

Need for Optimal Laparoscopic Ergonomics in Gynaecology

Geetha H.H.¹, K. Banu², Patil G.L.³, Patil L.S.⁴, Shashikala P.⁵

Abstract

Laparoscopic surgeries are in vogue, with little importance paid to the comfort of the surgeon and the operating team. We conducted a questionnaire based qualitative study with the following. *Objectives:* 1. Assess the ergonomic challenges faced by the laparoscopic surgeon 2. Assess the types and extent of ill health faced by these surgeons 3. Modifications to improve operative practice. *Methodology:* 25 gynaecologists practicing laparoscopic surgery were asked to answer a questionnaire to know the personal characteristics, their level of awareness of ergonomics and any ill health faced by them after performing a laparoscopic procedure. Statistical analysis was done using thematic analysis in the form of percentages. *Results:* Only 60% of surgeons adopted ergonomics, majority (80%) operated with poor OT setups, in odd postures, standard sized instruments were used. Patient related factors were trouble some to all surgeons. Neckpain, backache and finger joint pains were common physical constraints while mental fatigue and stress was common among surgeons in the post procedure period. *Conclusion:* Laparoscopic surgery is more demanding to the surgeons. Surgeons need to be aware and adopt optimal ergonomics during laparoscopic surgery.

¹Professor, Department of Obstetrics and Gynecology, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka 577502, India.

²Postgraduate Student

³Professor, Department of Obstetrics and Gynecology

⁴Professor, Department of Surgery, ⁵Professor & HOD, Department of Pathology, S S Institute of Medical Sciences and Research Centre, Davangere, Karnataka 577005, India.

Corresponding Author:
Gayatri L. Patil,

Professor, Department of Obstetrics and Gynecology, S S Institute of Medical Sciences and Research Centre, Davangere, Karnataka 577005, India.
E-mail:

ptlgayatri@yahoo.co.in

Received on 06.10.2017,

Accepted on 05.02.2018

Introduction

Laparoscopic surgery provides patients with less painful surgery but is more demanding for the surgeon. Laparoscopic surgery in gynaecology is the mainstream today for various benefits to the patients but it could be more demanding to the surgeons in terms of mental and physical ill health. Ergonomics is the "scientific study of people at work in terms of equipment design, workplace layout, the working environment, safety, productivity and training." Ergonomics is based on anatomy, physiology, psychology and engineering, combined in a systems approach.

Laparoscopic surgery has evolved in a great way. It has certain features which needs the surgeon to be familiar, like the two dimensional vision with loss of depth perception with no tactile feedback and lesser degree of freedom to the surgeon. Greater concentration with good hand-eye co-ordination with long hours of surgery with prolonged standing posture can lead to stress and exhaustion due to lactic acid build up.

Understanding the perceptions and experiences of laparoscopic surgeons is particularly critical and important for enhancing the surgeon's ability to perform. Sensorial ergonomics (manipulations and visualisation) improve precision, dexterity and confidence, while physical ergonomics provide comfort to the surgeon. Together these two elements of ergonomics increase safety with better outcome and reduce the stress. Application of ergonomics leads to, reduced suturing time, reduction of pressure related chronic pain, improved operative practice, enhances the surgeon's ability to perform.

Keywords: Laparoscopic Surgeon; Ergonomics in Laparoscopy; Surgeon Safety.

Operative setup is of prime importance, ideally height of the operating table should be 64-77 cms above the floor level, instruments to be positioned at elbow height, monitor at or within 25 optimal degrees below the horizontal plane of the eye which is a chin up arrangement, for less neck strain to the surgeon. Second monitor is good for the comfort of the assistants. Foot pedal location should be near the foot and aligned in the same direction as the instruments and the monitor direction. Too much crowding in the operative room with a large percentage of space being occupied by equipment and personnel is quite disturbing to the operating team, less experienced nurses assisting a junior surgeon could be very stressful to perform with efficiency. A good understanding anaesthesiologist who responds to the needs of the surgeon during the procedure is a boon to the surgeon, otherwise it will be a herculean task for the surgeon. In smaller healthcare centres spinal anesthesia is used for laparoscopic procedures which is dangerous to deal with. Surgeons are put in such a position that they are bound to perform for some good money.

Equipment related issues could be the make of laparoscopic instruments which are in a standard size may not be easy for all surgeons. At least half of the instruments should be inserted inside the patient's abdomen otherwise it causes shoulder pain. An ideal usage of instruments is to be in an axial line with both wrists in neutral position permitting the surgeon to keep both arms at the sides of the body to avoid strain on the functional areas of the hand.

Skill related problems could be based on individual experience and expertise. Intracorporeal suturing techniques and suturing in odd positions added with poor port placements could invite back strain to the operating surgeons. Trocar placements should be in a triangular fashion with a target of 15 – 20 cms from the centre port, accepted azimuth angle is 30° and manipulation angle is 60°. If trocars are placed too far off, the abdominal wall needs to be pushed and that causes strain on the finger and hand muscles. There is a direct correlation between manipulation angle and elevation angle and if the manipulation angle is restricted it makes the procedure difficult with degraded performance. Task efficiency causes deltoid and trapezius muscle strain.

Patient related problems could be worst in obese patients with a large size uterus, restriction with head low position. Manipulation of the uterus, morcellation of large fibroids, myomectomy of a large posterior wall fibroid are tiresome tasks.

Physical constraints commonly experienced by surgeons could be neck pain and spondylosis,

shoulder pain due to abduction of shoulder (chicken wing scapula) or simply called the laparoscopic shoulder. Cervical spondylitis, backache, hand and finger joint pain, thenar neuropathy, tenosynovitis, burning eyes, musculoskeletal injuries, vision errors, surgeon fatigue and exhaustion, mental stress were common ill effects faced by all the surgeons and the operating team.

In clinical practice, there are some expected risks to the surgeons, as there is a long learning curve where in a beginner works hard to learn. Benefits are always in terms of patients and not surgeons. No surgeon is bothered about himself during the procedure though money matters to a certain extent. Patient safety is always a prime concern to the laparoscopic surgeon.

There are some solutions for the surgeons to take care and perform better with less strain to himself or the operating team. A good operative setup, double monitor, using standard LCB monitors, good operating team, good instrumental design, adopting newer energy sources, good application of ergonomics could solve some problems for the surgeon. Hand instruments with a specially designed tip, length of the shaft and handle design. Robotic surgery is the latest advancement which has increased degree of freedom, specially designed chair like Ethostm chair allows the surgeon to sit and operate. Surgeons need to move about intermittently, loosen his or her hands, to prevent lactic acid build up (mini breaks). Adopting certain ergonomic principles during laparoscopic surgeries can minimise ill effects faced by the operating team.

Objectives

1. Assess the ergonomic challenges faced by the laparoscopic surgeon
2. Assess the types and extent of ill health faced by these surgeons
3. Modifications to improve operative practice.

Methodology

Around 25 gynaecologists practicing laparoscopic surgery in the city were included in this study. They were asked to answer a questionnaire to know the personal characteristics, their level of awareness of ergonomics and any ill health faced by them after performing a laparoscopic procedure and later they were assessed during surgery on various aspects of operative set up, equipment related, skill related and patient related factors which contribute to the ill effects faced by surgeons.

Statistical analysis was done using thematic analysis in the form of percentages. Thematic analysis is used in qualitative research and focuses on examining themes within data. Thematic analysis is performed through the process of coding in six phases to create established, meaningful patterns. It emphasizes pinpointing, examining, and recording patterns (or "themes") within data. Each participant's opinion is taken into account, as a common or uncommon response.

Results

Results were categorised in themes such as,

1. Personal characteristics of surgeons.
2. Level of awareness about ergonomics in laparoscopy
3. Operative setup problems faced by surgeons
4. Equipment related problems
5. Skill related problems
6. Patient related factors.

7. Physical and mental ill health or constraints faced by surgeons.

1. Personal characteristics of surgeons

Age: 29 - 60 years

Years of experience: 2-15 years

Freelance surgeon: 8%

Employed at Institute: 92%

Private practitioner: 76% Majority of the surgeons were juniors working in medical institute with an average experience of 4-5 years.

2. Level of awareness about ergonomics in laparoscopy

60% of the surgeons were aware of ergonomics but only 40 % were adopting them.

3. Operative setup problems faced by surgeons

Many (>80%) had to adjust to existing crowded operative area (<40%), small monitor, operating table with untrained nursing staff. Monitor was placed at eye level, which should ideally be 25 degrees lower to the eye level. Junior staff (50%) don't do optimal port placements, uterine manipulation and suturing skills are done in odd positions.

Sl. No.	Operative setup problems faced by surgeons	Percentage
1.	OT space- available operating space in the OT	< 40 %
2.	OT Space - occupied by equipment in the OT	>60 %
3.	Number of monitors in the operating room	Single
4.	Ceiling mounted monitors	No
5.	Table height - from the floor level	48 % kept it at the lowest
6.	Size of monitor screen	Many used 14" size
7.	Position of monitor screen : placed at what level to the horizontal plane of the eye.	50 % of them used it at their eye level
8.	Foot pedal placement	Axial line not followed
9.	Trained nursing assistants	100 % no

4. Equipment related problems

All the surgeons had to adjust with the existing size instruments.

5. Skill related problems

Majority (80%) were in bent position during the procedure, foot pedals were placed in alignment and

port placements only happened with experience. Manipulation of instruments was not adequate always. Anesthesiologists are always troublesome in giving good table tilt for good positioning and none of the surgeons took mini breaks during the procedure as it is very much required to prevent lactic acid build up.

Sl. No.	Problems	Percentage
1.	Standard sizes of instruments	100%
2.	Piston type handle	Not always
3.	Instruments positioned at elbow height or not	Not always
4.	Energy sources	Cautery - 100%

6. Patient Related Factors

Obese patients, less coordinating anaesthesia team, poor head low position caused problems to surgeons.

Spinal anaesthesia is frequently used in private nursing homes was less advantageous and stressful for surgeons (30%).

Sl. No.	Skill related problems	Percentage
1.	Position of the surgeon: American style or European style.	American style 100 %
2.	Posture	80 % are in bent position
3.	Foot pedals :placed near the foot Aligned in the same direction as the instruments or the monitor direction	100 %
4.	Intracorporeal suturing	20 %
5.	Port placements :Site, triangulation, instruments work at what angle	Gained with experience
6.	Ideal manipulation angle for instrumentation	Not keen always
7.	Axial use of instruments	30 %
8.	Uterine manipulation problems	100 % difficult
9.	Patient position / Head low tilt :	Not adequate
10.	Type of anaesthesia: General/Spinal	General
11.	Anesthesiologist in-coordination :	Very irritating
12.	Problems with large size uterus (>24 weeks):	15 % could manage
13.	Minibreaks taken by the surgeon during the procedure : Yes / No	100 % No

7. Physical and mental ill health or constraints faced by surgeons.

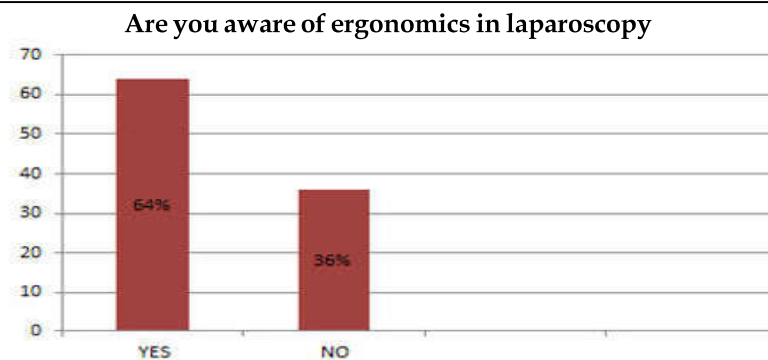
Physical constraints like neck sprain, spondylosis, shoulder pain, backache, burning sensation eyes,

fatigue and exhaustion, mental stress were common ill effects faced by all the surgeons and the operating team. Junior surgeons were more stressed after the surgery.

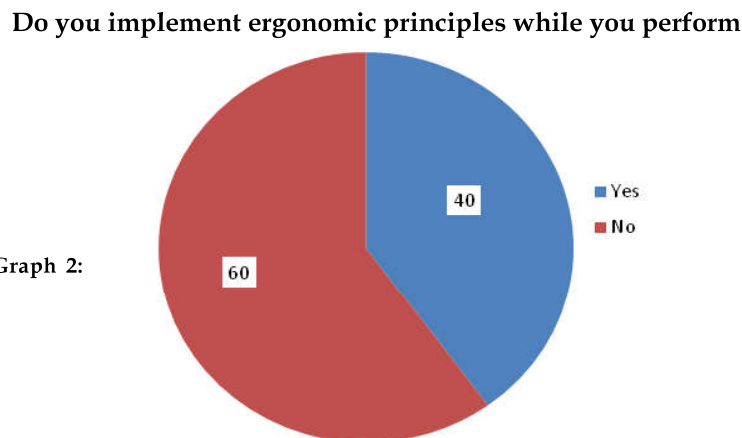
6. Patient related factors

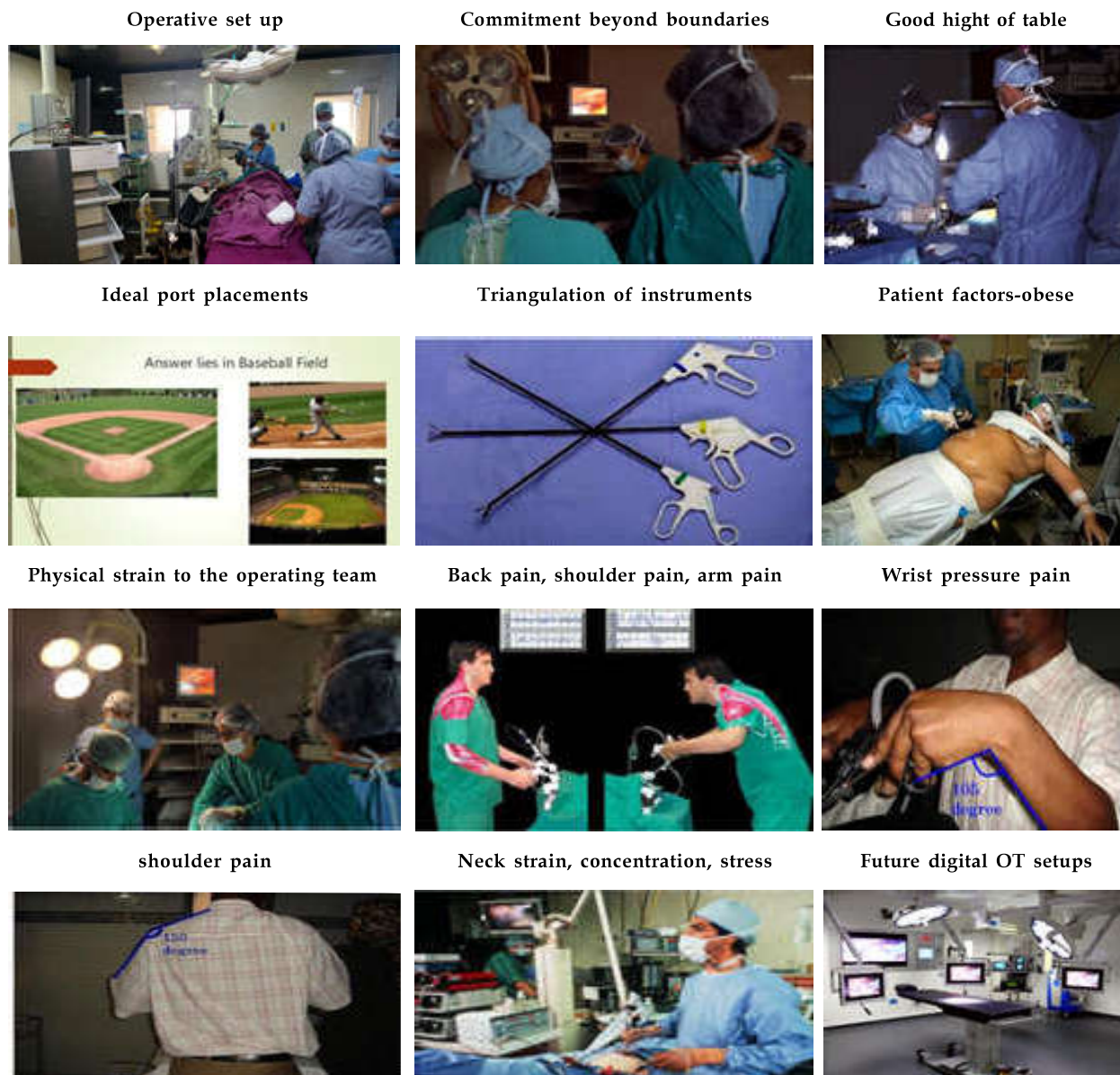
Sl. No.	Factors	Percentage
1.	Obese patients	100 % Yes
2.	Difficult port placements	100 % Yes
3.	Short length of trocars	100 % Yes
4.	Poor visibility	100 % Yes
5.	Difficult posture	100 % Yes
6.	Longer duration of surgery	100 % Yes
7.	Suturing in odd postures	100 % Yes

Graph 1:



Graph 2:





Discussion

The results of this study are unique, in a way that the participants themselves were confused to answer the questions and each one of them shared their views

and the results proved that performing the surgery itself was a big task for the surgeon. Modi [1] has done a similar study where awareness of ergonomics and comfort level during and after surgery was assessed. Similar results were observed and 66% of

Sl. No.	Physical Constraints	Percentage
1.	Neck pain	60 - 70 %
2.	Spondylosis	2 %
3.	Shoulder pain (due to abduction of shoulder)	50 %
4.	Cervical spondylosis	2 %
5.	Backache	40 %
6.	Hand finger joint pain	30 %
7.	Tenosynovitis	0 %
8.	Burning eyes	30 %
9.	Hand muscle injury	Sprain
10.	Vision errors	0 %

Sl. No.	Mental ill effects or constraints faced by surgeons	Percentage
1.	Fatigue	100 %
2.	Stress exhaustion	80 %
3.	Surgeon fatigue	80 %
4.	Discomfort	50 %

surgeons reported arm and shoulder pain and 32% had neck pain during or after surgery. Only 4% of surgeons advocated optimal table height and monitor height. 14 inch size monitors was used by 64% of surgeons. There are very references available for comparison.

In clinical practice, there are some expected risks to the surgeons, as there is a long learning curve where in a beginner works hard to learn. Benefits are always in terms of patients and not surgeons. No surgeon is bothered about himself during the procedure though money matters to a certain extent. Patient safety is always a prime concern to the laparoscopic surgeon. Modifications to improve operative practice is to implement optimal ergonomics during laparoscopic surgeries. Ergonomics include proper operative theatre setup, good set of instruments and trained staff will increase safety, improves operative practice and enhance the surgeon's ability to perform with better outcomes and reduced stress.

Conclusion

Laparoscopic surgery requires more physical and mental effort on the part of the surgeon and therefore

ergonomic integration and suitable operating room environment is essential to improve efficiency, safety and comfort for the operating team.

References

1. Modi YS, Kuswaha MR, Dave SP. Awareness of Ergonomic Guidelines regarding laparoscopic surgeries, its Practice among Surgeons and Comfort level during and after surgery. *Gujarat Med J* 2013;68(2):31-4.
2. Saleh AM, Shabila NP, Ali SK, Abdulhad FH. Faculty Development Program in Hawler Medical University, Iraq: A Qualitative Assessment from Participants' Perspectives *Br J Education, Society & Behavioural Science* 2014;4(4):485-94.
3. Van Veelen MA. Ergonomics in laparoscopic surgery. *J Minim Access Surg* 2010;6(2):31-6.
4. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med Res Methodol.* 2008;8:45. Published online 2008 Jul 10. doi: 10.1186/1471-2288-8-45 PMID: PMC2478656.
5. Berguer R. Ergonomics in Laparoscopic Surgery 454-63.