



Neonatal skin: Handle with care: A case series

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Abstract

The neonatal skin is fragile and should be handled with maximal care. The thin stratum corneum and attenuated rete ridges in neonatal skin makes them vulnerable to physical injury, insensible water loss, thermal instability and infection. The widespread use of Intensive Care Unit facilities for taking specialized care of the neonate brings along with it a better prognosis for survival but has introduced the caveat of many an iatrogenic skin disorder. Most of these iatrogenic disorders are potentially preventable by providing more inclusive rigorous training of neonatal health care providers and observation of utmost vigilance and care.

Keywords: neonatal intensive care, iatrogenic injuries, ecthyma gangrenosum, contact dermatitis

1. Introduction

The neonatal period is a sensitive period in human lifespan which comprises the first four weeks of extrauterine life, when the neonate is most vulnerable and ill equipped to face the hostile environment around it. The neonatal skin is characterized by a thin and fragile skin as compared to its adult counterpart and thus should be handled with utmost care and tenderness, especially in the eventuality of the neonate being premature. The advent of multicare, multifaceted intensive care facilities have heralded a host of potentially avoidable iatrogenic tragic incidents, due to improper use of the monitoring equipments by inadequately trained nursing personnel^[1]. Herein, we present a series of five cases where the neonatal skin was damaged following inappropriate use of devices in intensive care setting as also overzealous application of exogenous irritating agents on fragile neonatal skin.

The five cases discussed below depict the maladies that could strike a neonatal skin if not handled with due tenderness and respect. The appropriate use of iatrogenic devices in neonatal intensive care unit as well as topical applicants on neonatal skin will be highlighted.

2. Case history

Case 1

A two-day old critically ill premature neonate was admitted in Neonatal Intensive Care Unit following respiratory distress at birth. The baby was put on multisystem monitoring including digital pulse oximeter which was left in situ for prolonged periods without the mandatory protocol of intermittent release of pressure. Dermatological Examination of the toes showed necrotic skin changes with blackish discoloration and gangrene. The area was debrided along with topical dressings and systemic antibiotics. The nursing staff was counselled as to proper use of monitoring guidelines.

Case 2

A one-month old infant detected to have intestinal obstruction due to Hirschsprung's disease was operated upon to release the intestinal obstruction and ileostomy was performed. Due to improper care of the ileostomy site, the area showed evidence of stomal prolapse, peristomal excoriation and maceration with erythema and erosions due to enzyme degradation. The whole of right side of the abdomen was involved with glazed erythema and shallow erosions following inadequate ileostomy care. The patient was treated with proper care of ileostomy site with provision of well-fitting ileostomy bag along with topical soothing emollients. Surgical reconstruction of the ileostomy was also done.

Case 3

A premature neonate was placed on incubator care in Neonatal Intensive Care following respiratory distress, and was put on nasal CPAP which was delivered via nasal prongs. To monitor output of the neonate, urinary catheterization was carried out. Due to improper positioning of the airway and the bag the child suffered mucosal injury and necrosis of the columella nasi. The neonate was also found to have extensive erosions and ulcers over the groin, due to inadequate catheter care.

Case 4

A three-day old premature neonate born to a multigravida after 48hrs of premature rupture of membranes developed fluid filled hemorrhagic blisters over right cheek along with signs of toxemia in form of fever and history of decreased feeding associated with polymorphonuclear leucocytosis. Subsequently, the bullae gave way to formation of eschar overlying an ulcerative lesion, which on examination had a polycyclic erythematous border with an advancing edge. The culture from the site grew *Pseudomonas aeruginosa* and the patient was treated with Inj Ceftazidime

and Inj Amikacin in prescribed doses. The patient became afebrile by the fifth day and started accepting feeds and the crust separated by the second week and the wound healed with topical hydrocolloid dressing.

Case 5

A 3-day old neonate presented with generalized erythema associated with overlying bullous lesions more over the trunk and limbs. Careful history taking revealed overzealous application of vigorous mustard oil massage by the parents all over the body. Hence a diagnosis of extensive irritant bullous contact dermatitis following application of mustard oil was made. The neonate was treated with emollients and mild topical corticosteroids under antibiotic cover and parents were advised to stop mustard oil application, which resulted in complete resolution of the cutaneous lesions.

3. Discussion

The neonatal skin is fragile with very thin stratum corneum and attenuated rete ridges which makes them vulnerable to insensible water loss, thermal instability and infection. The surface area is proportionately larger than adults as the ratio of body surface area to weight is about five times rendering it all the more susceptible to physical injuries. The advent of newer sophisticated monitoring instruments has also ushered in an array of newer cutaneous complications ranging from pulse oximeter burns, transverse limb defects due to chorionic villous sampling, calcified nodules and puckered scars of amniocentesis.

The pulse oximeter was developed by Aoyagi using the principle of relative absorption of red to infrared light of pulsating components at the measuring site, which was later modified by Biox and Nellcou in 1982 to cater to the ever-increasing demand of non-invasive monitoring of the patients [2]. The monitoring electrode is generally heated to 42-44°C which measures the saturation from the capillary bed of the skin through a gas permeable membrane. The instrument can also cause complications if not used properly and under supervision. Complications associated with the use of pulse oximetry have been reported including burns, pressure erosion, skin necrosis and digital sensory loss [3]. Burns due to pulse oximeter probes are extremely rare and only a handful of cases reported in neonates. The causes of these complications may be due to the incompatibilities between the probes and the monitors used in products made by different companies, pressure duration for too long a duration on a single skin site or overheating induced by a short circuit of the probe cable. Our premature infant had severe pulse oximetry associated injury to the probe application site. This may have been due to the neonatal susceptibility to injury resulting from his critical condition, including low cardiac output, poor peripheral circulation and poor heat dissemination. Our experience shows that, when pulse oximetry is used especially in critically ill premature infants, frequent checking and changing sensor site every four hours is required to avoid burn injury or pressure erosion of the skin. In addition, the use of plastic sprays and Op-site micropore dressings have been seen to reduce electrode related injuries [4, 5].

Our second case amply demonstrates the catastrophe that can strike an ill managed ileostomy site in a neonate. Most surgically formed stomas are colostomies, ileostomies and urostomies. Usually ileostomies cause more problem than colostomies because of the proteolytic enzymes in an

alkaline medium which causes enzyme degradation dermatitis in the form of maceration, erythema and erosion. The spectrum of peristomal dermatoses as described by Lyon CC *et al.* includes irritant reactions, particularly from leakage of urine or faeces (42%); pre-existing skin diseases, principally psoriasis, seborrheic dermatitis and eczema (20%); infections (6%); allergic contact dermatitis (0.7%) and pyoderma gangrenosum (0.6% annual incidence) [6]. A further 15% of patients with skin problems had persistent or recurrent dermatitis not explained by allergy, frank infection or faecal irritation. This responded to short-term treatment with topical corticosteroids [6]. The management usually contains application of soothing compresses with saline or aluminum acetate solution with use of mild topical steroids and karaya occlusion. The irritant reactions as a whole offer the greatest potential for prevention. While some faecal or urine irritant reactions are inevitable because of a poorly sited or poorly formed stoma or as a result of high faecal output, most result from postoperative remodeling of the stoma or abdominal wall. Further avoidance of such complications can be done by proper application of the sealant pouch with a proper sealant or barrier like gelatin pectin formulation, karaya or acetylated polysaccharide leaving a rim of 1-2mm between the stoma and the appliance [7]. Hence the peristomal care in neonates requires a trained stoma care nurse and more intense monitoring for peristomal complications.

Our third case manifested severe nasal mucosal injury in form of columella nasi necrosis due to inadequately administered nasal continuous positive airway pressure (CPAP). Tissue irritation and pressure necrosis due to nasal skin breakdown is caused by infection, scarring, reintubation, and prolonged time of intubation [8]. Such neonatal injuries can be prevented by adjusting the height and level of the bed in the radiant warmer or incubator to maintain the tubing circuits on a direct path from nares to Nasal CPAP driver. This will prevent pressure on the nares and provide an additional benefit of less "drain out" from the tubing, thereby reducing the need for suctioning. Use of nasal masks or alternating between nasal prongs and mask and protectors or padding for septum can also reduce the injuries [9]. This emphasizes the requirement of a checklist at the bedside to provide consistency of practice related to positioning, skin assessment, and sizing of the NCPAP bonnet.

Our fourth case is of ecthyma gangrenosum (EG) which is a rare cutaneous condition characterized by single or multiple ulcers of the skin or mucous membranes caused by *Pseudomonas* group of organisms. Initially these lesions present as opalescent, tense, and grouped vesicles surrounded by erythematous halos. They subsequently become hemorrhagic and violaceous. Within a couple of days, rupture occurs to produce round ulcers with black necrotic centre [10]. *Pseudomonas aeruginosa* is the most frequently recognized pathogen of ecthyma gangrenosum but other organisms have been reported like non-pseudomonal bacteria and fungi, including *Klebsiella pneumoniae*, *Aeromonas hydrophila*, *Candida albicans*, *Aspergillus fumigatus*, etc [11]. In our case, the skin lesion revealed presence of *Pseudomonas aeruginosa*.

The common sites of distribution of EG lesions are the gluteal or perineal region (57%), extremities (30%), trunk (6%), and face (6%). The organism localizes to the vessel wall by hematogenous seeding in septicemic patients and by

direct inoculation in non-bacteremic ones. Subsequent proliferation of the organism in the vessel wall produces a necrotizing vasculitis by obstruction of the dermal vessels and dissolution of the elastic lamina of blood vessels by *Pseudomonas* elastase and exotoxin A. The characteristic painless, indurated ulcer with a central necrotic black eschar and surrounding erythema forms as a result ^[12]. Ecthyma gangrenosum requires prompt diagnosis because early institution of anti-pseudomonal agents reduces the high mortality associated with pseudomonal sepsis. There are two forms of this disease, septicemic and non-septicemic, with the non-septicemic variant carrying a better prognosis. The recommended treatment combines an antipseudomonal penicillin (piperacillin) with an aminoglycoside. Our case appears to be the bacteremic variant as manifested by fever and Polymorphonuclear leucocytosis, and we aggressively managed the infection with broad spectrum antibiotics, i.e. third generation Cephalosporins and Aminoglycosides, leading to complete cutaneous clearance with cure of the disease. In our case the forty-eight hours of premature rupture of membranes has contributed to Pseudomonal sepsis in the neonate, probably aggravated by iatrogenic causes.

Mustard oil is used as a flavoring agent in foods, soaps, and as a rubefacient or counterirritant in folk medicine, as a fungicide, and as a fumigant. Allyl isothiocyanate is the chief antigen in mustard oil, which is a volatile chemical, capable of inciting a contact dermatitis ^[13]. Eczematous and vesicular dermatitis are known to occur after contact with mustard oil, irritant reaction being much more common than allergic dermatitis ^[14]. Pasricha *et al.* and Gaul *et al.* have reported contact hypersensitivity to mustard khal and synthetic mustard oil, respectively ^[15, 16]. To the best of our information, there is a paucity of reports of generalized bullous Irritant Contact Dermatitis in the neonatal age group caused by mustard oil. We report this case for its rarity and the exaggerated bizarre form of clinical presentation caused by mustard oil, aggravated in this case by the fragility of neonatal skin.

The aim of this case series was to highlight across a gamut of iatrogenic neonatal dermatoses, the purpose of which was to sensitize all medical personnel about the heightened state of awareness and alertness required in the handling of the fragile entity called neonatal skin. Every NICU should have a laid down standard protocol which should be strictly adhered to by the medical and paramedical personnel. Special training and periodical update of the nursing staff should be carried out so that such disasters which can lead to fatality.

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