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Editorial

I would like to welcome readers to the World journal of laparoscopic surgery for this issue. Now it is an established fact that WJOLS is one of the most popular international scientific, technical, medical journals of Jaypee Brothers. Jaypee, as the pioneer medical publisher is linked to the world, with strengths in every major academic and professional field and partnerships with many of the world's leading medical societies. Jaypee online library hosts the world's one of the broadest and deepest multidisciplinary collection of online medical resources with hundreds of reference works, laboratory protocols and databases.

Featuring a clean and simple interface, online portal of World journal of laparoscopic surgery (www.wjols.com) delivers intuitive navigation, enhanced discoverability, expanded functionalities and a range of personalization and alerting options. The journal continues to progress with a strong inflow of submissions from surgeons and gynecologists from all over world and a concerted push for us to keep turnaround times to a minimum. Our current manuscript turnaround time for WJOLS journal is under 10 weeks on an average despite an increasing new paper submission rate.

We are in the process of final step for getting this journal indexed in PubMed this year and have a healthy pipeline of accepted 'Minimal access surgery articles' awaiting publication of a quality that continues to increase. We also continue to strengthen the quality of the editorial board, with the recent addition of new editors in it.

This issue contains many articles with a strong emphasis on recent advancements in minimal access surgery, but also a taste of review articles which will be giving the reader a flavor of evidence-based surgery. I hope the readers will like this issue very much and will give their valuable feedback.

RK Mishra
Editor-in-Chief

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ORIGINAL ARTICLE

Difference between the Inflammatory Reaction Caused by the Placement of a Conventional Laparoscopic Access and a Single Access (Single Port) in Pigs

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ABSTRACT

Single access (SA) has been developed to replace conventional laparoscopy (CL) in order to reduce trauma. However, it is a controversial issue.

Objectives: To compare the acute inflammatory responses of CL and SA, considering only the trauma caused by the placement of the access port, at first time without pneumoperitoneum or other surgical manipulation. The variations of serum interleukin (IL)-4, -6, -8 and -10, tumor necrosis factor-alpha (TNF-α) and C-reactive protein (CRP) were evaluated.

Materials and methods: Twenty pigs were randomly divided into two groups: a SA group and a CL group. In the SA group, the procedure began with a 2.5 cm skin incision, aponeurosis and peritoneum, and then the single-access device (Gelport®) was placed without pneumoperitoneum. In the CL group, the incision was performed on the skin, aponeurosis and peritoneum, and the four trocars were placed only with the traction of the abdominal wall. Once the access points were placed, blood samples were collected to measure the cytokines and CRP at: time zero (T0), immediately after anesthesia (including intubation); T1, immediately after the access point(s) was placed; T2, 120 minutes after the access point(s) was placed; and T3, 240 minutes after the access point(s) was placed.

Results: The concentrations of IL-4 and TNF-α decreased between T0 and T3. IL-10 and CRP also decreased, but not significantly. IL-6 and IL-8 increased, but not significantly.

Conclusion: During the study, there was no significant difference between the inflammatory response triggered exclusively by placing the SA and CL without pneumoperitoneum.

Keywords: Interleukin, Laparoscopy, Pig, Single port, Trauma.

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INTRODUCTION

Advances in minimally invasive surgery, such as laparoscopy, have brought undoubted benefits to patients because they are less traumatic to the tissues. Recently, a technique was introduced that accesses the peritoneal cavity using a single access (SA) ('single port' or laparoscopic and endoscopic single site, LESS). It is different from conventional laparoscopy (CL), which regularly uses three or more access points. This new method aims to further reduce the morbidity of surgical procedures. However, the real benefits of SA in terms of tissue damage are controversial.[1] Furthermore, the procedures that use SA, such as nephrectomy and pyeloplasty, are technically more difficult to perform. Therefore, in patients undergoing CL procedures, the inflammatory effects need to be evaluated more carefully and compared with SA to evaluate the benefits of this new technique.

The degree of tissue damage caused by both open and laparoscopic surgery can be measured by the immune humoral response mediated by cytokines.[1-4] These include interleukins (ILs), interferons, colony-stimulating factors, tumor necrosis factor-alpha (TNF-α) and growth factors. The level of C-reactive protein (CRP) is also used as a marker of tissue damage. Interleukins are a large group of cytokines produced by T lymphocytes and some phagocytes and tissue cells. They have many functions, especially the induction of proliferation and differentiation of other cells that express specific IL receptors.[5,6] Tumor necrosis factor-alpha activates macrophages and granulocytes, increases the adhesion of leukocytes to the endothelium and induces the synthesis of acute-phase proteins.[7,8] C-reactive protein is involved in the stress response to surgery, stimulating the phagocytosis by neutrophils and tissue macrophages.[9]

OBJECTIVE

The present study aimed to compare the acute inflammatory responses of CL and SA, considering only the trauma caused by the placement of the access point, by measuring the serum levels of IL-4, IL-6, IL-8, IL-10, TNF-α and CRP in surgeries performed in an animal model (pig).

MATERIALS AND METHODS

The present study was conducted at the Vicky Safra Surgery, Teaching and Research Center (Centro de Ensino e Pesquisa em Cirurgia-CEPEC-Vicky Safra) in association with the medical research laboratory of the Division of Urology (LIM55), with the approval of the Medical Ethics Committee of the School of Medicine of the University of São Paulo (Faculdade de Medicina da Universidade de São Paulo-FMUSP). The study was conducted according to the Ethical precepts of the animal research facility of FMUSP.

Twenty Landrace pigs (domestic pig) from a specialized farm were used in the present study. The animals were fasted, sanitized and injected intramuscularly with 3 ml xylazine and 4 ml ketamine, associated with intramuscular injection of 3 ml (15 mg) midazolam as a preanesthetic medication. The anesthesia, which consisted of 5 to 10 ml of thiopental, was administered by puncturing the ear vein before intubation. After this procedure, the animals were intubated with a 6 mm endotracheal tube, and 10 ml of thiopental, 4 ml of fentanyl and 2 ml of pancuronium were administered. The ventilation rate was set to 12 breaths per minute with 100% oxygen (FiO_2) and 1.5% isoflurane. Every 40 minutes, 10 ml thiopental, 4 ml fentanyl and 2 ml pancuronium were administered. An ear vein was punctured in the contralateral ear to collect blood samples.

Surgical Procedure, Collection of Blood Samples from Pigs and Analysis of the Samples

Two groups of pigs, with 10 animals each, were randomly assigned to SA or CL. The anesthetized pigs had their abdomen washed with 2% chlorhexidine disinfectant followed by antisepsis with 0.5% chlorhexidine alcohol, and sterile drapes were placed. The Gelport® (Applied Medical, California, EUA) device was used in the SA group, and a device from Storz® (Karl Storz, Tuttlingen, Germany), which consisted of two 10 mm trocars and two, 5 mm trocars, was used in the CL group.

In the SA group, the procedure began with a 2.5 cm incision in the skin, aponeurosis and peritoneum, followed by placement of a SA device (Gelport®) without pneumoperitoneum (Fig. 1). No other surgical manipulation was performed; we only collected blood samples from the ear of the pigs. In the CL group, the antiseptic preparation was the same. Skin, peritoneum and aponeurosis incision was performed, and the trocars were placed without insufflating the abdominal cavity, only with traction on the abdominal wall. In total, four access points (trocars) were placed: a 10 mm umbilical access, a 5 mm access in the xiphoid appendix, a 10 mm access in the iliac fossa and a 5 mm access in the hypochondrium (Fig. 2).

Once the access points were placed, blood was collected to measure the cytokines and CRP. Four samples were taken from each group: time zero (T0), immediately after anesthesia (including intubation); T1, immediately after the access was placed; T2, 120 minutes after the access was placed; and T3, 240 minutes after the access points were placed.

Analysis of Blood Samples by ELISA

The blood samples were collected from the ear vein contralateral to the ear used for the anesthesia. The samples were centrifuged, and the serum was immediately used to perform enzyme-linked immunosorbent assays (ELISAs). Swine IL-10, IL-4, IL-8 and TNF-α ELISA kits (Invitrogen Corporation, CA, USA) and a swine CRP kit (Pig CRP ELISA kit, Genway, CA, USA) were used.

STATISTICAL ANALYSIS

Student's t-test and the analysis of variance (ANOVA) were used to compare the data between groups. The differences were considered significant when $p \leq 0.05$.

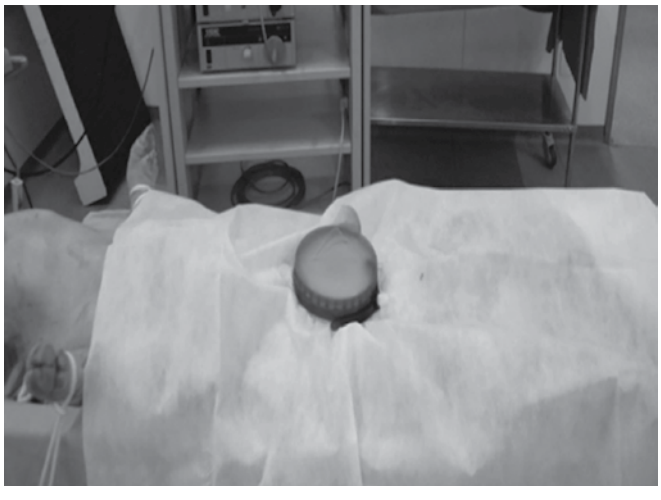

Fig. 1: Single port approach employed in the study 199 × 100 mm (81 × 122 DPI)

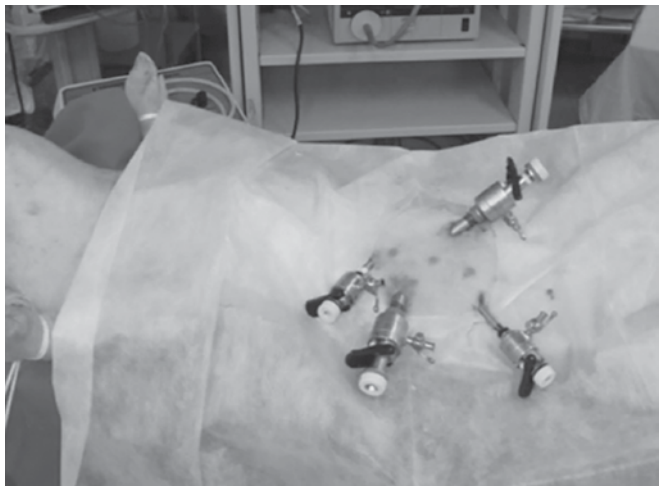

Fig. 2: Four trocars laparoscopic conventional approach employed in the study 167 × 110 mm (123 × 123 DPI)

RESULTS

IL-4 and TNF-α showed a significant, but borderline, reduction between T0 and T3. IL-10 and CRP also decreased, but not significantly. IL-6 and IL-8 increased, but not significantly (Table 1).

Table 2 shows that there were no significant differences between the two groups in IL-4, IL-6, IL-8, IL-10, TNF-α or CRP at 240 minutes (T3). There was a difference in the IL-4 level between the two groups only at T1. TNF-α showed a difference between groups at T0. A possible explanation for this finding is that TNF-α increased due to trauma during the transportation of the animals, which were supposedly healthy and had no visible lesions when they reached the laboratory. This difference persisted through T1 (immediately after the trocars were placed) but disappeared in the following measurements.

Table 1: Changes in IL-4, IL-6, IL-8, IL-10, TNF-α and CRP in all 20 pigs between T0 and T3 (240 minutes)

	Mean ± standard deviation (pg/mL)	*P*
T0: IL-4	0.184 ± 0.076	0.004*
T3: IL-4	0.123 ± 0.013	
T0: IL-6	0.253 ± 0.131	0.437
T3: IL-6	0.271 ± 0.173	
T0: IL-8	0.046 ± 0.005	0.228
T3: IL-8	0.054 ± 0.027	
T0: IL-10	0.116 ± 0.045	0.240
T3: IL-10	0.108 ± 0.038	
T0: TNF-α	0.072 ± 0.007	0.018*
T3: TNF-α	0.068 ± 0.004	
T0: CRP	3.112 ± 0.278	0.117
T3: CRP	3.011 ± 0.290	

*Significant

DISCUSSION

The goal of continually improving surgical techniques, with an emphasis on reducing tissue damage, has inspired several advancements in minimally invasive procedures. In this regard, video laparoscopic represents a major advance, as it is now the gold standard for the surgical treatment of many diseases. The main reason for using this technique is to minimize tissue damage, resulting in a weaker inflammatory response, which results in less pain, shorter postoperative recovery and earlier return to activities, in addition to better esthetic results. Techniques that, in theory, should cause less tissue trauma to the patients, such as natural orifice transluminal endoscopic surgery (NOTES) and SA or 'single port' or 'LESS,' have also been developed. However, it is still unclear whether these techniques, particularly the SA technique, are actually less traumatic than CL.[10]

The evaluation of the inflammatory response to surgical trauma can be performed by measuring the ILs in blood, and previous studies have emphasized the importance of IL-4, IL-6, IL-8 and IL-10.[11] Tumor necrosis factor-alpha and CRP are also used to evaluate the inflammatory response to surgical trauma.[10-12] However, many factors interfere with their measurement accuracy, and the results obtained with these markers are conflicting.[10-13]

The present study aimed to evaluate the acute inflammatory response triggered by the surgical trauma that results from two techniques currently used: SA, considered by some authors a less invasive procedure,[10] and video laparoscopic surgery. For this purpose, the serum levels of ILs, TNF-α and CRP were measured in a porcine model.

Table 2: Comparisons of serum cytokine and CRP concentrations between the SA group and CL group at T0 (immediately after anesthesia), T1 (immediately after the trocars were placed), T2 (120 minutes after the trocars were placed) and T3 (240 minutes after the trocars were placed)

	IL-4 (pg/ml)	*IL-6 (pg/ml)*	*IL-8 (pg/ml)*	*IL-10 (pg/ml)*	*TNF-α (pg/ml)*	*CRP (pg/ml)*
T0						
SA group	0.151 ± 0.788	0.199 ± 0.121	0.044 ± 0.052	0.096 ± 0.022	0.068 ± 0.006	3.102 ± 0.242
CL group	0.218 ± 0.059	0.308 ± 0.122	0.047 ± 0.058	0.135 ± 0.055	0.077 ± 0.006	3.123 ± 0.324
p-value	0.46	0.5	0.277	0.052	0.006*	0.873
T1						
SA group	0.143 ± 0.041	0.254 ± 0.252	0.045 ± 0.058	0.135 ± 0.126	0.067 ± 0.005	3.057 ± 0.266
CL group	0.235 ± 0.072	0.228 ± 0.079	0.055 ± 0.017	0.174 ± 0.136	0.078 ± 0.005	2.993 ± 0.156
p-value	0.003*	0.76	0.101	0.526	0.001*	0.522
T2						
SA group	0.138 ± 0.031	0.190 ± 0.097	0.050 ± 0.006	0.105 ± 0.030	0.067 ± 0.004	2.947 ± 0.381
CL group	0.160 ± 0.032	0.306 ± 0.188	0.054 ± 0.015	0.122 ± 0.038	0.070 ± 0.005	2.938 ± 0.314
p-value	0.137	0.098	0.469	0.286	0.168	0.957
T3						
SA group	0.129 ± 0.012	0.227 ± 0.122	0.051 ± 0.018	0.098 ± 0.029	0.066 ± 0.002	3.058 ± 0.305
CL group	0.118 ± 0.012	0.314 ± 0.209	0.057 ± 0.035	0.119 ± 0.044	0.070 ± 0.006	2.963 ± 0.005
p-value	0.061	0.27	0.649	0.239	0.128	0.482

*Significant; Concentrations are presented as means ± standard deviation

In most protocols, the SA technique is performed through a single 2.5 cm incision that passes through the skin, aponeurosis and muscles, called the port or access point. A trocar is placed on the access point, allowing instruments such as the optic and two to four clamps to be introduced into the body. This differs from laparoscopy, which is performed through a 1.0 cm incision in the abdominal wall, usually in the umbilical region, and two or three, 5 or 10 mm incisions in the abdominal wall, called ports or access points, where the trocars will be placed. Many video laparoscopic procedures use two 10 mm access points (one umbilical and one in the iliac fossa) and two 5 mm access points (one in the region of the xiphoid appendix and the other in the hypochondrium), so this setting was used for the present study. The SA technique imposes a space restriction between the hands of the surgeons when they manipulate surgical clamps, making the procedure considerably more difficult than CL. Therefore, the benefit to the patient depends on the experience of the surgeon.[14]

To evaluate only the inflammatory response triggered by the access points, pneumoperitoneum was not used because the gas used in SA or CL surgery may influence the inflammatory response markers (ILs, TNF-α and CRP).[10-13] Some studies have evaluated the differences between SA and video laparoscopy but included the entire surgical procedure.[14] However, each surgery may have different variables, such as the dissection length, bleeding and infections, which could modify the results. The present study evaluated only the trauma resulting from the access points. Recently, a study with a design similar to ours was published.[15] However, the author used pneumoperitoneum for 1 hour after the access points were placed, which could influence the IL levels.[10-12]

In the present study, we used healthy pigs as an animal model, all from a farm in a nearby town. The town is approximately 1 hour away from the lab, and the pigs were brought to the lab on the day of the procedure. This decision may have influenced the results because of the possibility that the transportation was traumatic for the animals. However, blood samples were collected from both groups at T0, immediately after anesthesia and intubation. Four pigs per day arrived on different days, and two pigs went to each group randomly, to minimize the influence of the temperature each day and variations in travel time. Ideally, the animals should be kept longer in the lab before the procedures, but this was not possible because of a municipal law that forbids maintaining these animals in the city. This was also the reason why the study time was set to 4 hours; ideally, the inflammatory response should be monitored for longer periods, such as days or weeks. Furthermore, ideal conditions, such as housing, medications and assessments of other inflammation foci, e.g. lungs require larger technical and financial resources, in addition to imposing postoperative suffering on the animals.

Nakano et al (2007) observed increased IL-4, 3 hours after laparotomy in rats, confirming that the sampling time used in the present study was sufficient to evaluate IL-4.[16] In a study on IL-4 and IL-10, Shapenko et al considering that these markers have anti-inflammatory action in animals, demonstrated that they are suitable for studies in humans.[17,18] The reduction of IL-4 might have resulted from the minor trauma caused by the access points in the present study. In support of this hypothesis, the reduction observed in the SA group (0.151 to 0.129 = 0.022) was lower than the reduction observed in group 2 (0.218 to 0.118 = 0.100). This effect may warrant investigation in future studies. Kimura et al (2006), who studied the kinetics of IL-4, IL-6, IL-8 and IL-10, observed increases in all these markers except for IL-4.[12]

IL-6 has been used as a marker of response to surgical trauma by several authors.[9-11] Shenkin et al demonstrated variations in the IL-6 level 90 minutes after skin incision, reaching a peak level at 4 hours.[19] Cruickshank et al found increased IL-6 after 2 to 4 hours in several procedures, demonstrating a correlation between IL-6 and tissue trauma.[20]

A study by Hao et al (2012), which analyzed the inflammatory response promoted by LESS and by CL in a procedure for treating varicocele in children, did not observe significant differences between the two procedures regarding IL-6 or TNF-α.[10] Matsumoto et al (2005), who compared laparoscopic nephrectomy, hand-assisted laparoscopy (insertion of a hand into the abdomen through a minimal incision) and the open technique, measured the inflammatory response in pigs by analyzing peritoneal IL-6 and plasma TNF-α, showing that the laparoscopic technique had weaker inflammatory effects than hand-assisted or open surgery.[1] Ypsilantis et al (2012) conducted a study of IL-6, IL-8, TNF-α and CRP in 20 pigs, aiming to evaluate the inflammatory responses to LESS and CL. The pigs were divided into four groups: SA with pneumoperitoneum for 1 hour; CL with pneumoperitoneum; only pneumoperitoneum; and only anesthesia. The analysis of IL-6, IL-8, TNF-α and CRP did not show differences between the various procedures.[14] Wang et al (2009) compared open pyeloplasty with laparoscopic pyeloplasty in children, analyzing IL-6, IL-8, IL-10, TNF and CRP.[21] They found that, in both groups, IL-6 was higher after 4 hours, and IL-6 and CRP were higher in open surgery.

IL-8 has also been used in studies on the inflammatory response to surgical trauma.[22] This IL has the ability to

recruit neutrophils and monocytes to the inflammatory site.[12,23] A study published by Kato et al (1997) showed a significant increase of IL-8 from baseline to 4 hours after the procedure in the plasma of patients who underwent upper-abdominal surgery.[22,24] In contrast, Torres et al (2008) did not observe increased IL-8 at any time up to 48 hours after laparoscopic cholecystectomy with 'standard and low' pneumoperitoneum pressure.[23]

IL-10 is also used to measure the inflammatory response to surgical trauma. A study by Dimopoulou et al (2007) that correlated IL-10 with infectious complications showed that IL-6, IL-8 and IL-10 increased proportionally with the surgery time (2, 4, 6 and 8 hours).[25] In a study that measured IL-6, IL-8 and IL-10 to analyze the surgical stress response to laparoscopic and open techniques, no change in the levels of these cytokines after 4, 24 or 48 hours was observed.[21] An analysis of laparoscopic surgery using standard-or low-pressure pneumoperitoneum did not show changes in the levels of IL-8 and IL-10.[24]

Tumor neorosis factor-alpha has an important proinflammatory action. This cytokine initiates the production of adhesion molecules that lead to the activation and proliferation of neutrophils.[1] Matsumoto et al found high plasma TNF-α 1 hour after surgery, reaching a peak at 4 hours and decreasing after 48 hours.[1] Wang et al did not observe significant changes in the level of TNF-α when comparing laparoscopic pyeloplasty with open pyeloplasty in children.[21] In the present study, TNF-α was significantly higher at T0 than at T3 when the 20 pigs were analyzed together. We think this increase was related to the transportation of the animals.

C-reactive protein is often used as a marker of surgical trauma because it has a predictable response to acute tissue damage. Its action is related to the activation of the complement cascade and the stimulation of phagocytes by neutrophils and macrophages. C-reactive protein increases by 4 hours after surgery and peaks at 24 hours.[9] C-reactive protein is lower in response to laparoscopic surgeries compared to open surgeries.[9]

Some authors analyze peritoneal and plasma interleukins to evaluate the traumatic effects of surgery.[1] In the present study, we chose to analyze only blood samples because we did not want to perform any manipulation inside the abdominal cavity. Because we chose not to use pneumoperitoneum, we only placed the access points and did not perform any further trauma.

The strengths of the present study include the fact that it is, to our knowledge, the only one that has compared the SA and CL techniques without handling structures inside the peritoneal cavity. It is also the only study comparing SA and CL without using pneumoperitoneum. The main limitation is that we had only 4 hours to collect the samples. Although studies using ILs demonstrate that more time could provide more consistent results, the present study allowed as much time as some other studies.[1] The present study aimed to achieve a short-term analysis, excluding the risk of infections or other traumas. In this regard, the transportation of the animals from the farm to the lab was a variable that could not be controlled due to legal impediments.

Like other studies that used rats, dogs or pigs, the present study was conducted in a porcine animal model.[1,16,26] Greco et al compared SA and CL in humans, but a nephrectomy was performed in these patients, which might have influence the analysis of ILs because that surgery involves different aspects of dissection and surgical trauma.[14]

The present study showed that there was no difference between SA surgery and CL surgery in terms of inflammatory stress in the absence of induced pneumoperitoneum. To our knowledge, this is the first study using access ports exclusively, without pneumoperitoneum. SA imposes more technical difficulty on the surgeon and a consequent risk to patients. Therefore, CL surgery remains the most appropriate. However, it is still unclear whether the ILs were increased with both techniques because the two types of access cause a minor inflammatory reaction, and it is also not certain whether there are other, more accurate ways to assess the degree of surgical trauma. Future studies should be performed to validate our findings.

During the first 4 hours after the opening of access points, there was no significant difference between the inflammatory response triggered by the SA technique and the CL technique, without pneumoperitoneum, as assessed by the levels of IL-4, IL-6, IL-8, IL-10, TNF-α and CRP.

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ORIGINAL ARTICLE

Role of Diagnostic Laparoscopy in Patients with Acute or Chronic Nonspecific Abdominal Pain

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ABSTRACT

Aim: The aim of our study was to evaluate and establish the role of diagnostic laparoscopy (DL) in unexplained/nonspecific abdominal pain (NSAP) in this era of therapeutic laparoscopy, and thus to analyze and support the theory of minimal access surgery in diagnosing and treating abdominal conditions.

Materials and methods: In this prospective study included patients with abdominal pain of (i) more than 6 hours and less than 6 days duration (acute) and (ii) more than or equal to 6 months duration (chronic) were included whether presenting as a surgical emergency or coming to surgical outpatient department (OPD) in whom a DL was performed after failure to achieve a diagnosis with conventional methods. The study included a total of 168 consecutive patients who fulfilled our inclusion criteria and underwent DL for NSAP. Their demographic and clinical data, admission dates and dates of surgery were noted. Outcome of surgery was recorded and the data were analyzed to ascertain the role and diagnostic yield of laparoscopy in our department, both in acute and chronic abdominal pain of nonspecific nature. Patients were followed postoperative for 3 months for any recurrence of symptoms.

Results: Laparoscopy yielded diagnoses in 161 of these patients giving a diagnostic yield of 95.8%. Appendicitis (39.2%), gynecological pathology (16%) and abdominal tuberculosis (8.9%) were the major findings. Therapeutic procedures were performed in 112 cases (66.6%) where peroperative pathology was identified. In 38 cases (22.6%) where there was strong clinical suspicion of appendicitis and no pathology could be identified peroperative, an appendectomy was performed. Twenty-eight (73.6%) of these appendix specimens were found inflamed on subsequent histologic examination. There were no complications in this series.

Conclusion: This study establishes the role of early DL as a safe procedure with high efficacy. Hence, it is an effective investigative tool in undiagnosed abdominal pain of both acute and chronic nature.

Keywords: Acute appendicitis, Diagnostic laparoscopy, Gynecological pathology.

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INTRODUCTION

In surgical practice, we frequently come across patients with lower abdominal pain who despite frequent routine examination and all major investigations remain undiagnosed. Many undergo appendectomy, some are put on antitubercular therapy (especially in our country) while females mostly end up taking anti-androgens. A vast majority are labeled functional. In short, patients with nonspecific abdominal pain (NSAP) continue be a frustrating experience for the patient and pose a challenge to the diagnostic capability of the general surgeon.

The traditional three step approach to abdominal pain of nonspecific nature including: (i) history and clinical examination including gynecological examination, (ii) investigations and (iii) therapeutic intervention is tedious and lengthy. Patients are hospitalized, subjected to a battery of costly investigations and often end-up undergoing a laparotomy which may prove unnecessary with no therapeutic benefit.[1,2] The end result is an unsatisfactory discharge from the hospital after a prolonged stay often without a precise clinical diagnosis.[3]

Laparoscopy for diagnostic purposes was introduced for the 1st time by Kelling in 1902 and since then has come a long way. Diagnostic laparoscopy (DL) is a minimally invasive surgical procedure that allows the visual examination and documentation of intra-abdominal organs in order to detect any pathology. Elective DL refers to the use of the procedure in chronic intra-abdominal disorders. Emergency DL is performed in patients presenting with acute abdomen.

With increasing the use of laparoscopy, the diagnostic yield in cases of NSAP has tremendously improved, it allows direct visualization of the peritoneal cavity without the need for old fashioned open exploratory laparotomy. It is especially useful in patients with equivocal signs and those who are hemodynamically stable not requiring urgent surgical intervention.[4]

The rapidly increasing popularity of laparoscopy may be attributed to several factors; including its applicability in both emergency and elective setups, high diagnostic yield, therapeutic management in the same setting (in cases where on-table diagnosis is possible), ability to manage most coexisting conditions, low patient morbidity, reduced hospital stay and expenditure.

Diagnostic laparoscopy has a role in many acute abdominal conditions including acute appendicitis, acute intestinal obstruction, acute salpingitis, pelvic inflammatory disease (PID), ovarian torsion, ruptured ovarian cysts, acute gut perforation, penetrating/blunt trauma to abdomen. Also, it has an important role in obtaining diagnosis, allowing therapeutic intervention where needed and establishing histopathologic diagnosis of chronic causes of abdominal pain, especially in cases of abdominal tuberculosis, endometriosis, adhesions due to inflammation and/or surgery.

Our study aims to establish the role of laparoscopy as a diagnostic tool investigating its effectiveness in the setting of acute as well as chronic abdominal pain.

MATERIALS AND METHODS

A total of 168 patients were included in our study who presented with either acute abdominal pain (n = 81) or chronic abdominal pain (n = 87) over a 12 months period. Only the patients who fulfilled our inclusion criteria were included in our study.

Inclusion Criteria

- Patients between ages of 12 and 65 years
- Abdominal pain lasting less than 6 days in acute cases and more than or equal to 6 months in chronic cases in whom there was no definitive diagnosis after thorough clinical examination (including gynecological examination) and relevant investigations.

Exclusion Criteria

- Precise diagnosis established after evaluation and investigations.
- Patients with clinical evidence of peritonitis and/or hemodynamic instability requiring urgent surgical intervention.
- Pediatric cases.
- The elderly in whom a surgical and/or anesthetic intervention outweighed the theoretic benefits of a diagnostic laparoscopy.
- Local signs of peritonitis.
- Previous major abdominal surgery.
- Prior diagnosis of malignancy or any other chronic disease.
- Patients with any contraindication to pneumoperitoneum.
- Accidents/trauma patients.
- Uncorrectable coagulopathy.
- Patients undergoing any elective abdominal/pelvic surgical procedure.
- Those who did not give consent.

Acute nonspecific abdominal pain was defined as abdominal pain of less than 6 days duration for which no cause was elucidated after thorough clinical examination and investigations. Chronic NSAP was defined as vague abdominal pain/discomfort lasting more than 6 months which remained undiagnosed after repeated evaluations and investigations. Main outcome measure in the series was diagnostic yield of laparoscopy in the setting of NSAP. Other outcomes were length of hospital stay, symptom control on follow-up, readmissions and time lapse between presentation and DL.

After all essential investigations patients with NSAP fulfilling the inclusion criteria were then subjected to DL in 12 to 24 hours in acute abdominal cases and 12 to 72 hours in those with chronic abdominal pain. Laparoscopy was performed under general anesthesia and comprised of a thorough exploration of all abdominal quadrants and the pelvic viscera.

An attempt was made to treat all surgical pathologies diagnosed at laparoscopy without the need for converting to open. In cases where no clear pathology could be identified peroperative and there was clinical suspicion of appendicitis, appendicectomy was done on the basis that symptomatic appendicitis is not always evident macroscopically.[5] Biopsy was taken of suspicious nodules and free peritoneal fluid if any was aspirated. All specimens were sent for histopathological, cytological, biochemical and microbiological analysis.

Follow-up was done at 10 days, 1 and 3 months postoperative. Patients were followed for:

- Results of biopsy specimen
- Improvement or worsening of symptoms
- Readmissions and indications for readmission
- Early and late complications of laparoscopy necessitating open intervention
- Patient compliance if post-laparoscopy medical management was initiated.

RESULTS

Patient demographics are summarized in Table 1. There were a total of 123 females included as against 45 males patients. The majority of the patients were young adults aged 16 to 30 years.

Out of 168 cases of DL performed, on table diagnosis and therapeutic management was possible in 112 (66.6%) cases. Eighty-one (48.2%) of these 168 patients had presented acutely whereas 87 (51.7%) presented with long standing complaint of NSAP.

Out of these 112 cases of positive on-table diagnoses, a majority, i.e. 66 (39.2%) cases showed a macroscopic involvement of appendix and appendectomy was done. Sixty-four

(96.9%) of these appendix specimen subsequent histology confirmed the diagnosis of acute appendicitis. In only two cases, reports of a normal appendix were obtained.

The second major pathology in our study was ovarian cyst. Twenty-seven (16%) cases of ovarian cysts were diagnosed and aspiration and/or cystectomy performed. Subsequent histopathology of the resected cysts revealed benign ovarian cysts in majority of cases, i.e. 17/27 (63%), whereas a diagnosis of endometriosis was established in 10/27 (37%) cases.

Peritoneal nodules were seen in 15 (8.9%) of cases, in all these cases biopsy was taken and sent for histopathology. All these biopsy specimens tested positive for tuberculosis (100%) and therapy was instituted.

In 38 (22.6 %) cases, no pathology could be identified and appendectomy was done [28 (73.6%) of these 38 appendix specimens showed inflammatory changes on histopathology]. Combinations of pathologies were also observed in 3 cases (1.8%) in which coexistence of macroscopic acute appendicitis was seen with ovarian cysts. It was possible to carry out therapeutic intervention in all these cases. One case (0.6%) of a solitary hydatid liver cyst was seen which was missed preoperatively as patient was un-affording and advanced radiological investigation were not carried out. De-roofing of the cyst was done followed by hypertonic saline wash. Drain was left *in situ* and tremendous improvement in patient progress was witnessed later on.

In 11 (6.5%) cases where the peroperative picture was unclear, biopsy/aspiration of suspicious nodules/serous fluid was taken for subsequent histopathological/cytological/microbiological/biochemical analysis. The following diagnoses were later reached based on results of histology and fluid cytology. Early Cirrhosis in 3 (1.7%), hepatoma in 3 (1.7%), lymphoma in 5 cases (2.97%). These patients were referred for expert opinion and management.

Thus, a diagnosis (either on table or via histopathology) was possible in 161/168 cases (95.8%). In 7 cases (4.1%), there was no diagnosis after DL (appendix specimens were also negative). These patients continued to have abdominal discomfort, however, they reported improvement in their symptoms post DL which may be a psychological phenomenon of 'an intervention' carried out.

The mean hospital stay in our study was 3.36 days, prolonged stay of 4 days or more was seen in a few patients who had initially presented with chronic abdominal pain (Table 2). Majority of patients were discharged on 1 to 3 postoperative day.

Follow-up was done at 10 days, 1 and 3 months post-laparoscopy. A majority of patients showed improvement in their condition in both groups, especially those who had initially presented with acute abdominal pain (Table 4). Medical management was initiated in 7 (4.1%) patients with acute and 22 (13%) patients with chronic abdominal pain (for TB or lymphoma, etc.). A small percentage of patients reported a persistence of their symptoms (2.3% in the acute pain group at 10 days, none thereafter and 5.9%, 2.9% at 10 days, 1 and 3 months respectively in the chronic pain group). This does not include the undiagnosed group. A majority of patients in the acute group (35.1%) underwent DL within 6 to 12 hours of presentation. However, in the chronic group, most DL were carried out in the 12 to 24 hours window (35.7%).

Table 1: Age and sex distribution of patients

n = 168		*Number*	*Percent*
Sex	Male	45	26.7
	Female	123	73.2
Age	< 15 yrs	12	7.14
	16-30 yrs	120	71.4
	31-45 yrs	21	12.5
	> 45 yrs	15	8.92

DISCUSSION

Nonspecific abdominal pain is a significant problem in general surgery and accounts for an estimated 13 to 40% of emergency surgical admissions for abdominal pain.[6,7] Studies have, however, doubted the effectivity of extensive investigations[8,9] and several authors have documented the utility of DL in the evaluation and management of such patients.[10-12] Sarfati et al[13] in his review of 203 appendectomies concluded that adjuvant testing was not helpful and showed that outcomes were improved by early

Table 2: Presentation and clinical outcomes

Mode of presentation (n = 168)			*Time lapse between presentation and surgery (n = 168)*			*Hospital stay duration (n = 168)*		
	Number	*Percent*	*Time (hrs)*	*Number*	*Percent*	*Days*	*Number*	*Percent*
Acute	81	48.2	< 6	10	5.9	2	20	11.9
			6-12	59	35.1	2-4	55	32.7
			> 12	12	7.14	> 4	6	3.57
Chronic	87	51.7	< 12	17	10.1	2	11	6.5
			12-24	60	35.7	2-4	60	35.7
			24-32	10	5.9	> 4	16	9.52

surgical intervention. Also in a developing country like ours where advanced radiological investigations are beyond the scope of grass root level medical practice (often not readily available and costly) this approach only serves to increase cost and delay treatment. Diagnostic laparoscopy should, thus, be considered as step II of the management.[14]

We were able to identify a pathology in 161/168 patients. Hence, our study reports a diagnostic yield of 95.8% for which is in accordance with other similar reports of high definitive diagnostic rates (between 86 and 100%)[15-18] for early DL Salky, in his study was able to identify pathology in 69 of 70 patients.[19] Sugerbaker et al gave a diagnostic accuracy of 96% and completion time of 20 minutes for DL. The major pathologies diagnosed in our study were acute appendicitis (39.2%), gynecological pathology (16%) and abdominal tuberculosis (8.9%) respectively. Acute appendicitis and gynecological pathology were also the main findings in Salky's series, whereas in an Indian study by Arya PK and associates abdominal and pelvic tuberculosis were the main pathologic findings followed by appendicitis.[20] This was also reported by A Gupta et al who gave a diagnostic accuracy of 92%[15] where abdominal tuberculosis and gynecological pathology were the most common diagnoses. This only serves to confirm the increased prevalence of tuberculosis in the subcontinent. Easter et al,[21] however, reported a high incidence (47%) of postoperative adhesions; adhesiolysis was done at the same sitting. No case of adhesions was reported in our study which is probably due to meticulous preoperative exclusion of cases with history of abdominal surgery.

Laparoscopy is very sensitive for the diagnosis of appendicitis whether acute or chronic; it not only detects appendicitis but also avoids negative appendectomies.[22] An early DL in suspected acute appendicitis reduces the risk of appendiceal perforation, improves diagnostic accuracy and reduces the number of negative laparotomies. It is especially useful in morbidly obese patients where large incisions are required for removing appendix and

Table 3: Presentation as related to diagnoses and their histopathologic outcomes

Presentation (n = 168)									
Acute (n = 81)		*Chronic (n = 87)*		*Diagnosis (n = 168)*			*Histologic diagnosis*		
Number	*Percent*	*Number*	*Percent*	*Diagnosis per DL*	*Number*	*Percent*		*Number*	*Percent*
10	5.9	28	16.6	None	38	22.6	28/38 cases of appendicitis		73.6
48	28.5	18	10.7	Acute appendicitis	66	39.2	64/66		96.9
6	3.5	21	12.5	Ovarian cysts	27	16	Benign	17	63
							Endometriosis	10	37
3	1.8	12	7.1	Abdominal tuberculosis	15	8.9	15/15		100
3	1.8	0	0	Acute appendicitis + ovarian cysts	3	1.8	3		100
0	0	1	0.6	Hydatid cyst	1	0.6	1		100
0	0	11	6.5	Biopsy +/– fluid for analysis	11	n/a	Cirrhosis	3	27
							Hepatoma	3	27
							Lymphoma	5	45
0	0	7	4.1	None	0	0	n	n	n

Table 4: Patient progress at follow-up visits

		10 Days		*1 Month*		*3 Months*	
Presentation (n = 168)	*Progress*	*Number*	*Percent*	*Number*	*Percent*	*Number*	*Percent*
Acute (n = 81)	Improved	68	40.4	74	44	70	41.6
	Persistent symptoms	4	2.3	0	0	0	0
	Medical management	7	4.1	5	2.9	1	0.6
	Readmission	2	1.2	0	0	0	0
	Total	81		79		71	
Chronic (n = 87)	Improved	45	26.7	50	29.7	47	27.9
	Persistent symptoms	10	5.9	5	2.9	5	2.9
	Medical management	22	13	23	13.7	20	11.9
	Readmission	0	0	1	0.6	0	0
	Total	77		79		72	
		10 lost, 158 seen		158 seen		Further 15 lost, 143 seen	

chances of wound infection are high. In our study, 92/104 appendix specimen showed inflammatory changes per histopathology (88.4%) although 38 of these were found to be normal macroscopically. Many authors favor the opinion that a normal appendix should be left *in situ*.[23] Twenty-eight out of 38 apparently normal appendix specimens showed inflammatory changes on histopathology in our study (73.6%) and thus, it proves that carrying out an appendectomy is advantageous in cases of negative laparoscopies.

The second most common finding in our study was gynecological pathology and it was possible to deal with all cases at the same setting showing the usefulness of DL in diagnosing and treating gynecological pathologies.[24] Ovarian cysts were a common finding in our study at 16%. Literature reports reiterate that any ovarian cysts found during laparoscopy can be treated laparoscopically[25] and in a cases of ovarian torsion, laparoscopic surgery may even be superior to open[26] and suitable even in pregnancy. Endometriomas were also encountered and were dealt with effectively. However, diagnosing endometriosis during laparoscopy can be difficult and is dependent on the surgeon's level of experience as its appearance can vary widely.[27,28]

In our study, 15 cases of suspected abdominal tuberculosis were biopsied and all were later proved by histopathology. The main finding was peritoneal +/– visceral tubercles in these cases. A further 11 patients had nonspecific findings (Table 3). Suspicious lesions were biopsied and free peritoneal fluid also aspirated. A histopathologic diagnosis was established in these cases and expert management instituted later on (3 cases of cirrhosis, 3 hepatoma and 5 lymphomas). Hence, these patients were saved from unnecessary laparotomies for nonresectable/nonsurgical pathologies.[29] Also DL safely provides adequate tissue for full Histologic evaluation allowing a change in the management of such patients.

We excluded trauma patients from our study as carrying out an immediate DL usually proves difficult due to non-availability of technical expertise at all times but DL has a role in trauma patients as well provided the patient is stable hemodynamically. It has been documented by two randomized studies.[30,31] However, this is an evolving field.

Mean hospital stay in our study was low as reported by other studies as well.[32] Follow-up of our patients showed an improvement in the symptoms in a majority of cases with very interventions needed post-laparoscopy. Chronic cases of abdominal pain also showed an improvement in their symptoms although 4.1% (n = 7) cases remained undiagnosed.

CONCLUSION

Diagnostic laparoscopy is a safe minimally invasive diagnostic cum therapeutic tool which has a high efficacy in diagnosing and managing acute and chronic abdominal conditions. It reduces morbidity, allows diagnosis and treatment in the same setting in a majority of instances, decreases hospital length of stay, decreases the cost of investigations and also the overall cost of treatment and has a degree of positive psychological impact on patients suffering from NSAP of chronic nature. Hence, it can be safely said that diagnostic laparoscopy is a safe and effective alternative to diagnostic laparotomy. There is need to make this modality readily available to the general population especially those in the lesser developed parts of the world.

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ORIGINAL ARTICLE

Prospective Randomized Trial of Low Pressure Pneumoperitoneum for Reduction of Shoulder Tip Pain following Laparoscopic Cholecystectomy: A Comparative Study

[1]Muzzafar Zaman, [2]Kunal Chowdhary, [3]Pradeep Goyal

ABSTRACT

Background: Abdominal pain and shoulder tip pain after laparoscopic cholecystectomy are distressing for the patient. Various causes of this pain are peritoneal stretching and diaphragmatic irritation by high intra-abdominal pressure caused by pneumoperitoneum. We designed a study to compare the postoperative pain after laparoscopic cholecystectomy at low pressure (7-8 mm Hg) and standard pressure technique (12-14 mm Hg).

Aim: To compare the effect of low pressure and standard pressure pneumoperitoneum in post-laparoscopic cholecystectomy pain. Further to study, the safety of low pressure pneumoperitoneum in laparoscopic cholecystectomy.

Settings and design: A prospective randomized double blind study.

Materials and methods: A prospective randomized double blind study was done in 50 ASA grade I and II patients. They were divided into two groups—25 each. Group A, patients underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum (7-8 mm Hg) while group B, underwent laparoscopic cholecystectomy with standard pressure pneumoperitoneum (12-14 mm Hg). Both the groups were compared for pain intensity, analgesic requirement and complications. Shoulder tip pain was recorded on a visual analog pain scale 1, 6, 12, 24 and 48 hours after operation.

Statistical analysis: Demographic data and intraoperative complications were analyzed using Chi-square test. Frequency of pain, intensity of pain, analgesics consumption and other pneumoperitoneum related complications were compared by applying ANOVA test.

Results: Postoperative pain score was significantly less in low pressure group as compared to standard pressure group. Number of patients requiring rescue analgesic doses was more in standard pressure group. This was statistically significant. Also total analgesic consumption was more in standard pressure group. There was no difference in intraoperative complications.

Conclusion: This study demonstrates the use of simple expedient of reducing the pressure of pneumoperitoneum to 8 mm results in reduction in both intensity and frequency of postoperative pain, and hence early recovery and better outcome. This study also shows that low pressure technique is safe with comparable rate of intraoperative complications.

Keywords: Laparoscopic cholecystectomy, Low pressure pneumoperitoneum, Shoulder tip pain.

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INTRODUCTION

Carbon dioxide is the commonest means of achieving pneumoperitoneum in modern minimal access surgery worldwide and it is the same gas responsible for postoperative shoulder tip pain. The reported incidence of shoulder tip pain following laparoscopic cholecystectomy is 30 to 50%.[1,2] Carbon dioxide is used for insufflations as it is 200 times more diffusible than oxygen, rapidly cleared by the lungs and does not support the combustion. Carbon dioxide when comes in contact with peritoneal fluid converts into carbonic acid which irritates diaphragm causing shoulder tip pain and discomfort in abdomen.

AIMS AND OBJECTIVES

The aim of this study is to see whether low pressure (10 mm Hg) laparoscopic cholecystectomy can be considered as the standard technique for uncomplicated symptomatic gall stone disease.

MATERIALS AND METHODS

The study was carried out in the Department of General Surgery, MMU Medical College and Hospital, Solan, from July 2014 to March 2015.

Inclusion Criteria

- Age 18 to 60 years
- Cholelithiasis (uncomplicated).

Exclusion Criteria

- Acute cholecystitis
- Age < 18 and > 60
- Pregnancy.

Table 1: Frequency of occurrence of shoulder tip pain was significantly higher in group B

	Group A		Group B	
	Number	*Percentage*	*Number*	*Percentage*
Patient having shoulder tip pain	2	8	8	32
Patient not having shoulder tip pain	23	92	17	68
Total	25	100	25	100

Table 2: Comparison of mean VAS among two groups

Groups	*Mean*	*SD*
A	0.92	3.19
B	5.72	8.59
p-value	0.012	

Classical four port laparoscopic cholecystectomy was done in all the 50 cases. Randomization of cases was done according to randomization chart and standard statistical methods were used for analyzing the outcome of the study p-value < 0.05 showed statistically significant value.

OBSERVATION AND RESULTS

The study was conducted at MMU Medical College and Hospital, Solan. Fifty patients were admitted having gall stone disease and 25 patients (group A) underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum (10 mm Hg) and another 25 patients (group B) underwent the same surgery with standard pressure pneumoperitoneum (14 mm Hg). They were followed-up for postoperative shoulder tip pain, operative time, analgesic consumption, postoperative hospital course and complication rates (Tables 1 and 2).

Comparison of shoulder tip pain in two groups.

Comparison of mean visual analog score (VAS) among two groups.

Visual analog score was significantly higher in group B.

Our findings are similar to the study carried out by Khetri et al.[4]

DISCUSSION

The advent of laparoscopic cholecystectomy is a milestone achieved in the treatment of gallstones. Though there have been obvious advantages of laparoscopic cholecystectomy but postoperative shoulder tip pain is still a very common and distressing complaint. The origin of referred pain to shoulder after laparoscopic cholecystectomy is poorly understood. The tissue trauma theory is based on stretching of the peritoneum and diaphragm secondary to pneumoperitoneum[7] resulting in release of inflammatory mediators that elicits referred pain to shoulder.[3,8] Another theory is based on pockets of residual CO_2 gas left in the abdomen after surgery.[1] The last theory is based on the assumption that CO_2 gas is converted to carbonic acid on the moist surface of peritoneum which irritates diaphragm leading to shoulder tip pain.

In our study, the frequency of shoulder tip pain was significantly lower in the group that underwent laparoscopic cholecystectomy with low pressure pneumoperitoneum compared to standard pressure pneumoperitoneum. Only two patients (8%) in group A and eight patients (32%) in group B suffered shoulder tip pain which is statistically significant with p < 0.05. Our findings are similar to Khetri,[4] Kandil,[3] Barczynski et al.[6] The intensity of shoulder tip pain was significantly lower in group A at 8, 12, 24, 48 hours than group B as recorded on VAS. In group A, the mean analgesic consumption was 123 mg as compared to group B which was 195 mg with p-valve of 0.04 which is statistically significant. Joshipura et al,[9] Kandil,[3] Barczynski et al[5] showed similar findings.

CONCLUSION

This study demonstrates that the use of simple expedient of reducing the pressure of the pneumoperitoneum to 10 mm Hg results in significant reduction in both the intensity and frequency of postoperative shoulder tip pain, had shorter hospital stay, early recovery, and hence better outcome. On the basis of these results, the widespread use of low pressure pneumoperitoneum can be used as a standard pressure for uncomplicated gallstone disease.

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ORIGINAL ARTICLE

Coagulation Profile is Randomly done but Never Helps in Preparation of Laparoscopic Surgery

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ABSTRACT

Study objective: To assess the usefulness of practicing preoperative coagulations tests in preparation of laparoscopic surgical procedures.

Design: Retrospective observational study.

Setting: King Fahad Medical City a tertiary-care referral center in Saudi Arabia.

Method: Five hundred and fifty adult patients scheduled for elective laparoscopic surgery were studied to determine whether plan of management was influenced by routinely done bleeding time (BT), platelet count (PC), prothrombin time (PT), activated partial thromboplastin time (APTT) and international normalization ratio (INR).

Results: No intervention or change of management was identified in 463 patients whom coagulation profiles were done routinely as part of preoperative preparation. However, management plan was changed in 5 (5.75%) of 87 patients having indications for coagulation profile test ($p < 0.01$).

Conclusion: The study shows that preoperative screening tests for coagulopathies not suspected on the basis of detailed clinical information are unnecessary and should not be done.

Keywords: Coagulation profile, Indicated test, Indication, Intervention, Screening test.

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INTRODUCTION

Prothrombin time (PT) and activated partial thromboplastin time (APTT), international normalization ratio (INR), platelet count (PC) and bleeding time (BT) are commonly ordered by clinicians as part of preoperative assessment. In preparation of patient for laparoscopic procedure these tests are never missed in KSA and some other countries like India. In Bangladesh though coagulation profile is not mandatory for all patients but still it is widely practiced by the surgeons and anesthesiologists before laparoscopic procedure.

Evidence-based guidelines on the use of preoperative tests before elective surgery have been published by the national institute for clinical excellence (NICE) a government organization in the UK in 2003 where these tests were not recommended routinely either in adult or in children before elective procedure in the absence of positive family or personal history of bleeding disorder. More recently British Committee for Standards in Haematology has confirmed the NICE guidelines appropriateness regarding this.[2] American Society of Anesthesiology (ASA) has published an advisory in 2002 saying that patient with negative abnormal bleeding history does not require coagulation screening prior to surgery.[3] A prospective study showed proper history taking can safely and effectively supplement preoperative screening test for coagulopathy.[4] British committee for standards in haematology also stated that unnecessary testing can delay surgery in appropriately because of low positive predictive value of these tests.[2] Canadian anesthesiologist society (CAS) published a simple guidelines regarding routine preoperative coagulation test.[5] In a systemic review done in Johns Hopkins University School of Medicine in 2005 conclude that there is very insufficient evidence to conclude that abnormal test results predict peroperative bleeding and suggested RCT to provide strong evidence.[6] On the other hand, Italian Society for Haemostasis and thrombosis recommended that PT, PTT, INR should be performed routinely before any invasive or surgical procedure.[7] There are many other studies and case reports supporting preoperative some sorts of coagulation profile.[8,9] Most of the country in Europe follow NICE guidelines and some other country is trying to prove this thought in their population for specific

operations. For instance, coagulation status is routinely checked before any operative procedure in Germany but German Society for Ear-Nose-Throat-Medicine, Head and Neck Surgery (DGHNO), the Working Group Paediatric Anaesthesiology of the German Society of Anaesthesiology and Intensive Care Medicine (DGAI), the German Society of Paediatric Medicine (DGKJ), and the Paediatric Committee of the German Society of Thrombosis and Haemostasis Research (GTH), published in the Deutsches Ärzte blatt in 2006, stressed that coagulation screening is not useful in the preoperative setting and advised to draw more attention on the patient's detailed history.[10]

It is obvious that preoperative routine coagulation profile is still in practice and a matter of contention between the physicians. In most of the country, it is considered as an obligatory part of preoperative evaluation for laparoscopic surgery. One of the reasons behind that is surgeon is very much cautious about bleeding during laparoscopic procedures, others are more general, to detect unsuspected abnormalities that might influence the risk of operative morbidity and mortality; establishing a baseline value for a test that has a likelihood of being monitored and changing after the surgical procedure; for medicolegal reasons; and as a tradition in individual institutional practices.

Here in Saudi Arabia, we found that no patients undergo elective surgical procedures without coagulation testing. In our institution, a tertiary referral hospital in the capital drawing a general catchment from all over the country PT, PTT, INR, BT and PC is a routine practice for all elective surgical patients. Science already proven that routine preoperative investigations is not necessary by the major medical societies of the world, we decided to check if there is any role of coagulation profile in preparation of patient for laparoscopy surgery.

STUDY DESIGN

Retrospective chart review.

SETTINGS

Department of surgical specialties, King Fahad Medical City a tertiary care super specialized referral center, Riyadh, Saudi Arabia.

METHODS

Upon approval from institutional review board (IRB) all patients underwent elective laparoscopy surgery in the year 2009 was identified from operation theater and anesthesia department co-ordinated data base system. We excluded pediatric patients, emergency procedures and pregnant patients. Elective surgery was defined as scheduled operation list published and distributed day before surgery.

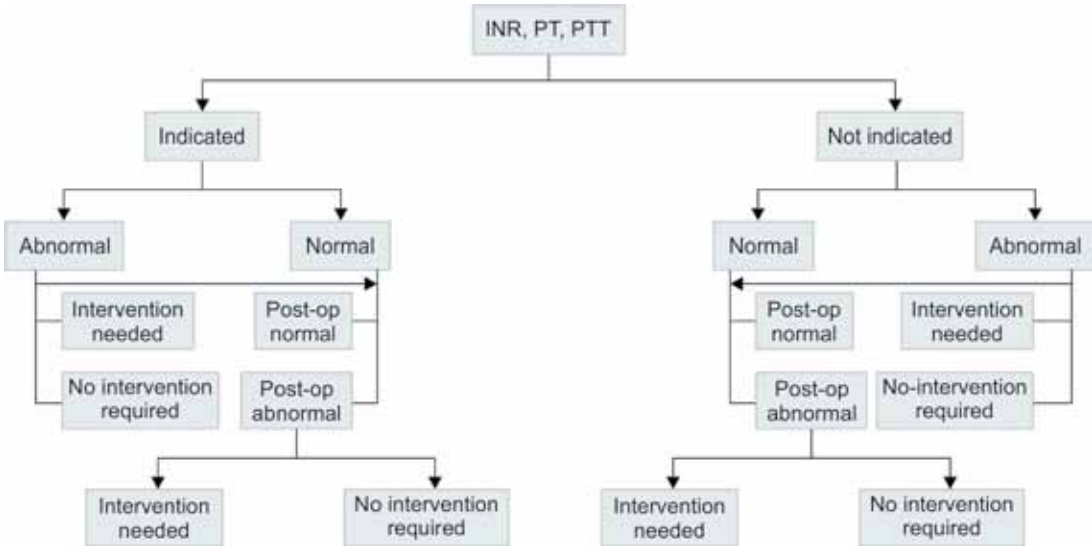
To identify patients predisposed to an abnormal coagulation system, a comprehensive list of indications (Table 1) for preoperative coagulation testing was derived with guidance of CAS guidelines, ASA advisory and Harvard medical school study.[11] Based upon the listed questionnaire patients file was reviewed to divide them into 'Indicated test group' and 'Screening test group'. Indicated test group patients were those whom coagulation test results might had been abnormal due to specific findings in history and physical examination. Screening tests group patients were those whom these investigations were not specifically needed; therefore, were done as screening for an unsuspected coagulopathy (Flow Chart 1).

Preoperative INR, PT, PTT, BT and PC results recorded from hospital electronic data base system. Postoperative results (up to 28 days postoperative period) also searched and recorded when available. Any change of management plan to overcome the abnormal results termed as 'Intervention', was identified from physician order documented in the file. Cancellation of procedure, transfusion of packed RBC, whole blood in excess of normal due to coagulopathy, transfusion of fresh frozen plasma, platelets, or other coagulation factors and Vit K

Table 1: Indications to request preoperative coagulation profile

• Bleeding diathesis, Family history of bleeding disorder	Prolonged bleeding
	Excessive bleeding
	Easy bruising
	Unable to give history
• Anticoagulant therapy	Aspirin
	Heparin, Enoxaparine
	Dipyridamole
	Warfarin
	Nonsteroidal anti-inflammatory drugs
• Past medical history	History of deep venous thrombosis or pulmonary embolism.
	Chronic renal failure on dialysis
	Cirrhosis, jaundice
	Splenic disease
	Platelet dysfunction
	Thrombocytopenia
• Malignancy	Metastatic carcinoma
	Malignancy with radio-chemotherapy
• Physical examinations	Petechiae
	Ecchymosis
	Jaundice
	Hepatomegaly, nodular liver
	Ascitis
	Splenomegaly

Flow Chart 1: Study scheme showing group differentiation



injection were taken as intervention, whereas preparation of packed RBC or total blood in an operative procedure where generally not ordered is also considered as change of management. Preoperative blood transfusion for anemia or blood transfusion for major surgery in absence of positive bleeding history was not considered as interventions for coagulation profile tests.

Statistical comparisons between the two groups in context of required interventions were made using Fisher's exact test, with the level of significance taken as $p < 0.05$.

RESULTS

A total 550 adult patient underwent elective laparoscopic surgery, of them 461 (83.82%) patients was female (Table 2). Laparoscopic cholecystectomy (Table 3) was the commonest procedure 245 (44.55%).

Among the 87 patients whom the coagulation profile was indicated, 14 (16.09%) patients had abnormal results, requiring intervention preoperatively for 5 (5.75%) patients (Table 4). Four hundred and sixty-three patients were in the screening test group. Of those, 455 (98.27%) patients were found to have normal results. Even the 8 (1.73%) patients with abnormal results did not require any intervention. The difference in the change of management (Table 4) between the two groups were highly significant ($p < 0.01$).

Among the test indicated group test was repeated at least once or multiple times in 45 patients (Table 5). Nine patients had once or more than once abnormal results and interventions were needed in 4 patients. On the other hand, 113 patients of the screening group were found to have coagulation profile repeated within 28 days postoperative period, only three patients had abnormal results, again not needing any active management.

DISCUSSION

The current study is the first ever evaluation regarding the usefulness of routine preoperative coagulation testing in case of only laparoscopic surgery patients. Comprehensive criteria derived from the patient history and physical examinations were used to determine that preoperative coagulation testing was indicated or not. The questionnaire was designed to supplement the standard history and physical examination by the chart reviewing physicians. It was made by assistance of a number of strong

Table 2: Demographic data and distribution of patients

Patients (n)	*Number*	*Percentage*
Total	550	100
Male	89	16.18
Female	461	83.82
General surgery	301	54.72
Gynecology	224	40.73
Urology	25	04.55

Table 3: Laparoscopic procedures performed

Name	*Number*	*Percentage*
Laparoscopic cholecystectomy	245	44.55
Laparoscopic ovarian cystectomy/ Oophorectomy/salpingo-oophorectomy	63	11.46
Total laparoscopic hysterectomy and laparoscopy-assisted vaginal hysterectomy	62	11.27
Diagnostic laparoscopy with or without hysteroscopy	46	8.36
Laparoscopic myomectomy	29	5.27
Laparoscopic sleeve gastrectomy	23	4.18
Laparoscopic colorectal procedures	20	3.64
Laparoscopic pancreatectomy, splenectomy, adrenalectomy, Nephrectomy	17	3.09
Laparoscopic vericocelectomy	13	2.36
Others	32	5.82
Total	550	100

Table 4: Summary of the coagulation profile results ($p < 0.01$)

Test indicated			*Screening test*		
Normal	*Total abnormal*	*Abnormal with intervention*	*Normal*	*Total abnormal*	*Abnormal with intervention*
73	14	5	455	8	0
83.91%	16.09%	5.75% (35.71%)*	98.27%	1.73%	—
Total number of patients = 87 (15.82%)			Total number of patients = 463 (84.18%)		

*35.71% of abnormal results (5 of 14) needed intervention which were 5.75% of total (5 of 87)

Table 5: Available postoperative coagulation profile results ($p < 0.01$)

Test indicated group			*Screening test group*		
Normal	*Total abnormal*	*Abnormal with intervention*	*Normal*	*Total abnormal*	*Abnormal with intervention*
36	9	4	110	3	0
Total number of patients = 45			Total number of patients = 113		

international guidelines CAS, ASA and Harvard medical school study to keep the evaluation process simple and which can be a tool for the surgeon and anesthetist for preoperative assessment of patient in future. When these criteria were applied to the general, gynecological and urological elective surgery patients who had been operated laparoscopically, 87 (15.82%) of them had at least one indication for the test. In 84.18% (463) of the patient test were not indicated were truly screening tests for an occult coagulopathy because they could not have been otherwise suspected. Although 1.73% of the screening tests were abnormal, all ignored by the surgeon and anesthetist, because they were marginally prolonged. Literature also suggests that minimally deranged coagulation result have a poor predictive value for a surgically significant coagulopathy.[12] Following an abnormal test result clinicians may go for correction of it, whereas a serious abnormality may suggest the surgery to be cancelled or delayed. But commonly most abnormalities are simply ignored. As per Roizen MF clinicians ignore more than 60% of abnormalities discovered on routine preoperative tests.[13] In our patients, 35.71% of abnormal results in indicated test group were taken for active management by the physicians others were simply ignored, whereas all[8] the abnormal results were amenable to overlook in screening test group.

Postoperatively (up to 28 days), some patients with major surgery and had to stay in hospital for couple of days, found to have repeat coagulation profile. Again there was no intervention identified in screening test group in comparison to four interventions in patients of indicated test group. We did not put emphasis on these findings in our study as all the patient had not gone through the same investigations after operation, although it gave an idea that illogical coagulation profile has no role in laparoscopic surgical procedures even in postoperative period.

Our study is retrospective; our control and study groups were not matched in number, age and sex, which could have influenced our test of significance. Most of our patients are female 461 (83.82%) this was because gynecological laparoscopic procedures 224 (40.73%) were included in the study. Moreover, our single most performed surgery was laparoscopic cholecystectomy which was also overtly dominated by female. We found a relatively high number of abnormal results in the screening test groups because we followed our local hospital definitions of abnormal results, rather than the more practical 'action limits'. We also considered total test result as abnormal when any component of the test breached the reference value. For instance, we labeled total coagulation profile as abnormal when any one of PT, APTT, INR, BT or PC being abnormal, As such, very few actual interventions were needed for these abnormal results. We considered the change of management plan named as intervention to differentiate between the results of two groups, as minor change of test value has no real benefits to calculate. Test values also fluctuate by reagent used and analyzer machines.

In summary, we could not appreciate any special clue or danger to carry on with the same traditional practice of routine preoperative coagulation tests for laparoscopic procedures. The results of our study show that most tests 84.18% (463, Table 4) ordered at our institution are incompatible with the applicable published guidelines. To follow established guidelines is usually the exception and not the rule in the majority of health institutions in the World. This failure to convert recommendations into practice is often not related to the content or quality of the guidelines themselves but is more related to difficulty changing established behavior of clinicians and institutions in addition to failure of dissemination, cost, and doubt of guideline's applicability in local populations.[14] We hope that our study result will be a guideline for asking coagulation profile tests in KSA as well as Bangladesh which will reduce the unnecessary financial burden on the society and patients.

CONCLUSION

It can be suggested based on our findings that routine preoperative PT, APTT, INR, BT, PC can be safely eliminated from preparation of patient for laparoscopic procedures by careful history taking and clinical examinations without endangering patient's life or adversely affecting the outcome.

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RANDOMIZED CONTROL TRIAL

Effect of Warm-up Exercises on Laparoscopic Trainer: Improvement of Operator Smoothness

[1]Nava Navaneethan, [2]Peter Hewett

ABSTRACT

Background: Several recent studies have produced conflicting results of warming up prior to laparoscopic surgery and surgical performance. The purpose of this study was to investigate whether warming up prior to a laparoscopic task improves a subsequent task performed on a laparoscopic trainer.

Materials and methods: A prospective randomized controlled trial was conducted to compare warm-up modalities to no warm-up. The study was conducted at a single site, with 44 participants, including surgeons, medical students and surgical trainees. Randomization done within each group.

Control group was asked to do a designated task without a warm-up. Warm-up groups were asked to perform a warm-up exercise prior to the designated task. Performances were recorded and analyzed with a computerized software different performance parameters were compared.

Results: Warm-up was a significant predictor of smoothness of the operator's hand movement at the 5% significance level ($p = 0.0358$).

While there were some improvement of performances between control groups was demonstrated, they were not clinically significant.

Conclusion: This study shows that warming up prior to a task has a positive influence in the subsequent performance in smoothness of instrument movement in surgeons group. The major limitation of the study was the number of participants.

Keywords: Exercises, Laparoscopy, Simulation, Training, Warm-up.

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INTRODUCTION

Preperformance practice is standard in many nonsurgical fields. Warming up is ubiquitous among athletes, musicians, artists and military personnel. Preperformance warm-up often consists of both mental and physical exercises. Studies have demonstrated that mental practice can significantly improve performance among not only in athletes but also in surgeons as well. Conflicting results are found among studies, with some smaller studies[1] showing improvement in subsequent performance and no improvement in another study.[2] Aim of this study is to analyze surgeon's performance in performing designated tasks in laparoscopic trainers with and without warm-up exercises, using multiple metrics analysis of performance including the speed. It is expected that warming up on a similar situation not only improves the speed but also helps the brain to adopt a 2 D perception quicker.

A similar study performed to compare the effects of warming up found no effect but the warming up exercises were not similar to actual surgical procedure in this study and analysis of surgical performance was subjective of investigator bias.[2] By using a computerized performance analysis the subjective investigator bias is eliminated.

MATERIALS AND METHODS

Surgeons, surgical trainees and medical students (total of 44) are randomized for control or post warm-up groups and tested for their speed and 3 other performance metrics.

Participants were given written explanation and written consent is obtained. An ethical approval was obtained for the study.

Control participants are tested for their speed and performance of a specific task A on a laparoscopic trainer.

Post warm-up group had warming up task B on a laparoscopic trainer for 10 minutes followed by the same specific task A.

(Task A threading through pegs)

(Task B applying paper clip chain on pegs).

The procedure was recorded and performances were analyzed with INSTRAC software program.

Outcome measures checked.

Following metrics were measured:

1. Average speed/time taken to complete the task
2. Acceleration
3. Smoothness
4. Working area.

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Statistical Analysis

Performance on the laparoscopic trainer is recorded and analyzed by a software (INSTRAC) and quantitative measures are obtained.

Data were analyzed using a general linear model testing. For all statistical analyses, a p-value less than 0.05 was considered statistically significant (Flow Chart 1).

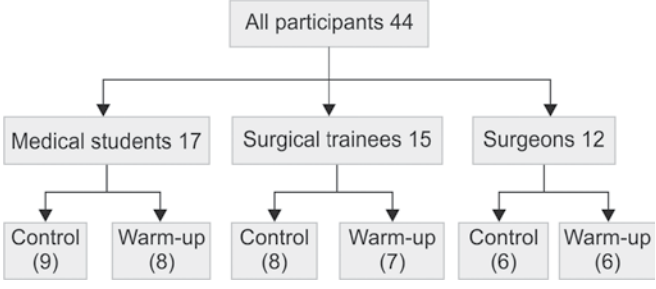
RESULTS

Descriptive statistics were produced for each of the four response variables (time, acceleration, smoothness and working areas) by surgical level (medical student, surgical trainee and surgeon) and warm-up.

A general linear model was fit to test the effect of surgical level and warm-up on each of the four response variables. The results of the 4 models are summarized below (Table 1).

Surgical level was a significant predictor of time when controlling for warm-up (p = 0.0112). But warm-up was not a significant predictor for time when controlling for surgical level (p = 0.9589). In other words, there is evidence that surgical level has an effect on time. While warm-up reduced the mean time of operation in surgeons and medical students group. But they were not to the level of clinically significant.

Flow Chart 1: Consort diagram for the study population



The interaction effect of surgical level and warm-up was not included in the model because it was not a significant predictor of time. A significant interaction effect would suggest that the effect of warming up differs between surgical levels (i.e. if warming up resulted in lower times for medical students, but did not make any difference to time for surgeons). The interaction effect was not significant in this model though, suggesting that the effect of warming up was the same for medical students, surgical trainees and surgeons.

Post hoc comparisons of the surgical level group were performed to compare mean times between the surgical levels. This showed that surgeons had significantly lower mean time than medical students (p = 0.0084) and surgical trainees (p = 0.0072). There was no significant difference between mean time for surgical trainees and medical students (p = 0.9145) (Graph 1 and Table 2).

Surgical level was a significant predictor of acceleration (p = 0.0004), While warm-up improved acceleration in all groups but warm-up was not clinically significant (p = 0.2157).

Post hoc comparisons of the surgical level group showed surgeons had significantly lower mean acceleration than medical students (p = 0.0035) and surgical trainees (p = 0.0001). There was no significant difference between mean acceleration for surgical trainees and medical students (p = 0.1677) (Graph 2).

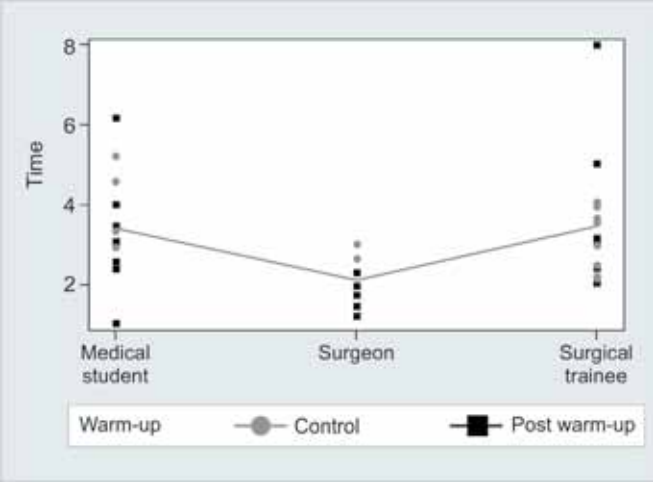
Both surgical level and warm-up were a significant predictor of smoothness at the 5% significance level (p = 0.0001 and p = 0.0358, respectively). Post hoc comparisons of the surgical level group showed surgeons had significantly higher mean smoothness than medical students (p < 0.0001) and surgical trainees (p = 0.0009). There was no significant difference between mean smoothness for surgical trainees and medical students (p = 0.3064).

Table 1: Analysis variable: time

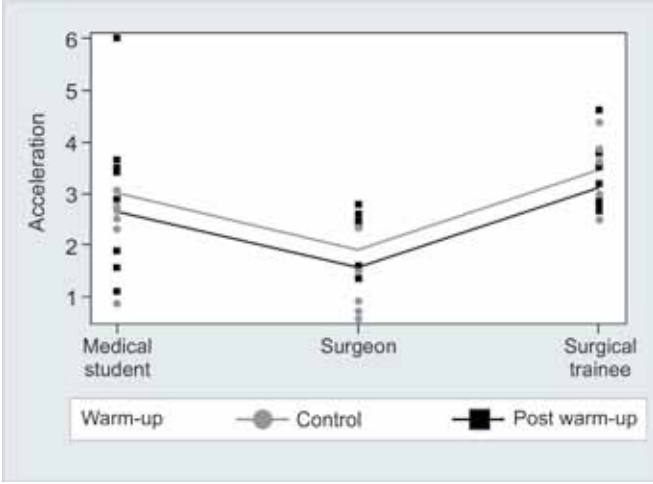
Operator	*Warm-up*	*Participants*	*Mean*	*Std dev*	*Minimum*	*Maximum*
Medical student	Control	9	3.48	0.93	2.45	5.21
	Post warm-up	8	3.35	1.50	1.04	6.16
Surgeon	Control	6	2.44	0.55	1.65	3.01
	Post warm-up	6	1.83	0.43	1.22	2.31
Surgical trainee	Control	8	3.14	0.77	2.14	4.06
	Post warm-up	7	3.83	2.06	2.03	8.00

Table 2: Analysis variable: acceleration

Operator	*Warm-up*	*Participants*	*Mean*	*Std dev*	*Minimum*	*Maximum*
Medical student	Control	9	2.64	0.80	0.87	3.65
	Post warm-up	8	3.01	1.55	1.12	6.00
Surgeon	Control	6	1.42	0.84	0.58	2.50
	Post warm-up	6	2.07	0.61	1.36	2.80
Surgical trainee	Control	8	3.22	0.66	2.49	4.38
	Post warm-up	7	3.32	0.77	2.66	4.62



Graph 1: Interaction plot for time

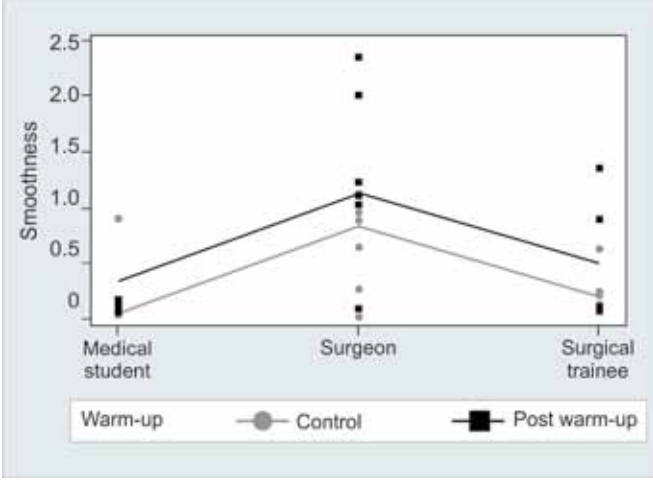


Graph 2: Interaction plot for acceleration

Post hoc comparisons of warm-up showed that those who had warmed up had significantly higher mean smoothness than those in the control group (p = 0.0358) (Graph 3 and Table 3).

Surgical level was a significant predictor of working areas (p = 0.0125). While warm warm-up reduces straying it was not significant the 5% level (p = 0.0562).

Post hoc comparisons of the surgical level group showed surgeons had significantly lower mean working areas than surgical trainees (p = 0.0039). Medical student also had significantly lower mean working areas than surgical trainees (p = 0.0470). There was no significant difference between mean working areas for surgeons and medical students (p = 0.1677) (Graph 4 and Table 4).



Graph 3: Interaction plot for smoothness

DISCUSSION

Minimally invasive surgery (MIS) has revolutionized the way surgeries are performed since its introduction and many open procedures are almost replaced by MIS because of the benefits for patients. Overall, the minimal incisions reduce postoperative pain and lead to earlier mobilization of patients and, therefore, shorter hospital stays. However, MIS is challenging for the surgeons performing the operation, because of the reduced tactile feedback and a loss of 3-dimensional (3D) vision. For trainees learning curves are longer and surgeries take longer time, triggering the need to find ways to improve speed and performance in the operating theater.[10]

This study was aimed to investigate the hypothesis that a warm-up activity prior to laparoscopic task on a simulator improves subsequent performance of specified task.

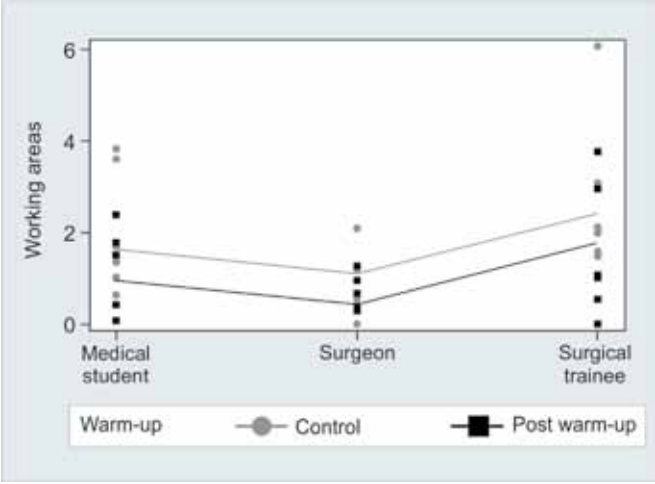
The performance was analyzed using a software named INSTRAC which analyses multiple movement metrics. A study performed by Rowland et al demonstrated the construct validity of the software.

Table 5 formulas used to calculate metrics reproduced with permission.

This study was performed with 23 controls and 21 participants. controls were recruited for each group (Surgeons, Surgical trainees, and medical students) and

Table 3: Smoothness analysis variable: smoothness

Operator	*Warm-up*	*Participants*	*Mean*	*Std dev*	*Minimum*	*Maximum*
Medical student	Control	9	0.17	0.28	0.04	0.91
	Post warm-up	8	0.21	0.29	0.06	0.92
Surgeon	Control	6	0.65	0.43	0.02	1.12
	Post warm-up	6	1.30	0.80	0.10	2.35
Surgical trainee	Control	8	0.22	0.18	0.09	0.63
	Post warm-up	7	0.50	0.53	0.07	1.36



Graph 4: Interaction plot for working areas

compared with a group who had warm-up prior to the designated task. As expected surgeons performed better in all aspects.

The post warm-up did show some improvement in time effect (speed), acceleration, and working areas but was not clinically significant. These results contrasts the outcome of a previous large randomized control study[2] which found no significant effect on warming up. Compared to the above study, in this study, the metrics are measured with a computer software, thereby observer error is avoided. Nevertheless there are some studies which show positive effect of warming up.[1,3] Due to the limited number in this study, power of the study is inadequate to prove the significance. The smaller number of surgeons participated would have widely varying laparoscopic skills and it is possible that due to sampling error, one arm could have had either very experienced or poor experienced, affecting the results.

Warming-up is routine for athletes and stage performers and there are studies in favor of warming up to improve athletic performance. A systematic review and meta-analysis of 32 studies that investigated performance after warm-up in various sports concluded that performance was improved after a warm-up 79% of the time.[4]

Apart from the main limitation of the study of small numbers, a logical question arises about the interpretation of the results to a clinical context. As the study is entirely performed in a nonclinical set up performance of the operator may be different to a situation, when performed in a clinical scenario. Nevertheless many studies[5,9] have shown the effectiveness of simulation training in improving surgeon's skill in operating room, thereby it could be logically argued that results could be generalized to a clinical context.

Van Heerzele et al (2008)[8] observed that experienced surgeons also benefit from simulator training. In their study, expert endovascular surgeons received a simulator training course, after which they showed shorter real surgery time and fewer errors, and also felt more competent to conduct the procedure. Also, group consistency was higher after the course; they all performed the task about as fast and as safe. Thus, there is evidence that skills acquired in a simulator are indeed transferable to reality and lead to reduction of errors in the operation theater[7] and an improvement in overall performance.[6]

The major difference of this study from the previous studies of similar nature is analyzing the movement and speed using computerized metric assessment tools, thereby not only avoiding the observer error but also analyzing other metrics such as acceleration, areas of tool employment. Handedness of the operator could have been analyzed using the same software but was not performed considering the small number of participants, which may not reflect accurate results.

In conclusion, this study did find a significant effect of warm-up on laparoscopic tasks in most of the

Table 4: Analysis variable: working areas

Operator	*Warm-up*	*Participants*	*Mean*	*Std dev*	*Minimum*	*Maximum*
Medical student	Control	9	1.70	1.26	0.07	3.85
	Post warm-up	8	0.90	0.88	0.07	2.40
Surgeon	Control	6	0.87	0.74	0.01	2.10
	Post warm-up	6	0.71	0.37	0.29	1.29
Surgical trainee	Control	8	2.56	1.51	1.50	6.10
	Post warm-up	7	1.65	1.36	0.01	3.79

Table 5: Formulas used to calculate metrics (Reproduced with permission from Rowland et al[9])

Metric	*Unit*	*Formula/description*
Time (t)	Seconds	
Average speed (as)	mm/second	average speed/time
Motion smoothness	$mm/second^3$	$\sqrt{((t^5/2) \times td^2 \times as^6)}$ td = total distance
Working area	mm	Average distance between instrument tips

performance metrics, but only clinically significant on operator smoothness. The study has major limitations due to the small number of participants.

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LITERATURE REVIEW

Comparison between Robotic Radical Hysterectomy with Laparoscopic and Open Abdominal Radical Hysterectomy in the Treatment of Early Stage Cervical Cancer

Boy Busmar

ABSTRACT

Robot-assisted procedures are being increasingly incorporated in gynecologic oncology. Several studies have confirmed the feasibility and safety of robotic radical hysterectomy for selected patients with early-stage cervical cancer. It has been demonstrated that robotic radical hysterectomy offers an advantage over laparoscopic and open abdominal radical hysterectomy approaches with regard to operative time, blood loss and hospital stay.

Also, initial evidences concerning oncological outcomes seem to confirm the equivalence to traditional open technique. Despite the fact that costs of robotic system are still high, they could be compensated by several health-related and social benefits: less pain, faster dismissal, and return to full activity than other surgical approaches.

Keywords: Abdominal radical hysterectomy, Blood loss, Conversion rate, Early cervical cancer, Hospital stay, Laparoscopic radical hysterectomy, Number of lymph node, Operative time, Postoperative infection, Recurrence, Robot-assisted radical hysterectomy, Urinary tract complication.

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INTRODUCTION

Cervical cancer is the third most common cancer in women, and the seventh overall, with an estimated 5,30,000 new cases in 2008. More than 85% of the global burden occurs in developing countries, where it accounts for 13% of the female cancers. High risk regions are Eastern and Western Africa (Age Standardized incidence Rate (ASR) greater than 30 per 100,000), South Central Asia (ASRs 24.6 per 100,000), South America and Middle Africa (ASRs 23.9 and 23.0 per 100,000 respectively). Rates are lowest in Western Asia, Northern America and Australia/New Zealend (ASRs less than 6 per 100,000).

Cervical cancer remains the most common cancer only in Eastern Africa, South Central Asia and Melanesia. Overall, the mortality incidence ratio is 52%, and cervical cancer is responsible for 2,75,000 deaths in 2008, about 88% of which occur in developing countries.[1]

The gold standard for over 100 years for early stage cervical cancer was open radical hysterectomy with pelvic lymph node dissection, resulting in 5-year survival rates of 75 to 90%. Intermediate risk factors for recurrence after radical hysterectomy include tumor size, lymphovascular space invasion (LVSI), and high risk factors include parametrial involvement, lymph node metastasis, and resection margin involvement.[2]

In 1984, Kurt Semm was the first to describe laparoscopic assistance at the time of vaginal hysterectomy. In 1989 Reich et al, performed the first laparoscopic hysterectomy. Soon after, enthusiastic pioneers claimed laparoscopic hysterectomy to be a better alternative to abdominal hysterectomy because of its lower postoperative morbidity, cosmetic result and reduced costs with no increase in complication rates. Now, it became the new technique to replace abdominal hysterectomy.[3,4]

In the past two decades, the gynecologic oncologic surgeons performed minimally invasive techniques in order to decrease morbidity while maintaining surgical and oncological outcomes.

The laparoscopic approach provides comparable long-term outcomes to open radical hysterectomy by adding benefits of minimally invasive surgery in terms of blood loss, analgesic requirement and hospital stay. Despite all these clear advantages, laparoscopic radical hysterectomy was not widely adopted in surgical practice, probably due to some drawbacks of this technique: long learning curve, two-dimensional (2D) view, poor ergonomics surgeon position, and limited instruments movements. These conditions negatively influenced the surgical performance, resulting in more tremor, fatigue, and subsequent less accuracy.

Robot-assisted technique through the da Vinci surgical system (Intuitive Surgical Inc, Sunnyvale, Calif, USA)

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emerged in the context of minimally invasive surgery to overcome shortcomings of conventional laparoscopy. Robotic system provides three-dimensional (3D) view, more ergonomic surgeon position and articulated wrist-like instruments, increasing surgical precision, and dexterity. Robotic also decrease the fatique that the doctors experience during surgeries that can last several hours. Exhausted surgeon can experience hand tremors as a result. The da Vinci has been programmed to compensate for tremors, so if the surgeons hands shakes, the computer ignores it and keep the mechanical arm steady.

The robotic application grew rapidly in gynecological oncology field, especially for technically challenging procedures by laparoscopy, such as radical hysterectomy.

The use of a robotic system in preset laboratory drills has been associated with faster performance times, increased accuracy, enhanced dexterity, faster suturing, and reduced number of errors when compared to conventional laparoscopic procedure.

Complex operations, such as radical hysterectomy, can be addressed in a more efficient fashion and the skills to perform this procedure are acquired not only in a shorter time but by a larger number of laparotomy surgeons who encountered difficulties with conventional laparoscopy.[4,5]

OBJECTIVE

In the present paper, we sought to review the available descriptive evidences and to compare intraoperative, pathologic finding, and postoperative, oncological outcomes of robot-assisted, laparoscopic and open abdominal radical hysterectomy, in the treatment of early cervical cancer.

MATERIALS AND METHODS

We searched the articles about robotic-assisted radical hysterectomy, laparoscopic radical hysterectomy and abdominal radical hysterectomy of early cervical cancer by google search engine and PubMed. We tried to elaborate the most recent publications.

REVIEW ARTICLES

Mean Operating Time

Longer operative time and learning curve are among the reasons why the minimally invasive staging has not yet been adopted worldwide in gynecological oncology practice. For robotic system, total operative time consists of docking time and console time. The first is the time needed to assemble instruments and attach patient to the robot, advancing the column to the operating table, fastening the robotic arms to the inserted trocars, and introducing the laparoscope. Console time is defined as the surgical time needed to perform the entire operation at the console.[5]

Salicrú and Gil-Moreno et al found the operative time for laparoscopic radical hysterectomy longer than open abdominal radical hysterectomy.[6]

Sert and Abeler describe 35 patients with early cervical cancer who underwent robot assisted radical hysterectomy,[7] laparoscopic radical hysterectomy and 26 abdominal radical hysterectomy, showing mean operating times 263 minutes for robot-assisted radical hysterectomy, 364 minutes for laparoscopic radical hysterectomy and 163 minutes for open abdominal radical hysterectomy.[7]

Kruijdenberg and van den Eiden et al among 342 cases of robotic assisted radical hystetrectomy and 914 cases of total laparoscopic radical hysterectomy, found that there was no statistical difference of mean operative time between the robotic and laparoscopic radical hysterectomy.[8]

A similar operative time was reported by Tinelli et al 323 minutes for robotic assisted radical hysterectomy and 255 minutes for laparoscopic radical hysterectomy ($p < 0.005$).[9]

Retrospective study by Lee and Kang et al also found no statistically significant difference existed between the laparoscopic radical hysterectomy and radical abdominal hysterectomy with respect to operative time.[10]

From a multi-institutional experience Lowe and Chamberlain et al found median operative time for robotic-assisted radical hysterectomy 215 minutes.[11]

From prospective studies of 7 patient who underwent robot-assisted radical hysterectomy and 7 patients who underwent traditional radical hysterectomy, Lowe and Hoekstra et al found the diference of operative time statitically not significant, 260 minutes in robot-assisted radical hysterectomy and 264 minutes in traditional radical hysterectomy.[12]

Estape et al compared 32 patiens who underwent robotic radical hysterectomy with 17 patients laparoscopic radical hysterectomy and 14 patients abdominal radical hysterectomy. Operative time for the robotic group was 2.4 h ± 0.8 and not significantly different from the laparoscopic group at 2.2 ± 0.7 hours nor the laparotomy group (1.9 ± 0.6 hours $p = 0.05$).[13]

Nezhat et al in their prospective analyzed cases of robotic radical hysterectomy and laparoscopic radical hysterectomy found no statistical difference were observed regarding operative time, (323 *vs* 318 minutes.[14]

Table 1 summarizes the means operating time of robotic, laparoscopic and open radical hysterectomy.

Blood Loss and Blood Transfusion

There is general agreement about the significant decrease of intraoperative bleeding in minimally invasive surgery. This benefit is confirmed also for robotic-assisted

Table 1: Operating time (in minute) robotic radical hysterectomy (RRH), laparoscopic radical hysterectomy (LRH) and open radical hysterectomy (ORH)

No. Authors	RRH	LRH	ORH	p
1. Salicrú et al[6]		> ORH		
2. Sert, Abeler[7]	263	364	163	
3. Kruijdenberg et al[8]	NS	NS		
4. Tinelli et al[9]	323	255		< 0.005
5. Lee et al[10]		NS	NS	
6. Lowe et al[11]	215			
7. Lowe et al[12]	260		264	NS
8. Estape et al[13]	2.4 ± 0.8	2.2 ± 0.7	1.9 ± 0.6	NS, 0.05
9. Nezhat et al[14]	323	318		NS

technique. The literature reported similar values of blood loss comparing robotic with laparoscopic radical hysterectomy, with important differences with respect to open surgery.

Among their 68 cases of robotic, laparoscopic and laparotomy radical hysterectomy, Sert and Abeler reported mean blood loss was 82 ± 74 ml, 164 ± 131 ml, and 595 ± 28 ml, respectively ($p < 0.0001$, $p = 0.023$).[7]

In comparison between robotic *vs* total laparoscopic radical hysterectomy, Kruijdenberg et al reported that among their 342 cases of robotic radical hysterectomy and 914 total laparoscopic radical hysterectomy, only 5.4% cases should get transfusion in robotic group and 9.7% cases in laparoscopic group, $p < 0.05$.[8]

Tinelli et al in their multicenter study found that mean blood loss was more in robot assisted radical hysterectomy in comparison to laparoscopic radical hysterectomy, 157 ml (CI 95%, 50–400) *vs* 95 ml (CI 95%, 30–500).[9]

Lee, Kang and Kim, found less blood loss in radical laparoscopy in comparison to radical abdominal hysterectomy, 414.3 ml in laparoscopic radical hysterectomy *vs* 836.0 in abdominal radical hysterectomy, $p < 0.001$. Blood tansfusion only 20% in laparoscopic radical hysterectomy in comparrison to 47.9% in abdominal radical hysterectomy, $p < 003$.[10]

Lowe and Chamberlain et al reported a mean blood loss of 50 ml and no transfusion among 42 patients who underwent robotic radical hysterectomy.[11]

Lowe and Hoekstra et al in their prospective study found significant difference of blood loss between robotic radical hysterectomy and abdominal radical hysterectomy, 75 and 700 ml, respectively.[12]

The estimated blood loss for patients undergoing robotic hysterectomy was 130 cm ± 119.4. This was significantly less than the laparotomy group (621.4 ml ± 294.0, $p < 0.0001$), but not the laparoscopic group (209.4 ml ± 169.9, $p = 0.09$). This data came from 32, 17 and 14 patients who underwent robotic, laparoscopic and abdominal radical hysterectomy as reported by Estape et al.[13]

In their prospective analyzed cases who underwent robotic radical hysterectomy and laparoscopic radical hysterectomy, Nezhat et al reported that there is no statistical difference regarding estimated blood loss between the two group (157 *vs* 200 ml).[14]

Nam and Kim, in 32 cases of robotis and 32 cases of abdomonal radical hysterectomy, found mean blood loss 220 ml in robotic radical hysterectomy and 531 ml in abdominal radical hysterectomy, $p < 0.001$.[15]

Table 2 summarizes the means intraoperative blood loss of robotic, laparoscopic and open radical hysterectomy.

Intraoperative Complications

An intraoperative complications rate was found lower in robot assisted and laparoscopic paroscopic technique, than open approach, due to a more accurate tissue manipulation and a better anatomic visualization. Robotic surgery may further reduce intraoperative morbidity and improve surgical precision as a consequence of several technical advantages over conventional laparoscopy. Urinary injuries, which may happen during ureterolysis and bladder isolation steps, are frequent reported complications for radical hysterectomy.

The multi-institutional experience by Lowe and Chamberlain et al reported one bladder injury adjacent to the trigone and one ureteral injury (2.4%) and one conversion to laparotomy.[11]

On the contrary, Nezhat et al did not note significant differences between robotic and laparoscopic approach with respect to intraoperative complications: in both groups two incidental cystotomies were described.[14]

Sert and Eraker described, among 25 robotic radical hysterectomies, three cases of bladder perforation, which were successfully repaired robotically.[16]

Table 2: Intraoperative blood loss (in ml) of robot radical hysterectomy (RRH), laparoscopic radical hysterectomy (LRH) and open radical hysterectomy (ORH)

No. Authors	RRH	LRH	ORH	p
1. Sert, Abeler[7]	82 ± 74	64 ± 131	595 ± 28	< 0.0001, 0.023
2. Kruijdenberg et al[8]	NS	NS		
3. Tinelli et al[9]	157	95		
4. Lee et al[10]		414.3	836.0	< 0.001
5. Lowe et al[11]	50			
6. Lowe et al[12]	75		700	
7. Estape[13]	130 ± 119.4	209.4 ± 169.9	621 ± 294.4	< 0.0001, 0.09
8. Nezhat et al[14]	NS	NS		
9. Nam, Kim[15]	220		531	< 0.001

Postoperative Complications

Wound infection following laparoscopy is less but not rare. Many types of post laparoscopic surgery has been reported including bladder infection, pelvic cellulitis and pelvic abces.[4]

There are evidences of an increased relative risk of vaginal cuff complications for minimally invasive hysterectomy techniques when compared to vaginal or abdominal ones. It may be associated with an extensive use of monopolar and bipolar electrosurgery, which may increase thermal injury and devascularization of the cuff site. Other organs are also at risk of thermal injury. Thermal injury to bowel may be more difficult to diagnose intraoperatively.[4]

Kruijdenberg et al from 342 cases of robotic assisted radical hysterectomy and 914 laparoscopic radical hysterectomy reported 9.6 and 5.5% postoperative complication respectively ($p < 0.05$).[8]

Lowe and Chamberlain et al reported an experience from multi-institutional, 12% postoperative complications, including: one (2.4%) deep venous thrombosis (DVT), 7.2% infection, and 2.4% bladder/urinary tract complication.[11]

Estape et al reported that the incidence of postoperative complications was less in the robotic cohort (18.8%) as compared to the laparoscopic (23.5%), and laparotomy cohorts (28.6%), a.[13]

Ucella et al reported vaginal dehiscence in 2 of 665 (0.3%) patients after laparoscopic hysterectomies with transvaginal colporrhaphy. Their literature search identified postoperative vaginal separation 91 of 13.030 (0.66%) endoscopic hysterectomies. The incidence of vaginal dehiscence was lower for transvaginal cuff closure (0.18%) than for both laparoscopic [0.64%; odds ratio (OR), 0.28; 95% confidence interval (CI), 0.12–0.65] and robotic (1.64%; OR, 0.11; 95% CI, 0.04–0.26) colporraphy. Laparoscopic cuff closure was associated with a lower risk of dehiscence than robotic closure (OR, 0.38; 95% CI, 0.28 to 0.6).[17]

Vaginal cuff separation is a rare but a serious complication following hysterectomy. Nick et al reported among 36 laparoscopic radical hysterectomy and 19 robotic-assisted radical hysterectomy, 7 (1.7%) developed a cuff complication. Three (1.1%) patients in the laparoscopy group suffered a vaginal cuff evisceration (n = 2) or separation (n = 1). Four patients in the robotic group (3.0%) had a vaginal evisceration (n = 1) or separation (n = 3). Vaginal cuff complication were 9.46 fold higher among patients who had a radical hysterectomy ($p < 0.01$). Median time to presentation of vaginal cuff complication was 128 days (58–175) in the laparoscopy group and 37 days (32–44) in the robotic group.[18]

Kho and Akl et al reported 21 of 519 (4.1%) patients were identified with vaginal cuiff dehiscence after robotic cuff closure. Nine among 21 patients the robotic procedure was performed for a gynecologic malignancy.[19]

Older literature review by Magrina JF et al showed that there was no difference of intraoperative and postoperative complication among patiens who underwent robotic, laparoscopic and abdominal radical hysterectomy.[20]

Hospital Stay and Costs

Kruijdenberg et al reported a shorter median hospital stay for the robotic radical hysterectomy than laparoscopic radical hysterectomy, 3.3 days and 6.2 days ($p < 0.04$), respectively.[8]

Tinelli et al also reported a shorter median hospital stay for the robotic radical hysterectomy than laparoscopic radical hysterectomy, 3 and 4 days. The difference is not statistically significant.[9]

Lowe and Chamberlain et al reported median hospital stay of 1 day, among 42 cases of roboti-assisted radical hysterecrtomy.[11]

Estape et al reported a 2.6 days hospital stay in robotic group and 2.3 and 4.0 days in laparoscopic and abdominal radical hysterectomy groups, respectively.[13]

Comparison between robotic, laparoscopic and abdominal radical hysterectomy, Magrina et al reported a short hospital stay in robotic group than in laparoscopic and abdominal radical hysterectomy group, 1.7, 2.4 and 3.6 days, respectively.[20]

Table 3 summarizes the means hospital stay among patients of robotic, laparoscopic and open radical hysterectomy.

Oncological Outcomes

The primary endpoint to be considered when comparing minimally invasive techniques and conventional laparotomy for gynecological oncology is the equivalence in terms of surgical staging completeness and survival. Oncological outcomes after radical hysterectomy for early cervical cancer are the number of lymph node retrieved and the recurrence rate. There are controversial results concerning the number of lymph nodes collected by different surgical approaches.

Table 3: Hospital stay (in day) among patient after robotic radical hysterectomy (RRH), laparoscopic radical hysterectomy (LRH) and open radical hysterectomy (ORH)

No.	Authors	RRH	LRH	ORH	p
1.	Kruijdenberg et al[8]	3.3	6.2		< 0.04
2.	Tinelli et al[9]	3	4		NS
3.	Lowe et al[11]	1			
4.	Estape et al[13]	2.6	2.3	4.0	
5.	Magrina et al[20]	1.7	2.4	3.6	

Recent review of a large series by Kruijdenberg et al showed that there is no difference in the number of lymph node resected, between robotic-assisted radical hysterectomy and total laparoscopic hysterectomy.[8]

Regarding recurrent rate comparison between robotic radical hysterectomy and laparoscopic radical hysterectomy, Tinelli et al found no significant difference.[9]

Lee et al in the retrospective study reported that there was no significant difference of the number of lymph nodes resected between laparoscopic and radical abdomional hysterectomy.[10]

Lowe and Hoekstra et al reported the similar number of lymph nodes resected in robotic radical hysterectomy and abdominal radical hysterectomy, 19 and 14 nodes, respectively.[12]

Estape et al reported the number of lymph nodes resected by robotic and laparoscopic radical hysterectomy was significantly different, 32.4 and 18.6, $p < 0.0001$. The number of lymph nodes resected by laparotomy radical hysterectomy was 25.7, $p = 0.05$.[13]

Nehzat et al reported the the number of lymph nodes resected by robotic radical hysterectomy and laparoscopic radical hysterectomy almost the same, 25 and 31 nodes, respectively. And no recurrences in laparoscopic and robotic radical hysterectomy groups at 12 months and in laparoscopic group at 29 month.[14]

In the prospective study by Magrina et al all patients of the three groups are alive and free from disease at mean follow-up of 31.1 months.[20]

A comparative study by Kho and Muto et al showed a mean number of lymph nodes resected did not differ between robotic radical hysterectomy and open radical hysterectomy (15.6 *vs* 17.1, $p = 0.532$).[21]

Boggess et al reported number of lymph nodes resected during robotic assisted radical hysterectomy and open radical hysterectomy. There is a significant differences between the number of lymph nodes resected, in favor of robotic radical hysterectomy ($p = 0.0003$).[22]

Finally, Cantrell et al assessed the progression-free and overall survival for 71 women who attempted RRH for cervical cancer. Their experience demonstrated that RRH appears to have equivalent oncological outcomes compared with laparotomic surgery in the first 3 years of follow-up. They showed a 94% of progression-free and overall survival in the robotic cohort at 36 months.[23]

Table 4 summarizes the means number of lymph nodes resected among patients of robotic, laparoscopic and open radical hystetrectomy.

Table 4: Number of lymph nodes resected after robotic radical hysterectomy (RRH),), laparoscopic radical hysterectomy (LRH) and open radical hysterectomy (ORH)

No.	Authors	RRH	LRH	ORH	p
1.	Kruijdenberg et al[8]	NS	NS	NS	
2.	Lee et al[10]		NS	NS	
3.	Lowe et al[12]	19	14		
4.	Estape et al[13]	32.4	18.6	25.7	< 0.0001, p 0.05
5.	Nezhat et al[14]	25	31		
6.	Kho et al[21]	15.6	17.1		0.532
7.	Boggess et al[22]	RRH > ORH			0.0003

DISCUSSION

Robot-assisted radical hysterectomy is associated with a long operative time. The shorter length of hospital stay is one of the most important advantages of minimally invasive surgery. All comparative studies concerning robotic radical hysterectomy reported a mean length of hospital stay of 1 to 2 days, similar to the laparoscopic group, but significantly shorter than the open group.

Accordingly, robotic surgery provides other advantages, such as lower perioperative complications and reintervention rates, less postoperative pain, and analgesic consumption. All these issues positively influence hospital stay, quality of life, and time to return to full activities, providing a benefit from a medical and socioeconomic point of view.

However, longer operative time and a possible high cost due to sophisticated instrument, robotic radical hysterectomy has advantages over conventional surgery, including short hospital stay, lower perioperative complication, enhanced precision and reduced trauma to the patient, less bleeding, less postoperative pain and analgesic consumption. All these issues influence quality of life and time to return to full activities, providing a benefit from a medical and socioeconomic point of view.

An increased risk of vaginal cuff complications for minimally invasive hysterectomy techniques when compared to vaginal or abdominal ones, may be associated with an extensive use of monopolar and bipolar electrosurgery, which may increase thermal damage and devascularization of the cuff site. This thermal injury is difficult to estimate its extent of damage by visual inspection as the zone of desiccation may exceed the area of visual damage. An understanding of the differing impacts of the various types of electrical current is essential for estimation of the extent of injury. With patience, prudence, and meticuluos technique, thermal injury could be prevented.

The outcome of the robotic radical hysterectomy surgery according to oncological points of view is acceptable, in term of surgical completeness, number of nodes resected, recurrence and survival rate.

The reviewed data suggests that robotic-assisted radical hysterectomy may offer an alternative to traditional radical hysterectomy. The growing literature about

robotic-assisted radical hysterectomy and prospective comparisons with traditional radical hysterectomy will show a benefit of this minimal access surgery.

Prospective randomized controlled trials will give more definite results, especially concerning surgical outcomes comparing robotic and laparoscopic techniques.

CONCLUSION

Robotic-assisted radical hysterectomy, facilitates the better surgical approach in comparison to laparoscopy in the treatment of early cervical cancer. It is superior due to its steady 3-dimensional visualization, instrumentation with articulating tips, and an adaptive downscaling of the surgeons movements without tremor, allowing very selective dissection and good clinical end point result.

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TECHNIQUE PRESENTATION

Single-incision Laparoscopic Cholecystectomy. How can We Reduce the Costs? Presentation of a Technique using Straight Non-articulating Instruments and One Conventional Trocar, without Commercially Available Single Port Devices

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ABSTRACT

Single-incision laparoscopic surgery (SILS) offers an approach to cholecystectomy without visible evidence that the cholecystectomy occurred.[9] Cosmesis is the only documented benefit of the single-incision laparoscopic cholecystectomy (SILC), while SILC remains equivalent to multi-incision laparoscopic cholecystectomy (MILC) in all other respects.[14]

We report our experience of performing SILC without any commercially available port devices allowing laparoscopic instrument placement. We use conventional, straight, non-articulating laparoscopic instruments with a roticulating function and only one conventional 10 mm trocar.

Single-incision laparoscopic cholecystectomy has a potential to maximize benefits of MILC.[12] Our procedure, without any port device, is a reliable, low-cost alternative to conventional SILC, offering the same level of patient safety and cosmesis.

Keywords: Cost-effectiveness, Single-incision laparoscopic cholecystectomy, Single-incision laparoscopic surgery.

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INTRODUCTION

Laparoscopic surgery allows the surgeon to perform abdominal surgery with minimal trauma. Single-incision laparoscopic surgery (SILS) requires only one incision in the umbilicus. Single-incision laparoscopic cholecystectomy (SILC) was described first in 1999.[1] Although it offers an approach to cholecystectomy without a visible scar, the systemic inflammatory response, postoperative pain and analgetic use are not reduced significantly.[4,7] The same blood loss, operating time, pain of both SILC and multi-incision laparoscopic cholecystectomy (MILC) procedures are reported.[2] Good cosmetic effect is the only documented benefit of the SILS, while SILS remains equivalent to MILC in all other respects.[12,14] The SILC procedure is safe and easy for experienced laparoscopic surgeon and has manageable learning curve.[11,12] Single-incision laparoscopic cholecystectomy compared to MILC is technically more challenging, but in contrast to MILC it gives access to each quadrant of the abdominal cavity with one umbilical approach.[10]

Higher costs must be considered in SILC cases. In our health system it was necessary to assess the economic feasibility of SILC.

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TECHNIQUE PRESENTATION

We report our experience of performing SILC without any commercially available port device allowing laparoscopic instrument placement. We use conventional, straight, non-articulating laparoscopic instruments with a roticulating function and only one conventional 10 mm trocar.

Single-incision laparoscopic cholecystectomy has been performed in patient with gallbladder stones with or without inflammation, under general anesthetic with endotracheal intubation. A single vertical intraumbilical incision through the center of umbilical stalk is performed, the umbilicus is pulled out. The pneumoperitoneum is induced using Veress needle access. The carbon dioxide pneumoperitoneum to 13 mm Hg is established. The 10 mm trocar is introduced at the congenital umbilical fascial defect to explore abdominal cavity with a 30°, 10 mm laparoscopic camera. The camera is removed then

and reintroduced without any additional trocar directly to the abdominal cavity above the trocar, following the small incision of the fascia. Subsequently the grasper is introduced with the same technique beneath the only one trocar (Fig. 1). We do not use additional transcutaneous sutures suspending the gallbladder. The dissector, hook cautery, scissors and clip applicator are introduced respectively through the only one trocar. The triangle of Calot is dissected, the cystic artery and cystic duct are separately identified, dissected, clipped and divided between clips. Then the normal retrograde cholecystectomy is performed. The gallbladder dissection from the liver bed and removing through the umbilical incision finishes the procedure.

All procedures were completed successfully using SILS technique. The mean operative time was 76 minutes (62–103). Conversion to MILC or open surgery was not required in any case. The mean postoperative stay was 1.9 days. Mortality was nil. All patients were satisfied with the cosmetic results (Fig. 2).

Fig. 1: Instrument placement. The 10 mm trocar in the middle. A 30° 10 mm laparoscopic camera above and the grasper beneath the trocar

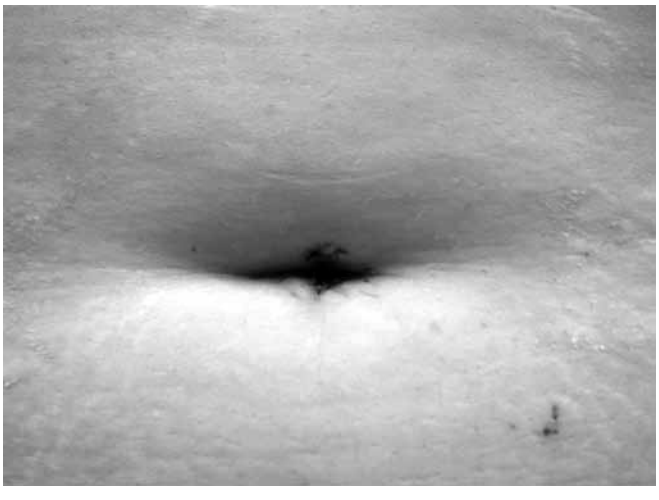

Fig. 2: No visible scar effect

DISCUSSION

Single-incision laparoscopic cholecystectomy is a relatively new, effective and safe procedure with a significant patient satisfaction.[13,14] Single-incision laparoscopic cholecystectomy compared to MILC has the same or longer operation time, equivalent morbidity and quality of life.[6-10,14] The cosmetic results[2,3,9,14] and global patient satisfaction[6] are rated excellent by the patients undergone SILC. Despite higher complication rate in initial cases has been reported in some papers,[5] SILC remain a safe, although technically more challenging alternative to traditional MILC.[10] Losing the advantage of instrument triangulation related to SILC procedure, causes the technical difficulties for the surgeon.[10] The use of port devices allowing laparoscopic instrument placement and curved, articulated or wristed instruments makes the SILS procedure less difficult. Improved cosmetic result is an advantage of SILC, with no data to prove the lower pain or shorter recovery time.[9]

Our procedure may represent an alternative to SILC. It requires conventional straight non-articulating laparoscopic instruments, which we use in MILC procedures. We need one forceps, one dissector, one scissors and clip applier. We use only one conventional 10 mm trocar. To reduce costs we gave up commercially available single port devices (Fig. 1).

Although the trocars with low-profile backends helps to prevent collisions during instrument movement,[9] we use standard trocars. Crucial to avoid trocar's backend collisions remains the coordination between the operator and the assistant manning the optics.

There were no postoperative complications. There were no need for conversion either to standard MILC or open cholecystectomy. The patients were pleased with the cosmetic results, with scar concealed in the umbilical depression (Fig. 2).

The patient safety remains the same with additional advantage of minimal costs. And the main goal of SILS, which is eliminating the visible scar from abdominal procedures, was achieved.

CONCLUSION

Single-incision laparoscopic cholecystectomy is feasible, efficient, effective, safe procedure associated with high cosmetic patient satisfaction, without visible evidence that the operation occurred and with excellent cosmesis.

Our procedure, without any commercially available port device allowing laparoscopic instrument placement, is a reliable, low-cost alternative to conventional SILC, offering the same level of patient safety and patient cosmesis.

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