Journal of Pediatric Surgery (2010) 45, 1192–1197

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Journal of Pediatric Surgery

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Conservative management of giant omphalocele with topical povidone-iodine and its effect on thyroid function

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Received 13 February 2010; accepted 22 February 2010

Key words:
Omphalocele;
Giant omphalocele;
Povidone-iodine;
Hypothyroidism;
Conservative management

Abstract

Purpose: The aim of the study was to evaluate topical povidone-iodine as a bridge to delayed fascial closure of giant omphaloceles with emphasis on its effect on thyroid function.

Methods: Newborns from a single institution with giant omphaloceles treated with topical povidone-iodine for a 10-year period were reviewed. Recorded data included sex, associated anomalies, length of stay, frequency of povidone-iodine application, thyroid function tests, frequency of laboratory draws, and thyroid supplementation administration.

Results: Six neonates with giant omphaloceles were treated with povidone-iodine. Thyroid function testing occurred weekly as inpatients and monthly as outpatients, with abnormal values normalized by the subsequent laboratory draw. One patient demonstrated persistent hypothyroidism and subsequently died secondary to cardiac complications, but this infant's newborn thyroid screening suggested congenital hypothyroidism. Five patients remained euthyroid and ultimately achieved fascial closure without the need for a prosthetic implant. None of these patients had abnormal outpatient thyroid tests nor did they require thyroid hormone supplementation.

Conclusion: Topical povidone-iodine promotes escharification and epithelialization of the omphalocele sac. Because transient hypothyroidism may occur, thyroid function studies may guide inpatient therapy. After sac desiccation, systemic effects of iodine are minimal and thyroid supplementation is not necessary. Topical povidone-iodine is an effective initial strategy for giant omphaloceles and does not produce clinically significant hypothyroidism.

Omphalocele is a congenital abdominal wall defect that occurs in 1 in 4000 live births [1]. The definition of a giant omphalocele is controversial, ranging from specific anatomical criteria to the basic description of inability to primarily close the defect [2]. Most authors classify an omphalocele as giant when the diameter of the defect is greater than 5 cm and the sac contains liver [3-6]. Giant omphaloceles are often difficult to close because of the inability to provide adequate skin coverage and lack of abdominal domain, such that attempts at initial primary closure may result in respiratory insufficiency, preload reduction, and abdominal compartment hypertension. Conservative management strategies as a bridge to eventual fascial closure include the use of a silo or

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doi:10.1016/j.jpedsurg.2010.02.091

other prosthetic material, Gross skin closure, or sac escharification with topical agents such as silver sulfadiazine or povidone-iodine [7-9]. Several case reports suggest a small but significant risk of hypothyroidism when topical povidone-iodine is used [2,10,11]. We analyzed our own institution's experience with topical povidone-iodine as a bridge to delayed fascial closure in infants with giant omphaloceles, with a specific emphasis on its effect on thyroid function. We hypothesized that topical povidone-iodine escharification of an omphalocele sac is safe, effective, and does not cause clinically significant hypothyroidism.

1. Methods

This study was approved by the Children's Hospital of Wisconsin Institutional Review Board (no. 09/03, GC no. 808). Medical records of all newborns with an *International Classification of Diseases, Ninth Edition*, code for omphalocele were reviewed from January 1998 to December 2008. Defects with a diameter more than 5 cm were defined as giant omphaloceles, and only patients initially treated nonoperatively with topical povidone-iodine were included in this review. Patients with smaller defects and those who were initially treated either surgically or by alternative conservative methods were excluded. All patients were treated at a single tertiary care children's hospital by 1 of 8 pediatric surgeons.

Data collected included sex, gestational age, mode of delivery, associated anomalies, diameter of omphalocele (centimeter), length of initial hospital stay, days of mechanical ventilation, time (days) to full enteral feeds, dilution of povidone-iodine, frequency of topical application, complications from desiccation, serum thyroid function tests, frequency of laboratory draws, administration of thyroid supplementation, days until first operation, number of operations required for fascial closure, and postoperative complications.

Table 1 Patient characteristics at birth

Patient	Sex	Gestational age (wk)	Birth weight (kg)	Size of defect (cm)	Associated anomalies
1	Male	36	3.9	15	None
2	Female	36	2.7	8	None
3	Female	38	2.8	10	Dextrocardia
4	Male	39	2.9	7	Pentalogy of Cantrell
5	Male	37	2.5	8	Morgagni hernia
6	Male	38	3.0	>5	VSD, PFO

Baseline characteristics of the 6 infants diagnosed with giant omphaloceles and initially treated with topical povidone-iodine. Gestational age is reported in weeks, weight in kilograms, and size of defect in centimeters. Associated anomalies are also listed (VSD indicates ventricular septal defect; PFO, patent foramen ovale).

Table 2 Povidone-iodine desiccation

Patient	Povidone-iodine dilution factor	% iodine applied	Frequency of application	Desiccation complications
1	1:4	2.5	Every 1-2 d	None
2	1:4	2.5	Daily	Sac infection
3	1:4	2.5	Daily	None
4	1:4	2.5	Daily	None
5	1:4	2.5	Every 2 d	None
6	1:10	1.0	Daily × 7 d, then every 2 d	None

Povidone-iodine was diluted with sterile saline. The percentage of iodine applied reflects the dilution factor combined with the amount of iodine present in povidone-iodine (10%).

2. Results

Six patients with giant omphaloceles treated with dilute topical povidone-iodine for sac escharification were identified. Although the review included 10 years, all 6 patients were treated during the last 4 years. Patients before 2005 were treated with alternative methods including primary and staged repairs, silo application and serial reduction, or topical silver sulfadiazine. Povidone-iodine became the desiccation agent of choice in the latter half of the review period because of its antimicrobial properties, ease of application, and effective escharification.

Patient characteristics at the time of birth are presented in Table 1. Of the 6 patients, 4 were male. All 6 were diagnosed by prenatal ultrasound and subsequently delivered via cesarean delivery at 36 to 39 weeks of gestational age. The diameter of the omphaloceles ranged from 5 to 15 cm and contained a portion of the patient's liver. Four patients (66.7%) were diagnosed with associated anomalies including pentalogy of Cantrell, dextrocardia, Morgagni diaphragmatic hernia, patent foramen ovale, and ventricular septal defect.

All infants were evaluated at the time of birth. In each case, the size of the defect and/or the physiologic status precluded primary closure. Topical application of dilute povidone-iodine was initiated on the first day of life but varied in technique (Table 2). All but one patient had a 1:4 dilution of povidone-iodine to sterile saline. One patient had a 1:10 dilution. The original povidone-iodine solution contained 10% iodine (Betadine), so the diluted solutions used in these patients actually delivered 2.5% iodine with a 1:4 dilution and 1.0% iodine with a 1:10 dilution. A gauze wrap was soaked in the diluted povidone-iodine solution and applied to the entire omphalocele sac. Dressing changes occurred daily or every other day, with decreasing frequency as epithelialization developed or occurrence of abnormal thyroid function. An occupational therapist fitted each patient with a brace to support the omphalocele sac and its contents in an effort to decrease the risk of sac trauma or rupture (Fig. 1). One patient developed a *Pseudomonas*