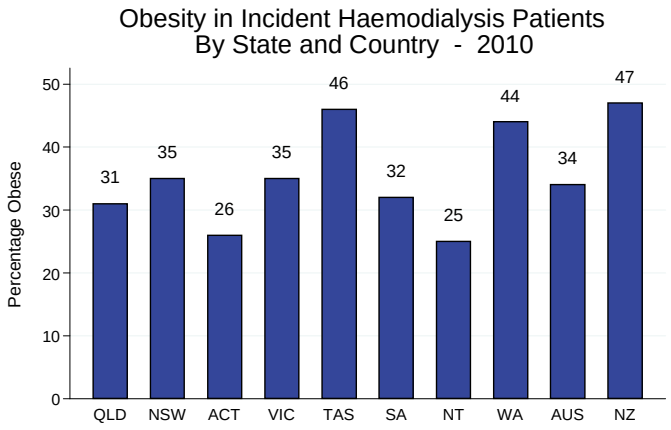
In many units this represents up to 20% of work with a steady increase in patients on dialysis. There is a trend to older sicker patients and a specific emphasis on trying to create an autogenous fistula. One of the main drivers of this is the “Fistula First” initiative in the US with further guidelines at National Kidney Foundation (www.kidney.org/professionals/kdoqi/).

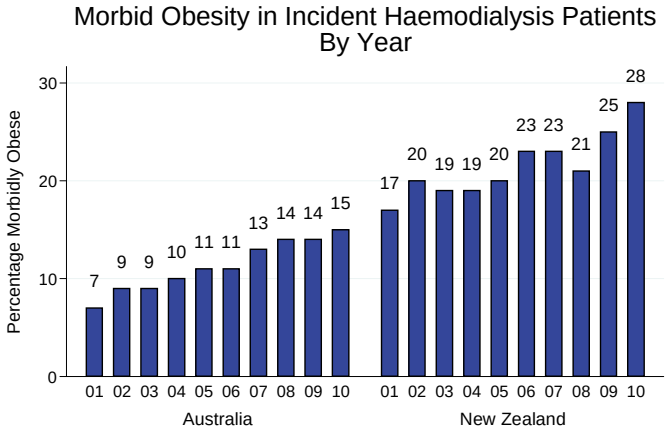
Local data is available on the ANZDATA website which has free public access at ANZ data (www.anzdata.org.au/v1/). And the following tables are taken from the ANZDATA 2010 report.



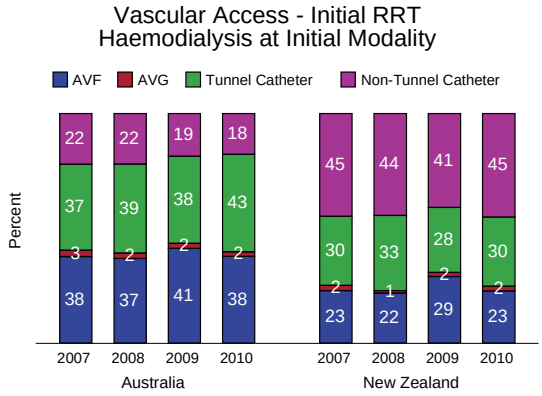
Obesity is an increasing problem with more than 45% of patients in New Zealand starting dialysis obese. Obesity for these analysis is defined as a BMI > 30kg/m^2. Morbid obesity is defined as ≥ 25kg/m^2.



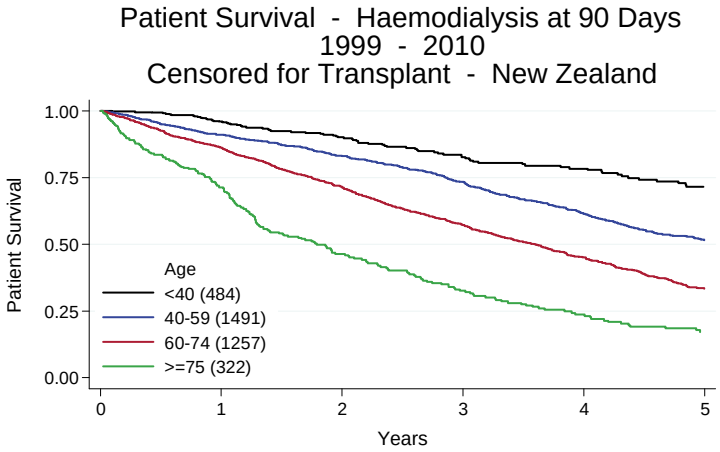




Many patients start dialysis with a central venous line and this confers a significant burden of catheter related sepsis central venous thrombosis and central venous stenosis.



Graft / line in older risk can be considered due to poor life expectancy and longer times to achieve a functioning fistula. Currently at Auckland Hospital a minority of patients have a functioning fistula at 6 months after referral.



Venous Intervention

Venous intervention has made its way back to public hospitals and is riding the “gadget” wave. Techniques for thermal (RFA or EVLT) and chemical (Ultrasound Guide Foam Sclerotherapy, USGFS and Clarivein) ablation of the saphenous vein. “Currently available clinical trial evidence suggests RFA and EVLT are at least as effective as surgery in the treatment of great saphenous varicose veins. There are insufficient data to comment on USGFS.” These are local anaesthetic day stay procedures. EVLT and RFA utilise “tumescent” anaesthetic, which

is ultrasound guided peri-venous delivery of relatively large volumes of dilute local anaesthetic. This acts as an analgesic but also as a heat sink.

Hyperhydrosis

Thorascopic sympathectomy remains used for palmar sweating but popularity has waned due to compensatory flushing and hyperhidrosis on the trunk and face.

Audit

Both the Australian and New Zealand Society of Vascular Surgery (ANZSVS) and the Vascular Society of New Zealand have made full practice audit a condition of membership. The Australasian Vascular Audit (AVA) is a case based on-line data entry system fully funded and owned by the ANZSVS. Index procedures are aortic surgery, fistula patency at discharge, fempop patency at discharge and stroke/death rates for carotid intervention.

Aortic Surgery

Start Date: 1-Jan-2010 **End Date:** 31-Dec-2012
Consultant: auckland **Hospital:** Auckland City Hospital - Auckland -

	auckland @ Auckland City Hospital - Auckland - Auckland	ANZSVS
Open Elective Cases	58	2008
Survival Rate %	96.55%	96.76%
Open Emergency Cases	80	1283
Survival Rate %	85%	79.73%
EVAR Elective Non-Fen Cases	85	3897
Survival Rate %	100%	99.38%
EVAR Emergency Non-Fen Cases	11	289
Survival Rate %	90.91%	86.51%
EVAR Fenestrated Cases	23	302
Survival Rate %	100%	96.03%

Training

There is a dedicated Vascular Surgery training programme and this has been in place with an exit exam since 1997. Currently there are about 50 trainees over 5 years in Australia and New Zealand. There are specific requirements for surgical procedures, US, endovascular procedures, Research/Publication and sign off each run and pre-exam.

Multi-disciplinary teams have had some growth in complex areas including Trauma, Placenta Accreta and high-risk foot clinics.

References

1. Mechanisms of Vascular Disease: A Reference Book for Vascular Specialists. edited by Robert Fitridge and Matthew Thompson , University of Adelaide Press, 2011

Aortic

2. Trends in incidence and mortality from abdominal aortic aneurysm in New Zealand. Sandiford P. Mosquera D. Bramley D. British Journal of Surgery. 98(5):645-51, 2011 May.
3. Systematic review and meta-analysis of the early and late outcomes of open and endovascular repair of abdominal aortic aneurysm. Stather PW. Sidloff D. Dattani N. Choke E. Bown MJ. Sayers RD. British Journal of Surgery. 100(7):863-72, 2013 Jun.
4. Comparison of surveillance versus aortic endografting for small aneurysm repair (CAESAR): results from a randomised trial. Cao P. De Rango P. Verzini F. Parlani G. Romano L. Cieri E. CAESAR Trial Group. European Journal of Vascular & Endovascular Surgery. 41(1):13-25, 2011 Jan.
5. Interpretation of the results of OVER in the context of EVAR trial, DREAM, and the EUROSTAR registry. Malas MB. Freischlag JA. Seminars in Vascular Surgery. 23(3):165-9, 2010 Sep.
6. A Randomized Trial Comparing Conventional and Endovascular Repair of Abdominal Aortic Aneurysms Monique Prinssen, M.D., Eric L.G. Verhoeven, M.D., Jaap Buth, M.D., Philippe W.M. Cuypers, M.D., Marc R.H.M. van Sambeek, M.D., Ron Balm, M.D., Erik Buskens, M.D., Diederick E. Grobbee, M.D., and Jan D. Blankensteijn, M.D. for the Dutch Randomized Endovascular Aneurysm Management (DREAM)Trial Group. N Engl J Med 2004; 351:1607-1618.
7. N Engl J Med. 2012 Nov 22;367(21):1988-97. doi: 10.1056/NEJMoa1207481. Long-term comparison of endovascular and open repair of abdominal aortic aneurysm. Lederle FA, Freischlag JA, Kyriakides TC, Matsumura JS, Padberg FT Jr, Kohler TR, Kougias P, Jean-Claude JM, Cikrit DF, Swanson KM; OVER Veterans Affairs Cooperative Study Group.
8. Initial experience with the Ventana fenestrated system for endovascular repair of juxtarenal and pararenal aortic aneurysms. Holden A. Mertens R. Hill A. Marine L. Clair DG. Journal of Vascular Surgery. 57(5):1235-45, 2013 May.
9. Initial clinical experience with a sac-anchoring endoprosthesis for aortic aneurysm repair. Donayre CE. Zarins CK. Krievins DK. Holden A. Hill A. Calderas C. Velez J. White RA. Journal of Vascular Surgery. 53(3):574-82, 2011 Mar
10. Four-year follow up of patients with untreated abdominal aortic aneurysms. Aziz M. Hill AA. Bourchier R. ANZ Journal of Surgery. 74(11):935-40, 2004 Nov.
11. The UK Small Aneurysm Trial Participants. Mortality results for randomised controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms. Lancet 1998 November 21;352(9141):1649-55.
12. Long-term outcomes of immediate repair compared with surveillance of small abdominal aortic aneurysms United Kingdom Small Aneurysm Trial Participants; Anonymous. The New England Journal of Medicine 346.19 (May 9, 2002): 1445-52.
13. Immediate repair compared with surveillance of small abdominal aortic aneurysms. Lederle, Frank A; Wilson, Samuel E; Johnson, Gary R; Reinke, Donovan B; Littooy, Fred N; et al. The New England Journal of Medicine 346.19 (May 9, 2002): 1437-44
14. Hybrid thoracoabdominal aortic aneurysm repair: current perspectives. Yamaguchi D. Jordan WD Jr. Seminars in Vascular Surgery. 25(4):203-7, 2012 Dec.
15. Durability of branches in branched and fenestrated endografts. Mastracci TM. Greenberg RK. Eagleton MJ. Hernandez AV. Journal of Vascular Surgery. 57(4):926-33; discussion 933, 2013 Apr.
16. Zenith p-branch standard fenestrated endovascular graft for juxtarenal abdominal aortic aneurysms Atsushi Kitagawa, Roy K. Greenberg, Matthew J. Eagleton, Tara M. Mastracci . J Vasc Surg2013;58:291-301

Aortic Dissection

17. Circulation. 2009 Dec 22;120(25):2519-28. doi: 10.1161/CIRCULATIONAHA.109.886408. Epub 2009 Dec 7. Randomized comparison of strategies for type B aortic dissection: the INvestigation of STEnt Grafts in Aortic Dissection (INSTEAD) trial. Nienaber CA, Rousseau H, Eggebrecht H, Kische S, Fattori R, Rehders TC, Kundt G, Scheinert D, Czerny M, Kleinfeldt T, Zipfel B, Labrousse L, Ince H; INSTEAD Trial.
18. J Vasc Surg. 2012 Mar;55(3):629-640.e2. doi: 10.1016/j.jvs.2011.10.022. Epub 2011 Dec 9. Prospective multicenter clinical trial (STABLE) on the endovascular treatment of complicated type B aortic dissection

using a composite device design. Lombardi JV, Cambria RP, Nienaber CA, Chiesa R, Teebken O, Lee A, Mossop P, Bharadwaj P; STABLE investigators.

Trauma

19. J Vasc Surg. 2013 Apr;57(4):899-905.e1. doi: 10.1016/j.jvs.2012.10.099. Epub 2013 Feb 4. Results of a multicenter, prospective trial of thoracic endovascular aortic repair for blunt thoracic aortic injury (RESCUE trial). Ali Khoynezhad, Ali Azizzadeh, Carlos E. Donayre, Alan Matsumoto, Omaida Velazquez, Rodney White, RESCUE investigators

Genetics

20. Human Molecular Genetics, 2013 1–7 doi:10.1093/hmg/ddt141. A sequence variant associated with sortilin-1 (SORT1) on 1p13.3 is independently associated with abdominal aortic aneurysm. Gregory T. Jones,∗, Matthew J. Bown, Solveig Gretarsdottir, Simon P.R. Romaine, Anna Helgadottir, Grace Yu1, Gerard Tromp, Paul E. Norman, Cao Jin, Annette F. Baas, Jan D. Blankensteijn, Iftikhar J. Kullo, L. Victoria Phillips, Michael J.A. Williams, Ruth Topless, Tony R. Merriman, Thodor M. Vasudevan, David R. Lewis, Ross D. Blair, Andrew A. Hill, Robert D. Sayers, Janet T. Powell, Panagiotis Deloukas, Gudmar Thorleifsson, Stefan E. Matthiasson, Unnur Thorsteinsdottir, Jonathan Golledge, Robert A. Arie¨ns, Anne Johnson, Soroush Sohrabi, D. Julian Scott, David J. Carey, Robert Erdman, James R. Elmore, Helena Kuivaniemi, Nilesh J. Samani, Kari Stefansson and Andre M. van Rij

PAOD

21. Eur J Vasc Endovasc Surg. 2007;33 Suppl 1:S1-75. Epub 2006 Nov 29. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG; TASC II Working Group, Bell K, Caporusso J, Durand-Zaleski I, Komori K, Lammer J, Liapis C, Novo S, Razavi M, Robbs J, Schaper N, Shigematsu H, Sapoval M, White C, White J, Clement D, Creager M, Jaff M, Mohler E 3rd, Rutherford RB, Sheehan P, Sillesen H, Rosenfield K.
22. Bypass versus Angioplasty in Severe Ischaemia of the Leg (BASIL) trial: An intention-to-treat analysis of amputation-free and overall survival in patients randomized to a bypass surgery-first or a balloon angioplasty-first revascularization strategy.[Erratum appears in J Vasc Surg. 2010 Dec;52(6):1751 Note: Bhattachary, V [corrected to Bhattacharya, V]] Bradbury AW. Adam DJ. Bell J. Forbes JF. Fowkes FG. Gillespie I. Ruckley CV. Raab GM. BASIL trial Participants. Journal of Vascular Surgery. 51(5 Suppl):5S-17S, 2010 May.
23. Bypass versus Angioplasty in Severe Ischaemia of the Leg (BASIL) trial in perspective. Bradbury AW. BASIL trial Investigators and Participants. Journal of Vascular Surgery. 51(5 Suppl):1S-4S, 2010 May.
24. Drug-coated balloons in the lower limb. [Review] Zeller T. Schmitmeier S. Tepe G. Rastan A. Journal of Cardiovascular Surgery. 52(2):235-43, 2011 Apr.
25. Lancet. 2005 Dec 3;366(9501):1925-34. Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial.
26. Adam DJ, Beard JD, Cleveland T, Bell J, Bradbury AW, Forbes JF, Fowkes FG, Gillepsie I, Ruckley CV, Raab G, Storkey H; BASIL trial participants.
27. N Engl J Med. 2008 Feb 14;358(7):689-99. doi: 10.1056/NEJMoa0706356. Local delivery of paclitaxel to inhibit restenosis during angioplasty of the leg. Tepe G, Zeller T, Albrecht T, Heller S, Schwarzwälder U, Beregi JP, Claussen CD, Oldenburg A, Scheller B, Speck U.
28. A contemporary meta-analysis of Dacron versus polytetrafluoroethylene grafts for femoropopliteal bypass grafting. Takagi H. Goto SN. Matsui M. Manabe H. Umemoto T. Journal of Vascular Surgery. 52(1):232-6, 2010 Jul.
29. Popliteal Versus Tibial Retrograde Access for Subintimal Arterial Flossing with Antegrade-Retrograde Intervention (SAFARI) Technique. Hua WR. Yi MQ. Min TL. Feng SN. Xuan LZ. Xing J. European Journal of Vascular & Endovascular Surgery. 46(2):249-54, 2013 Aug.
30. Heparin-bonded, expanded polytetrafluoroethylene-lined stent graft in the treatment of femoropopliteal artery disease: 1-year results of the VIPER (Viabahn Endoprosthesis with Heparin Bioactive Surface in the Treatment of Superficial Femoral Artery Obstructive Disease) trial. Saxon RR. Chervu A. Jones PA. Bajwa TK. Gable DR. Soukas PA. Begg RJ. Adams JG. Ansel GM. Schneider DB. Eichler CM. Rush MJ. Journal of Vascular & Interventional Radiology. 24(2):165-73; quiz 174, 2013 Feb.
31. Sustained Safety and Effectiveness of Paclitaxel-Eluting Stents for Femoropopliteal Lesions: 2-Year Follow-Up From the Zilver PTX Randomized and Single-Arm Clinical Studies. Dake MD. Ansel GM. Jaff

MR. Ohki T. Saxon RR. Smouse HB. Snyder SA. O'Leary EE. Tepe G. Scheinert D. Zeller T. Zilver PTX Investigators. Journal of the American College of Cardiology. 61(24):2417-27, 2013 Jun 18.
32. Are bio-absorbable stents the future of SFA treatment? Peeters P. Keirse K. Verbist J. Deloose K. Bosiers M. Journal of Cardiovascular Surgery. 51(1):121-4, 2010 Feb.
33. Plast Reconstr Surg. 1998 Sep;102(3):599-616; discussion 617-8. Angiosomes of the leg: anatomic study and clinical implications. Taylor GI, Pan WR.
34. Iida O, Soga Y, Hirano K, Kawasaki D, Suzuki K, Miyashita Y, Terasi H, Uematsu M. Long term reults of direct and indirect endovascular revascularization base don the angiosome concept in patients with critical limb ischemia presenting with isolated below-the knee lesions. J Vasc surg 2012;55:363-70

Renal

35. Influence and critique of the ASTRAL and CORAL Trials. Sarac TP. Seminars in Vascular Surgery. 24(3):162-6, 2011 Sep.
36. Revascularization versus Medical Therapy for Renal-Artery Stenosis. The ASTRAL Investigators. N Engl J Med 2009; 361:1953-196.
37. The management of renovascular disease: ASTRAL and beyond. Cheung CM. Chrysochou C. Kalra PA. Current Opinion in Nephrology & Hypertension. 20(1):89-94, 2011 Jan.
38. Revascularization versus medical therapy for renal-artery stenosis. ASTRAL Investigators. Wheatley K. Ives N. Gray R. Kalra PA. Moss JG. Baigent C. Carr S. Chalmers N. Eadington D. Hamilton G. Lipkin G. Nicholson A. Scoble J.. New England Journal of Medicine. 361(20):1953-62, 2009 Nov 12.
39. Lancet. 2010 Dec 4;376(9756):1903-9. doi: 10.1016/S0140-6736(10)62039-9. Epub 2010 Nov 17. Renal sympathetic denervation in patients with treatment-resistant hypertension (The Symplicity HTN-2 Trial): a randomised controlled trial. Symplicity HTN-2 Investigators, Esler MD, Krum H, Sobotka PA, Schlaich MP, Schmieder RE, Böhm M

Carotid

40. Carotid artery stenting compared with endarterectomy in patients with symptomatic carotid stenosis (International Carotid Stenting Study): an interim analysis of a randomised controlled trial.[Erratum appears in Lancet. 2010 Jul 10;376(9735):90 Note: Nasser, H-C [corrected to Nahser, H-C]] International Carotid Stenting Study investigators. Ederle J. Dobson J. Featherstone RL. Bonati LH. van der Worp HB. de Borst GJ. Lo TH. Gaines P. Dorman PJ. Macdonald S. Lyrer PA. Hendriks JM. McCollum C. Nederkoorn PJ. Brown MM. Lancet. 375(9719):985-97, 2010 Mar 20.
41. Characteristics of ischemic brain lesions after stenting or endarterectomy for symptomatic carotid artery stenosis: results from the international carotid stenting study-magnetic resonance imaging substudy. Gensicke H. Zumbrunn T. Jongen LM. Nederkoorn PJ. Macdonald S. Gaines PA. Lyrer PA. Wetzel SG. van der Lugt A. Mali WP. Brown MM. van der Worp HB. Engelter ST. Bonati LH. ICSS-MRI Substudy Investigators. Stroke. 44(1):80-6, 2013 Jan.
42. A simple score (ABCD) to identify individuals at high early risk of stroke after transient ischaemic attack. Rothwell, P M; Giles, M F; Flossmann, E; Lovelock, C E; et al. The Lancet 366.9479 (Jul 2-Jul 8, 2005): 29-36. General anaesthesia versus local anaesthesia for carotid surgery (GALA): a multicentre, randomised controlled trial. Lewis, S C; Warlow, C P; Bodenham, A R; Colam, B; Rothwell, P M; et al. The Lancet 372.9656 (Dec 20, 2008/Jan 2, 2009): 2132-42. http://www.dcn.ed.ac.uk/gala/
43. North American Symptomatic Carotid Endarterectomy Trial Collaborators. Beneficial effect of carotid endarterectomy in symptomatic patients with high-grade stenosis. N Engl J Med. 1991;325:445–453.
44. Barnett HJM, Taylor DW, Eliasziw M, Fox AJ, Ferguson GG, Haynes RB, Rankin RN, Clagett GP, Hachinski VC, Sackett DL, Thorpe KE, Meldrum HE, for the North American Symptomatic Carotid Endarterectomy Trial Collaborators. Benefit of carotid endarterectomy in patients with symptomatic moderate or severe stenosis. N Engl J Med. 1998;339:1415.
45. European Carotid Surgery Trialists' Collaborative Group. MRC European Carotid Surgery Trial: interim results for symptomatic patients with severe (70–99%) or with mild (0–29%) carotid stenosis. Lancet. 1991;337:1235

Imaging

46. Gadolinium-induced nephrogenic systemic fibrosis. Hellman RN. Seminars in Nephrology. 31(3):310-6, 2011 May.

47. Disease-Specific Kidney Imaging Contrast-Induced Acute Kidney Injury: Short- and Long-Term Implications. Steven D. Weisbord and Paul M. Palevsky. Seminars in Nephrology, 2011-05-01, Volume 31, Issue 3, Pages 300-309

Venous

48. Endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus conventional surgery for great saphenous vein varices. Nesbitt C. Eifell RK. Coyne P. Badri H. Bhattacharya V. Stansby G. Cochrane Database of Systematic Reviews. (10):CD005624, 2011