



# Barriers to adoption of laparoscopic cholecystectomy in a county hospital in Guatemala

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## Abstract

**Background** Despite international efforts to increase performance of laparoscopic cholecystectomy (LC) in rural Guatemala, the vast majority of cholecystectomies are still performed via the open cholecystectomy (OC) approach. Our goal was to explore barriers to the adoption of LC in Guatemala as well as possible mechanisms to overcome them.

**Methods** We reviewed 9402 cholecystectomies performed over 14 years by surgeons at the Hospital Nacional de San Benito (HNSB) in El Peten, Guatemala, with either an open or a laparoscopic approach. We conducted personal interviews with all the surgeons who perform cholecystectomies at HNSB to determine current practice and barriers to adopting LC.

**Results** Overall, seven general surgeons were interviewed who regularly perform cholecystectomy. Of the total number of cholecystectomies reviewed, 8440 (90%) were open and 962 (10%) were laparoscopic. The mean number of cholecystectomies performed per surgeon was  $1341.1 \pm 1244.9$ , with OC at  $1205.7 \pm 1194.9$ , and LC at  $137.4 \pm 188.0$ . Lack of formal training in laparoscopy was identified in 57% of surgeons. Lack of government funds to implement a laparoscopic program was noted by 71% of surgeons (29% felt there was insufficient ancillary staff, 29% poor allocation of hospital funding to purchase laparoscopic equipment/training). Lack of sufficient laparoscopic equipment was identified by 71% of surgeons.

**Conclusions** Ninety percent of cholecystectomies performed by surgeons at HNSB continue to be OC. The major limitation is the lack of funding to provide sufficient equipment or ancillary staff. The majority of surgeons preferred to perform LC if these problems could be addressed.

**Keywords** Guatemala · Laparoscopic · Cholecystectomy · Rural · Low-income · Barriers

Laparoscopic cholecystectomy (LC) is the standard of care for most forms of benign gallbladder disease in Western countries. However, in some developing nations, open cholecystectomy (OC) is still performed regularly. Overcoming the initial barriers to performing LC was a major success in laparoscopic surgery. LC rapidly became the dominant technique for management of biliary colic and cholecystitis, and since its introduction more than half a million LCs are performed annually in the United States [1]. Given this

achievement, it is important to elucidate the barriers to performing LC in other areas of the world. The adoption of laparoscopic surgery in lower income countries in Africa and other areas of the world has been difficult, and is likely due to a variety of factors, presumably a lack of resources to consistently perform these minimally invasive operations, the surgical culture, and a need for further training and education in laparoscopic surgery [2–4]. However, none of the issues limiting laparoscopic surgery has undergone substantial formal analysis, especially in Central American countries.

To initiate laparoscopic surgical programs in low- and middle-income countries, there is a heavy reliance on support from abroad, especially from volunteer organizations. The Hospital Nacional de San Benito (HNSB) is one of the major referral hospitals in El Peten, Guatemala, and until recently did not perform LCs. El Peten is the largest department of Guatemala with an estimated population of 450,000

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in 2005. Within El Peten there are 12 municipalities and four public hospitals. HNSB is a 70-bed hospital, making it the largest of the public hospitals in the region, and it serves as the main referral hospital for the area. The emergency department at HSNB evaluates, on average, 380 patients a month, with the general surgery service consulting on over 250 patients. The hospital has six intensive care unit beds that are shared between medicine and surgery, and while HSNB is the major referral hospital for all of El Peten, it does not have access to computed tomography imaging, interventional radiology, or endoscopic capabilities. The hospital has four operating rooms that are staffed by a team of general surgeons and surgeons from other subspecialties (i.e., orthopedic surgery), who perform around 40 elective and 120 emergent operations a month [5, 6].

In conjunction with Refuge International, a nonprofit organization, laparoscopic equipment was donated and volunteer US surgeons were recruited to initiate LCs at HNSB in 2013 [7]. This effort allowed for the first laparoscopic surgery to be performed in El Peten. Despite this, a large proportion of the hospital's patients still undergo OC in both the emergent and elective settings.

We have previously shown that the adoption of LC at this site did not lead to more complications compared to the open approach [5]. The setting at HNSB provides a unique opportunity to determine current practices with regard to the hospital's approach to gallbladder disease. In this study, we aim to identify barriers that prevent the full implementation of LC there, with a future goal of providing avenues to allow

for the regular performance of LC and other minimally invasive surgical procedures at HNSB. This information should serve as a platform for global health organizations assisting developing countries with similar endeavors.

## Materials and methods

This was a retrospective observational study conducted at HNSB. Approval for this study was obtained from the institutional review board at the University of Texas Southwestern Medical Center. In addition, written permission from the chief of staff and the chief of general surgery at HNSB was obtained.

We conducted face-to-face interviews with all surgeons who regularly performed OC or LC at HNSB to determine current practices and barriers to the adoption of LC as the standard of care. Seven surgeons were interviewed by a male medical student from the University of Texas Southwestern Medical School; interviews were carried out using a standardized questionnaire developed by principal investigator Dr. Sergio Huerta and Dr. Annie Ochoa-Hernandez (Table 1), which was based on information about previous barriers to laparoscopy published elsewhere [5]. No participants were dropped from the study and the interviewer had no prior relationship with the survey participants. All surgeons kept records of all procedures performed during the study period, and those records were available for review.

**Table 1** A standardized set of questions was asked to each surgeon

|                                      | Surgeon  | Age |
|--------------------------------------|--|-----|
| Surgeons experience                  | Years in practice<br># cholecystectomies performed<br># open cholecystectomies<br># lap cholecystectomies<br>Hospital of training<br># of lap cholecystectomies during training<br># of open cholecystectomies during training<br>Hospital of current practice |     |
| Limitations for laparoscopic surgery | Experience of the surgeon<br>Lack of training<br>Patient preference<br>Surgeons preference   |     |
| Specific limitations                 | Anesthesia limitations<br>Absence of a laparoscopic tower<br>Lack of trocars<br>Lack of laparoscopic Instruments<br>Others   |     |

Data were catalogued as either continuous variables (i.e. number of cholecystectomies) or dichotomous variables (i.e. "do you think that lack of training is a major limitation to adoption of laparoscopic surgery?" Yes = 1, No = 0). Collective data were expressed as percentages

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## Results

### Survey on current practices at HNSB by general surgeons

The total number of cholecystectomies performed by all surgeons who were surveyed was 9402 (8440 [90%] OC, 962 [10%] LC). The mean ( $\pm$  SD) number of cholecystectomies performed per surgeon was  $1341.1 \pm 1244.9$  (OC  $1205.7 \pm 1194.9$ , LC  $137.4 \pm 188.0$ ), with a mean number of cholecystectomies performed during their residency training of  $262.8 \pm 263.9$ . The mean surgeon age was  $43 \pm 12.1$  years with an average of  $14.1 \pm 9.9$  years in practice. The specific demographics of the seven surgeons participating in the study are included in Table 2.

### Survey on specific barriers to the adoption of the laparoscopic approach at HNSB

A lack of formal training in laparoscopy was identified as a barrier to the complete adoption of LC at HNSB in 57% of surgeons; 71% of surgeons felt that there was minimal to no government funds available to implement a consistent laparoscopic program (29% felt there was insufficient ancillary staff, 29% noted a poor allocation of hospital funding to purchase laparoscopic equipment/training). A lack of sufficient

laparoscopic equipment to perform LC was identified by 71% of surgeons.

When surveying surgeon preference for cholecystectomy approach in the emergent and elective setting, 57% preferred to perform LC if possible, 29% preferred OC, and 14% did not have a preference. Regarding patient preference, 14% of the surgeons believed patients preferred LC, another 14% felt patients preferred OC, 43% felt that patients were split, and 29% did not feel their patients were educated enough to make this decision. In addition, 43% did not feel their anesthesia providers were appropriately trained to provide adequate general anesthesia for laparoscopy.

## Discussion

In developed nations, many surgical diseases are preferably treated with a minimally invasive approach as it may reduce infection, postoperative pain, and allow for a more rapid return to normal activity [8–10]. The findings from our current study are in sharp contrast to cholecystectomy practices in the United States, as we found that over a 14-year period, only 10% of cholecystectomies performed by general surgeons were done via a laparoscopic approach. Other low- to moderate-income countries have shown a similar delay in the adoption of LC, and OC may be more cost-effective in these developing nations [11, 12]. In addition, arguments have been made in favor of OC over LC mainly due to the potential cost increases associated with transitioning to LC [13–15]. However, this has been overcome in a low-income setting, as evidenced by the work done by Udwardia in Mumbai, India, where over 1000 LCs were performed with a total cost per patient of 20 dollars [16].

Our current study aims to define the barriers to LC at a county hospital in rural Guatemala, as there is limited information regarding its implementation in Central American countries. Other groups have sought to determine what

**Table 2** Demographics for, and operations performed by, the surgeons currently practicing at the HNSB

| Surgeon | Gender | Age | Years in practice | Total no. of chole performed | OC   | LC  | Hospital of training                                       | LC during training |
|---------|--------|-----|-------------------|------------------------------|------|-----|--|--------------------|
| 1       | M      | 29  | 5                 | 350                          | 260  | 90  | San Juan de Dios, Guatemala City                           | 145                |
| 2       | M      | 38  | 9                 | 2500                         | 1960 | 540 | Instituto Guatemalteco de Seguridad Social, Guatemala City | 800                |
| 3       | M      | 55  | 25                | 3500                         | 3495 | 5   | Hospital Roosevelt, Guatemala City                         | 120                |
| 4       | M      | 60  | 27                | 1300                         | 1195 | 105 | Hospital General Clinico Quirurgico, Pinal del Rio, Cuba   | 400                |
| 5       | M      | 50  | 21                | 312                          | 300  | 12  | Hospital Roosevelt, Guatemala City                         | 35                 |
| 6       | F      | 31  | 3                 | 230                          | 200  | 30  | Hospital Roosevelt, Guatemala City                         | 110                |
| 7       | M      | 38  | 9                 | 1210                         | 1030 | 180 | Hospital Roosevelt, Guatemala City                         | 230                |

Note that the total number of cholecystectomies performed include those at the hospital and in private practice  
OC open cholecystectomy, LC laparoscopic cholecystectomy, *chole* cholecystectomies

factors are considered barriers to a full adoption of LC and other minimally invasive surgeries. A study from 2013 evaluating barriers to the adoption of laparoscopic surgery, including LC, at a large West African hospital found that three major barriers existed. These included the organizational structure for funding laparoscopic surgical procedures, the hierarchical nature of the surgical culture, and the expertise and skills associated with a change in practice [4]. The results from the current study mirror these findings, and we found that the barriers can be largely divided into (1) a lack of governmental support to implement LC, (2) a need for ancillary staff training and laparoscopic equipment, (3) a lack of surgeon/anesthesia training in laparoscopy, and (4) surgeon preference of OC over LC. At HNSB, 71% of the surveyed surgeons believed that there was minimal government support to implement a functional laparoscopic surgery program that could provide consistent and high-quality care. This included both a need for hiring and training of ancillary staff for laparoscopic cases and a lack of funding to purchase laparoscopic tools, cameras, trocars, and other necessary equipment. All the laparoscopic equipment used for LC there has been donated from various charitable sources. HNSB does provide sterilization of the equipment after use, but has no role in its regular maintenance beyond this. Moreover, 57% of the surgeons at HNSB felt that a lack of formalized training in laparoscopy was a barrier to the complete adoption of LC. Interestingly, two surgeons in our study preferred OC in both the emergent and elective settings. This was most apparent with the more senior surgeons who did not have experience in laparoscopy during their residency training. In addition, 43% of surgeons believed the anesthesia providers available at certain times were not appropriately trained to provide adequate general anesthesia for LC. Due to monetary constraints, an anesthesiologist is not present for all cases at HNSB and instead anesthesia technicians with experience in regional anesthesia monitor and provide care to the patients during the operation.

To initiate a laparoscopic surgical program at HNSB, Refuge International donated the equipment and recruited the necessary volunteer personnel to begin LC at HNSB in 2013. From our current work, it is evident that there was a longstanding interest to perform LC at HNSB, but the technique was only implemented once a volunteer organization could absorb the cost associated with an LC program. From prior work, we were able to conclude that there is no difference between OC and LC in terms of outcomes even in a young program, so that it can likely be implemented safely in this setting [5]. However, a recent disappointing observation was that once the support from international programs decreased at HNSB so did the number of LCs (personal communication with Dr. Annie Ochoa-Hernandez [chief of surgery at HNSB], December 2018). This problem does not appear unique to HNSB and to overcome this, Alfa-Wali

and Osaghae have indicated that surgical mission trips and organizations providing services and equipment to hospitals in low- to middle-income countries should focus on goal-directed and long-term planning that will provide continuous teaching and support for hospitals and surgeons. This should also include technical skills and training workshops in laparoscopy [17]. Further work and resources should be provided at HNSB to ensure proper support for long-term success with LC and potentially other laparoscopic operations.

Our study has several limitations. First, it was based on interviews and personal logs of surgeons to collect the numbers presented in the study. HNSB does not have a centralized system to collect this information directly from hospital records. Thus, collection and recollection bias can be a factor. Second, we did not perform any interviews with patients, and the patients' preferences were inferred from the surgeons, which is highly subjective.

Overall, the implementation of laparoscopy at HNSB is not impossible, yet many barriers to the full adoption of LC continue to exist. This study provides a first step in helping to identify the perceived barriers to laparoscopy at HNSB. Although one of the main issues (a lack of funding) appears to be intrinsic to the healthcare system of rural Guatemala, understanding the barriers may help the hospital, local government, and surgeons to develop systems to more consistently perform laparoscopy at HNSB.

## Conclusion

In our study, 90% of cholecystectomies performed by surgeons at HNSB were done using an open approach. The major limitation to performing them laparoscopically is the lack of funding to provide sufficient equipment or ancillary staff, and if these problems could be addressed, the majority of surgeons would prefer to perform LC. Enlisting a charitable organization from an industrialized nation is pivotal, but the support must be constant.

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## Compliance with ethical standards

**Disclosures** Jonathan B. Imran, Annie Ochoa-Hernandez, Juan Herrejon, Cesar Ortiz, Blarimir Mijangos, Tarik Madni, and Sergio Huerta have no conflicts of interest or financial ties to disclose.

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