Case Report

Anesthetic management in a patient of autosomal dominant polycystic kidney disease with end stage renal disease undergoing endovascular coiling for multiple intracranial aneurysms

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Abstract

A 27-year-old woman of autosomal dominant polycystic kidney disease presented with multiple intracranial aneurysms at anterior communicating artery and left middle cerebral artery bifurcation. She was undergoing hemodialysis every alternate day and was waiting for a renal transplantation. Endovascular coiling of both these aneurysms was performed under general endotracheal anesthesia. During the procedure special precaution was taken with regard to intra-procedural fluid management and maintenance of cerebral perfusion pressure. The procedure remained uneventful during which a stable hemodynamics was maintained. In this report, the implication of intraprocedural fluid infusion by the neuroradiologist its possible influence on overall anesthetic management has been described.

Keywords: Anesthesia, autosomal dominant polycystic kidney disease, endovascular coiling, end-stage renal disease

Introduction

Autosomal dominant polycystic kidney disease (ADPKD) is one of the most common genetic disorders with the prevalence of 1:400-1:1000 live births.[1] In these patients, the incidence of intracranial aneurysm is 4-11.7%.[2,3] Majority of these aneurysms are <10 mm diameter with a risk of rupture being five-fold higher in ADPKD than the general population.[2,3] The risk of rupture depends on the size, location, and a history of subarachnoid hemorrhage (SAH).[4] Routine screening is recommended for patients with unruptured aneurysm admitted to undergo elective surgery if they have co-existing ADPKD and a family history of previous SAH.[5] Treatment options for intracranial aneurysm range from surgical clipping to endovascular coiling based on location of the aneurysm, number, and current renal status with respect to hemodialysis.[6] The literature search did not reveal much about the management of patients with ADPKD and end-stage renal disease (ESRD) undergoing coil embolization (coiling) under anesthesia for intracranial aneurysm. Here, we share our experience in this regard.

Case Report

A 27-year-old female patient (52 kg) of ADPKD with anuria presented to our interventional neuroradiology (INR) suite for endovascular coiling of multiple intracranial aneurysms. She was undergoing hemodialysis every alternate day and was waiting for a renal transplantation. Twelve years back she

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underwent clipping for right middle cerebral artery (MCA) aneurysm under anesthesia that was uneventful. She also underwent caesarean section under spinal anesthesia 2 years back for pregnancy-induced hypertension with intra uterine growth retardation of the fetus. At that time, her creatinine level was elevated (2 mg/dl) and subsequently, it remained elevated. A thorough renal assessment revealed bilateral polycystic kidney disease. She was diagnosed with ADPKD and hemodialysis was carried out for anuria by establishing an arterio-venous fistula on right forearm. Based on the diagnosis of ADPKD with the previous history of SAH screening was done which suggested multiple aneurysms at anterior communicating artery and left MCA bifurcation. As she was scheduled to undergo renal transplantation, coiling of the aneurysms was planned prior to transplantation. There was no associated cardiac or metabolic illness associated with chronic renal failure. Hemodialysis was carried out in the night before the procedure. Routine investigation on the day of coiling found a raised level of urea and creatinine up to 260 and 2.8 mg/dl, respectively. The electrolytes and coagulation profile were within normal limits. Her chest X-ray and two-dimensional echocardiography reports were also normal.

In the INR suite, standard monitors like electrocardiogram, noninvasive blood pressure, pulse oximeter, and skin temperature probe were attached. An 18G intravenous (IV) cannula was secured on dorsum of the left hand. Anesthesia was induced with propofol and fentanyl, and neuromuscular relaxation was achieved with rocuronium. Trachea was intubated with cuffed endotracheal tube. Anesthesia was maintained with O_2, N_2O and isoflurane and atracurium infusion rate of 0.6 mg/kg/h. An arterial line was secured in left dorsalis pedis artery for continuous monitoring of blood pressure. End-tidal CO_2 and inspired concentration inhalational agents were monitored. During the procedure, no additional IV fluid was given. The procedure lasted for 165 min during which 1200 ml of the heparinized flush was used by the neuroradiologist. The total fluid requirement was 1100 ml and urine output was 50 ml. Iodinated contrast (iodixanol 320 mgl/ml) 80 ml was used during the procedure for coil embolization of both the aneurysms [Figure 1]. The mean arterial pressure was 82 mmHg at the start of the procedure. Despite one brief episode of hypotension during induction that responded to the fluid bolus, rest of the procedure remained uneventful [Figure 2]. At the end of the procedure, residual neuromuscular blockade was reversed, and trachea was extubated after ascertaining hemostasis at the arterial-puncture site. She was shifted to the intensive care unit for further management and was discharged on 2nd day after the procedure.

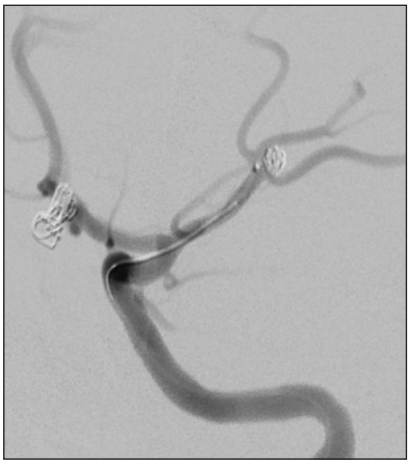

Figure 1: Digital substraction angiography shows coiling of anterior communicating artery and left middle cerebral artery bifurcation aneurysm

Discussion

Patients with ADPKD progress to ESRD at a mean age of 53 and 69 years in Type-1 and Type-2 varieties of the disease, respectively.[7] In our patient, the early-onset ESRD could be due to additional mutations that require further investigation. Possibly, the occurrence of pregnancy-induced hypertension caused further deterioration of renal function.[8] This patient posed two important anesthetic challenges: Maintenance of intravascular volume and prevention of fluid overload. Over hydration manifests with increased lung water or frank pulmonary edema which could prolong the post procedural recovery and hence, increase the duration of hospital stay.[9] This additional fluid burden requires removal by hemodialysis. Since volume load occurs early in chronic renal disease,[10] the maintenance fluid, in this case, was restricted to the amount of heparin flush used.

A review of the literature on the use of heparin flush by interventional neuroradiologists produced scant results.[11] The protocol is to use a loading of 3000-5000 U (50-100 U/kg) followed by a drip at the rate of 1000-1500 U/h (10-20 U/kg/h),[12,13] to maintain an activated clotting time (ACT) more than 250-300 s during the procedure. In our institute, 2500 U of heparin is added to 500 ml of 0.9% normal saline during aneurysmal coiling with variable rate of administration based ACT carried out every 30 min. Hence, approximately 1.2-1.5 L of heparin flush used over a period of three hours. In this case, 1200 ml of heparinized saline used for the procedural use also met the maintenance fluid requirements as a patient might not have tolerated the additional maintenance fluid and contrast load. Hence, maintenance fluid was not given, and the blood pressure was maintained within 10% of baseline without use of vasopressors [Figure 2]. This restrictive fluid therapy was used as the patient had no signs of hypovolemia.

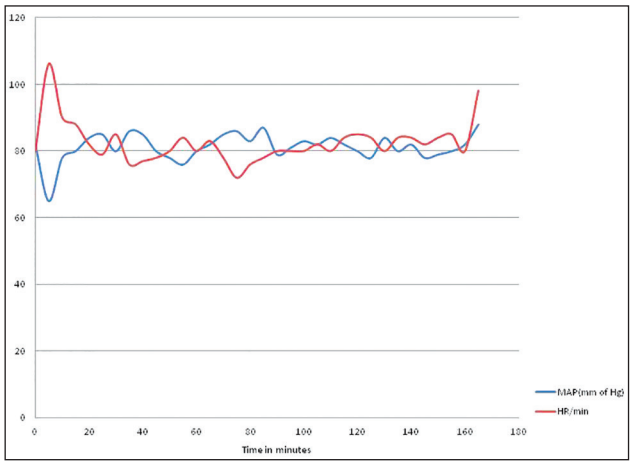

Figure 2: Trend of hemodynamics changes during endovascular coil embolization

Moreover, the procedure of endovascular coiling does not involve major fluid shifts. The contrast load was a nonissue, in this case, as the patient was on hemodialysis.

The choice of anesthetic agents of propofol, fentanyl, atracurium and isoflurane has already been validated in patients with renal failure.[14,15] The anesthetic end-points such as patient immobility, hemodynamic stability, and maintenance of cerebral perfusion pressure, were met with.[16] As the patient was not presented with SAH or mass effect, a reduced intracranial compliance was ruled out, and normocapnia was maintained. A balanced technique of anesthesia provided immobility of the patient and hence, acquisition of fluoroscopic images was better.

A central venous catheter was not used as major fluid shifts were not anticipated. The basic tenets of anesthesia management in chronic renal failure[17] were followed, in our case, to preserve residual renal function by ensuring perfusion of the brain with maintenance of blood pressure.

In retrospect, this case allowed us to draw the conclusion that for interventional neuroradiological procedures in patients with compromised renal function, the heparin flush used by the neuroradiologist should be monitored and included in the maintenance fluid regimen.

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Conflicts of interest
There are no conflicts of interest.

References

1. Schievink WI, Torres VE, Piepgras DG, Wiebers DO. Saccular intracranial aneurysms in autosomal dominant polycystic kidney disease. J Am Soc Nephrol 1992;3:88-95.
2. Unruptured intracranial aneurysms — Risk of rupture and risks of surgical intervention. International study of unruptured intracranial aneurysms investigators. N Engl J Med 1998;339:1725-33.
3. Rinkel GJ, Djibuti M, Algra A, van Gijn J. Prevalence and risk of rupture of intracranial aneurysms: A systematic review. Stroke 1998;29:251-6.
4. Pirson Y, Chauveau D, Torres V. Management of cerebral aneurysms in autosomal dominant polycystic kidney disease. J Am Soc Nephrol 2002;13:269-76.
5. Xu HW, Yu SQ, Mei CL, Li MH. Screening for intracranial aneurysm in 355 patients with autosomal-dominant polycystic kidney disease. Stroke 2011;42:204-6.
6. Yanaka K, Nagase S, Asakawa H, Matsumaru Y, Koyama A, Nose T. Management of unruptured cerebral aneurysms in patients with polycystic kidney disease. Surg Neurol 2004;62:538-45.
7. Halvorson CR, Bremmer MS, Jacobs SC. Polycystic kidney disease: Inheritance, pathophysiology, prognosis, and treatment. Int J Nephrol Renovasc Dis 2010;3:69-83.
8. Chapman AB, Johnson AM, Gabow PA. Pregnancy outcome and its relationship to progression of renal failure in autosomal dominant polycystic kidney disease. J Am Soc Nephrol 1994;5:1178-85.
9. Jones DR, Lee HT. Surgery in the patient with renal dysfunction. Med Clin North Am 2009;93:1083-93.
10. Pecoits-Filho R, Gonçalves S, Barberato SH, Bignelli A, Lindholm B, Riella MC, *et al.* Impact of residual renal function on volume status in chronic renal failure. Blood Purif 2004;22:285-92.
11. Ramesh VJ, Tweedie I, Sacha N. An audit of fluid and heparin administration during interventional neuroradiologic procedures. J Neurosurg Anesthesiol 2006;18:251-5.
12. Song JK, Niimi Y, Fernandez PM, Brisman JL, Buciuc R, Kupersmith MJ, *et al.* Thrombus formation during intracranial aneurysm coil placement: Treatment with intra-arterial abciximab. AJNR Am J Neuroradiol 2004;25:1147-53.
13. Pelz DM, Lownie SP, Fox AJ. Thromboembolic events associated with the treatment of cerebral aneurysms with Guglielmi detachable coils. AJNR Am J Neuroradiol 1998;19:1541-7.
14. Ickx B, Cockshott ID, Barvais L, Byttebier G, De Pauw L, Vandesteene A, *et al.* Propofol infusion for induction and maintenance of anaesthesia in patients with end-stage renal disease. Br J Anaesth 1998;81:854-60.
15. deBros FM, Lai A, Scott R, deBros J, Batson AG, Goudsouzian N, *et al.* Pharmacokinetics and pharmacodynamics of atracurium during isoflurane anesthesia in normal and anephric patients. Anesth Analg 1986;65:743-6.
16. Varma MK, Price K, Jayakrishnan V, Manickam B, Kessell G. Anaesthetic considerations for interventional neuroradiology. Br J Anaesth 2007;99:75-85.
17. Wagener G, Brentjens TE. Anesthetic concerns in patients presenting with renal failure. Anesthesiol Clin 2010;28:39-54.