

UMBILICAL GRANULOMA: AN UMBILICAL PROBLEM OFTEN ENCOUNTERED IN OUTPATIENT SETTINGS: A REVIEW

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ABSTRACT Newborns can often present with several umbilical abnormalities, such as benign granulomas or more serious lesions due to persistent remnants. The persistence of granulation tissue in the umbilical is common and quite be alarming to parents and often encountered by physicians in outpatient settings. The most common signs and symptoms are umbilical discharge and a round lump from the umbilicus. If the size of the granuloma is large enough it can easily be seen by examination. There is very minimal literature that elaborates on the treatment and management of umbilical granuloma of such patients. A literature search was carried out in PubMed and Google Scholar for articles published between 2002 and 2020, with keywords such as “treatment of umbilical granuloma” and “management of umbilical granuloma”. These articles were used to draw down some basic guidelines and clinical tips that can aid in the treatment of umbilical granuloma in limited facilities.

KEYWORDS umbilicus, granulation tissue, umbilical discharge, round lump

Background

Newborns can often present with several umbilical abnormalities, such as benign granulomas or more serious lesions due to persistent remnants, many of which can change the normal course of cord detachment and may be related to significant morbidities if left unrecognized and untreated. In normal situations, the umbilical cord detaches within 7–10 days from birth and the granulation tissue of an absorbable umbilical stump of a newborn disappears by the second or third week of life.[1] The persistence of granulation tissue after this time is common and quite be alarming to new parents and often encountered by physicians in outpatient settings.

An umbilical granuloma is defined as a moist, fleshy and pale red granulation tissue at the center of the umbilicus that occurs after separation of the umbilical cord. The tissue is soft, usually

3 to 10 mm in size, vascular and granular, dull red or pink in color, and may show a seropurulent secretion.[2]

The number of epidemiological studies dealing with its incidence/prevalence is still limited. The prevalence of umbilical granuloma has been reported as 1 in 500 newborns.[3] The method for treating umbilical granuloma is a surgical procedure such as double ligation or excision methods.[4] However, for the limited facilities, it can also be treated topically with silver nitrate, steroids, antibiotics, and salt application with a satisfying result.

Pathophysiology and Risk Factor

An inflammatory process is suggested for granuloma formation. The umbilical cord usually dries and detached within 6–8 days after birth. The base surface is then covered by a thin layer of skin, scar tissue forms, and the wound is healed within 12–15 days. The presence of saprophytic organisms impedes the separation of the cord and increases the possibility of infection by pathogenic organisms. Subclinical infection or incomplete epithelialization may ensue in a moist granulating area at the base of the cord with a slight mucoid or mucopurulent discharge.[2]

A study between two groups of 1000 healthy newborns, using different clamping techniques showed that 8% of newborns with

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conventional clamping techniques had granulomas, whereas in the proximal clamping technique none of the newborns had granulomas.[5]

The umbilical granuloma is caused by an excessive physiologic response that surpasses the normal restorative process of the skin after the umbilical cord detachment. This skin lesion is associated with a proliferation of fibroblasts with unbalanced to connective and granulation tissue. Additionally, the proliferation of vascular endothelial cells, angiogenesis, and neovascularization is present. The etiology of umbilical granuloma has been associated with infections or colonizing bacteria, but this relation is not well established.[6] Disruption of the balance between umbilical skin flora and saprophytic organisms affected the detachment of the cord by facilitating the invasion of pathologic microorganisms. These subclinical infections may preclude skin epithelization and trigger granuloma formation.[7]

Clinical Presentation

The most common signs and symptoms are umbilical discharge and a round lump from the umbilicus. If the size of the granuloma is large enough it can easily be seen from the outside without having to press the area around the umbilicus. The discharge is odorless and is not a discharge originating from the digestive or urinary tract. These granulomas do not contain nerve fibers so they are painless unless complicated by infection.[2,7]

In physical examination, umbilical granulomas are seen as small, soft, non-tender, and pale red lesions 1–10 mm in size at the base of the umbilicus. The surrounding skin is normal. Its granular surface can be recognized by a careful open eye inspection or using an optical magnifier (dermoscopy). Gentle pressure on the surrounding area and sometimes a surgical tweezer is required to see a small granuloma hidden in the umbilicus pit, to ensure sufficient exposure. An otoscope can also be used to view small sessile umbilical granulomas.[6,7] The clinical features of umbilical granuloma are shown in Fig. 1a and b.

Local infectious symptoms such as edema, redness around the umbilicus, purulent discharge accompanied by a fever and poor general condition suggest the possibility of omphalitis and/or sepsis in neglected cases.[7]

Assessment and Diagnosis

Most umbilical granulomas can be easily diagnosed with a careful medical history and physical examination with a high index of suspicion, but in some circumstances, the use of additional diagnostic methods may be necessary.[2,8]

Omphalomesenteric duct anomalies emerge from partial or complete failure of the omphalomesenteric duct (OMD) obliteration that connects the yolk sac to the gut in the embryo. The exact cause of this incomplete obliteration remains unknown. Persistence of OMD happens in 2–3% of children and depends on the degree and location of involution, has a variation of anatomical patterns that include vitelline cyst (Fig 2A and D), umbilical sinus (Fig 2B), umbilical polyp (Fig 2C), Meckel diverticulum (Fig 2E), and completely patent omphalomesenteric fistula (Fig 2F). Although OMD remnants are usually asymptomatic, 40% of these lesions may be symptomatic, including gastrointestinal bleeding, obstruction, or umbilical abnormalities, depending on the particular type of defect.[1]

Meckel diverticulum (MD) is the most common abnormality resulting from incomplete obliteration of the omphalomesenteric duct. An estimated overall prevalence of MD in the general

population is 0.6–4%.[9] The rule of 2s is helpful in MD's description because MD occurs in 2% of the population, appears within 2 feet of the ileocecal valve, is 2 in long, approximately 2–4% of patients develop complications over the course of their lives, and typically presents before age 2 years.[10] Most MD is asymptomatic. Clinical presentations include lower gastrointestinal bleeding due to ulceration of the heterotopic gastric mucosa and intestinal obstruction due to intussusception or volvulus.[11] Technetium 99 scan, or Meckel scan, is the most commonly used modality for detecting heterotopic gastric mucosa-associated with MD.[10]

Patent omphalomesenteric fistula, a patent conduit connecting the umbilicus to the ileum, is one of the least common variants of OMD anomalies and usually presents with a minimal but persistent discharge of intestinal contents at the umbilicus. Diagnosis is usually made during infancy as feces or bilious drainage is eminent at the umbilicus. Severe, erosive dermatitis may occur in the skin adjacent to the umbilicus due to the irritating effects of fecal drainage.[10,11]

Umbilical cysts may present typically as asymptomatic erythematous cystic swelling at the umbilicus. On some occasions, they may present with bowel obstruction or infection. An OMD sinus should be considered when mucus discharge is marked in the presence of an umbilical polyp or granuloma. Patent OMD may be promptly identified in the neonatal period due to persistent feculent discharge. Nevertheless, cysts and sinus tract may require additional evaluation, including ultrasonography and fistulography.[10,11]

An umbilical polyp is a remnant of the urachal embryologic remnant. An umbilical polyp may coincide with urachal sinus, cyst, fistula, or a band and may be associated with urine or fecal discharge.[1] Umbilical polyp present as a bright red, firm, painless mass with mucoid/bloody discharge. They may be mistaken clinically for umbilical granulomas or pyogenic granulomas, which may have a pink or velvety presentation. Unlike umbilical granulomas, it should be remembered that umbilical polyps do not respond to chemical cauterization. Histopathologic evaluation is justified if there is any doubt whether an umbilical mass in a neonate is a polyp or granuloma. If an umbilical polyp is considered as a working diagnosis, further evaluation for possible embryologic anomalies should be carried out. Umbilical polyps are related to an underlying OMD anomaly in 30–60% of patients. In such conditions, ultrasonography or fistulography may be beneficial.[1,10]

Treatment and Management Overview

It is remarkable in the principal pediatric and neonatology textbooks that silver nitrate application is advocated as a first-line treatment option, and other non-invasive approaches almost are not mentioned.[2,12] Different management options are available through literature search although evidence-based ones are limited. The reasons for seeking these alternatives are some unresponsive cases to silver nitrate application, the necessity of medical personnel for its application, and the risk of periumbilical burn injury with silver nitrate.

Umbilical cord care is a potential factor affecting cord separation time and may indicate an association with the granuloma formation. Despite dry cord care has been found to be effective in developed countries, cord care with antiseptics continues to be favored in developing countries.[13–15] Method of cord clamping has also been suggested as a potential factor that may modulate the granulomatous process. In their prospective study,

Al Siny et al. suggested that proximal clamping of the umbilical cord for 24 hours is a very simple and effective method that diminishes the incidence of local umbilical infection and consequently avert the development of granuloma.[5]

In addition to silver nitrate application, some other therapeutic options are topical steroids, topical antibiotics, topical antiseptic solution, and home salt application.[13,16–21] Other procedural measures include suture ligation, surgical excision, electrocautery, and cryotherapy.[7,11] The spontaneous regression of untreated granulomas is not well documented. Whichever method of treatment is being used, it is important to keep the diaper folded under the navel to avoid contact of a wet diaper with the granuloma that can further lead to rapid epithelialization of the granuloma.[7]

Silver Nitrate

Treatment of umbilical granulomas with silver nitrate is a common practice. Although the antiseptic effects of silver nitrate are remarkable, it has caustic effects. These effects are behind its therapeutic function, adjacent healthy tissues may be damaged if silver nitrate is contacted. Pencil-like preparates consisting of silver nitrate should be touched on the lesion with caution to avoid chemical burns in the surrounding skin. Hence, applicators or sticks contain 75% silver nitrate and 25% potassium nitrate should be preferred for chemical cauterization. Before the silver nitrate administration, the umbilical area should be rinsed with an antiseptic solution and dried with sterile gauze. Care should be taken only touching the applicator on the granulation tissue. The surrounding area may be protected by petroleum jelly.[3,7]

If the granuloma persists after 3 applications which are performed with an interval of 3–4 days, other potential umbilical pathology or alternative treatments should be considered. It should be taken into account that umbilical polyps do not respond to silver nitrate application.[12]

Topical Steroids

A study conducted by Broadsgaard et al on 109 neonates with umbilical granuloma who were divided into three intervention groups: ethanol wipe, silver nitrate, and clobetasol propionate. The cure rate after 30 days of therapy was 18/34 in neonates receiving ethanol therapy, 29/30 for neonates receiving silver nitrate therapy, and 27/30 for neonates receiving clobetasol therapy. Clobetasol propionate 0.05% is applied twice daily. Treatment of umbilical granuloma with topical clobetasol propionate cream (0.05%) at home is as effective as treatment with topical silver nitrate in the clinic.[20]

A study conducted by Ogawa et al on 207 neonates who were divided into two intervention groups: topical steroid ointment (TSO) and silver nitrate cauterization (SNC) therapy. In the TSO group, patients were applied with 0.12% betamethasone valerate ointment to the lesion twice a day after washing or bathing by parents, without occlusive dressing used to dry the lesion. In the SNC group, patients were treated once a week by pediatricians using silver nitrate applied using a clean stick applicator at a concentration of 20% in a hospital or clinic. The stick was dried before application, the surrounding area protected with petroleum jelly, and contact with normal skin was avoided. All patients attended the outpatient settings once a week and followed-up for 3 weeks until the lesion was determined to be healed. Healing rates of SNC and TSO treatment at 14 days were

87.5% and 82.0%, respectively. However, healing rates at 21 days were 90.4% and 91.0%, respectively, and were considered to be almost identical.[16]

Topical Antibiotics

A study conducted by Wang et al on 84 neonates showed that the treatment of umbilical granuloma using topical doxycycline once daily for 5 days is safe and of high efficacy. The administration of doxycycline can be performed conveniently by parents at home, which can reduce the cost of therapy.[17]

Tetracyclines are broad-spectrum antibiotics that act at the ribosomal level which interfere with the protein synthesis, indicated for use against many bacterial infections. Recent studies suggested besides antimicrobial property, tetracyclines also have anti-inflammatory and anti-angiogenesis effects. As anti-inflammatory and anti-angiogenesis agents, they are widely used in the treatment of various skin diseases.[22] Doxycycline and other tetracyclines are predicted to be similarly effective agents in other disorders in which the inflammatory reaction and granuloma formation are affected.[17]

Doxycycline powder was administered topically once daily. After removing the discharge at the umbilicus, an adequate amount of doxycycline powder (varying from 20 mg to 50 mg) was powdered finely over the surface of the lesion to make sure that the lesion was well enveloped by the agent, and the umbilicus then covered with a dressing until the next administration. The lesion was reassessed daily, and the treatment discontinued after 5 days as a protocol. The pediatrician administered the agent in the inpatient group, meanwhile, the parents assigned to administer the agent in the outpatient group. The cure was determined as complete regression and detachment of umbilical granuloma. The overall cure rate was 82.14% (69/84). With two-courses (10 days) of therapy, the overall cure rate was 94.05% (79/84).[17]

Salt Application

The initial evidence related to salt treatment is based on studies conducted in developing countries. The results of this method appear to be consistent and indicate a good clinical outcome.[7] Although different methods have been determined for salt application, general principals are similar.

The clinical trial conducted by Faranoush et al divided 105 infants with umbilical granuloma into three groups, the group receiving salt therapy, 70% alcohol, and then the tape water group. The recovery rate among infants with salt treatment, alcohol, and tape water was 100%, 34.3%, and 14.3%, respectively. This study showed that the use of common salt in treating the lesion was more effective than 70% alcohol.[23] A comparative experimental study conducted by Farhat et al showed that a 24-hour treatment of umbilical granuloma with salt was more effective than the 2-hours treatment method.[24]

The salt application is painless to the infants and non-invasive. First, the umbilical area is cleaned with a wet cotton pad soaked in warm water, and then a pinch of crystal salt is sprinkled on the granuloma. Then, the granuloma is closed with an adhesive drape to keep the salt in place for 30 minutes. The drape is opened after the procedure and the area is cleaned using a wet cotton ball. This process is repeated 2–3 times a day for 3 to 5 consecutive days. In a prospective study, Hosain et al.[18] found that table salt application prompted good outcomes in 91.7% of patients. A study conducted by Saleh

et al.[19] in 50 neonates showed excellent results, all neonates (100%) experienced shrinkage and healing of the lesion after 3 weeks of therapy using the salt application. Sharma et al also did a similar study and showed that treatment with table salt showed a 100% cure rate.[25]

Dhungel et al studied 180 neonates with the salt application and 145 neonates with silver nitrate treatment. In the salt therapy group, 95% improved without surgery; 9 patients were operated on after a week whereas 12.4% needed surgery in the silver nitrate group. A total of 27 cases (8.3%) underwent electric cauterization that was not responded to both treatments. Patients had been followed-up for 3 different periods (1 week, 1 month, and 6 months), and no major pathological changes of surrounding skin or recurrence were observed in the salt application group, only a mild bluish discoloration of the umbilicus was reported in 4% cases, all of which were self-cured on 1-month follow-up without any treatment. Minor burns and ulceration were reported in 19% cases around the umbilicus with a 7% recurrence rate among the 127 patients treated during the 6 months follow-up in the silver nitrate group.[21]

Bagadia et al conducted a modification of salt therapy in their study, namely by leaving salt in the lesion for 24 hours. The study shows that a single salt application for 24 hours once, gives good results.[26]

The mechanism of the salt application when used in the umbilical granuloma is thought to its desiccant effect and other biologic properties, the high concentration of sodium ion in the area pulls water out of the cells and results in shrinkage and necrosis of the granulation tissue. However, this effect is not so robust as to cause damage to normal surrounding cornified tissue when applied for short treatment duration.[18]

Ligation

Some of the umbilical granulomas are located deep into the umbilical pit and are difficult to locate. The double-ligature technique surpasses the technical difficulty of ligating the granuloma on its base. After wiping the periumbilical area with a povidone-iodine solution, 3-0 silk sutures are used for ligation. The utilization of 4-0 silk sutures is also required with more delicate and friable umbilical granulomas. The first stage of the double-ligature procedure involves placing the superficial hold ligature, which brings the granuloma into a steadier position. The second stage requires placing a deeper and more precise ligature at the base of the lesion. The granuloma becomes necrotic and falls off within 7–14 days, similar to the original umbilical cord remnant. The complications of this technique are minor and include bleeding, especially with large sessile umbilical granulomas.[4]

The contraindications for this double-ligature technique are the large sessile umbilical granulomas with a wide base, small deep lesions, and friable lesions that easily bleed during the procedure. Before performing the ligation, a complete evaluation should be carried out to rule out more serious pathological abnormalities.[4]

Surgical Excision

Excision of the granuloma requires a surgeon or pediatric surgeon, sterile conditions, and equipment. Surgical excision could be the mainstay of treatment for large or non-resolving umbilical granuloma after chemical cauterization.[7,11,27] Fahmy et al. recommend the use of electrocautery by bipolar as a treatment of choice for all cases accurately diagnosed as an umbilical



Figure 1A: Small umbilical granuloma on the umbilical pit (authors personal documentation).



Figure 1B: Larger umbilical granuloma (authors personal documentation).

granuloma, either with light anesthesia or sedation. The advantages of this technique include the precise total excision of the granuloma at the moment, with secured haemostats, and to get a tissue sample for histopathological workup, which is not possible with chemical cauterization.[27]

Conclusions

Most of the umbilical granulomas can be diagnosed through medical history and physical examination. Treatment options should be individualized considering the health care facilities and the family compliance, silver nitrate application should be considered as a first-line treatment for the patients who can easily access the health care facility. The patients who will not maintain their medical care in a health center can undergo topical steroid treatment (clobetasol propionate 0.05% or betamethasone valerate 0.12%) twice daily for 30 days, topical antibiotics (doxycycline) once daily for 5–10 days, or using the simple salt application with several options, 24-hour once, or left the agent for 30 minutes to 1 hour, repeated two times a day for 3 to 5 consecutive days.

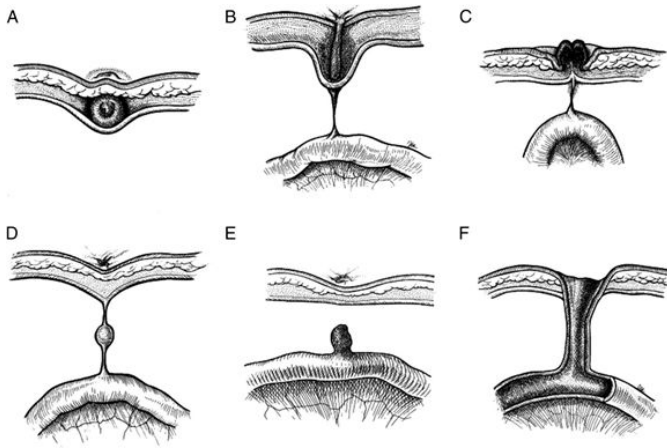


Figure 2: Omphalomesenteric duct remnants. A. An umbilical cyst containing intestinal tissue. B. Umbilical sinus with a band. C. Umbilical polyp covered with intestinal mucosa. D. Fibrous band containing a cyst. E. Meckel diverticulum. F. Patent omphalomesenteric duct. (Adapted from Cilley R. Disorders of the umbilicus. In: Pediatric Surgery. 7th ed. Philadelphia, PA: Elsevier; 2012:961–962.)

Further workup and/or surgical intervention may require if silver nitrate, topical steroid, topical antibiotics, or salt application is unsuccessful. In such conditions, consultation and evaluation with the pediatric surgery are warranted.

Conflict of interest

There are no conflicts of interest to declare by any of the authors of this study.

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