ypeebrothers.com, for detailed information on laparoscopy books, visit our website www.jaypeebrothers.com, for detailed information on laparoscopy books

Complimentary Online
3 Videos (Duration approx. 37 minutes)



BASIC LAPAROSCOPY & INSTRUMENTATION

Sadashiv Patil

2nd Edition

JAYPEE

Contents

1. Beginning of Laparoscopy 1
- History *1*

2. Imaging System in Laparoscopy 7
- Camera *7*
- Laparoscope *8*

3. Instruments 13
- Laparoscopic Hand Instruments *13*

4. Pneumoperitoneum 24
- Insufflators *24*
- Terminologies *25*
- Pneumoperitoneum Insufflation *26*

5. Peritoneal Access 30
- Anatomy of Anterior Abdominal Wall *30*
- Methods of Peritoneal Access *30*

6. Electrocautery 36
- Newer Energy Sources *36*

7. Harmonic and Vessel Sealing Device 43
- Ultrasonic Shears (Harmonic) *44*
- Bipolar Vessel Sealing Device *45*

8. Homeostasis and Suturing 47
- Homeostasis and Suturing Technique *47*

9. Troubleshooting and Complications 56
- Troubleshooting in Laparoscopy and Remedies *56*
- Complications of Laparoscopy *57*

10. Laparoscopic Appendectomy 60
- Appendicitis *60*
- Laparoscopic Appendectomy *63*

11. Anatomy and Physiology of Gallbladder 67
- Surgical Anatomy of Gallbladder *67*
- Surgical Physiology of Gallbladder *69*

12. Chronic Cholecystitis 71
- Natural History *71*

13. Acute Cholecystitis 73
- Clinical Features *73*
- Treatment *74*
- Acalculous Cholecystitis *74*

14. Laparoscopic Cholecystectomy 76
- History of Cholecystectomy *76*
- Operative Setup *77*
- Port Positions *77*
- Procedure *79*

15. Diagnostic Laparoscopy 87
- Procedure *87*
- Indications *87*

16. Ergonomics in Laparoscopic Surgery 94
- Mechanics and Principal Angles *94*
- Instruments *95*
- Principles of Port Placement *96*
- Operating Room Environments *97*

17. Endotrainer 100
- Components *100*
- Suturing Exercises *101*
- Endotrainer Exercises *101*

Index 105

CHAPTER

16

Ergonomics in Laparoscopic Surgery

INTRODUCTION

The term ergonomics is derived from the Greek words "ergon" meaning work and "nomos" meaning natural laws or arrangement. 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. In simple words, it is the science of best suiting the worker to his job, or to make the setting and surroundings favorable for the laparoscopic surgeon. The term was formally defined in 1949 and has brought benefit and safety to many areas of human endeavor.

MECHANICS AND PRINCIPAL ANGLES

Ideally the fulcrum effect should be in the middle and the instrument should be at an equal length both intra- and extracorporeally (Fig. 16.1).

Figure 16.2 represents the fulcrum near to the load arm. In this, large movements have to be made extracorporeally to produce movements intracorporeally. Also greater force is exerted at the tip of instrument, leading to tissue injury.

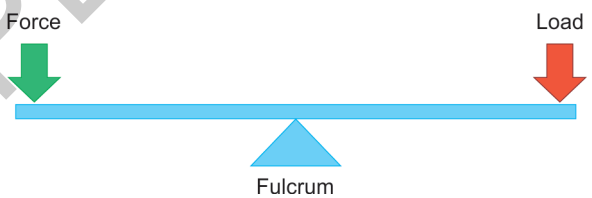


Fig. 16.1: Fulcrum middle of force and load

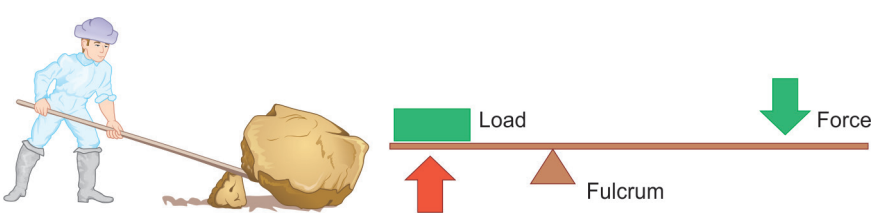


Fig. 16.2: Fulcrum near load

JAYPEE BROTHERS

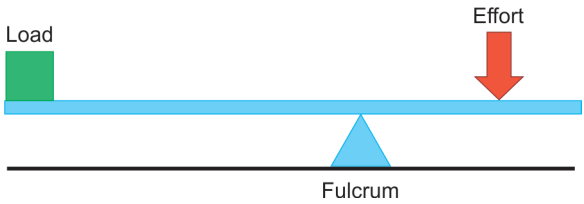
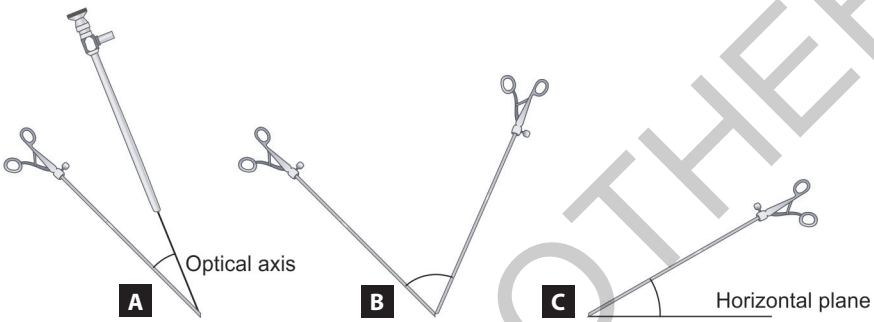


Fig. 16.3: Fulcrum near effort



Figs 16.4A to C: (A) Azimuth angle; (B) Manipulation angle; and (C) Elevation angle

Figure 16.3 represents fulcrum near the force arm, small movements extracorporeally will produce large movements intracorporeally at the tip.

Both of which are not ideal for laparoscopic surgery.

Therefore, the instruments must be equidistance both intracorporeally and extracorporeally.

In order to prevent the stress, it is necessary to follow below-mentioned principal angles (Figs 16.4A to C).

- *Azimuth angle (30°):* The angle between telescope and operating instrument.
- *Manipulation angle (60°):* The angle formed between two operating instruments.
- *Elevation angle (60°):* The angle between instrument and body.

If the azimuth angle is >45° then there will strain in shoulder joints of the operating surgeons shoulder joints. If the angle is <30°, there will be swording action between the instruments.

Manipulation angle should be <60°. If it is >60°, there will be strain at the shoulder joint.

If elevation angle is >60°, it is not feasible for any operation. If elevation angle is <30°, it causes difficulty in operation, contact with target tissue will be lost, and extracorporeal part of the instrument will touch the anterior abdominal wall.

INSTRUMENTS

In open surgery, the thumb and the fingers exert the forces simultaneously in opposing directions. The laparoscopic instruments have pistol grip with rings

JAYPEE BROTHERS

for both thumb and the fingers, the force to open and close the jaws is done by the thumb alone. The thumb ring is usually located on the mobile ring of the instrument. The remaining finger ring is fixed, as the instrument is activated, the force is transmitted from thumb ring to handle and ultimately to tip of the instrument. Poor ergonomic design of the laparoscopic instruments is countered by adapting the nearest joint and limb. This relieves fatigue in group of muscles.

The palmar grip technique enables a more powerful grip, this grip uses the deep forearm flexors instead the thenar and hypothenar muscles. This decreases the fatigue of the muscles of the hand.

The standard length of the instruments in adults is 360 mm, in neonates the length of the instruments is 200 mm, in pediatrics the length of the instruments is 280 mm, and in morbidly obese, it is 450 mm.

PRINCIPLES OF PORT PLACEMENT

The first thing that strikes our mind when starting laparoscopic surgery is the position of the port. It is a well-established thing that the primary port is placed at the umbilicus as this is the thinnest portion of the abdominal wall. This port can be placed either by an open or closed method (Veress needle).

For placing the secondary ports, two circles are drawn keeping target at center, inner circle at a distance of 18 cm from target and the outer circle at a distance of 24 cm. Secondary ports are placed within the green area as shown in the circle (Fig. 16.5).

If the port is placed within the circle, then the port will be very near to the target area and large length of the instrument remains extracorporeal, and large movements at the operating hand have to be made small effects at the target of dissection. There is possibility that the uninsulated effector part

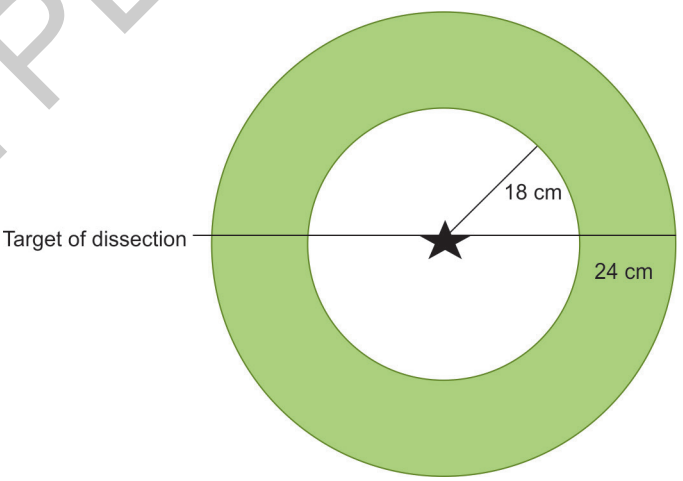


Fig. 16.5: Green area indicates area for port placements

JAYPEE BROTHERS

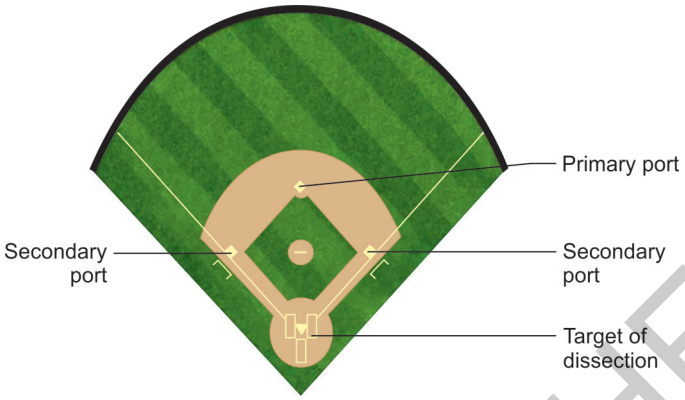


Fig. 16.6: Baseball diamond concept in laparoscopic surgery



Fig. 16.7: Parachute concept in laparoscopic surgery

of the instrument may come in contact with the trocar and cause coupling injury to the vital organs.

If the port is outside the outer circle, then it will be difficult to reach the target organ. Small movements at the operating hand will produce large movements at the target of dissection.

In a 0° scope, the optical axis aligns with the physical axis of the telescope (Figs 16.6 to 16.8). Whereas in a 30° scope, the optical axis makes a 30° with the physical axis of the telescope (Fig. 16.9).

OPERATING ROOM ENVIRONMENTS[1]

Distractions and interruptions to surgical workflow are defined as an event of visible pause in the work of the surgeons or one of the team members.[1]

JAYPEE BROTHERS

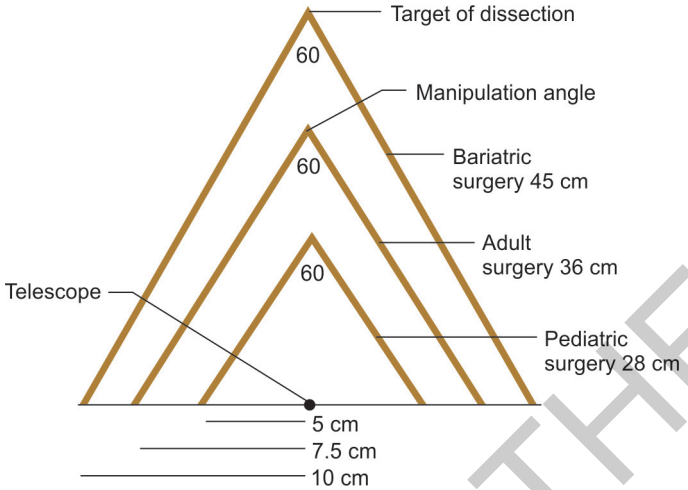


Fig. 16.8: Placement of instrument and telescope with different age group patients in laparoscopic surgery

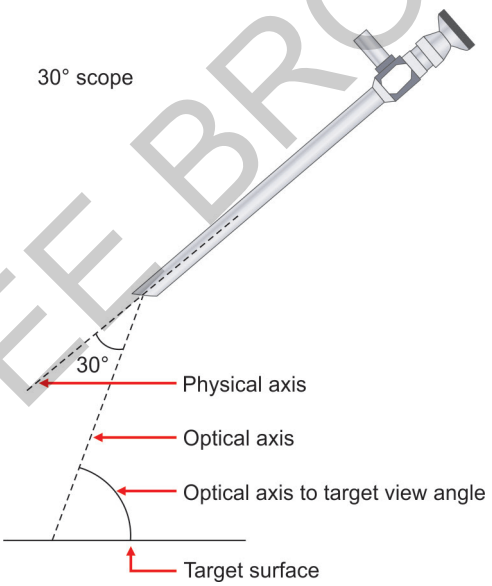


Fig. 16.9: Placement of optical axis, physical axis, and target surface in laparoscopic surgery

Psychological burdens of laparoscopic surgeons are higher than open surgeons. Minimal access surgery is more demanding and requires more concentration than open surgery, both stress and fatigue affect the surgical team in less time than open surgery. This leads to surgical fatigue syndrome manifested by exhaustion, irritability, impaired surgical judgment, and reduced dexterity.

JAYPEE BROTHERS

Laparoscopic surgery entails a limited range of movements, which leads to acquire static, forced, and awkward long-term postures. The primary risk factor for appearing of musculoskeletal disorders is body deviation from neutral position.[2]

Apart from the laparoscopic monitor, the operative room should be kept in a dim to no light setting, in order to adequately expose the operating field.[1]

Monitors should be ceiling mounted and adjustable. The common problem that the surgeons face is the extension of the neck which is not ergonomically safe. The optimal position for gaze-down viewing should be 15° neck down. This is to prevent overextension of neck.[1]

Additional ceiling mounted monitor to be provided for the assistant surgeons and the nurses.

Table height is 30–60 cm (adjustable range for MIS) which allows adequate range of movements.[1]

Optimal position of arm is slight abduction, retroversion, and inward rotation. Elbow should be flexed from 90 to 120°. Intermittent relaxation of hands is advised in order to prevent fatigue.[3]

Hand activated controls for diathermy and ultrasonic energy sources are advised in order to prevent task disruption.[3]

Trunk should not be flexed >20° to avoid backache.[4]

REFERENCES

1. Soper NJ, Scott-Conner CEH. The SAGES Manual, 3rd edition. New York: Springer; 2012.
2. Sánchez-Margallo FM, Sánchez-Margallo JA. Ergonomics in laparoscopic surgery. In: Malik A (Eds). Laparoscopic Surgery. United Kingdom: IntechOpen; 2017.
3. Supe AN, Kulkarni GV, Supe PA. Ergonomics in laparoscopic surgery. J Minim Access Surg. 2010;6(2):31-6.
4. Yurteri-Kaplan LA, Park AJ. Surgical Ergonomics and Preventing Work-Related Musculoskeletal Disorders. Obstet Gynecol. 2023;141(3):455-62.

JAYPEE BROTHERS

for detailed information on laparoscopy books, visit our website www.jaypeebrothers.com, for detailed information on laparoscopy books, visit our website w

BASIC LAPAROSCOPY & INSTRUMENTATION

Salient Features

- Written in a simple and easy-to-understand language
- A must-read for all the beginners in laparoscopic surgery
- Deals with basics in laparoscopic surgery
- Laparoscopic instruments dealt with in detail as a separate chapter
- High resolution self-explanatory photographs of various techniques included
- Ergonomics deals with working conditions in operation theater
- The Endotrainer chapter has been added taking into consideration the requirement of enhanced skills.

Sadashiv Patil MS FMAS FIAGES FACRSI did his MBBS from Mahadevappa Rampure Medical College, Kalaburagi, Karnataka, India. Presently he is working as Professor, Department of General Surgery, Sapthagiri Institute of Medical Sciences, Bengaluru, Karnataka, imparting knowledge to undergraduate and postgraduate students.



Printed in India

Available at all medical bookstores or buy online at www.ejaypee.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
EMCA House, 23/23-B, Ansari Road,
Daryaganj, New Delhi - 110 002, INDIA
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers
Follow us on instagram.com/JaypeeMedicalPublishers

Shelving Recommendation
LAPAROSCOPIC SURGERY

ISBN 978-93-5696-747-2