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## Letter to the Editor

Paediatric extravasation injuries: A review of 69 consecutive patients<sup>☆</sup>

Dear Editor,

Extravasation injury occurs when fluid from an intravenous (IV) line leaks into the surrounding tissue spaces. It has the potential to cause significant long standing aesthetic and functional morbidity. Extravasation injury has a reported incidence of 0.1–6.5%, and is higher among the paediatric population [1]. The higher incidence in this age group, particularly in neonates is due to small fragile veins, IV lines required over long periods of time and the inability to communicate clearly [2].

The extent of damage following extravasation injury depends on the extravasate substance, site and amount. As most extravasation injuries remain localised and heal spontaneously with conservative management, the potential sequelae are often underestimated. The damage caused can lead to necrosis and soft tissue loss. Furthermore, scarring can lead to contractures and deformity. Severe extravasation injuries may result in large wounds requiring surgical intervention such as debridement, reconstruction and even limb amputation [3]. There are currently no national guidelines on the management of extravasation injuries in the United Kingdom. We review the literature on extravasation injuries and present the management outcomes at a single tertiary hospital.

All patients under the age of 18 who had extravasation injuries between 2011 and 2012 were retrospectively studied. Outcomes were correlated with patient characteristics, management and timing of events. A total of 69 cases were identified, of which 54% were female and the mean age was 36 months (range 1 day–18 years). The paediatric extravasation injury rate was 0.2% of all paediatric hospital admissions with the majority associated with prematurity (Table 1). The site of injury was upper limb in 65% of cases (40% on the dorsum of hand), 25% lower limb and 10% other locations. Average time from injury to review by the plastic surgery team was 4 h (range 0.2–24) and the average inpatient follow up was 3 days (range 1–21). Of all the substances extravasated, 32% were maintenance fluids (NaCl, glucose, KCl), 23% total parenteral nutrition and 45% others. Overall, 62% of cases were washed out and none of these developed complications.

There were 5 significant complications including 3 cases of associated infection, 1 case of ischaemic toe with subsequent digit amputation and 1 case of calcinosis cutis (Fig. 1). The latter case involved prolonged hospitalisation and readmission for secondary infection.

There was no statistical difference in age or the average time from injury to review by the plastic surgery team between complicated and non-complicated cases. However, all cases with

complications required significantly longer inpatient (9 vs. 2 days;  $p < 0.0001$ ) and outpatient plastic surgery follow up (44 vs. 5 days;  $p < 0.0001$ ) as compared to non-complicated cases.

Despite a small number of other published series [1,4–6], there still remains a significant lack of awareness of the potential morbidity associated with extravasation injuries, particularly with non-cytotoxic drugs. A good example in our case series is the extravasation of calcium gluconate leading to calcinosis cutis. The latter is the deposition of insoluble calcium salts in the skin and subcutaneous tissue. It can be easy to diagnose with the clinical history and radiographs. In most reported cases, the calcification resolves spontaneously over time with conservative management. However, due to its non-specific appearance, it can be mistaken for other conditions such as cellulitis, osteomyelitis, abscess, perioritis, myositis ossificans and thrombophlebitis. This can lead to potentially unnecessary interventions such as incision and drainage of an incorrect diagnosis of abscess [7].

Extravasation injury is often under-diagnosed, under-treated and under-reported. The optimal extravasation management is uncertain due to ethical considerations limiting controlled research. The best treatment is prevention but when an extravasation injury occurs, the infusion should be stopped and an attempt made to aspirate fluid from the extravasation site prior to removing the vascular access device.

In our case series, the majority of patients received an early saline washout using the Gault technique [8,9] and none developed complications. The technique involved creating multiple skin punctures around the periphery of the injury area with an atraumatic cannula and flushing each puncture with 0.9% sodium chloride [9]. Although not a controlled study, our study supports the efficacy of washouts. A previous study of washout in 89 cases of vesicant chemotherapy extravasation also showed minimal harm [10]. The efficacy of the washout technique is further supported by radiographs taken before and after washout of contrast medium [11]. Controlled trials of chemotherapy extravasation in rats have shown that saline washout may reduce the area of necrotic tissue [12].

Although there are a number of antidotes available, there is limited literature demonstrating their efficacy or role. All our washouts used hyaluronidase, which is thought to allow more rapid diffusion of the extravasate by breaking down hyaluronic acid in tissue and should ideally be injected within 1 h [13]. There is evidence supporting the use of hyaluronidase in reducing ulcer rates and preventing skin necrosis in vinc alkaloids [14,15]. Antibiotics may be indicated in some patients depending on severity. It was difficult to analyse in our series as many patients were already on them for other clinical reasons.

None of our cases require surgical intervention. Clear indications for surgical intervention include abscesses or vascular compromise

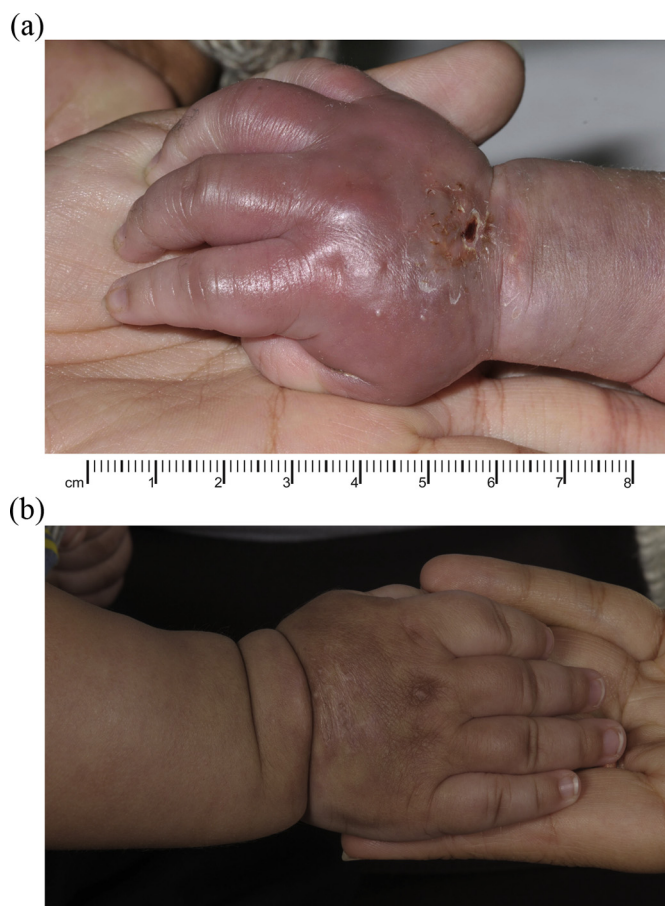
<sup>☆</sup> Presentation: Presented at the 12th European Society of Plastic, Reconstructive and Aesthetic Surgery Congress, 8 July 2014, Edinburgh, UK.

**Table 1**  
Demographic characteristics of 69 paediatric extravasation injuries.

Age	36 months (range 1 day–17 years)
Sex	46% male
Admission diagnosis	
Prematurity	40%
Gastrointestinal	21%
Cardio-respiratory	16%
Sepsis	16%
Other	7%

of the limb. A combination of washout and liposuction has been demonstrated radiographically to be effective at removing extravasated substance from surrounding subcutaneous tissues [16].

We believe that all paediatric extravasation injuries require early referral to the on-call plastic surgery team [8,9]. Appropriate treatment such as early washout with normal saline using the Gault technique is recommended. Serial photography of the wound is a useful tool for assessing and monitoring progress. The lack of national guidelines for management of extravasation injuries in the United Kingdom has led to varying treatment methods within and across hospitals. Our case series represents the largest case series of paediatric patients to date and further reiterates the need for further investigation to establish best practice. A centralised register of extravasation events would be a useful means to monitor, assess, and review outcomes.



**Fig. 1.** (a) Calcinosis cutis post extravasation of calcium gluconate in the dorsum of a neonatal right hand. (b) Dorsum of right hand at 20 weeks post extravasation injury.

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None required.

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## Author contribution

All authors contributed to the study design, data analysis and writing of the paper.

Daniel Ching collected the data.

## Conflict of interest

None.

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