Collodion Baby

ABSTRACT

Collodion baby, estimated to occur in 1 in 100,000 newborns, is a visually striking clinical presentation seen in neonates that is often a sign of an underlying autosomal recessive congenital ichthyosis. The baby is wrapped in a taut, translucent membrane, which is often compared to plastic wrap, saran wrap, a cocoon, or armour. A formal clinical diagnosis is often not reached until shedding of the membrane reveals the underlying phenotype. This can be isolated or associated with other structural and systemic congenital abnormalities. Patients may require ongoing monitoring and sometimes surgical intervention. Collodion baby is a rare and challenging condition that requires multimodal management including dermatologic care, infection prevention, nutritional support, developmental monitoring, and procedural interventions, if needed.

KEYWORDS: Collodion baby, ichthyosis, neonate, newborn, pediatrics, dermatology

Introduction

A "collodion" is a component of many over-the-counter wart removal solutions that leaves a shiny film on the skin when applied topically.[1] This was the inspiration for the first recorded usage of the term "collodion baby" (CB) in 1884 by Hallopeau and Watelet, describing the shiny, taut skin of neonates born with a collodion membrane (CM) (Figure 1).[2] CB is a descriptive term rather than a specific diagnosis and is primarily a disorder of cornification driven by an underlying genetic condition with most CB falling under the umbrella of autosomal recessive congenital ichthyosis (ARCI).[3,4] The natural progression of CB involves shedding of the membrane within 3 to 4 weeks, revealing the underlying ichthyosis.[3,5] Clinically, CBs may encounter homeostatic issues, including dehydration, electrolyte imbalance, temperature dysregulation, and heightened susceptibility to immune-related complications such as sepsis.

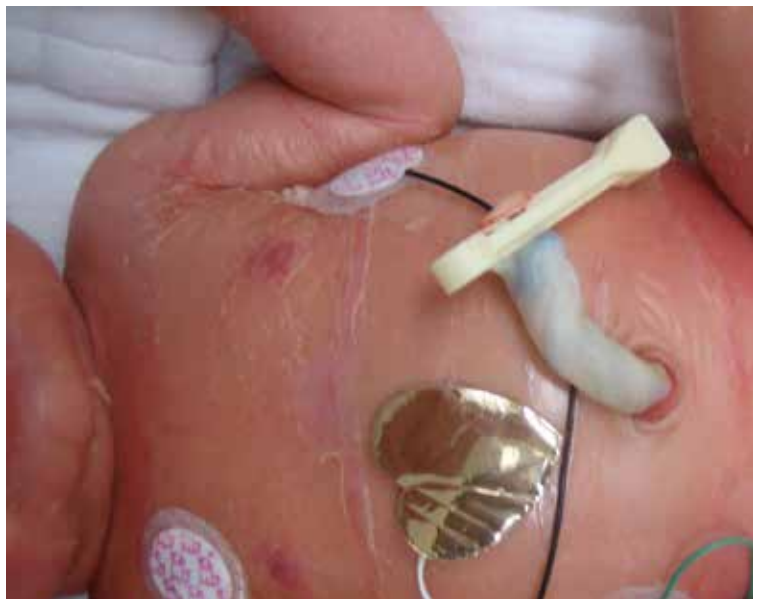

Figure 1: Collodion membrane over the skin of a newborn demonstrating the shiny, taut skin over the chest and abdomen.

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Epidemiology

Collodion baby is considerably rare, with an estimated 270 cases reported in the literature from 1892 to 2011.[6] The Foundation for Ichthyosis and Related Skin Types (FIRST) estimates the incidence of CB to be 1 in 100,000.[7] The majority of CBs were born at term and were appropriate for gestational age, with males being slightly more affected.[3,8] Mortality has consistently improved over time, with mortality rates decreasing from 50% in 1960 to 11% in 1986 and 5% in 2012.[3,8] In approximately 10% of CB cases, the ichthyosis spontaneously improves, leaving virtually normal-appearing skin.[4] This phenomenon is known as "self-improving collodion ichthyosis".[9]

Pathophysiology

The pathophysiology of CB is not well understood. However, it is believed that there is increased epidermal germinal cell activity and a failure of the stratum corneum cells to separate.[10]

Cornification is a slow, coordinated process that occurs in the upper layers of the epidermis and allows for the formation of a layer of dead cells (corneocytes) which create a physical barrier for the skin.[11] In various ichthyoses, there are abnormalities of the cornified layer which are characterized by a CM.[12]

Inherited ichthyoses are categorized into syndromic and non-syndromic ichthyosis. Syndromic ichthyoses have non-cutaneous features such as developmental delay and other organ involvement, while non-syndromic ichthyoses have isolated skin abnormalities without associated systemic features.

CB is encountered in many cases of autosomal recessive congenital ichthyosis (ARCI) and is frequently the result of pathogenic variants in TGM[1], ALOXE[3], or ALOX12B.[4]

Differential Diagnosis of Collodion Baby

Several congenital ichthyoses present at birth with skin findings that must be distinguished from a baby with true CB (Table 1). This is particularly significant due to life-threatening complications in several of the listed conditions.[4]

Underlying a true CB is most commonly ARCI, which encompasses a spectrum of congenital ichthyoses ranging from lamellar ichthyosis to congenital ichthyosiform erythroderma, with overlap clinically between the two phenotypes. Less commonly reported causes of CB in the literature are summarized in Table 2.[4]

History

A generalized newborn history should be gathered, including the prenatal, antenatal and postnatal period. In a small retrospective case study, half of the patients with CB had a family history of ichthyosis.[14]

Table 1: Collodion Baby Differential Diagnosis

Disease	Physical Findings[13]	Ancillary lab/radiographic test[4]
Harlequin ichthyosis (HI)	Large, diamond-shaped plates separated by deep cracks, extreme ectropion and eclabium, contractures, high mortality	EM: reduced or absent lamellar bodies in stratum corneum
Ichthyosis prematurity Syndrome (IPS)	Respiratory distress and generalized hyperkeratosis with focal accentuation on scalp and eyebrows at birth with spontaneous improvement, followed by atopic dermatitis and asthma	Eosinophilia, lamellar deposits in swollen corneocytes and edematous granular cells
Netherton syndrome (NS)	Congenital ichthyosiform erythroderma, ichthyosis linearis circumflexa, atopic dermatitis, frequent skin infections, anaphylaxis from food allergy	Hair: trichorrhexis invaginata
Sjögren-Larsson Syndrome (SLS)	Congenital ichthyosis with focal accentuation on scalp and neck, pruritus, spastic paraplegia, intellectual disability, glistening dot retinal pigmentation, dental enamel dysplasia	Eye examination, increased fatty alcohols in blood, reduced aldehyde dehydrogenase or fatty alcohol NAD oxidoreductase in leukocytes

Table adapted from Collodion baby: An update with a focus on practical management (Prado et al. 2012)

A complete history should include immunizations, nutrition, development, medication, allergies, family history and social history.

Physical Examination

A general well-being assessment should be completed to assess for alertness, responsiveness, tone and respiratory effort. A full body cutaneous examination should focus on examination of the hair and nails, ectropion (eversion of the eyelid margin), eclabium (eversion of the lips) (Figure 2) and signs of facial or limb dysmorphia, including hypoplasia of nasal and auricular cartilage. Hair examination should include microscopic evaluation of the scalp and eyebrow hair with

Table 2: Possible Outcomes of Collodion Baby

Category	Disease	Physical Findings[13]	Ancillary lab/radiographic test[4]
Non-syndromic ichthyosis	Lamellar ichthyosis	CM with ectropion and eclabium, congenital ichthyosiform erythroderma, platelike scaling, hypohidrosis	In situ: transglutaminase-1 assay in cryostat-cut sections
	Congenital ichthyosiform erythroderma	CM with ectropion and eclabium, congenital ichthyosiform erythroderma fine scaling, hypohidrosis	In situ: transglutaminase-1 assay in cryostate-cut sections
	Ichthyosis vulgaris	Xerosis, generalized scaling sparing flexural areas, pruritus accentuated palmoplantar markings	H&E: reduced or absent stratum granulosum
	Self-healing collodion baby (SHCB)	Nearly complete resolution of CM and scaling within first 3 months	In situ: transglutaminase-1 assay in cryostat-cut sections
	Recessive x-linked ichthyosis	Generalized scaling sparing body folds, neck usually more severely involved, corneal clouding, cryptorchidism	Absent steroid sulfatase activity in leukocytes and fibroblasts, elevated blood cholesterol sulfate levels
	Epidermolytic ichthyosis	Large erosions, mild scaling, and erythroderma at birth, followed by hyperkeratosis in first few months	H&E: epidermolytic hyperkeratosis; EM: aggregations and clumping of keratin filaments in suprabasal cells
	Bathing suit ichthyosis	CM at birth, followed by brownish scaling restricted to bathing suit areas	In situ: transglutaminase-1 assay in cryostat-cut sections
Syndrome ichthyosis	Neutral lipid storage disease with ichthyosis	Generalized ichthyosiform erythroderma, hepatosplenomegaly, mild myopathy, cataract, short stature, mild intellectual disability	Lipid vacuoles within leukocytes, monocytes, and keratinocytes, abnormal LFT results and fasting lipids, increased CPK
	TTD with ichthyosis	Generalized ichthyosiform erythroderma, brittle hair, impaired intelligence, short stature, with or without photosensitivity	Polarizing microscopy of hair shaft: alternating light and dark bands, other hair abnormalities, e.g., trichoschisis or trichorrhexis nodosa

Table 2 continued: Possible Outcomes of Collodion Baby

Category	Disease	Physical Findings[13]	Ancillary lab/radiographic test[4]
Syndromic ichthyosis (continued)	Conradi-Hünermann-Happle syndrome	Congenital ichthyosiform erythroderma in lines of Blaschko followed by hyperkeratosis, follicular atrophoderma, stippled epiphyses, cataracts, asymmetic facial appearance	H&E: calcification in follicular keratosis in neonates, bone x-ray X-ray: asymptomatic bone densities that resolve with time, limb shortening, extra digits and hip dysplasia
	KID syndrome	Severe generalized or localized erythrokeratoderma with spiky hyperkeratosis, PPK, keratitis, hearing loss	MRI: absence of corpus callosum
	Loricrin keratoderma	Congeital ichthyosiform erythroderma, diffuse PPK with honeycomb pattern, pseudoainhum, knuckle pads	H&E: parakeratosis and hypergranulosis; EM: electron dense intranuclear granules in granular cells
	ARC syndrome	Generalized scaling with sparing of skin folds, arthrogryposis, renal tubular degeneration, intrahepatic bile duct hypoplasia with cholestasis, metabolic acidosis abnormal platelet function, cerebral malformation	Liver and renal biopsy
	KLICK syndrome	Congenital ichthyosis, linear keratosis in skin folds sclerosing PPK	EM: hypergranulosis and abnormally big keratohyaline granules
Metabolic	Holocarboxylase synthetase deficiency	Metabolic acidosis, hyperammonemia, organic aciduria, metabolic encephalopathy, poor feeding, lethargy, respiratory distress, and hypotonia	Carboxylases assay in leukocytes or cultured skin fibroblasts
	Gaucher disease type 2	Congenital ichthyosiform erythroderma, hepatosplenomegaly, opisthotonus, hypotonia, facial anomalies, arthrogryposis, respiratory distress, and progressive neurologic deterioration	Definiciency of b-glucosidase in leukocytes or cultured skin fibroblasts, LFTs, increased serum acid phosphatase, Gaucher cells in bone marrow

Table 2 continued: Possible Outcomes of Collodion Baby

Category	Disease	Physical Findings[13]	Ancillary lab/radiographic test[4]
Other	Hypohidrotic ectodermal dysplasia	Hypohidrosis or anhidrosis with hyperpyrexia, atopic dermatitis, sparse hair, frontal bossing, saddle nose, supraorbital ridging, hypoplastic midface, thick everted lips, hypodontia or anodontia, peg-shaped/ conical incisors and canines, hypoplastic or absent breast and nipple-areolar complex	Hair with longitudinal groove on EM
	Congenital hypothyroidism	Clavicular pad; puffiness of periorbital tissues and tongue, lips, hands, and genitals; dry, cold, and pale skin; dry and brittle nails and hair; patchy alopecia; dwarfism; intellectual disability; somnolence; constipation; feeding problems; poor muscle tone; persistence of jaundice; and respiratory problems	Serum total or free T4, TSH, thyroid-binding globulin
	Koraxitrachitic syndrome	A syndromic form of SHCB: collodion baby at birth, with patchy erythema, progressive thinning of hyperkeratotic membrane, generalized irregular dermal atrophy, alopecia, absent eyelashes and eyebrows, and conjunctival pannus, hypertelorism, prominent nasal root, large mouth, micrognathia, brachydactyly, syndactyly involving all interdigital spaces, and camptodactyly of fingers III-V	H&E: orthophyperkeratosis and marked atrophy of dermis, immature dermal extracellular matrix, factor XIII-a-positive dendrocytes are rare and globular rather than dendritic
	PPK with anogenital leukokeratosis	Diffuse, nonprogressive PPK in combination with intermittently pruritic, slowly progressive anogenital leukokeratosis	Keratin immunocytochemistry shows marked expression of suprabasal K17 and absence of K6 and K16

Table 2 continued: Possible Outcomes of Collodion Baby

ARC: Arthrogryposis-renal dysfunction-cholestasis; CPK: creatine phosphokinase; EM: electron microscopy; H&E: hematoxylin and eosin; In Situ: in the natural or original place or order; KID: keratitis-ichthyosis-deafness; KLICK syndrome: keratosis linearis with ichthyosis congenita and sclerosing keratoderma; LFT: liver function test; MRI: magnetic resonance imaging; NAD: nicotinamide adenine dinucleotide; PPK: palmoplantar keratoderma; SHCB: self-healing collodion baby; T4: thyroxine; TSH: thyroid-stimulating hormone; TTD: trichothiodystrophy.

Table adapted from Collodion baby: An update with a focus on practical management (Prado et al. 2012)

both regular and polarized light to assess for "tiger-tail" hair of trichothiodystrophy and trichorrhexis invaginata of NS.[4] Assessment of movement can identify pseudocontracture and distal limb constriction/ischemia or distal edema.[15]

Non-specific physical exam findings that provide little help towards differentiation of underlying disease include generalized scaling, xerosis, erythroderma and hypohidrosis, as these are often seen in several of the underlying conditions. Physical exam findings that are more specific to certain conditions are included above in Table 2.

Investigations

The diagnosis of collodion baby is confirmed clinically.

Routine skin biopsy is generally unhelpful in diagnosis and management until after the membrane has been shed, given that histology will show orthohyperkeratosis in most cases.[4,16] If the newborn is stable and specialized testing is not available, waiting until the CM has shed prior to considering a biopsy is reasonable given that the pheno-

Table 3: Questions to Ask on History to Identify Common Complications

Hypo-/hyperthermia	Has baby had a difficult time keeping their temperature in a normal range?
Dehydration	How many wet diapers does baby produce per day?
Poor growth	Is baby having any feeding difficulties?
Infection	Has baby had a temperature higher or lower than normal range?
Ectropion	Has baby shown difficulty closing their eyes?
Eclabium	Has baby shown difficulty closing their mouth?
Pseudocontracture	Has baby shown difficulty moving their limbs?
Distal edema	Has baby had any swelling of the hands or feet?

type may become recognizable with time.[4] After the membrane has been shed and the phenotype emerges, a skin biopsy, if still required, may show disease-specific findings.[4]

Clinical features such as intensity of erythroderma and presence of scaling can help differentiate between congenital ichthyosiform erythroderma (erythema with fine white scale) from lamellar ichthyosis (large, dark plate-like scales without erythroderma) (Figure 3), the two most common diagnoses in CB.[4]

Additional ancillary laboratory and radiologic tests that can be used to rule in or out specific diseases are summarized in Table 2.

Genetic testing can help identify a genetic phenotype, with a gene panel now available to assess for 39 identified genes and numerous non-coding variants.[17] Other investigations include a biochemical and metabolic assay to assess for Sjögren-Larsson syndrome or leukocyte glucocerebrosidase activity in Gaucher disease.[4]

Table 4: Specific Questions to Help Rule In/Out Conditions in the Postnatal Period

At how many weeks was baby born?	Ichthyosis prematurity syndrome (IPS)
History of irritability, lethargy or respiratory distress?	Metabolic cause* Congenital hypothroidism Ichthyosis prematurity syndrome (IPS)
Any signs of neurologic deteriration?	Metabolic cause*
Did the baby fail their newborn hearing screen?	Keratitis-icthyosis-deafness (KID syndrome)
Has baby showed signs of difficult or wheezy breathing?	Ichthyosis prematurity syndrome (IPS)
Any difficulties with feeding so far?	Metabolic cause* Congenital hypothyroidism
Is baby small for their age?	Syndromic ichthyosis#
Any signs of an anaphylactic allergic reaction?	Netherton syndrome (NS)
Is there any chance that the child's parents are related?	Autosomal recessive congenital ichthyosis (ARCI)

*Metabolic cause includes holocarboxylase synthetase deficiency and Gaucher disease type 2
#Syndromic cause includes neutral lipid storage disease with ichthyosis, trichothiodystrophy (TTD) with ichythyosis, Conradi-Hünermann-Happle syndrome, keratitis-ichthyosis-deafness (KID) syndrome, Loricrin keratoderma, Arthrogryposis-renal dysfunction-cholestasis (ARC) syndrome, keratosis linearis with ichthyosis congenita and sclerosing keratoderma (KLICK) syndrome

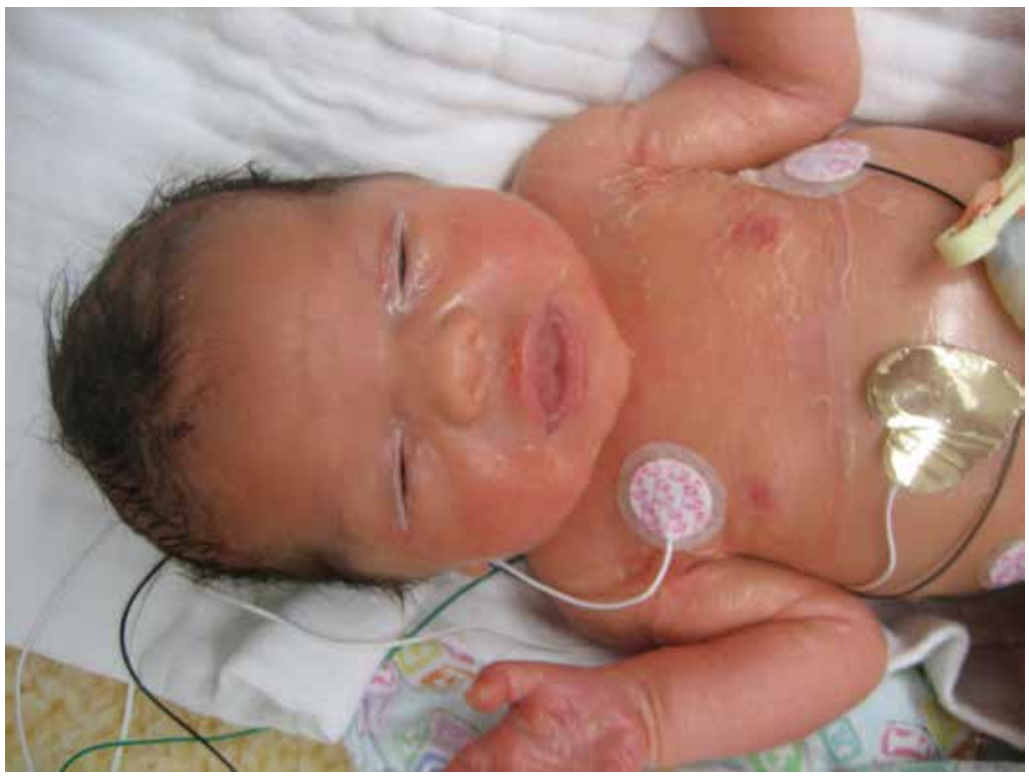

Figure 2: Eversion of the periorbital (ectropion) and perioral skin (eclabium) in a neonate with collodion membrane:

Prenatally, molecular biology testing (e.g. non-invasive prenatal testing or NIPT[18]), can be performed at around 10-12 weeks gestational age.[19] Genomic PCR from chorionic villus sampling can also be done for genetic counseling measures. In the detailed second trimester anatomical ultrasound, a CM sometimes can be visualized, along with signs of ectropion, flattened nose, and eclabium.[20]

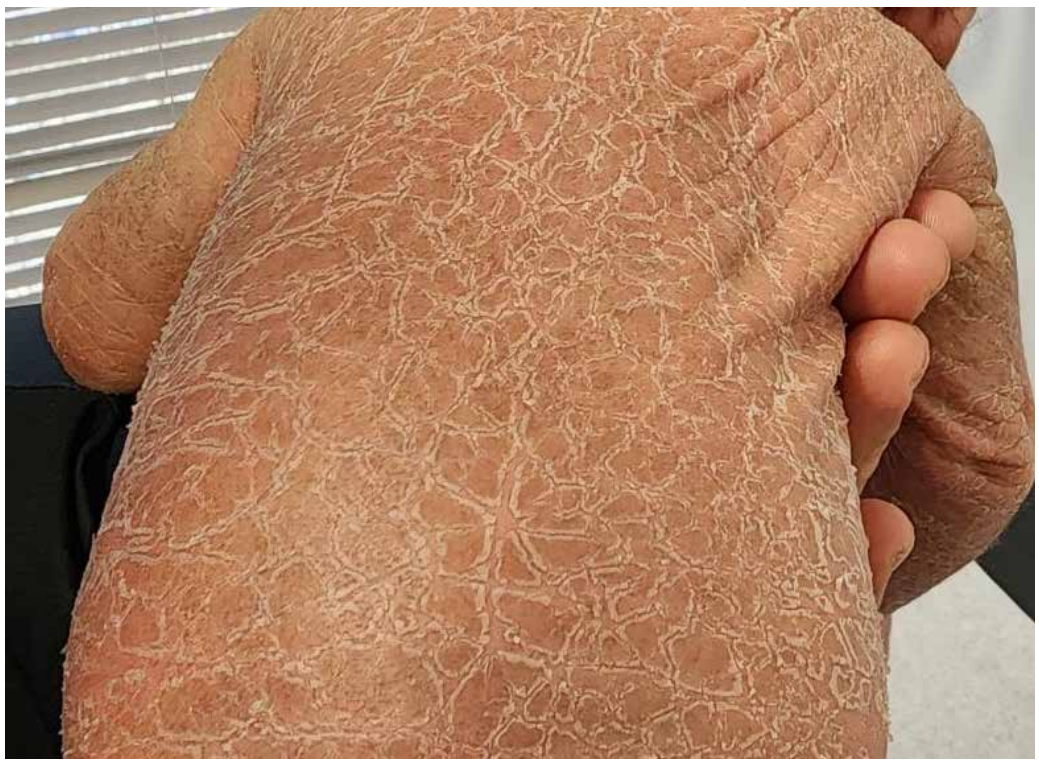

Figure 3: Large plate-like scales over the back of a neonate with lamellar ichthyosis.

Management

Neonates with a CM require special care as they are at increased risk of complications that include impaired temperature regulation (hypothermia from heat loss and hyperthermia from hypohydrosis), hypernatremia dehydration, poor feeding/poor weight gain, infection (superficial or systemic), systemic toxicity (topical medication absorption), aspiration pneumonia (aspiration of squamous debris in amniotic fluid), distal limb ischemia (from mechanical compression), ophthalmologic complications, and obstruction of ear canal.[4] Compromise of the epidermal skin barrier is responsible for the majority of the listed complications. Of notable concern is the transepidermal water loss which is 7 times higher than in normal skin.[21]

Management includes the following for all patients with CB.[4]

- Admit to Neonatal Intensive Care Unit (NICU)
- Placement in a highly humidified incubator (minimum 60%)
- Monitor body temperature regulation and avoid hyper- and hypothermia
- Monitor water and electrolyte balance
- Monitor for signs of systemic infection (may include hypothermia)

- Use standard NICU infection prevention protocol
- Use of petroleum-based topical lubricant several times a day.
- Avoidance of medicated ointments
- Encouragement of parental involvement in care of baby
- Diagnosis of underlying condition

If necessary:

- Caloric supplementation if poor growth
- Ophthalmologic evaluation if ectropion
- Otorhinolaryngologic evaluation if external ear canal is obstructed
- Pain management
- Nasogastric tube placement if difficulty sucking prevents adequate feeding
- Topical retinoids (such as tazarotene) to reduce scaling and normalize skin cell turnover[22]
- Oral retinoid if delayed membrane shedding or with severe underlying ichthyosis, such as in harlequin ichthyosis

Neonates with a CM can be transitioned to a crib when there has been adequate caloric intake, appropriate weight gain and an absence or resolution of complications associated with the impaired skin barrier.[4]

Parental bonding with their newborn should be encouraged, and parents should be actively involved in the care. Even with time in the incubator, parents should have skin-to-skin for many hours a day with close monitoring, whenever possible.[4] At day of life 2, neonates with CM can have 30-minute "holidays" outside the incubator every 3.5 hours to breastfeed and bond with the parents, with progressive increase in time out of the incubator over the subsequent two weeks.[23]

SUMMARY OF KEY POINTS

- Collodion baby is both a diagnosis and a clinical manifestation in newborns who commonly have autosomal recessive congenital ichthyosis.
- A highly compromised skin barrier puts the patient at a high risk of both hypo-/hyperthermia, dehydration, poor growth, infection and several other organ-specific complications. Due to these increased risks, admission to the neonatal intensive care unit is necessary to facilitate close monitoring and access to a highly humidified incubator.
- The collodion membrane (CM) is shed within 3 to 4 weeks, revealing the underlying ichthyosis. Special investigations can be undertaken before the membrane sheds such as a skin biopsy or blood work. These investigations can provide clinical clues to an earlier diagnosis. If the patient is stable, it is reasonable to wait for the membrane shedding to reveal an underlying diagnosis.
- Petroleum-based moisturizers can protect the skin as the membrane peels off.
- The most common underlying diagnoses of collodion baby are congenital ichthyosiform erythroderma and lamellar ichthyosis. However, an estimated 10% of patients will have near normal-appearing skin, referred to as self-improving collodion ichthyosis.

Conclusion

Collodion baby, a rare clinical presentation in newborns, is commonly a marker of autosomal recessive congenital ichthyosis (commonly congenital ichthyosiform erythroderma and lamellar ichthyosis) with an estimated 10% of patients progressing to near normal-appearing skin, a condition referred to as self-improving collodion ichthyosis.

Neonates with a CM have a compromised skin barrier and are at high risk of developing complications such as hypo-/hyperthermia, dehydration, decreased growth velocity and systemic infection. Additional complications include aspiration pneumonia, ectropion, external ear canal blockage and distal limb ischemia. Managing these risks entails admission to the NICU for close monitoring and incubator placement to maintain high humidity and to regulate temperature.

The membrane typically sheds within 1 to 4 weeks, allowing for clinical diagnosis of the underlying ichthyosis and subsequent management.

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CLINICAL PEARLS

Skin barrier dysfunction can lead to significantly higher transepidermal water loss and poor temperature regulation. A highly humidified incubator (minimum 60%) can help reduce water loss and assist in adequate temperature regulation.

Other keys to management include close observation for signs of infection, dehydration, electrolyte imbalance and/or poor feeding/decreased growth velocity.

Topical petroleum-based lubricants should be applied multiple times per day while medicated ointments should be avoided due to risk of systemic toxicity.

Complications involving the lungs (chest constriction or respiratory distress), eyes (ectropion or keratitis) and ears (obstruction, conductive and sensorineural hearing loss) may also be seen. In these instances, consultations with pulmonology, ophthalmology or otorhinolaryngology may be necessary for comprehensive care.

Skin biopsy prior to membrane shedding is generally unhelpful but may provide disease-specific histological findings if done after the collodion sheds.

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Key Points for the Practitioner

History (key points to cover)

- Detailed newborn history including prenatal, antenatal and postnatal complications.
- Detailed family history including consanguinity and affected family members.

Physical Examination (key features to note)

- Generalized assessment of well-being (alertness, responsiveness, tone, respiratory effort)
- Full body skin examination to assess for:
  - Shiny white skin
  - Erythroderma
  - Scaling
- Taut skin around eyes (ectropion), ears (hypoplasia of auricular cartilage), mouth (eclabium), distal limbs (pseudocontractures or ischemia)
  - Hypohydrosis
  - Poor sucking
  - Restricted pulmonary ventilation
  - Distal edema

Investigations (key features to note)

- The underlying phenotype becomes apparent once the membrane sheds in 3-4 weeks
- Several diagnostic tests can help with earlier diagnosis in atypical cases (e.g. molecular genetic testing, electron microscopy)

Management (key points to note)

- Admit to NICU
- Placement in a highly humidified incubator (minimum 60%)
- Close monitoring of body temperature regulation, water/electrolyte imbalance, and signs of systemic infection
- Use of standard NICU infection prevention protocol
- Application of petroleum-based topical lubricant multiple times per day
- Avoid use of medicated topical treatment
- Encourage parental involvement in daily care
- Diagnose underlying condition

Can consider adding:

- Caloric supplementation (if poor growth)
- Ophthalmologic evaluation (if ectropion)
- Otorhinolaryngologic evaluation (if external ear canal obstructed)
- Pain management
- Nasogastric tube placement (if difficulty sucking prevents adequate feeding)
- Oral retinoid (if delayed membrane shedding or with severe underlying ichthyosis)

Information for the Patient and Family

What is Collodion Baby?
Collodion baby (CB) is not a diagnosis or disease, but rather a term used to describe the shiny, tight skin covering the newborn. This condition is very rare and occurs at birth. It is most commonly a sign of a condition called "ichthyosis" (pronounced "ik-thee-ow-suhs").

How long will the "collodion membrane" last?
The collodion membrane usually begins to break down 3 to 4 weeks after birth, and then the specific condition or disease will be revealed. Patience is encouraged, as it can be several weeks before we can reach a diagnosis with certainty.

What is the most likely condition or disease underlying collodion baby?
Most commonly, CB is a sign that the baby has a condition called ichthyosis (genetic dry skin). Ichthyosis is present from birth and is inherited from the baby's parents, even if both parents are not affected. Ichthyosis leads to irregular skin cornification for the baby, meaning that their skin will be thicker and scalier than normal. Occasionally, babies with CB will have a very mild version of ichthyosis, and their skin will become almost normal after membrane shedding.

What are the complications of collodion baby?
Even though the skin appears thick, loss of water through the skin is seven times higher than normal. This water loss means challenges in staying hydrated, balancing electrolytes and temperature regulation. It is also important to keep an eye out for occasional signs of infection.

What can be done to help collodion baby?
Usually, when they are born, babies with collodion membranes will be taken to the neonatal intensive care unit (NICU). They will need to be placed in a special bed with a glass covering to keep water in the skin, salts in the blood and to keep the temperature normal. If the baby continues to remain healthy and shows good progress in shedding the membrane and healing, they can be moved from their special covered bed to a crib. Lubricants are usually applied several times per day and the parents are encouraged to be actively involved in feeding and bonding with skin-to-skin contact.

Will my baby be in pain or uncomfortable?
Some babies with a collodion membrane may experience discomfort because of the tightness of the membrane and the limited movement. The NICU usually maintains a good temperature and is air conditioned so that sweating is minimal. The skin can be protected with liberal applications of creams to keep water in the skin. The special beds with glass covering also have humidifying technology, to protect the baby's skin and reduce discomfort.