

Title: The First International Delphi Consensus Statement on Laparoscopic Gastrointestinal Surgery**Short Title:** Laparoscopic GI Surgery Consensus**Original Article****Authors:**Islam Omar ¹Karl Miller ²Brijesh Madhok³Bassem Amr ⁴Rishi Singhal ⁵Yitka Graham ^{6,7}Sjaak Pouwels⁸Mohammad Abu Hilal^{9, 10}Sandeep Aggarwal¹¹Irfan Ahmed¹²Ali Aminian¹³Basil Jaser Ammori ¹⁴Tan Arulampalam ¹⁵Altaf Awan³José María Balibrea¹⁶Aneel Bhangu¹⁷Richard Raymond Brady¹⁸Wendy Brown¹⁹Manish Chand²⁰Ara Darzi ²¹Talvinder Singh Gill²²Ramen Goel²³Bussa R Gopinath ²⁴Mark van Berge Henegouwen²⁵Jacques M Himpens²⁶

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Abstract

Background: Laparoscopic surgery has almost replaced open surgery in many areas of Gastrointestinal (GI) surgery. There is currently no published expert consensus statement on the principles of laparoscopic GI surgery. This may have affected the training of new surgeons. This exercise aimed to achieve an expert consensus on important principles of laparoscopic GI surgery.

Methods: A committee of 38 international experts in laparoscopic GI surgery proposed and voted on 149 statements in two rounds following a strict modified Delphi protocol.

Results: A consensus was achieved on 133 statements after two rounds of voting. All experts agreed on tailoring the first port site to the patient, whereas 84.2% advised avoiding the umbilical area for pneumoperitoneum in patients who had a prior midline laparotomy. Moreover, 86.8% agreed on closing all 15 mm ports irrespective of the patient's body mass index.

There was a 100% consensus on using cartridges of appropriate height for stapling, checking the doughnuts after using circular staplers, and keeping the vibrating blade of the ultrasonic energy device in view and away from vascular structures.

An 84.2% advised avoiding drain insertion through a ≥ 10 mm port site as it increases the risk of port-site hernia. There was 94.7% consensus on adding laparoscopic retrieval bags to the operating count and ensuring any surgical specimen left inside for later removal is added to the operating count.

Conclusion: Thirty-eight experts achieved a consensus on 133 statements concerning various aspects of laparoscopic GI Surgery. Increased awareness of these could facilitate training and improve patient outcomes.

Keywords: Laparoscopic Surgery, Minimally Invasive, Hepatobiliary, Gastrointestinal Surgery, Guidelines, Ergonomics, Patient Safety, Surgical Training.

Introduction

Laparoscopic surgery has become the standard of care for many Gastro-Intestinal (GI) surgeries over the last two decades. In some areas, such as bariatric and metabolic surgery, cholecystectomy, and diagnostic laparoscopy ^(1,2), it has replaced open surgery almost completely.

Yet, laparoscopic surgery is technically demanding and requires different skill sets compared to open surgery due to reduced tactile feedback, counterintuitive movements, smaller working fields, and two-dimensional images. These skills include visual-spatial skills, hand-eye coordination, and depth perception skills. ^(3,4) Laparoscopic surgery is also physically demanding due to factors such as prolonged static posture, the need for more precision, and the use of longer instruments. Data suggest a higher incidence of work-related musculoskeletal disorders amongst laparoscopic surgeons. ^(5, 8)

There are several key differences in comparison to open surgery. Common to all laparoscopic procedures, for example, is the creation of pneumoperitoneum, which can be associated with life-threatening visceral injury in addition to the cardiovascular, renal, and pulmonary side-effects of raised intra-abdominal pressure. ⁽⁹⁾ Laparoscopic surgery is also more dependent on sophisticated stapling and energy devices.

Moreover, certain steps of surgical procedures need to be modified to allow the procedure to be performed laparoscopically. For example, specimens with or without retrieval bags are usually left for removal at the end of the procedure during laparoscopic surgery. However, that brings its own challenges, as demonstrated by the many reports of these items being retained after laparoscopic surgery, probably because the theatre operating counts from the "open surgery" era do not include specimens and laparoscopic retrieval bags. ⁽¹⁰⁾

Despite the numerous differences from traditional open surgery, there is no published consensus amongst experts on the main principles of Laparoscopic Gastrointestinal (LGI) surgery. This may have hampered training and the dissemination of good practice. Hence, we undertook this consensus-building exercise involving a group of experts using a strict modified Delphi protocol. The aim of this exercise was to develop a set of principles governing LGI surgery that would advance training and practice.

Methods

We constituted an expert committee of 38 representative experts in various areas of LGI surgery from ten countries. Experts were invited based on their surgical experience, academic credentials, established interest in education or Delphi consensus-building strategies, willingness to help, and working knowledge of the English language. We further sought to bring in representation from different countries and different subspecialties within GI surgery. Out of the 40 experts invited initially, 38 (95.0%) agreed to participate in the project. All experts voted in the first round of the Delphi process and 37 (97.3%) voted in the second round. Appendix 1 provides the full list of expert clinicians involved in this consensus-building exercise with their subspecialties and credentials.

The project was coordinated by a steering group (**Appendix 2**) which maintained a complete oversight including collecting the initial statements for voting; proposing the initial set of statements for discussion after a thematic analysis; modifying the statements as per the feedback from experts; conducting the voting; analysing the results, and preparing the manuscript for publication.

The modified Delphi protocol was shared with all the committee members at the beginning of the project, and they were asked to communicate only through the moderator to prevent influencing others' responses. Experts were first asked to share their learnings ("pearls of wisdom") based on their knowledge and experience of laparoscopic surgery. No specific criteria were laid down and experts were encouraged to think freely about the lessons relating to laparoscopic surgery they have learnt over the years. The steering committee then analysed the responses independently using thematic analysis and formulated the initial set of statements. These statements then went through several cycles of discussions and modifications within the committee. This process was carried out over emails involving all the committee members until the committee agreed on a series of assertive statements that the members could vote on in an agree/ disagree format. No Likert scale was used.

Experts were not allowed to skip any statement while voting, and an agreement amongst $\geq 70\%$ of experts was regarded as consensus. The threshold of 70% has been used widely in consensus-building exercises in the surgical literature. ⁽¹¹⁾

The whole process was repeated during the second round of voting. There was no prior agreement on the number of rounds for voting. But after two rounds of voting, experts felt that no further rounds were necessary because the statements that did not reach consensus were all from the first round.

Voting was conducted virtually on an online platform (Typeform™). The results of the first round were then shared with the expert panel and they were encouraged to think of ways to achieve consensus on the remaining statements. The whole process for statement preparation was then repeated as for the first round. Committee members were also able to add new statements or suggest a modification to previous statements. This process of discussion went over several cycles until the committee agreed on a set of 17 new statements for second-round voting. The first-round voting link was live from 15th June 2021 to 6th July 2021, and the second round from 2nd October 2021 to 3rd November 2021.

The work has been reported in line with the Standards for Quality Improvement Reporting Excellence (SQIURE) criteria.

Results

Thirty-eight LGI surgery experts (**Appendix 1**) voted on 132 statements in the first round and 37 experts voted on 17 statements in the second round. A consensus was eventually achieved on 133 statements. The committee did not achieve consensus on 16 statements after two rounds of voting. (Figure 1)

The committee achieved a consensus on 28 statements out of 31 proposed (**Table 1**) on theatre setup, ergonomics, and general considerations. There was a unanimous agreement (100%) on informing the whole team in the operating theatre of unusual or complex operations, seeking a second opinion when struggling, not letting industry influence clinical decisions, and keeping the scrubbed nurse informed. However, only 65.8% agreed to always start with standard four-quadrant diagnostic laparoscopy in the first round. In the second round, the statement was modified, and 91.9% advised to begin with laparoscopy to get a general idea of the intra-abdominal field.

There was 100% consensus on securing patients appropriately according to the anticipated positions during surgery, padding all the pressure points, and following the principles of ergonomics. Moreover, 94.7% advised to hold the instruments with the tips of one's thumb and fingers and not to place the entire thumb or finger in the instruments.

Table 2 includes the 76 proposed statements on the technical aspects, pneumoperitoneum, ports and camera, staplers, and energy devices. The expert panel achieved consensus on 65 statements. All experts agreed on tailoring the first port site to the patient, keeping in mind any previous operations, body mass index, and body habitus, whereas 84.2% advised avoiding the umbilical area for pneumoperitoneum in patients who had a prior midline laparotomy. Regarding the intra-abdominal pressure, 97.4% agreed on keeping the intra-abdominal pressure at the minimum possible without compromising the view, and 92.1% agreed that a pressure of 12 millimetres of mercury (mm Hg) is adequate for most patients except in cases with severe obesity.

There was 92.1% consensus on using a 30° or 45° laparoscope for most procedures, and 86.8% agreed that a 0° laparoscope provides a better view during insertion of the optical port. Additionally, 100% agreed on the placement of subsequent ports after insufflation for precise positioning, 97.4% advised inserting additional ports if needed, and 86.8% agreed on closing all 15 mm ports irrespective of the patient's body mass index.

There was a complete (100%) consensus on using cartridges of appropriate height depending on the tissue thickness and ensuring that there is no foreign body or unintended tissue in the jaws of the staplers before engaging the stapler. Additionally, 89.5% advised not to over-fill the stapler space with the first tissue when doing an anastomosis to avoid luminal discrepancy, and 73.7% agreed on using a safety checklist before engaging the stapler.

There was complete consensus (100%) on keeping the vibrating blade of the ultrasonic energy device in view and away from vascular structures. Moreover, 97.4% agreed that ultrasonic and bipolar energy devices do not work on blood vessels of all sizes, so if in doubt, surgeons should apply a clip first before using the vessel sealing instrument. Additionally, 97.4% advised not to leave a swab inside after it has served its purpose because it may be challenging to find it later, and 100% agreed on adding any swab inserted into the abdomen to the operating count immediately.

Table 3 includes the 18 statements related to patient safety during laparoscopic surgery. There was a 100% consensus on checking patient allergies before induction, and 89.5% advised using the World Health Organisation's "Safe Surgery" checklist. There was 100% consensus on adding any foreign body inserted into the abdomen to the operating count and ensuring the integrity of instruments on removal from the abdominal cavity to avoid leaving broken parts of instruments behind. Additionally, there was 94.7% consensus on adding laparoscopic retrieval bags to the operating count and ensuring that surgical specimen left inside for later removal is added to the operating count. Furthermore, 94.7% advised to step back at the end of the procedure and think if everything has been done, while 97.4% agreed that after laparoscopic surgery, the patient should get better daily. If this does not happen, the surgeon should investigate this promptly.

Table 4 includes the 24 training-related and miscellaneous statements. The committee achieved consensus on 22 statements. There was a 100% consensus on focusing on precision, not speed, learning to use the non-dominant hand effectively, encouraging the trainees to plan the procedure steps mentally, and questioning if the surgeon chooses otherwise. Additionally, 92.1% agreed on zooming out from time to time, and 75.7% advised obtaining further training if a procedure seemed too difficult. Additionally, 89.5% agreed on placing the drains through a 5-mm port site only, and 84.2% advised avoiding drain insertion through a \geq 10 mm port site as it increases the risk of port-site hernia. An 89.5% of the experts advised using sharp dissection with cold scissors for adhesions, 86.8% advised taking a break during lengthy procedures, and 97.4% agreed that for procedures where a previously placed foreign body (such as a gastric band) is being removed, surgeons should ensure all parts are removed, and if that was not possible to document the reasons.

Discussion

In this consensus-building exercise, 38 international experts achieved consensus on 133 statements concerning various aspects of LGI surgery. Increased awareness of these principles should help trainees and practitioners of LGI surgery.

Laparoscopic surgery has largely replaced open surgery in many areas of GI surgery. ⁽²⁾ Yet, sometimes converting to open surgery may be the only safe thing to do. Unsurprisingly our expert panel advised that conversion should not be deemed a failure and should be considered pre-emptively rather than reactively to avoid converting too late.

Secure positioning of the patient with the protection of pressure areas is an important consideration for any surgical patient. This is all the more important for patients undergoing laparoscopic surgery as surgeons often need extreme tilts to be able to perform the surgery laparoscopically. Patient slippage or fall from the operating table and development of peroneal nerve palsy have been reported with laparoscopic surgery. ⁽¹²⁾ All experts agreed on the importance of padding the pressure points and securing the patients appropriately, keeping in mind the anticipated positions during surgery.

Work-related musculoskeletal injuries are not uncommon amongst laparoscopic surgeons, and they can significantly impact the surgeons. ⁽¹³⁻¹⁶⁾ Our committee achieved a complete consensus on the importance of following the principles of ergonomics principles in theatre, ensuring the whole team is comfortable and paying attention to table and screen position and height.

There is an ongoing debate on the most appropriate technique for creating pneumoperitoneum. The Veress needle insertion is probably safe in the hands of experts, but previous abdominal surgery is associated with a higher incidence of bowel injury during its insertion. ^(17,18) A recent systematic review ⁽¹⁹⁾ of 57 randomised controlled trials (RCTs), with a total of 9 865 participants, evaluated 25 different entry techniques and concluded that evidence was insufficient to support any technique over another. There was an agreement amongst the experts in this exercise on having multiple options available for safe access to the abdominal cavity and choosing the first port site based on previous surgery and scars, body mass index, and body habitus of the patient.

The intra-abdominal pressure (IAP) required for laparoscopic surgery is associated with physiological changes affecting cardiovascular, renal, and pulmonary systems. ^(9,20) In this study, there was a consensus on maintaining an IAP of 12 mm Hg for most of the operations except in case of severe obesity and on not exceeding an IAP of 15 mm Hg. On similar lines, a recent systematic review and meta-analysis of 22 RCTs concluded that low IAP (< 12 mm Hg) might reduce post-operative pain, shoulder tip pain, and length of stay after laparoscopic cholecystectomy. ⁽²¹⁾

Port site hernia is not a rare problem, with the reported incidence being somewhere between 0 to 5.2%. ⁽²²⁾ Trocar size, obesity, open pneumoperitoneum, and old age have been suggested as predisposing factors. ^(22,23) The panel agreed on closing all 15 mm ports irrespective of the patient's body mass index and considering closing 10-12 mm ports, especially in those without obesity and if the ports haven't been angled.

Stapling technology has aided surgical advancement and improved perioperative safety. ⁽²⁴⁾ Although the design and functionality of the staplers have undergone significant evolution since their inception, stapler malfunction continues to be reported, with an incidence ranging from 0.022% to 2.3%. ⁽²⁵⁾ It can be quite a daunting and stressful experience and may adversely impact clinical outcomes. A pre-stapler engagement safety checklist has been proposed. ⁽¹²⁾ Any such checklist should probably include using stapler clips of appropriate size, removing loose staples from the crotch area, adequate compression time, avoiding stapling over a foreign body (such as an orogastric tube, nasogastric tube, Liga clips, or temperature probes), and ensuring a safe distance from other critical organs.

Similarly, haemostatic devices have greatly helped the progression of laparoscopic surgery. A recent survey, however, showed a significant gap in knowledge on the safe use of surgical energy devices amongst trainees and even qualified surgeons. ⁽²⁶⁾ The panel reached a consensus on 20 statements regarding the usage of energy devices and haemostasis (Table 2). Salient points include minimising the use of energy devices via dissection in the correct tissue planes, using traction and counter traction effectively, avoiding unnecessary dissection, and using mechanical techniques for controlling large and named blood vessels.

The modern surgical theatre has evolved into a highly sophisticated work environment with many interrelated factors at play, including multidisciplinary operating teams, complex

equipment and devices, heavy workload, and multi-comorbid patient population. All efforts should, therefore, be made to ensure patient safety. The panel agreed on using the World Health Organisation (WHO) "Safe Surgery" checklist. However, the use of the checklist by itself does not eliminate the possibility of errors and mistakes, and surgeons need to be aware of specific pitfalls in their areas of practice to prevent the so-called "never events".

Retained swabs and specimens have been reported as relatively common 'Never Events'.⁽²⁷⁾ To avoid such errors, the panel strongly supported adding the laparoscopic retrieval bags, any foreign body inserted into the abdomen, and surgical specimens left inside for later removal to the routine operating counts. There was a consensus on checking the integrity of instruments on removal from the abdominal cavity to avoid leaving broken parts behind and having a clear institutional protocol for missing or retained items. In addition, we propose a mental check at the end of each procedure to include the following questions - "Have I finished all steps of the procedure? Have I taken out all foreign bodies? Have I taken out the retrieval bag or specimen? Did the patient need another procedure?" and so on.

With regards to training, there was a consensus on recording trainee performed operations, giving them feedback, using simulators and laparoscopic trainers, developing hand skills outside the theatres, and not using the patient as a training model.

Implications and Next Steps

Expert opinion is regarded as the lowest level of scientific evidence and even though our consensus statement is an opinion of a group of experts rather than one single expert, it is still an expert opinion, and findings, therefore, need confirmation in adequately designed scientific studies.

At the same time, many of the principles suggested appear to be dictated by logic and can be incorporated into textbooks and courses without any need for further verification. In areas where there can be more than one view, it would be useful for new laparoscopic surgeons to learn the consensus opinion of a group of experienced laparoscopic surgeons. Our findings need to be discussed in scientific meetings and incorporated into textbooks and laparoscopic surgery courses for wider dissemination. The authors have identified one committee member

who will be responsible for coordinating the dissemination of this work to various surgical societies and on social media. Authors further believe that their findings would also be useful for surgeons in low- and middle-income group countries as there are surgeons in our committee who are currently working or have worked in past in these countries.

Strengths and Limitations:

This is the first consensus-building exercise on laparoscopic GI surgery involving 38 experts with significant experience and credentials. It is the strength of our Delphi process that we were able to identify so many statements that the experts could converge on because statements went through a process of iterative discussion before they were put forward for formal voting.

The committee included presidents and important office bearers of highly regarded surgical federations and associations, academic program directors, editors of prestigious surgical journals, as well as high-volume surgeons and pioneers of laparoscopic surgery. Therefore, the exercise can genuinely be regarded as a consensus amongst expert clinicians. Moreover, the experts followed a robust Delphi methodology. Given the number of experts who participated in this exercise, it would be very unlikely that any significant viewpoint has not been included in this exercise.

Several limitations of this paper need to be highlighted. The choice of expert clinicians can be considered arbitrary. The threshold of 70% for consensus can also be debated. However, it has been used in several prior consensus-building exercises in the surgical disciplines. ⁽¹¹⁾

Conclusion

In this consensus-building exercise, 38 experts achieved a consensus on 133 key statements concerning various aspects of laparoscopic GI Surgery. Wider awareness of these points should facilitate the training of surgeons and improve patient outcomes.

Statement of Human and Animal Rights: Not Applicable

Statement of Informed Consent: Not Applicable

Institutional Research Committee Approval Number: Not required for this kind of consensus building.

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Table 1 Theatre setup, Ergonomics and General Considerations

		1 st Round (N= 38)	2 nd Round (N= 37)
1- General Category Statements			
1	Know your equipment and devices.	100 %	NA
2	Know your team.	100 %	NA
3	Pre-warn the whole team if you are planning an unusual or complex operation.	100 %	NA
4	Do not hesitate to obtain a second opinion if in doubt or struggling.	100 %	NA
5	Ensure the whole team is trained for the task at hand.	84.2%	NA
6	In difficult cases, check with your assistant to avoid tunnel vision.	94.7%	NA
7	Standardise your processes and steps.	97.4%	NA
8	Inform nurses what you plan to do next so that they can prepare.	100 %	NA
9	Do not let industry influence clinical decisions.	100 %	NA
10	A pre-emptive conversion is superior to a reactive conversion.	97.4%	NA
11	A conversion is not a failure.	97.4%	NA
12	Use equipment only when appropriately trained.	100 %	NA
13	Always start with a systematic four-quadrant diagnostic laparoscopy.	65.8%*	NA
14	It is advisable to start with laparoscopy to get a general idea of the intra-abdominal field.	NA	91.9%
15	Assess your patient's abdomen when s/he is lying flat on the operating table before you start.	NA	86.5%
2- Operating Table and Patient Positioning			
16	Supervise patient positioning.	97.4%	NA
17	Have a monitor on both sides of the patient or at least one hanging from the ceiling that can be moved around.	81.6%	NA
18	Secure patients.	92.1%	NA
19	Learn emergency stop for digitally controlled operating tables.	89.5%	NA
20	Position patient arms so as to allow the team to move around the patient if needed.	92.1%	NA
21	Use a footrest to prevent sliding during steep reverse Trendelenburg position.	78.9%	NA
22	Use shoulder pads to prevent cephalad sliding during steep Trendelenburg position.	68.4%*	NA
23	Use straps across the chest and thighs to prevent sliding of patients during steep Trendelenburg and reverse Trendelenburg position.	65.8%*	NA
24	Secure the patients appropriately, keeping in mind the anticipated positions during surgery.	NA	100%
25	A proper wash out of all quadrants and pelvis is only possible (for example, in peritonitis patients) if the patient is properly secured to the table.	78.9%	NA
26	Pad all pressure points.	100 %	NA
3- Ergonomics Related Statements			
27	Ensure you and your team are physically comfortable. This may include a chair for the camera person to sit on.	100 %	NA
28	Pay attention to table and screen position. Have the table at an appropriate height to minimise the strain on your shoulders and back.	100 %	NA
29	The surgeons' eyes, the camera, the point of triangulation of the instrument tips and the monitor should ideally be aligned in one straight line.	97.4%	NA
30	Learn to use the modular function of graspers. Most graspers can rotate 360 degrees.	92.1%	NA
31	Do not place your entire thumb/finger in the instruments. Hold the instruments with the tips of your thumb/fingers.	94.7%	NA

* Statement did not achieve consensus.

Table 2 Technical Considerations		1st Round (N= 38)	2nd Round (N= 37)
4- Pneumoperitoneum Related Statements			
32	Have multiple options for abdominal entry.	94.7%	NA
33	Tailor the first port site to the patient (consider previous surgeries and scars, body mass index, Body habitus etc.).	100 %	NA
34	Open juxta-umbilical (supra, trans, or infra) port placement is the best technique for first port placement in most patients.	63.2%*	NA
35	Open juxta-umbilical (supra, trans, or infra) port placement is generally the best technique for first port placement, especially for those not suffering from severe obesity and without a previous midline laparotomy.	NA	73%
36	Use a vertical skin incision for juxta-umbilical port placement if you anticipate having to convert it into a midline laparotomy.	81.6%	NA
37	If in doubt, insert your finger to feel the smooth inner surface of the peritoneal cavity prior to insertion of the first port via the open method.	89.5%	NA
38	Consider stay sutures on the fascial edges of the first port, especially in patients with severe obesity.	78.9%	NA
39	Avoid the umbilical area for pneumoperitoneum in patients who have had a previous midline laparotomy.	84.2%	NA
40	Consider closed pneumoperitoneum for patients with obesity.	86.8%	NA
41	Use Veress needles with caution.	84.2%	NA
42	Do not use the Veress needle at all.	NA	64.9%*
43	Use Palmer's point for closed pneumoperitoneum.	84.2%	NA
44	Use optical trocar for first port placement for all closed techniques of pneumoperitoneum.	73.7%	NA
45	Insufflator settings are the responsibility of the operating surgeon.	100 %	NA
46	Keep intra-abdominal pressure at a minimum whilst not compromising the view.	97.4%	NA
47	For most intra-abdominal surgery, a pressure of 12 mm Hg is adequate. (This may not be the case in patients with severe obesity.)	92.1%	NA
48	Do not exceed an intra-abdominal pressure of 15 mmHg.	71.1%	NA
49	Use a high-flow insufflator.	89.5%	NA
50	In some cases, it is preferable to insert ports before positioning the patient (head up or down or roll), and in others, it is preferable to position the patient first. Plan what is best for your patient.	92.1%	NA
5- Port and Camera Related Statements			
51	Make appropriately sized skin incisions to prevent skin trauma and prevent the ports from slipping out.	97.4%	NA
52	Balloon tipped trocars help prevent port dislocation during surgery.	63.2%*	NA
53	Use 30 degrees or 45 degrees laparoscope (for most procedures).	92.1%	NA
54	A zero-degree camera provides a better view during the insertion of optical ports.	86.8%	NA
55	It is better to have one assistant specifically for the camera with both hands free.	68.4%*	NA
56	For complex procedures, it is better to have an assistant specifically for the camera.	NA	94.6%
57	Place the subsequent ports after insufflation for precise positioning.	100 %	NA
58	Maintain optimal vision at all times.	100 %	NA
59	Place all subsequent ports (after the first port) under vision.	97.4%	NA
60	Do not pre-decide sites for port placement. Place ports guided by the internal anatomy.	97.4%	NA

61	Use blunt-tipped trocars (rather than bladed or sharp trocars).	81.6%	NA
62	Triangulate the ports.	97.4%	NA
63	Consider the change of function of ports (For example, retraction port to camera port).	100 %	NA
64	Keep an extra camera in the camera warmer	52.6%*	NA
65	Keep an extra camera available.	NA	78.4%
66	Close all 15 mm ports irrespective of the patient's body mass index.	86.8%	NA
67	Close all 10-12 mm ports irrespective of the patient's body mass index.	50%*	NA
68	Consider closing 10-12 mm ports, especially in patients without obesity and if the ports haven't been angled.	NA	91.9%
69	Pre-infiltrate port sites with a long-acting local anaesthetic agent.	65.8%*	NA
70	Pre-infiltrate 10-12 mm port sites with a long-acting local anaesthetic agent.	NA	67.6%*
71	Do not hesitate to insert additional ports.	97.4%	NA
72	Use a smoke evacuator.	76.3%	NA
6- Stapling Device Related Statements			
73	Know your staplers and obtain appropriate training in using them.	100 %	NA
74	Ensure nurses and assistants are trained to use the staplers, including how to reload them correctly.	100 %	NA
75	Use cartridges of appropriate height depending on the perceived tissue thickness.	100 %	NA
76	Ensure that all left-over staples from the previous stapling have been removed before applying the stapler again.	86.8%	NA
77	Ensure there is no foreign body (such as liga-clip or orogastric tube or nasogastric tube or temperature probe) or unintended tissue in the jaws of the staplers before engaging the stapler.	100 %	NA
78	Follow the manufacturer's instructions on compression time (waiting time between compression and engaging the stapler) and firing speed.	94.7%	NA
79	Avoid tissue bunching at the stapler crotch by not letting any tissue proximal to the 45/60 mark on the stapler shaft. This might prevent cutting without stapling.	94.7%	NA
80	Release the stapler for a fraction of a second before closing again to release any tissue under stretch and prevent strain on the staple line later.	68.4%*	NA
81	Avoid excessive tension on tissues while stapling.	NA	100%
82	Keep the angle between 45 and 90 degrees while stapling across a staple line.	89.5%	NA
83	Do not over-fill the stapler space with the first tissue when doing an anastomosis. You'll not be able to pull enough of the second part of the gastrointestinal tract leading to a luminal discrepancy.	89.5%	NA
84	Consider using a safety checklist before engaging the stapler.	73.7%	NA
85	Check doughnuts after using circular staplers.	NA	100%
7- Energy Device and Haemostasis Related Statements			
86	Use trans-illumination through the abdominal wall when placing a port near the inferior epigastric artery.	76.3%	NA
87	Bleeding is minimal in correct tissue planes. If tissues are bleeding more than expected, you may be dissecting in an incorrect tissue plane.	100 %	NA
88	Keep the vibrating blade of ultrasonic instruments in view and away from vascular structures.	100 %	NA
89	Avoid unnecessary dissection. It is not necessary to dissect out a structure to preserve it.	97.4%	NA
90	Use traction and counter traction to minimise energy usage.	94.7%	NA

91	Ultrasonic and bipolar vessel sealers do not work on vessels of all sizes. If in doubt, put a titanium clip or Hem-o-lok first before using the vessel sealing instrument.	97.4%	NA
92	In cases of major bleeding, pack the area with a swab while preparing to deal with it.	97.4%	NA
93	Do not leave a swab inside after it's served its purpose. It may be difficult to find again later.	97.4%	NA
94	Add any swab inserted into the abdomen to the operating count immediately.	100 %	NA
95	Use clips or energy in a targeted fashion for control of bleeding.	100 %	NA
96	Apply a clip before using energy sealing devices on calcified vessels (seen on CT).	NA	59.5%*
97	Use clips or hem-o-loks rather than energy devices for named vessels.	92.1%	NA
98	Zoom out if it bleeds for a better estimation of the situation.	97.4%	NA
99	Minimise the use of energy.	86.8%	NA
100	Diathermy settings are the responsibility of the operating surgeon.	97.4%	NA
101	Reduce cutting down to zero if you are not going to use it if you are using a foot paddle. This will prevent inadvertent use of cutting diathermy with a foot paddle or the accidental pressing of the cutting paddle by staff/ equipment.	86.8%	NA
102	Reduce the intra-abdominal pressure for the final haemostasis check.	76.3%	NA
103	Ask the anaesthetist to ensure a systolic BP of at least 120 mm Hg for the final haemostasis check.	65.8%*	NA
104	Ensure the patient is not hypotensive at the time of the final haemostasis check.	NA	100%
105	Remove all ports under vision and control any port site bleeding.	92.1%	NA
106	Familiarise yourself with the latest haemostatic products (such as biodegradable oxidised cellulose patch).	100 %	NA
107	Position the energy equipment close to the monitor to allow for freer movement of the surgical team and staff.	86.8%	NA

* Statement did not achieve consensus.

Table 3 Patient Safety Considerations

		1st Round (N= 38)	2nd Round (N= 37)
8- Patient Safety Issues and Communication Related			
108	Use World Health Organisation's "Safe Surgery" checklist.	89.5%	NA
109	Ensure all necessary instruments and equipment are available and fit for purpose.	100.0%	NA
110	Insert a urinary catheter for procedures where a suprapubic port insertion is needed.	73.7%	NA
111	Use suprapubic ports carefully, especially if the patient does not have a catheter.	NA	97.3%
112	Check patient allergies before induction, especially with a view to identifying if the patient is allergic to something you will be using during the procedure and can the surgery proceed with an alternative option.	100 %	NA
113	Remove needles under vision.	94.9%	NA
114	Hold a needle with the thread while inserting and removing.	100 %	NA
115	Ensure surgical specimen left inside for later removal is added to the operating count.	94.7%	NA
116	Ensure laparoscopic retrieval bag (such as BERT bag) is in the operating count.	94.7%	NA
117	Ensure any foreign body inserted into the abdomen is added to the operating count.	100 %	NA
118	Remove tonsil swabs at the earliest opportunity.	100 %	NA
119	Ensure integrity of instruments on removal from the abdominal cavity to avoid leaving broken parts of instruments behind.	100 %	NA
120	There should be a clear institutional protocol for missing or retained items.	97.4%	NA
121	Try not to hand over an operation in the middle.	100 %	NA
122	If you are going to hand over in the middle of a procedure, follow a structured handover policy.	97.4%	NA
123	At the end, step back and think if you have done everything.	94.7%	NA
124	See the patient in recovery.	84.2%	NA
125	After laparoscopic surgery, the patient should get better daily. If not, wonder why.	97.4%	NA

* Statement did not achieve consensus.

Table 4 Training-related and miscellaneous statements

		1 st Round (N= 38)	2 nd Round (N= 37)
9- Training Related			
126	Record trainee performed operations and give them feedback.	92.1%	NA
127	Trainees should learn intracorporeal suturing.	97.4%	NA
128	Use simulators and trainers for training.	92.1%	NA
129	Encourage trainees to plan steps and select instruments in their head and question if the surgeon chooses otherwise.	100 %	NA
130	Optimal hand skills must be developed outside the operating theatres. The patient should not be used as a training model.	92.1%	NA
131	Focus on precision, not speed.	100 %	NA
132	Avoid unnecessary movements/actions.	97.4%	NA
133	Avoid using more expensive equipment for the same result.	97.4%	NA
134	The tissues need to be handled gently. Atraumatic instruments are traumatic.	100 %	NA
135	Be aware of where you are. Zoom out from time to time.	92.1%	NA
136	Understand your instruments and equipment.	100 %	NA
137	A good camera assistant understands most/all steps of the procedure and, crucially, anticipates them.	100 %	NA
138	Learn to use your non-dominant hand effectively.	100 %	NA
139	If a procedure seems too difficult, consider obtaining further training.	NA	75.7%
10- Miscellaneous Statements			
140	Use sharp dissection with cold scissors for adhesions.	89.5%	NA
141	Most staplers and curved needles will not go through a 5-mm port.	94.7%	NA
142	Do not use a ≥ 10 port site for drain placement. It increases the risk of port-site hernia when the drain is removed. If it is unavoidable, partly close the fascial opening.	84.2%	NA
143	Place drains through a 5-mm port track.	89.5%	NA
144	When in doubt, Use NIR/ICG fluorescence imaging to verify anatomy and perfusion.	71.1%	NA
145	For long procedures, take a break(s) during the procedure.	86.8%	NA
146	Consider intraperitoneal instillation of a long-acting local anaesthetic agent at the end of the procedure.	63.2%*	NA
147	Consider intraperitoneal instillation of the long-acting local anaesthetic agent at the end for day case procedures.	NA	51.4%*
148	Consider Transversus Abdominis Plane (TAP) block for day case procedures.	NA	78.4%
149	For procedures where a previously placed foreign body (such as gastric band) is being removed, ensure all parts are removed. If it is not possible to remove all parts, clearly document the reasons.	97.4%	NA

* Statement did not achieve consensus.

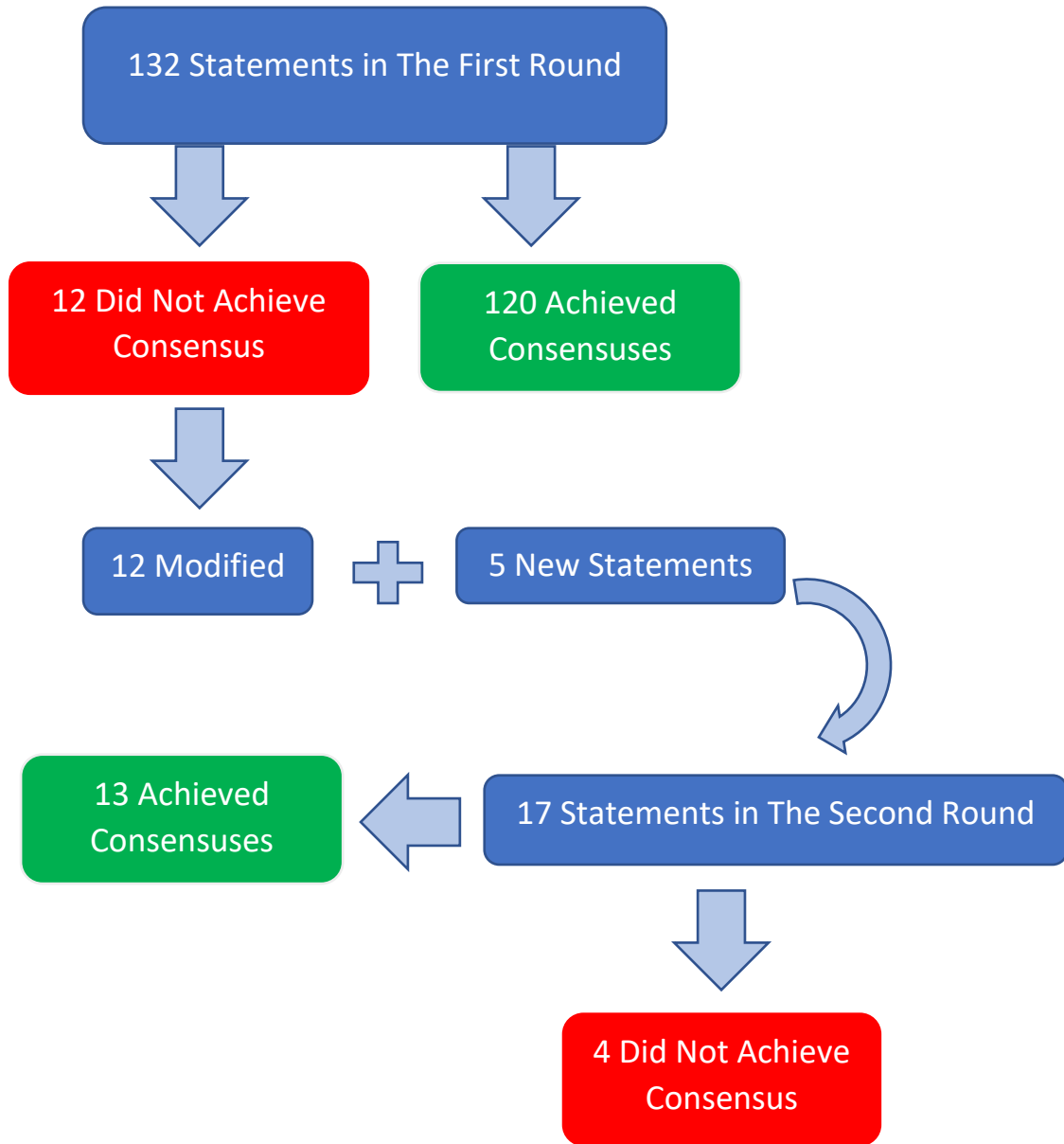


Figure 1 – Study Flowchart