# Resuscitation in major burns: The problem of fluid creep

**A D Rogers, J S Karpelowsky, A Argent, A J W Millar, H Rode**

**To the Editor:** We have noticed an alarming tendency for burn patients to be over-resuscitated, and we believe that protocols should be reviewed in light of our own and international experience.

We recently managed an 8-year-old boy with 52% full-thickness burns, who developed abdominal and limb compartment syndromes during the period of resuscitation. The fluid volumes infused above those calculated were 1.6 and 4.7 litres on days 1 and 2 respectively to maintain haemodynamic stability and urine output above 2 ml/kg/h. Within 48 hours of the injury, he developed poor peripheral perfusion and a distended abdomen; the intravesical pressure was 32 mmHg and the abdominal perfusion pressure 23 mmHg. Abdominal decompression and three limb fasciotomies were performed, but small-bowel and lower limb muscle necrosis had developed. The patient deteriorated rapidly despite inotropic support and died.

Fluid calculations were based on the Parkland formula at 4 ml/kg/% burn, and a major goal of resuscitation was to maintain urine output above 2 ml/kg/h.[1] The Advanced Paediatric Life Support (APLS) course manual[2] states that the Parkland formula is 'only a guide; subsequent therapy will be guided by urine output, which should be kept at 2 ml/kg/hour or more'.

Such formulae and guidelines do not negate the value of regular re-assessment of the patient's clinical condition. Over-reliance on the Parkland formula, and attempts at maintaining fluid output above 2 ml/kg/h as prescribed by APLS,[2] may lead to over-hydration; if severe, this may manifest as compartment syndromes in unburnt limbs and in the abdomen, with potentially lethal consequences.[3-5]

The pendulum appears to have swung from under-resuscitation before use of the Parkland formula towards over-hydration, the sequelae encapsulated as 'fluid creep', a term coined by Pruitt.[3] Over-resuscitation can result in pulmonary oedema, acute respiratory distress syndrome, pneumonia, multiple organ dysfunction, compartment syndromes, and cerebral oedema.[4,5]

The British Burn Association has suggested that formulae be adjusted to 3 ml/kg/% burn, with a target urine output of 0.5 ml/kg/h for children and adults, and also recommended that colloids be introduced early (within 12 hours of the burn) to decrease fluid requirements.

We suggest the following to optimise fluid resuscitation and prevent adverse complications:

1. The first 8 hours are critical; intravenous resuscitation should start immediately for all burns with body surface area involvement of more than 15%.
2. The fluid volume formula should be reduced to 3 ml/kg/% burn during the initial 24 hours.
3. Urine output goals for both adults and children should be reduced to 0.5 - 1 ml/kg/h.
4. Colloids should be introduced early (after 8 hours) and inotropes initiated judiciously to maintain haemodynamic stability.
5. Biochemical markers, lactate, mixed venous saturation and base excess should be aggressively normalised and used as endpoints in conjunction with urine output.[6,7]
6. Feeding (preferably transpyloric) should be initiated early.
7. Intravesical and abdominal perfusion pressures should be measured routinely and regularly.[8,9]
8. The concept of an escharotomy for a burn eschar may fall short of adequate decompression of burnt tissues, necessitating frequent re-assessment and possible conversion of an eschar release to a fascial release.[10]
9. Guidelines and protocols should be used, such as those recently published in the *SAMJ*.[11]
10. Patients with major burns should be referred to the local burns unit during the initial assessment and resuscitation phase.
11. If the response to resuscitation is inadequate despite adequate fluid replacement, one should consider a covert source of fluid loss (internal haemorrhage, undetected trauma, etc.) or the early onset of a toxic shock syndrome-like state (usually caused by Gram-positive organisms).

Fluid creep is a recognised entity with significant detrimental effects on cardio-respiratory function, and it may also result in limb and abdominal compartment syndromes. Strategies to prevent and manage its development should be incorporated into 'care bundles' designed for the management of severely

*Department of Paediatric Surgery, Red Cross War Memorial Children's Hospital and University of Cape Town*
**A D Rogers,** MB ChB
**J S Karpelowsky,** MB BCh, FCS (SA), Cert Paed Surg (SA)
**A J W Millar,** MB ChB, FRCS (Eng), FRACS, FCS (SA), DCH
**H Rode,** MB ChB, MMed (Surg), FCS (SA), FRCS (Edin)

*Department of Paediatric Critical Care, Red Cross War Memorial Children's Hospital and University of Cape Town*
**A Argent,** MB BCh, OCH, MMed, FCP (SA)

***Corresponding author:*** *A Rogers (rogersadr@gmail.com)*

burnt patients. A modified Parkland formula (3 ml/kg/% burn) is a useful guide to fluid resuscitation calculations, but the patient's general condition should be repeatedly reviewed and alterations made according to clinical examination findings, biochemical markers and endpoints of resuscitation, in addition to urine output.

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# HIV-negative mother with an HIV-infected child: A diagnostic dilemma

**Mohammed Mitha, Raveen Parboosing, Andiswa Nzimela**

**To the Editor:** Vertical transmission of the human immunodeficiency virus (HIV) accounts for the vast majority of HIV cases in children before, during and after birth.[1] However, there are cases where the transmission mechanism is not fully explicable.[2] We present such a case: an HIV-negative mother with a 6-month-old HIV-positive infant.

## Case report

A term infant was delivered by caesarean section (CS) at King Edward VIII Hospital, a tertiary-level hospital in Durban. The CS was indicated by a previous CS, and the delivery was uneventful. The baby was exclusively breastfed by the mother for 2 months and formula-fed thereafter. The mother was the sole caregiver of the child. At 2 months of age, the child was admitted to hospital in respiratory distress and ventilated in the ICU. A diagnosis of acyanotic congenital heart disease was made. The child was admitted for cardiac surgery at age 6 months to Inkosi Albert Luthuli Central Hospital, a quaternary hospital in Durban. Two days after the operation, he developed cardiac arrest twice and was successfully resuscitated on both occasions; he also developed nosocomial sepsis. He was ventilated and received a blood transfusion during this period. An HIV test was done, as per routine ICU protocol, having not been tested for HIV prior to this admission. He tested positive with a 4th-generation HIV enzyme-linked immunosorbent assay (ELISA).[3] An HIV DNA polymerase chain reaction (PCR)[4] test confirmed the result. The CD4 count was 22%.

The mother had tested negative 6 times previously at various local government clinics, using rapid HIV diagnostic tests; 2 of these tests were performed after delivery.

The virologist was consulted and suggested an HIV ELISA on the mother and father, as well as a repeat HIV ELISA and DNA PCR on the infant. The repeat ELISA and DNA PCR was positive for the infant, and the mother's ELISA was negative on a 4th-generation immunoassay. Owing to the exceptional nature of the case, a DNA PCR test was also done on the mother, which was negative. The father tested positive on a rapid test, which was confirmed by DNA PCR (Table I).

Since this was a sensitive matter with major emotional, social and diagnostic implications, clerical errors were excluded by verifying patient details and sample identification.

**Table I. Results of HIV tests**

| | 4th-generation ELISA | DNA PCR | Rapid test |
|---|---|---|---|
| Patient | Positive × 2 | Positive × 2 | Not done |
| Mother | Negative | Negative | Negative × 6 |
| Father | Not done | Positive | Positive |

*Department of Virology, University of KwaZulu-Natal, Durban*
**Mohammed Mitha,** MB ChB
**Raveen Parboosing,** MB ChB, FCPath (Viro) (SA)

*Department of Paediatric Cardiology, Inkosi Albert Luthuli Central Hospital, Durban*
**Andiswa Nzimela,** MB ChB, FCPaed (SA)

***Corresponding author:*** *M Mitha (momitha@telkomsa.net)*