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# Oblique lateral incision and subpectoral dissection in modified Nuss procedure minimize future breast deformity<sup>☆</sup>

Hiroaki Kimura<sup>\*</sup>, Tomoyuki Yasuoka, Munetomo Nagao, Shin Kudoh, Seiichiro Kobayashi

Department of Plastic, Reconstructive and Aesthetic Surgery, Iwate Medical University School of Medicine, 19-1 Uchimaru Morioka, Iwate 020-8505, Japan

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## KEYWORDS

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**Summary** *Background:* We experienced the occurrence of breast deformity in some young female patients who underwent a modified Nuss procedure before breast development. We studied the causes of and preventive measures for this complication.

*Methods:* We classified 13 prepubescent female patients who underwent our modified Nuss procedure into three groups according to the direction of the skin incision and the dissection layer for bar insertion. Four patients who underwent transverse lateral thoracic skin incision and bar insertion through a subpectoral dissection were assigned to the T/SP group, five who underwent oblique skin incision along the rib and bar insertion through a suprapectoral dissection were assigned to the O/IP group, and four who underwent oblique skin incision and subpectoral dissection were assigned to the O/SP group. Each patient in the T/SP group underwent the operation by a different surgeon, two of whom were the authors, including the first author; the first author performed all operations in the O/IP and O/SP groups. The first author evaluated the shape of the developed breasts using the frontal- and oblique-view photographs. We also investigated the location of the lateral border of the mammary gland in seven other adolescent and adult female patients using three-dimensional computed tomography images.

*Results:* Lateral depression of the breast occurred in four of eight breasts with a transverse incision, and flattening of the lowermost portion of the inframammary fold occurred in six of 10 breasts with suprapectoral dissection. None of the eight breasts with an oblique incision and subpectoral dissection exhibited deformities. The lateral border of the mammary gland was on the fifth rib in five patients and on the fifth intercostal space in two patients.

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<sup>\*</sup> Corresponding author. Tel.: +81 19 651 5111; fax: +81 19 651 8402.

E-mail address: [hkimura@iwate-med.ac.jp](mailto:hkimura@iwate-med.ac.jp) (H. Kimura).

**Conclusion:** An oblique lateral thoracic skin incision along the sixth rib and subpectoral dissection may reduce the occurrence of breast deformity.

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## Introduction

We began performing a modified Nuss procedure for the treatment of pectus excavatum in 1999. Several authors have stated that the optimal age for this method is 6–12 years.<sup>1–3</sup> We considered that the optimal age is 7–10 years because chest wall rigidity becomes more diverse among patients after 10 years of age as they approach puberty.<sup>4</sup> In our experience, almost all 50 patients who underwent repair with the modified (i.e., extrapleural bar insertion) Nuss procedure before puberty obtained satisfactory results. However, some young female patients acquired several degrees of breast deformities as their breasts developed (Figure 1). In the present study, we evaluated the causes of and preventive methods for this complication.

## Patients and methods

Thirteen prepubescent girls underwent a modified Nuss procedure with an extrapleural approach from July 1999 to September 2012. We classified them into three groups based on the surgical approach and dissection method. Patients who underwent a *transverse* lateral thoracic skin incision (Figure 2a) and bar insertion through a *subpectoral* dissection (Figure 2c) comprised the T/SP group ( $n = 4$ ). Patients who underwent an *oblique* skin incision along the rib (Figure 2b) and bar insertion into the intercostal space with piercing *into the pectoralis major muscle* through a *suprapectoral* dissection (Figure 2d) comprised the O/IP group ( $n = 5$ ). Patients who underwent an *oblique* skin incision and *subpectoral* dissection comprised the O/SP group ( $n = 4$ ).

All patients underwent the first operations at a prepubescent age. Each patient in the T/SP group underwent the operation by a different surgeon (two of whom were

authors, including the first author). The first author performed all operations in the O/IP and O/SP groups. Although the bar was removed from patients in the T/SP and O/IP groups more than 2 years previously, it was not removed from patients in the O/SP group because their postoperative period was 18–31 months (Table 1).

## Investigation of patients with breast deformity

The first author evaluated the shape of the 26 developed breasts among all groups using frontal- and oblique-view photographs. Statistical analysis was performed with Fisher's exact test using R version 3.1.2. (R Foundation for Statistical Computing, Vienna, Austria).

## Investigation of the position of the mammary gland

We also investigated the position of the lateral border of the mature mammary gland in seven other adolescent and adult female patients with pectus excavatum using preoperative three-dimensional computed tomography (3D-CT) images (Figure 3). The patients ranged in age from 16 to 27 years.

## Results

### Patterns of breast deformities

We recognized two patterns of breast deformity. One involved a depression across the border of the lateral portion of the inframammary fold (IMF) when the lateral incision line reached the breast mound, and there were no deformities at the lowermost portion of the IMF. The other involved flattening of the lowermost portion of the IMF coinciding with the position of the bar, and the lateral aspect of the breast contained no deformities related to the incisional scar along the lateral portion of the IMF (Figure 4). Depression of the lateral portion of the IMF occurred in four of eight breasts in the T/SP group. However, flattening of the lowermost portion of the IMF occurred in six of 10 breasts in the O/IP group and in one of eight breasts in the T/SP group. None of the eight breasts in the O/SP group exhibited deformities (Table 2). There were statistically significant differences among the three groups ( $p = 0.0007489$ ). In other words, all lateral depressions of the breast occurred in breasts with a transverse incision, and six of seven cases of flattening of the lowermost portion of the IMF occurred in breasts with suprapectoral dissection.



**Figure 1** A 14-year-old female patient who underwent a modified Nuss procedure 10 years previously. Severe breast deformity was recognized on the inframammary fold (IMF).

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