



The Thai Journal of SURGERY

Official Publication of the Royal College of Surgeons of Thailand
www.surgeons.or.th/ejournal

Volume 34

January-March 2013

Number 1

SPECIAL ARTICLE

- 1 **Innovations in Burn Treatment in Thailand**
Chomchark Chuntrasakul

ORIGINAL ARTICLES

- 4 **Evaluation of Rectal Pouch Level in Anorectal Malformations : Comparison between Invertogram and Prone Lateral Cross-table Radiograph**
Jitlada Konjanat, et al.
- 10 **Laparoscopic Totally Extra-peritoneal Hernia Repair Using a Non-Fixed Mesh Patchand Mesh Plug Versus Open Repair**
Supoj Laiwattanapaisal
- 17 **Outcomes of Hepatic Resections for Synchronous Colorectal Liver Metastases in a Low-volume Setting**
Kijja Jearwattanakanok

CASE REPORT

- 22 **Transmesenteric Intraabdominal Hernia: A Case Report**
Suthat Chottanapund, Priyanut Phokhom

Secretariat Office :

Royal Golden Jubilee Building, 2 Soi Soonvijai, New Petchburi Road, Huaykwang, Bangkok 10310, Thailand
Tel. +66 2716 6141-3 Fax +66 2716 6144 E-mail: frcst@surgeons.or.th www.surgeons.or.th



Royal College of Surgeons of Thailand

Secretariat Office :

Royal Golden Jubilee Building, 2 Soi Soonvijai, New Petchburi Road, Bangkok 10310, Thailand

OFFICERS 2011 - 2013

<i>President</i>	: Soottiporn Chittmittrapap
<i>President-Elect</i>	: Vajarabhongsa Bhudhisawasdi
<i>Vice President</i>	: Krisada Ratana-Olarn
<i>Secretary General</i>	: Tanaphon Maipang
<i>Assistant Secretary</i>	: Sopon Jirasiritham
<i>Treasurer</i>	: Sukij Panpimanmas
<i>Past Presidents</i>	: Udom Poshakrisna Sem Pring-Puang-Geo Kasarn Chartikavanij Charas Suwanwela Thira Limsila Kijja Sindhvananda Arun Pausawasdi Kitti Yensudchai Thongueb Uttaravichien Chomchark Chuntrasakul Prinya Sakiyalak Vithya Vathanophas Naronk Rodwana Nopadol Wora-Urai

BOARD OF DIRECTORS

Darin Lohsiriwat	<i>Representative of General Surgeons</i>
Dusit Viravaidya	<i>Representative of Pediatric Surgeons</i>
Apirag Chuangsuwanich	<i>Representative of Plastic & Reconstructive Surgeons</i>
Pansak Laksanabunsong	<i>Representative of Thoracic Surgeons</i>
Nakornchai Phuenpathom	<i>Representative of Neurosurgeons</i>
Chakrapan Euanorasetr	<i>Representative of Colorectal Surgeons</i>
Sathit Ruangdilokrat	<i>Representative of Urological Surgeons</i>
Thavat Prasatritha	<i>Representative of Orthopedic Surgeons</i>
Kamphol Laohapensang	<i>Member</i>
Thanyadej Nimmanwudipong	<i>Member</i>
Preecha Siritongtaworn	<i>Member</i>

The THAI Journal of SURGERY

Official Publication of Royal College of Surgeons of Thailand

ISSN 0125-6068

Editorial Board

First Editor : Thongdee Shaipanich

Emeritus Editor : Soottiporn Chittmittrapap
Nopadol Wora-Urai

Editor-in-Chief : Pornchai O-charoenrat

Editorial Team :

Apirag Chuangsuwanich
Kawin Leelawat
Kriengchai Prasongsukarn
Panuwat Lertsithichai
Potchavit Aphinives
Sukchai Satthaporn

Bannakij Lojanapiwat
Kittipan Rerkasem
Paisarn Vejchapitap
Pornprom Muangman
Somkiat Sunpaweravong
Thawatthai Akaraviputh

International Editorial Board :

Lohfa Chirdan (Nigeria)
Suzanne A. Eccles (United Kingdom)
Young-Chul Jang (Korea)
Clifford P. Shearman (United Kingdom)
Shuji Shimizu (Japan)
Anusak Yiengpruksawan (USA)

Advisory Board :

Apichat Kongkanand
Chalit Chienvichai
Charas Suwanwela
Chomchark Chuntrasakul
Kamphol Laohapensang
Maiyadhaj Samsen
Naris Janviriya
Phaibul Jitpraphai
Pongsak Vathana
Prasert Trairatvorakul
Prinya Sakiyalak
Sathit Ruangdilokrat
Suchai Soontrapa
Supot Wudhikarn
Suthorn Bavonratanahevch
Vatana Supromajakr
Visist Dhitavat

Arun Pausawasdi
Chana Sathornkich
Charoen Chotigavanich
Chumsak Pruksapong
Kijja Sindhvananda
Manus Satienchaoak
Naronk Rodwana
Pichit Anuwutnavin
Pradischai Chaiseri
Prasert Vasinanukorn
Prompong Peerabool
Somboon Boonkasem
Suchart Chaimuangraj
Suprecha Mokkhavesa
Thongueb Uttaravichien
Vibul Sachakul
Vivat Visuthikosol

Auchai Kanjanapitak
Chanvit Thanphiphat
Chawalit Ongcharit
Chusak Kuptarnond
Kris Bhothisuwan
Montri Kitmanee
Ouichai Pleangprasit
Piyasakol Sakolsatayadorn
Prapan Kitisin
Prasith Gonggetyai
Ravi Phimolsarnti
Somprasong Songcharoen
Suchat Areemit
Surachai Khaoroptham
Trichak Sundhu
Vibul Trakulhoon
Voravut Chanyavanich

Bantern Rajatapiti
Charan Mahatumarat
Chesada Sangsubhan
Darin Lohsiriwat
Krit Chatamra
Nakornchai Phuenpathom
Paisal Pongchairerks
Polpatt Talalak
Prasert Sarnvivad
Preeyaphas Nilubol
Sanchai Kanchanalarp
Sonchai Sirivunnabood
Sukawat Watanatittan
Surapong Supaporn
Vajarabhongsa Bhudhisawasdi
Vinai Parkpian
Yongyudh Vajaradul

Editorial Board:

Adisorn Patradul
Apichart Ploysangwal
Arun Rojanasakul
Burapat Sangthong
Chaiya Chansai
Chanvate Sattaputh
Chopeow Taecholarn
Dusit Viravaidhya
Kittichai Luengtaviboon
Narong Kulvatanyou
O-Tur Saeseow
Parinya Thavichaigarn
Phichaya Sujijantararat
Pramook Mutirangura
Preecha Siritongtaworn
Saranatra Waikakul
Siraruj Sakoolnamarka
Sorawuth Chu-ongsakul
Sukij Panpimanmas
Supanit Nivatvong
Suriya Chakkaphak
Tavatchai Kanchanarin
Thamrongroj Temudom
Vicha Charoonratana
Vinaisak Kattipattanapong
Wanchai Krailadsiri
Woramin Riansuwan

Akkrapol Mungnirandr
Apirak Santingamkun
Asada Methasate
Chaichoompol Suwantemee
Chaiyut Thanapaisai
Chareonkiat Rergklian
Chuchep Sahakitrungruang
Kriengsak Limpastan
Krisada Ratana-olarn
Narong Lertakyamanee
Paiboon Jivapaisarnpong
Patpong Navicharern
Piya Teawprasert
Prasit Watanapa
Puttisak Puttawibul
Sathien Tumtavitikul
Smarn Tangaroonsin
Srichai Chaiyaphruk
Sukij Mekraksavanich
Supoj Ratchanon
Suvit Sriussadaporn
Taveesin Tanprayoon
Thanyadej Nimmanwudipong
Vichai Benjachonlamas
Viroon Boonnuch
Wichai Pansrimangkorn
Wuttichai Thanapongsatorn

Anan Manomaipiboon
Arkorn Chaiwerawattana
Banchong Mahaisavariya
Chairat Pokawattana
Chakrapan Euanorrasetr
Choosak Kasemsarn
Chumpon Wilasrusmee
Kriangsak Prasopsanti
Mongkol Laohapensang
Narong Punyahotra
Paisit Siriwittayakorn
Peenutchanee Chartiburus
Pongnares Purasiri
Prayuth Chokrungravanont
Rangsan Niramis
Sathit Karanes
Somkiat Wattanasirichaikul
Sriprasit Boonvisut
Sumit Wongkietkachorn
Supol Chindasub
Tanaphon Maipang
Tawee-sak Trivej
Thirawud Khuaprema
Vichai Srimuninnimit
Vitoon Chinsawangwatanakul
Wichai Vassanasiri
Yodruk Prasert

Anupan Tantiwong
Arthi Kruavit
Boonchoo Sirichindakul
Chaiwat Palawatvichai
Chanchai Nimitrvanich
Choosak Pripatnanont
Danaiphand Akarasakul
Kitti Kanpirom
Narain Chotirosniramit
Nopporn Choeypunt
Panupan Songcharoen
Pichai Boonyongsunchai
Pornthep Pramyothin
Prayuth Sirivongs
Sahachart Pipithkul
Sindhujai Thansathit
Sopon Jirasiritham
Sukasom Attavanich
Supachoke Chitvanith
Surithorn Soontornpun
Tara Vongviriyangkoon
Taweewong Chulakamontri
Tongkao Rattanasuwan
Vichien Laohacharoensombut
Wachira Kachakarn
Witaya Chadbunchachai
Youwanush Kongdan

The THAI Journal of SURGERY

Official Publication of the Royal College of Surgeons of Thailand

INFORMATION FOR AUTHORS

The Thai Journal of Surgery is the official publication of the Royal College of Surgeons of Thailand issued quarterly.

The Thai Journal of Surgery invites concise original articles in the field of clinical and experimental surgery as well as surgical education. Articles must be contributed solely to The Thai Journal of Surgery and when published become the property of the Royal College of Surgeons of Thailand. The Royal College of Surgeons of Thailand reserves copyright on all published materials and such materials may not be reproduced in any form without the written permission.

The Royal College of Surgeons of Thailand accepts no responsibility for opinions expressed by contributors. Manuscripts submitted for publication should be sent to :

Pornchai O-charoenrat, M.D.
The Thai Journal of Surgery
Royal College of Surgeons of Thailand
Royal Golden Jubilee Building
2 Soi Soonvijai, New Petchburi Road
Huay Kwang, Bangkok 10310, Thailand
Tel. : +66 2716 6141-3 Fax : +66 2716 6144
E-mail : frfst@surgeons.or.th

Manuscripts

Manuscripts should be typewritten on one side of A4 paper only with double spacing and at least one inch margins. Separate pages: title page, text, acknowledgments, references, individual tables, and legends (as the format in this journal). Number pages consecutively, beginning with the title page. Type the page number in the upper right-hand corner of each page. An original and one additional copy of all materials including figures and tables, using the *Microsoft Words* Program, must be submitted for editorial review. Metric measurements should be used. Generic names for drugs should be used and if trade name is mentioned, it should be put in parenthesis.

The title page of the manuscript should be typed on a separate sheet and contain the following informations :

1. Title of the paper
2. Name of Author(s), including first name(s) with academic degree(s)
3. Name of department and institution in which the work was done
4. Index word(s)
5. Short running title

Illustrations and Tables

Glossy, black and white photographs of illustration are requested. Original drawing should be professionally drawn in black India ink. Typewritten or freehand lettering is not acceptable. Illustration should be numbered, the tops indicated and the title of the article and the authors name in brief typed on a label pasted on its back. Do not mount the illustrations in the manuscripts. Each table should be prepared on a separate sheet and should be numbered consecutively as mentioned in the text and each must have a heading. Illustrations are accepted with color prints or color slide (not the negatives).

References

References must be listed on a separate sheet in numeric order as referred to in the article, not alphabetically. Only references mentioned in the text should be listed and should be selective with not more than 30 references except under unusual circumstances. Number references consecutively in the

order in which they are first mentioned in the text. Identify references in text, tables, and legends by arabic numerals (in superscript).

The references must be verified by the author(s) against the original documents.

Example forms of references are given below.

Journal

1. Standard Journal Article :

List all authors when six or less; when seven or more, list only first three and add et al.

Soter NA, Wasserman SI, Austen KF. Cold urticaria: release into the circulation of histamine and eosinophil chemotactic factor of anaphylaxis during cold challenge. *N Engl J Med* 1976; 294:687-90.

2. Corporate Author :

The Committee on Enzymes of the Scandinavian Society for Clinical Chemistry and Clinical Physiology. Recommended method for the determination of gamma glutamyltransferase in blood. *Scand J Clin Lab Invest* 1976; 36:119-25.

Books and Other Monographs

3. Personal Author (s) :

Osler AG. Complement: mechanisms and functions. Englewood Cliffs: Prentice - Hall, 1976.

4. Corporate Author :

American medical Association Department of Drugs. AMA drug evaluations. 3rd ed. Littleton: Publishing Sciences Group, 1977.

5. Editor, Compiler, Chairman as Author :

Rhoades AJ, Van Rooyen CE, comps. Textbook of virology: for students and practitioners of medicine and the other health sciences. 5th ed. Baltimore: Williams & Wilkins, 1968.

6. Chapter in Book :

Weinstein L, Swartz MN. Pathogenic properties of invading microorganisms. In: Sodeman WA Jr. Sodeman WA, eds. Pathologic physiology: mechanism of disease. Philadelphia: WB Saunders, 1974:457-72.

7. Agency Publication :

National Center for Health Statistics. Acute conditions: incidence and associated disability, United States, July 1968-June 1969. Rockville. Md.: National Center for Health statistics, 1972. Vital and health statistics. Series 10: Data from the National health Survey, No. 69 : (DHEW publication no. (HSM) 72-1036).

Other Articles

8. Newspaper Article :

Shaffer RA. Advances in chemistry are starting to unlock mysteries of the brain: discoveries could help cure alcoholism and insomnia, explain mental illness. How the messengers work. *Wall Street Journal* 1977 Aug 12:(col. 1), 10(col.1).

9. Magazine Article :

Rouche B. Annals of medicine: the Santa Claus culture. *The New Yorker* 1971 Sep 4:66-81.

Abbreviations

Use only standard abbreviations of commonly used approved abbreviations. Avoid abbreviations in the title. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

SUBSCRIPTION INFORMATION

Subscription rate : B 200.00. single issue B 60.00

International : Individual US\$ 35.00, Institutional US\$ 45.00

Postage and handling - Surface mail included.

Air mail added US\$ 15.00 for each or US\$ 40.00 for bulk of 4 copies.

Combined subscriptions > 4 copies available for institutional only at US\$ 35.00 each subscription.

Medical Students, Intern and Residents : B 100.00

Business Address : Subscriptions, advertising, and all business communications should be addressed to:

THE THAI JOURNAL OF SURGERY
Royal Golden Jubilee Building
2 Soi Soonvijai, New Petchburi Road
Bangkok 10310, Thailand

Change of Address : Please allow 30 days before date of issue for change of address. Notification should include the old as well as the new address, with indication of whether the change is temporary or permanent.

The THAI Journal of SURGERY

Official Publication of the Royal College of Surgeons of Thailand

Vol. 34

January - March 2013

No. 1

Special Article

Innovations in Burn Treatment in Thailand

Chomchark Chuntrasakul, MD

*Department of Surgery, Faculty of Medicine Siriraj Hospital,
Mahidol University, Bangkok, Thailand*

Abstract

The author relates the beginning of systematic and specialized burn care in Thailand, first established at Siriraj Hospital. He emphasizes the innovative nature of burn care during the first few decades of establishing the Burn Unit. Shortages of medical supplies and high costs were behind many of the author's innovations, these included early fluid resuscitation, burn wound management, topical antiseptics and wound dressing, nutritional management and formulae, as well a philosophy of burn care. The story ends with a plea for a competent and ethical approach to burn management.

BACKGROUND

Morbidity and mortality of burn patients in Thailand are similar to those in other developing Asian countries. In the past, most burn patients in Thailand were seen by plastic surgeons or their associates. Innovations in burn treatment at Siriraj Hospital started after the completion of my surgical training in general surgery, and after becoming a Fellow in vascular surgery and burns in the United States.

MATERIALS & METHODS

In January 1973 I started working in burn care with zero experience. Decades before, most burn patients were seen by plastic surgeons. After the Division of Traumatology was established at the Faculty of Medicine, Siriraj Hospital, late in 1972, I returned from the United States and joined this Division with a few staff surgeons. At that time there was no burn unit in the new Trauma building. Since I was the only one who knew how to care for burn patients admitted to

Correspondence address : Chomchark Chuntrasakul, MD, Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand; Telephone: +66 2419 7727; Fax: +66 2419 7730; Email: chomchark@gmail.com

the Division of Traumatology, I had to see both trauma and burn patients. I started to treat a case of severe burn in a two-bedroom with the help from nurses from the Trauma ward. I continued to treat severely burned patients for six years before obtaining an opportunity to work at “the first Burn Unit in Thailand” which was opened in 1978. The Burn Unit was built on the top floor of the Trauma building and was composed of 8 to 12 beds. Male and female patients were divided into two separate, large rooms, and one single-bed room was set up as an ICU for severely burned patients. There was one non-functioning operating room. Not very long after that, I had to restructure the rooms in the Unit into an isolated single-bedroom in order to accommodate six to eight patients at the same time. The financial donations from the patients’ relatives were used for the reconstruction. Each year more than 100 severely burned patients were admitted to this Unit. This provided me with greater opportunities to see more burn cases and carry out better clinical research studies. In 2009 a brand new Burn Unit with well-equipped isolated rooms with six to eight beds was opened.

My philosophy in caring for burn patients has been - “Good beginning makes a good ending”, and “Treat patients like they are a part of your family”. In caring for burn patients it is important to consider cost-effectiveness, safety, efficacy and sufficiency, and above all practicing with medical ethics in mind.

My approaches to better burn care include:

1) Maintaining a clear and clean Burn Unit environment.

2) For emergency care of every severely burned patient after arrival at the ER and after assessing the patient using the “ABCD” principle: using hypertonic saline solution (Na 200 mEq/L) for the first 8 hours after burn injury followed by crystalloid solution (RL: Na 130 mEq/L) for the next 16 hours after injury. Adequate hourly urine output for the first 48 hours after injury is very important.

3) Using early endotracheal intubation in patients with associated inhalation injury as well, for severely burned patients who received large amounts of loading fluid in the early burn phase [usually seen in severe burns, over 50% or 60% of body surface area (BSA)].

4) Performing early escharotomy with or without

fasciotomy for deep contractive burns.

5) Performing early excision of eschar either by tangential or deep fascial excision. Small deep burns can be treated with immediate skin grafting.

6) Providing early enteral feeding after achieving hemodynamic stability.

A common topical antimicrobial agent used in severe burn wounds is “1% silver zinc sulfadiazine” (modified from 1% silver sulfadiazine). For the last decade nanocrystalline silver has been used more and more frequently. Systemic antibiotics are not routinely given to severe burns. It is used only in patients with sufficient or definitive indications.

In 1973 I was the first person who brought the “amion” for use in burn dressing (biologic dressing) in Thailand, achieving dramatic results for superficial burns. In 1978 I innovated the “burn diet” prepared as a blenderized diet composed of eight eggs per litre, with adult patients requiring two litres per day. In 1985 I also innovated the “immune-enhancing diet” for burn, trauma and critically ill patients.

Most burn experts accept that early eschar excision with early enteral feeding will provide the best outcome for patients. At present, Versajet hydrosurgery is the most advanced equipment for burn wound debridement. Immune-enhancing diet administered to the patient through nasogastric tubes as enteral feeding is most suitable for those critically ill.

In the past, in addition to the care of complex burn patients, individual groups providing nursing care might advocate different ways of treating patients. This problem occupied my thoughts, and led me to find the methods to get these people to act the same way and aim at the same destination. This was the reason that made me establish four societies of related professionals, such as the Society of Parenteral and Enteral Nutrition of Thailand (SPENT) in 1985, as well as the Parenteral and Enteral Nutrition Society of Asia (PENSA) in 1995. I also founded the Thai Society of Burn Injury in 1990, and the Thai Society of Wound Healing in 2006.

Establishing these societies would bring related professionals who have been working in the same or similar medical fields together, comprising a multidisciplinary approach, and should lead them to the same destination. Their meetings should foster updated knowledge and provide a forum for exchanges of ideas, as well as to learn about new advanced

equipments. This is crucial for successful practice and should benefit burn patients.

RESULTS

The time from the initial examination of severely burned patients to their admission to the Unit was limited by space availability. The first Burn Unit in Thailand was set up at Siriraj Hospital in 1978, with 8 to 12 beds. My clinical research studies were carried out along with what I did for these patients. About 50%, more or less, of our admitted burn patients was referred to our Unit after the first 24 hours of burn injury. Overall mortality rate was around 10%, and higher in referred cases. In patients with deep burns the mortality was less than 20%. Early eschar excision with immediate skin graft could be done in these cases. However, in severe and extensive burns of over 50% BSA, treatment was conservative and skin coverage was performed well after the growth of granulation tissues.

DISCUSSION

In the past, due to our shortage of medical products, we had to create or innovate something for our patients, such as enteral diet formulas and parenteral nutrition. Burn treatment four decades ago was very different from that of the last one and a half decades, in which we have more efficient topical wound dressing, better enteral diet formula, and better equipment for wound debridement. Also, skin

substitutes are available as well as better environment in the “well-equipped burn unit”. After the good outcomes and superior burn care facilities at Siriraj Hospital Burn Unit were recognized, more burn units have since been established. Currently there are 18 burn units in different regions of the country.

CONCLUSION

Most severe burns should be seen by experts. Morbidity and mortality rates usually vary according to the capability of the caregiver, the doctors and the nurses. Good burn care usually begins with the first physician who saw the patient. The best way to a better care of burn patients is to set up a “burn team” with a surgeon as the leader. The leader must possess good knowledge and experience in burn care. He or she should be a nice and kind hearted person. The outcome of treatment depends on the capability (knowledge and experience) of the responding doctors and nurses. Cost-effectiveness, safety, and sufficiency as well as medical ethics should be in the mind of every surgeon or related personnel treating burn patients.

REFERENCE

Most of references are derived from my own research work and written papers which are available in my curriculum vitae or upon request. I can be contacted on my mobile phone: +668 1854 9512 or e-mail: chomchark@gmail.com .

Evaluation of Rectal Pouch Level in Anorectal Malformations : Comparison between Invertogram and Prone Lateral Cross-table Radiograph

Jitlada Konjanat, MD*
Maitree Anuntkosol, MD*
Veera Buranakitjaroen, MD*
Varaporn Mahatharadol, MD*

Rangsan Niramis, MD*
Narong Nithipanya, MD**
Achariya Tongsin, MD*

*Department of Surgery, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

**Department of Radiology, Queen Sirikit National Institute of Child Health, Bangkok, Thailand

Abstract

Background: Invertogram has been used to evaluate the level of blind rectal pouch in neonates with anorectal malformations (ARM) for over 80 years. In recent years, prone lateral cross-table radiograph (PLCTR) has been recommended for demonstrating these anomalies, providing equivalent information as the traditional procedure.

Objective: The aim of this study was to compare the effectiveness in evaluation of rectal pouch level in ARM between invertogram and PLCTR.

Materials and Methods: During January 2009 to June 2012, all of the neonates with ARM who had no evidence of cutaneous, urinary or genital fistula underwent both invertogram and PLCTR for demonstration of the blind rectal pouches. Demographic data and radiographic findings of the patients were collected and analyzed.

Results: Fifty-two neonates with ARM (46 males and 6 females) were available for the study. Thirty-nine patients (75%) were full term babies, whereas 13 patients (25%) were premature. Invertogram and PLCTR were done within 13 to 36 hours after birth. Radiographic findings of the two methods in 46 patients (89%) were not different. In the remaining 6 cases (11%), the findings of PLCTR were more accurate, with confirmation by colostomy study (loopogram) or operative findings, while the evidence of rectal gas shadow in the invertogram revealed higher than the actual levels.

Conclusion: PLCTR is much easier to position, less time consuming and more accurate in some cases than invertogram regarding interpretation of the level of rectal pouch in ARM. PLCTR should be routinely used instead of invertogram for evaluation in ARM.

Key words: Anorectal malformations, invertogram, prone lateral cross-table radiograph, rectal pouch level

INTRODUCTION

Anorectal malformations (ARM) are one of the commonest anomalies in the neonates. The reported incidence is between 1:1500 and 1:5000 live births¹⁻⁵. Major advances have been made in the last decade in operative techniques to correct this abnormality⁶. The

initial surgical management of an infant with ARM depends on the level of anomaly as well as the presence or absence of fistula between the rectal pouch and adjacent organs^{7,8}. Radiographic investigation is used to evaluate the blind rectal pouch for determining the level of anomalies. Anoplasty is the surgical method of

choice for patients whose rectal pouch terminates close to the perineal skin, whereas the colostomy is usually chosen for patients with intermediate to high-lying rectum and/or internal fistula⁹. The level of anomalies in the majority of cases can be determined by a careful clinical examination. However, radiologic investigations are necessary in 10% to 20% of patients when clinical data is not sufficient¹⁰. In the radiologic evaluation of the neonates with ARM, the invertogram, first described by Wangenstein and Rice in 1930¹¹ has withstood the test of time. Precautions in the technique and pitfalls in its interpretation have been well documented^{12,13}. In 1983, the prone lateral cross-table radiograph (PLCTR) was recommended by Narasimharao¹⁴. PLCTR was claimed to be an easy procedure, providing equivalent or better evaluation compared with the invertogram. The aim of this study was to compare the accuracy in the evaluation of rectal pouch level of ARM between invertogram and PLCTR.

MATERIALS AND METHODS

The study was approved by the Institutional Review Board of Queen Sirikit National Institute of Child Health (QSNICH). A prospective study of neonates with ARM treated at our institute between January 2009 and June 2012 was carried out. Neonates with ARM who had no evidence of cutaneous, urinary and genital fistula underwent both invertogram and PLCTR for demonstration of the blind rectal pouches at the same time. Details of the radiological procedure were explained to, and informed consent was obtained from, the parents. Most of the patients were planned to undergo radiological examination approximately 24 hours after birth, but was done earlier in some cases with rapid abdominal distension or delayed passage of intestinal gas to the rectum during the examination. However, all radiologic examinations were performed at least 12 hours after birth in order to allow enough time for the air to reach the rectum. Skin markers were not used. Nasogastric tube was passed through to the stomach before the radiological investigation to rule out esophageal atresia.

The patients were held in inverted position for five minutes in routine invertogram. In the PLCTR, the patients were held face down with their hip flexed and were kept in this genupectoral position for five minutes with the centre of radiographs at the greater trochanter, as in the invertogram. The radiographs

were evaluated by a pediatric radiologist. The levels of blind rectal gas shadow were classified as being due to low, intermediate, or high anomalies, based upon the bony landmarks of the pubococcygeal (PC) line and the ischial (I) point¹². A blind rectal gas shadow seen above the PC line was interpreted as due to a high anomaly, that seen between the PC and I-line as due to an intermediate anomaly, and below the I-line as due to a low anomaly. Accuracy of the blind rectal gas levels were proven during anoplasty for low anomaly, and by barium examination of the distal loop of the colon (distal loopogram) after colostomy for intermediate and high anomalies.

Exclusion criteria included ARM patients with clinical findings of cutaneous, urinary and genital fistula, those with esophageal atresia, and those with clinical instability requiring endotracheal intubation and respiratory support.

Statistical analysis of radiological evaluation comparing invertogram and PLCTR were performed using the exact McNemar test, as implemented in Stata v. 12 (Stata Corp, College Station, TX, USA). A two-tailed p-value of less than 0.05 was considered statically significant.

RESULTS

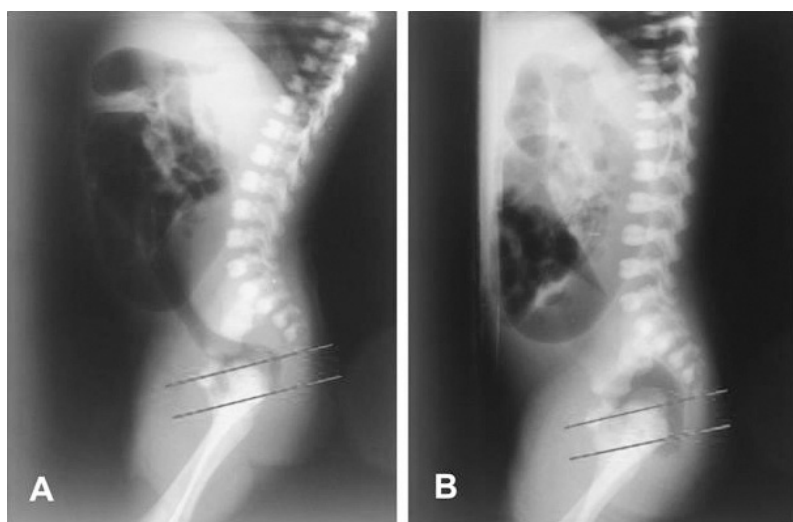
During the study period, 171 neonates with ARM were referred to the Institute. One hundred and twelve cases had cutaneous or genitourinary fistula and seven cases had a combination of ARM with esophageal atresia. Only 52 neonates (46 males and 6 females) were enrolled for radiographic investigations (invertogram and PLCTR). Thirty-nine patients (75%) were full term babies and 13 patients (25%) were premature (Table 1).

The age of patients at the time radiography was performed ranged from 13 to 39 hours. In 26 patients invertogram was done before PLCTR, the remaining 26 underwent PLCTR first. There was no difference in the interpretation of the distal rectal pouch level in 46 sets of radiographs (89%): high, intermediate and low anomaly in 10, 26 and 10 cases, respectively (Figure 1 and Table 2). In 6 cases (11%) the interpretation differed between radiography techniques. Four cases were interpreted as having a high anomaly on the invertogram, but PLCTR showed intermediate anomaly (Figure 2). These patients underwent sigmoid colostomy. The definitive diagnosis was established by

Table 1 Demographic data of the 52 patients with anorectal malformations

Clinical data	No. of patients (%)
Sex	
male : female	46:6 (77:23)
Gestational age (weeks)	
less than 33	2 (4)
33-36	11 (21)
37-40	39 (75)
Age at radiological evaluation (hours)	
13-18	6 (12)
19-24	22 (42)
25-30	18 (35)
31-36	4 (8)
over 36	2 (4)

loopogram which showed intermediate anomaly in all of the 4 cases (Figure 3). The remaining 2 cases were interpreted as having intermediate anomaly on the invertogram, but as a low anomaly on PLCTR (Figure. 4). These 2 cases were diagnosed as low anomaly and successfully underwent anoplasty. There was no statistically significant difference ($p > 0.05$) in the comparison between invertogram and PLCTR for each anomaly, but a significant difference ($P < 0.05$) was seen in the comparison for all ARM patients (Table 2). In addition, 33 of the 46 patients (72%) with no difference in the interpretation of the rectal pouch level, had terminating rectal gas shadows seen in the PLCTR lower than those seen in the invertogram.

**Figure 1** A. Invertogram showed low type A RM with rectal gas shadow at the I-line
B. PLCTR also showed low type. but level of rectal gas shadow is more caudal than the invertogram**Table 2** Comparison of radiological evaluation between invertogram and prone lateral cross-table radiograph (PLCTR)

Type of Anorectal Malformation Radiological procedures	Correct Diagnosis No.(%)	Incorrect Diagnosis No.(%)	p-value ^a
Low ^b (n = 12)			
Invertogram	10 (83)	2 (17)	0.500
PLCTR	12 (100)	0	
Intermediate ^c (n = 30)			
Invertogram	26 (87)	4 (13)	0.125
PLCTR	30 (100)	0	
High ^c (n = 30)			
Invertogram	10 (100)	0	0.999
PLCTR	10 (100)	0	
Total no. of patients (n = 52)			
Invertogram	46 (89)	6 (12)	0.031
PLCTR	52 (100)	0	

^ap-value by exact McNemar test; ^bproven by anoplasty; ^cproven by colostomy study (distal loopogram)



Figure 2 A. Invertogram showed rectal gas shadow above the PC-line PC-line (high type)
B. PLCTR showed level of rectal gas shadow between PC and I-line (intermediate type)

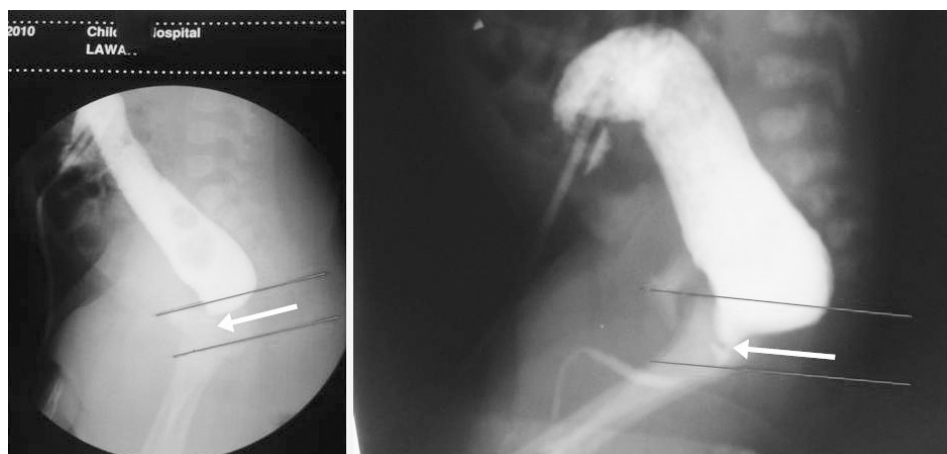


Figure 3 The colostomy study revealed intermediate type imperforate anus with rectourethral fistula (arrow)

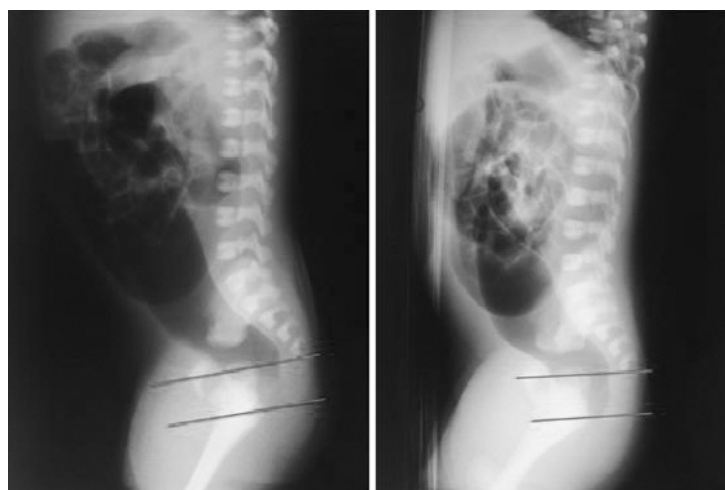


Figure 4 A. Invertogram showed rectal gas shadow between the PC and I-line (intermediate type)
B. PLCTR showed level of rectal gas shadow at the I-line (low type). Low type ARM was proven by the operative procedure (anoplasty)

DISCUSSION

Anorectal malformations comprise a spectrum of anatomical defects. Some of these are minor, and can be surgically treated early on with an excellent functional prognosis. Others are complex and difficult to manage and have uncertain prognosis¹⁵⁻²⁰. Most infants with low anomalies undergo a definitive anoplasty within a few days after birth. Higher anomalies have poor sphincteric development and have higher chances of an associated internal fistula. A temporary colostomy is essential, and helps in the detailed investigations of the anomaly by allowing the performance of a contrast study called a distal loopogram⁹.

The upside-down x-ray (invertogram) originally described by Wangenstein and Rice¹¹ in 1930 has been considered the classic method for determining the level of the blind rectal pouch. In this method, the patient must be carefully held upside down. A modification of a prone lateral cross-table radiography (PLCTR) as described by Narasimharao¹⁴ was reported in 1983. Patients were held face down with their hips flexed and were kept in this genupectoral position. The evaluation of the rectal gas shadow was based on bony landmarks (pubococcygeal line and ischial point) in both the invertogram and the PLCTR. Narasimharao¹⁴ recommended the routine use of PLCTR instead of invertogram because the former provided equivalent or sometimes better information than the invertogram.

The results of our study are similar to, and support, the previous study of Narasimharao¹⁴. PLCTR offers certain advantages such as easy positioning, better distension or delineation of rectal gas, and is less time consuming. The patient is usually calm and relaxed in the genupectoral position. The full extent of the rectal gas shadow could be well demonstrated on the radiograph. The patient usually cry during invertogram positioning, which causes contraction of puborectalis sling and a deceptive obliteration of the lower rectum⁶. In addition, we found evidence that the blind rectal pouch seen on invertogram is higher than the actual levels in some cases.

In conclusion, the present study revealed that PLCTR was more accurate than the invertogram regarding interpretation of rectal pouch level in ARM. Thus, we advocate the routine use of PLCTR instead of the invertogram in the evaluation of ARM because it is

easier to perform and is more accurate.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. Siraporn Sawasdivorn, the Director of Queen Sirikit National Institute of Child Health, for permission to publish this paper, Dr. Sukawat Watanatittan, the Senior Consultant of Surgery Department, for editing of the manuscript and Miss Sasichol Kamproh for support in statistical analysis.

REFERENCES

1. Chatterjee SK. Anorectal malformations. A surgeon's experience. Delhi: Oxford University Press; 1991.
2. Gupta DK, Charles AR, Srinavas M. Pediatric surgery in India. A specialty come of age. *Pediatr Surg Int* 2002;18:649-52.
3. Shaul DB, Harrison EA. Classification of anorectal malformations-initial approach, diagnostic tests and colostomy. *Semin Pediatr Surg* 1997;16:187-95.
4. Pena A. Current management of anorectal malformations. *Surg Clin North Am* 1992;72:1393-416.
5. Templeton JM, O' Neill JA Jr. Anorectal malformations. In: Welch KJ, Randolph JG, Ravitch M, et al, eds. *Pediatric surgery*. 2nd ed. Chicago: Year Book Medical Publishers; 1986:1022-37.
6. Chowdhary SK, Gupta A, Samujh R. Management of anorectal malformation in neonates. *Indian J Pediatr* 1999; 66:791-8.
7. Pena A, Hong A. Advances in management of anorectal malformation. *Am J Surg* 2000;180:377-81.
8. Holschneider AM, Pfrommer W, Gerresheim B. Results in the treatment of anorectal malformations with special regard to the history of the rectal pouch. *Eur J Pediatr Surg* 1994;4:303-9.
9. Horsiramanont S, Sangkhathat S, Utamakul P. Appraisal of invertograms and distal colostograms in the management of anorectal malformation. *J Med Assoc Thai* 2004;87:492-502.
10. Pena A. Imperforate anus and cloacal malformations. In: Aschcraft KW, Murphy JP, eds. *Pediatric surgery*. 3rd ed. Philadelphia: WB Saunders; 2000:473-92.
11. Wangenstein OH, Rice CO. Imperforate anus: a method of determining the surgical approach. *Ann Surg* 1930;92:77-81.
12. Stephens FD, Smith ED. Anorectal malformations in children. Chicago: Year Book Medical Publishers; 1971.
13. Gordon IRS, Ross FGM. Diagnostic radiology in pediatrics. London: Butterworths; 1977.
14. Narasimharao KL, Prasad GR, Katariya S, et al. Prone cross-table lateral view: an alternative to the invertogram in imperforate anus. *AJR* 1983; 140: 227-9.

15. Berdon WE, Baker DH, Santulli TV, et al. The radiologic evaluation of imperforate anus: an approach correlated with current surgical concepts. *Radiology* 1968; 90: 446-71.
16. Santulli TV, Schullinge JN, Liesewette WB, et al. Imperforate anus: a survey from the members of the surgical section of the American Academy of Pediatrics. *J Pediatr Surg* 1971; 6: 484-7.
17. Pathak IC, Saifullah S. Congenital anorectal malformations : an experience based on 50 cases. *Indian J Pediatr* 1969;36: 370-9.
18. Hasse W. Associated malformations with anal and rectal atresia. *Prog Pediatr Surg* 1976;9:99-103.
19. Hassink EA, Rieu PN, Hamal BC. Additional congenital defects in anorectal malformations. *Eur J Pediatr* 1996;155:477-82.
20. Pena A. Anorectal malformations. *Semin Pediatr Surg* 1995;4:35-47.

Laparoscopic Totally Extra-peritoneal Hernia Repair Using a Non-Fixed Mesh Patch and Mesh Plug Versus Open Repair

Supoj Laiwattanapaisai, MD

Department of General Surgery, Rayong Hospital, Rayong, Thailand

Abstract

Objective: To determine post-operative outcomes after laparoscopic totally extra-peritoneal hernia repair using a non-fixed mesh patch and mesh plug, compared with open repair.

Material and Method: We retrospectively studied the cases of 70 patients who all underwent hernia repair surgery using either laparoscopic TEP or an open repair technique, performed by a single surgeon (the author). All cases took place between May 18, 2008 and April 30, 2010. Patient characteristics including gender, age, hernia type classification, pain score, operative time, recovery time, recurrence rate and any complications was obtained by reviewing each patient's medical record.

Results: Thirty patients underwent laparoscopic TEP with non-fixed mesh, and 40 patients underwent open repair. Mean patient age was 49.6 ± 16.1 years in the TEP group and 47.8 ± 15.9 years in the open repair group ($P = 0.632$). Patients in the TEP group suffered from indirect hernias (73.3%), direct hernias (20%) or combined hernias (6.7%). Patients in the open repair group had indirect hernias (90%) or direct hernias (10%). The mean operative time was 147.3 ± 33.5 minutes in the TEP group and 43.8 ± 10.8 minutes in the open repair group ($P < 0.001$). Pain scores within 24 hours of the procedures averaged 3.5 ± 2.1 in the TEP group and 5.9 ± 2.9 in the open repair group ($P < 0.001$). Mean hospital stay was 5.6 ± 0.77 days in the TEP group and 3.5 ± 1.8 days in the open repair group ($P < 0.001$). The follow-up period averaged 29.8 ± 4.2 months in the TEP group and 36.3 ± 3.2 months in the open repair group ($P < 0.001$). No recurrences were reported in either group. Common complications included minor morbidities such as seroma, urinary retention, chronic groin pain, epididymitis, and subcutaneous emphysema, which were not significantly different between groups.

Conclusions: Although the operative time for the laparoscopic TEP method was longer and resulted in a longer hospital stay, we demonstrated that it can be performed safely, with only minor complications and with no recurrence.

Keywords: extra-peritoneal repair, inguinal hernia, laparoscopic herniorrhaphy

INTRODUCTION

Minimally invasive surgery has changed the face of traditional surgery, offering patients intervention with less pain, faster recovery times and improved

cosmesis. At present, there are many techniques for tension-free herniorrhaphy, including the Lichtenstein tension-free repair, the "Plug and Patch" technique, pre-peritoneal repair and laparoscopic hernia repair.

Correspondence address: Supot Laiwattanapaisai, MD, Department of General Surgery, Rayong Hospital, 138 Sukhumvit Road, Tambol Tha Pradoo, Amphur Muang, Rayong 21000, Thailand; Telephone: +66 3861 1104; Fax: +66 3861 2003; E-mail: supoj_laiwattana@yahoo.co.th

Regardless of the method used, the two main objectives have always been to reduce the incidence of recurrence and to minimize complications. Evans MD et al. conducted a randomized control trial study that compared the laparoscopic TEP technique with the open Lichtenstein technique and found no significant difference between the two with regard to recurrence rate¹. However, the laparoscopic TEP technique yielded other benefits that contributed toward patient quality of life, such as less pain and a speedier return to normal activity¹⁰. In a 2005 review, by Cochrane² laparoscopic TEP was compared to laparoscopic transabdominal pre-peritoneal repair (TAPP). Cochrane concluded that there were no significant differences with regard to operating time, occurrence of hematoma, length of hospital stay, recovery time, hernia recurrence, or conversion to open rate. However, despite these findings, the use of mesh fixation with the laparoscopic TEP technique remains a controversial issue. In some studies, the practice of rolling up the mesh graft has been shown to increase the risk of hernia recurrence^{5,6}. Fixation of the mesh graft with a spiral staple is recommended to prevent recurrence; however, spiral staples have been shown to cause chronic groin pain and neurovascular injury in 2-4% of cases^{7,8}. In addition, the use of such tools may increase the total cost of the surgery. Meta-analyses comparing techniques using non-fixed mesh with those using fixed mesh have shown that no statistically significant differences exist in terms of operation time, reported post-operative pain levels, post-operative complications, length of hospital stay or chronic groin pain^{3,4}. In the present study, we compare the laparoscopic total extra-peritoneal (TEP) technique for inguinal hernia repair vs. the open repair technique. The laparoscopic TEP method discussed here combines the use of a non-fixed mesh patch and a mesh plug. This method is similar to the Plug and Patch technique, except that it uses a posterior approach rather than an anterior one. It was anticipated that, without the use of spiral staples to fix the mesh graft, this technique would result in a lower recurrence rate, no visceral organ injuries, reduced risk of trocar site herniation and neurovascular injury, fewer foreign bodies, and reduced chronic groin pain. Finally, the authors' method followed the philosophy of sufficient economy of His Majesty King Bhumibol Adulyadej of Thailand.

MATERIALS AND METHODS

This retrospective cohort study of 70 patients with unilateral hernias was designed to determine the effectiveness of the laparoscopic TEP hernia repair technique compared to traditional open repair. The patients were each informed of the advantages and disadvantages of the procedure as well as the potential complications and risks prior to surgery. All patients underwent surgery between May 18, 2008 and April 30, 2010. Thirty patients underwent laparoscopic TEP, and 40 underwent open repair (modified Bassini operation). The author used the Nyhus classification system (Table 1) for dividing the hernias into four subtypes⁹. Each patient was treated by one surgeon and was assessed postoperatively every 3 - 4 months. Patient data were collected by telephone as well as by reviewing each patient's medical records two years post-surgery. Post-operative pain levels were assessed using a visual analog pain scale (VAS).

Inclusion criteria

Adults who had reducible inguinal hernias were included in the study.

Exclusion criteria

Patients with irreducible hernias, hernia recurrence cases, patients with medical contraindications to surgery and patients with scars from previous lower abdominal surgeries that may have interfered with the operative field were excluded from this study

Variable definitions

The operative time was defined as the time of skin incision to the time of skin closure. Seroma was defined as aspiration of > 5mL of fluid. Subcutaneous emphysema refers to air or gas that is trapped in subcutaneous tissues. Chronic groin pain was defined as pain at the operative site that persisted for three

Table 1 Nyhus hernia classification

Type I	Indirect hernia without dilation of the internal ring
Type II	Indirect hernia with dilation of the internal ring
Type IIIa	Direct hernia with back wall defect
Type IIIb	Indirect hernia with backwall defect (combined hernia)
Type IIIc	Femoral hernia
Type IV	Recurrent hernia

months post-surgery. The length of hospital stay was defined as the total number of nights that the patient remained under hospital care.

Statistical analysis

Pearson's chi-squared test was used to analyze the data in both groups independently, and the mean data from each group was compared using an independent *t*-test. Data collected in the database was analyzed using SPSS version 11.5. A *P*-value of < 0.05 was considered statistically significant.

Open surgical technique

The inguinal canal was accessed through a transverse incision, and the hernia sac was identified and isolated from the spermatic cord. For indirect hernias, the sac was reduced to the peritoneal cavity through ligation. For direct hernias, the sac was reduced without ligation. The transverse fascia was not incised. The medial tissue, including the internal oblique muscle and the transverse abdominis muscle, were then fixed to the shelving edge of the inguinal ligament with 1/0 Prolene interrupted sutures.

Mersilene mesh was not used in open hernia repairs.

Laparoscopic technique

One gram of Cefazolin was administered intravenously 1/2 to 1 hour prior to surgery. A catheter was inserted into the bladder and a naso-gastric tube into the stomach for decompression. After incising the anterior rectus sheath to expose the posterior rectus sheath, a 10 mm port was placed at the midline of the lower abdomen, 1.5-2 cm below the umbilicus. A 5 mm, 30° camera was inserted into the extra-peritoneal channel and bluntly advanced toward the pubic symphysis. Gentle medial to lateral sweeping of the camera helped to create a pre-peritoneal space. The author did not use a space-maker dissection balloon. Carbon dioxide gas was used to insufflate the pre-peritoneal space to 12 mmHg. Two additional 5 mm trocars were placed at the lower midline. One was placed suprapubically, while the other was placed between the first and third trocars. The patient was placed in Trendelenburg to retract bowel from the hernia site. A 14 × 15 cm piece of Mersilene mesh was used for patching. A 2 × 8-10 cm mesh plug was rolled

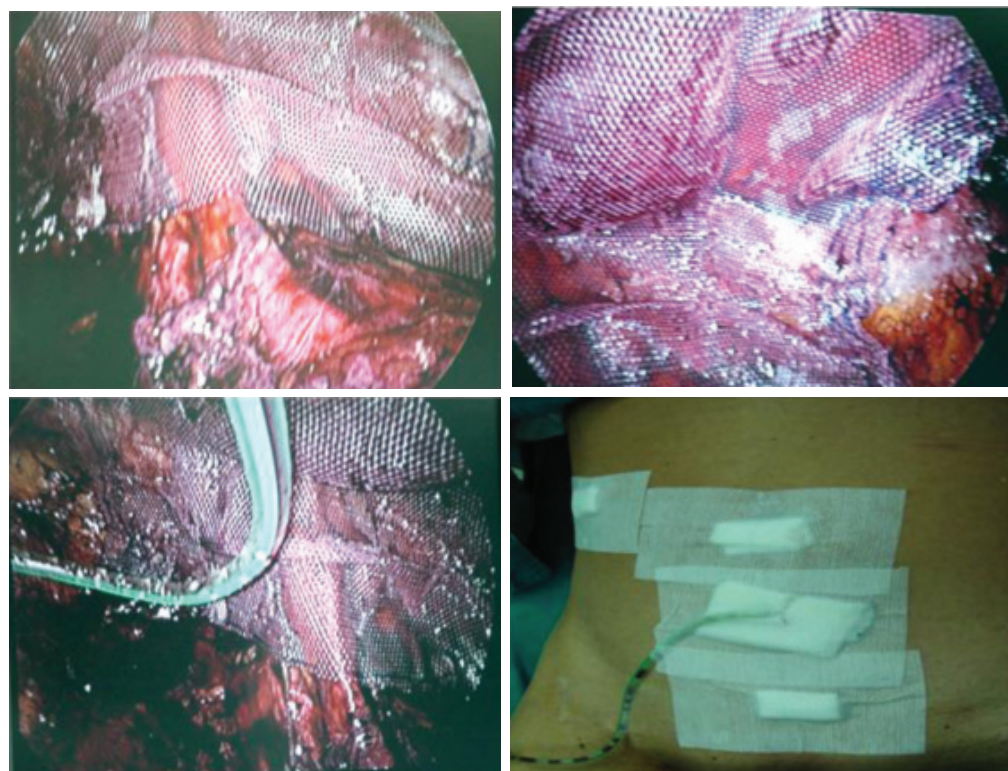


Figure 1 Laparoscopic totally extra-peritoneal (TEP) hernia repair and drain

in a cylindrical fashion and inserted into the internal ring to occlude the indirect hernia sac entrance. Mersilene mesh was selected because of its light weight and flexibility, allowing it to easily mold to the anterior abdominal wall. A #8 Redivac drain was inserted into the middle trocar and placed in the pre-peritoneal space. The space was then deflated slowly under direct visualization to ensure proper mesh positioning. The trocars were removed and only the camera port site was sutured using 3/0 Vicryl. The skin was sutured using 4/0 nylon. The surgical steps are illustrated in Figure 1.

RESULTS

Data for all patients are shown in Table 2. The mean age was 49.6 ± 16.6 years in the TEP group and

47.8 ± 15.9 years in the open repair group. No significant difference was observed between groups, $P = 0.632$. The male-to-female ratio was 29:1 in the TEP group and 9:1 in the open repair group. Thirty-three cases were right-sided hernias (12 in the TEP group, 21 in the open repair group) and thirty seven cases were hernias located on the left side (18 in the TEP group, 19 in the open repair group), with no significant difference in the distribution of right vs. left-sided repairs, $P = 0.427$. Most of the cases were indirect hernia (73% in the TEP group, 90% in the open repair group, with no statistically significant difference between the two groups, $P = 0.109$). Based on Nyhus hernia classifications, however, there were significant differences between the hernia types found in each group ($P < 0.001$). The operative time was significantly longer for the TEP group, averaging 147.3 ± 33.5

Table 2 Patient characteristics based on intervention

Variable	TEP (n = 30)	Open (n = 40)	P- value
Age in Years (Mean \pm SD)	49.6 ± 16.1	47.8 ± 15.9	0.632
Gender (Male: Female)	29 : 1	36 : 4	0.383
Hernia side (Right : Left)	12 : 18	21 : 19	0.427
Hernia type			0.109
Indirect hernia	22 (73.3%)	36 (90%)	
Direct hernia	6 (20%)	4 (10%)	
Combined	2 (6.7%)	0	

Table 3 Nyhus Hernia Classification

Type	TEP (n = 30)	Open (n = 40)=	P- Value
I	0	0	-
II	11(36.7%)	31(77.5%)	< 0.001
IIIa	6(20%)	1(2.5%)	< 0.001
IIIb	13(43.3%)	8(20%)	< 0.001
IIIc	0	0	-
IV	0	0	-

Table 4 Postoperative outcomes

Variable	TEP (n = 30)	Open (n = 40)	P- Value
Operative time in minutes (Mean \pm SD)	147.3 ± 33.5	43.8 ± 10.8	< 0.001
Pain score 24 hrs post surgery (Mean \pm SD)	3.5 ± 2.1	5.9 ± 2.9	< 0.001
Length of hospital stay in days (Mean \pm SD)	5.6 ± 0.77	3.5 ± 1.8	< 0.001
Time of follow-up in months (Mean \pm SD)	29.8 ± 4.2	36.3 ± 3.2	< 0.001
Recurrence rate (%)	0	0	-

Table 5 Postoperative complications

Variable	TEP (n = 30)	Open (n = 40)	P- Value
Seroma	1 (3.3%)	1(2.5%)	1.000
Subcutaneous emphysema	1 (3.3%)	0	0.429
Chronic groin pain	0	2(5%)	0.503
Epididymitis	0	2(5%)	0.503
Visceral organ injury	0	0	-
Urinary retention	0	1(2.5%)	1.000

minutes and 43.8 ± 10.8 minutes for the open repair group, $P < 0.001$. The pain score recorded 24 hours postsurgery for the TEP group and open repair group were 3.5 ± 2.1 and 5.9 ± 2.9 , respectively. The pain levels for those patients who underwent open repair procedures were significantly higher than those observed in the TEP group, $P < 0.001$. The length of hospital stay, however, was longer for the TEP group than for the open repair group, with stays of 5.6 ± 0.77 days and 3.5 ± 1.8 days, respectively, $P < 0.001$. Average follow-up was more than two years for both groups. There were no recurrences reported in either group after two years.

As shown in table 5, minor complications occurred in both groups. They occurred more frequently in the open repair group, however, the difference was not statistically significant. Complications experienced by patients in the TEP group were seroma 1(3.3%), subcutaneous emphysema 1(3.3%), pneumoperitoneum 7(23.3%). Additionally, patients in the open repair group experienced seroma 1(5%), chronic groin pain 2(5%), epididymitis 2(5%) and urinary retention 1(2.5%).

DISCUSSION

In the early 1990s, laparoscopic inguinal herniorrhaphy was first described by Ger, Schultz, Corbitt, and Filipi¹². A 2002 meta-analysis^{13,14} concluded that the laparoscopic technique is superior to the open technique because it allows patients to return to their normal activities more quickly, and it reduces persistent pain and resulted in lower recurrence rates than those associated with open non-mesh repairs. Interestingly, no difference was found when compared to open mesh repairs. In spite of these apparent benefits, laparoscopic hernia repair carries higher costs and

prolonged operative time, compared to open surgery¹². Thus, the question is raised: Which type of laparoscopic hernia repair yields the best patient outcomes and is most cost-effective? In a 2005 Cochrane review, laparoscopic TEP and laparoscopic trans-abdominal pre-peritoneal repairs (TAPP) were compared and contrasted. It was concluded that there were no significant differences in operative time, occurrence of hematoma, length of hospital stay, recovery time, recurrence rates, or conversion to open rates². In this study, patients underwent hernia repair using either the laparoscopic TEP technique, with a non-fixed mesh patch and a mesh plug or a traditional open repair. There was no difference in patient characteristic data between the two groups.

The operative time for the laparoscopic TEP procedures in this study averaged 147 ± 33.5 minutes. This is significantly longer than operative times recorded for the same procedure in the Cochrane review². One of the primary reasons for this difference in operative time is the inexperience of the surgeon. The Cochrane review suggested that the operative time for an inexperienced surgeon (up to 20 cases) performing laparoscopic TEP should average 95 minutes. In three different studies of Thai surgeons performing laparoscopic TEP, operative times were estimated at 81.5 ± 37.9 minutes, 72.74 minutes and 132.15 ± 37.2 minutes^{14,16,17}. Many authors have reported that the average operating time for laparoscopic TEP hernia repair could be longer than procedures using the open repair technique^{12,21,22}; however, other studies^{18,20} have found the operative times to be similar.

In this study, the average operative time for the laparoscopic TEP procedures was significantly longer than operative times for the open repairs. The average laparoscopic TEP operative time was longer than those recorded in other studies due to six factors, including 1) operating teamwork, 2) surgical technique (no balloon dissector was used to create pre-peritoneal space and a non-fixed mesh patch and plug repair technique was used) and 3) surgeon inexperience (the learning curve for performing laparoscopic TEP repairs is typically at least 30 cases^{2,15}). Next, 4) The presence of pneumoperitoneum in 23.3% of the laparoscopic TEP cases, which caused a narrowing of the operative space and contributed to an accidental tear in the peritoneal layer while dissecting to identify the hernia sac or dividing the hernia sac in Type IIIB

hernias. This was remedied by using a 10 mm clip staple to seal the hole in the peritoneal layer and by positioning one 5 mm trocar through the lateral abdominal wall and into the peritoneum to release carbon dioxide. 5) A combination of DIH and IIH or secondary disease also contributed to lengthier operative times. For example, one 27-year-old patient had an undescended testis in the extra-peritoneal cavity that was identified 10 years prior to this procedure. As such, a laparoscopic orchiectomy was performed with the TEP (no malignant changes were observed). The final contributing factor, 6) was the difference in types of hernias among patients within the two groups ($P < 0.001$). The reported pain scores 5.9 ± 2.9 in the patients who underwent open repairs were higher than those reported by patients in the TEP group ($P < 0.001$). It should be noted that when pain scores were higher than 5, intravenous analgesic drugs were used. The length of hospital stay was 5.6 ± 0.77 days in the laparoscopic TEP group, longer than those in the open repair group. In many studies, the average hospital stay was less than three days, due largely to the placement of a closed-system drain into pre-peritoneal space to drain serum fluid, prevent rolling, folding and twisting of the Mersilene mesh, and reducing the risk of scrotal seroma. The drain was typically removed one day prior to discharge.

There was no hernia recurrence in either group, after greater than two years of follow up for each patient. A recurrence rate of between 1.6-4.3% is generally found in cases that constitute a surgeon's "learning curve" period¹⁶. The factors¹¹ that most commonly contribute to hernia recurrences are inexperienced surgeons, inadequate dissection, insufficient prosthesis size, insufficient prosthesis overlap of the hernia defect, folding and twisting of the prosthesis, mesh lifting from hematoma/seroma and a missed hernia. Patients with indirect inguinal hernias experience the majority of recurrences, with rates estimated at 22%⁶. The etiologies of these recurrences are typically inadequate lateral fixation of the spiral staple due to fear of vessel or nerve injury, and inadequate dissection below the iliopubic tract. Therefore, in this study, a mesh plug was placed into the internal ring entrance so as to prevent an indirect inguinal hernia recurrence. The hope was that by using the non-fixed mesh and mesh plug, one could greatly reduce the risk of accidental nerve and vessel

injury, bleeding and chronic groin pain.

There are currently two accepted methods for avoiding chronic groin pain. The first is the use of a non-fixed mesh hernia repair technique. The second is the use of fibrin glue to fix the mesh. Treepongkaruna et al.¹⁴ presented a novel technique for mesh fixation by using a Cyanoacrylate agent - an adhesive substance that when used, has resulted in no chronic groin pain and no cases of recurrence, similar to the results of this study.

There were no serious complications in either the laparoscopic TEP group or the open repair group, however, minor complications were observed more frequently in the open repair group (6 cases, 15%) than in the TEP group (2 cases, 6.6%). In the cases involving seroma, the seroma was aspirated 2-3 times, after which it did not appear again. In one case, subcutaneous emphysema extended to the lower chest wall on the same side as the repaired hernia, however, it did not cause any serious issues and it spontaneously reabsorbed within one day. There was one case of urinary retention, which was treated with a Foley catheter for 2-3 days. The cases of chronic groin pain typically subsided after six months with conservative treatment. The cases of epididymitis were treated with antibiotics and analgesic drugs, and resolved within one week.

Based on these findings, it is anticipated that the laparoscopic TEP technique for hernia repair will continue to increase in popularity as a favorable alternative to open repair. However, careful patient selection, expertise with the surgical technique and good teamwork in the operating room are crucial for a successful surgery and good patient outcomes.

CONCLUSION

By using a non-fixed mesh patch and mesh plug, the laparoscopic TEP procedure can be performed safely with only minor complications, and with a low or absent rate of recurrence, similar to those associated with open repair. Some factors may extend operative time and length of hospital stay; however, for some patients, the minimization of pain and improved cosmetic appearance associated with laparoscopic TEP will make this surgical option preferable to open repair.

REFERENCES

1. Evans MD, Williams GL, Stephenson BM. Low recurrence rate after laparoscopic (TEP) and open (Lichtenstein) inguinal hernia repair: a randomized, multicenter trial with 5-year follow-up. *Ann Surg* 2009;250:354-5.
2. Wake BL, McCormack K, Fraser C, Vale L, Perez J, Grant AM. Transabdominal pre-peritoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. *Cochrane Database Syst Rev* 2005(1): CD004703.
3. Tam KW, Liang HH, Chai CY. Outcomes of staple fixation of mesh versus nonfixation in laparoscopic total extraperitoneal inguinal repair: a meta-analysis of randomized controlled trials. *World J Surg* 2010;34:3065-74.
4. Sajid MS, Ladwa N, Kalra L, Hutson K, Sains P, Baig MK. A meta-analysis examining the use of tacker fixation versus no-fixation of mesh in laparoscopic inguinal hernia repair. *Int J Surg* 2012;10:224-31.
5. Deans GT, Wilson MS, Royston CM, Brough WA. Recurrent inguinal hernia after laparoscopic repair: possible cause and prevention. *Br J Surg* 1995;82:539-41.
6. Felix E, Scott S, Craffton B, Geis P, Duncan T, Sewell R, et al. Causes of recurrence after laparoscopic hernioplasty. A multicenter study. *Surg Endosc* 1998;12:226-31.
7. Stark E, Oestreich K, Wendl K, Rumstadt B, Hagmuller E. Nerve irritation after laparoscopic hernia repair. *Surg Endosc* 1999;13:878-81.
8. Lantis JC, 2nd, Schwaitzberg SD. Tack entrapment of the ilioinguinal nerve during laparoscopic hernia repair. *J Laparoendosc Adv Surg Tech A* 1999;9:285-9.
9. Sherman V, Macho JR, Brunicaudi FC. Inguinal hernia. In: Brunicaudi FC, editors. *Schwartz's Principles of Surgery*. 9th ed. New York: McGraw-Hill; 2009. p. 1305-42.
10. Myers E, Browne KM, Kavanagh DO, Hurley M. Laparoscopic (TEP) versus Lichtenstein inguinal hernia repair: a comparison of quality-of-life outcomes. *World J Surg* 2010;34:3059-64.
11. Lowham AS, Filipi CJ, Fitzgibbons Jr RJ, Stoppa R, Wantz GE, Felix EL, et al. Mechanisms of hernia recurrence after preperitoneal mesh repair: traditional and laparoscopic. *Ann Surg* 1997;225:422-31.
12. Davis CJ, Arregui ME. Laparoscopic repair for groin hernias. *Surg Clin North Am* 2003;83:1141-61.
13. Voyles CR, Hamilton BJ, Johnson WD, Kano N. Meta-analysis of laparoscopic inguinal hernia trials favors open hernia repair with preperitoneal mesh prosthesis. *Am J Surg* 2002;184:6-10.
14. Treepongkaruna SA, Subwongcharoen S. Novel technique of mesh fixation with cyanoacrylate in totally extraperitoneal laparoscopic hernia repair: early experience. *J Med Assoc Thai* 2012;95 (Suppl 3):S98-101.
15. Voitk AJ. The learning curve in laparoscopic inguinal hernia repair for the community general surgeon. *Can J Surg* 1998;41:446-50.
16. Jongsiri N. A 9-year Experience of Laparoscopic Herniorrhaphy at FortPrajaksilapakom Hospital. *Thai J Surg* 2009;30:42-6.
17. Luangchna V. Laparoscopic repair of inguinal hernia using two layers of mesh with reinforcement of the inner mesh by 2 sutures. *J Med Assoc Thai* 2004;87:1425-30.
18. Choi YY, Han SW, Bae SH, Kim SY, Hur KY, Kang GH. Comparison of the outcomes between laparoscopic totally extraperitoneal repair and prolene hernia system for inguinal hernia; review of one surgeon's experience. *J Korean Surg Soc* 2012;82:40-4.
19. Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons Jr R, Dunlop D, Gibbs J, et al. Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med* 2004;350:1819-27.
20. Vidović D, Kirac I, Glavan E, Filipovic 'Cugura J, Ledinsky M, Bekavac-Beslin M. Laparoscopic totally extraperitoneal hernia repair versus open Lichtenstein hernia repair: results and complications. *J Laparoendosc Adv Surg Tech A* 2007;17:585-90.
21. Khoury N. A randomized prospective controlled trial of laparoscopic extraperitoneal hernia repair and mesh-plug hernioplasty: a study of 315 cases. *J Laparoendosc Adv Surg Tech A* 1998;8:367-72.
22. Chung RS, Rowland DY. Meta-analyses of randomized controlled trials of laparoscopic vs conventional inguinal hernia repairs. *Surg Endosc* 1999;13:689-94.

Outcomes of Hepatic Resections for Synchronous Colorectal Liver Metastases in a Low-volume Setting

Kijja Jearwattanakanok, MD

Department of Surgery, Nakornping Hospital, Chiang Mai, Thailand

Abstract

Objective: To assess outcomes of hepatic resections for synchronous colorectal liver metastases in a low-volume setting.

Materials and Methods: Medical records of patients undergoing hepatic resections for synchronous colorectal liver metastases from October 2003 to September 2012 were reviewed. Progression-free survival was estimated with the Kaplan-Meier method. Risk factors of disease progression were identified and tested using the Cox proportional hazards regression models.

Results: There were 21 patients who underwent hepatic resection for synchronous colorectal metastasis. There was no hospital death. Operative morbidity was 38% (8 of 21 patients). Progression was observed in 9 patients, of whom 5 died. Median progression-free survival was 30 months. Increased Fong's clinical risk score (HR: 4.03; 95% CI: 1.35 to 11.97), preoperative carcinoembryonic antigen > 200 ng/mL (HR: 5.43; 95% CI: 1.21 to 24.40), and positive resection margin (HR: 9.70; 95% CI: 2.12 to 44.37) were associated with higher risk of disease progression.

Conclusion: Hepatic resection for colorectal liver metastases can be performed in low-volume settings with good outcomes. Selection of low-risk patients is advised.

Keywords: colorectal cancer, liver metastasis, hepatic resection, progression-free survival

Colorectal cancer is a one of the most common cancers in Thailand. Data from cancer registries showed a trend for increasing incidence, and it had been projected to reach an incidence of 16.9 per 100,000 in year 2008¹. The incidence colorectal cancer may exceed that of lung cancer in the next decade². Many of colorectal cancer patients present with synchronous liver metastasis. In western countries, 12% to 15% of colorectal cancers have synchronous liver metastases at the time of diagnosis³. Hepatic resection is the only treatment known to achieve long term survival in these

patients⁴. Since most colorectal cancers are treated by general surgeons, who may not have much experience with liver surgery, many synchronous colorectal liver metastases may not have been optimally treated. One study showed that, according to specialist opinions, as much as 63 % of colorectal liver metastases treated with chemotherapy were resectable⁵. The current guidelines for resection of colorectal liver metastases suggested that hepatic resection should be performed in high-volume centers⁶. However, in countries with limited healthcare resources such as Thailand, where

specialized liver surgical units are not widely available, it might be necessary for low-volume centers to perform liver resection for synchronous colorectal liver metastases, at least for selected cases. The aim of the present study was to assess hospital and oncologic outcomes of hepatic resection for synchronous colorectal liver metastases in a low-volume center.

MATERIAL AND METHOD

Data were collected from medical records of patients with synchronous colorectal liver metastases who underwent hepatic resection at Nakornping Hospital between October 2003 and September 2012. Patients' baseline data, timing of surgery (simultaneous or delayed after primary tumor resection), type of hepatic resection (anatomical or non-anatomical resection), site and lymph node involvement of primary tumor, number of liver nodules, tumor involvement at resection margins, preoperative serum carcinoembryonic antigen (CEA) level, operation time, intraoperative blood loss, morbidity according to Clavien-Dindo classification⁷, length of hospital stay, discharge status were recorded. Fong's clinical risk score⁸ was calculated for each patient. Follow-up time until disease progression or death was recorded. Patients who were lost to follow-up were censored at the time of their last visit.

Surgical technique, adjuvant chemotherapy, and follow-up

Standard technique for colorectal cancer resection was performed in all patients. Simultaneous hepatic resection was done whenever possible. Hepatic pedicle clamping was applied in most patients except for those who received hepatic lobectomies, where the extrahepatic hepatic artery and portal vein were selectively controlled. Fluorouracil/Leucovorin was standard regimen for adjuvant chemotherapy. Patients were followed every three months for two years after completion of adjuvant chemotherapy, and every six months afterward. Physical examination, chest x-ray, abdominal ultrasonography, and serum CEA were checked during follow-up visits.

Statistical analysis

Baseline data, type and timing of surgery, tumor characteristics, surgical outcomes, and morbidity were

summarized using appropriate descriptive statistics such as counts and percentage, mean and standard deviation (SD), and median and range. Kaplan-Meier methods were used for the analysis of progression-free survival time. Cox's proportional hazards model was used to identify significant risk factors of disease progression. Hazard ratios (HR) and their 95% confidence intervals (95% CI) were reported. A two-tailed p-value less than 0.050 was considered statistically significant.

RESULTS

There were 21 patients in the present study. Patients' age at time of surgery ranged from 43 years to 85 years with a mean age of 60.5 years. There were slightly more female patients than male patients (57% vs. 43%). The right sided colon was the most common site of primary tumors. There were 6 patients who had 2 metastatic liver nodules while 15 patients had a single liver nodule. Positive hepatic margin was observed in 4 (19%) patients. Lymph node involvement was seen in 14 (67%) patients. Median preoperative

Table 1 Baseline characteristic of synchronous colorectal liver metastasis patients

Characteristic	Number (%); n = 21
Age in years: mean (SD)	60.5 (9.70)
Gender	
Male	9 (43)
Female	12 (57)
Site of primary tumor	
Caecum and ascending colon	7 (33)
Transverse colon	2 (10)
Descending colon	3 (14)
Sigmoid colon	3 (14)
Recto-sigmoid colon	2 (10)
Rectum	4 (19)
Number of liver nodule	
1	15 (71)
2	6 (29)
Positive hepatic resection margin	4 (19)
Lymph node positive in primary tumor	14 (67)
Preoperative carcinoembryonic antigen >200 ng/mL	3 (14)
Fong's clinical risk score	
1	5 (24)
2	10 (48)
3	5 (24)
4	1 (5)

SD: standard deviation

Table 2 Operative characteristics and hospital outcomes of hepatic resection for colorectal liver metastases

Operation characteristic/outcome	Number (%); n = 21
Timing of liver resection	
Simultaneous with primary tumor resection	18 (86)
Delayed after primary tumor resection	3 (14)
Type of liver resection	
Anatomical resection	8 (38)
Non-anatomical resection	13 (62)
Hepatic pedicle clamping	14 (67)
Operative blood loss in mL: mean (SD)	450.5 (196.6)
Operation time in minutes: mean (SD)	180.6 (52.3)
Morbidity*	8 (38)
Length of stay in days: mean (SD)	11.9 (6.6)

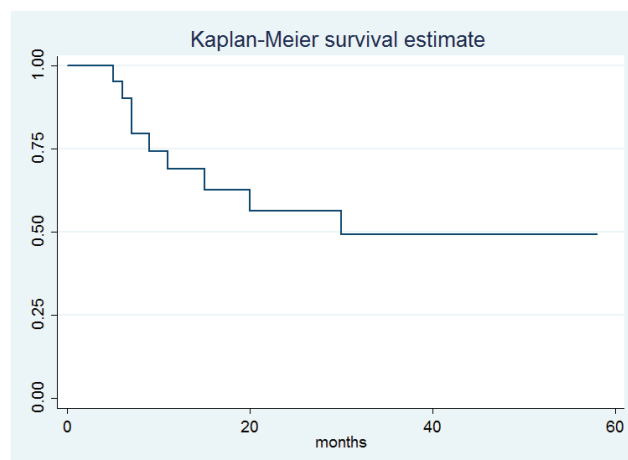
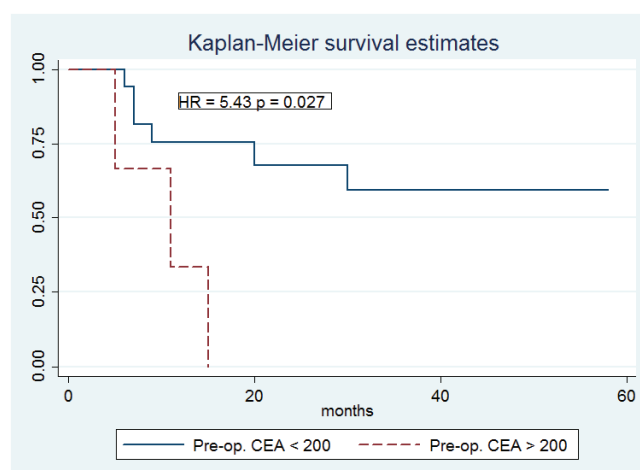
*Clavien-Dindo classification grade 2 and 3; SD: standard deviation

carcinoembryonic antigen (CEA) level was 36.2 ng/mL, and 3 patients had preoperative CEA over 200 ng/mL. The majority of patients had Fong's clinical risk score of two or less (Table 1).

Simultaneous hepatic and primary colonic tumor resection was performed in 18 patients (86%). Thirteen patients (62%) received non-anatomical hepatic resections. Hepatic pedicle clamping was applied in 14 patients (67%). The average length of hospital stay was 11.9 days (SD, 6.6 days). There was no in-hospital death, but eight patients (38%) experienced significant operative complications. One patient required reoperation due to colonic anastomosis leakage (Table 2).

Patients were followed for a period between 4 and 58 months, with a median follow-up time of 15 months. Disease progression was seen in nine patients. Sites of progression were intrahepatic alone (two patients), extrahepatic (lung & peritoneum, four patients), both intra and extrahepatic (three patients). There were five deaths, all with disease progression. Median progression-free survival (PFS) was 30 months (Table 3 and Figure 1).

On univariable Cox regression, the risk of disease progression increased significantly with positive hepatic margins (HR 9.70; 95%CI: 2.12 to 44.37) and higher Fong's clinical risk score (HR 4.03; 95%CI: 1.35 to 11.97). Preoperative CEA > 200 ng/mL was also a significant risk factor of disease progression (HR 5.43; 95% CI: 1.21 to 24.40; Figure 2). Lymph node

**Figure 1** Progression-free survival of synchronous colorectal liver metastases in months after hepatic resections**Figure 2** Effect of high serum carcinoembryonic antigen (CEA) > 200 ng/mL on progression-free survival. Dashed line shows rapid progression of disease in patients with high serum CEA.

involvement and liver nodule > 1 also increased the risk of disease progression, but were not statistically significant (Table 4).

Table 3 Follow-up time and progression-free survival (PFS) after hepatic resection

Follow-up time in months: median (range)	15 (4 to 58)
Number of patients with disease progression	9
Number of deaths*	5
Median progression-free survival (PFS) in months	30

*all were patients with disease progression

Table 4 Risk factor hazard ratio (HR) from univariable Cox proportional hazards regression analysis of disease progression, with 95% confidence interval (95% CI) and p-values

Risk factor	HR (95%CI)	p-value
Positive hepatic margin	9.70 (2.12 to 44.37)	0.003
Increased Fong' clinical risk score	4.03 (1.35 to 11.97)	0.012
Preoperative carcinoembryonic antigen > 200 ng/mL	5.43 (1.21 to 24.40)	0.027
Lymph node positive in primary tumor	1.88 (0.39 to 9.06)	0.433
Liver nodule > 1	2.53 (0.68 to 9.48)	0.167

DISCUSSION

Increasing evidence supports the safety and long-term benefits of hepatic resection for colorectal liver metastases even in low-volume centers⁹⁻¹¹. Surgical and oncologic outcomes in the present study confirmed similar trends. That more hepatic resections for colorectal liver metastases are being performed may be due to two reasons. Firstly, hepatic resections are associated with better long-term survival for colorectal liver metastases than that of chemotherapy alone¹¹ or minimally invasive radio frequency ablation¹². Secondly, there is evidence that non-anatomical hepatic resection, which is technically easier to perform than major hepatic resection, is less morbid and has comparable oncologic results to major hepatic resection^{13,14}. The narrow hepatic resection margin (0.5 to 1.0 cm) in non-anatomical resections apparently has no adverse effect on disease recurrence^{15,16}. Such evidence has encouraged more surgeons to perform hepatic resections for colorectal liver metastases.

The timing of liver surgery in synchronous colorectal liver metastases is controversial. Compared with delayed liver surgery strategy, simultaneous hepatic resection has less overall morbidity, but increases the chance of disease recurrence¹⁷. The "reverse" strategy (hepatic resection first) can also be applied with good surgical and oncologic outcomes^{18,19}. In the present study, simultaneous hepatic resection was performed more often than the conventional delayed hepatic resection. This was because we selected patients who did not need complex liver resection, and it was more convenient for patients to undergo only one operation. Adjuvant chemotherapy also improves survival after hepatic resections for colorectal liver metastases. In a large prospective study, chances of survival after hepatic resection for colorectal liver metastases improved between 1.3 to 2.0 times when patients received adjuvant

chemotherapy²⁰. Unlike adjuvant chemotherapy after liver resection, preoperative neoadjuvant chemotherapy has no benefit for resectable tumors. Increased complications were reported without survival benefits^{21,22}. In the present study, adjuvant chemotherapy was standard treatment after hepatic resection.

The present study included the analysis of risk factors for disease progression because these risk factors might be used as criteria for selection of treatment strategies. Patients with CEA level > 200 ng/mL and presenting with more than 1 liver nodule might be better treated with delayed hepatic resection, to reduce the chance of disease recurrence, although the present analysis did not clearly support this recommendation. In addition, patients with other risk factors such as Fong's clinical risk score > 2 and positive resection margins might be candidates for second line chemotherapy, or hepatic artery chemotherapy infusion^{23,24}.

CONCLUSION

Hepatic resection for synchronous colorectal liver metastases can be performed safely in low-volume settings. Selection of patients with low risks of progression is advised, especially for the simultaneous resection strategy.

REFERENCES

1. Sriplung H, Wiangnon S, Sontipong S, Sumitsawan Y, Martin N. Cancer incidence trends in Thailand, 1989-2000. *Asian Pac J Cancer Prev* 2006;7:239-44.
2. Kruaprema T, Srivatanakul P. Colon and rectum cancer in Thailand: an overview. *Jpn J Clin Oncol* 2008;38:237-43.
3. Manfredi S, Lepage C, Hatem C, Coatmeur O, Faivre J, Bouvier AM. Epidemiology and management of liver metastases from colorectal cancer. *Ann Surg* 2006;244:254-

- 9.
4. Brown RE, Bower MR, Martin RC. Hepatic resection for colorectal liver metastases. *Surg Clin North Am* 2010;90:839-52.
5. Jones RP, Vauthey JN, Adam R, Rees M, Berry D, Jackson R, et al. Effect of specialist decision-making on treatment strategies for colorectal liver metastases. *Br J Surg* 2012;99:1263-9.
6. Garden OJ, Rees M, Poston GJ, Mirza D, Saunders M, Ledermann J, et al. Guidelines for resection of colorectal cancer liver metastases. *Gut* 2006;55 Suppl 3:iii1-8.
7. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;240:205-13.
8. Fong Y, Fortner J, Sun RL, Brennan MF, Blumgart LH. Clinical score for predicting recurrence after hepatic resection for metastatic colorectal cancer: analysis of 1001 consecutive cases. *Ann Surg* 1999;230:309-18; discussion 18-21.
9. Kavlakoglu B, Ustun I, Oksuz O, Pekcici R, Ergocen S, Oral S. Surgical treatment of liver metastases from colorectal cancer: experience of a single institution. *Arch Iran Med*. 2011;14:120-5.
10. Nygard IE, Lassen K, Kjaeve J, Revhaug A. Mortality and survival rates after elective hepatic surgery in a low-volume centre are comparable to those of high-volume centres. *ISRN Surg* 2012;2012:783932.
11. Sirichindakul B, Prichayudh S. Outcome of colorectal liver metastases. *J Med Assoc Thai* 2004;87 Suppl 2:S5-9.
12. Khajanchee YS, Hammill CW, Cassera MA, Wolf RF, Hansen PD. Hepatic resection vs minimally invasive radiofrequency ablation for the treatment of colorectal liver metastases: a Markov analysis. *Arch Surg* 2011;146:1416-23.
13. Lalmahomed ZS, Ayez N, van der Pool AE, Verheij J, JN IJ, Verhoef C. Anatomical versus nonanatomical resection of colorectal liver metastases: is there a difference in surgical and oncological outcome? *World J Surg* 2011;35:656-61.
14. Finch RJ, Malik HZ, Hamady ZZ, Al-Mukhtar A, Adair R, Prasad KR, et al. Effect of type of resection on outcome of hepatic resection for colorectal metastases. *Br J Surg* 2007;94:1242-8.
15. Bodingbauer M, Tamandl D, Schmid K, Plank C, Schima W, Gruenberger T. Size of surgical margin does not influence recurrence rates after curative liver resection for colorectal cancer liver metastases. *Br J Surg* 2007;94:1133-8.
16. Nuzzo G, Giulianti F, Ardito F, Vellone M, Giovannini I, Federico B, et al. Influence of surgical margin on type of recurrence after liver resection for colorectal metastases: a single-center experience. *Surgery* 2008;143:384-93.
17. de Haas RJ, Adam R, Wicherts DA, Azoulay D, Bismuth H, Vibert E, et al. Comparison of simultaneous or delayed liver surgery for limited synchronous colorectal metastases. *Br J Surg* 2010;97:1279-89.
18. Brouquet A, Mortenson MM, Vauthey JN, Rodriguez-Bigas MA, Overman MJ, Chang GJ, et al. Surgical strategies for synchronous colorectal liver metastases in 156 consecutive patients: classic, combined or reverse strategy? *J Am Coll Surg* 2010;210:934-41.
19. Andres A, Toso C, Adam R, Barroso E, Hubert C, Capussotti L, et al. A survival analysis of the liver-first reversed management of advanced simultaneous colorectal liver metastases: a LiverMetSurvey-based study. *Ann Surg* 2012;256:772-8; discussion 8-9.
20. Parks R, Gonen M, Kemeny N, Jarnagin W, D'Angelica M, DeMatteo R, et al. Adjuvant chemotherapy improves survival after resection of hepatic colorectal metastases: analysis of data from two continents. *J Am Coll Surg* 2007;204:753-61; discussion 61-3.
21. Lehmann K, Rickenbacher A, Weber A, Pestalozzi BC, Clavien PA. Chemotherapy before liver resection of colorectal metastases: friend or foe? *Ann Surg* 2012;255:237-47.
22. Karoui M, Penna C, Amin-Hashem M, Mitry E, Benoist S, Franc B, et al. Influence of preoperative chemotherapy on the risk of major hepatectomy for colorectal liver metastases. *Ann Surg* 2006;243:1-7.
23. Goere D, Benhaim L, Bonnet S, Malka D, Faron M, Elias D, et al. Adjuvant chemotherapy after resection of colorectal liver metastases in patients at high risk of hepatic recurrence: a comparative study between hepatic arterial infusion of oxaliplatin and modern systemic chemotherapy. *Ann Surg* 2013;257:114-20.
24. Goere D, Deshaies I, de Baere T, Boige V, Malka D, Dumont F, et al. Prolonged survival of initially unresectable hepatic colorectal cancer patients treated with hepatic arterial infusion of oxaliplatin followed by radical surgery of metastases. *Ann Surg* 2010;251:686-91.

Transmesenteric Intraabdominal Hernia: A Case Report

Suthat Chottanapund, MD*

Priyanut Phokhom, MD**

*Department of Surgery, **Department of Radiology

Bamrasnaradura Infectious Disease Institute, Ministry of Public Health

Abstract

We present a case report of a rare condition called transmesenteric intraabdominal hernia. A 66-year old patient presented with severe abdominal pain without radiologic evidence of gut obstruction. The finding on CT scan led to the diagnosis of left side paraduodenal hernia (a congenital malformation). The report points out the key clinical symptoms and CT findings which lead to the decision for surgery on this patient. The correct diagnosis was made during surgery. In the report we also describe clinical and CT findings of transmesenteric intraabdominal hernia.

Keyword : Abdominal hernia, transmesenteric hernia

INTRODUCTION

Intraabdominal or internal hernia is defined as an abnormal protrusion of intestines through a normal or abnormal gap or hole in the peritoneum or mesentery. These are rare conditions in adults. The conditions can be either congenital or acquired. Internal hernias account for 1% to 5.8% of all intestinal obstructions¹⁻³. Internal hernias are divided into distinct subgroups based on their location, such as transmesenteric or paraduodenal. Paraduodenal hernias are responsible in nearly half of the patients who have internal hernias⁴.

Transmesenteric hernia is a rare cause of abdominal pain. It can lead to bowel obstruction, ischemia, and perforation with a high mortality. A timely and correct diagnosis with appropriate diagnostic tool is mandatory. A clinical diagnosis of transmesenteric hernia is difficult because of nonspecific

symptoms. In this study, we present a 66 year-old male patient with a transmesenteric hernia.

CASE REPORT

An obese 66 year-old Thai man presented with acute epigastric pain for six hours. He developed abdominal pain one day prior to arrival at our hospital. He went to another hospital previously and was diagnosed as having gastroenteritis. Six hours prior to arrival, his symptoms worsened. He did not have any gastrointestinal symptoms such as diarrhea or vomiting. He had benign prostatic hyperplasia. He was currently treated with an alpha-adrenergic receptor blocker for his urinary symptoms. He never had abdominal surgery. On the physical examination, there was epigastric tenderness with soft abdomen. He did not have inguinal hernia. Peripheral blood examination revealed mild

Correspondence address : Suthat Chottanapund, MD, *Department of Surgery, Bamrasnaradura Infectious Disease Institute; 126 Tiwanon 14, Tiwanon Road, Nonthaburi 11000, Thailand; Telephone: +66 2590 3408; Email: suthat_97@yahoo.com

leukocytosis, 10,400 per cumm, with 92% neutrophils. Serum electrolytes, liver enzyme and bilirubin levels, as well as urine examination were all normal. Acute abdomen radiographs (Figure 1) revealed focal small bowel dilatation and air-fluid levels at the left upper abdomen, with a soft tissue mass below.

The patient was treated with intravenous anti-spasmodic and intravenous morphine. His symptoms persisted. He had palpitation, sweating and severe abdominal pain. At this point, we decided to perform a CT scan of the whole abdomen (Figure 2). The provisional diagnosis on CT scan was left paraduodenal hernia. The patient was sent to operating theatre for abdominal laparotomy and was found to have a transmesenteric internal hernia.

On laparotomy, under general anesthesia, we found a well-formed transmesenteric hernia at mesentery of transverse colon. The contents of the hernia sac included small bowels, which were found to be viable. There was a small amount of reactive fluid. We reduced the contents of the sac and repaired the hernia defect using silk 3-0 simple sutures. There was only minimal blood loss.

The patient's symptoms were much improved on the second day after surgery. He was discharged home uneventfully after removal of the stitches, seven days after surgery. At one month follow-up, he was in excellent health.

DISCUSSION

Internal hernias are named according to their location. Commonly seen internal hernias include paraduodenal, transmesenteric, pericecal, intersigmoid, supravesical, foramen Winslow, retroanastomotic, and omental hernias. Paraduodenal hernia was first described by Treitz in 1857. Paraduodenal hernia is the most common form of internal hernias, accounting for 30% to 53% of all cases.

Paraduodenal hernias result from abnormal rotation of the midgut during embryonic development and can be divided into two subtypes, left and right paraduodenal hernias, according to their distinct pathogenesis and the resultant anatomical derangement. Approximately 75% are located on the left side, in Landzert's paraduodenal fossa. Around 50% of

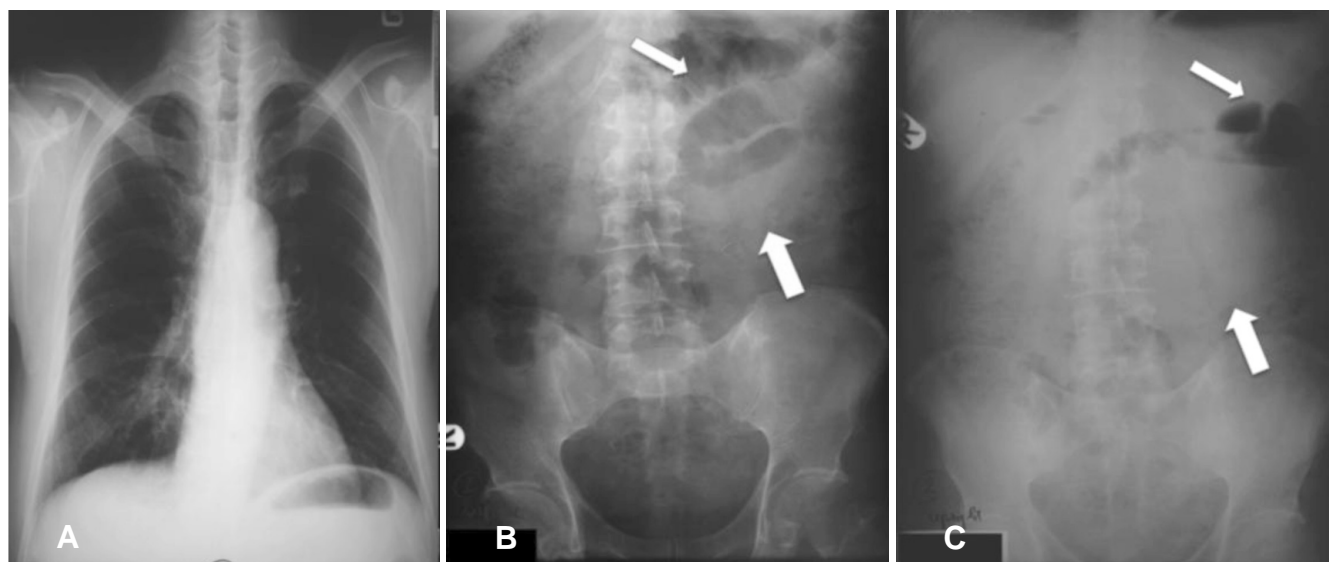


Figure 1 Acute abdomen radiographs

- A. Chest radiograph shows suboptimal study due to poor inspiration. However, no obvious cardiopulmonary abnormality can be seen.
- B. Supine anteroposterior abdominal radiograph shows focal dilatation of small bowel loops (small arrow) at left upper abdomen and a soft tissue density just below and overlying focal bowel loops dilatation (large arrow).
- C. Upright anteroposterior abdominal radiograph shows air-fluid level at peripheral part of focal dilatation of small bowel loops at left upper abdomen (small arrow), and a large soft tissue opacity in left upper to mid abdomen below focal bowel loops dilatation (large arrow) is seen.

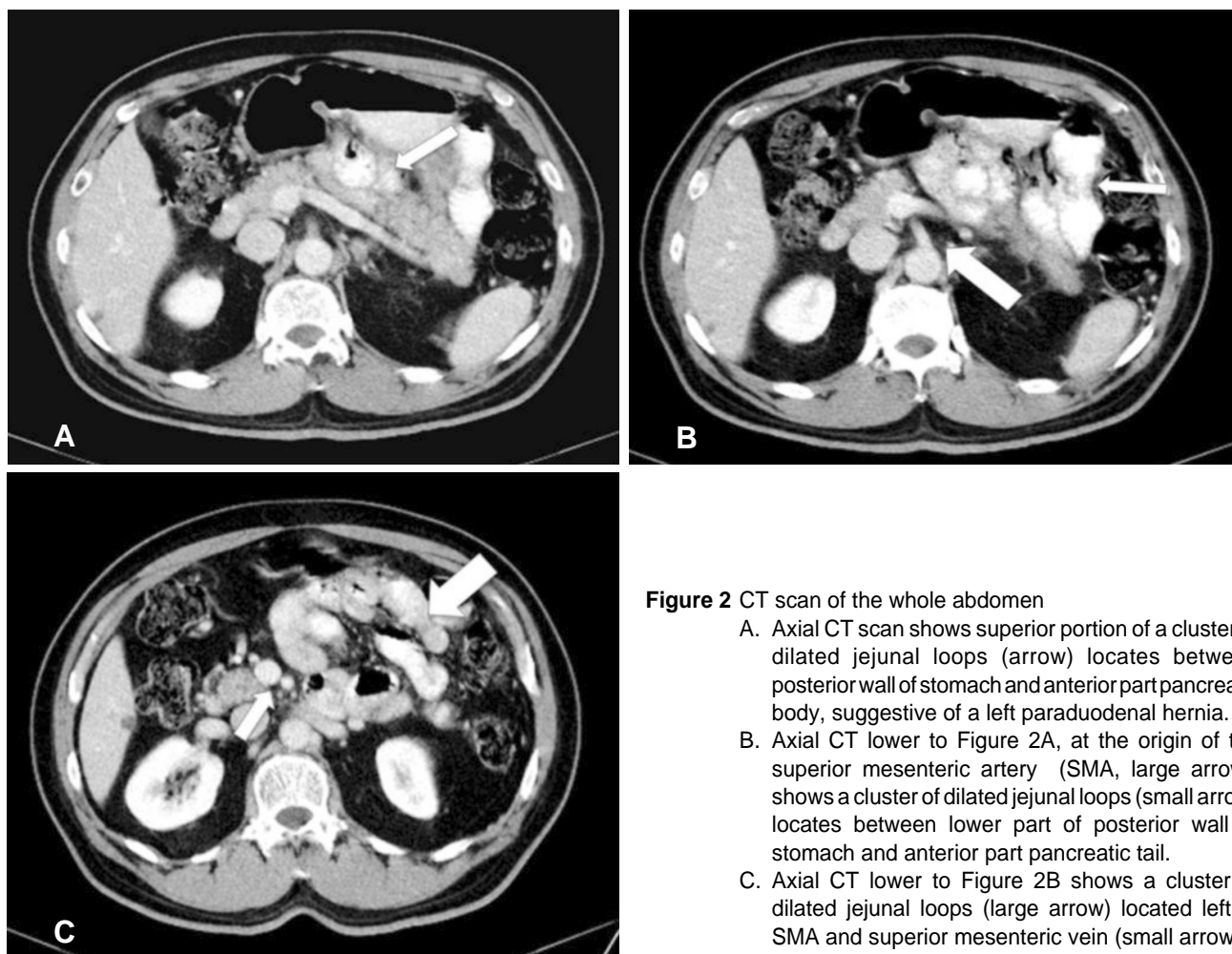


Figure 2 CT scan of the whole abdomen

- A. Axial CT scan shows superior portion of a cluster of dilated jejunal loops (arrow) locates between posterior wall of stomach and anterior part pancreatic body, suggestive of a left paraduodenal hernia.
- B. Axial CT lower to Figure 2A, at the origin of the superior mesenteric artery (SMA, large arrow), shows a cluster of dilated jejunal loops (small arrow) locates between lower part of posterior wall of stomach and anterior part pancreatic tail.
- C. Axial CT lower to Figure 2B shows a cluster of dilated jejunal loops (large arrow) located left to SMA and superior mesenteric vein (small arrow).

patients with paraduodenal hernias have episodes of intestinal obstruction during certain periods of their lives. Symptoms seen in these cases can range from transient colicky abdominal pain to those of intestinal obstruction. The remaining 50% of the cases follow an asymptomatic clinical course and are diagnosed incidentally¹.

Imaging methods play a pivotal role in the diagnosis of internal hernias. Plain X-rays can yield information regarding the intestinal segment from which the herniation stems and the extent of intestinal obstruction, while abdominal CT shows dislocated, distended, expanded, and gathered small intestinal segments¹⁻⁵. Moreover, the CT can also show displacements of mesenteric vascular structures. Diagnostic laparoscopy can provide both verification of the diagnosis and simultaneous surgical intervention, especially in cases that could not be diagnosed by radiological methods.

The basic principles in the treatment of any type of hernia also hold true in the treatment of paraduodenal hernia. These are the repair of the defect and the resection of the hernial sac at times when reduction of incarcerated intestinal segments is necessary. Treatment of left and right paraduodenal hernias may require cutting the sac which may be a part of small bowels mesentery in order to free the hernia contents. Surgeons should be aware of this fact to reduce complications from mesenteric vascular injuries.

Transmesenteric hernias are intraperitoneal hernias which have no sac and consist of the protrusion of a loop of bowel through an aperture in the mesentery⁵. Transmesenteric hernia is a rare cause of small bowel obstruction and is seldom diagnosed preoperatively partly because of unfamiliarity with this type of internal hernia. A number of publications have recommended CT as a useful tool for diagnosis of the

lesion^{6,7}. The operative treatment is easier than that of paraduodenal hernias. This simply consists of reduction and closure of the mesenteric defect.

CONCLUSION

We presented a case of transmesenteric internal hernia. Transmesenteric internal hernia is a rare cause of small bowel obstruction. Clinical symptoms include repeated severe abdominal pain and gut obstruction, but without definite radiologic evidence. The condition can lead to serious complications such as bowel ischemia. Because of the difficulty in diagnosis, transmesenteric internal hernia should be in the differential diagnosis of patients with no prior abdominal surgery who frequently have recurrent clinical of gut obstruction.

REFERENCES

1. Martin LC, Merkle EM, Thompson WM. Review of internal hernias: radiographic and clinical findings. *Am J Roentgenol* 2006;186:703-17.
2. Lin CT, Hsu KF, Hong ZJ, et al. A paraduodenal hernia (Treitz's hernia) causing acute bowel obstruction. *Rev Español Enferm Digest* 2010;102:220-1.
3. Sen M, Inan A, Dener C, Bozer M. Paraduodenal internal hernias: clinical analysis of two cases. *Ulusal Travma ve Acil Cerrahi Dergisi* 2007;13:232-6.
4. Virich G, Davies W. A massive left paraduodenal fossa hernia as an unusual cause of small bowel obstruction. *Ann R Coll Surg Engl* 2010;92:7-9.
5. Janin Y, Stone AM, Wise L. Mesenteric hernia. *Surg Gynecol Obstet* 1980;150:747-54.
6. Blachar A, Federle MP, Brancatelli G, Peteson MS, Oliver III, JH, Li W. Radiologist performance in the diagnosis of internal hernia by using specific CT findings with emphasis on transmesenteric hernia. *Radiology* 2001;221:422-8.
7. Blachar A, Federle MP, Dodson SF. Internal hernia: clinical and imaging findings in 17 patients with emphasis on CT criteria. *Radiology* 2001;218:68-74.