nCPAP.[2] Furthermore, this new device allows the delivery of accurate nitric oxide levels, thus avoiding NO_2 accumulation.[3]

In a bench study, we measured the noise levels generated by neonatal helmet CPAP. Measurements were performed on the C scale (using a C-weighting filter). A phonometer (MK 5350, Mitek Industries, Phoenix, AZ, USA) was positioned in the pressure chamber of the device corresponding to the ear of the neonate (''ear zone''). Noise levels were detected at different flow rates (8, 10 and 12 l/min) while maintaining the level of CPAP constant at 5 cm H_2O. Measurements for each flow rate lasted 15 min and the noise level was calculated every 20 s. All measurements were obtained in the neonatal intensive care unit (NICU) in the afternoon (3:00–5:00 pm). In the neonatal helmet CPAP system, the mean (SD) noise levels were significantly higher in comparison with those measured in the NICU (60.4 (0.7) dB) and within the baby compartment of the incubator (62.3 (0.5) dB). Noise levels significantly changed with increasing flow rates in the system, with 69.9 (0.5) dB at 8 l/min, 71.5 (0.2) dB at 10 l/min and 73.5 (0.3) dB at 12 l/min, (fig 1).

In agreement with Karam *et al*,[1] our results show that CPAP systems produce potentially dangerous noise levels for the developing ear of a preterm infant. The level of noise is directly related to the flow rate through the system rather than the pressure level. New CPAP devices need to take this crucial aspect into account.

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Competing interests: None.

Arch Dis Child Fetal Neonatal Ed 2008;**93**:F396–F397. doi:10.1136/adc.2008.140715

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Linezolid for treatment of catheter-related cerebrospinal fluid infections in preterm infants

Ventriculostomy-related cerebrospinal fluid (CSF) infection remains a major problem in neonatal intensive care. The spectrum of pathogens causing these infections is dominated by coagulase-negative staphylococci, and vancomycin is the antibiotic of choice for treatment. However, vancomycin is known to have only poor penetration into the CSF when applied intravenously and is therefore being applied intraventricularly.[1]

The oxazolidinone linezolid has antibacterial activity against most drug-resistant Gram-positive bacteria and has been shown to have excellent penetration into the CSF in adults.[2] Trials on the pharmacokinetics and efficacy of linezolid in the treatment of children and neonates have confirmed that its safety and efficacy is similar to that of vancomycin.[3 4] However, data on its use for paediatric CSF infections are scarce.

We present five cases of premature infants with ventriculostomy-related CSF infection treated with linezolid as a single agent or in combination with other antibiotics. The patients had subcutaneous tunnelled external ventricular drainage (EVD) inserted for treatment of post-haemorrhagic hydrocephalus.

The mean gestational age of the infants was 26.4 (SD 1.1) weeks and mean birth weight was 910.2 (SD 223.5) g. Mean age at first insertion of EVD was 16 (SD 3.4) days. Starting with the day of drain insertion, the patients received antibiotic prophylaxis for 3 days and none thereafter. Mean duration of EVD until infection occurred was 10.4 (SD 7.5) days. Mean duration of EVD was 20.3 (SD 12.5) days per drain and 40.6 (SD 23.6) days per patient. The pathogens causing infection were *Staphylococcus epidermidis* in three cases, and *Enterococcus faecium* and *Staphylococcus haemolyticus* in one case each.

Prior to linezolid treatment, one patient received fosfomycin plus intravenous and intraventricular vancomycin for 4 days, one patient received intravenous vancomycin for 3 days, and one patient received intravenous plus intraventricular vancomycin for 3 days. Concomitant with linezolid treatment, one patient received intraventricular vancomycin plus intravenous fosfomycin and three patients received intraventricular vancomycin. One patient had linezolid monotherapy.

Linezolid was administered at a dosage of 10 mg/kg every 8 h intravenously or orally. CSF was clear of bacterial growth within a mean of 3.8 (SD 2.1) days after starting linezolid treatment. Mean duration of linezolid treatment was 20.8 (SD 10.6) days. Microbiological clearance of CSF and clinical cure were achieved in all five patients. No haematological or other laboratory or clinical side effects of linezolid were observed.

We concluded that linezolid could be an appropriate alternative in the treatment of ventriculostomy-related CSF infections in preterm infants. Well-designed prospective studies providing additional information on linezolid levels in plasma and cerebrospinal fluid are necessary to confirm this observation.

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Competing interests: None.

Arch Dis Child Fetal Neonatal Ed 2008;**93**:F397. doi:10.1136/adc.2008.140038

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Tissue plasminogen activator therapy for renal venous thrombosis

Renal venous thrombosis (RVT) is a well-recognised and potentially fatal entity in children, and approximately 80% of RVTs present in the first month of life.[1] Management of RVT remains controversial. Anticoagulation or thrombolytic therapy is recommended for bilateral RVT, unilateral RVT with extension of the clot into the inferior vena cava, or impending renal failure.[2] We report a case of bilateral RVT in a premature infant who was treated with recombinant tissue plasminogen activator (r-TPA) and had a good outcome with eventual complete recovery.

CASE REPORT

A 2850 g, 36-week baby boy was born to a 29-year-old woman via emergency caesarean section, undertaken due to pre-eclampsia and fetal heart rate deceleration. At 3 h of age, the infant required resuscitation and intubation. His haemogram revealed haemoglobin, 153 g/l; white blood cell count of $32\,750\times10^9$/l; and platelet count of $298\,000\times10^9$/l. An echocardiogram showed persistent pulmonary hypertension, and a brain ultrasound showed grade IV intraventricular haemorrhage on days 2 and 8. Laboratory studies revealed haemoglobin 123 g/l; platelets $53\,000\times10^9$/l; blood urea nitrogen (BUN) 9.3 mmol/l; and creatinine (Cr) 247.5 μmol/l on day 3. On day 3, there

were palpable bilateral abdominal masses and macroscopic haematuria with blood clot. A renal ultrasound showed prominent hyperechogenic medullary pyramids, measuring 5.47 cm and 5.07 cm in length in the right and left kidney, respectively. The renal ultrasound showed thrombus in the renal veins and inferior vena cava on day 9. Given the extensive nature of the thrombus and the progressive deterioration of renal function (BUN 18.2 mmol/l and Cr 282.8 μmol/l), systemic thrombolytic therapy using r-TPA at a dose of 0.1 mg/kg/h was administered for 8 h after correction of thrombocytopenia on day 10. The coagulation profile was normal after r-TPA infusion. Renal function returned to normal with BUN 10.7 mmol/l and Cr 44.2 μmol/l on day 19. A renal ultrasound taken at 2.7 years of age showed normal renal structure and blood pressures.

We used r-TPA because of its short half-life with rapidly reversible hypocoagulability and strong and specific affinity for fibrin. Safety was acceptable and no complication occurred, even though r-TPA was administered 6 days after the onset of RVT and in the presence of intraventricular haemorrhage. The majority of neonatal RVT is associated with considerable renal morbidity including hypertension, renal atrophy and renal failure.[3] Our patient had a complete recovery of renal function. This outcome is in agreement with the findings of Winyard *et al*,[4] who found that kidneys larger than 6 cm at presentation never have a normal outcome.

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Competing interests: None.

Patient consent: Parental/guardian consent obtained.

Arch Dis Child Fetal Neonatal Ed 2008;**93**:F397–F398. doi:10.1136/adc.2008.140947

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Postnatal glucocorticoids in preterm neonates: use in French neonatal centres in 2006

In 1999, 80% of French neonatal centres used corticosteroids, mainly betamethasone, to prevent or to treat bronchopulmonary dysplasia (BPD).[1] As many data suggested a low benefit/risk ratio, an updated assessment of this use was necessary.[2–5]

METHODS

Questionnaires addressing the use of and indications for corticosteroids were sent to all French neonatal centres.

RESULTS

The study was performed over five months (July–November 2006). Questionnaires were sent to 202 centres, of which 186 (92%) centres completed them. Of these 186 centres, 147 (79%) units had a standard protocol for corticosteroids use, covering systemic and inhaled steroids (76 units), systemic steroid therapy only (30 units) and inhaled steroids only (41 units).

Systemic corticosteroids were used in 106 centres for haemodynamic reasons in 42 cases (40%), prevention of BPD in one case (1%), early treatment of BPD (day 4 to day 21) in 23 cases (22%), and late treatment of BPD (after day 21) in 74 cases (70%). Hemisuccinate hydrocortisone (HSHC) was the only corticoid used for haemodynamic failure. The steroids used for early treatment of BPD were betamethasone (21/23), dexamethasone (1/23) and HSHC (1/23). The duration of treatment was less than 4 days in 10 centres (43%). The steroids used for late treatment were betamethasone (67/74), HSHC (4/74) and dexamethasone (3/74). The duration of treatment was less than 4 days in 29 centres, between 4 and 8 days in 22 centres and greater than 8 days in 26 centres. Among 117 centres administering glucocorticoids by inhalation, 74% used budesonide, 45% used beclomethasone and 8% used fluticasone. Use of corticosteroids was higher in teaching hospitals (86%) than in others (49%), probably due to the immaturity of the neonates in these centres.

DISCUSSION

The high response rate (92%) ensures that our data are representative. We found that corticosteroids are still frequently used in preterm infants in France, but only after the fourth day of life, to treat BPD and not as prevention therapy. We also found marginal use of dexamethasone, in accordance with reports of both short-term (digestive complaints, hyperglycaemia, arterial hypertension) and long-term (delayed growth affecting both height and weight, and neuropsychological development) adverse side effects[2–5] suggesting an unbalanced benefit/risk ratio, despite its beneficial effect on respiratory status. In France, betamethasone is often used, as are inhaled steroids, in spite of the weak evidence base regarding its efficiency and long-term tolerance.

Our findings indicate the need for national recommendations and trials to assess oral betamethasone treatment in premature neonates with BPD.

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Acknowledgements: We would like to thank Dr S Guyetant, Service de Pharmacologie du CHRU de Tours, for her helpful expertise in quality control in this study.

Funding: This study was funded by the Agence Française de Sécurité Sanitaire des Produits de Santé (AFSSaPS).

Competing interests: None.

Arch Dis Child Fetal Neonatal Ed 2008;**93**:F398. doi:10.1136/adc.2008.141085

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