If less toxic antibiotics are suitable. If it is used, plasma magnesium, calcium, and potassium levels should be monitored during and after treatment.

We thank Dr C. Chantler for help with this case.

References


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Infrared irradiance from phototherapy units and the effect on osmolality of serum and urine in term infants

The technical simplicity of phototherapy has resulted in many neonatal departments having phototherapy units built for them by local craftsmen, usually to a similar specification as those available commercially. Infrared radiation of >650 nm is emitted by these light sources and causes an increase in skin blood flow (Oh et al., 1973; Wu et al., 1974), and a 2- to 3-fold increase in insensible water loss in infants (Oh et al., 1972; Oh and Karecki, 1972). We decided to measure the osmolality of urine and blood in term infants receiving phototherapy for hyper-bilirubinaemia of unknown cause. We also measured the infrared emission from commercial and locally constructed phototherapy units.

Methods

The group studied comprised 10 normal baby boys born spontaneously at term after normal pregnancies, of appropriate weight-for-gestational-age, and Apgar scores of 8 or more at 1 and 5 minutes. Indirect bilirubin concentration at start of therapy was >250 μmol/l (>14.6 mg/100 ml) and none of the babies had evidence of haemolytic disease, infection, or galactosaemia. The babies were placed in an Air Shields Isollette C86, with proportional control of heating. A urine bag was applied and urine was collected as it was passed immediately before, during, and for 24 hours after discontinuing phototherapy. 1 ml venous blood was obtained 12-hourly for serum bilirubin and osmolality estimations, the latter being determined by freezing point depression using an Advanced Instruments osmometer. Infants were weighed before and after breast feeds, and the volumes of milk given by bottle were carefully measured.

The Air Shields phototherapy unit PT 531 comprises a bank of 8 Philips 40 W daylight 33 fluorescent lamps, encased in a protective metal box with a plexiglass G acrylic plastic cover 6 mm thick (sold in UK as Oronas G, its irradiation transmission characteristic is illustrated in Rohm and Hass technical leaflet OR–53). The light source is adapted to be 45 cm above the infant. The locally made units are of similar design. Infrared radiation was measured using a Heimann bolometer KT14, calibrated in degrees centigrade (Micron Marketing, Gordon House, Station Road, Mill Hill, London). The range chosen was 0 to 50°C and accuracy was ±0.5°C when standardised with an AGA black body source for the range 27–39°C. The initial incubator reading was 30–32°C, with humidity of 60%. Infrared radiation measurements of the light source emission were made at the level of the infant, within the incubator and outside it. Air temperature was recorded by an Ellab universal digital thermometer DU3 with probe N TRA 1 at the level of the infant. Measurements were made at 0, 30, 60, 90, and 180 minutes after beginning phototherapy and the results expressed as the average of 3 separate studies. The unpaired Student’s t test was used to evaluate the significance of the results.

Results

The infants were studied between days 5 and 8 of life, and phototherapy was given for 24 to 46 hours.
4 infants used the Air Shields unit and 6 the locally made units. 3 infants continued to receive full-strength evaporated milk feeds and the 7 others were breast fed and received complements of half-strength evaporated milk. Average intake was 165 ml/kg per 24h (132–198 ml) during phototherapy and 166 ml/kg per 24h (139–204 ml) in the following 24 hours. Maximum osmolality recorded was 308 mmol/kg H₂O for plasma and 297 mmol/kg H₂O for urine. The incremental change in urine osmolality from before to during phototherapy was a mean of $+84.8 \pm 58.6$ SD with a range of $-6$ to $+171$ mOsm/kg H₂O. The difference was significant at $P<0.01$. No significant difference was found between maximum urine osmolalities before and after phototherapy, or plasma osmolalities before, during, and after phototherapy. The number of infants was too small to assess the effect of the 2 different types of phototherapy units. The Table shows that the infrared radiance at the level of the infant in the incubator rose by between 4 and 10°C in 3 hours; the greatest rise was in the first half to one hour. Transmission of heat energy was considerably reduced by interposing a 6-mm Oroglass G acrylic sheet at a 30° angle or by horizontally suspending it between 2 and 10 cm above the incubator, as recommended by Wu and Berdahl (1974). This was also effective in reducing the apparent rise in the incubator temperature recorded by the thermometer inserted in the acrylic plastic lid of the incubator. The commercial unit was cooler in operation than the locally made unit, probably because the thick aluminium metal casing of the latter acted as a heat store.

Discussion

We have shown that the stress of phototherapy produces a significant change in osmolar concentration of urine, even in the term infant, and we confirmed previous water balance studies (Oh et al., 1972; Oh and Karecki, 1972; Wu et al., 1974). No infants in this study had serum hyperosmolality, but the risk is evident even when low-solute foods are offered. Extra osmotically free water feeds of 5% dextrose should be offered, especially to preterm babies. Of particular concern was the finding that the thermometer in the incubator read 1.5–2°C higher than the actual temperature at the level of the baby. An infant might therefore be nursed in error below its optimal environment. On the other hand, the high radiant energy found at baby level is transformed into heat and may increase the infant’s skin temperature with the attendant risk of an increased incidence in preterm infants of apnoea (Daily et al., 1969), as well as overheating (Elliot et al., 1974), and dehydration. Both these doubts and the osmolar stress can be removed by interposing a suitable 6-mm acrylic sheet 2–12 cm above the incubator, and this is strongly recommended if locally made, uncalibrated units are used.

Summary

The osmolality of urine increased in 10 term infants receiving phototherapy. Phototherapy units made locally were likely to emit more infrared radiation than a unit available commercially, but both types led to falsely increased incubator thermometer readings. Interposing a 6-mm acrylic sheet prevents these effects.

Our thanks to Professor J. O. Forfar, Dr F. Cockburn, and Dr W. M. McCrae for allowing study of their patients, to Miss Taylor, Sister Michie, and Sister Graham without whom the study could not have been done, and to Dr N. R. Belton and his staff for statistical advice and biochemical support.

References


Table: Temperature changes from 0 to 180 minutes after beginning phototherapy

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<th>Incremental change in °C</th>
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<td>Incubator thermometer</td>
<td>30</td>
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<tr>
<td>Infrared radiance</td>
<td>26</td>
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<td>Out of incubator</td>
<td>29</td>
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Slow growth of an untreated Wilms’s tumour in the adolescent

Case history

A 16-year-old white girl presented symptomatically in May 1976 with left upper quadrant discomfort and fatigue. She had been seen by her family physician, found to be mildly anaemic with Hb 10.5 g/dl, and placed on iron treatment. In August she lost 8.63 kg during a 2-week period and developed anorexia, night sweats, and dyspnoea. She was admitted to a local hospital and x-rays and urograms taken in September showed a large renal mass on the left side (Fig. 1), and the chest x-ray revealed pulmonary metastases. She subsequently developed increasing distress due to a left pleural effusion and was transferred to Vancouver General Hospital.

History revealed recurrent bouts of cystitis between ages 5 and 11 years, during which time she had received treatment with antibiotics. At age 11 she had seen a urologist who carried out a urogram. Cystoscopy and urethral dilatation had also been undertaken. Figs 2 and 3, x-rays taken in February 1972, show an intrarenal mass consistent with Wilms’s tumour. Subsequently she had an aching flank on the left side believed related to chronic urinary tract infection.

![Fig. 1] 1976. Huge intrarenal mass with distortion and displacement of calyces.

On presentation to Vancouver General Hospital with metastatic Wilms’s tumour in 1976 she underwent drainage of the pleural effusion and was treated initially with vincristine and then with actinomycin-D. This was followed by irradiation to the thorax. There was regression of the pulmonary metastases and abdominal mass, and surgery was then performed to remove the renal tumour. Splenectomy was also done at time of surgery due to attachment of the mass. The tumour excision was not complete. Histology confirmed the diagnosis of Wilms’s
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