

Various Ultrasonographic Manifestations of Bacille Calmette-Guerin (BCG) Lymphadenitis in Infants after BCG Vaccination

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= Abstract =

PURPOSE : To evaluate the various ultrasonographic manifestations of BCG lymphadenitis complicated by BCG vaccination in infants

MATERIALS and METHODS : Among a total of 59 patients of BCG lymphadenitis, we retrospectively evaluated the ultrasonographic findings of five patients (seven involved areas), who were operated and confirmed by histopathology. Three cases were male and two were female and the age range is from 3 months to 9 months (mean : 5.5 months).

RESULTS : Among five cases two had only a single lesion and three had multiple lesions, and two of those had multiple lesions at 2 separate locations. All five cases had ipsilateral supraclavicular lesions with same BCG vaccination site and two also had ipsilateral axillary lesions. Ultrasonography showed enlarged lymph nodes and heterogeneous hypoechoic changes suggesting internal necrosis or suppurative changes in three cases, but 1 had cystic necrotic change with fluid-fluid level and another had conglomerated mass with intermingled hyper and hypoechoic areas, which were initially suspected to be a tumorous condition but revealed conglomerated lymph nodes on follow-up ultrasonography and MRI.

CONCLUSION : BCG lymphadenitis is usually located adjacent to a BCG vaccination site, but ultrasonography can show single or multiple lymph node enlargement and various manifestations from homogeneous lymphadenitis to cystic abscess changes and even a mass-like appearance, demonstrating that the evaluation of ultrasonography should be done very carefully.

Index Words : Infants, newborn, lymphatic system
Bacillus Calmette-Guerin (BCG)
Ultrasound (US)

Introduction

Local ulceration and abscess formation at the vac-

ination site, sometimes accompanied by swelling of regional lymph nodes, are the most common complications of BCG vaccination[1]. Other complications include non-fatal cases of a localized or generalized tu-

: 1998 11 17 , : 1999 1 9 , : 1999 3 24 , : 1999 8 24

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berculous-like lesion following BCG dissemination (lesions of bone and joints, renal lesions, pulmonary or hilar lesions, and mesenteric lymphadenitis etc.), fatal cases of generalized tuberculous lesion, and post-BCG syndromes or diseases clinically associated with BCG vaccination[2].

Enlargement of the regional lymph nodes, BCG lymphadenitis is actually a form of immune response and secondary to invasion of the nodes by a non-virulent strain of the vaccine [3]. BCG lymphadenitis is also called BCGitis or BCG granuloma.

We report the various ultrasonographic manifestations of BCG lymphadenitis.

Materials and Methods

Among a total of 59 patients of BCG lymphadenitis

we retrospectively reviewed the ultrasonographic findings and the medical records in five patients (seven involved areas) of BCG lymphadenitis confirmed by histopathology. The age range was from 3 months to 9 months (mean = 5.5 months). Among five patients three were males and two were females. The duration between BCG vaccination and ultrasonography was from 2 months to 8 months (mean = 4.5 months).

Ultrasonography was performed by Acuson 128 or 128 XP/10 (Acuson, Mountainview, CA, USA) with 5.0 or 7.0 MHz linear transducer. CT scan and MRI examination were performed in one case for differentiation from neoplastic condition

Location, size, multiplicity, echogenicity, echotexture and posterior wall enhancement of the lesion were reviewed according to ultrasonographic findings.

Table 1. Summary of Cases with BCG Lymphadenitis

Case No.	Sex/Age	Location	Number	Size (cm)	Shape	Margin	Echogenicity	Echotexture	Posterior wall enhancement	Surgical & Pathological Fx
1.	f/5months	left supraclavicular	multiple	1.5-1.8	oval	partly defined	low	heterogeneous	marked	CGI with caseous n.
		left axillar	multiple	0.8-1.4	oval	well defined	low	homogeneous	marked	CGI with caseous n.
2.	m/9months	left supraclavicular	multiple	3.3	oval	conglomerated & poorly defined	mixed	heterogeneous	equivocal	CGI with caseous n.
3.	f/3months	left supraclavicular	single	1.7	oval	well defined	low	heterogeneous	moderate	CGI with caseous n.
4.	m/4months	left supraclavicular	single	2.8	oval	well deined	low	homogeneous	moderate	CGI with caseous n.
5.	m/5months	left supraclavicular	single	3.1	oval	well defined	anechoic-echoic layer	heterogeneous	marked	CGI with caseous n. & abscess formation
		left axillar	single	1.8	round	well defined	low	heterogeneous	equivocal	CGI with caseous n.

Fx : findings, n. : necrosis CGI : chronic granulomatous inflammations

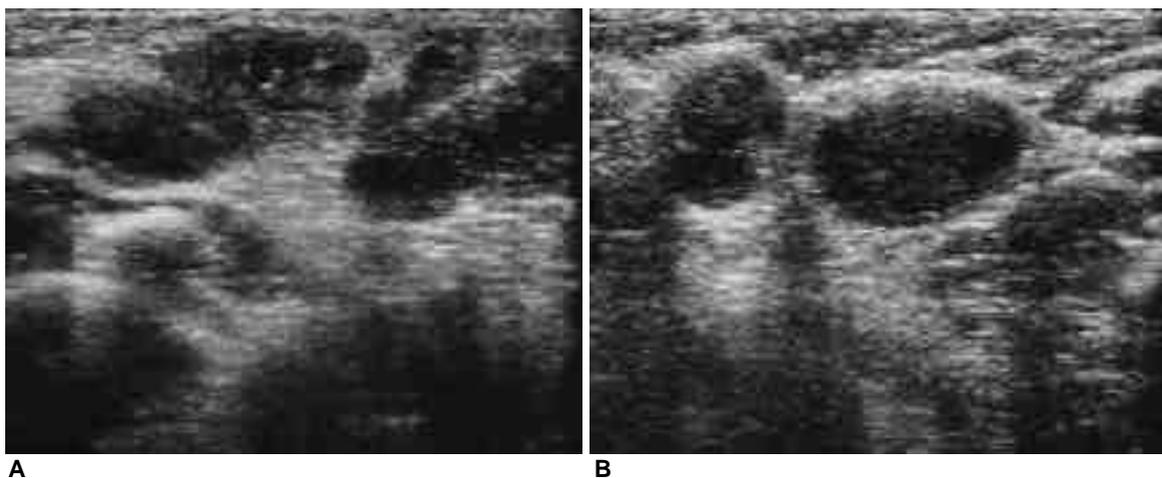


Fig. 1. A 5-month-old female infant with multiple BCG lymphadenitis at the left supraclavicular (A) and axillary (B) areas. **A.** Ultrasonography shows multiple heterogeneous low echoic enlarged lymph nodes suggesting suppurative lymphadenitis with partly defined margins and posterior wall enhancement in the left supraclavicular area. **B.** Two oval-shaped heterogeneous low echoic lymph nodes are noted in the left axillary area with well-defined margins and posterior wall enhancements.

Results

The clinical and ultrasonographic findings are summarized in Table 1.

A palpable mass was found at the supraclavicular area or axillary area in all five patients. Among the five cases, two had only a single lesion. Three had multiple lesions, and two of those had multiple lesions in double locations. All five cases had ipsilateral supraclavicular lesions at the same BCG vaccination site and two also had ipsilateral axillary lesions (Table 1). Ultrasonography showed single or multiple enlarged lymph nodes with sizes varying from 0.8 to 3.3 cm in diameter and heterogeneous hypoechoic changes, sug-

gesting internal necrosis or suppurative changes in three cases (Fig. 1, 2). However, one case had cystic necrotic change with fluid-fluid level (Fig. 3) and another had conglomerated mass with intermingled hyper- and hypo-echoic areas, which was initially suspected as a tumorous condition but revealed conglomerated lymphnodes on follow-up ultrasonography and MRI (Fig. 4).

Operative and histopathologic studies all showed chronic granulomatous inflammations with varying degrees of caseous necrosis suggestive of tuberculous lymphadenitis. While another case was associated with abscess formation, in which cystic necrotic lesion was noted with fluid-fluid level on ultrasonography.

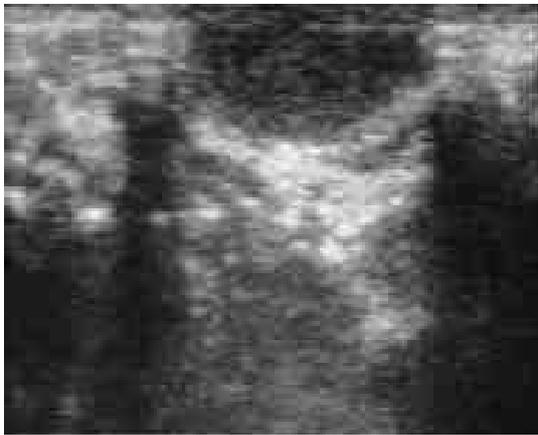


Fig. 2. A 4-month-old male infant with single BCG lymphadenitis.

Ultrasonography shows an oval-shaped and relatively homogeneous low echoic lymph node with a 2.8cm diameter and well-defined margin and posterior wall enhancement at the left supraclavicular area.



Fig. 3. A 5-month-old male infant with BCG lymphadenitis and abscess formations at two separate locations.

At the left supraclavicular area, ultrasonography shows a well-defined, oval-shaped mass 3.1cm in diameter with anechoic layering, suggesting abscess formation. Note marked posterior wall enhancement.

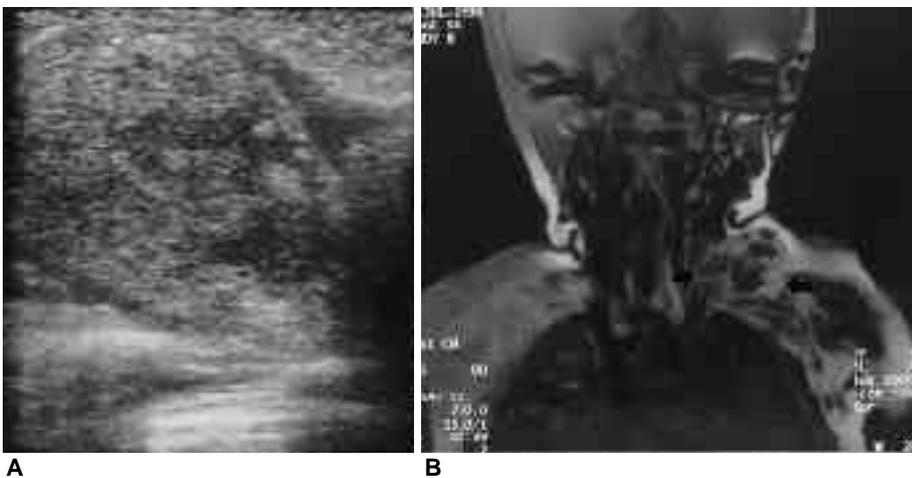


Fig. 4. A 9-month-old male infant with large conglomerated BCG lymphadenitis.

A. Initial ultrasonography shows a large 3.3cm-sized and poorly-defined, lobulated heterogeneous mixed echoic mass at the left supraclavicular area, which was considered as a malignant tumor. **B.** Gadolinium-enhanced T1-weighted coronal MR image shows large conglomerated lymph nodes (arrows), which have centrally low signal intensities and peripherally enhanced rims, suggesting caseous necrosis.

Discussion

Bacille Calmette-Guerin (BCG) vaccination against tuberculosis is widespread throughout the world. There are complications arising from the use of such tubercular vaccines. The overall rate is estimated at about 0.01% to 3.6%, comprising suppurative lymphadenitis (1/100), osteitis (1/100,000), and even fatal generalized tuberculosis (1/1,000,000) [4]. Changes of strain have led to outbreaks of BCG complications, mainly lymphadenitis, in up to 10% of cases [5]. The most common reported complications are lymphadenitis, with or without suppuration, and abscess formation. Cellular immunodefects, DiGeorge Syndrome, defect of bactericide capability of macrophages and pathological processes associated with severe salmonella infections are given as causes [3]. However, BCG granuloma cases with obvious immunocompetency also have been described [3]. Enlargement of the regional lymph nodes is actually a form of immune response and secondary to invasion of the nodes by a non-virulent strain of the vaccine. In order to prevent complications after BCG vaccination, it is necessary to follow high risk infants closely. Infants with immunodeficiency have BCG vaccination contraindicated [3]. The rate and variety of complications depend on several factors: dosage, vaccine used, mode of application, and to a certain extent the site of vaccination. The site of a BCG vaccination should always be over the insertion of the deltoid muscle, because the drainage from this region reaches only the axillary lymph nodes. The distribution of affected lymph nodes in the collar region, neck, and superior to the clavicular region clearly shows that the site of many vaccinations was wrong [5]. In our study, all 5 cases had ipsilateral supraclavicular lymphadenitis and only 2 had ipsilateral axillary lymphadenitis suggestive of a previous improper injection site, as well, ipsilateral lymph node involvement which is suggestive of host immune response.

In one report ultrasonographic findings of cervical tuberculous lymphadenitis showed hypoechoic lesions were 90.9% and mixed echoic lesions were 9.1% [6]. With caseation, however, there were blurred borders. In cold abscesses, an inhomogeneous texture with inhomogeneous shadows was found. In our cases, the various ultrasonographic manifestations shown in Table 1

seem to be due to the various stage of BCG lymphadenitis. On histopathological examination, chronic granulomatous inflammations with various degrees of caseous necrosis were revealed in 4 cases, while 1 case was shown to have abscess formation. So different ultrasonographic manifestations seem to be caused by the presence and degree of caseous necrosis and abscess formation. Among our cases, one was initially thought as a tumorous condition due to mass-like appearance with heterogeneous echogenicity on initial ultrasonography but MRI showed an infiltrative inflammatory lesion with multiple lymphadenitis.

Different therapeutic modalities have been suggested for the treatment of BCG lymphadenitis, whether suppurative or not. Surgical excision with anti-tuberculous therapy, fine-needle aspiration (for suppurative cases), oral erythromycin, systemic anti-tuberculous therapy for 1 year, intranodal isoniazid administration and even no therapy are examples [1, 7, 8]. Karnak et al. [8] described that although BCG lymphadenitis is self-limiting, chronically discharging nodes and tumor-like lymphadenopathy masses need to be excised. Hengster et al. [4] described that among 116 lymphadenitis developed after BCG vaccination, surgical treatment was found to be necessary in 96 cases and concluded that isoniazid therapy did not prove successful when inflamed lymph nodes exceeded a certain size. Suppurative lymphadenitis in lymph nodes exceeding 1.0 to 1.5 cm in diameter usually led to infiltration or even perforation of the skin. Surgery prevents these complications and significantly reduces healing time. They did not recommend adjuvant isoniazid therapy, except for generalized BCG tuberculosis [5].

All of our cases had no evidence of immunodeficiency and some of them were excised multiple BCG lymphadenitis. We consider various ultrasonographic appearances as manifestations of different stages of BCG lymphadenitis, including the degree of caseous necrosis and abscess formation. So radiologists who examine a palpable mass in the axillary or supraclavicular area in infants with previous BCG vaccination should keep in mind the possibility of multiplicity and various ultrasonographic findings of BCG lymphadenitis.

BCG lymphadenitis is usually located adjacent to a BCG vaccination site, but ultrasonography shows various manifestations from homogeneous lymphadenitis to cystic abscess changes and even mass-like appear-

ances, therefore the evaluation of ultrasonography should be done very carefully.

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