

# Is there a Future for Robot-assisted Laparoscopic Nissen Fundoplication (RALF)...?

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## ABSTRACT

**Introduction:** Gastroesophageal reflux disease (GERD) has been the main health concern in the last few years, both in term of quality of life and symptomatology and also causing long-term health concern like cancer. In our current practice laparoscopic Nissen fundoplication is the most commonly performed operative procedure for reflux disease.

**Aim and methodology:** We performed our review to predict the future of robot-assisted laparoscopic fundoplication (RALF) by looking at this new technology from different angles namely, comparison with conventional laparoscopic Nissen fundoplication (CLF), in term of operative complications and postoperative outcome, training aspect of RALF, application in complicated cases and difficult tasks, and also in pediatric population.

**Conclusion:** We are in the opinion that there is a promising future for RALF, despite the increased cost and longer operation time. It has been found that RALF can function better in smaller spaces and more capable in finer dissection and it has shorter and steeper learning curve. The time and the cost issue is expected to reduce with further development and upgrades of the robotic surgery, and increase in surgeons experience in RALF. Therefore, we think the trend should be more toward RALF as a future of antireflux surgery.

**Keywords:** Robotic surgery, Gastroesophageal reflux disease, Nissen fundoplication.

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## INTRODUCTION

Gastroesophageal reflux disease (GERD) has long been recognized as a significant public health concern. It develops when the reflux of stomach contents causes troublesome symptoms and/or complications that affect individual's quality of life and well being.<sup>18</sup>

There is evidence that the prevalence of GERD has increased during the past 2 decades. If this trend continues, it could contribute to the rapidly increasing incidence of more serious complications associated with GERD, such as esophageal adenocarcinoma, as well as costs to health care systems and employers.<sup>17</sup>

From a surgical perspective, GERD is the failure of the antireflux barrier, allowing abnormal reflux of gastric

contents into the esophagus. It is a mechanical disorder, which is caused by a defective lower esophageal sphincter (LES), a gastric emptying disorder, or failed esophageal peristalsis. These abnormalities result in a spectrum of disease ranging from symptoms only, such as 'heartburn', to esophageal tissue damage with or without subsequent complications including malignancy or airway disease. While the exact nature of the antireflux barrier is incompletely understood, the current view is that the LES, the diaphragmatic crura, and the phrenoesophageal ligament are key components.<sup>18</sup>

Management of the condition in term of diagnosis and treatment of the GERD has been the matter of debate. The extent of the investigation for the condition preoperatively vary depends on individual surgeons practice. For example, requirement for esophageal physiology and 24 hours pH check, are not routinely performed preoperatively by all surgeons. Patient's selection is also another example which has been the matter of expert's debate. Change of lifestyle and medical treatment, of course, is the initial step in the management. However, if the medical treatment is not feasible option any more, for variety of reasons for example, patients intolerance or partial response to PPI, in this case depend on the surgeons approach when to make the decision about operative option. Even after the operation been decided by the surgeon there are still controversy about different kind of techniques and the type of fundoplication needs to be performed depends on individual patients and the result of their preoperative investigation. It should also be noted that there are regional differences in expert opinion and practice in the choice of fundoplication type for GERD with most North American experts choosing a total fundoplication due to concerns for the long-term effectiveness of the procedure.<sup>18</sup>

## AIM AND METHODOLOGY

Our aim is to predict the future of RALF, not only by comparing adult cases of RALF with conventional laparoscopic Nissen fundoplication (CLF); but we also reviewed pediatric papers. Other fields of gastrointestinal surgery like colorectal surgery, as well as learning curve of robotic surgery are also explored.

Literature search from variety of sources including PubMed, Google search engine, Medscape and SAGES

website were used for our review, majority of the studies were comparative studies.

The parameters taken in to account in the review were intraoperative outcome measures were: Operative time, blood loss and complications. Length of hospital stay, functional results and patient satisfaction were all used to compare postoperative outcome.<sup>5,9,10,12,15</sup>

We also reviewed few papers who reviewed robotic application in variety of gastrointestinal surgery, including colorectal and pediatric gastrointestinal surgery.<sup>3,4,8,13,14</sup> The other part was the training aspect of robotic surgery;<sup>1,8,16</sup> to predict the future of robot in gastrointestinal surgery especially in Nissen fundoplication. Our strategy is not just a confined review by only comparing adult cases of RALF with CLF but considering other aspects involved in the review like learning curve of robotic surgery, robot in difficult and complicated cases as well as pediatric fundoplication. I am in the opinion that this approach gives better understanding about the future of RALF.

**RESULTS AND DISCUSSION**

The articles reviewed were nine comparative papers with total adult 432 patients comparing RALF and CLF.

During our review we can state that majority of the articles agree in their result were comparable between RALF and CLF. The parameters reviewed were operative time, intraoperative difficulty, complication, length of the hospital stay, postoperative outcome, cost and last but not least is patient’s satisfaction and quality of life.<sup>2</sup>

All the results agreed that all the operative and postoperative outcomes are comparable between two modalities however, the cost for RALF was higher ranging between 600 to 1800 Euros, depending on the center where

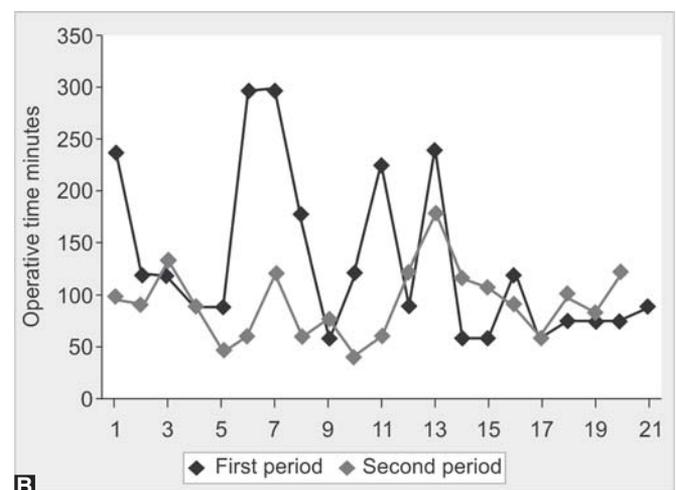
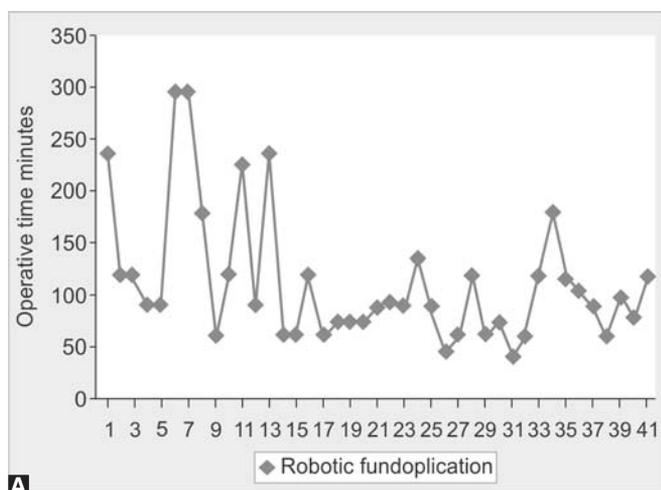
the study was performed. The other disadvantage of robot was the operative time which was longer for robotic surgery.<sup>2,4-7,9-11</sup> On the other hand, a few studies agreed on the safety, increased precision and dexterity and the feel of haptic feed back with RALF.<sup>4,7,9,11,13</sup>

In one of the studies Nissen fundoplication was done in 49 cases (there were also two other types of fundoplication in this group). The mean operative time was 110 minutes (range: 40-300 minutes) for robotic fundoplication and 120 minutes (range: 60-280 minutes) for laparoscopic fundoplication. In the first period (n = 21 cases), the mean operative time was 132.8 minutes (median: 90 minutes) vs 92 minutes (median: 90 minutes) for the second period (n = 20 cases).<sup>19</sup> This indicates short learning curve and reduction in operative time when the surgeons become more familiar with robot (Graphs 1A and B).<sup>19</sup>

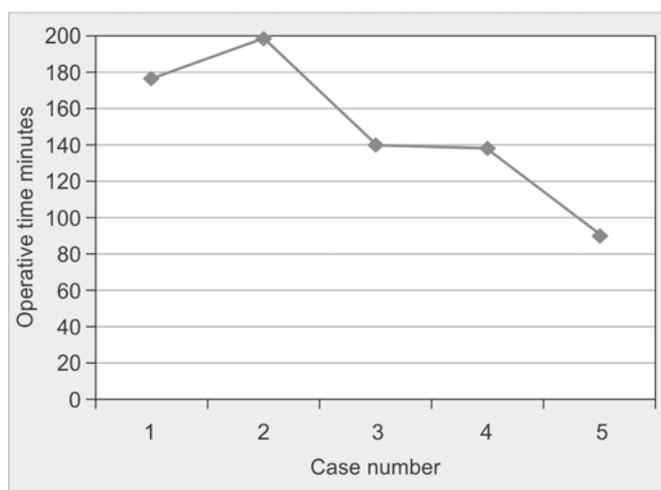
Four papers studied, where the robot applied for training purpose in fundoplication procedure. The outcome from their study reviewed and they all agreed in shorter and steeper learning curve with RALF (Graph 2) and decreasing operator workload.<sup>1,8,16</sup>

Three papers used and compared robot in performing robot in pediatric population. One of the papers quoted comparable operative time between RALF and CLF. However, the cost remained the main disadvantage of RALF. Again in pediatric population as in adult age group additional dexterity was quoted for robotic fundoplication and the advantage of the RALF in training in this age group and its application complicated cases.<sup>3,8,14</sup>

Finally, one paper studied in using robot in gastrointestinal surgery. They recruited 129 patients with abdominal procedures (six cases were Nissen fundoplication), they looked at indications, technique and results of the modern technology. Even though, the papers were



**Graphs 1A and B:** Robotic fundoplication. (A) Overall operative time. The line indicates the boundary between the first and second periods of experience. (B) Comparison of the operative times between the first period and the second period<sup>19</sup>



**Graph 2:** The rapid drop of the operative time after five cases of RALF performed by staff surgeons<sup>6,8</sup>

not specialized in investigating and comparing RALF with CLF, the conclusion was that robot had ability to operate in smaller operative, fine and precise dissection, like lymphadenectomy and nerve sparing procedures, and also intracorporeal suturing.<sup>4</sup>

## CONCLUSION

From our broad spectrum review we came to the conclusion that the future for robot is bright and promising. The papers performed not specifically mentioned the difficult or complicated cases like Re-do Nissen fundoplication, in which more precise and meticulous dissection is required.

We also think that the centers with better experience and more wider performance of RALF procedure quoted shorter operative time. With regard to the cost there were some differences in the cost depending on when the study was performed, as this was possibly due to drop of the cost as the time progress. In addition, it is a well-known fact that further technological upgrades and development is inevitable in every discovery, which in turn lead to more affordable robotic machines and more practical and quicker setup time. The other argument in favor of cost cutting with RALF is the shorter learning curve.

From our conclusion we recommend that the disadvantage of higher cost and longer operative time at this stage should not function as an obstacle in front of RALF. For junior surgeons and residences RALF has a big place in their future. Furthermore, for senior surgeons we think that the Re-do Nissen fundoplication should be done routinely using RALF. Almost all the comparative studies stated the advantage of RALF in complicated cases; however, we do not have enough data to confirm this fact. Further, randomized clinical trials are required to compare RALF with CLF in Re-do Nissen fundoplication cases.

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