

Infusion of low dose dopamine did not reduce renal failure in at risk patients in the intensive care unit

Bellomo R, Chapman M, Finfer S, et al. *Low-dose dopamine in patients with early renal dysfunction: a placebo-controlled randomised trial. Australian and New Zealand Intensive Care Society (ANZICS) Clinical Trial Group. Lancet* 2000 Dec 23/30;356:2139-43.

QUESTION: Does low dose dopamine decrease the risk of renal failure in at risk patients in the intensive care unit (ICU)?

Design

Randomised (allocation concealed), blinded (patients, clinicians, outcome assessors, data analysts), controlled trial with follow up to defined study events.

Setting

23 ICUs in Australia, New Zealand, and Hong Kong.

Patients

328 patients who had central venous catheters, ≥ 2 pathophysiological changes of the systemic inflammatory response syndrome (SIRS) over a 24 hour period, and ≥ 1 indicator of early renal dysfunction (mean urine output < 0.5 ml/kg/h over ≥ 4 h, serum creatinine concentration > 150 $\mu\text{mol/l}$ with no premonitory renal dysfunction, increase in serum creatinine concentration of > 80 $\mu\text{mol/l}$ in < 24 h without creatine kinase > 5000 IU/l or myoglobin in the urine). Exclusion criteria were age < 18 years, episode of acute renal failure in the previous 3 months, previous renal transplantation, use of dopamine during current hospital stay, baseline serum creatinine concentration > 300 $\mu\text{mol/l}$, inability to administer the drug for ≥ 8 hours, or unsuitability for renal replacement therapy. 99% of patients (mean age 62 y, 60% men) were included in the analysis.

Intervention

163 patients were allocated to a continuous infusion of low dose dopamine ($2 \mu\text{g kg}^{-1} \text{min}^{-1}$) given through a central venous catheter, and 165 were allocated to an equivalent infusion of placebo. The infusions were stopped when the patient was discharged from the ICU or died, a serious adverse event related to the infusion occurred, the patient was given renal replacement therapy, or the patient's SIRS and renal dysfunction had resolved for ≥ 24 hours.

Main outcome measures

Main outcome was peak serum creatinine concentration during the infusion (a clinical marker of glomerular filtration rate and renal function). Secondary outcomes included hourly urine output, need for renal replacement therapy, duration of mechanical ventilation, duration of ICU and hospital stay, and survival to hospital discharge.

Main results

Patients who received the dopamine infusion did not differ from those who received the placebo infusion for peak serum creatinine concentration (245 v 249 $\mu\text{mol/l}$, $p=0.93$), urine output after 1 hour (71 v 72 ml/h, $p=(0.87)^*$), 24 hours (96 v 92 ml/h, $p=(0.81)^*$), and 48 hours (99 v 109 ml/h, $p=0.71^*$), need for renal replacement therapy (35 v 40 patients, $p=0.55$),

duration of mechanical ventilation (10 v 11 d, $p=0.63$), duration of ICU (13 v 14 d, $p=0.67$) and hospital stay (29 v 33 d, $p=0.29$), and survival to hospital discharge (92 v 97 patients, $p=0.66$).

Conclusion

Infusion of low dose dopamine did not reduce the risk of renal failure in at risk intensive care unit patients.

*Information provided by author.

COMMENTARY

For many years, dopamine has been given at low doses ($2-3 \mu\text{g kg}^{-1} \text{min}^{-1}$) to critically ill patients in the belief that its dopaminergic effects will dilate renal blood vessels to improve renal function. This practice has continued, despite the lack of evidence to support any true renal benefit associated with low dose dopamine.

This well designed study by the ANZICS clinical trial group included quadruple blinding (patients, clinicians, outcome assessors, and data analysts) and had 90% power to detect a difference $> 25\%$ in peak serum creatinine. The effect of low dose dopamine on renal function was compared with placebo. Peak serum creatinine was measured as a marker of renal failure. Creatinine is a byproduct of muscle protein metabolism that is completely filtered by the kidney and eliminated in the urine. Although measurement of the rate of creatinine clearance in the urine provides the best indicator of renal function, creatinine clearance collection is more complicated. Generally, serum creatinine only rises if glomerular filtration falls (renal failure) or there is an overproduction of creatinine (eg, massive muscle damage). The exclusion of patients with creatinine overproduction (creatinine kinase > 5000 IU/l or myoglobinuria) makes peak serum creatinine a suitable outcome indicator. No difference in serum creatinine or urine output was found between the 2 groups.

This study supports a change in practice for many nurses and physicians. Nurses frequently seek out orders to initiate low dose dopamine or to wean dopamine after resolution of hypotensive shock to a maintenance "renal" dose. This study clearly shows a lack of benefit associated with low dose dopamine. When the potential complications associated with dopamine are considered (eg, increased myocardial oxygen consumption, or depression of respiratory drive, endocrine function, or immune response), the use of low dose dopamine to improve renal function can no longer be supported. This study only evaluates the role of dopamine at low doses; the beneficial effect of improved cardiac output on renal function when higher doses of dopamine are used was not studied.

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