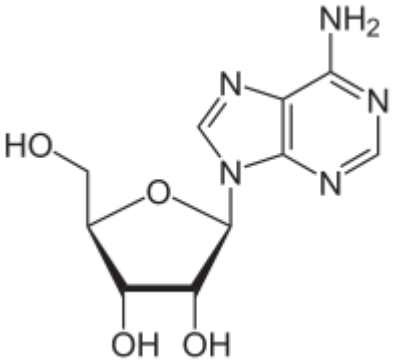
Adenosine

Adenosine is a purine nucleoside composed of a molecule of adenine attached to a ribose sugar molecule (ribofuranose) moiety via a β-N9-glycosidic bond.



Adenosine is widely found in nature and plays an important role in biochemical processes, such as energy transfer—as adenosine triphosphate (ATP) and adenosine diphosphate (ADP)—as well as in signal transduction as cyclic adenosine monophosphate (cAMP). It is also a neuromodulator, believed to play a role in promoting sleep and suppressing arousal. Adenosine also plays a role in regulation of blood flow to various organs through vasodilation.

Adenosine is an endogenous nucleoside analog that alters electrical conduction at the atrioventricular (AV) node and has a negative chronotropic effect on the sinoatrial node. Adenosine acts on cardiac A1 receptors to reduce cyclic adenosine monophosphate activity, which decreases inward calcium conductance and diminishes pacemaker current, resulting in bradycardia, AV nodal blockade, and sinus pauses. It has a very short half-life time (less than 10 seconds) and is rapidly taken up by the vascular endothelium and erythrocytes. The effect on heart rate is seen within 10 to 20 seconds after administration, with the duration of asystole reaching a plateau between 40 to 60 seconds at 1 mg/kg. There is a relative hypotension period of 1 minute after asystole.

Multiple doses are usually required for very large and complex aneurysms to obtain repeated episodes of asystole [1].

see Adenosine induced cardiac standstill.

see Adenosine receptor.

Case reports

A 25-year-old female underwent attempted endoscopic endonasal resection of an advanced right-sided chondrosarcoma. During resection of the tumor, brisk arterial bleeding was encountered consistent with focal injury to the right cavernous ICA. Stable vascular hemostasis could not be achieved with tamponade. An intravenous bolus dose of adenosine was administered to induce a transient decrease in systemic blood pressure and facilitate placement of the muscle patch over the direct site of vascular injury. The patient subsequently underwent endovascular deconstruction of the right ICA.

This is the first reported use of adenosine to induce transient hypotension for a major vascular injury sustained during endonasal skull-base surgery. Based on well-established safety data from neurosurgical application, adenosine has the potential to be used as a safe and effective adjunctive technique in similar endonasal circumstances and may represent an additional tool in the

armamentarium of the skull-base surgeon. Surgeons should consider having adenosine available when a risk of ICA injury is anticipated [2].

References

1)
Britz GW. Adenosine-induced transient asystole. Methodist Debakey Cardiovasc J. 2014 Oct-Dec;10(4):220-3. doi: 10.14797/mdcj-10-4-220. Review. PubMed PMID: 25624976; PubMed Central PMCID: PMC4300060.
2)
Fastenberg JH, Garzon-Muvdi T, Hsue V, Reilly EK, Jabbour P, Rabinowitz MR, Rosen MR, Evans JJ, Nyquist GN, Farrell CJ. Adenosine-induced transient hypotension for carotid artery injury during endoscopic skull-base surgery: case report and review of the literature. Int Forum Allergy Rhinol. 2019 Jul 10. doi: 10.1002/alr.22381. [Epub ahead of print] PubMed PMID: 31291066.