Surgical Diseases

1. **Salient Features**

   - Short but informative descriptions of all surgical diseases.
   - About 1000 schematic diagrams to understand pathophysiology, pathology, clinical presentations and treatment.
   - Photographs of diseases and imaging to get ideas about the disease itself.
   - Quotations by renowned personalities are added in each chapter to make the reading experience more comfortable.

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MS (General Surgery) is Associate Professor in Department of Surgery, Bankura Sammilani Medical College, Bankura, West Bengal, India. He has teaching experience of over 5 years. He has published articles in various national and international journals.

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Illustrated Surgery

A Road Map

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Bankura Sammilani Medical College
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The Health Sciences Publisher
New Delhi | London | Philadelphia | Panama
Dedicated to
My teachers, my parents,
spouse Tapati and daughter
Tannishtha for their love and support
'Books are the compass and telescopes and sextants and charts which other men have prepared to help us navigate the dangerous seas of human life.'

I strongly believe that in the seas of life we all need some help in any moment from others. I also believe that in midst of seas of medical science, all medical personnels particularly the medical students need a GPS and a philosopher. That GPS can come in his or her life in the form of a teacher or a good book or both.

In my short period of teaching, I have experienced that most of the students can remember the diseases and their management as a whole but without understanding the disease process, it’s pathophysiology or the principles of treatment. From my understanding, the reason is so many subjects in a too short period.

In this book I have attempted to describe the diseases in such a illustrative manner so that the students can understand as well as recover his or her memories from the illustrations. Better understanding, not a better memory make a average medical student to a good doctor.

As the book is based on illustrations, most of the diseases are described in a illustrative manner, less text more illustrations.

I hope that the book will be more of a guide book for travelling in seas and mountains of medical science than a reference book. Your safe journey can only make me happy.

Wish you a happy journey.

Nilay Mandal
Acknowledgments

‘Writing a book is a horrible, exhausting struggle, like a long bout with some painful illness. One would never undertake such a thing if one were not driven on by some demon whom one can neither resist nor understand.’

I am grateful to my teachers, my students and friends whose encouragement and emotional support make me courageous to do this task.

I am also grateful to Shri Jitendar P Vij (Group Chairman), Mr Ankit Vij (Managing Director) and Mr Tarun Duneja (Director-Publishing) of M/s Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India, for publishing this book. I would also like to thank all staff members of Kolkata production unit of Jaypee Brothers Medical Publishers (P) Ltd for their constant support and cooperation to complete this book.
## Contents

### Chapter 1  Wound Healing  1–12

**Introduction**  3  
Wound healing involves any of the two processes  3  
Classification of wound  4  
Types of wound healing  4  
Three phases of wound healing  5  
Role of growth factors in healing  8  
Factors affecting wound healing  8  
Complications of abnormal wound healing  9  
Wound closure techniques  11  
Treatment of wound  12  

### Chapter 2  Fluid, Electrolyte and Acid-base Balance  13–27

**Fluid, Electrolyte and Acid-base Balance**  15  
Body fluids  15  
Fluid input-output  16  
Disturbances in fluid balance  16  
Electrolyte imbalance  18  
Acidosis and alkalosis  25  

### Chapter 3  Hemostasis-Coagulation-Hemorrhage  28–35

**Hemostasis-Coagulation**  30  
Evaluation to assess risk of bleeding during surgery  30  
Congenital hemorrhagic disorders  31  
Acquired hemorrhagic disorders  31  
Hemorrhage  32  
Transfusion of blood and its components  33  

### Chapter 4  Gallbladder and Extrahepatic Biliary System  36–119

**Anatomy of the Gallbladder and Extrahepatic Biliary System**  38  
Things to Remember  38  
Pathologies of Gallbladder and Biliary System  40  
Benign pathology  40  
Malignant pathology  40  
**Gallstone**  41  
Risk factors  41  
Varieties  41
Pathogenesis of Gallstone  42
Pathogenesis of cholesterol stone  42
Pathogenesis of black pigment stones  42
Pathogenesis of brown pigment stones  43

Things to Remember  43
Spectrum of gallstone disease  44
Spectrum of symptomatic gallstone disease  44
Complicated case scenario  48
Prepare for emergency cholecystectomy  48
Be prepared for partial cholecystectomy  48
More careful during cholecystectomy  48
Acute acalculous cholecystitis  58
Biliary dyskinesia  59
Choledocholithiasis  60
Acute cholangitis  67
Choledochal cyst  69
Recurrent pyogenic cholangitis (cholangiohepatitis)  76
Primary sclerosing cholangitis  77
Gallbladder carcinoma  78
Cholangiocarcinoma  86

Anomalous Anatomy  96
Anomalous gallbladder anatomy  96
Variations of cystic duct insertion with common hepatic duct  97
Variations in arterial supply of gallbladder  97

Endoscopic Therapeutic Approaches to Biliary System  98
Percutaneous transhepatic approach  98
Removal of retained CBD stone through T-tube tract  99
Removal of CBD stones by endoscopic sphincterotomy  99

Surgical Approaches to Gallbladder and Biliary System  101
Cholecystectomy  101
Open cholecystectomy  105
Why bile duct injury?  107
Bile duct injury recognized at operation  108
Injuries recognized in immediate postoperative period  110
Injuries presenting at an interval after initial operation  111
Laparoscopic management of CBD stones  112
Management of CBD stone (open approach)  115
Choledochoduodenostomy  117
Roux-en-Y hepaticojejunostomy  118
Chapter 5  Liver  120–172

Diseases of the Liver  122
- Couinaud system of segmental nomenclature  122
- Segmental anatomy of the liver by CT scan  123
- Benign pathology  124
- Malignant pathology  124
- Pyogenic abscess of liver  125
- Amebic liver abscess  131
- Hydatid cyst  136
- Congenital liver cyst  148
- Polycystic liver disease associated with polycystic kidney disease  150
- Cystadenoma  151
- Solid benign neoplasm  152
- Hepatocellular carcinoma  153
- Liver metastases  161
- Portal hypertension  162

Chapter 6  Pancreas  173–206

Diseases of the Pancreas  175
- Anatomy  175
- Acute pancreatitis  175
- Chronic pancreatitis  187
- Cystic neoplasms of pancreas  195
- Pancreatic carcinoma  199

Chapter 7  Spleen  207–217

Splenic Pathologies  209
- Anatomy  209
- Functions of spleen  211
- What is accessory spleen?  212
- What is ectopic spleen (wandering spleen)?  212
- What is splenosis?  212
- When to do splenectomy?  213
- Cyst and tumors of spleen  214
- Iatrogenic splenectomy  215
- Incidental splenectomy  215
- Postsplenectomy blood picture  217

Chapter 8  Abdominal Wall, Peritoneum, Mesentery, Retroperitoneum  218–240

Abdominal Wall  220
- Congenital defect  220
- Acquired abnormalities of the abdominal wall  227

Peritoneum and Peritoneal Cavity  229
- Abdominal abscess  230
Malignant peritoneal mesothelioma 233
Pseudomyxoma peritonei 233

Mesentery 234
Mesenteric cyst 234
Acute mesenteric lymphadenitis 234
Mesenteric panniculitis 235
Malignancies of the mesentery 235

Omentum 235
Omental infarction 235
Omental cyst 235
Omental graft and transpositions 236

Retroperitoneum 236
Retroperitoneal abscess 236
Retroperitoneal hematoma 236
Retroperitoneal fibrosis 237
Retroperitoneal neoplasm 239

Chapter 9 Stomach
Diseases of the Stomach 243
Anatomy 243
Peptic ulcer disease 243
Pathophysiology 246
Clinical presentations of gastric ulcer 247
Investigations 248
Treatment 251
Perforation 258
Bleeding peptic ulcer 262
Gastric outlet obstruction 263
Gastritis 266
Malignant neoplasms of stomach 267
Gastrointestinal stromal tumor (GIST) 280
Gastric lymphoma 283
Other gastric lesions 284
Postvagotomy syndromes 287

Chapter 10 Intestine
Diseases of the Intestine 294
Intestinal obstruction 294
Small intestinal obstruction 294
Clinical features of intestinal obstruction 297
Diagnostic evaluation 299
Treatment 300
Principles of surgery in intestinal obstruction 301
<table>
<thead>
<tr>
<th>Condition</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>304</td>
</tr>
<tr>
<td>Intussusception</td>
<td>306</td>
</tr>
<tr>
<td>Crohn’s disease</td>
<td>309</td>
</tr>
<tr>
<td>Typhoid enteritis</td>
<td>320</td>
</tr>
<tr>
<td>Intestinal tuberculosis</td>
<td>321</td>
</tr>
<tr>
<td>Jejunal and ileal diverticula</td>
<td>324</td>
</tr>
<tr>
<td>Duodenal diverticula</td>
<td>325</td>
</tr>
<tr>
<td>Meckel’s diverticulum</td>
<td>326</td>
</tr>
<tr>
<td>Neoplasm of small intestine</td>
<td>330</td>
</tr>
<tr>
<td>Short bowel syndrome</td>
<td>331</td>
</tr>
<tr>
<td>Diverticular disease of colon</td>
<td>333</td>
</tr>
<tr>
<td>Volvulus of the colon</td>
<td>339</td>
</tr>
<tr>
<td>Ileosigmoid knotting</td>
<td>344</td>
</tr>
<tr>
<td>Large bowel obstruction</td>
<td>344</td>
</tr>
<tr>
<td>Ulcerative colitis</td>
<td>345</td>
</tr>
<tr>
<td>Colorectal polyp</td>
<td>353</td>
</tr>
<tr>
<td>Familial adenomatous polyposis (FAP)</td>
<td>359</td>
</tr>
<tr>
<td>Cancer of colon</td>
<td>361</td>
</tr>
</tbody>
</table>

**Chapter 11**

**Appendix**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Appendicitis</td>
<td>378</td>
</tr>
<tr>
<td>How it develops?</td>
<td>378</td>
</tr>
<tr>
<td>How appendix looks in acute appendicitis</td>
<td>380</td>
</tr>
<tr>
<td>Clinical presentation</td>
<td>380</td>
</tr>
<tr>
<td>Risk factors for perforation</td>
<td>381</td>
</tr>
<tr>
<td>Investigations to confirm diagnosis</td>
<td>381</td>
</tr>
<tr>
<td>How diagnostic laparoscopy helpful</td>
<td>382</td>
</tr>
<tr>
<td>Think other possibilities also</td>
<td>382</td>
</tr>
<tr>
<td>Special consideration in</td>
<td>383</td>
</tr>
<tr>
<td>What is alvarado scoring?</td>
<td>384</td>
</tr>
<tr>
<td>Treatment</td>
<td>385</td>
</tr>
<tr>
<td>Appendiceal Mass (Appendicular Lump)</td>
<td>390</td>
</tr>
<tr>
<td>During appendectomy if these things happen</td>
<td>391</td>
</tr>
<tr>
<td>Neoplasm of the Appendix</td>
<td>392</td>
</tr>
<tr>
<td>Carcinoid tumor (argentaffinoma)</td>
<td>392</td>
</tr>
</tbody>
</table>

**Chapter 12**

**Rectum and Anal Canal**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolapse of the Rectum</td>
<td>395</td>
</tr>
<tr>
<td>How it develops?</td>
<td>395</td>
</tr>
<tr>
<td>Associated with some anatomical changes</td>
<td>396</td>
</tr>
<tr>
<td>How will you differentiate complete rectal prolapse from mucosal prolapse?</td>
<td>397</td>
</tr>
<tr>
<td>Clinical presentation</td>
<td>397</td>
</tr>
<tr>
<td>Investigation</td>
<td>398</td>
</tr>
<tr>
<td>Treatment</td>
<td>398</td>
</tr>
</tbody>
</table>
Solitary Rectal Ulcer Syndrome 399

Fissure-in-ano 400
Location of fissure 400
How fissure develops? 401
Clinical presentation 401
Treatment 402

Anorectal Abscess 404
Sites of anorectal abscess 404
Clinical presentation 404
Investigations 404
Treatment 405

Fistula-in-ano 406
Classification of fistula 406
Clinical presentation 407
How to examine a fistula? 408
Investigation 409
What is Goodsall’s rule? 410
Treatment 410

Hemorrhoids or Piles 413
What is hemorrhoids? 413
What is anal cushion? 413
Types 414
Clinical presentation 415
How to examine a patient with hemorrhoids? 415
Treatment 416
Principles of hemorrhoidectomy 419
Postoperative complications 420

Pilonidal Sinus 420
How it develops? 420
Clinical presentation 421
Treatment 421

Rectal Cancer 423
Spread of rectal carcinoma 423
Clinical presentation 424
Assessment of tumor 424
Preoperative staging 425
Treatment 425

Cancer of the Anus 429
Risk factors 429
Pathology 430
Clinical presentation 430
Assessment of the tumor and investigations to confirm diagnosis 430
Treatment 431
<table>
<thead>
<tr>
<th>Chapter 13</th>
<th>Breast</th>
<th>432–472</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diseases of the Breast</strong></td>
<td>434</td>
<td></td>
</tr>
<tr>
<td>Inflammations and infections of breast</td>
<td>434</td>
<td></td>
</tr>
<tr>
<td>Other uncommon infections of the breast</td>
<td>441</td>
<td></td>
</tr>
<tr>
<td>Breast lump</td>
<td>441</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 14</th>
<th>Thyroid</th>
<th>473–513</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diseases of the Thyroid Gland</strong></td>
<td>475</td>
<td></td>
</tr>
<tr>
<td>Different thyroid pathologies</td>
<td>475</td>
<td></td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>491</td>
<td></td>
</tr>
<tr>
<td>Neoplasm of thyroid</td>
<td>496</td>
<td></td>
</tr>
<tr>
<td>Surgical approaches to thyroid</td>
<td>509</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 15</th>
<th>Parathyroid, Adrenal, Endocrine Pancreas and MEN</th>
<th>514–562</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parathyroid</strong></td>
<td>516</td>
<td></td>
</tr>
<tr>
<td>Sites of ectopic parathyroid</td>
<td>516</td>
<td></td>
</tr>
<tr>
<td>Under microscope</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>How Ca²⁺ level maintains?</td>
<td>517</td>
<td></td>
</tr>
<tr>
<td>Diseases of parathyroid</td>
<td>518</td>
<td></td>
</tr>
<tr>
<td><strong>Diseases of Adrenal Gland</strong></td>
<td>531</td>
<td></td>
</tr>
<tr>
<td>Anatomy and anatomical variations</td>
<td>531</td>
<td></td>
</tr>
<tr>
<td>Variant drainage of right adrenal vein</td>
<td>532</td>
<td></td>
</tr>
<tr>
<td>Microscopic features of adrenal gland</td>
<td>533</td>
<td></td>
</tr>
<tr>
<td>Hyperaldosteronism</td>
<td>534</td>
<td></td>
</tr>
<tr>
<td>Hypercortisolism [Cushing syndrome]</td>
<td>537</td>
<td></td>
</tr>
<tr>
<td>Adrenogenital syndrome</td>
<td>543</td>
<td></td>
</tr>
<tr>
<td>Adrenal insufficiency</td>
<td>544</td>
<td></td>
</tr>
<tr>
<td>Adrenal crisis</td>
<td>545</td>
<td></td>
</tr>
<tr>
<td>Diseases of adrenal medulla</td>
<td>546</td>
<td></td>
</tr>
<tr>
<td>Principles of adrenal surgery</td>
<td>552</td>
<td></td>
</tr>
<tr>
<td><strong>Endocrine Pancreas</strong></td>
<td>553</td>
<td></td>
</tr>
<tr>
<td>Pancreatic endocrine neoplasms</td>
<td>554</td>
<td></td>
</tr>
<tr>
<td><strong>Multiple Endocrine Neoplasia (MEN) Syndromes</strong></td>
<td>560</td>
<td></td>
</tr>
<tr>
<td>Multiple endocrine neoplasia type I</td>
<td>561</td>
<td></td>
</tr>
<tr>
<td>Multiple endocrine neoplasia type II</td>
<td>562</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chapter 16</th>
<th>Trauma</th>
<th>563–673</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>565</td>
<td></td>
</tr>
<tr>
<td>Types of injury</td>
<td>565</td>
<td></td>
</tr>
<tr>
<td>Head injury</td>
<td>582</td>
<td></td>
</tr>
<tr>
<td>Assessment of severity of brain injury</td>
<td>595</td>
<td></td>
</tr>
<tr>
<td>Maxillofacial injuries</td>
<td>597</td>
<td></td>
</tr>
<tr>
<td>Neck injury</td>
<td>602</td>
<td></td>
</tr>
<tr>
<td>Thoracic trauma</td>
<td>612</td>
<td></td>
</tr>
</tbody>
</table>
Abdominal injuries 624
Damage control surgery 670
Abdominal compartment syndrome 673

### Chapter 17 Burn

**Introduction** 676  
Different mechanisms of burn injury 676  
When you refer a burn patient to a dedicated burn center? 677  
Management of burn injury 677  
Prognosis 680  
Management 681  
Systemic changes in burn 688  
Electric burn 689  
Chemical burn 692  
Late complications of burn 692

### Chapter 18 Arterial Diseases, Venous Diseases and Diseases of Lymphatics

**Diseases of the Arteries** 696  
Arterial occlusive diseases 696  
Acute arterial occlusion of the extremity 701  
Chronic occlusive disease of the extremity 709  
Arterial occlusive disease of the upper extremity 712  
In aortoiliac occlusive disease 716  
In femoral, popliteal and tibial occlusive disease 716  
Upper extremity occlusive diseases 716  
Thromboangiitis obliterans 717  
Chronic visceral ischemia 718  
Aneurysmal vascular disease 724  
Diseases of thoracic aorta 738  
Vascular trauma 746  

**Venous Diseases** 749  
Different types 749  
Deep vein thrombosis (DVT) 750  
Venous insufficiency 754  
Venous ulcer 765  

**Disorders of Lymphatic System** 765  
Acute lymphangitis 766  
Lymphedema 766

### Chapter 19 Hernia

**Introduction** 776  
Different types of hernia 778  
Nyhuis classification of groin hernia 783
Anatomy of the groin  783
Inguinal hernia  785
Special types of inguinal hernia  795
Some unusual types of hernia  796
Femoral hernia  797
Umbilical hernia  799
Epigastric hernia  801
Incisional hernia  802
Unusual hernia  808

Chapter 20 Diseases of the Testes, Scrotum and Penis  813–831
Diseases of the Testes  815
Undescended testis  815
Torsion of the testis (syn. Torsion of the spermatic cord)  822
Varicocele  823
Hydrocele  825
Hematocele  828
Pyocele  828
Chylocele  828
Other scrotal swellings  828
Other scrotal diseases  829
Phimosis  830
Paraphimosis  831

Chapter 21 Diseases of the Esophagus  832–863
Hiatus hernia  834
Gastroesophageal reflux disease (GERD)  837
Esophageal motility disorder  841
Esophageal diverticula  846
Esophageal perforation  849
Cancer of esophagus  857

Chapter 22 Diseases of the Salivary Gland  864–878
Salivary Gland Pathologies  866
Inflammatory pathologies  866
Obstructive pathology  868
Salivary gland tumors  871
Surgical procedures for salivary gland pathology  875

Chapter 23 Skin and Adnexal Lesion  879–911
Diseases of the Skin and its Adnexa  881
Cystic lesions of the skin  881
Ganglion  883
Vascular lesions of the skin  884
Benign tumors 890
Skin infection 895
Benign pigmented lesions 898
Premalignant lesions 900
Malignant lesions 901
Other malignancies of the skin 910

Chapter 24  Ulcer, Sinus and Fistula
Ulcer 914
Basic principles of ulcer dressing 926
Sinuses and Fistula 927
Sinus 927
Fistula 927

Chapter 25  Urology
Diseases of the Kidney 931
Urinary symptoms 931
Diseases of Kidney and Uretzer 936
Congenital malformations 936
Cystic disease of kidney 943
Other malformations 946
Hydronephrosis 948
Renal stone 950
Percutaneous nephrolithotomy 959
Open surgery for renal stone 961
Infections of kidney 963
Tuberculosis of kideney 972
Kidney tumors 975
Diseases of Ureter 984
Ureteral calculi 984
Urothelial tumors of renal pelvis and ureter 985
Urinary Bladder 988
Congenital anomalies 988
Bladder calculi 990
Schistosomiasis of the urinary bladder 994
Bladder tumor 996
Diseases of Prostate 1000
Benign prostatic hyperplasia 1000
Prostate 1010
Prostatitis 1010
Carcinoma of prostate 1011
Urethra 1016
Urethral stricture 1016
Hypospadias 1019
Contents

Priapism 1022
Peyronie’s disease 1024
Carcinoma of penis 1025
Neoplasms of Testis 1031

Chapter 26  Minimally Invasive Surgery, Robotic Surgery 1037–1053
Minimally Invasive Surgery 1039
Different minimal access techniques 1039
Physiology of pneumoperitoneum 1041
Access 1042
Port placement 1045
Instrumentation 1045
Advantages and disadvantages 1049
Examples of laparoscopic procedures 1049
Contraindications 1050
Complications 1050
New techniques of minimally invasive surgery 1050
Robotic surgery 1051

Chapter 27  Nerve Injury 1054–1062
Introduction 1056
Classification of nerve injuries 1056
Sunderland’s classification 1058
Clinical features 1058
Management of nerve injury in closed injury 1059
Management of nerve injury in open injury 1059
Principles of nerve repair 1059

Chapter 28  Surgery of Hand 1063–1071
Introduction 1065
Infections in hand 1067
Injuries in hand 1069

Chapter 29  Neck Swelling 1072–1082
Neck 1074
Anatomy of neck 1074
Neck swellings 1075

Chapter 30  Cleft Lip and Palate 1083–1089
Cleft lip 1085
Cleft palate 1088
Chapter 31  Anesthesia  1090–1103

Introduction  1092
Types of anesthesia  1092
Preoperative evaluation  1101
Intraoperative management  1102
Complications of general anesthesia  1103

Chapter 32  Instrument  1104–1131

Surgical Instruments  1106
Parts of an instrument  1106
Instruments used for antiseptic dressing and draping  1106
Instruments used for fixation  1107
Instruments used for giving incision over the skin  1107
Instruments used for hemostasis  1108
Instruments used for holding tissues  1112
Instruments used for suturing  1115
Other methods of skin closure  1119

Index  1133–1140
Chapter 26

Minimally Invasive Surgery, Robotic Surgery
Important Topics

- Different Minimal Access Techniques
- Physiology of Pneumoperitoneum
- Laparoscopic Access
- Port Placement
- Instrumentation
- Advantages and Disadvantages of MIS
- New Techniques of MIS
- Robotic Surgery

‘The mind likes a strange idea as little as the body likes a strange protein and resists it with a similar energy. It would not perhaps, be too fanciful to say that a new idea is the most quickly acting antigen known to science.’

Wilfrid Batten Lewis Trotter (1872–1939)
British Surgeon and Sociologist
Minimally Invasive Surgery

It is not a discipline of surgery, rather a philosophy of surgery.

The philosophy—
- Small incision
- Use of miniaturized sophisticated instruments and imaging techniques
- Performing basic to complex surgical interventions
- Less sufferings of the patient.

Different Minimal Access Techniques

Laparoscopy

Access to the inflated peritoneal cavity (pneumoperitoneum) through sleeve (metal or plastic)

Extracavitary Endoscopy

Body planes (retroperitoneal space, space of Retzius, extraperitoneal space, subfascial space of leg) are accessed, but needs inflation to develop the working space.

Examples: TEP repair of inguinal hernia, Laparoscopic nephrectomy, subfascial perforator ligation.
Endoluminal Endoscopy

Rigid or flexible endoscopes are introduced into the urinary tract (e.g. cystoscopy), gastrointestinal tract (upper and lower gastrointestinal endoscopy), respiratory tract (e.g. bronchoscopy).

Thoracoscopy

Thoracic cavity is accessed through a rigid endoscope.
Physiology of Pneumoperitoneum

Effects of pneumoperitoneum on body systems

Metabolic effect

1. Respiratory acidosis
   - Carbonic acid is formed
   - Co₂ rapidly absorbed through the peritoneum into the circulation
   - Bone buffers the carbonic acid (upto 120)
   - If buffers saturated
     - Respiratory acidosis develops

2. Increased serum cortisol

Mechanical effects

1. Altered venous return
   - Venous return from lower extremity
   - Deep venous thrombosis (DVT)

2. Bradycardia—Sudden stretching of peritoneum may cause vasovagal response that leads to bradycardia, hypotension

3. Elevated diaphragm—Resulting in ↑ CVP and ↑ filling pressure of right and left heart. Also ↑ chance of barotrauma

4. ↓ renal circulation—↑ intra-abdominal pressure decreases renal blood flow, GFR and urine output by the mechanism of pressure effect on kidney and renal vein

5. ↑ ADH—Decreases the urine output
Access

- Laparoscopic access
- Extraperitoneal and subcutaneous access
- Hand-assisted laparoscopic access.

Laparoscopic Access

Two techniques for abdominal access

- Direct puncture technique (with Veress needle)
- Open technique (Hasson technique)

Direct puncture technique

- Measures to be taken—
  - Site of incision—Umbilicus is one of the preferred points of access, because the abdominal wall is quite thin in this location, even in obese patient.

Trajectory of Veress needle

Wrong trajectory—Chance of injury to aorta or iliac vessels
Correct trajectory—Chance of injury to vessels is less
Force and depth of insertion of needle—
Veress needle is inserted after lifting the abdominal wall with towel clips or firm hand grip.

Surgeon can feel two pops as the needle penetrate the fascia and peritoneum.
Confirmation of proper placement of needle—
Then the Veress needle is connected to the insufflation tubing.

Open technique (Hasson technique)

Particularly indicated in patients who have undergone abdominal operations previously.

Extraperitoneal and Subcutaneous Access

- Access to retroperitoneum
  - For nephrectomy, ureterolithotomy, adenectomy
- Access to preperitoneal space
  - For TEP repair of inguinal hernia
- Access to subcutaneous space
  - For subfascial perforator ligation
  - Minimally invasive thyroid surgery
  - Saphenous vein harvesting
Hand-assisted Laparoscopic Access

- In laparoscopy, a ‘port’ for the hand is created in such a way that the pneumoperitoneum is preserved
- Tactile advantages of open surgery can be achieved due to use of hand
- Particularly indicated in advanced colon surgery.

Port Placement

Ideal trocar orientation will create an equilateral triangle between the surgeon’s right hand, left hand and the telescope. Each arm will be about 10–15 cm.

Instrumentation

1. Imaging system
   - Telescope—Standard laparoscope is a metal shaft containing a series of quartz-rod lenses and optical fibers.
Video camera:
- Video camera is attached to the eyepiece of the telescope
- For perfect color representation, three-chip camera is required—Red, green and blue (RGB) input
- In minimally invasive techniques—
  Priority is on—
  Illumination — 1st priority
  Resolution — 2nd priority
  Color — 3rd priority.
2. Energy sources
   a. Radiofrequency electrosurgery —
   - Most popular energy source in minimally invasive surgery.
   - RF electrosurgery delivers an alternating current of 500 000 cycles/s (Hz). This causes tissue heating that results in coagulation (60°C), dessication (100°C) and carbonization (> 200°C).
   - The RF can be delivered by monopolar and bipolar electrodes.

   - A short, high voltage current (coagulation current) is used for coagulation necrosis of bleeding sources. Lower voltage, higher-wattage current (cutting current) is used for tissue division.

   - Complications:
     - Capacitive coupling
     - Direct coupling.

   ![Diagram of electrosurgery setup]

   ![Diagram of heat production and returning electrons]

   ![Diagram of ground plate and returning electrons]

   ![Diagram of current flow through unipolar electrode]
Ligasure— A newer bipolar device—Both coagulates (larger vessels) as well as divides the tissue.

Argon beam coagulation—
- A special type of monopolar electrosurgery.
- Uniform field of electrons is delivered across a tissue surface with the help of a jet of argon gas.
- Not preferable in laparoscopic surgery because the argon gas increases the chance of gas embolism.

b. Ultrasonic shears (harmonic scalpel)—
- Can coagulate and divide the blood vessels.
- A generator produces an current (55,500 Hz) that transmits to the piezoelectric crystal stack (in the transducer). The crystal stack converts the electrical energy to mechanical vibration at the same frequency. This vibration is further amplified as it traverses the active blade of the harmonic scalpel. The shearing force separates the tissue and produces heat, results in coagulation of bleeding vessels.
- Damage to adjacent tissues is minimal.
3. **Hand instruments**
   - They are larger and narrower than conventional hand instruments (in open surgery).
   - Standard hand instruments are 30 cm long and 5 mm in diameter.
   - Shorter and narrower instruments are required for pediatric (2–3 mm) laparoscopy, whereas longer instruments are required for bariatric surgery.

4. **Ports**
   - All ports have attachments for insufflation and valves to prevent gas leaks.

5. **Insufflator**
   - Rapid-flow insufflator supplies the CO₂ and maintains the pneumoperitoneum.
   - It maintains the gas-flow according to present pressure values.

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**Advantages and Disadvantages**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Smaller incisions</td>
<td>• Two dimensional representation of the operative field makes the depth perception difficult</td>
</tr>
<tr>
<td>• Cosmetically better</td>
<td>• Hand-eye coordination is required.</td>
</tr>
<tr>
<td>• Decreased tissue trauma</td>
<td>• Loss of tactile feedback</td>
</tr>
<tr>
<td>• Earlier return to activity</td>
<td>• Technical expertise and infrastructure facility is required</td>
</tr>
<tr>
<td>• Reduced hospital stay</td>
<td>• Video recording of the procedure is possible in all cases</td>
</tr>
<tr>
<td>• Video recording of the procedure is possible in all cases</td>
<td>• Decreased chance of contact with HIV and hepatitis B virus</td>
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</tbody>
</table>

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**Examples of Laparoscopic Procedures**

<table>
<thead>
<tr>
<th>Basic</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cholecystectomy</td>
<td>• Bile duct exploration</td>
</tr>
<tr>
<td>• Appendectomy</td>
<td>• Nissen fundoplication</td>
</tr>
<tr>
<td>• Hernia repair (TEP and TAPP)</td>
<td>• Splenectomy</td>
</tr>
<tr>
<td>• Diagnostic laparoscopy</td>
<td>• Colectomy (hand assisted)</td>
</tr>
<tr>
<td></td>
<td>• Nephrectomy</td>
</tr>
<tr>
<td></td>
<td>• Adrenalectomy</td>
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</tbody>
</table>
Contraindications

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized peritonitis</td>
<td></td>
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<tr>
<td>Intestinal obstruction</td>
<td></td>
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<tr>
<td>Cirrhosis of liver</td>
<td></td>
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<tr>
<td>Coagulopathy</td>
<td></td>
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<tr>
<td>Pregnancy</td>
<td></td>
</tr>
<tr>
<td>History of multiple abdominal operations</td>
<td></td>
</tr>
<tr>
<td>Organomegaly</td>
<td></td>
</tr>
</tbody>
</table>

Complications

<table>
<thead>
<tr>
<th>Related to pneumoperitoneum</th>
<th>Related to port insertion</th>
<th>Related to procedure</th>
<th>Delayed complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage to major vessels or viscera</td>
<td>Injury to viscera, vessels</td>
<td>Diathermy related injury (direct coupling, capacitive coupling)</td>
<td>Port site infection (e.g. atypical mycobacterial infection)</td>
</tr>
<tr>
<td>CO₂ embolus</td>
<td>Hemorrhage</td>
<td>Inadvertent organ injury or ligation (e.g. CBD ligation)</td>
<td>Port site hernia (commonly in umbilical part)</td>
</tr>
<tr>
<td>Metabolic acidosis</td>
<td></td>
<td>Hemorrhage</td>
<td></td>
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<tr>
<td>Cardiorespiratory compromise</td>
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</tbody>
</table>

New Techniques of Minimally Invasive Surgery

1. NOTES (Natural Orifice Transluminal Endoscopic Surgery)
2. SILS (Single Incision Laparoscopic Surgery).

NOTES (Natural Orifice Transluminal Endoscopic Surgery)

▲ This concept involves access within the abdominal cavity through a natural orifice (vagina, mouth, urethra) to perform surgical procedures.
▲ Transvaginal and transgastric approach are common in NOTES.
▲ TV NOTES is a safe alternative to traditional laparoscopic surgery in female patients.
   - Appendectomy, cholecystectomy, nephrectomy, adrenalectomy, hernia repair are now performed by TV NOTES.
   - The advantages are better cosmetic outcome, decreased postoperative pain and shorter recovery period.
▲ In transgastric NOTES, dual channel flexible endoscope is used and through the gastrotomy wound, the endoscope along with instruments reach to the target organ.
   - The site of gastrotomy depends on the type of surgery.
   - Cholecystectomy, appendectomy are performed by transgastric NOTES.
Still now, robotic surgery is performed by a surgeon with the help of robotic arms, not by a preprogramed robots. ‘surgeon with robotic arms’.

Two surgical robotic system—
- Zeus robotic surgical system
- da Vinci surgical robotic system
  (the robotic system now used.)

**How da Vinci surgical robotic system works?**
- Its working principle is based on the master-slave concept.
- Made up of 3 components.
Components of da Vinci Robotic System

**Surgeon console:**
Viewing a 3-D image of the operative field, the surgeon moves the master controllers at the console. These movement, are exactly translated to the robotic arm, but with more degree of movement, more preciseness and without any tremor or fatigue.

**The patient (robotic) cart:** Consists of 4 arms—One for the camera and others for the instruments.

- Each arm has 3 joints (resembling the human arm)
- Setup joint (shoulder)
- Instrument clutch button (elbow)
- Effector instrument (wrist)
- Each instrument have a wrist—The wrist provides six degrees of freedom at the tip and the seventh degree of freedom is by the instrument itself.
Vision cart: Consists of 3-D high resolution endoscope, camera (3-chip) with camera control unit, high intensity illuminators.

- This system provides 3-D stereoscopic vision to the surgeon.

Advantages

- 3-D stereoscopic vision to the surgeon—Depth perception of binocular vision can be achieved.
- More degrees of freedom of instruments.
- Improved hand-eye coordination due to visual and spatial alignment, the surgeon feel as though his hands are inside the patient’s body.
- Motion scaling—A unique feature of da Vinci system. It scales down coarse movements of the surgeon (master) to smaller and finer movements made by the robotic arm (slave) and instrument tip.
- Useful in difficult anatomic areas (e.g. pelvis) where extremely fine dissection is warranted (e.g. nerve sparing dissection).

Disadvantages

- Higher cost
- Needs expertise proper training
- Needs adequate setup.

Uses

- **Urology**
  - Robotic radical prostatectomy (RRP)
  - Robotic radical cystectomy (RRC)
  - Reconstructive surgeries (e.g. pyeloplasty, bladder augmentation)

- **GI surgery**
  - Colorectal surgeries
  - TME

- **Hepatic and pancreatic surgery**
  - Pancreaticoduodenectomy
  - Hepatic resection

- **Bariatric surgery**
  - Gastric bypass
  - Gastric banding