Surgical Protocol

POLAND SYNDROME

3D Custom-Made Implants technique

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Expert in chest deformities treatment by custom-made implants with over 800 cases operated

AM-PRO-POL-EN-V3-202509

PROTOCOL CONTENTS

INTRODUCTION

Poland Syndrome is mainly diagnosed by partial or total agenesis of the Pectoralis Major (P.M.), mostly right sided. It is a rare congenital deformity, the incidence is estimated at only one in 30.000 births per year worldwide.

Poland Syndrome may be associated with varying degrees of thoracic abnormalities and malformations of the upper limb (20%). But, whatever the clinical type, the functionnal impact is weak, whereas the psychological impact is strong.

Surgery with a 3D custom-made implant is a first choice procedure, simple, unique and lasts throughout the patient's entire life. The risk of complication or failure is low.

For women, it can be associated in a second procedure with breast symmetrization and/or breast implant or lipofilling if needed.

It is adapted to male and female (sex-ratio 6/4) from 18 and until 60 years old. The techniques of myo-cutaneous flap transfer have been discontinued, while lipofilling retains some indications. Lipofilling may also be indicated in overweight men or those with unilateral gynecomastia.

This very precise protocol is the result of an extensive experience of plastic, thoracic and pediatric surgeons, on hundreds of cases. Its objective is to avoid technical mistakes, to reduce the risk of complications, and to guarantee the best morphological results.

PREREQUISITES

CT Scan of the thorax

Performed in a lying position, arms along the body (not in the standard elevated position), without contrast agent, and using fine slices (1 to 1.2 mm) of the entire thorax and abdomen.
Scans taken with arms elevated cannot be used to design a Poland implant due to the deformation of the healthy contralateral muscle and the inability to create a mirror-effect design.

Chest and Abdomen Photos

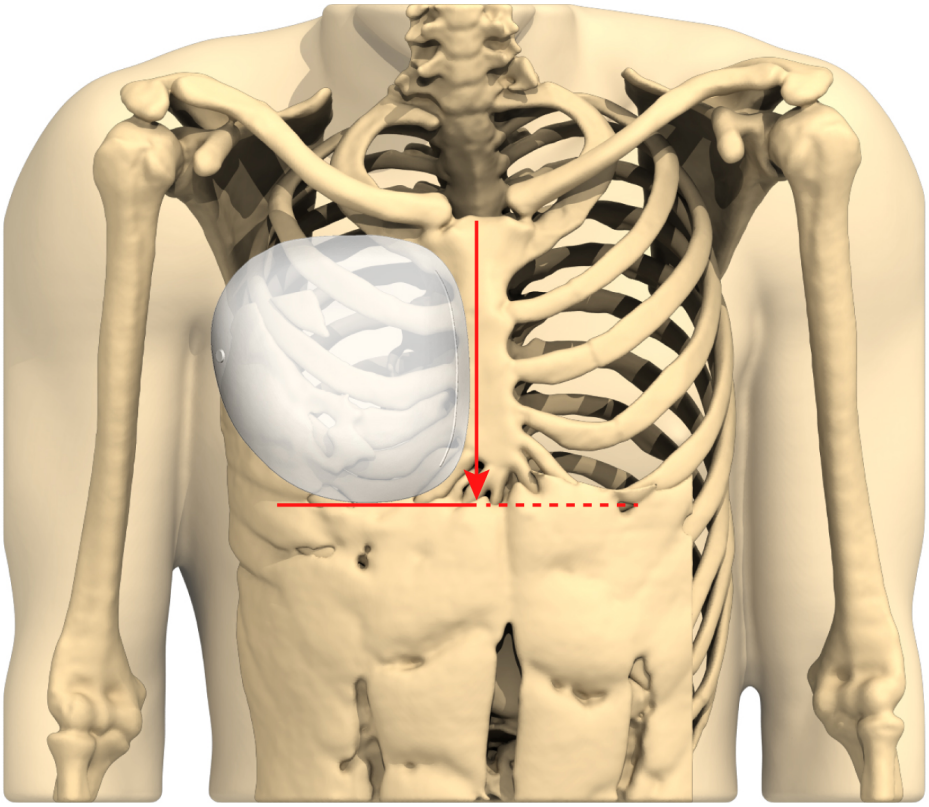
The breast and subcutaneous tissue atrophy in Type 2 cases must be considered, as well as the volume and shape of the contralateral breast in women (tuberous breasts) and men (adipomastia).

Photos of the chest in standing position can complement scan data, providing better insights into the external morphology of soft tissues, breasts, and adipose tissue. Specifically for Poland syndrome, the atrophy of the breast and subcutaneous tissue in Type 2 cases and the volume of the contralateral breast in both women and men must be considered:

- standing position photos: front and three-quarter views, arms along the body, from the neck to the iliac crests,
- lying position photos: taken as a profile or from a low-angle perspective.

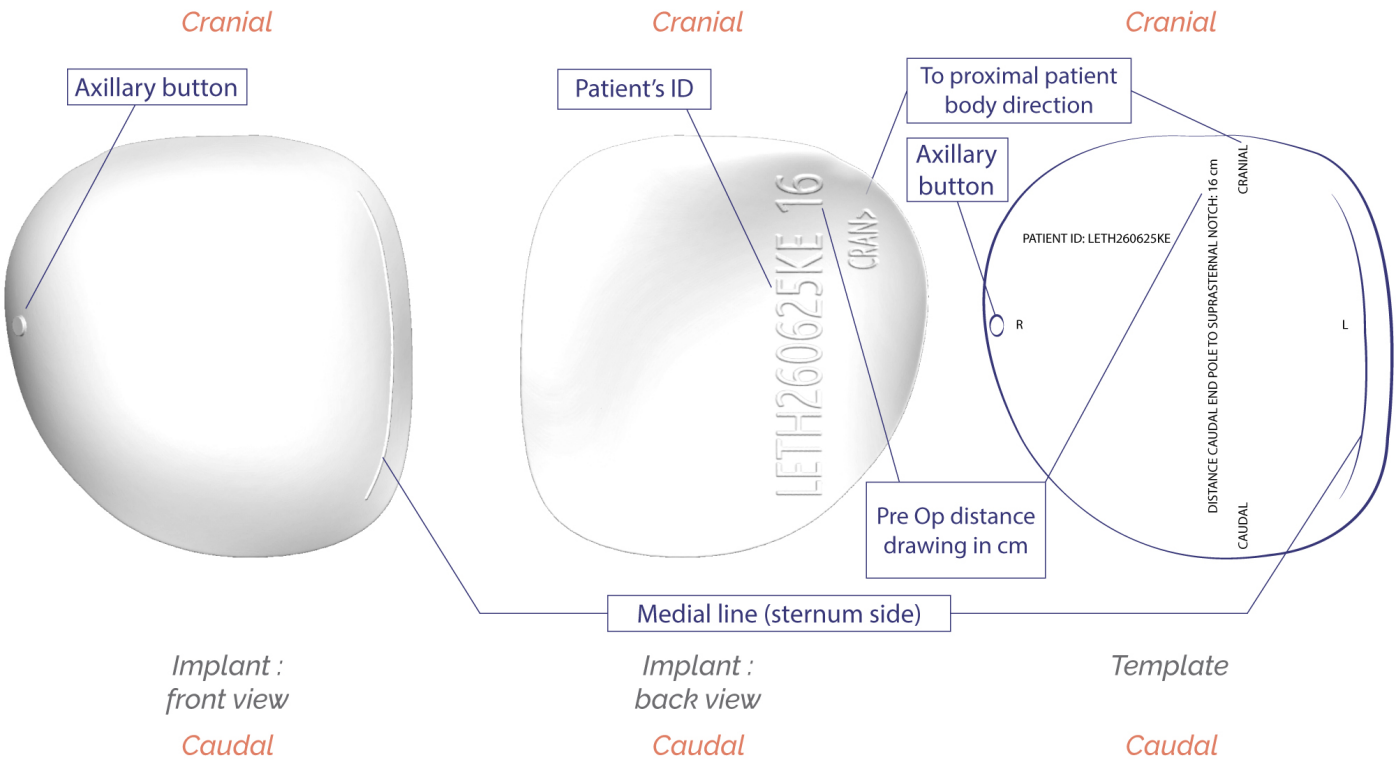
PRE-SURGERY

Measurement and implant/2D template marking



Vertical distance between the sternal notch and a sub-pectoral horizontal line.

A transparent rigid template is also provided with the implant for preoperative planning. This template includes all the guidelines needed to perform the preoperative drawing.



On the implant's and 2D template's front face, a line represents the medial implant's edge. On the

lateral part, a «button» will be in the middle of the axillary approach. With these two indications, the 2D template can be placed precisely in the correct position to trace around.

Preparation of the patient

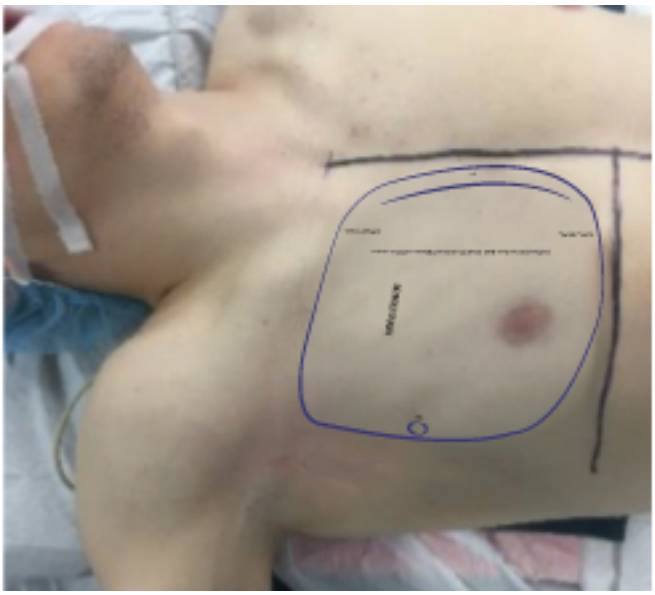
- Classic shower: brushing hands and feet. Nails must be unvarnished,
- Shave with trimmer, limited to the axillary and semi-chest area (dressing area),
- Dissuasive antibiotic infusion therapy with cefazoline 2G iv at the time of anesthesia induction, 30 minutes before the skin incision.

Pre-surgery drawing

Patient in supine position, arms along the body.
The precise implant's area is drawn with a permanent felt pen, using the non-sterile 2D template.

- Draw the pre-sternal midline from the supra sternal notch to the umbilicus,
- Mark the distance (printed on the 2D template) between the supra sternal notch and the sub pectoral line,
- From this mark, draw the sub-pectoral horizontal line perpendicular to the previous one,
- 2D template must be placed in the good direction, «cranial» upwards and «medial» towards the sternum,
- The line on the frontal face of the 2D template is medial, close to the sternal axis drawn on the skin. The «button» is placed at the axillary lateral side. R and L labels help ensure correct implant orientation,
- Outline the position of the 2D template inside the two lines.

Then the arm is placed in abduction to mark the axillary approach with a 8cm lazy shape.



SURGERY

Antiseptic preparation, operating drapes, checkup, lighting control.

Surgical approach and incision

- Axillary 8cm incision of the skin with scalpel blade in a lazy S shape,
- Assistant holds the skin edges with two Gillies hooks,
- Incision of the subcutaneous plan in section mode is performed with the diathermy unit protected short electrode (ideal: Stryker Colorado tips) to prevent skin edges burning.

Dissection

- Progress in the ventral direction, push aside the anterior skin edge using Farabeuf retractors, respect the latissimus dorsi muscle (LD) backward, and the vascular-nervous pedicle of the Serratus Anterior muscle (SA),
- Continue the forward progression up to the thoracic plane with Metzenbaum scissors while spreading the window with the two index fingers. The detachment between skin and smooth thoracic wall continues easily with the fingers and possibly by burying the whole hand. Proceed up to the limits drawn on the skin,
- In case of a too hard fibrous tract, dissection with the fingers is relayed by a section with long curved Mayo scissors,
- The dissection is not hemorrhagic, the para-sternal perforating vessels being atrophic unlike those in Pectus Excavatum cases,
- At the end of the dissection, the finger checks the limits of the implant compartment:
  - In cranial and medial, the detachment exceeds by 1cm approximately from the limits drawn on the skin to avoid folding of the very thin edges,
  - In caudal, the limits traced of the new sub-pectoral fold are strictly respected.
- In cases of complete pectoralis major atrophy, subcutaneous cannulation (Rigottization) can be useful to promote traumatic subclavian adipogenesis and prevent a depression, the need

for secondary lipostructure,
- Installation of large gauzes soaked in hot saline (not lukewarm!): this accelerates primary coagulation (transformation of fibrinogen into fibrin).

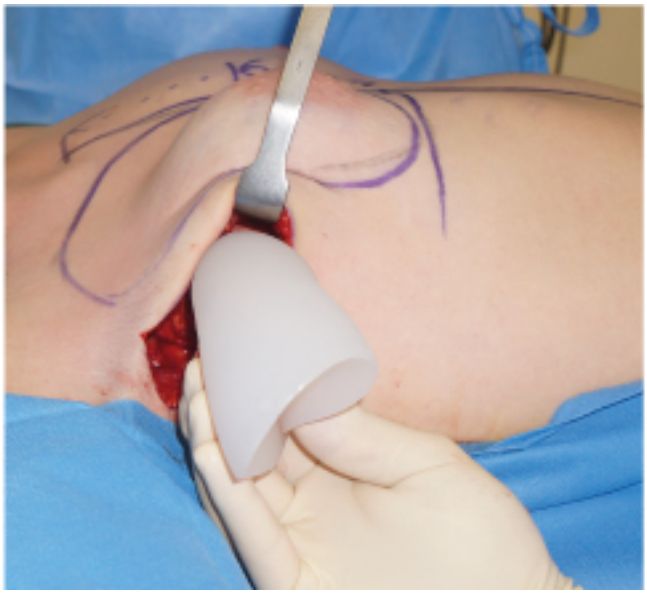
Insertion

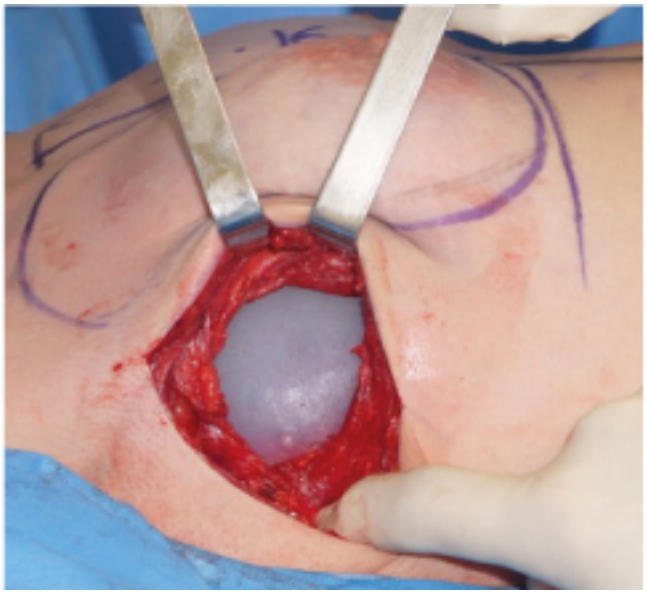
- The operators change their gloves. The instrumentalist cleans the skin with serum, dries it, sets up clean border drapes and orders the implant.

The implant is sterile in a double envelope: only the first is half-opened and presented to the instrumentalist who grabs the second sterile pocket containing the implant (in the event of an accidental fall, the implant could still be recovered sterile!).

The elastomer used is more flexible (Extra Very Soft), facilitating folding and axillary approach, although medial folds may occur if dissection is insufficient.

- After changing gloves, the surgeon will check the whole cavity a last time, its limits and of course complete the hemostasis if necessary,
- The surgeon will then ask the instrumentalist to open the pocket of the implant which they grab, fold it on its transverse axis (button laterally, protruding line medially) and immediately introduce it into the cavity in the right direction (supported by Farabeuf retractors),
- The implant will spontaneously deploy and position itself precisely within its cavity: the protruding line medially and the lateral «button» in the middle of the axillary approach.





Suture

The closure can begin in the absence of bleeding:

- No deep fascial suture,
- The subcutaneous plane is sutured with absorbale 3/0 monocryl with 5 inverted stitches in the absence of tension, 3 or 4 knots cut short are sufficient: the knots remains deep, the strands must not appear towards the surface,

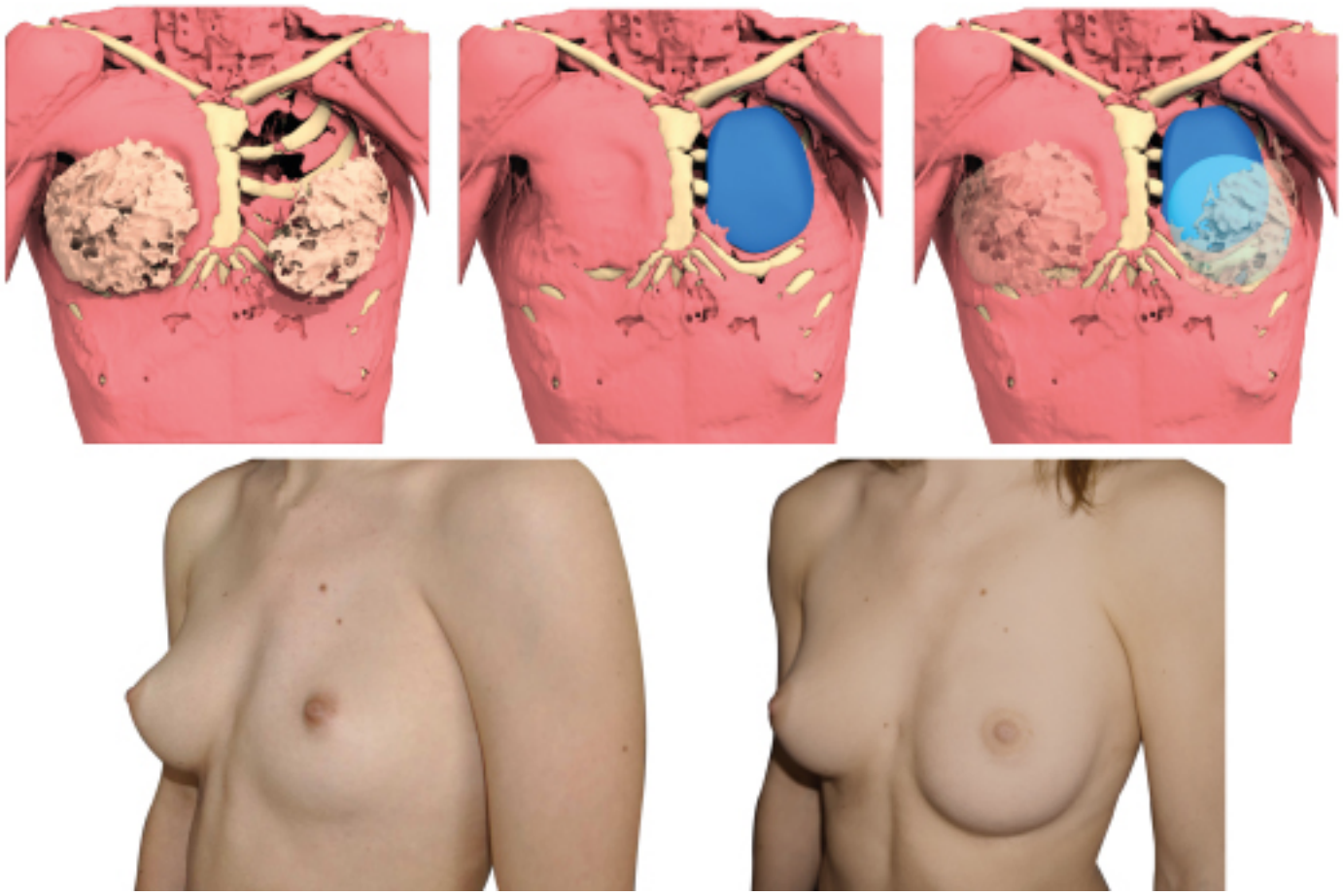
The use of absorbable braided Vicryl or Polysorb threads is not recommended for subcutaneous use, as they have a higher risk of picking up saprophytic germs from the skin, especially if the numerous knots lead to the formation of a rigid "braid" which risks becoming direct outwards - a real highway for saprophytic skin germs with rapid seeding of the entire suture line and then of the implant.

- The deep dermal plane is sutured with 3/0 monocryl in continuous suture,
- The continuous intradermal suture must slide well: it will be locked up by a single small knot inserted by a longitudinal traction. The wire is cut 3cm from its outlet and held by a steri-strip.
- Suction drain not needed,
- The dressing is standard,
- The contention is ensured by a polyurethane band (Microfoam 10cm) in two (or three) oblique passages from the dorsal region to the sternal region: simple pose without stretching to avoid an epidermal tearing.

SPECIFIC CASES

Insertion of breast implant after Poland syndrome treatment

The first step is always to put the chest implant and correct the muscle defect.
Then a breast implant can be used in a second procedure after 6 months. The preservation of a fibrous capsule avoids sliding.



Breast implant present before Poland syndrome treatment

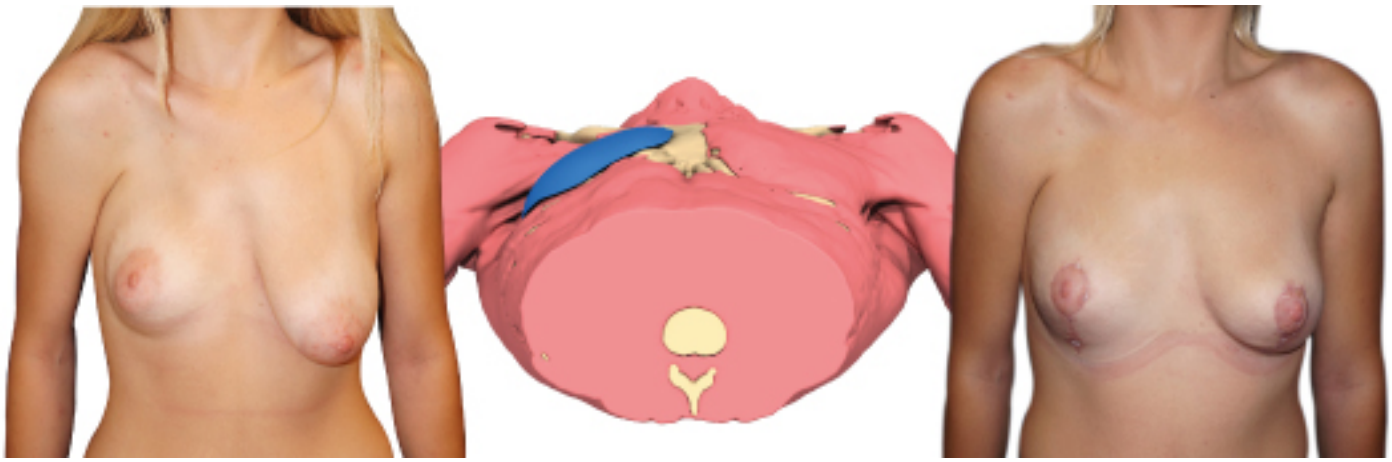
One breast implant has been put subcutaneously to correct the Poland's breast atrophy in a primary procedure with a partial result.

In a first step the 3D custom-made implant is inserted on the chest wall beneath the breast implant and its fibrous capsula let on place provisionally.

In a second step, after 6 months, the old breast implant is removed, the fibrous posterior wall respected and the new accurate breast implant is put in place without a risk of sliding on the previous one. The opposite breast may be treated through a mammoplasty for symmetrization.

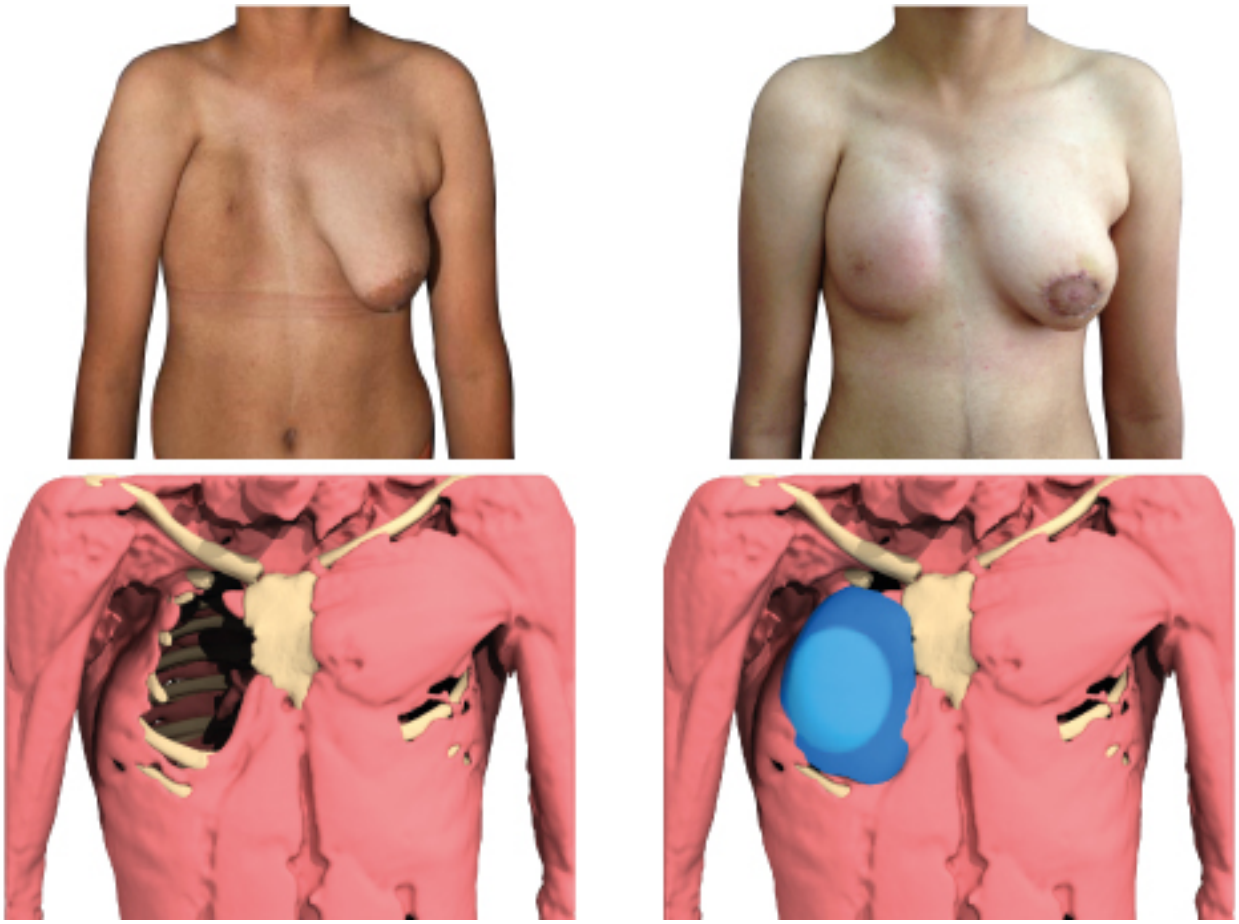
Breast implant and plastic surgery for tuberous disease after Poland Syndrome treatment

The first step is always to treat the Poland Syndrome deformity with the 3D implant. Then, 6 months later, both breasts can be symmetrized with or without a breast implant.



Poland Syndrome type 3 with deep chest deformity

The custom-made implant allows to correct both muscular and even costal agenesy. If necessary, 6 months later, a breast implant can be added on the Poland side, and the tuberous breast corrected for a better symmetry of the chest.



SURGICAL OUTCOMES

- **D+1**: Checkup: ablation of the Microfoam bands contention.

First puncture if necessary: patient lying sideways. The puncture is aseptic, this is made using a 19g trocar and 60cc luer-lock syringe. Puncture should be made in the lower area of the scar in case of collection. The basic dressing is changed to a hydro-colloid Mepilex border EM 9x15 Monlyncke dressing. The chest vest restraint is put in place for 15 days. (Medical Z - Romeo).

- **D+2**: Checkup.

Control consultation. Dressing change. Often no seroma.

- **D+8**: Control consultation.

Dressing change. No seroma

- **D+15**: Control consultation.

Dressing and contention removal.

Follow-up at three months (authorization for a progressive resumption of sports activity) and at one year.

References: thoracic jacket Medical Z Romeo (male) and Z Bra (female)

SILICONE ELASTOMER PROPERTIES

The implant is made from a medical grade silicone elastomer and chosen according to its firm consistency in the medial part, flexible laterally and ending in “airplane wing”. The introduction via a short approach is made easier by the possibility of folding it. The edges of the implant are very thin and therefore not visible subcutaneously.

This material is a foreign body, there is no immune «rejection» reaction, but a classic fibrous encapsulation which is an «exclusion» reaction and removes the risk of later contamination by blood.

It is a solid rubber silicone elastomer: there is no risk of tearing, perforation or rupture, even in the long term. There is never any fibrous retraction (shell) compared to gel-filled breast implants.

Unlike breast implants, these implants can be kept for life. With a smooth surfaced silicone elastomer and in the absence of a macro-textured surface, the long-term development of anaplastic large-cell lymphoma recently described for some breast implants has not been reported to date.

Three silicone elastomer durometers are available. AnatomikModeling selects the appropriate softness depending on indication, volume, and desired projection. For Poland syndrome, “Extra Very Soft” durometer is usually chosen.

BIBLIOGRAPHY

Chavoin J-P., Taizou M., Moreno B., Leyx P., GrolleauJ-L., Chaput B. - **Correcting Poland Syndrome with a custom-made implant: contribution of a three dimensional computer aided design reconstruction** - Plast. Reconstr. Surg. vol 142/2 pp. 109-119 Aug. 2018

Chavoin J-P, editor. - **Pectus Excavatum and Poland Syndrome Surgery: Custom-Made Silicone Implants by Computer Aided Design** - Springer International Publishing 2019

VIDEOS

Step by step surgery guide
(bit.ly/Poland-syndrome-surgery)

Webinar - Poland Syndrome Treatment
(bit.ly/Webinar-Poland-syndrome)

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