Renal Outcome After Open Surgery and Fenestrated Endovascular Aneurysm Repair of Juxta-renal Aneurysms

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Shahverdyan et al. present the results of a single centre series and evaluate the difference in outcome between open surgery and fenestrated endovascular aneurysm repair (FEVAR), with a particular focus on renal function. New onset of renal insufficiency was detected in 26.5% of the open surgery group and 8.5% of the endovascular group, which was persistent in 11.8% and 5.7%, respectively. Three per cent of the patients in each group required dialysis in the longer term. The rate of renal failure after open repair and after FEVAR in a recent systematic review were 13.9% and 11.4%, respectively, with no difference in the rate of permanent dialysis between the groups (2.8% and 1.9%, respectively). In a propensity-matched comparison, the rates of perioperative renal insufficiency were 2.7% after open repair and 7.1% after FEVAR (p = .1); the FEVAR group was initially considered to be at risk for open surgery. Despite the transient nature of postoperative renal dysfunction, in most cases it remains a significant predictor of mortality in these patients.

Serum creatinine is the most commonly reported marker of renal function, but estimated glomerular filtration rate (eGFR) can offer greater functional sensitivity. Renal volume has been assessed in various urological studies as a predictor of graft function in living donor renal transplantation. It can be calculated from computed tomography (CT) data and has been shown in the context of endovascular aneurysm repair to be an early marker of renal dysfunction and to correlate well with eGFR.

Renal impairment in FEVAR is related to the nephrotoxicity of the contrast medium and macro- and micro-embolisation into the renal arteries during device manipulation in the aorta, and the inflammatory response associated with the procedure. Carbon dioxide has been used as a contrast medium in patients with renal failure, but it is associated with a high complication rate including right heart strain and fatal non-occlusive mesenteric ischaemia. The repositionability of the Cook and Anaconda stent-grafts is intended to allow better alignment between the device and the renal artery ostia but it may also cause embolisation of athero-embolic material into the renal arteries. Other endovascular considerations include the design of the bridging stents, the amount of flaring of the proximal end, and the anatomy of the renal artery.

Aortic cross-clamping during open surgical repair results in renal hypoperfusion and every additional 5 minutes of renal ischaemia time has been shown to double the risk of postoperative renal dysfunction. Clamp placement above both renal arteries, and manipulation of the aorta and renal arteries results in embolisation of material and this effect is compounded by ischaemia-reperfusion injury. Division of the left renal vein increases the risk of renal dysfunction by six times. Perfusion of the renal arteries with cold crystalloid solution may preserve renal function during thoracoabdominal aneurysm repair but is not widely used in juxta-renal aneurysm repair.

Imaging surveillance is mandatory after FEVAR but repeated CT angiography exposes the patient to nephrotoxic iodinated contrast agent. Studies investigating the effect of different CT contrast agents on renal kinetics and renal oxygenation have shown that low osmolar compared with iso-osmolar contrast agents have a superior profile regarding rapid excretion, short-term renal exposure, and renal oxygenation. Surveillance is currently changing from repeated CT angiography to immediate post-FEVAR cone-beam CT in the hybrid room with ultrasound performed prior to hospital discharge. CT angiograms are then performed at years 1 and 3 in the presence of good renal function with ultrasound performed annually. Ultrasound provides a hemodynamic evaluation of the bridging stents and target vessels, and the CT images are used to verify device integrity and positioning. Contrast-enhanced ultrasound has been shown to be as accurate as CT scan in detecting endoleaks and in assessing both target vessel patency and aortic diameter after fenestrated endovascular repair.

Future work should be directed towards investigation of potential biomarkers to predict risk, prognosis, and therapeutic response in patients with acute kidney injury. Renal impairment should be assessed with eGFR, which is a sensitive and reliable measure of renal function. Definite evidence of a difference between open surgical repair and FEVAR would require a randomised controlled trial and long term follow-up of 5–10 years.

REFERENCES