

Original Research Article

Devastating complications of intravenous line/ drugs extravasation in hand

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Received: 16 August 2018

Revised: 24 September 2018

Accepted: 26 September 2018

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ABSTRACT

Background: Peripheral intravenous (IV) line insertion for treatment purpose is a common practice and a very simple procedure in hospitals undertaken worldwide. These intravascular lines are crucial in resuscitation, allow vital medication to be administered, and can be used to monitor the patients vital parameters. Thus the complications due to it like phlebitis, leaking or extravasation are usually we come across. This study reviews some serious complications of peripheral intravenous infusion in hand and discusses the treatment approaches and its an endeavour to provide information regarding healthy practise of IV line insertion, recognising complications at the earliest and treat them accordingly.

Methods: In our study, we have received 30 cases with devastating complications due to post IV line extravasation in hand in which most of them intervened surgically. Though these complications most of the time subside of its own for which these are frequently underestimated but sometimes there may be serious enough to endanger the limb at risk and threaten the life with devastating complications like septicaemia.

Results: In our series, we have got abscess or necrotising fasciitis in (17%), compartment syndrome with VIC (10%), Gangrene (13%), cellulitis (30%), non-healing ulcer (20%), suppurative thrombophlebitis (10%) etc.

Conclusions: Hence, this study should encourage the health personnel to have good knowledge about the drug to be used, to practice healthy technique of IV line insertion, to diagnose the complication if any, at a earliest possible time and if the complication is already established, then they should not hesitate to take the help of proper speciality dealing with hand.

Keywords: Intravenous line insertion, Extravasation, Complications, Surgical approach

INTRODUCTION

Peripheral intravenous (IV) line insertion for treatment purpose is a common practise in hospitals undertaken worldwide. Thus the complications due to it like phlebitis, leaking or extravasation are usually we come across. Extravasation injury is defined as the damage caused by the efflux of solutions from a vessel into the surrounding tissue spaces during intravenous infusion.

The damage can extend to involve nerves, tendons, joints and can continue for months after the initial insult.¹ Its occur either by leakage, previous venipuncture or mispositioned IV cannula. The complications that occur due to extravasations depends upon the type of medication, amount of exposure, site or location. If the treatment is delayed, surgical debridement, skin grafting, and even amputation may be the unfortunate consequences of such injury. No particular data about the

incidence of IV extravasation is available in literature. It is not due to its rare occurrence rather due to very common occurrence but as most of the time it subsides of its own, so it is often ignored. One report published in patients receiving chemotherapy, reported incidence of 0.1-6%. This published rate is an underestimation as many cases of extravasations go unreported.¹ This study reviews some serious complications of peripheral intravenous infusion in hand and discusses the treatment approaches and it's an endeavour to provide information regarding healthy practice of IV line insertion, recognizing complications at the earliest and treat them accordingly.

METHODS

This study is a case series study carried out at department of Orthopaedics of SCB medical College and Hospital, Cuttack, India from September 2016 to September 2018. It includes cases of post IV infusion of drugs/IV fluids extravasation complication involving hand and upper limbs that required hospitalisation with or without surgical intervention. All data were taken from the hospital records, analysed and patients are followed up in the OPD from time to time at 2, 4 and 6 month intervals. Besides this study analyses the history of preexisting comorbid medical conditions, type of drug abused, the complications, intra OP findings if any, pre and post op systemic complications if any, biochemical and microbiology results and outcome.

RESULTS

Age 0-20 years (20%), 40-60 years (40%). Female (70%) are more prone than male. Left hand (60%) more common than right as it is non-dominant hand hence may be preferred for IV cannulation. Hand with forearm 18 patients (60%) are more involved than only hand (40%) cases. Diabetes as an associated comorbid condition in (60%) cases may be due to atherosclerotic rigid veins and less pain sensitivity due to diabetic neuropathy.

Table 1: Patients demographic data.

Age (in years)	0-20	6 cases (20%)
	20-40	9 cases (30%)
	40-60	12 cases (40%)
	>60	3 cases (10%)
Female: Male	21:9 (70%:30%)	
Dominant upper limb	Left>Right	
Most comorbid condition	Diabetes	
Hand with forearm	18 patients (60%)	
Hand only	12 patients (40%)	

Complications like abscess or necrotising fasciitis in (17%), compartment syndrome with VIC (10%), gangrene (13%), cellulitis (30%), non-healing ulcer (20%), suppurative thrombophlebitis (10%). All are serious complication of which cellulitis has the highest

incidence followed by non-healing ulcer, abscess or necrotising fasciitis, compartment syndrome/VIC and those indicates the seriousness of the complication.

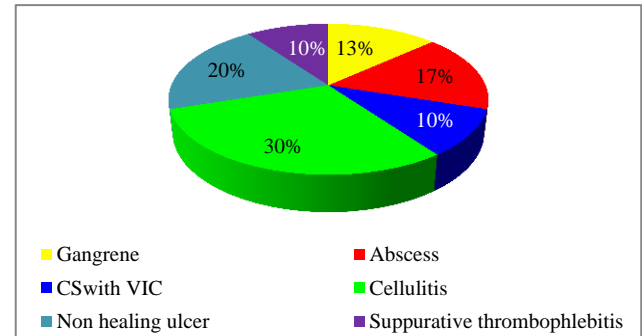


Figure 1: Complications.

Out of the 30 cases 17 (56.6%) had been operated and 13 (43.3%) managed conservatively. Out of 30, particular drug abused is confirmed in 20 (66.6%) cases, crystalloid IV fluids 13 cases (43.3%), Pentazocine with Promethazine 1 case (3.3%), IV Albumin 2 case (6.6%), Iodine contrast 1case (3.3%), IV Insulin infusion 1case (3.3%), i.v. artesunate in 2 (6.6%) cases, and in ten cases (33.3%) particular history of drug abuse cannot be confirmed but all cases follows IV extravasations.

Case 1

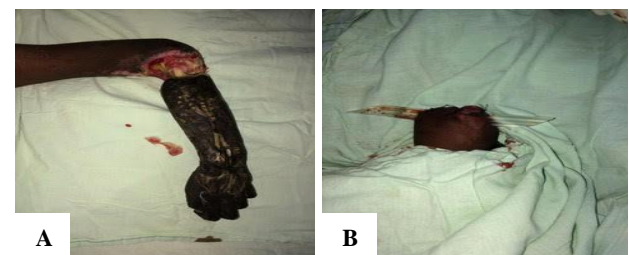


Figure 2 (A and B): Post antimalarial I.V. injection (artesunate) with wet gangrene below elbow followed by amputation.

Case 2



Figure 3: 60 yrs female crystalloid solution infusion for LVF f/b Compartment syndrome.

Case 3

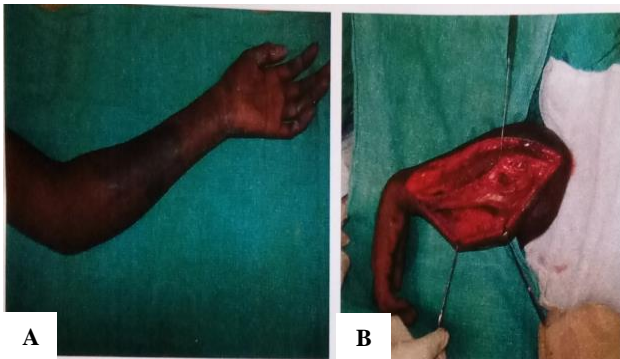


Figure 4: (A): 26 yrs female I.V. injection (pantozocine+promethazine) leads to compartment syndrome (B): Fasciotomy showing radial & ulnar artery thrombosis.

Case 4



Figure 5: Cellulitis following I.V. crystalloid infusion.

Case 5



Figure 6 (A and B): Tocolytics (Ergometrine) I.V. in PPH leads to dry gangrene.

Case 6



Figure 7 (A and B): I.V. Insulin regimen with suppurative thrombophlebitis ended with phlebectomy.

Case 7

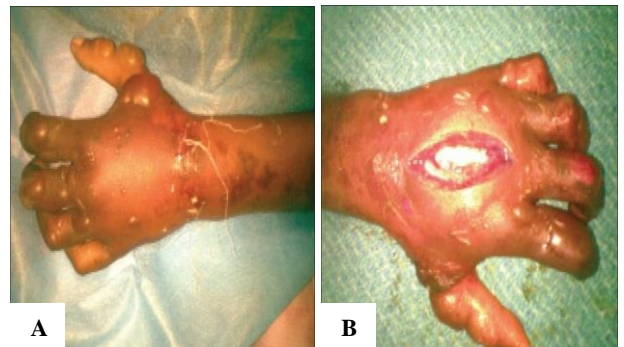


Figure 8: (A): 48 yrs male with DM, I.V. post crystalloid with abscess in dorsum of hand; (B): I/D of dorsum of hand.

From the above data analysis it is found that post IV extravasation related complications is a multifactorial issue starting from the age of the patient, the preexisting comorbidity, proper technique of insertion, site, and early recognition of the complication. Prompt measures to treat it, may reduce the incidence and possible devastating complications.

DISCUSSION

From the study it is clear that post IV extravasation related complications are multifactorial. Tissue damage may be slight that is local or limited inflammatory response or may be large and extensive causing severe tissue necrosis to gangrene. Infant and young children are more prone as small lumen often gets double punctured, immature skin and subcutaneous tissue and poor ability to communicate pain. In elderly veins are brittle those are difficult for cannulation intima get easily damage with cytotoxic drugs. This study shows a female preponderance (60%) but no such factors seems to be responsible for it and perhaps merely a coincidence. Left hand (60%) more common than right as it is non

dominant hand hence may be preferred for IV cannulation. Diabetic patients with peripheral neuropathy may not experience pain at infusion site.^{2,3} Diabetes as an associated comorbid condition in (60%) cases may be due to atherosclerotic rigid veins and less pain sensitivity due to diabetic neuropathy like diabetes, chronic liver disease, chronic kidney disease, immune compromised patients or cancer patients are more prone for such injuries. In such patients asepsis and proper technique should be strictly followed during IV cannulation as they are more prone for infection. Left more than right may be due to less dominant hand preferred more for IV cannulation. Dorsum of hand, cubital fossa, wrist are more implicated as the joint areas chances of dislodgment are more common and so also less subcutaneous tissue available to accommodate extravasations.⁴⁻⁶ In our study, Hand with forearm (60%) are more involved than only hand (40%) cases. Antineoplastic agents is the most important associated with the severity of complications following IV extravasations.⁴ Health personnel must have a clear knowledge about the drug infused, its physical and chemical property, pH, osmolality, vesicant or irritant. Special precaution to be taken during administering antineoplastic drugs, antibiotics, vasopressors or drugs that recombinations before infusion. If possible at least the first dose of any drugs given I.V. should be given under supervision and site of infusion should be closely monitored. In our study most of the extravasations (46%) occurs at night and often goes unnoticed similar to a study by Brown et al.⁶ However, data from the national extravasation information service green card reporting database shows that 44% of extravasations occur between the hours of 2 pm and 10 pm, 10% occurred between 10 pm to 6 am and 38% occurred between 6 am to 2 pm. A study by Panwar et al shows possible devastating complication of I.V. extravasation, which is most of the times underestimated.⁸ Park et al reported the dangerous complication that is compartment syndrome due to extravasation of peripheral parental nutrition.⁹ Another study by Sbitany et al reported the potential sequel of extravasation by CT scan contrast include compartment syndrome, skin sloughing and necrosis.¹⁰ Cardiovascular reported localized bullous eruption after extravasation of normal saline in the fore arm during left ventricular device assisted surgery.¹¹ In our study, 13 cases with alleged history of IV fluid (crystalloid) administration of Post extravasation non healing ulcer dorsum of hand in 3 cases, cellulitis in 6 cases, gangrene in 2 case, abscess in 2 cases, suppurative thrombophlebitis 1 case. 2 patients, one with post IV drug (albumin) extravasation and another after iv antibiotics, one develop cellulitis of forearm and hand, another one develop compartment syndrome with left upper limb abscess with non alcoholic liver disease with diabetes. Both were managed with incision and drainage with debridement of left upper limb abscess with secondary closure of the wound. Both were treated with appropriate antibiotics after culture sensitivity. Post CT contrast (30 ml of iodine contrast) extravasation cellulitis involving left cubital fossa and arm seen in one cases. It was diagnosed early and managed conservatively with IV antibiotic and limb

elevation and rest and it subsided without any serious complication. Post IV (basal bolus regimen of IV Insulin) for uncontrolled diabetes leading to cellulitis of left forearm and suppurative thrombophlebitis involving the cephalic vein in one patients. It was managed with phlebectomy of cephalic vein from anatomical snuff box to left cubital fossa. Culture was gram negative bacilli (*Klebsella*, *Pseudomonas*) that was managed with proper antibiotics. One case diagnosed with post IV extravasation of drugs (IV pentazocine and promethazine) leading to compartment syndrome of left forearm. It was managed with fasciotomy, thrombectomy of thrombosed radial and ulnar artery with excision superficial flexors and flexor carpi-culnaris followed with split thickness skin graft (STSG) for the raw area over the left forearm. It finally end up with residual Volkman ischemia that has improved with physiotherapy in the institution. 4 cases of gangrene of hand and forearm, one following post I.V. artesunate given for malaria, another after I.V. ergometrine and rest 2 after iv crystalloid, following post IV extravasation. All were managed with below elbow amputation of forearm. Every effort has to be undertaken to identify the complication at the earliest possible time. If the complication has already established; it should be classified under Millam's classification. Mild and moderate (stage I and II) usually subside with conservative measures like stopping the infusion, elevation of the affected extremity and cold compression. Stage III & IV of moderate to severe variety if recognised early, managed with limb elevation, cold compression, aspirating back the infusion if possible and if known antidote are available it can be tried. If irreversible complication has already established than surgical intervention to be undertaken at earliest possible time to minimise further tissue damage.

Recommendations

(1) Only trained health personnel to venipuncture at least while administering known vesicant or irritant drugs or anti neoplastic drugs. (2) To choose good quality veins, large veins with good flow. (3) Digits, hand and wrist to be avoided as there is close network of tendon, nerve and blood vessels underneath. (4) Avoid veins those are crossing joints like wrist, elbow, ankle as there is chance of dislodgment. (5) Place the smallest gauze and smallest length catheter. (6) Monitor the I.V. site and look for signs and symptoms of extravasation like oedema, erythema and rise in local temperature. (7) Always use the suitable carrier solution or diluent as prescribed with appropriate medication during IV infusion. (8) After I.V. infusion has finished flush the cannula. (9) Depending on the clinical circumstances never hesitate to put the central line if required.

CONCLUSION

This study was a very small study to conclude out the final results but it's an endeavour to enlighten the possible serious complications of this often underestimated procedure (i.e. is intravenous line

insertion) which is almost always a part of our patient care. From our study, we tried to bring to the notice of all health care personnel (doctors, sister and paramedical staff) about importance of practicing aseptic and healthy methods of insertion of IV peripheral lines, selecting proper site for IV cannulation, importance of knowledge about the kind of drugs and its possible adverse effect and to recognise the leak or extravasation as soon as possible so that necessary measures can be undertaken to neutralise it. At the end, whatever precaution we may take, these complications can still be unpreventable. So, its our clinical acumen to diagnose the complication as soon as possible because the initial hours (that is before any irreversible tissue damage can happen) are really important to reverse them by stopping the infusion, hand elevation, cold compression, dilution or wash out of the drugs or for using of the specific antidote. And if tissue damage has already established, we need to take surgical intervention or help of the specific speciality like hand surgery, plastic surgery at the earliest possible time to prevent further tissue damage and salvage the limb and life of the patient..

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Maharaj RC, Sethy RC, Chand DK, Mishra NR, Panigrahi S. Devastating complications of intravenous line/ drugs extravasation in hand. Int J Res Orthop 2018;4:940-4.