

Laparoscopic Appendectomy in Lagoon Hospitals, Nigeria

Bamidele Johnson Alegbeleye^{1a}, Akinoso Olujimi Coker², Jerome Ohene³

Abstract— BACKGROUND: The first laparoscopic procedures were performed well for over thirty years in Europe. Mostly, these include appendectomy and cholecystectomy. However, in Nigeria and other developing countries, the practice commenced only recently and with encouraging results in many centers. Laparoscopic appendectomy (LA) in the low resource setting remains controversial. We audit the procedures; highlight the cost-saving technique, and the practical skills transfer model for laparoscopic appendectomy performed at Lagoon Hospitals in Lagos, Nigeria.

METHODS: We review the hospital records per case of appendectomy done from June 2013 through December 2016 at the Lagoon Hospitals, Lagos - Nigeria.

RESULTS: Two hundred and fifty-eight 258 patients were diagnosed with acute appendicitis (AA) within the study period. (Number - n=97; 37.6%) Patients had open appendectomy (OA). Then (n=16; 6.2%) patients that presented with clinical and radiological diagnosis of complicated AA eventually had an open laparotomy. Meanwhile, (n=145; 56.2%) cases had LA. In the laparoscopy group, (n=4; 1.6%) patients who had initial diagnostic laparoscopy revealed a normal appendix in addition to other operative findings that precluded appendectomy. Subsequently, an estimated (n=141; 54.6%) patients underwent LA, for which conversion to open laparotomy was inadvertently required in (n=2; 0.8%) of these cases. The median time for the LA procedure was higher than that observed for OA (49.5 vs. 34.5 min). Patients in the LA group had a shorter median postoperative stay (1.5 vs. 2.5 days). Wound infection occurred in 1 (0.8%) patient from the LA group and 4 (1.6%) from OA and p=0.098 (the difference was not statistically significant). There was no indication for readmission of the patients during the follow up period of three months.

CONCLUSION: LA reduced the rate of unnecessary appendectomy, and postoperative hospital stays in our patients, potentially reducing crowding in our surgical wards. The complications were very similar to those seen in other facilities elsewhere. LA is safe, average cost, and gradually gaining acceptance among Surgeons in Nigeria. For effective training of qualified surgeons on site, short but repetitive hands-on training sessions has been advocated as appropriate. LA is achievable in resource-constrained settings.

Index Terms— Appendicitis, Appendectomy, Laparoscopy, Skill-Transfer Model, Lagoon Hospitals.

1 INTRODUCTION

Acute appendicitis is the most frequently encountered general surgical emergency worldwide [1]. Ever since McBurney, in 1894, first described open appendectomy (OA), the procedure remains the traditional option for AA [2]. Laparoscopic appendectomy (LA) had equally gained ground since 1981, when it was first performed by Kurt Semm [3]. Advances in Technology in the last ten years, most notably the unveiling of the three-chip camera, have contributed significantly to improved outcomes of laparoscopic surgeries [4]. Presently, these improved outcomes now conferred full acceptance of the practice of LA globally; nonetheless, the method is yet to attain the desired equilibrium in several developing countries [3], [4]. In most African countries like Nigeria, Cameroon, Ghana, and Kenya, etc., laparoscopic surgeries are in the developmental phase. The introduction of LA was therefore greeted with initial reluctance, skepticism, or outright rejection by many surgeons globally [3], [4]. Surgeons were discouraged by the disadvantages of the laparoscopic approach, including longer duration of operation, increased cost to the patient, and reports of complications [3], [4]. Surgeons express concerns about some aspects of the laparoscopic surgery to date, including i) prolonged duration of operation, ii) high overhead cost to the patient, and iii) reports of complications [3], [4].

The benefits of LA remain controversial. Laparoscopic surgery

offers many proven advantages over conventional open surgery for many procedures [5], [6], [7]. The benefits include: i) minimal surgical trauma, ii) less postoperative pain, iii) rapid postoperative recovery, iv) exploration of the entire abdominal cavity, v) management of unexpected findings, vi) better cosmetic outcomes, and vii) prompt return to normal activities [5], [6], [7], [8], [9], [10], [11]. These advantages have increased the utilization and acceptability of laparoscopy.

"In many developing countries like Nigeria, the challenges posed by the burden of infectious diseases and other primary healthcare concerns have limited government support for the development of modern tertiary healthcare facilities. Indeed, laparoscopic surgery is practiced in only a few tertiary hospitals across the country" [10], [11], [12], [13], [14], [15]. Lagoon Hospitals is one of the best private hospitals in Nigeria, with the best of facilities comparable to what obtained in the western countries. It operates Laparoscopic full-fledged surgery as part of the general surgical practice [10], [11], [12], [13], [14], [15]. The laparoscopic unit in Lagoon Hospitals is led by an experienced, world-renown Laparoscopic and Colorectal Surgeon- Dr. Akinoso Olujimi Coker (FRCS). Dr. Coker is at the moment pioneering training program for young Nigerian Surgeons in Laparoscopic surgery.

We audit the procedures; highlight the cost-saving technique and the practical skills transfer model for laparoscopic appen-

dectomy performed at Lagoon Hospitals in Lagos, Nigeria.

2 METHODS

2.1 Study Design and Setting

The study was a retrospective observational cohort study conducted by the laparoscopic surgery unit over five years from June 2013 through December 2016. Lagoon Hospitals is the premier private tertiary hospital in Nigeria. The world-class multi-center facilities located in Lagos- Nigeria, with head-quarter in Ikoyi, is a referral center for several government district hospitals, private hospitals, and other mission hospitals in the southwestern region and its environs.

2.2 Study Population and Procedure

Lagos state is predominantly cosmopolitan, with a population estimate of 21 million, according to the National Population Commission of Nigeria from the 2016 statistics. All patients above 14 years with a clinical diagnosis of uncomplicated appendicitis who voluntarily consented to LA were included in the study. A pretested proforma, which was developed by the researcher, was used for data collection. The data obtained from the electronic medical records (EMR) of the hospital include patient's socio-demographics, clinical presentations, pre-operative workup investigations done, and comorbidities identified. A working diagnosis of acute appendicitis was made based on clinical presentation and findings on Abdomino-pelvic Computerized Tomographic (CT) as well as Ultrasound Scan. While in a few patients, only the Ultrasonographic study of the abdomen was done. When the diagnosis was inconclusive, such patients were usually considered for diagnostic laparoscopy.

2.3 Novel Laparoscopic Appendectomy [16], [17]

"The operative time was calculated as the duration of incision to that of the wound dressing. At the induction of anesthesia, all the patients had peri-operative antibiotics consisting of Ceftazidime (1gm). Within the first 12 hours after surgery, the choice analgesic regimen was parenteral opioids, usually when the patient was fully awake the analgesic is subsequently converted to non-steroidal anti-inflammatory drugs. The anesthetists determined the method of anesthesia (general anesthesia/regional). The cost of surgery was borne by health insurance (HMO) or the patients. However, the hospital charges the same price for OA and LA. The open approach at the umbilicus created Pneumo-peritoneum. A 10-mm port was then inserted for the telescope at the same site for initial diagnostic laparoscopy. Before conducting an LA, a 5-mm port was introduced in the suprapubic region and another one in the left iliac fossa, as seen in figure 2. The appendix was iden-

and sharp dissection. "The mesoappendix was then serially divided after coagulation with bipolar electrocautery, and one the appendix base has been secured, and it is then divided between two PDS endo-loop (Roeder's knots) or endo-clips." The specimen was then retrieved in a retrieval bag through the 10 mm port under direct vision and times the improvised glove is used as an alternative to retrieval bag, which is equally cost-effective. The two 5 mm ports are then withdrawn after the peritoneal cavity has been inspected. The umbilical fascia was repaired with 'O' PDS ® II (polydioxanone) suture on J-needle and the skin with 3'O' vicryl ® (polyglactin 910) - (sub-cuticular) suture, while the two 5 mm ports had only the skin approximated with 3'O' vicryl suture. The patient is discharged the next day, and follows up period was between two and three months. The laparoscopic procedures were essentially done by two surgeons, one usually serving as assistant surgeon in the course of the procedure. Both two surgeons had laparoscopic surgery training within and outside Nigeria but with very few years of experience in basic laparoscopic procedures. All patients received prophylactic intravenous antibiotics on induction, and postoperative antibiotics only continued if indicated. A combination of Paracetamol and the non-steroidal anti-inflammatory agent was used for postoperative analgesia in all patients. Postoperative administration was evaluated according to patient tolerance and signs such as nausea or vomiting."

2.4 Statistical Analysis

Data regarding the operative findings and its duration, postoperative requirement for analgesia, postoperative length of stay, and complications were recorded. The analysis of data was achieved using the Statistical Package for Social Sciences (SPSS) version 22. A comparison between the two groups was made using chi-square and Student t-tests. Therefore, the test of statistical significance was set at P=0.05. 3

2.5 Skills Transfer Model [16], [17]

"During the period of study lasting January 2012 to December 2016 at the Lagoon Hospitals, Lagos - Nigeria, three general surgeons (including the authors) were trained in the country (onsite). The training happened in four sets of - One-week intense hands-on courses and three Laparoscopic workshops; one in-house and two at the Lagos University Teaching Hospital surgical skill laboratory, each one lasting one full week. There was also regular daily on-job training sessions conducted by Dr. Olujimi Coker and other visiting experienced surgeons of Nigerians in Diaspora. The one-week courses were structured in three parts. Part one was composed of three didactic lectures. Two facilitators covered the program using PowerPoint presentations and DVDs. Details include the history /evolution of minimally invasive surgery, indications for surgery, the step by step operative procedures, possible complications, and their management options as well as equipment failure and consumables and appliances. The second part was by simulation using dummy trainers run for several hours for each trainee with one on one supervision and immediate feedback. The third part was seven days in the operating room one on one with the trainer. The training program was a continuous one. The set goal was to making Lagoon

1. ©Dr. Bamidele J. Alegbeleye is a Consultant Surgeon with St Elizabeth Catholic General Hospital, Shisong, Cameroon. PH: +237-670628857. E-mail: drbalegbeleye@gmail.com. (Corresponding Author).
2. Dr. Akinoso O. Coker is the Chief Medical Director & Chief Surgeon with Lagoon Hospitals, Lagos-Nigeria.
3. Dr. Jerome Ohene is a Consultant General Surgeon with Lagoon Hospitals, Lagos-Nigeria.

tified and freed from any adhesions by a combination of blunt

Hospitals, Lagos – Nigeria, a model training facility for laparoscopic surgery in the country. The training covers all aspects of General Surgery practice, Endoscopy, Urological Surgery as well as Bariatric Surgery.”

3 RESULTS

During the study period from June 2013 through December 2016, there were 258 patients diagnosed with acute appendicitis. Open surgery was performed directly in 113 (43.8%) patients. These include OA in 97 (37.6%) patients and laparotomy in 16 (6.2%) patients, especially those with complicated appendicitis following clinical and radiological examinations. One of the patients undergoing OA (0.4%) due to difficulties with delivering the appendix through the classical Lanz incision had the incision extended. Within the study period, 145 (56.2%) patients had laparoscopic procedures.

In the laparoscopy group, initial diagnostic laparoscopy in 4 (1.6%) patients revealed a normal appendix along with other findings that precluded appendectomy. Laparoscopic appendectomy (LA) was then performed in 141 (54.6%) patients with 2 of these (0.8%) requiring conversion to open laparotomy, due to findings of a complex inflammatory mass in one patient and torrential primary bleeding from the appendicular artery due to slipped endo-clips in another patient.

Patients in the laparoscopy group were aged 15 to 55 years with a mean of 28.5± SD 10.02 years, while patients in the OA group were aged 14 to 65 years with a mean of 27.6 ± SD 08.34 years, as shown in Table 1. Both LA and OA groups were equally matched for sex distribution. Preoperative abdominal CT scan revealed features suggesting acute appendicitis in 88.2% and 80.4% of patients in the LA and OA groups, respectively. Intraoperative findings in the LA group included a grossly inflamed appendix in 134 (92.4%) of patients with a normal appendix in 4 patients (2.8%) with pathologies, such as ileocecal adhesions in 5 (3.5%), ovarian pathologies and chronic pelvic inflammatory disease in 2 (1.4%) patients.

In addition, the median time for the LA procedure was higher than that observed for OA (49.5 vs. 34.5 minutes) with a reduction in time for LA, as depicted in Figure 1. Postoperatively, a prolonged ileus extending beyond 48 hours was recorded in 2 (0.8%) patients in the OA. Patients in the LA group were discharged between the first and third day after surgery (mean 1.5) as compared to 2 to 5 (mean 2.5) days for the OA group. Postoperative superficial wound infection occurred in the port sites of 1 (0.8%) LA patient, while similar superficial infection occurred in 4 patients, from the OA group and p=0.098 (the difference was not statistically significant). The histopathological report confirmed appendicitis in all patients (99%) but 1 in the LA and 92.3% patients in the OA group. There was no indication for the readmission of the patients during the follow-up period of three months.

4 DISCUSSIONS

4.1 Audit of Procedures

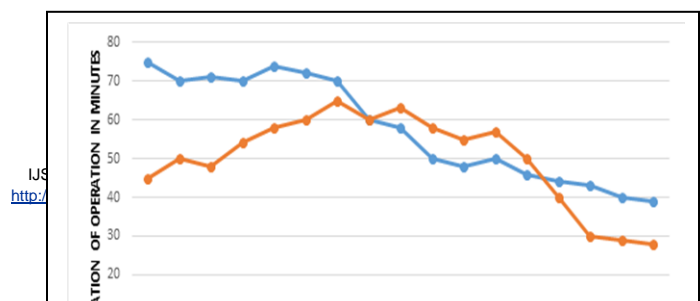
Globally, “LA is readily being adopted as the gold standard for AA in developed countries with increasing safety, whether performed by surgeons or trainees [16], [17]. Surgical procedures for AA and its complications are one of the most typical emergency surgeries performed in our center. Previous studies across Nigeria have reported a high incidence of complications in need of immediate laparotomy [18], [19], [20]. Both OA and LA have advantages [15]; However, LA is associated with less postoperative analgesic requirements, early recovery, and shorter hospital stay, as well as less scarring” [21].

In this study, 16 (6.2%) patients presented with complications that required immediate laparotomy, while two from the LA group had complications requiring open laparotomy. This low incidence of complications is partly due to patients in the high social-economic class attending the hospital; most present very early due to quick referrals from their primary care physicians, and do not utilize over-the-counter drugs at the onset of the symptoms. Most of the procedures (145 of 258) were performed by the Laparoscopic approach. Having in mind that laparoscopic surgery is the first line of care for appendicitis and cholecystitis in Lagoon Hospitals. The procedure is performed by experienced surgeons, especially in the emergency setting, which is in agreement with other earlier reports [5], [13], [14], [15].

Patients selected for the laparoscopic approach included young females in the reproductive age group with suspected pelvic conditions, patients presenting with signs not specific to appendicitis, and older patients with features of AA. We found dense adhesions between pelvic organs and terminal ileum in one patient, and pelvic inflammatory disease in a 28-year-old female patient with limited collection in the Pouch of Douglas and right paracolic gutter in another patient. The appendix in these two patients appeared normal; hence, they were not eligible for LA. Earlier reports have highlighted several benefits of initial diagnostic laparoscopy in these groups of patients [22], [23], [24].

The populist thinking among surgeons is that LA helps to prevent negative appendectomy, if well embraced across Nigeria and other similar developing settings. However, in Nigeria, a negative appendectomy rate ranges between 15% and 30% and is more common among women [18], [25], [26].

The median duration of operation time was significantly longer in the laparoscopy group compared with the open group (P<0.021), as shown in Table 1. The initial period of our learning curve contributed significantly to the longer duration of the procedure in the early period of this study. After that, the learning curve, however, declined considerably over time, as reported in Figure 1. The median operation time for LA in our study is similar to that reported in other countries [15], [27], [28].



4.2 Skills Transfer Model

“Diagnostic laparoscopic procedures, appendectomy, and cholecystectomy are less technically demanding as compared to procedures such as Nissen's fundoplication, splenectomy, and colectomy; Therefore, Starting with the prior mentioned category of procedures was a prudent starting platform to train in safe cannulation, ligation, dissection, and clipping” [16], [17], [29], [30]. The priority of Lagoon Hospitals remains an excellent qualitative service with less emphasis on cost-saving. This high standard of care delivery is based on the Hospital policy as demanded by Joint - Committee International (JCI), which granted the Hospital international accreditation in 2011. The only significant expense is the appendiceal ligation procedure with endoloops. Self-made loops with a sliding knot are another cost containment option. We were able to make cost-effective savings by using metallic reusable trocars and cannulae instead of the single-use disposables trocars. Other appendiceal removal options include; linear endoscopic staplers, clip- applicators with cautery on mesentery, pre-tied loop ligatures (on appendix), self-made endoloops with sliding knot and Pelosi's method as described later in the text. Laparoscopically, the appendix should be placed in an endo-retrieval bag before its removal, and it's important to mention that the improvised glove is used as an alternative to retrieval bag, which is equally cost-effective. In this way, the inflamed appendix has no contact with the skin or subcutaneous tissues resulting in a meager infection rate. In these series, the retrieval bag was frequently used. This may account for the low infection rate of near-zero out of 145 cases.

“Laparoscopic manipulations require precise eye-hand coordination, with awkwardly long and narrow instruments. Retraction is unlike the one surgeons are used to performing. Simple knotting is not simple and needs to be learned new. These mentioned factors predispose minimal access surgery to an increased rate of complications such as bleeding, cautery, and bile duct injuries, etc. [16], [17], [29], [30]; Hands-on training and under supervision is, therefore, critical in the technique explored in this paper” [16], [17], [29], [30]; “Another technique for removing the appendix has been described using only one 10mm trocar.

Pelosi describes a method that uses a 10mm laparoscope with a 5mm operating channel within it [30]. Pelosi's knotting is extracorporeally done. The appendix is visualized, and any adhesiolysis required is performed using bipolar coagulation forceps. The appendix once mobilized is then grasped with an atraumatic for-

ceps. The trocar is removed desufflating the abdomen, and the appendix is delivered through the umbilical trocar site. The appendix is then divided into a standard open fashion; subsequently, care must be exercised to avoid too much tension in the appendix while bringing it up through the umbilicus” [16], [17], [29], [30], [31].

The Laparoscopic Surgeons Society of Nigeria was set up in 2016 with one goal of promoting laparoscopic training among member Surgeons. “There is also a focused plan for credentialing and granting of privilege to surgeons desirous of entering the laparoscopic arena” [16], [17], [32]. “The challenges in such settings as Nigeria include inadequate manpower, limited- resources, and this makes a commitment to long-term training of personnel pretty difficult; specialist health professionals are so few that the administrators are reluctant to have some travel for long periods of study abroad” [5]. Therefore training on-site is ideal, and it does not take anyone away. “The training happens in the context in which the actual practice takes place. However, this does not solve the funding issue; funds need to be available to have the more experienced surgeons, mostly from industrialized wealthier nations (more developed countries), come to the resource-constrained environments to train as volunteers. The cost of consumables could be another critical factor in the development of laparoscopy in the developing world; consequentially, ways of cost-cutting, but maintaining safety and efficiency ought to be continually sought” [5], [14], [15], [16], [17].

Furthermore, “unlike other laparoscopic procedures, LA may not have gained much universal acceptance among general surgeons, but it is a useful addition to the options, especially in patients with right lower quadrant pain of uncertain etiology as in women of reproductive age, the elderly and the obese in whom one is not certain of the diagnosis” [33], [34]. “A selective approach to LA has been recommended both to the patient and to what resources to use, as the essential strategies in making the procedure safe and cost-effective in the long run,” [33], [34].

5 END-SECTIONS.

The study shows successful outcomes in performing LA. The benefits inherent in LA include improved diagnosis, cosmesis, less post-operative pain, and shorter hospital stay is recommended, especially in fertile women, the gainfully employed and specific disease entities like the immunocompromised for treatment of uncomplicated AA. We could also argue that the improved diagnosis was related to the use of a CT scan in a significant number of our patients. Appropriate training and equipment, though expensive, are needed for its extensive practice. With the level of safety demonstrated in the various cases done, LA may prove to be the procedure of choice in the acquisition of necessary laparoscopic surgery skills (hand-eye coordination and orientation) in general.

6 CONCLUSION

Laparoscopic surgery is appropriate for developing countries, the proven benefits apply in these environment. Short repeated well supervised hands on training courses is a workable skills transfer strategy for training qualified surgeons in practice and without leaving their workstations. Cost containment

but safe techniques need to be continually looked for to tackle the sustainability issue in low resourced countries.

DECLARATIONS

Acknowledgments: Many thanks to Professor Charles Adisa for supervising the Doctorate Thesis entitled: "Acute Appendicitis in A Tropical African Population" and also profound gratitude to **Dr. BJA's** Teachers at Bircham International University.

Funding: No record of the financing for this Clinical Research Study declared.

Authors' Contributions: The study was conceived by **BJA** conceived of the study and also was involved in the design and coordination as well as helped to draft the manuscript; also read and approved the final manuscript. **AOC** and **JO** participated in its design, manuscript draft, also read and accepted the final manuscripts.

Ethics Considerations: Institutional Ethical Approval was obtained. Confidentiality was ensured by not writing the names of patients on proforma by the Helsinki declaration. A copy of the written Approval is available for review by the Editor-in-Chief of this journal.

Consent for Publication: The retrospective study had no direct human participant; therefore, written informed consent for publication was not required. Trial Registration also with Pan African Clinical Trial Registry unique identification number for the registry is PACTR201903475913135.

Competing Interests: No conflict of interest declared.

Disclosures:

1. This Clinical Research is an extract from **Dr. BJA's** Doctorate Thesis completed in January 2019.
2. **Dr. Bamidele Johnson Alegbeleye** was a staff Surgery/Laparoscopic Unit of Lagoon Hospitals during the June 2013 to December 2016 study period.

7 References

- [1] S. B. Naeder, "The Appendix." In: Principles and Practice of surgery including Pathology in Tropics. Third Edition, eds. Badoe EA, Archampong EQ, da Rocha - Afodu JT. Assemblies of God Literature Centre Ltd. Publication of 2000; 518-521.
- [2] G. R. Williams, "Presidential Address: A History of Appendicitis." *Ann of Surgery* 1983; 127: 495-506.
- [3] K. Semm, "Endoscopic appendectomy." *Endoscopy* 1983; 15:59-64.
- [4] S. H. Teh, S. O' Ceallaigh, J. G. K. McKeon, O. O'Donohoe, W.A. Tanner, F. B. V. Keane, "Should an appendix that looks 'normal' be removed at diagnostic laparoscopy for acute right iliac fossa pain?" *Eur J Surg* 2000; 166:388-389.
- [5] A. O. Adisa, O. I. Alatishe, O. A. Arowolo, O. O. Lawal, "Laparoscopic Appendectomy in a Nigerian Teaching Hospital." *Journal of the Society of Laparoscopic Surgeons (JLS)* 2012;16: 576-580
- [6] R. Ali, M. R. Khan, T. Pishori, M. Tayeb, "Laparoscopic Appendectomy for Acute Appendicitis: Is This a Feasible Option for Developing Countries?" *Saudi J Gastroenterol* 2010; 16(1): 25-29.
- [7] S. Sauerland, R. Lefering, E. A. Neugebauer, "Laparoscopic versus open surgery for suspected appendicitis." *Cochrane Database Syst Rev.* 2007; 4:CD001546.
- [8] A. Klingler, K. P. Henle, S. Beller, J. Rechner, A. Zerz, G. J. Wetscher *et al.* "Laparoscopic appendectomy does not change the incidence of postoperative infectious complications." *Am J Surg.* 1998; 175: 232-235.
- [9] K. H. Long, M. P. Bannon, S. P. Zietlow, E. R. Helgeson, W. S. Harmsen, C. D. Smith *et al.* "A prospective randomized comparison of laparoscopic appendectomy with open appendectomy: Clinical and economic analyses." *Surgery.* 2001; 29: 390-400.
- [10] C. K. Kum, S. S. Ngoi, P. M. Goh, Y. Tekant, J. R. Isaac, "Randomized controlled trial comparing laparoscopic and open appendectomy." *Br J Surg.* 1993; 80: 1599-1600
- [11] A. E. Ortega, J. G. Hunter, J. H. Peters, L. L. Swanstrom, B. A. Schirmer, "Prospective, randomized comparison of laparoscopic appendectomy with open appendectomy." *Am. J Surg.* 1995; 169:208-212.
- [12] O. O. Afuwape, and O. O. Ayandipo, "Knowledge and Perception of Laparoscopic Surgery among Surgical Outpatients in a Nigerian Teaching Hospital." *Medical Journal of Zambia* 2017; 44 (4): 276-281
- [13] C. P. Fischer, A. Castaneda, and F. Moore, "Laparoscopic appendectomy: indications and controversies." *Semin Laparosc Surg.* 2002; 9:32-39.
- [14] R. Golub, F. Siddiqui, D. Pohl, "Laparoscopic versus open appendectomy: A meta-analysis." *J Am Coll Surg.* 1998;186:545-553
- [15] Z. Liu, P. Zhang, Y. Ma, H. Chen, Y. Zhou, M. Zhang, *et al.* "Laparoscopy or not: a meta-analysis of the surgical effects of laparoscopic versus open appendectomy." *Surgical laparoscopy, endoscopy & percutaneous techniques.* 2010 Dec; 20(6): 362-370.
- [16] M. Galukande, and J. Jombwe, "Feasibility of Laparoscopic Surgery in a Resource Limited Setting: Cost Containment, Skills Transfer and Outcomes." *East and Central African Journal of Surgery* 2011 July/ August;16 (2) :112-117
- [17] A. Emmanuel, J. Byrne, I. Wilson, P. Balfe, "Is laparoscopic appendectomy a safe procedure for trainees in the peripheral hospital setting?" *Irish medical journal.* 2011 Oct; 104(9):276-278.
- [18] S. T. Edino, A. Z. Mohammed, O. Ochichia, M. Anumah. "Appendicitis in Kano, Nigeria: A 5-year review of pattern, morbidity and mortality." *Annals of African Medicine.* 2004; 3(1):38-41.
- [19] P. I. Okafor, J. C. Orakwe, and G. U. Chianakwana, "Management of appendiceal masses in a peripheral hospital in Nigeria: review of thirty cases." *World J Surg.* 2003; 27(7):800-803.
- [20] O. D. Osifo and S. O. Ogiemwonyi, "Peritonitis in children: our experience in Benin-City, Nigeria." *Surg Infect (Larchmt).* 2011; 12(2):127-130.
- [21] A. Koluh, S. Delibegovic, S. Hasukic, V. Valjan, F. Latic, "Laparoscopic appendectomy in the treatment of acute appendicitis." *Medicinski arhiv.* 2010; 64(3):147-150.
- [22] P. G. Larsson, G. Henriksson and M. Olsson *et al.* "Laparoscopy reduces unnecessary appendectomies and improves diagnosis in fertile women." *Surg Endosc.* 2001;15:200-202
- [23] W. T. Van den Broek, A. B. Bijnen, P. V. van Eerten, P. de Ruiter, D. J. Gouma, "Selective use of diagnostic laparoscopy in patients with suspected appendicitis." *Surg Endosc.* 2000; 14:938-941.
- [24] G. Tzovaras, P. Liakou, and I. Baloyiannis, *et al.* "Laparoscopic appendectomy: Differences between male and female patients with suspected acute appendicitis." *World J Surg.* 2007;31:409-413
- [25] I. B. Fashina, A. A. Adesanya, O. A. Atoyebi, O. O. Osinowo, C. J. Atimomo, "Acute appendicitis in Lagos: a review of 250 cases." *Niger Postgrad Med J.* 2009; 16(4):268-273.
- [26] E. D. Mangete, and B. B. Kombo, "Acute appendicitis in Port Harcourt, Nigeria." *Orient Journal of Medicine.* 2004;16(1):1-3
- [27] H. Wei, J. L. Huang, Z. Zheng, *et al.* "Laparoscopic versus open appendectomy: a randomized comparison." *Surg Endosc.* 2010; 24:266-269.
- [28] S. Y. Kim, S. G. Hong, H. R. Roh, S. B. Park, Y. H. Kim, G. B. Chae, "Learning

Curve for a laparoscopic appendectomy by a surgical trainee." J Korean Soc Coloproctol. 2010;26(5):324-328

[29] R. K. Rezmick, and H. Macrae, "Teaching surgical skills - changes in the wind." N Engl J Med 2006; 355; 25: 2664-2696.

[30] E. A. Halm, C. Lee, and M. R. Chassin, "Is volume rated to outcome in health care? A systematic review and methodological critique of the literature." An Intern Med 2002; 137: 511-520.

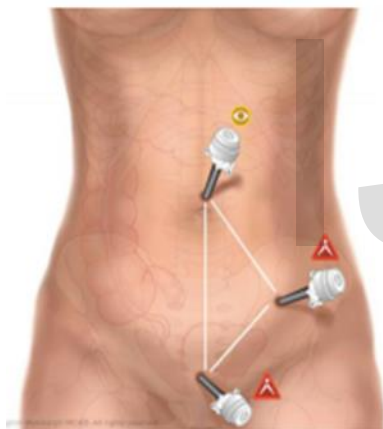
[31] K. A. Zucker, "Surgical Laparoscopy" 2nd Edition 2001. Lippincott Williams & Willins14.

[32] K. Gurusamy, R. Aggarwal, L. Palanively, B. R. Davidson, "Systematic review of randomized controlled trials on the effectiveness of virtual reality training for laparoscopic surgery." Br J Surg. 2008 Sep; 95(9):1088-1097. DOI: 10.1002/bjs.63448.

[33] J. A. A. Awe, A. M. Soliman, R. W. Gourdie, "Stump Appendicitis: An Uncompleted Surgery, a Rare but Important Entity with Potential Problems." Case Reports in Surgery (Hindawi) 2013, Article ID 972596, 4 pages. <http://dx.doi.org/10.1155/2013/972596>

[34] D. M. Gallmann, K. A. Stoessel, O. Schoeb, "Appendicitis after laparoscopic ovarian cystectomy – coincidence or complication." Journal of Surgical Case Reports, 2016;4: 1-3 doi: 10.1093/jscr/rjw052

**FIGURE 2:
TROCAR PLACEMENT IN LAPAROSCOPIC APPEXDECTOMY**



	Laparoscopic Appendectomy (n= 145)	Open Appendectomy (n= 113)	
Demographic Features			
Age Range (years)	15-55	14-65	
Mean age (years)	28.5	27.6	
Sex Distribution (M:F)	62:83	51:62	
Clinical Features & Investigation Findings			
RLQ Pain	145/145	113/113	
Nausea	130/145	104/113	
Vomiting	40/145	28/113	
Fever	22/145	18/113	
Guarding	28/145	14/113	
CT Scan findings	120/145	100/113	
Outcome			
Duration of surgery (min.), Range (median)	39-75 (49.5)	28-65 (34.5)	X ² =10.455, df=1, p=0.0015
Prolonged ileus.	0/145	4/113	
Length of stay, Range (mean)	1-3 (1.5)	2-5 (2.5)	X ² =12.342 df=1, p=0.0065
Postoperative surgical site infection	1	4	X ² =0.874 df=2, p=0.945
Histopathological confirmation	144/145 (99%)	104/113 (92.3%)	

TABLE 1: COMPARING LAPAROSCOPIC AND OPEN APPEXDECTOMY IN A TROPICAL PRIVATE HOSPITAL