Effects of adenosine diphosphate (ADP), a purinoreceptor agonist, on blood pressure and renal function in the rat

Roszkowska-Chojecka Malwina Monika, Dobrowolski Leszek

IMDiK POLSKA AKADEMIA NAUK

Department of Renal & Body Fluid Physiology,

M. Mossakowski Medical Research Centre, Polish Academy of Sciences, Warsaw, Poland

Background

P2 purinergic receptors (P2R-Y and P2R-X families) are expressed in kidney vessels and tubules, however, the role either in physiological and pathological states, remains unclear. There is only a few data based on the in vivo studies

This whole-kidney study is focused on the renal function in response to ADP, a non-selective agonist of P2R-Y.

Aim of the study

Could P2Y-R stimulation modify the intrarenal blood circulation and renal excretion in normotensive rats?

Materials and methods

- Acute experiments with male Sprague-Dawley rats

Group	BW
ADP	313±8 g
Solvent	319±11 g

with **ADP infusion** (n=9)

or its **solvent** (saline) (n=7)

- Anaesthesia: sodium thiopental, 100 mg/kg BW i.p
- Measurements:

- **MAP** - mean arterial pressure and heart rates, via femoral artery cannula; pressure transducer (Stoelting);
- **RBF** - whole kidney blood flow, by flow probe placed on renal artery (Transonic TS420 flowmeter);
- **Renal regional blood perfusion:**
  determined using laser-Doppler probes placed on the kidney surface or inserted into respective zones of the medulla

  CBF – cortical-, **OMBF** and **IMBF** - outer- and inner-medullary blood flow
- **Renal excretion:**

  Urine flow (*V*), **sodium** (*$U_{Na}V$*), potassium and **total solute excretion** *(UosmV)* - calculated per gram of the kidney.

- Protocol of acute experiments:

- Arterial pressure, renal haemodynamics and excretion were measured simultaneously.
- After control period (C) the drug solvent i.v. infusion was replaced **three subsequent doses (2, 4, 8 mg/kg/h) of ADP,** later replaced by solvent again - recovery period (R).

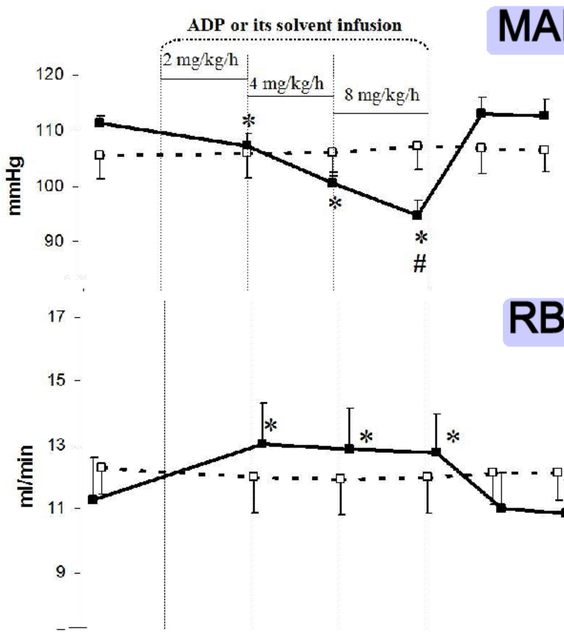
Conclusions

Stimulation of P2R-Y in the kidney:

- modulates blood perfusion of the deep cortex (as indicated by comparison of changes in RBF with lack of changes in CBF);
- possibly, vasodilatatory action of the P2R in outer-medullary circulation keeps the perfusion of this zone stable despite the changes in arterial blood pressure;
- stimulates tubular water and solute transport independently of the changes in renal haemodynamics; reduces the urine concenration ability.

Results

MAP



- ADP induced a dose-dependent decrease; MAP returned rapidly to the control value in R;

*p<0.05 or less vs. C,
#p < 0.05 between groups

RBF

- increased with the lowest dose of ADP and remained elevated througout drug infusion periods;
*p<0.02 vs. C.

OMBF

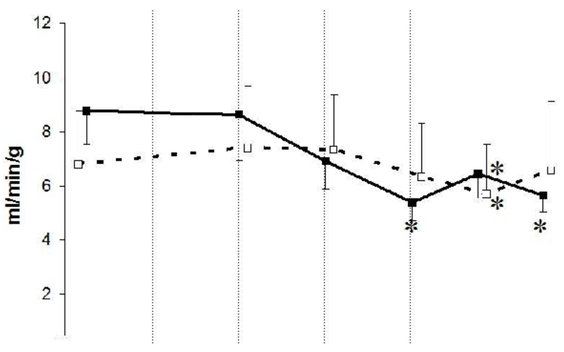
- was not affected by ADP but decreased in recovery period by 10%;

*p<0.01 vs. C.

#p < 0.05 between groups

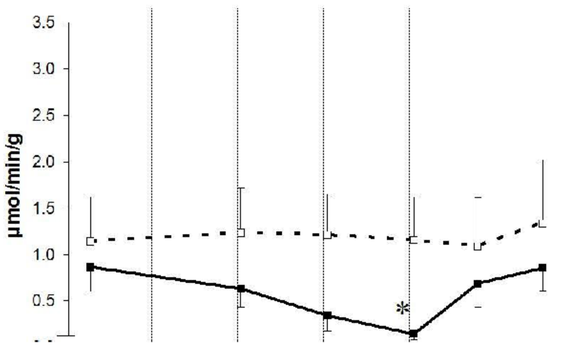
- CBF increased by 10% after the lowest dose of ADP (p<0.04) and declined slightly after the second dose to the value not different from C;
- IMBF remained stable throughout the experiment, similarly as in the control group.

V/g



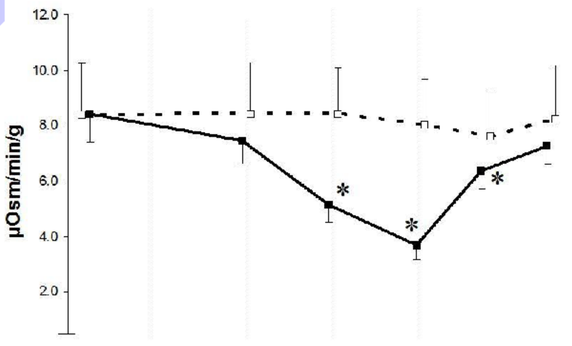
- There was a small, persistent drop induced by the highest dose of ADP;
*p<0.02 vs. C.

$U_{Na}V/g$



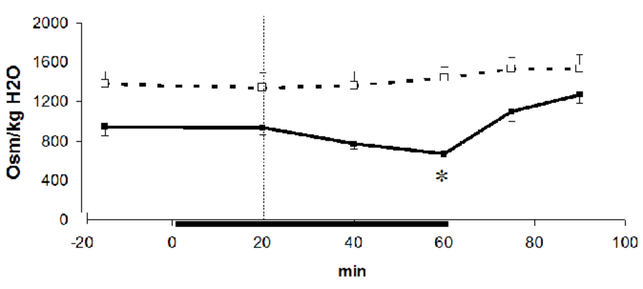
- There was a distinct decrease in sodium excretion;
*p<0.02 vs. C.

$U_{osm}V/g$



- ADP caused dose-dependent decrease in total solute excretion after the 2nd and 3rd dose;
*p<0.001 vs. C.

U_{osm}



- There was a distinct decrease urine concentration induced by th highest dose of ADP;
*p<0.02 vs. C.

All values are means SEM

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