

Synopsis of Medical Instruments & Procedures

*Including Surgical, Medical, Orthopedics,
ENT, Obs. & Gyne., Anesthesia,
Ophthalmology Instruments, Bandages,
Minor Operations: Techniques & Management*

4th
Edition

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Contents

Section 1: General Surgical Principles and Instruments

1

1. The Surgical Patient

3

- Routine Preparation of the Patient 3
- Operating Room Technique 4

2. Instruments Used for Preparing the Surgical Patient

9

- Cheatle Forceps 9
- Rampley Sponge Holding Forceps 9
- Towel Clips 10
- Instruments Used in Preparation of Limb Surgery 12

3. Incision Making: Methods and Instruments

15

- Incision Planning—General Principles 15
- Method of Making Good Incision 15
- Major Abdominal Incisions 17
- Vertical Incisions 18
- Oblique Incisions 18
- Transverse/Horizontal Incisions 18

4. Hemostasis: The Methods and the Means

19

- Techniques of Using an Artery Forceps 19
- Artery Forceps 20
- Mosquito Artery Forceps 21
- Kocher Hemostatic Forceps 21
- Mayo Kidney Pedicle Clamp 22
- Negus Artery Forceps 22
- Potts Bulldog Clamp 22
- Wells Arterial Clamp 23
- Electrosurgery or Diathermy 24
- Cryosurgery 24
- Laser 25

5. Retractors

26

Types of Retractors 26

- Single Hook Retractor 26
- Volkmann Retractor 27
- Langenbeck Retractor 27
- Czerny Retractor 27
- Nerve Hook Retractor 28
- Love Nerve Root Retractor 28
- Morris Retractor 28
- Deaver Retractor 29

■ Doyen Retractor	30	
■ Allison Lung Retractor	30	
■ Self-retaining Retractor	30	
6. Dissecting Forceps		32
■ Types	32	
■ Russian Forceps	33	
7. Scissors		34
■ Types of Scissors	34	
■ Mayo Scissors (Mayo)	35	
■ Metzenbaum Scissors	35	
■ Bandage Scissors	36	
■ Gauze-cutting Scissors	36	
■ Stitch-cutting Scissors	36	
8. Tissue-holding Forceps		38
■ Classification of Tissue-holding Forceps	38	
■ Allis Tissue Forceps	38	
■ Lane Tissue Forceps	39	
■ Babcock Tissue Forceps	39	
■ Duval Tissue Forceps	40	
■ Vulsellum and Tenaculum	40	
9. Wound Closure: The Traditional Methods and Sutures		41
■ Types of Suture Material	41	
■ How to Select a Suture?	42	
■ Absorbable Sutures	43	
■ Nonabsorbable Sutures	44	
■ Methods of Suturing	45	
■ Types of Knot	47	
■ Various Methods and Steps of Making Surgical Knots	48	
■ Sutures as Commonly Chosen for Various Functions	49	
10. Surgical Needles and Needle Holder		50
■ Surgical Needles	50	
■ Aneurysm Needle	52	
■ Needle Holder	53	
11. Modern Techniques of Wound Closure		55
■ New Techniques of Wound Closure	55	
12. Drains and their Purposes		58
■ Indications of Using a Drain	58	
■ Disadvantages of Using a Drain	58	
■ Types of Drains	58	
Section 2: Special Surgical Procedures and Instruments		61
13. Thyroid Surgery: Method and Instruments		63
Method		63
■ Thyroidectomy	63	

Instruments Used in Thyroid Surgery	64
▪ Kocher's Thyroid Dissector	64
▪ Kocher's Thyroid Retractor	64
▪ Jolls Thyroid Retractor	65
▪ Strap Muscle Clamp	65
14. Bowel Surgery: Methods and Instruments	67
▪ Lahey Goiter Traction Forceps	65
▪ Preparation of the Bowel for Surgery	67
▪ Instruments for Bowel Surgery	67
▪ Gastric Clamps	67
▪ Moynihan Gastric Clamp	68
▪ Payr Gastric Crushing Clamp	68
▪ Lane Gastroenterostomy Clamp	69
▪ Intestinal Clamps	70
▪ Parker-Kerr Clamp	71
▪ Doyen Intestinal Clamp	71
▪ Colostomy Rod	73
▪ Kocher Appendicectomy Clamp	73
▪ Payr Appendix Clamp	73
15. Biliary Tract Surgery and Instruments	74
▪ Cholecystectomy Forceps	74
▪ Desjardin's Choledocholithotomy Forceps	74
▪ Cheatle Gallstone Scoop and Hook	75
▪ Bakes Dilator	75
▪ Kehr's T-Tube	76
16. Anorectal Surgery: Methods and Instruments	78
▪ Fistula Director	78
▪ Brodie Fistula Director	78
▪ Proctoscope	79
▪ Gabriel Syringe	80
▪ Injection Treatment of Hemorrhoids	80
▪ Rectal Dilator	81
▪ Hemorrhoid Ligator/Banding Set	81
17. Urological Surgery: Methods and Instruments	82
Catheters	82
▪ Plain Catheter	82
▪ Foley Catheter and Introducer	83
▪ Gibbon's Catheter	84
▪ Malecot Catheter	86
▪ Penile Clamp	87
▪ Filiform Bougie	87
▪ Metallic Bougies/Urethral Dilator	88
▪ Suprapubic Trocar and Cannula	88
▪ Bladder Sound	89

- Cystolithotomy Forceps 89
- Randall Renal Calculus Forceps 89
- Dormia Stone Dislodger 90

18. Orthopedic Instruments

91

- Mallet 91
- Osteotome 91
- Chisel 92
- Bone Gouge 92
- Amputation Saw 92
- Gigli Wire Saw 93
- Bone Cutter 93
- Bone Nibbler 94
- Farabeuf Raspatory or Periosteal Elevator with Thumb Rest 94
- Charnley Periosteal Elevator 95
- Doyen Rib Raspatory 95
- Rib Shear with Serrated Blade 96
- Bickford Bronchial Clamp 96
- Volkmann Scoop 97
- Bone Lever 97
- Bone Holding Forceps 98
- Bone Reduction Forceps 98
- Steinmann Pin 99
- Denham Pin 99
- Schanz Screw 99
- Kirschner Wire 100
- Rush Intramedullary Nail 100
- Bohler Stirrup 101
- Crutchfield Tongs 101
- Lowman Bone Clamp 102
- Smith-Petersen Nail 102
- Dynamic Hip Screw 102
- Kuntscher Intramedullary Nail 103
- Charnley Compression Arthrodesis Clamp 103
- Hip Hemiarthroplasty Prosthesis 104
- Femoral Rasp 105
- Moore Femoral Head Extractor 105

19. Rubber and PVC Instruments

106

- Nasogastric Tube 106
- Ryle Tube 106
- Levin Tube 107
- Double Lumen Nasogastric Tube (Salem Sump) 107
- Infant Feeding Tube 108
- Mousseau Barbin Tube 109
- Stomach Wash Tube 110

- Flatus Tube 110
- Sengstaken Blakemore Tube 111

20. Miscellaneous Instruments 113

- Myers Vein Stripper 113
- Doyen Mouth Gag 114
- Humby Skin Grafting Knife 114
- Kidney Tray 115

Section 3: Minor Operative Procedures and Bandages 117

21. Minor Surgical Procedures 119

- Types of Local Anesthesia Used in Minor Operations 119
- Minor Operations: Incision and Drainage of an Abscess 120
- Sebaceous Cyst Removal 121
- Excision of Skin Swellings Like Lipoma, Fibroma, Neurofibroma, etc. 121
- Lymph Node Biopsy 121
- Venous Cutdown/Venesection 121
- Circumcision 123
- Suprapubic Cystostomy 124
- Condom Drainage 124
- Eversion of Hydrocele Sac 124
- Vasectomy 125

22. Dressings and Bandages 126

- Dressings 126
- Bandages 126

Section 4: Medical Instruments and Procedures 133

23. Injections and Infusions 135

- Intramuscular Injections 135
- Subcutaneous Injections 137
- Intradermal Injections 137
- Intravenous Infusion 138
- Arterial Puncture and Cannulation 140
- Intraosseous Infusion 142

24. Lumbar Puncture: Indications and Methodology 143

- Indications for Lumbar Puncture 143
- Lumbar Puncture Needle 143
- Methodology of Lumbar Puncture 144
- Ventricular Tap 146
- Cisternal Puncture 147

25. Bone Marrow Biopsy: Methods and Instruments 148

- Aspiration Biopsy 148
- Bone Marrow Trephine Biopsy 151
- Jamshidi Trephine Biopsy Needle 151

26. Liver Biopsy: Indications and Technique	153
▪ Indications for Liver Biopsy	153
▪ Menghini Aspiration Biopsy Needle	154
▪ Vim-Silverman Biopsy Needle	155
▪ Core Biopsy (Travenol Tru-Cut®) Needle	156
27. Renal Biopsy: Indications and Procedure	158
▪ Method of Taking a Renal Biopsy	158
28. Abdominal Paracentesis	161
▪ Indications	161
▪ Causes of Ascites	161
▪ Site	161
▪ Procedure	162
▪ Contraindications	162
▪ Complications	162
29. Thoracentesis and Pleural Biopsy	163
▪ Pleural Tap	163
▪ Tube Thoracotomy	164
▪ Needle Biopsy of the Pleura	165
30. Pericardiocentesis	168
▪ Pericardial Effusion	168
▪ Pericardiocentesis	168
Section 5: Instruments and Procedures Related to ENT	171
31. Examination of Ear: Method and Instruments	173
▪ Head Mirror	173
▪ King's College Hospital Model Headlight	173
▪ Aural Speculum	173
▪ Electrical Otoscope	174
▪ Jobson's Aural Probe	175
▪ Tuning Fork	175
32. Instruments Used for Aural Surgery	176
▪ Aural Syringe	176
▪ Eustachian Catheter	177
▪ Politzer Bag	177
▪ Siegel's Pneumatic Speculum	178
▪ Myringotome	178
▪ Mastoid Retractor	179
▪ Mastoid Gouge	179
▪ Mallet	180
▪ Mastoid Cell Seeker with Scoop	180
33. Examination of Nose: Method and Instruments	181
▪ Thudichum Nasal Speculum	181
▪ St. Clair Thomson Nasal Speculum	182

■ Posterior Rhinoscopy Mirror	182
■ Nasal Foreign Body Hook	183
■ Nasal Packing Forceps	183
34. Instruments Used for Nasal Surgery	185
Instruments Used for the Management of Sinusitis	185
■ Antral Trocar and Cannula	185
■ Intranasal Antrostomy	186
■ Luc's Forceps	187
■ Krause's Nasal Snare	188
Instruments Used in Septal Surgery	188
■ Frer's Septal Knife	188
■ Long Bladed Nasal Speculum	188
■ Killian Long Bladed Self-retaining Nasal Speculum	189
■ Ballenger's Swivel Knife	189
■ Bayonet-Shaped Gouge	189
■ Walsham's Forceps	190
35. Examination of Throat: Method and Instruments	191
■ Lack's Spatula	191
■ Laryngeal Mirror	191
■ Direct Laryngoscope	192
■ Anterior Commissure Laryngoscope	193
■ Rigid Bronchoscope	193
■ Flexible Fiberoptic Bronchoscope	194
■ Esophagoscope	196
■ Esophagoscopy	197
■ Esophageal Speculum	197
■ Laryngeal Forceps	197
■ Crocodile Punch Biopsy Forceps	198
36. Instruments Used for Tonsillectomy	199
■ Boyle-Davis Mouth Gag	199
■ Denis-Browne Tonsil Holding Forceps	199
■ Yankauer's Tonsillar Suction Tube	200
■ Tonsillar Dissector and Anterior Pillar Retractor	200
■ Eve's Tonsillar Snare	200
■ Ballenger's Guillotine	200
■ St. Clair-Thomas Adenoid Curette with Cage	201
■ Peritonsillar Abscess Drainage Forceps	201
37. Tracheostomy: Method and Instruments	202
■ Tracheostomy Tubes	202
■ Fuller's Biflanged Tracheostomy Tube	202
■ Jackson's Tracheostomy Tube	203
■ Nonmetallic Tracheostomy	203
■ Tracheostomy	204

Section 6: Ophthalmological Instruments**207****38. Instruments Used for Examination of the Eye****209**

- Desmarres Eyelid Retractor 209
- Ophthalmic Loupe 209
- Priestley-Smith Retinoscope 210
- Ophthalmoscope 210
- Trial Frame 211
- Schiötz Tonometer 211
- Lang's Universal Eye Speculum 212
- Foreign Body Spud and Spoon 212
- Cartella Eye Guard/Shield 213
- Pin Hole 213
- Maddox Rod 214

39. Instruments Used for Cataract Operations**215**

- Fixation Forceps 215
- Conjunctival Forceps 215
- Iris Forceps 215
- Corneal Forceps (Disc Forceps) 216
- Lims Forceps 217
- Pierse Hoskin Forceps 217
- Arruga Capsule Forceps 217
- De Wecker Scissors 218
- Needle Holder 218
- Spring Scissors 218
- Blunt Pointed Scissors 219
- Sharp Pointed Scissors 219
- Vannas Scissors 219
- Von Graefe Knife (Cataract Knife) 220
- Keratome 220
- Blade Breaker and Holder 221
- Broad Needle 221
- Paracentesis Needle 221
- Cystitome (Capsulotomy Knife) 221
- Curette 222
- Wire Vectis 222
- Irrigating Wire Vectis 222
- Ziegler Knife 223
- Bowman Needle 223
- Iris Retractor 223
- Expression Hooks 224
- Lens Spatula 224
- Superior Rectus Forceps 224
- Irrigation-Aspiration Cannula 225
- Kraft Posterior Capsule Polishing Curette 225

40. Intraocular Lens Implants and Instruments	226
▪ Types of Intraocular Lenses (IOLs)	227
Instruments Used for IOL Surgery	228
▪ Clayman Lens Holding Forceps	228
▪ Mcpherson Micro-forceps	229
▪ Vannas Long Blade Scissors	229
▪ Sinskey Shearing Lens Hook and Manipulator	229
▪ Operating Microscope	229
41. Instruments Used for Glaucoma Surgery	230
▪ Iris Forceps	230
▪ Disc Forceps	230
▪ Paracentesis Needle	230
▪ Tooke Knife	230
▪ Corneoscleral Trephine	231
▪ Iris Repositor	231
▪ Elschmig Cyclodialysis Spatula	231
▪ Barkan Goniotomy Knife	232
▪ Harms Trabeculotomy Probe	232
42. Instruments Used for Lid Surgery	233
▪ Beer Knife	233
▪ Chalazion Scoop	233
▪ Chalazion Clamp	233
▪ Jaeger Protective Spatula (Lid Spatula)	234
▪ Lid Clamp (Entropion Clamp)	234
▪ Epilation Forceps/Cilia Forceps	234
▪ Berke Ptosis Clamp	235
43. Instruments Used for Lacrimal Sac Surgery	236
▪ Nettle ship Canaliculus Dilator (Punctum Dilator)	236
▪ Tweedy Canaliculus Knife	236
▪ Bowman Lacrimal Probe	236
▪ Lacrimal Rasp	237
▪ Lacrimal Syringe and Cannula	237
▪ Lacrimal Retractor	237
▪ Lacrimal Sac Dissector and Curette	238
▪ Bone Punch	238
▪ Rougine	239
▪ Mucoperiosteal Elevator	239
▪ Worst Pigtail Probe	240
44. Miscellaneous Instruments	241
▪ Strabismus Hook	241
▪ Undine	241
▪ Knapp's Roller Forceps	241
▪ Enucleation Spoon with Optic Nerve Guard	242
▪ Enucleation Scissors	242

- Evisceration Scoop 242
- Bowman's Heat Caution 242
- Castroviejo Caliper and Rule 243

Section 7: Gynecological and Obstetrical Instruments and Procedures

245

45. Instruments Used for Examination of Female Reproductive System

247

- Auvard Weighted Vaginal Speculum 247
- Sims Speculum 247
- Cusco Bivalved Speculum 248
- Fergusson Speculum 249
- Nella Speculum 250
- Cervical Dilators 250
- Simpson Uterine Sound 252
- Bladder Sound 252
- Anterior Vaginal Wall Retractor 253
- Ayre Spatula 253
- Sponge (Swab) Holding Forceps 253
- Gelpi Vulva Retractor 254
- Uterine Curettes 254
- Vulsellum Forceps 255
- Tenaculum 256
- Cervical Punch Biopsy Forceps 256
- Endometrial Biopsy Curette 257
- Pinard's Fetoscope 257
- Pelvimeter 258

46. Investigative Procedures in Gynecology and Obstetrics

260

- Dilatation and Curettage (D & C) 260
- Rubin's Test (Tubal Insufflation Test) 261
- Rubin's Tubal Insufflation Cannula 263
- Currently Preferred Tests for Tubal Patency 264

47. Episiotomy

265

- Episiotomy Scissors 268

48. Obstetric Forceps and Vacuum Extractor

269

Types of obstetric forceps

269

- Outlet Forceps 270
- Axis-Traction Forceps 270
- Mode of Action of the Obstetric Forceps 271
- Types of Forceps Application 271
- The Vacuum Extractor (Ventouse) 275

49. Medical Termination of Pregnancy

277

- Indications 277
- Methods of Induction 278

- Menstrual Regulation 279
- Manual Vacuum Aspiration Syringe 279
- Dilatation and Evacuation 280
- Intra-amniotic Injections 280
- Laminaria Tent Introducing Forceps 281
- Laminaria Tent 281
- Hysterotomy 282

50. Embryotomy 283

- Craniotomy 283
- Evisceration 285
- Decapitation Hook and Saw 285
- Cleidotomy 285

51. Intrauterine Contraceptive Devices 286

- First Generation IUCDs 286
- Lippes Loop 286
- Second Generation IUCDs 287
- Copper-T 287
- Second Generation IUCDs 287
- Third Generation IUCDs 288

52. Miscellaneous Instruments 293

- Green-Armytage Forceps 293
- Ovum Forceps 294
- Broad Ligament Forceps 294
- Bozeman Catheter 294
- Uterine Packing Forceps 295
- Myoma Screw 296
- Bonney Myomectomy Clamp 296
- Bladder Retractor 297
- Vant Uterine Polypus Forceps 297
- Allis Forceps 297
- Uterus Holding Forceps 298
- Trocar and Cannula 298
- Pye-Smith Forceps (Trocars) 299
- Nelaton Forceps 299
- Willet Scalp Traction Forceps 299
- Umbilical Cord Clamp 300
- Bonney Vaginal Forceps 300

53. Laparoscopy and its Equipment 301

- Laparoscope 302
- Pneumoperitoneum Needle 303
- Trocar and Cannula 303
- Pneumoperitoneum Apparatus 303
- Laparoscopy Procedure 303

Section 8: Instruments and Equipment Used for Anesthesia	305
54. Anesthetic Machine and its Attachments	307
▪ Boyle Machine	307
▪ Gas Cylinders	308
▪ Flowmeters	309
▪ Vaporizers	310
55. Breathing Circuits and Attachments	312
▪ Schimmelbusch Mask	312
▪ Magill Breathing Attachment	313
▪ Ayre T-piece System	313
▪ Closed or Rebreathing Systems	313
▪ Carbon Dioxide Absorption System	314
▪ Components of Breathing Attachments	314
▪ Reservoir Bag	315
▪ Breathing Tubes	315
▪ Face Masks	316
▪ Harness	316
▪ Endotracheal Tubes	316
▪ Endotracheal Connectors	319
▪ Catheter Mounts	319
56. Instruments Aiding Anesthesia	320
▪ Laryngoscope	320
▪ Macintosh Spray	321
▪ Manual Resuscitators	321
▪ Medical Suction Apparatus	322
▪ Oropharyngeal Airway	323
▪ Nasopharyngeal Airway	323
▪ Laryngeal Mask Airway	324
▪ Nasal Cannula	325

Hemostasis: The Methods and the Means

Hemostasis—control of bleeding, is a very important aspect of surgery, having direct implications over the outcome of surgical procedure. The natural method involved in hemostasis has essentially two important parts. First, the retraction of a vessel within its sheath following the contraction of the cut ends of the vessel. The second important part is the formation of a clot which blocks the bleeding vessel. The clotting factors are stimulated by the damaged intima of the vessels.

Hemostasis can artificially be obtained by any of the following means:

- i. By pressure on the bleeder:
 - a. Direct pressure by means of clamps and artery forceps.
 - b. Indirect pressure by means of cuffs and tourniquets.
- ii. By ligating the bleeder.
- iii. By the heat coagulation of the bleeding end using diathermic procedure or lasers.
- iv. By the application of styptics and vasoconstrictors locally.

One of the most important methods used for hemostasis during surgery is to catch hold of the bleeding vessel by an arterial clamp and ligate it. Some of the smaller vessels stop bleeding by simple application of artery forceps (hemostats) and they need not be ligated. Hemostatic forceps, called artery forceps loosely, stops bleeding by apposing the cut ends of the vessel and also by damaging the intima of the vessel thereby stimulating the natural mechanisms of clot formation and hemostasis.

TECHNIQUES OF USING AN ARTERY FORCEPS

- ❖ **Localization of the bleeder:** The bleeder can be localized exactly by either mopping the bleeding surface or by irrigating the bleeding surface with saline, in which case the bleeder is localized by the stream of blood.
- ❖ **Holding the bleeder:** The bleeder should be held securely, without causing any damage to the surrounding tissues. To ensure this, the hemostatic forceps are so designed that their blunt conical ends avert any damage to the surrounding tissues.
- ❖ **Ligation of the artery:** Once the bleeder is caught, the artery forceps are held by the assistant and the surgeon passes a ligature around its tip and then slips it beneath the tip of the forceps. The ligature is fastened neatly and tightly.
- ❖ **Release of forceps:** As the surgeon tightens the knot, the assistant releases the forceps. The extra length of the ligature is snipped off.

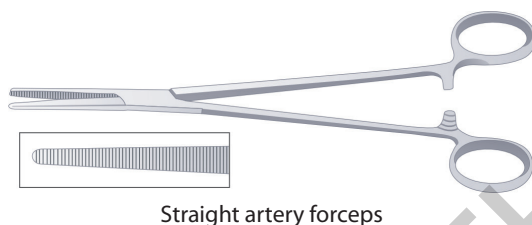
In cases of large vessels, such as those within the pedicle, e.g., hemorrhoids, where the slippage of ligature may lead to severe bleeding, it is always better to transfix the bleeder by passing a suture through it before ligation.

When a large vessel is to be divided, it should always be cut after holding it between two forceps and then each end should be tied off with nonabsorbable suture.

ARTERY FORCEPS

Classification on the Basis of Size and Shape

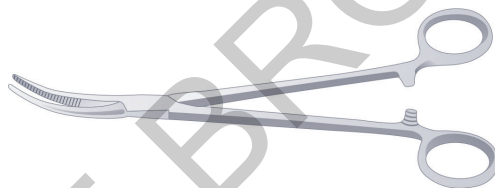
1. Small or mosquito
 2. Medium
 3. Large or pedicular
- Each can be again a straight type or a curved type of instrument.



Straight artery forceps

Artery forceps can also be classified as:

1. Toothed type, e.g., Kocher artery forceps, Lane artery forceps.
2. Non-toothed types, e.g., Crile artery forceps, Spencer-Wells artery forceps, Halstead artery forceps.



Curved artery forceps

Common Features of Artery Forceps

- ❖ It is a light but strong instrument.
- ❖ The inner margins of the blades are serrated and on closure the blades are well apposed, leaving no gap in between.
- ❖ The blades are conical and blunt.
- ❖ The blades can be held together by means of a catch-lock.

Uses of Artery Forceps

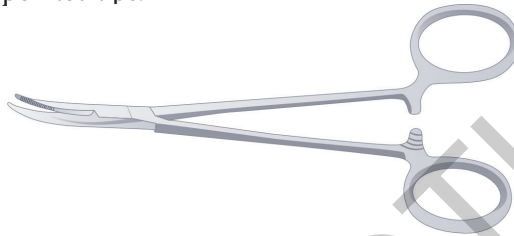
- ❖ As a hemostat.
- ❖ As a pedicular clamp for spleen and kidney.
- ❖ To crush the base of the appendix during appendicectomy.
- ❖ To hold the cut edges of fascia, aponeurosis, peritoneum, after incising them, during dissection or for closure after surgery.
- ❖ To open up the abscess cavity, breaking all the loculi and causing free bleeding (Hilton's method).
- ❖ To hold needles for suturing, as a substitute for a needle holder.
- ❖ To hold free ends of tension sutures as they are passed one after the other without tying, till the requisite number of sutures are given.
- ❖ Similarly, to hold the free ends of sutures left long during intestinal anastomosis, till they are finally tied off.

- ❖ To hold the tape of the abdominal packs to the drapes, thereby ending any chance of leaving the abdominal pack inside undetected.
- ❖ Can be used to hold umbilical cord in place of Kocher forceps.
- ❖ Can be used to clamp the uterine pedicle while removing the uterus as in rupture uterus.

MOSQUITO ARTERY FORCEPS

Feature

The basic features are essentially the same as above except that these forceps are very small in size and have relatively pointed tips.



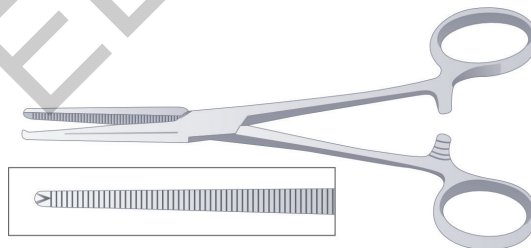
Uses

- ❖ It is used for holding small pointed bleeding sites. It stops bleeding by crushing the bleeder.
- ❖ It can be used for any of the uses mentioned above.
- ❖ To hold gauze-pellets for blunt dissection (*Peanut*).

KOCHER HEMOSTATIC FORCEPS

Feature

It is a toothed variety of hemostatic forceps, having a single sharp tooth at its tip. It provides a better and effective grip. The rest of the features are same as mentioned earlier in context of artery forceps.



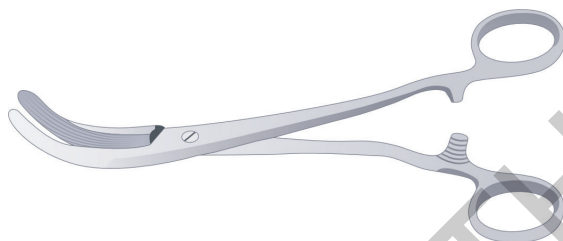
Uses

- ❖ It is specifically used to hold the retracting cut ends of the vessels in tough fibrous tissues such as in palms, soles and scalp.
- ❖ To catch hold of perforating vessels in radical mastectomy.
- ❖ To clamp the umbilical cord to occlude the vessels.
- ❖ To hold the fallopian tubes during hysterectomy or ectopic pregnancy.
- ❖ To hold gauze-pellets for blunt dissection.
- ❖ To hold superficial thyroid vessels, the original use of this instrument.
- ❖ To hold rib during rib resection.
- ❖ To cause artificial rupture of gestational membranes.
- ❖ To hold the incised peritoneal layer and tough fibrous fascia of palms and soles.

MAYO KIDNEY PEDICLE CLAMP

Features

- ❖ It is a stout large forceps with a screw joint.
- ❖ The blades have vertical serrations.
- ❖ The blades are doubly angled to give a good grip at depth without obstructing the operating surgeon's vision.
- ❖ The inner margin is pocked, to avoid slippage of tissue being held with this instrument.



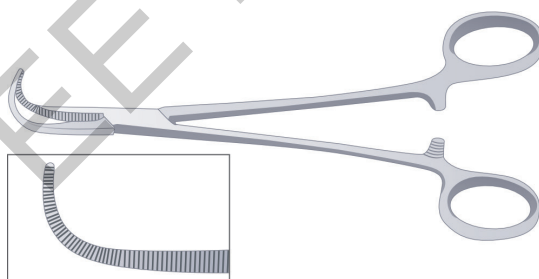
Use

It is used as a pedicular clamp to hold the kidney pedicle near its hilum during nephrectomy.

NEGUS ARTERY FORCEPS

Features

- ❖ It is a stout, long jawed forceps.
- ❖ The jaws are bent in the form of a hook.
- ❖ The inner margins of the jaws are transversely serrated.



Uses

It is used to ligate the vessels present at depth. The bleeder is held with a straight artery forceps and then Negus curved artery forceps is used to ligate it, e.g., cystic artery during cholecystectomy, bleeding points in tonsillar fossa following tonsillectomy.

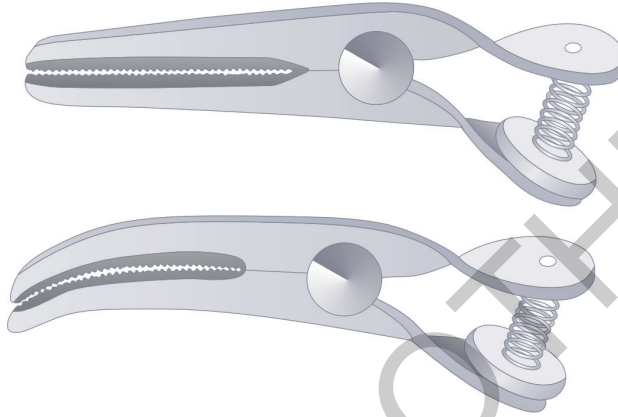
The forceps can also be used to pack wounds after the surgical procedure.

POTTS BULLDOG CLAMP

Features

- ❖ It is a paper clip-like instrument with large strong jaws.

- ❖ The handle of this clamp is spring loaded.
- ❖ The strong spring present in between the handles of these instruments ensures a very secure grip of the tissue held.
- ❖ The jaws are strong and have fine serrations on their inner margins. The jaws may be covered with red rubber tubing to prevent crushing of vessels.



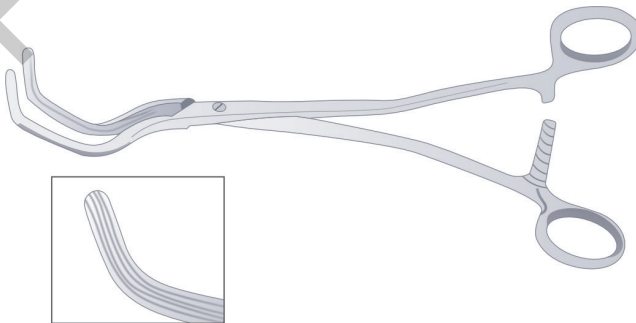
Use

It is used to clamp the large vessels during any surgery on them or for accidental bleeding from these vessels.

WELLS ARTERIAL CLAMP

Features


- ❖ It is an angled forceps with a screw joint.
- ❖ It has got doubly right-angled jaws.
- ❖ The jaws have longitudinal serrations.



Use

It is used as a pedicular clamp for nephrectomy or splenectomy.

Differentiation between an Artery Forceps and a Needle Holder

Features	Artery forceps	Needle holder
1. Size of the jaws	The jaws are usually at least half as big as the shaft.	The jaws are very small as compared to the shaft.
2. Serrations on the jaws	Usually transversely serrated.	Has criss-cross serrations and might have a longitudinal groove for needle.
3. Shape of the jaws	The jaws are conical and blunt but not very thick.	The jaws are blunt and stout.
		

ELECTROSURGERY OR DIATHERMY

The basic principle is to deliver a high-frequency electric current to the human body by means of an active electrode and this after passing through the target tissues returns via a return electrode. The intense heat produced by the passage of electric current destroys it in different ways depending on the type of current used. **Cutting current** is undamped and produces cutting effect secondary to intense heat generation within the tissues. It is not hemostatic, and bleeding can occur. **Coagulating current** is highly damped and coagulates by tissue dehydration. Its effect is mainly hemostatic. **Blended current** is a combination of two types of waves producing both cutting and coagulating effects. Newer surgical units deliver low voltage cutting or blended current from a solid-state generating unit through an isolated bipolar system which is considered the safest.

In **monopolar diathermy**, the pointed tip pencil like active electrode is placed in the tissue to be cut or blood vessel to be coagulated. The large return electrode plate is separated and attached to the patient by conductive gel. In **bipolar diathermy**, the active and return electrode are side to side and is like forceps. Bipolar diathermy does not have separate return electrode and causes less thermal tissue damage. The electric current only passes through the tissue between the two electrodes of the instrument.

CRYOSURGERY

Cryosurgery is the technique of devitalization of living tissues by extreme controlled cooling. The cryosurgical system consists of a cryoprobe cooled by expanding either carbon dioxide, nitrogen or argon gas reaching temperatures of -60° to -190° Celsius. An automatic defrosting device reheats the probe. The subfreezing temperature so produced causes physicochemical changes leading to cellular death without producing a bleeding wound. It has been suggested that cell death occurs due to formation of intracellular ice crystals with resulting cell dehydration and denaturation of cell proteins.

The obliteration of microcirculation within frozen tissue causes further cell death. No cell can survive ischemic infarction, regardless of its ability to withstand low temperature. Because the biological tissues are poor conductors of heat, a prime safety factor of cryosurgery is the predictable extent and depth of coagulation necrosis with sharp margins. The lesion eventually assumes a spherical shape. There is a direct relationship between the size of lesion and the size of probe and its temperature.

LASER

Laser is an acronym for 'light amplification by stimulated emission of radiation'. A parallel beam of coherent light with uniform wavelength is focused by means of a lens to an area of small dimension of tissue where it can produce a power density of unprecedented magnitude causing photocoagulation of tissue proteins and destruction of blood vessels. The depth of destruction would depend on the power output received and the duration of exposure. The source of light varies with different types of lasers, e.g., xenon, argon, carbon dioxide and YAG lasers.

The effect of laser beam on tissues depends on its spectrum, energy and tissue absorption. Carbon dioxide laser uses a mixture of CO_2 and nitrogen, CO_2 being the active medium. Its emission is in the middle of infrared spectrum ($10.6 \mu\text{m}$) and is well absorbed by water. The cells are vaporized and the latent heat is transferred to adjacent cells. The adjacent area of damage is thus small, in spite of local rise of temperature to around 100°C . **CO_2 laser** is used for incisions or ablation of tissue by vaporization. The laser beam can be delivered via an operating microscope to well selected specific targets.

Argon laser utilizes argon gas as an active medium. The light is in visible green wavelength ($0.5 \mu\text{m}$) and is capable of producing very little energy. It is largely absorbed by hemoglobin and its main effect on tissues is coagulation. It is used to seal blood vessels, hemangiomas and other skin lesions. It can be delivered via flexible fiber optic rods using in conjunction with endoscopes.

Neodymium-yttrium-aluminum-garnet (YAG) laser is a solid-state laser utilizing krypton or xenon lamp as a pump. It produces an invisible beam of light ($1.06 \mu\text{m}$) and is capable of producing four times as much energy as an argon laser. Although it is less strongly absorbed by hemoglobin, its main effect is tissue coagulation. It cannot be delivered via fiber-optic rods.

Laser, though an expensive tool, has an advantage of being accurate in sealing small vessels as it cuts and is clean. The tissue healing following laser therapy is rapid.

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The book *Synopsis of Medical Instruments and Procedures* is meant to serve the dual purpose of helping the final-year MBBS students to pass the examinations as well as assisting the fresh graduates to acquire proficiency in the skills they are going to practice in their clinical practice.

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