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Robotic nipple-sparing mastectomy for cancer risk reduction: demonstration of applicability and surgical results

Mastectomia poupadora de mamilo robótica para redução do risco de câncer: demonstração de aplicabilidade e resultados cirúrgicos

Rodrigo Bernardi[*1], José Clemente Linhares[1], Audrey Tsunoda[1], Sérgio Bruno Bonatto Hatschbach[1], Reitan Ribeiro[1], Anne Karoline Groth[2], Isabeli Lopes Kruk[3]

ABSTRACT

Introduction: Robotic nipple sparing mastectomy (RNSM) may be a breakthrough for breast cancer risk reduction surgeries, providing better aesthetic results. This study aims to spread the knowledge of the robotic surgical technique, still little performed in the world, and to demonstrate the applicability and surgical results. **Methods:** RNSM was offered to patients with small or medium volume breasts, ptosis up to grade 2, and all with genetic mutations at increased risk for breast cancer. The Surgical System da Vinci Si® (Intuitive Surgical, Sunnyvale, CA) was used for the surgeries. The satisfaction of each patient and the time of the surgeries were evaluated. **Results:** A total of 4 patients underwent surgery, all of whom had genetic mutations that would make breast cancer prevalent. The duration of the surgery was drastically reduced from 6h20min to 3h in the last surgery. There were no serious complications, such as prosthesis loss or nipple necrosis. Skin burning was noted in two patients, with complete resolution over the weeks. **Conclusion:** RNSM has a fast-learning curve and excellent aesthetic results in patients who fit the criteria for surgery.

Keywords: Prophylactic mastectomy; Robotic surgical procedures; Breast neoplasms.

1. Department of Oncogynecology and Mastology, Hospital Erasto Gaertner, Curitiba (PR), Brazil.
2. Department of Plastic Surgery, Hospital Erasto Gaertner, Curitiba (PR), Brazil.
3. Medical School Student, Faculdade Pequeno Príncipe (FPP), Curitiba (PR), Brazil.

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Correspondence author: Rodrigo Bernardi.
E-mail: drrodrigobernardi@hotmail.com

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RESUMO

Introdução: A mastectomia poupadora de mamilos robótica (MPMR) pode ser um avanço para cirurgias de redução de risco de câncer de mama, proporcionando melhores resultados estéticos. Este estudo visa difundir o conhecimento da técnica cirúrgica robótica, ainda pouco realizada no mundo, e demonstrar a aplicabilidade e os resultados cirúrgicos. **Métodos:** O MPMR foi oferecido a pacientes com mamas de pequeno ou médio volume, ptose até grau 2 e todas com mutações genéticas com risco aumentado para câncer de mama. O Surgical System da Vinci Si® (Intuitive Surgical, Sunnyvale, CA) foi utilizado para as cirurgias. A satisfação de cada paciente e o tempo das cirurgias foram avaliados. **Resultados:** Foram operadas 4 pacientes, todos com mutações genéticas que tornariam o câncer de mama prevalente. A duração da cirurgia foi drasticamente reduzida de 6h20min para 3h na última cirurgia. Não houve complicações graves, como perda da prótese ou necrose mamilar. Queimação na pele foi observada em dois pacientes, com resolução completa ao longo das semanas. **Conclusão:** O MPMR apresenta curva de aprendizado rápido e excelentes resultados estéticos em pacientes que se enquadram nos critérios para cirurgia.

Palavras-chave: Mastectomia profilática; Procedimentos cirúrgicos robóticos; Neoplasias mamárias.

INTRODUCTION

In recent years, nipple-sparing mastectomy is increasingly being used for both risks reducing surgery and cancer treatment.[1,2] The aesthetic aspect that comes from it, made new surgical techniques to be thought of for a better result. Small incisions, oncoplastic techniques, endoscopic techniques, and even robotics are being practiced providing the best aesthetic result.

Robotic surgery has been a great advance in all surgical areas. Numerous studies in recent years have demonstrated the benefits of this technique, especially in urological, gynecological, and coloproctological surgeries.

In the field of mastology, robotic nipple sparing mastectomy (RNSM) is performed by few surgeons in the world, who are already reporting on articles better aesthetic results and fewer complications compared to the open mastectomy technique. At the European Institute of Oncology, in Milan, breast surgery robots have been a reality since 2015. The creator of the technique, Dr. Antonio Toesca, made it possible for us to learn the surgery, and we decided to bring this new oncological treatment tool.[5,6]

The first robotic surgery in Latin America was performed on January 29th, 2019 at Hospital Erasto Gaertner by a team led by the mastologist José Clemente Linhares. By December 2020, four robotic surgeries were performed.

The purpose of this article is to describe the surgical technique, demonstrate the aesthetic results, complications of RNSM, and spread the knowledge of this new technique.

METHODS

The study was approved by the research ethics committee of the Erasto Gaertner Hospital, opinion number 5,046,233. The participants who met the inclusion criteria and agreed to participate in the study signed the informed consent form, thus agreeing to have their information used, maintaining the confidentiality of not being identified.

For the surgery, we determined that the breast should be small or medium volume and with ptosis up to grade 2 by Regnault classification, all surgeries being risk-reducing. We performed prior to the surgeries, mammograms, and MRI scans to establish that the patients were probably not breast cancer at the time of surgery.

Surgical technique

The da Vinci Si® Surgical System (Intuitive Surgical, Sunnyvale, CA, U.S.) was used to perform the nipple sparing mastectomy surgery. As described by Dr. Antonio Toesca at the European Institute of Oncology, first the inframammary fold is marked with a skin pen, the mid-axillary line, and the incision is made at nipple level, around 2/3 of the mid-axillary line.[5,6] The marking also divides the breast into 4 quadrants by 2 perpendicular straight lines at the nipple height and with dashed lines in a circle covering all quadrants, thus dividing them into medial and lateral. The left arm of the patients remains open with bulkheads on the head and arm to protect the patient in case the robot arms touch these parts (Figure 1). Through a 3cm long incision, the subcutaneous cellular tissue is dissected with electrocautery under right vision up to an area of 5cm in diameter, allowing the adaptation of a portal in the tissue.

Figure 1. Patient position and surgical marking.

To facilitate dissection and reduce bleeding, 500ml of saline 0.9% diluted with adrenaline 1mg/ml is infiltrated through the incision into the subdermal breast tissue in all quadrants. Multiple tunneling is performed with Metzembaum scissors for dissection and release of subdermal breast tissue. The device (GelPOINT Advanced Access Platform™) is attached to the previously made space. It contains four trocars from 5 to 12mm for the camera, instruments, and gas access. The portal is sterile and approved for use in Brazil. So that the forceps does not touch the patient's arm, the robot is placed contralateral to the operation. The gas pressure used was 8mmHg. The camera chosen was a rigid 30 degree (up and down as needed) 12mm diameter camera, placed centrally in the portal.

In the robotic arm 3 the ProGrasp forceps is allocated, in arm number 1 the monopolar curved scissor forceps and in the middle arm the video camera is placed (Figure 2). The assistant is of fundamental importance in the surgery, reporting the quadrant that the surgeon is in and the thickness of the skin through the passage of light through the flap and helping with the traction of the nipple when it is manipulated by the surgeon. Initially, the superficial dissection is done by the upper quadrants and then by the lower quadrant, leaving the retro nipple region last. After that, the separation of the mammary tissue from the pectoralis major musculature occurs, until the complete extraction of the mammary gland. The space between the major and minor pectoral muscles is created with robotic surgery for the allocation of the 400ml expander. The plastic surgery team refines the space between the pectorals and introduces the submuscular expander, nº 4.8 drains into the submuscular and subcutaneous store. The skin is sutured with Monocryl® 3.0, continuous intradermal stitches.

Figure 2. Location of the robotic forceps on the incision portal.

RESULTS

In total, there were four patients who underwent risk-reducing NSRM. The first was due to mutation of the CHEK2 gene, the second due to mutation of BRCA1, the third surgery due to BRCA2, and the last one due to mutation in the RAD51 gene.

So on clinical analysis, on the recommendation of the geneticist at Hospital Erasto Gaertner, adenomastectomy was indicated. Three of these patients had unilateral robotic nipple sparing mastectomy and only one had bilateral surgery (Figures 3, 4, 5, 6, 7 and 8).

Figure 3. 1º postoperative left adenomasthectomy.

Figure 4. 17º postoperative of left adenomastectomy

Figure 5. 14º postoperative of bilateral robotic adenomastectomy.

The initial duration of surgery, from patient positioning, incision and allocation of the robotic arms was reduced from 01h20min in the first surgery to 35 min in the last one. Related to mammary gland extirpation, it took about 5hrs in the first unilateral adenomastectomy surgery to 01h45min in the last one for the same type of surgery. In total, the first surgery took 06h20mmin to 3h in the last one (Figure 9).

No serious complications were observed, such as prosthesis loss, extrusion or infection, nipple necrosis or suture dehiscence. In two surgeries, we found burns on the skin caused by electrocautery. These, however, were resolved within weeks, with no need for surgical intervention. We did not see complications such as seroma, hematoma, significant pain, infection, or subcutaneous emphysema due to carbon dioxide.

Figure 6. 14º postoperative robotic left adenomastectomy.

Figure 7. Four months postoperative of robotic left adenomastectomy.

Figure 8. Four months postoperative of robotic left adenomastectomy.

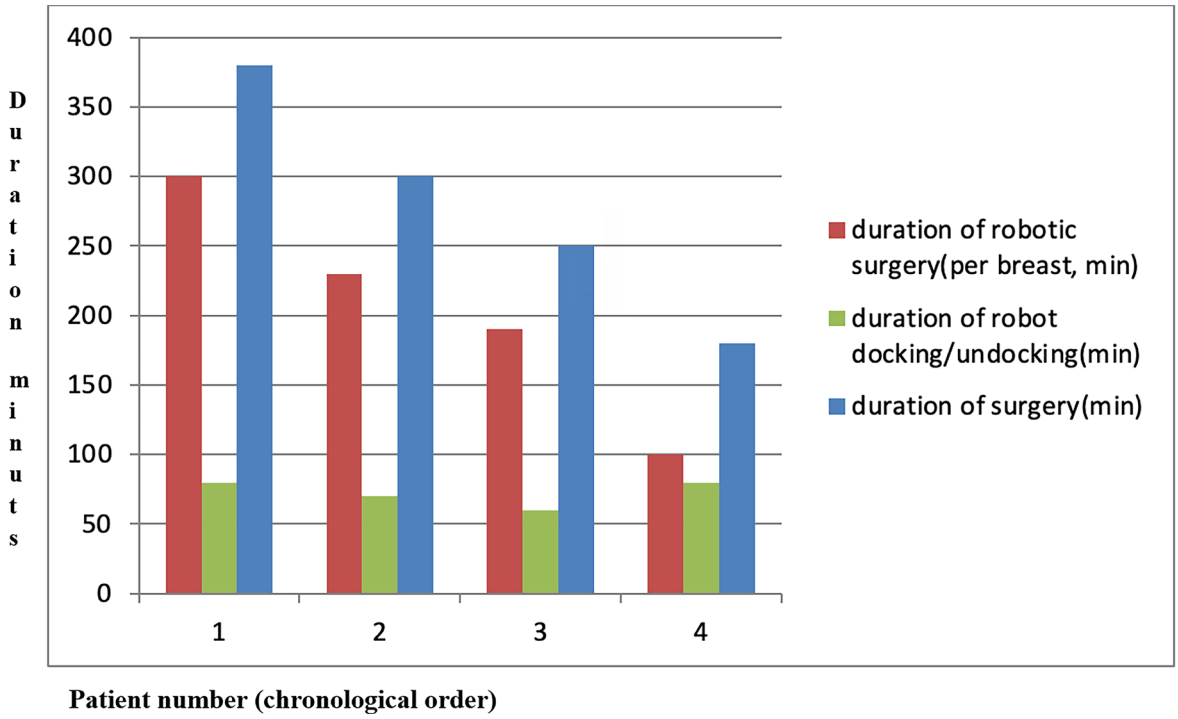

Figure 9. Duration of surgeries in relation to operated cases.

DISCUSSION

Skin and nipple preserving mastectomy via open technique as oncologic treatment is widely accepted. For surgeons, this technique incites several questions. The first challenging point of the surgery is the technical difficulty, that even through large incisions, access to quadrants distant from the incision is difficult, with the risk that resection of the entire breast parenchyma will not occur. The second topic observed are the complication rates that can reach up to 50% of the surgeries, as demonstrated in the article by Endara et al. (2013),[1] such as skin and areola-papillary complex necrosis, extrusion of the prosthesis and other minor ones, such as hypertrophic scars and keloids.

The innovative technique of robotic breast surgery is described in several articles by Italian, French, and Taiwanese authors, which demonstrate its oncological safety, and is available in scientific journals and newspapers worldwide.[5-8]

It was essential to observe in loco the robotic mastectomy at the European Institute of Oncology since there are many details to be considered in its execution. At the oncogynecology and mastology department of the Hospital Erasto Gaertner, robotic surgery is offered for several neoplasms, a fact that provided a quick adaptation to the RNSM technique, without the need for a learning curve in robotic surgery.

The robotic mastectomy surgery has the advantage of lower complication rates because there is no ischemia and skin trauma caused by retractors in relation to open surgery, and the insufflation of carbon dioxide is sufficient to visualize the mammary gland, making it possible to safely dissect all quadrants of the breast, even those that are far from the incision. Other advantages are the tenfold magnification of the surgical field, the correction of the delicate movements performed by the robot, and the fact that the operation is more comfortable for the surgeon and the entire surgical team. Undoubtedly the main benefit is aesthetic, and the scar in the axillary region, far from the breast, is the most positive factor pointed out by patients. The main disadvantage is still the higher cost than open surgery.

Complication rates are low, as demonstrated by Lai et al. (2019)[8] who, analyzing their case series, evidenced the highest complication rate being transient nipple ischemia (10.3%), but no nipple necrosis or prosthesis loss. Safarti et al. (2018),[7] on the other hand, reported a prosthesis loss due to infection (1.6%). Of these articles, no nipple necrosis or prosthesis extrusion occurred.[7,8]

In the cases operated on at the Hospital Erasto Gaertner, the aesthetic results were very well evaluated both by the patients and by the plastic surgery and mastology teams. Minor complications were resolved within weeks, maintaining an excellent outcome. The learning curve of the robotic technique was extremely fast, with an important reduction of surgical time.

CONCLUSION

We believe that innovative robotic surgery can contribute to the advancement of breast surgery in the world. The excellent aesthetic results were very satisfactory in the immediate and late postoperative period. The drastic reduction in the surgical time of the first in relation to the last RNSM demonstrates the ease of learning the technique. This article may contribute to further studies on robotic breast surgery and encourage new surgeons to perform the technique.

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