

Shailesh Puntambekar
Sambit M. Nanda
Kajal Parikh

Laparoscopic Pelvic Anatomy in Females

Applied Surgical Principles

 Springer

Laparoscopic Pelvic Anatomy in Females

Shailesh Puntambekar • Sambit M. Nanda
Kajal Parikh

Laparoscopic Pelvic Anatomy in Females

Applied Surgical Principles

 Springer

Shailesh Puntambekar
Galaxy Care Laparoscopy Institute Pvt. Ltd.
Pune
India

Kajal Parikh
Consultant Gynecologist and
Laparoscopic Surgeon
Thunga Hospital
Malad
Mumbai
India

Sambit M. Nanda
Consultant Gynecologist and
Laparoscopic Surgeon
Dr. Pattnaik's Hospital
Bandra
Mumbai
India

ISBN 978-981-13-8652-7 ISBN 978-981-13-8653-4 (eBook)
<https://doi.org/10.1007/978-981-13-8653-4>

© Springer Nature Singapore Pte Ltd. 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

This book is dedicated to all the patients who allowed me to learn and relearn the concepts of anatomy. My sincere thanks also go to my colleagues who have tirelessly worked backstage, believing me as a leader for the last 25 years.

Dedicated to my parents, my wife and my children.

Preface

It has been my long dream to teach everything that I learnt and everything that I gained from my experiences to the world. I have always believed that there are anatomical planes that have been existing in the human body. For a surgeon to do a good surgery, it is the understanding of these planes that would make the difference between good and bad surgeons. I always thought that there is a reason why the anatomy exists in a particular way and how best its knowledge can be used for the betterment of dissection. That is the time I then realised that the entire surgery is based on the fascias which surround the various structures and spaces and, of course, the vessels. Where are these fascias? How do they cover the organs? Where are the spaces? How do we find them? Where are the vessels? How do we work not to damage them? These were the questions that always come to my mind. Some surgeons are God-gifted, while majority are not. But for any surgery to survive, it has to be duplicable and the steps reproducible. With this single-handed motto, I decided to embark on the journey of unravelling the mystery and the magic of anatomy. This was more relevant in the era of minimal access surgery where a 360-degree vision is not possible, and hence one has to predict the next structure before it arrives on the operative fields. Thus, we coined the term “predictive anatomy”. Along with these words came a few sentences which are not in correct English but were accepted in the world like “fat belongs to the rectum”, “fat belongs to the bladder” and “dissection should always be parallel to the tubular structures”. I later realised, when I coined these phrases, a lot of surgeons do the dissection the same way. But we gave words in a way in which dissection is to be done. The understanding of anatomy was solely responsible for me to achieve my ultimate dream of live laparoscopic uterine transplant.

This book has been a compilation of 1200 images which were drawn and selected, reselected, rejected and then finalised after reviewing more than 10,000 images. This was done over a period of 2 years wherein even the camera systems changed and we could get better pictures every time that we changed the systems. This involved a huge team effort and hard work. A lot of nights and a lot of tempers were involved. I remain indebted to few people who have worked hard to make these images see the light of the day. I am especially thankful to Dr. Sambit Nanda, Dr. Kajal Parikh, Dr. Shruti Ugran and Mr. Nilesh Sonawane who have taken monumental efforts to scan and change the pictures at every point where I was not satisfied.

I also thank my wife, Dr. Seema, and my two daughters, Shreya and Dr. Aishwarya, for their continued support and excusing me from the daily courses of life. It would remain incomplete if I do not thank my team of surgeons and gynaecologists, Dr. Mangesh Panse, Dr. Ravindra Sathe, Dr. Manoj Manchekar, Dr. Mihir Chitale, Dr. Mehul Mehta, Dr. Advait Jathar, Dr. Raviraj Tiruke and Dr. Tejashree Bakre, who provided valuable inputs and helped

me complete the book. Finally, I would like to thank the publishers and all my colleagues and staff at Galaxy Care Hospital who have stood behind me. I hope, you enjoy reading this book and learn anatomy in such a way as that of Shiv Khera's saying: "You can win too".

Pune, India
Mumbai, India
Mumbai, India

Shailesh Puntambekar
Sambit M. Nanda
Kajal Parikh

Introduction

The pelvic anatomy is a constant anatomy with very few variations. Thus, it is easy to master the anatomy. A thorough knowledge of anatomy leads to better surgery. Surgery is an art of science, and anatomy is a network of fasciae and planes. Finding these planes would lead to bloodless surgery.

The art of surgery has been revolutionised due to the introduction of various technologies. There has been a long journey from open to minimal access surgery. The minimal access surgery has further evolved from multiport to single port to NOTES to robotic surgery. Though there has been advancement in the technology and modes of access, what has remained constant is the *anatomy*. The basic foundation of any ultramodern surgery was and will always remain anatomy. Thus, a deep understanding of this anatomy is needed to perform good surgery and not just the understanding of anatomy from the anatomy books.

The biggest disadvantage of minimal access surgery is a limited vision. Hence, one needs to predict the next structure, the next organ and the next fascia. This is what we call as “predictive anatomy”. The entire book will give you an insight into the art and science of understanding the “predictive anatomy”. The anatomy is beneficial to surgeons, gynaecologist, urologist and any other surgeons who wish to do pelvic surgery.

Contents

1 Pelvic Organs	1
2 Pelvis Boundaries	9
2.1 Sacral Promontory	12
2.2 Concepts of the Blood Supply	16
2.3 Lateral Boundary	21
2.4 Caudal Boundary	22
2.5 Anterior Boundary	22
3 Ligaments and Supports of the Uterus	25
3.1 Uterosacral Ligaments	28
3.1.1 Concepts	31
3.1.2 Rules	36
3.2 Mackenrod's Ligaments	37
3.2.1 Rules	37
3.3 Paravaginal/Paracolpos	41
3.3.1 Rules	44
3.4 Round Ligaments	44
3.4.1 Rules	44
3.5 Broad Ligament	47
4 Bones and Muscles	51
4.1 Coccyges	51
4.2 Psoas Muscle	51
4.3 Bones	57
4.4 Inferiorly Pubic Symphysis	57
5 Vascular Anatomy	59
5.1 Aorta/Vena Cava	64
5.2 External Iliac Artery and Vein	73
5.2.1 Important Aspects of Inferior Epigastric Artery and Vein	73
5.2.2 Internal Iliac Artery	81
5.2.3 Rules	103
5.3 Uterine Artery	106
5.3.1 Rules	112
5.4 Superior Vesical Artery	112
5.5 Obliterated Hypogastric Artery	116
5.5.1 Rules	116
5.5.2 Obturator Artery	119
5.5.3 Ovarian Artery	119
5.5.4 Ovarian Vein	124

5.6	Veins.....	128
5.6.1	Common Iliac Vein	128
5.6.2	Internal Iliac Vein.....	128
5.6.3	External Iliac Vein	139
6	The Spaces.....	141
6.1	Pouch of Douglas or the Rectovaginal Space	141
6.2	Pararectal Space.....	145
6.3	Paravesical Space.....	151
6.4	Prevesical Space.....	154
7	Fascial Anatomy	163
7.1	Cervicovesical Fascia.....	163
7.2	Denonvilliers' Fascia.....	163
7.3	Endopelvic Fascia	163
7.4	Waldeyer's Fascia.....	163
8	Anatomy of the Ureter	183
8.1	Blood Supply.....	204
9	Nerves.....	209
9.1	The Genitofemoral Nerve	209
9.2	The Obturator Nerve	215
9.3	The Hypogastric Nerve	221
9.4	Pelvic Splanchnic Nerve	227
9.5	Sciatic Nerve	229
10	Lymphatics.....	231
10.1	Ilio-Obturator Nodes	235
10.2	Internal Iliac Nodes	244
10.3	Lumbosacral Chain	245
10.4	Para-aortic and Paracaval Nodes	246
11	Applications of Anatomy	255
11.1	Dissection of the Pararectal Space and Paravesical Space.....	255
11.2	Medial Pararectal Space.....	259
11.3	Exposure of the Retroperitoneum	260
11.3.1	The Lateral Approach	260
11.4	Radical Hysterectomy (<i>Pune Technique</i>)	263
11.5	Nerve Sparing	271
11.6	Hysterectomy Type I or Intrafascial.....	273
	Suggested Reading	279

About the Authors

Shailesh Puntambekar is a cancer surgeon who specialised in laparoscopic cancer surgery. He is heading 'Galaxy Care Laparoscopy Institute', Centre for Advanced Laparoscopy and Robotic Surgery, in Pune. Considered as an expert in laparoscopic pelvic surgery and gynaecological cancer surgery in the world, he has developed laparoscopic radical hysterectomy for cervical cancer known to the world over as the "Pune technique". He has to his contribution the largest published series of laparoscopic exenteration for advanced pelvic cancers. His highest contribution comes in the form of laparoscopic live donor uterine transplant. This was done in May 2017 and remains the first in the world. The outcome of our transplant was with the delivery of a female child on 18th October 2018. He sincerely believes that every procedure in gynaecology from the simplest TLH to the uterine transplant is possible with an excellent understanding of the pelvic anatomy. He has coined the word "predictive anatomy", which is extremely helpful in anticipating the anatomical structures. He has developed applied surgical anatomy which means using the knowledge of anatomy to develop the surgical planes. Since the last few years, the annual congress of AAGL (American Association of Gynecologic Laparoscopy) has had him doing live cadaveric dissection at an inaugural event. He is also a regular faculty at the International School of Surgical Anatomy (ISSA) which rest the cadaveric courses at Tubingen, Germany. He has trained more than 150 international surgeons and gynaecologists and 300 Indian surgeons and gynaecologists who duplicate the anatomical steps devised by him. He has demonstrated live surgeries in 35 countries all around the world and in 200 national workshops. His teaching and concepts of pelvic anatomy have been widely acknowledged by surgeons and gynaecologists. He has authored four books, out of which the *Atlas of Laparoscopic Surgery in Gynecologic Oncology* is now in its third edition. He has had more than 100 publications in peer-reviewed journals.

Sambit M. Nanda is a consultant gynaecologist and laparoscopic surgeon from Mumbai and is associated with Galaxy Care Hospital (Pune) since 2016. He received his formal training in Advanced Gynaec Laparoscopic Surgery as a fellow to renowned Laparoscopic Oncosurgeon Dr. Shailesh Puntambekar (Pune). During his tenure as a FMAS-MUHS fellow at Galaxy Hospital, Pune, he was privileged to be a team member of India's first successful uterine transplant surgery and the ongoing uterine transplant project till the year 2018. He holds his special interests in gyne-oncology and was recommended and selected for the coveted UICC International Fellowship in Germany under Dr. Ivo Meinhold. He is forever indebted to Dr. Shailesh Puntambekar for giving him the opportunity to participate and contribute in all aspects of research and data analysis for studying the anatomy of the pelvis and further culminating in the making of this book.

Kajal Parikh is a consultant gynaecologist and laparoscopic surgeon from Mumbai and is associated with Galaxy Care Hospital (Pune). She has received her training in Advanced Gynaec Laparoscopic Surgery, Laparoscopic Gynaec-Oncosurgery from the renowned Dr. Shailesh Puntambekar (Pune) and Dr. Neeta Warty (Mumbai). During her tenure as a FMAS-MUHS fellow at Galaxy Care Hospital, Pune, she was privileged to be a team member of

India's first successful uterine transplant surgery and the ongoing uterine transplant project. She is forever indebted to Dr. Shailesh Puntambekar for giving her the opportunity to participate in the research and data analysis for studying the anatomy of the pelvis that was involved in the making of this book.

The organs in the abdomen are classified as abdominal and pelvic organs (Figs. 1.1 and 1.2).

This classification is important to understand from the surgical point of view. All the organs of the pelvis lie in the midline (Fig. 1.3a, b).

Thus there is enough surgical space available for dissection on the lateral side for dissection. This is true even if the organ expands (myomas, bladder tumours) (Figs. 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, and 1.12).

The organs have an external opening and thus all of them can be visualised through various scopes. Thus the intracavitary pathologies can be easily diagnosed and treated in the initial conditions (Figs. 1.13, 1.14, 1.15, and 1.16).

All the pelvic organs are supported by the fascias and muscles. Thus weakness of either the fascias or the pelvic muscles or both allows them to herniate either internally or externally (Figs. 1.17 and 1.18).

Understanding this concept is very important. Thus the organs are a victim of the weakness of the fascias and muscles and the pathology does not lie within them. The treatment therefore should be directed more towards the correction of the fascias rather than the resection of the organ except in the most advanced or serious cases. The tightening of the fascias can be done perineally or laparoscopically without removing any part of the organ (Fig. 1.19).

The pelvic organs are dynamic organs and hence are actively innervated with the nerves. The autonomic supply is distributed like a main pipeline with offshoots. Thus the main nerve can be preserved by cutting the offshoots of the nerve going to the organ. The nerve supply is always accompanied with a small vessel and hence it is called as neurovascular supply (Fig. 1.20).

These concepts are important to understand that just cutting the nerves going to the organ may lead to bleeding. Additionally the main nerve can always be preserved if we understand the neurovascular anatomy (Fig. 1.21).

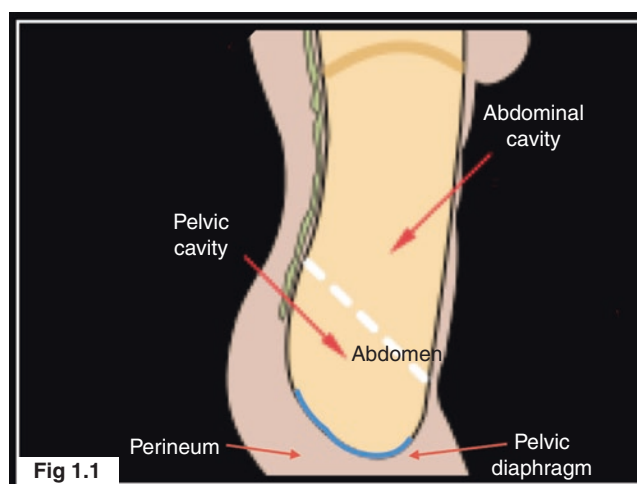


Fig. 1.1 Division of the abdomen into abdominal and pelvic cavity by an imaginary line from the sacral promontory to the pubic symphysis

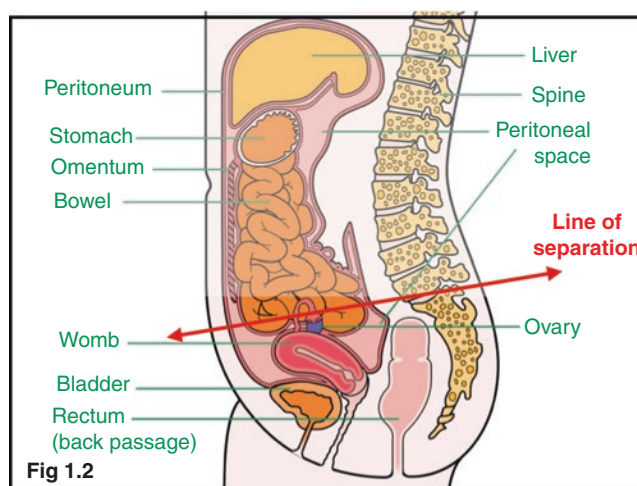


Fig. 1.2 Division of organs in the abdominal and the pelvic cavity

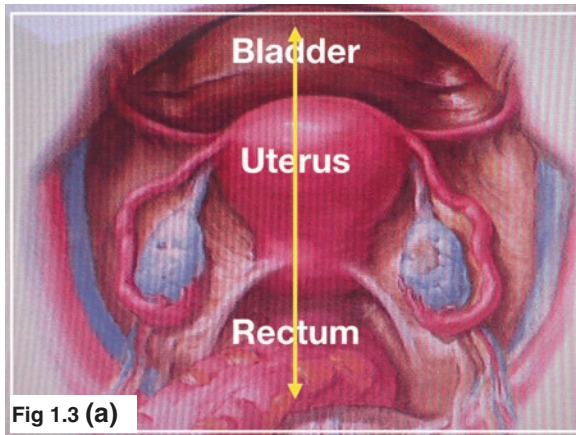


Fig 1.3 (a)

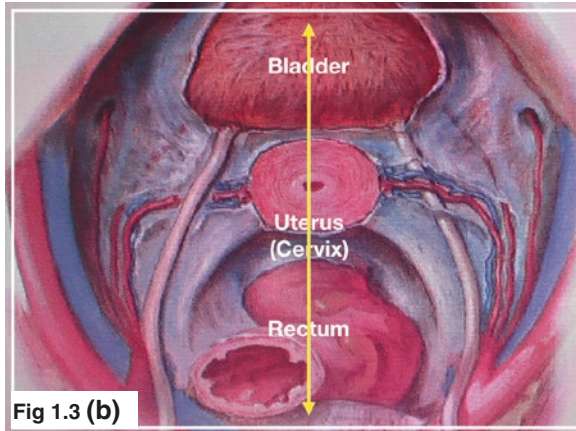


Fig 1.3 (b)

Fig. 1.3 (a) Surgical view point: Superior view of the pelvic cavity with normal anatomical position of organs. Uterus in the centre with the urinary bladder anteriorly and the rectum posteriorly. The organs are aligned in the centre. Image courtesy Parker-Macmillan Book of Pelvic Anatomy. (b) Surgical view point: Superior view of the pelvic cavity with the organs at the level of their vascular communications. Image courtesy Parker-Macmillan Book of Pelvic Anatomy

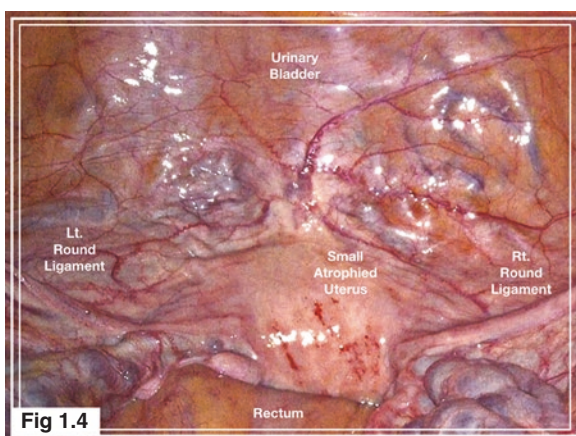


Fig 1.4

Fig. 1.4 Normal view on laparoscopy: Urinary bladder remains anterior, identification of the Foley can be appreciated. Small atrophic uterus with bilateral round ligaments retroverted and in midline, rectum identified along with the fat of appendices epiploicae identified posteriorly. Bilateral venous engorgement seen extending from near the cornua of uterus to the level of infundibulopelvic ligament

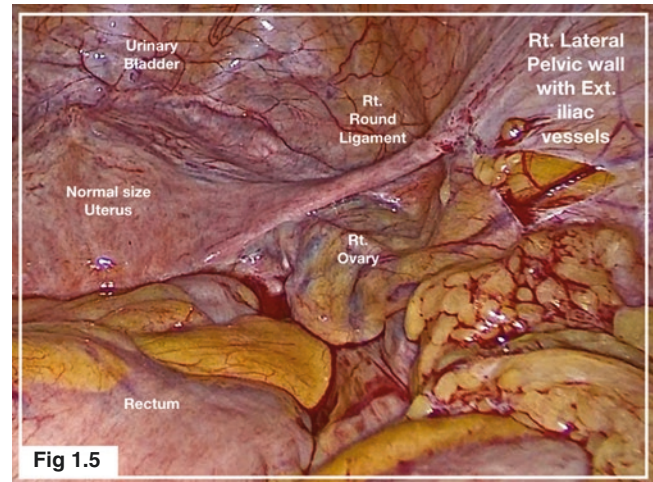


Fig 1.5

Fig. 1.5 Normal view on laparoscopy: Urinary bladder remains anterior; normal-size uterus retroverted and in midline position and the rectum lies posterior. The Right round ligament attached to the uterus can be used to trace up to the deep inguinal ring. The right lateral pelvic wall can be seen by the impressions of the Right external Iliac vessels and covered by retroperitoneal fat

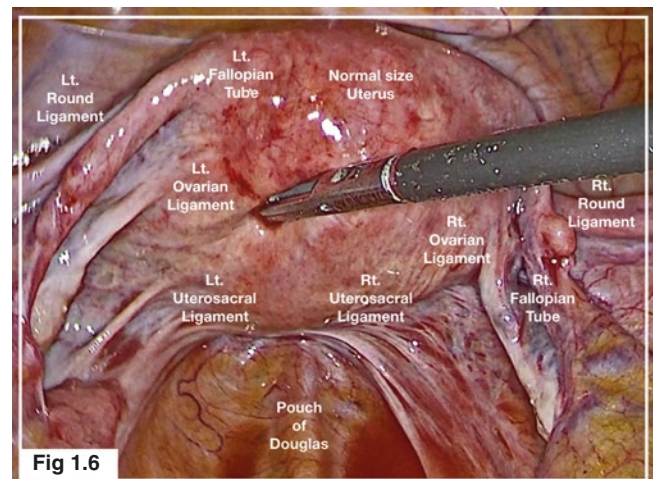


Fig 1.6

Fig. 1.6 Normal view on laparoscopy: Uterus in midline and mid-prone position with both round ligaments attached to the cornua. Both the fallopian tubes and the ovarian ligaments can be seen. The uterosacral ligaments can be identified inferiorly forming lateral boundaries for the pouch of Douglas which lies in the midline and inferior to the uterus. This patient had a history of tubal ligation which can be seen as the beaded appearance on the Right fallopian tube due to the silastic ring and engorgement of the mesosalpingeal vessels due to occlusion of the vessels with the silastic ring

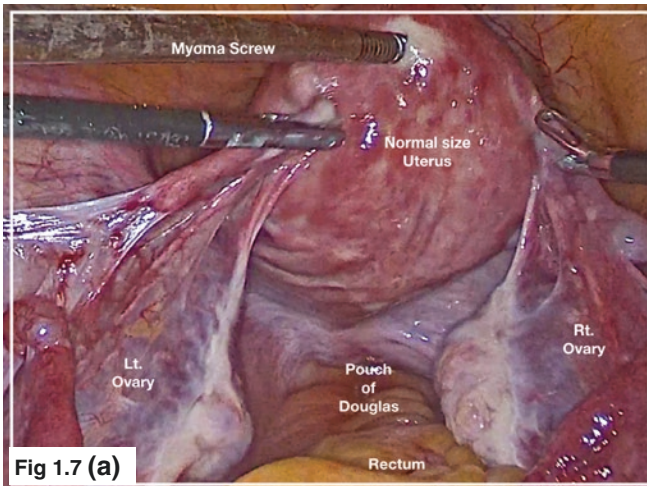


Fig 1.7 (a)

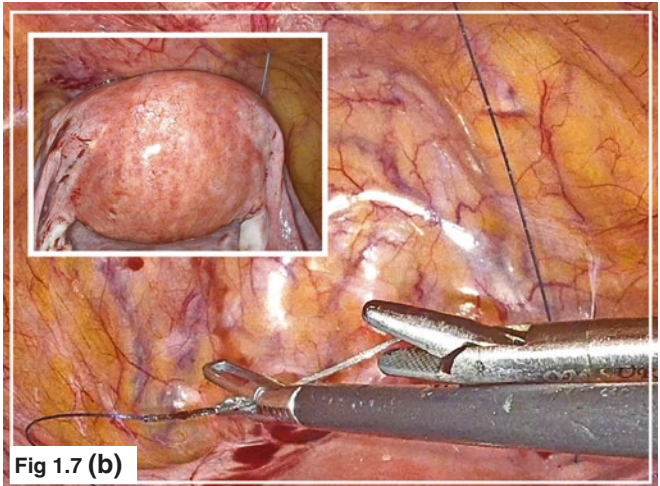


Fig 1.7 (b)

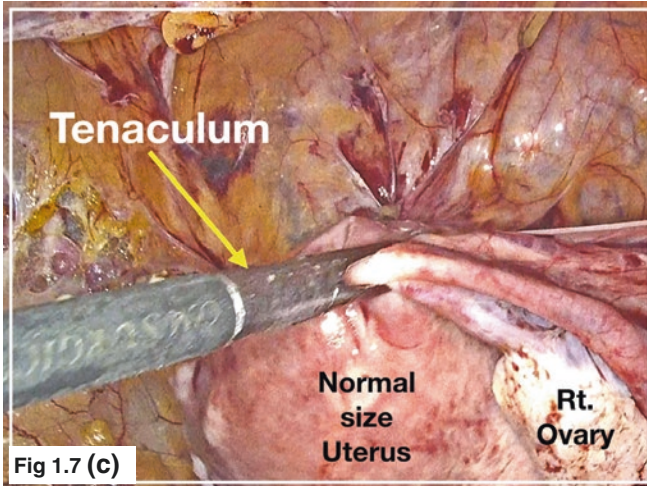


Fig 1.7 (c)

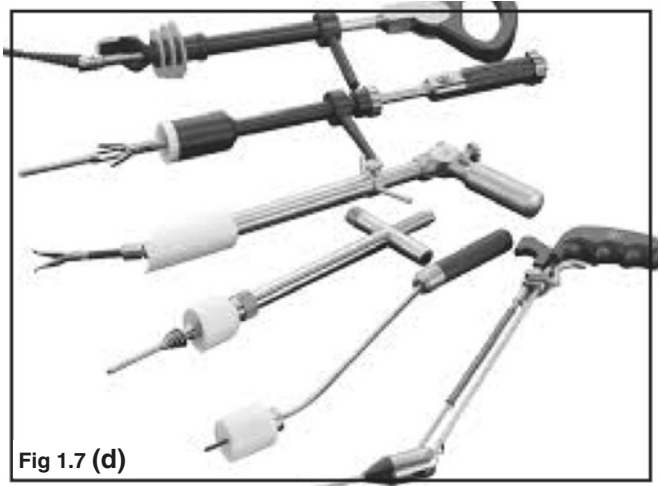


Fig 1.7 (d)

Fig. 1.7 (a) Uterine manipulation: Myoma screw inserted at the funds of the uterus used for manipulation and traction on the uterus. The myoma screw is a traumatic instrument and hence avoided in cases of fertility-preserving surgeries and cases of Ca endometrium. Both the ovaries are seen in their normal dependent positions, falling into the pouch of Douglas and towards the midline. The tubes appear ligated. (b) Tenaculum: In case of Ca endometrium or fertility-preserving surgery the uterus can be held and manipulated with the help of a tenacu-

lum as well. (c) Hitch: Amongst the techniques of manipulation if the uterus is needed to be fixed upwards a uterine hitch can also be done to fix the uterus to the anterior abdominal in case of rectal surgeries as show here. Inset: The uterus is lifted to the anterior abdominal wall. (d) There are various vaginal manipulators available which are very popular amongst gynaecologists. Image courtesy: Karl Storz uterine manipulators