There is no disease more conducive to clinical humility than aneurysm of the aorta.

–Sir William Osler
The Aortic Team is dedicated to personalised world-class evidence-based care, excellence in education and research, and altruistic innovation in healthcare delivery.
**Complex endovascular aneurysm repair** is the repair of juxtarenal and thoracoabdominal aneurysms with bespoke endografts. The complexity of these procedures and the durability of the repair is dependent on the number of branching stents used. Over the last three years, we have changed our practice to provide the most durable repairs for our patients, while ensuring that we maintain superior outcomes.

Public reporting of resource intensive procedures is essential in a public healthcare system to ensure responsible use of resources. Traditionally, when reporting falls below 100%, outcomes are skewed in favour of survival, leading to a biased report. The Aortic Team supports the [National Vascular Registry](https://www.nvrr.org.uk) and since 2014, we have implemented systems to ensure that 100% of aortic aneurysm procedures performed at Royal Free London are publicly reported.
The benefit of minimally invasive surgery for complex aneurysms is realised when the impact on a patient is reduced to make the recovery easier, hastening the return to baseline quality of life. We have worked hard to refine our techniques to improve outcomes for our patients and make their return to ‘normal life’ swift. This includes preoperative rehabilitation programmes that are speeding post operative recovery and advanced imaging techniques to reduce radiation dose.
Following the Lifespan of Aneurysm Disease.
We are dedicated to providing for patients with aneurysm disease at all points along their path of care. Our Aneurysm Screening programme identifies high risk individuals using ultrasound screening. Once found, small aneurysm surveillance is undertaken by our expert screening technicians, and our Nurse Clinician Yasmin Uddin, who runs a one-stop-shop small aneurysm clinic. After surgery, the same efficient model is used to wisely follow patients who require annual surveillance after endovascular repair!

Inpatient Care for Aneurysm Patients. The early days of recovery from aneurysm surgery is the one time when our patients spend time at the hospital. During that period, we work hard to build early mobilisation and rehabilitation into the daily routine. Our therapies team, including occupational therapists and physical therapists work with patients daily to get them moving and ready for home.
Dedicated Vascular Specialist Nurses.
One of the greatest strengths of the Aortic Team at Royal Free is the strong team of specialist vascular theatre nurses that participate in every case. Training to develop expertise in both open and endovascular procedures, our theatre staff is versatile, skilled and professional. This makes perioperative outcomes in both elective and emergencies procedures better! If you want to join our nursing team, please contact rf.aorticreferrals@nhs.net.

Simulating Ruptured Aneurysms.
Preparation is everything! Under the leadership of Dr. J Lowery and the expert educational coordinators at Royal Free, the aortic team runs immersive high fidelity simulation of ruptured aneurysm scenarios throughout the year. This allows us to test response time and team coordination so we can be ready for our patients when they arrive. We strive towards a ‘door to knife’ time of under 30 minutes, in keeping with global guidelines and putting us on par with leading aortic centres. Research describing this work has been submitted to the Vascular Anaesthesia Society of Great Britain and Ireland for the 2017 meeting. (J Lowery, NSchofield, D Kemp, T Mastracci)

Aneurysm Screening. The North Central London Abdominal Aortic Aneurysm (AAA) Screening Programme continues to deliver aneurysm screening to 65 year old men in the area, led by Miss M Davis. This year 4032, men were screened representing 78.5% of all men eligible in our sector, an increase compared with previous years. Within the screening year, 10 men were referred for and successfully underwent aortic aneurysm surgery. In addition there were 328 men who self referred to the service and in this cohort aneurysms were identified in 3%; in contrast to the incidence of aneurysms in the invited cohort of 0.64%, suggesting that focusing on awareness and education in the community will improve the detection and treatment of aneurysms. In February 2017, our AAA Screening Programme underwent its national quality assurance visit. This was a comprehensive review of all aspects of the service. The team received a positive report and were commended on several initiatives undertaken to promote the service, including the ‘aortic hotline’, which has been active for 3 years. This report is available on Public Health England website.
**Calcification of Prosthetic Vascular Materials**

In work done for European Society of Vascular Biomaterials (ESVB) our team has contributed a review of prosthetic calcification. Currently the need for small diameter prosthetic grafts is growing and with patients living longer, the demand for vascular graft materials with longer patency rates and more durability has increased. Recent observations, which have also been corroborated by others in published literature have shown that calcification may be an under-estimated occurrence in vascular prosthetic graft materials. These studies advocate that an international registry be set up where explanted grafts can be sent for analysis and research. This melds well with the work on biomaterials development done by Professor G Hamilton and D Chong over the last few years, hopefully bringing us closer to a truly perfect conduit for blood vessel replacement. *(D Chong, G Hamilton)*

**Outcomes for Women Undergoing Complex Aneurysm Surgery**

Recent reports have suggested that women have unfavourable outcomes when compared with men when undergoing endovascular aneurysm repair (EVAR) or thoracic endovascular aneurysm repair (TEVAR). However there has not been any published data looking at outcomes in women when undergoing complex endovascular procedures such as fenestrated and branch repairs, especially when compared with the published outcomes of men. Combining data from Royal Free and Lille increased the population size to find meaningful outcomes which will change device design for women worldwide. The results of this project have been accepted for presentation later this year at the European Society for Vascular Surgery Annual Meeting 2017 in Lyons, France. *(D Chong, T Martin-Gonzalez, K vanCalster, S Haulon, T Mastracci)*

**Reducing Radiation Exposure During Complex Endovascular Procedures.** J Edwards, radiation physicist, has been working in collaboration with D Chong to analyse the amount of radiation exposure that operating surgeons are exposed to during Complex Endovascular Procedures and ways to reduce radiation exposure through staff education and training. Complex Endovascular procedures are known to result in high dose to both the patients undergoing the procedure as well as the staff performing the procedure. Therefore it is important to make sure vascular surgery staff members are educated in radiation training especially in accordance with the ALARA (as low as reasonably achievable) principles, to become personally accountable for their dose. Ring dosimeters were added to the operating surgeons armamentarium, in addition to standard waist and collar dosimeters, and the radiation exposure were monitored over the last 2 years. The rings and collar doses are recorded to be around 5 and 10 times lower, respectively, than those published in current literature, and provides an international benchmark. This has been achievable due to the rigorous radiation training and awareness training that the Royal Free staff undergo regularly. These excellent results have been submitted for presentation to Vascular Society of Great Britain and Ireland Annual Meeting 2017. *(D Chong, J Edwards, M Davis, T Mastracci)*
Exploring fusion imaging in aneurysm surveillance. Augmented reality, known as fusion imaging in the endovascular field, plays an important role in operating theatres, but has never been explored for its uses after the operation is complete. This year’s aortic fellow dedicated her research time to developing a novel system for using fusion imaging to compare post operative imaging, providing a truly automated and accurate method for assessing the morphology of stent grafts after implantation. Our pilot study found that fusion for post operative imaging could reliably identify stent malfunction. It is our hope that the use of machine learning will allow this incredibly interesting early data to be expanded to develop a tool for routine clinical use — taking human error and inexperience out of the equation and catching problems before they become complications. This research will be presented at the European Society of Vascular Surgery in Lyon in 2017. (T Martin-Gonzalez, G Penney, T Mastracci)
Aneurysm screening in deprived groups. Nationally it has been noted that areas of higher deprivation have the lowest uptake of aneurysm screening. National data suggests that, in areas with highest deprivation score 68% attended aneurysm screening compared with 88% in privileged areas.* In addition the areas with the highest deprivation score were twice as likely to decline to attend aneurysm screening. This is an area of concern to the screening programme and highlights the importance of engaging with our more deprived communities, which we are starting to do by partnering with the tech industry to embrace digital and social media strategies, which we hope will be available this year. We would welcome any opportunities to discuss ways to improve awareness of aneurysm screening in our area. If you would like to discuss this further please email: rf.nclaaascreening@nhs.net (*stats from Jacomelli et al, EJVES 2017)

Embracing the spirit of our founder, William Marsden, who started the Royal Free Hospital in 1828 to provide high quality treatment to patients in financial need, the Aortic Team has refocused the direction of research and innovation this year to include a spirit of altruism. This movement, which we call ‘Altruistic Innovation’ aims to infuse a broader underlying purpose to our work: both to benefit our patients, and to have a vision to benefit a cause outside our local reach. We have found different ways of incorporating altruistic innovation into our practice this year, and are always keen to explore more. We know that not every endeavour may succeed on a more global scale, but we feel very strongly that our actions, when purposed with the goal of doing good for a global population, may prove to be multiplicative and hopefully inspire a similar trend in our colleagues around the world.

Fusion for Infrarenal EVAR  Fusion imaging has changed practice as it has decreased radiation dose and shortened procedure time in complex endovascular repairs. We wanted to prove that it had benefit in simple aneurysm repairs, while also pioneering a system that could be used on the mobile c-arms present in most small or under-resourced centres. We partnered with Cydar Medical and Siemens Cios Alpha to test fusion on a mobile system and proved that it is feasible, and the benefits seen in complex repairs are realised for EVAR as well. Presented at Society for Vascular Surgery in San Diego, California. (B. Maurel, T Martin-Gonzalez, D Chong, A Irwin, M Davis, T Mastracci)
Validating imaging systems. As the widespread use of endovascular surgery increases, there is a greater need for post processing software to ensure that images can be properly interrogated and follow up scans can be assessed for potential stent complications. With limited competition in this marketplace, these software packages can be extremely expensive and burdensome for healthcare systems with lower opportunity for investment, and while freeware versions exist, they have not been validated for clinical use. This year, we have tested and validated a software package developed by Siemens to prove its accuracy compared with the gold standard. Finding positive results, we are hoping similar software can be refined and used as ‘freeware’ packages to make accurate tools available for aortic interventionists around the world. (T Martin-Gonzalez, D Chong, N Rudarakanchana, M Davis, TM Mastracci)

Dose Awareness Matters. The use of ionising radiation in vascular surgery is not just commonplace, but it is increasing the occupational exposure to those who care for vascular patients. Radiation education is imperative to good surgical practice, but easily digestible educational tools are hard to find. We partnered with Cydar Medical and Gripped Communication to develop a well researched film that reviews the most important aspects of dose awareness and made it available for global use. The Aortic Charity was started to provide funding for educational tools such as this, and we are hoping that more projects like this will bring greater awareness to the whole endovascular community. (View it at https://youtu.be/bz4bQWb_6dE) (B Maurel, TM Mastracci, J Cole, J Edwards, J Gough)
Exercise training in patients awaiting complex aortic surgery. Physical fitness has benefits in almost every context of health and disease and there is mounting evidence confirming the relationship between physical fitness and improved surgical outcomes. Aneurysm repair, both open and endovascular, carries risks and patients with complex abdominal aortic aneurysms frequently have poor exercise capacity due to deconditioning and other medical problems. We are currently recruiting to a study involving patients awaiting complex aortic surgery, to see whether it is possible to use an individualised exercise training programme to improve their fitness and potentially benefit recovery after surgery. This observational study involves CPET (Cardiopulmonary Exercise Testing) for objective assessment of cardiopulmonary fitness at baseline and after 3 and 6 weeks of personalised exercise training on a static bicycle, carried out in the Royal Free Hospital three times a week. We are also providing patients with simple pedometers to assess day-to-day activity. To date, we have recruited a total of 19 patients across both the intervention and control arms. We will be reporting the results in early 2018. (C Morkane, N Schofield, T Mastracci, D Martin)

Patient Reported Outcomes Study The Royal Free Aortic team has some of the best clinical outcomes in the world for aortic surgery. To ensure our patients receive the best care possible, we are undertaking an innovative research study to identify whether mobile phone technology can be used to measure long term post operative quality of life outcomes in patients undergoing aortic surgery. The study will look at preoperative and postoperative quality of life to ensure patients get long term quality of life following surgery. Introducing digital technology into our patient care pathway allows us to develop tools that will grow with the times, and be responsive to individual patient needs. (C Sathanathan, J Benham-Hermetz, L Shovel, C Donohue, T Mastracci, N Schofield)

Post-operative Cognitive Function. The Royal Free Perioperative Research group has teamed up with Dr Daniel Davies, who is a leading academic in Care for Older People. Dr Davis is the PI of the Delirium and Population Health Informatics Cohort (DELPHIC) study, which tracks cognition before, during and after acute illness in older Camden residents. By working together we will look at the effect that major surgery has on cognitive function following surgery, and try to understand the underlying mechanisms that may lead to cognitive decline in older patients undergoing surgery. Understanding cognitive decline helps us prepare older patients for surgery and bring them back to preoperative function after major vascular surgery. (C Sathanathan, J Benham-Hermetz, D Davis, D Walker, H Zetterberg, N Schofield, J Whittle)
Frailty in aortic surgery. The aortic team has a holistic approach in the journey of patients. As well as pre-operative discussions with the surgical team about the nature and risks of surgery, the patient also sees a highly experienced anaesthesia team, who discuss the risks and benefits of surgery, and ensure that the patient is in the most optimal condition to undergo surgery. Part of this assessment looks at frailty, as well as other comorbid conditions that may increase the risks of surgery. The anaesthesia team has recently published work showing that patients with lower muscle mass have higher risks at the time of surgery. This has lead to a greater emphasis on optimising patients before surgery and ensuring good planning for their post operative care. Ongoing work to study whether exercise can improve muscle strength and physiological reserve before surgery, and the use of a dedicated consultant in Surgical Medicine to help treat patients with complex medical needs during the perioperative period, are being investigated.

(C Morkane, L Shovel, C Donohue, S Wylie, N Schofield)
Mutlidisciplinary team simulation teaching sessions. Teaching new members of the team to maintain high standards is an important intervention in hospital teaching centres with high turn over and many student learners. Our radiographers have spearheaded the development of high fidelity teaching sessions, which use radiolucent aortic models, and fusion imaging coupled with a digital flat panel c-arm to allow radiographers, nurses, anaesthetists and vascular surgeons in training to participate in all aspects of infrarenal aneurysm repair so they understand the roles they play and how they all fit within the theatre ecosystem! This research was presented at UKRCO this year. (B. Reeve, J Cremer, D Chong, T Mastracci)

Hands on surgical education. Traditionally, surgery is a skill passed down through technical demonstration and guided instruction. Despite our high-tech world, we continue to provide teaching to surgical colleagues in this way. The Lille endovascular course is one example of an organised and interactive multi-day hands on event that is supported by the Royal Free aortic team. This year, we have branched out, and created training videos, as well as taking on an expanded international proctoring and speaking role. Dr. Mastracci gave the Roy Greenberg Lecture at SVS VAM 2017. Video Courtesy M Tonge, illustration M Phillips, Photo SVS


Perioperative patient blood management to improve outcomes N Desai, N Schofield, T Richards. Accepted in Anesthesia & Analgesia. In press


Medical identification or alert jewellery: an opportunity to save lives or an unreliable hindrance? S. Rahman, D Walker, P. Sultan. Anaesthesia. July 2017

Unlocking the phenotype of aneurysm disease: Are women the key? Mastracci T Vasc Med. 2017 Apr;22(2):119-120.


The Aortic Team would like to acknowledge the incredible photographic talent of David Bishop, and the ongoing support and leadership of Linda McGurrin who keeps our division moving forward.