

An emergent history of neonatal skin care

It is remarkable how little attention most clinicians have paid to optimising skin care, given how fragile the skin of the preterm baby is, and how serious the consequence of poor care can be. Those who wish to understand how such issues are currently managed would do well to understand how such care has evolved over the last fifty years.

Use of antiseptics

One of the challenges faced by the first generation of paediatricians to become involved in the care of the otherwise healthy newborn baby immediately after birth was the epidemic of staphylococcal sepsis that was triggered by the rapid shift from home birth to hospital birth in the 1950s and 1960s. It was a problem further compounded by the routine way babies were separated from their mothers, and herded, often within inches of each other, into small hospital side-wards. Since, as a result, routine care then had to be undertaken by midwifery staff, epidemics of neonatal staphylococcal infection were almost inevitable. While overcrowding was undoubtedly part of the problem, such infection was, all too easily, carried from baby to baby on the hands of attendant staff (Mortimer *et al.* 1966).

Hexachlorophene emerged around this time as a very effective trichlorophenol antiseptic, and came to be used very widely to combat this problem. Babies were immersed in it as part of a daily bathing ritual, and the practise was considered not just safe but highly beneficial. It certainly proved capable of reducing the incidence of staphylococcal infection then prevalent (Gezon *et al.*, 1864), and the drug's effectiveness was enhanced by its adherence to the skin – little came off with rinsing. What was not initially realised is that it was also absorbed *through* the skin (Curley *et al.*, 1972), especially in the preterm baby (Kopelman *et al.*, 1973). Significant absorption occurred when preterm infants were bathed in a 3% hexachlorophene solution, or washed with hexachlorophene soap. Some years later absorption was even found to have occurred in older infants exposed to talcum powder accidentally contaminated with 6% hexachlorophene (Martin-Bouyer, *et al.*, 1982).

Unfortunately, it was only after hexachlorophene had been in widespread use for nearly ten years that clinicians came to realise that it was extremely neurotoxic. Symptoms were first seen in patients whose burns were washed with 3% hexachlorophene (Larson, 1968). Rats fed hexachlorophene were later shown to develop vacuoles in the myelin sheathing their nerves (Kimbrough & Gaines, 1972), and similar lesions were soon found in the brains of preterm babies who had been bathed regularly in hexachlorophene (Powell *et al.*, 1973; Shuman *et al.*, 1974). Older children even developed signs of an acute encephalopathy similar to that seen in rats (Goutieres & Acardi, 1977). Not surprisingly the neonatal use of hexachlorophene was abandoned very abruptly once this was realised the routine separation of the babies from their mothers, and their herding, within inches of each other, into a small hospital side-ward, but only after its use had almost certainly killed many babies. Even after this salutary lesson struck home, it took many years for clinicians realise that other antiseptics, such as iodine, can also be absorbed through the skin to a dangerous degree – particularly in the preterm baby (Parravicini *et al.*, 1996).

Use of emollient skin ointments

Studies by Lane and Drost in 1993 and by Nooper *et al.* in 1996 were the first to show that the twice daily use of a commonly used commercial emollient ointment (Aquaphor[®]) not only reduced skin damage in babies of less than 33 weeks gestation, but also reduced the risk of nosocomial bacterial sepsis (care-related infection). Five years later a much larger collaborative trial, involving 1191 babies of 501–1000 grams in 53 nurseries, has come to a rather different conclusion (Edwards *et al.*, 2001). While the administration of this ointment to the whole body twice a day for the first two weeks of life improved the appearance of the skin, and seemed to reduce the amount of visible damage, it did not reduce the risk of nosocomial infection in the babies of 751–1000 grams. Indeed it actually *increased* the problem in babies weighing 501–750 grams (odds ratio 1.54 [95% CI 1.04 – 2.30]), with the excess infection (28.9 v. 20.9%) being entirely due to an increase in coagulase negative staphylococcal infection. That is in line with the finding of a small retrospective case-control study reported at the same meeting by Oski (2001). It took three years for a full report of that important trial to find its way into print (Edwards *et al.*, 2004) but the findings are now there for all to see and the relevant Cochrane Review is currently under urgent revision.

The latest study exemplifies three common themes to emerge from much recent neonatal research. **First**, that early small trials often come up with findings that are not confirmed when larger studies are undertaken. **Second**, that just because a little treatment is beneficial, that does not always mean that more energetic treatment will be even more beneficial. And **third** that, because treatment works in one group of babies, it can not be assumed that it will also work in a very different group of babies. More interestingly recent work in Bangladesh has shown that, at least in babies of 28-32 weeks gestation, daily skin massage with 4 grams (a teaspoonful) of plain sunflower seed oil can be just as effective as a similar quantity of a complex commercial emollient (Darmstadt *et al.*, 2005).

Risk of candidiasis

Campbell (2000) also found an excess of systemic candidiasis in babies weighing 1000 g or less who had regular skin care with a petrolatum-based ointment in a retrospective case-control study. There was, however, no significant difference in the amount of fungal sepsis in the recent large collaborative trial. Two recent papers have suggested that prophylactic fluconazole may reduce the risk of colonisation and sepsis in very low birth weight babies (Kicklighter, 2001; Kaulfman, 2001), but most clinicians would hold that fungal prophylaxis should only, for the moment, be considered in very high risk babies.

Traditional approaches to skin care

It is traditional in many parts of the Mediterranean and South Asia to massage the skin of every baby regularly with oil. Early findings suggest that, while a linoleate-rich oil, such as sunflower seed oil seems to enhance skin barrier function, mustard oil in particular may be positively harmful, especially if it is contaminated (Darmstadt *et al*, 2002). Given that mustard oil is the commonest product in use in many of these countries, there is a clear need to influence current custom and practice. What is more, while it seems clear that once daily massage can be beneficial, there is already some evidence that excessive use could be harmful in the same way as over-early use immediately after birth can result in dangerous hypothermia.

References

- Gezon HM, Thompson DJ, Rogers RD, *et al*. Hexachlorophene bathing in early infancy: effect on staphylococcal disease and infection. *N Engl J Med* 1964;**270**:379–86.
- Mortimer EA, Wolinsky E, Gonzaga AJ, *et al*. Role of airborne transmission in staphylococcal infections. *BMJ* 1966;**1**:319.
- Larson DL. Studies show hexachlorophene causes burn syndrome. *Hospitals* 1968;**42**:63.
- Kimbrough RD, Gaines TB. Hexachlorophene effects on the rat brain: study of high doses by light and electron microscopy. *Arch Environ Health* 1972;**23**:114–22.
- Alder VG, Burman D, Corner BD, *et al*. Absorption of hexachlorophene from infants' skin. *Lancet* 1972;**ii**:384–5.
- Kopelman AE. Cutaneous absorption of hexachlorophene in low birthweight infants. *J Pediatr* 1973;**82**:972–5.
- Powell H, Swarmer O, Gluck L, *et al*. Hexachlorophene myelinopathy in premature infants. *J Pediatr* 1973;**82**:976–81.
- Shuman RM, Leech RW, Alvord EC. Neurotoxicity of hexachlorophene in the human. I A clinicopathologic study of 248 children. *Pediatrics* 1974;**54**:689–95.
- Goutieres F, Aicardi J. Accidental percutaneous hexachlorophene intoxication in children. *BMJ* 1977;**2**:663–5.
- Martin-Bouyer G, Lebreton R, Toga M, *et al*. Outbreak of accidental hexachlorophene poisoning in France. *Lancet* 1982;**i**:91–5.
- Lane AT, Drost SS. Effects of repeated application of emollient cream to premature neonates' skin. *Pediatrics* 1993;**92**:415–9. [RCT]
- Nooper AJ, Horii KA, Sookdeo-Drost S, *et al*. Topical ointment therapy benefits premature infants. *J Pediatr* 1996;**128**:660–9. [RCT] (See also **130**:330–4.)
- Parravicini E, Fontana C, Paterlini GL, *et al*. Iodine, thyroid function, and very low birth weight infants. *Pediatrics* 1996;**98**:730–4.
- Pabst RC, Starr KP, Qaiyumi S, *et al*. The effect of application of Aquaphor on skin condition, fluid requirements, and bacterial colonisation in very low birth weight infants. *J Perinatol* 1999;**19**:278–83.
- Campbell JR, Zaccaria E, Baker CJ. Systemic candidiasis in extremely low birth weight infants receiving topical petrolatum ointment for skin care: a case-control study. *Pediatrics* 2000;**105**:1041–5.
- Edwards WH, Conner JM, Soll RF. The effect of Aquaphor® original emollient ointment on nosocomial sepsis rates and skin integrity in infants of birth weight 501 to 1000 grams. [Abstract] *Pediatr Res* 2001;**49**:388A. [RCT]
- Oski K, Pappagallo M, Lerer T, *et al*. Does the use of Aquaphor® (Aq) in extremely low birth weight infants (ELBW) infants increase the risk of nosocomial sepsis? [Abstract] *Pediatr Res* 2001;**49**:227A
- Kaulfman D, Boyle R, Hazen KC, *et al*. Fluconazole prophylaxis against fungal colonization and infection in preterm infants. *N Engl J Med* 2001;**345**:1660–6. [RCT]
- Kicklighter SD, Springer SC, Cox T, *et al*. Fluconazole for prophylaxis against candidal rectal colonisation in the very low birthweight infant. *Pediatrics* 2001;**107**:293–8. [RCT] (See also 404–6.)
- Darmstadt GI, Mao-Qiang M, Chi E, *et al*. Impact of oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatr* 2002;**91**:546–54.
- Edwards WH, Conner JM, Soll RF, for the Vermont Oxford Network Neonatal Skin Care Study Group. The effect of prophylactic ointment therapy on nosocomial sepsis rates and skin integrity in infants with birth weights of 5001 to 1000 g. *Pediatrics* 2004;**113**:1195–203. [RCT]
- Darmstadt GL, Saha SK, Nawshad Uddin Ahmed ASM, *et al*. Effect of topical treatment with skin barrier-enhancing emollients on nosocomial infections in preterm infants in Bangladesh: a randomised controlled trial. *Lancet* 2005;**365**:1039–45. [RCT]

Hand hygiene matters too.

We have known that handwashing matters, and matters particularly in a maternity hospital setting, ever since Semmelweis recognised how puerperal fever was being spread in the Great Hospital in Vienna in the 1840s. We still know it matters, and we *still* do not do it. Just thirty seconds with soap and water achieves a great deal. Rings and watches need to be removed, and false nails can be a hazard, but repeated scrubbing can be counterproductive because of the skin damage that eventually builds up. It is becoming increasingly clear that an alcohol-based hand rub requires less time, is microbiologically more effective, and is less irritating to the skin, than traditional washing with soap and water if the hands are already socially clean. As methicillin resistant staphylococci, gentamicin resistant enterobacter and vancomycin resistant

enterococci become more prevalent the need for this discipline becomes ever greater, and the need for senior staff to lead by example more pressing.

References

- Lowbury E JL, Lilly HA, Bull JP. Disinfection of hands: removal of transient organisms. *BMJ* 1964;**2**:230–4.
- Sprunt K, Redman W, Leidy G. Antibacterial effectiveness of routine hand washing. *Pediatrics* 1973;**52**:264–71.
- Larson EL. APIC guideline for handwashing and hand antisepsis in health care settings. *Am J Infect Control* 1995;**23**:251–69.
- Rotter ML. Semmelweis' sesquicentennial: a little noted anniversary of handwashing. *Curr Opin Inf Dis* 1998;**11**:457–60.
- Larson E. A causal link between handwashing and risk of infection? Examination of the evidence. *Infect Control Hosp Epidemiol* 1988;**9**:28–36.
- Handwashing Liason Group. Handwashing: a modern measure with big effects. *BMJ* 1999;**318**:686.
- Pittet D, Hugonnet S, Harbarth S, *et al*. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet* 2000;**356**:1307–12. (See also 2196.)
- Stone SP. Hand hygiene – the case for evidence-based education. *J R Soc Med* 2001;**94**:278–81.
- Girou E, Loyeau S, Legrand P, *et al*. Efficacy of handrubbing with alcohol based solution versus standard handwashing with antiseptic soap: randomised clinical trial. *BMJ* 2002;**325**:362–5. [RCT]
- Guidelines for hand hygiene in healthcare settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HIPAC/SHEA/APIC/IDSA Hand Hygiene Taskforce. *MMWR* 2002;**51**:1–44.
- Trampuz A, Widmer AF. Hand hygiene: a frequently missed lifesaving opportunity during patient care. *Mayo Clin Proc* 2004;**79**:109–16.
- Pittet D. The Lowbury lecture: behaviour in infection control. *J Hosp Infect* 2004;**58**:1–13.
- Luby SP, Agboatwalla M, Feikin RD, *et val*. Effect of hand washing on child health: a randomised controlled trial. *Lancet* 2005;**366**:225–33. (See also 185–7.) [RCT]

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