Title: Nursing interventions to prevent hypertensive emergencies in children undergoing haematopoietic stem cell transplantation

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Background

Hypertension is the most common side effect of calcineurin inhibitors seen in children undergoing hematopoietic stem cell transplantation (HSCT). Early recognition and treatment of hypertension can prevent progression to hypertensive crises such as seizures and posterior reversible encephalopathy syndrome (PRES). In our study, we aim to analyze the risk factors for hypertension in children and the incidence of PRES in our unit. We have used this information to help identify the children at risk early and guide aggressive control of hypertension and prevent seizures.

Methods

The study was conducted at the Blood and Marrow Transplantation unit at our hospital from January 2017 to December 2019. All patient families had been counseled in detail regarding the complications of HSCT and informed consent was obtained. Hypertension was defined as a blood pressure above the 90th centile for the age and was followed up by the standard age wise nomogram from a measurement using a multiparameter monitor and an appropriate size cuff. Hypertension related emergencies were defined as seizures and PRES.

Results

A total of 425 children underwent HSCT in our unit of which 68 developed hypertension (16%). The children aged 5 months to 18 years with a male female ratio of 1.6:1. The majority of the HSCT were performed for benign hematological disorders at 73% with leukemia accounting for 27%. The incidence was higher in infants and in children undergoing matched unrelated donor transplantation for thalassaemia major. The incidence was high when calcineurin inhibitors were used along with steroids. We documented PRES in 17/68 (25%) and these children needed care in the pediatric intensive care unit including mechanical ventilation in 4 children. The timing of the event was statistically significant with over 90% seizures due to hypertension occurring early morning. The interventions included fluid restriction, antihypertensive agents including nifedepine, atenolol, enalapril, prazocin, clonidine and intravenous sodium nitroprusside or labetolol. Seizure control was achieved with the use of intravenous levetiracetam or fosphenytoin along with 3% sodium chloride infusion to reduce intracranial pressure. The calcineurin inhibitor was withdrawn in only 3 children and tacrolimus was replaced with cyclosporine in all infants with hypertension. All children recovered completely with no neurological deficit.

Conclusions

Hypertension occurs in 16% of children undergoing HSCT. The high risk groups include infants with primary immune deficiency and children undergoing alternate donor HSCT for haemoglobinopathies. Progression from hypertension to its complications such as seizures and posterior reversible encephalopathy syndrome can be prevented by working with physicians.

Early morning vigilance and serial recording of blood pressure by nurses at the bedside is the single most important factor in the management.