Efficacy and safety of Ivabradine in post − operative management of pediatric congenital heart disease

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Introduzione

Ivabradine is a new generation antiarrhythmic, and there is still little information on its efficacy and safety in children. By inhibiting of the I(f) channels, which are highly expressed in the sinoatrial and AV nodes, this drug regulates the cardiac pacemaker. Other isoforms of this channel have been found in non-pacemaker cardiac cells, in atria and in pulmonary veins. Studies suggest that, a mixture of pacemaker cells and working myocardium cells may potentially induce atrial arrhythmias. We report two cases of pediatric patients with congenital heart disease (CHD), surgically treated, who then developed atrial tachyarrhythmias successfully treated with ivabradine.

Case 1

An 8-month-old boy underwent a total repair for Fallot tetralogy (with transannular patch) and for a sinus venous type of atrial septal defect. Following surgery, he was admitted to ICU under milrinone infusion at 0.5μg/kg/min, midazolam and dobutamine infusion at 5μg/kg/min. He had protract abundant peritoneal serum-fluid drainage; then, he developed recurrent hyperpiressia along with pleural effusion, which required an urgent thoracentesis. The patient developed sporadic narrow QRS tachycardia, still maintaining a good blood pressure. The tachycardia was transiently resolved with electrolyte supplement and cooling, nonetheless his condition fell: he presented recurrency of supraventricular tachycardia (SVT), diuresis contraction, respiratory distress (which required intubation), increased peritoneal effusion drainage and increased pericardial effusion. Because of the worsening right ventricular failure, milrinone was administred again; cordarone was administered as well, starting with 5mg/kg/h and then increasing at 10mg/kg/24h. This made him return to sinus rhythm and improve his overall condition. A few days after cordarone administration, SVT recurred. As the patient underwent cardiac surgery, instead of beta-blocker, oral ivabradine was administered starting with 0.2mg/day in BID. Approximately 90 minutes after the first dose, he returned to stable sinus rhythm. Ivabradine was stopped one month later.

Case 2

The second case is that of a 13-years-old boy with Double Outflow Right Ventricle, dextrocardia, aortic arc interruption, surgically corrected by aortoplasty, bidirectional Glenn Shunt, Damus-Stansel-Kaye procedure and subsequently subjected to take-down Fontan. For few months after the last procedure he was stably in functional class NYHA III, on anticongestive therapy. He was recovered for acute heart failure and chronic renal failure III stage. Transcutaneous oxygen saturation was 64% on room air. Blood pressure was mantained. Chest X-ray showed right pleural effusion, and an echo examination revealed severe biventricular disfunction. Recurrent runs of chaotic atrial tachycardia were found at EKG. Cordarone i.v. converted him to sinus rhythm and then was replaced with oral ivabradine at 2.5 mg twice/day. He stably maintained the sinus rhythm, with a mean heart rate of 90-100 bpm. His cardiac functional status improved on ivabradine, diuretics, sacubritil/valsartan and aspirin therapy, and NT-proBNP levels decreased. No side effects were observed.

Discussion

These cases show the success of ivabradine when used to treat pediatric patients who develop SVT after surgery for complex CHD. This provides further evidence that ivabradine is effective in maintaining a stable sinus rhythm. Moreover, ivabradine has low effects on hemodynamics: this makes it a suitable antiarrhythmic than beta-blockers
for post-surgical patients with ventricular dysfunction. Normally, in the Fontan circulation, heart rate response is inadequate due to lack of a sub-pulmonary pump;this results in significant deterioration of ventricular performance and long-term progressive failure of the ventricle. Indeed, selective heart rate inhibition might be a therapeutic strategy in patients with Fontan circulation, and ivabradine, which seems to improve left ventricular ejection fraction in chronic heart failure and dilated cardiomyopathy, could be a useful drug. No ivabradine-related adverse effects have been reported. Till now there are few reports on the usefulness of ivabradine in post-operative management of congenital heart disease.

Conclusion

Ivabradine's relatively hemodynamically neutral profile makes it an attractive antiarrhythmic agent, especially for patients with ventricular dysfunction or in the immediate postoperative setting in the management of pediatric heart failure in the setting of congenital heart surgery.