Hernia Repair Sequelae

IN COLLABORATION WITH KLAUS-JOACHIM CONZE

VOLKER SCHUMPELICK
ROBERT J. FITZGIBBONS
EDITORS

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Preface

At the last Suvretta meeting in 2006 on recurrent hernia prevention and treatment, we demonstrated that with the wide range of available techniques, materials, and meshes at our disposal today, an experienced hernia surgeon will be able to prevent or at least treat a recurrent hernia.

But whereas recurrences can be treated successfully in most cases, some other hernia repair sequelae can result in severe, sometimes untreatable problems, e.g. pain, infection, adhesion, or infertility. That was the reason to focus the 5th Suvretta meeting in 2008 on hernia repair sequelae. We are convinced that such sequelae can be a more serious problem for the patient than the mostly treatable recurrent hernia. Therefore, it was appropriate to focus the 5th Suvretta meeting on these longterm problems.

During a four-day meeting, we discussed all technical aspects of the various operations and materials to generate a consensus concerning the best techniques and meshes. We explored methods to improve surgical techniques to look into the multifactorial causes of post hernia repair sequelae. In the seclusion of the Swiss plateau valley we had a perfect setting to discuss these important hernia repair problems in detail with the top hernia specialists in the world.

With this book, the results of this exceptional 5th Suvretta meeting have been made accessible for every surgeon who is interested in hernia surgery and its sequelae.

V. Schumpelick
List of First Authors

Alfieri, S.
Department of Digestive Surgery
Catholic University of Sacred Heart
Largo Agostino Gemelli 8
00168 Rome
Italy
s.alfieri@rm.unicatt.it

Amid, P. K.
Department of Surgery
David Geffen School of Medicine at UCLA
Lichtenstein Hernia Institute at UCLA
1260 15th Street, Suite 1200
Santa Monica, CA 90404
USA
pamid@onemain.com

Arlt, G. D.
Department of Surgery
Park-Klinik Weissensee
Schönstrasse 80
13086 Berlin
Germany
arlt@park-klinik.com

Aufenacker, T. J.
Department of Surgery (C22)
Canisius Wilhelmina Ziekenhuis (CWZ)
Postbus 9015
6500 GS Nijmegen
The Netherlands
aufenacker@hetnet.nl

Aydede, H.
Associate Professor of Surgery
Celal Bayar University Medical Faculty
Department of Surgery
Manisa
Turkey
hasanaydede@hotmail.com

Bachman, S. L.
University of Missouri
Department of Surgery
Missouri Hernia Institute
University of Missouri–Columbia
414 McHaney Hall
Columbia, MO 65211
USA

Bellows, C.
Associate Professor of Surgery
Chief, General Surgery
Director of Surgical Research
General and Laparoscopic Surgery
Tulane University
New Orleans, LA
USA

Berger, D.
Department of Surgery
Stadtlinik
Balgerstrasse 50
76532 Baden-Baden
Germany
d.berger@klinikum-mittelbaden.de

Binnebösel, M.
Department of Surgery
RWTH Aachen University Hospital
Pauwelsstrasse 30
52074 Aachen
Germany
mbinneboesel@ukaachen.de

Bringman, S.
Clinetc, Karolinska Institutet
Stockholm, Sweden
Departments of Surgery, Södertälje Hospital
Södertälje
Sweden
sven.bringman@ki.se

Champault, G. G.
Paris University XIII – Medical School »Léonard de Vinci«
Department of Digestive Surgery
University Hospital Jean Verdier
Avenue du 14 Juillet
93140 Bondy
France
gerard.champault@jvr.aphp.fr

Chowbey, P. K.
Minimal Access, Metabolic and Bariatric Surgery Centre
Sir Ganga Ram Hospital
Room No. 200 (1Ind floor)
New Delhi 110060
India
chowbey1@vsnl.com

Conze, J.
Department of Surgery
University Hospital RWTH
Pauwelsstrasse 30
52074 Aachen
Germany
jconze@ukaachen.de

Demirer, S. D.
Ankara University School of Medicine
Department of Surgery
Ankara
Turkey
demirers02@yahoo.com

Deysine, M.
Professor of Surgery
Winthrop University Hospital
Mineola, NY
USA
maxdey@optonline.net
Diaz, J. J., Jr.
Division of Trauma and Surgical Critical Care
Department of Surgery
Vanderbilt University Medical Center
Nashville, TN
USA
jose.diaz@vanderbilt.edu

Dilek, O. N.
Professor of General Surgery
School of Medicine
Kocatepe University
PK:70
03100 Afyonkarahisar
Turkey
ondilek@hotmail.com

Falagas, M. E.
Department of Medicine, Henry Dunant Hospital, Athens, Greece
Department of Medicine, Tufts University School of Medicine, Boston, MA, USA
Alfa Institute of Biomedical Sciences (AIBS)
9 Neapoleos Street, 151 23 Marousi Athens, Greece
m.falagas@aibs.gr

Fawole, A. S.
Department of Academic Surgery
St. James’s University Hospital
Beckett Street
Leeds LS9 7TF
UK
adeshina.fawole@midyorks.nhs.uk

Flament, J. B.
Department of Surgery
Faculty of Medicine
University of Reims Champagne-Ardenne
General Surgery Service
Hôpital Robert Debré
Rue Serge Kochman
51100 Reims
France
jbflament@chu-reims.fr

Franz, M. G.
Associate Professor of Surgery
Chief, Minimally Invasive Surgery
University of Michigan
Department of Surgery
2214F Taubman Center
1500 East Medical Center Drive
Ann Arbor, MI 48109
USA
mfranz@umich.edu

Goldenberg, A.
Associate Professor
Department of Surgery
Federal University of Sao Paulo
Brazil
goldenb@terra.com.br

Gryska, P. vR.
Tufts University School of Medicine
Boston, MA
Department of Surgery
Newton-Wellesley Hospital
Suite 365, 2000 Washington Street
Newton, MA 0246
USA
pgryska@partners.org

Hansson, B.
Department of Surgery
Canisius Wilhelmina Hospital
Nijmegen
The Netherlands

Hegarty, D.
Department of Anaesthesia, Intensive Care & Pain Medicine
Cork University Hospital
Cork
Ireland
dominichegarty@hotmail.com

Honigsberg, E.
Mount Sinai Medical Center
1010 5th Avenue
New York, NY 10028
USA

Hopf, H. W.
Department of Anesthesiology, University of Utah
Medical Director, Urban Central Region Wound Care Services
LDS Hospital
8th Avenue and C Street
Salt Lake City, UT 84132
USA
harriet.hopf@hsc.utah.edu

Jansen, M.
Department of Surgery
University Hospital
RWTH Aachen
Pauwelsstrasse 30
52074 Aachen
Germany
mjansen@ukaachen.de

Jansen, P. L.
Department of Surgery
University Hospital
RWTH Aachen
Pauwelsstrasse 30
52074 Aachen
Germany
plynen@ukaachen.de
Junge, K.
Department of Surgery
Technical University of Aachen
Pauwelsstrasse 30,
52057 Aachen
Germany
kjunge@ukaachen.de

Kaemmer, D.
Department of Surgery
RWTH Aachen
Pauwelsstr. 30
52074 Aachen
Germany
dkaemmer@ukaachen.de

Kavvadias, T.
Department of Obstetrics and Gynaecology
Lucerne Cantonal Hospital
Lucerne
Switzerland

Kehlet, H.
Section for Surgical Pathophysiology 4074
Rigshospitalet Copenhagen
University
Blegdamsvej 9
2100 Copenhagen
Denmark
henrik.kehlet@rh.regionh.dk

Klinge, U.
Institute for Applied Medical Engineering
Helmholtz Institute for Applied Medical Technology
RWTH Aachen University
Pauwelsstraße 20-30
52074 Aachen
Germany
Klinge@hia.rwth-aachen.de

Kolbe, T.
Biomodels Austria, University of Veterinary Medicine
Veterinärplatz 1
1210 Vienna
Austria
Thomas.Kolbe@wu-wien.ac.at

Kukleta, J. F.
Klinik Im Park
Seestrasse 220
8027 Zurich
Switzerland
jfkukleta@bluewin.ch

Kurzer, M.
British Hernia Centre
87 Watford Way
London NW4 4RS
UK
m.kurzer@mac.com

Lammers, B. J.
Department for Colorectal and Hernia Surgery
Lukaskrankenhaus Neuss
Neuss
Germany
blammers@lukasneuss.de

Matthews, B. D.
Chief, Section of Minimally Invasive Surgery
Department of Surgery
Washington University School of Medicine
660 S. Euclid Ave., Campus Box 8109
St. Louis, MO 63110
USA
matthewsbr@wustl.edu

Miserez, M.
Department of Abdominal Surgery
University Hospitals
Herestraat 49
3000 Leuven
Belgium
marc.miserez@uz.kuleuven.ac.be

Montgomery, A.
Department of Surgery
Malmö University Hospital
20502 Malmö
Sweden
agneta.montgomery@skane.se

Morales-Conde, S.
University Hospital Virgen del Rocio.
Betis 65, 1º
41010 Sevilla
Spain
smoralesc@gmail.com

Muschaweck, U.
Hernienzentrum Dr. Muschaweck – München
Arabellastrasse 5
81925 Munich
Germany
info@hernien.de

Neumayer, L.
Professor of Surgery
Department of Surgery
University of Utah
Salt Lake City VA Healthcare System
1950 Circle of Hope Room 6540
Salt Lake City, UT 84132
USA
leigh.neumayer@hsc.utah.edu

Nordin, P.
Head of the Swedish Hernia Register
Department of Surgery
Östersund Hospital
831 83 Östersund
Sweden
par.nordin@jll.se

Otto, J.
Department of Surgery
University Hospital
RWTH Aachen
Pauwelsstrasse 30
52074 Aachen
Germany
jeotto@ukaachen.de
Page, B. P.
University Department of Surgery
Western Infirmary
Glasgow G11 6NT
Scotland
blaithin.page@hotmail.com

Pascual, G.
Department of Medical Specialities
Alcalá University
Networking Research Centre on Bioengineering, Biomaterials and Nanomedicine (CIBER-BNN)
Madrid
Spain

Peiper, C.
Surgical Clinic
Evangelisches Krankenhaus
Werler Strasse 110
58455 Hamm
Germany
cpeiper@evkhamm.de

Penkert, G.
Friederikenstift Hannover
Department of Neurosurgery
Humboldtstrasse 5
30169 Hannover
Germany
goetz@familie-penkert.de

Read, R. C.
Emeritus Professor of Surgery
304 Potomac Street
Rockville, MD 20850
USA
read@post.harvard.edu

Schippers, E.
Surgical Clinic
Department of General and Visceral Surgery
Juliusspital
Juliuspromenade 19
97070 Würzburg
Germany
e.schippers@juliusspital.de

Schug-Paß, C.
Department of Surgery
Center for Minimally Invasive Surgery
Vivantes Hospital Spandau
Neue Bergstrasse 6
13585 Berlin
Germany
christine.schug-pass@vivantes.de

Schumpelick, V.
Department of Surgery
University Hospital RWTH
Pauwelsstrasse 30
52074 Aachen
Germany
vschumpelick@ukaachen.de

Simons, M. P.
Department of Surgery
Onze Lieve Vrouwe Gasthuis
Postbus 95500
1090 HM Amsterdam
The Netherlands
mpsimons@worldonline.nl

Smeds, S.
The Sergel Clinic
Department of Clinical and Experimental Medicine
Faculty of Health Sciences
University Hospital
Linköping University
58185 Linköping
Sweden
staffan.smeds@carema.se

Stanton-Hicks, M.
Vice Chairman, Anesthesiology Institute
Consulting Staff, CCF Shaker Children's Pain Rehabilitation Cleveland Clinic
Pain Management Department
9500 Euclid Avenue – C-25
Cleveland, OH 44195
USA
stantom@ccf.org

Stroh, C.
Department of General, Abdominal and Paediatric Surgery
Municipal Hospital (Teaching Hospital of the Friedrich-Schiller University at Jena, Germany)
Strasse des Friedens 122
07548 Gera
Germany
Christine.Stroh@wkg.srh.de

Stumpf, M.
Department of Surgery
RWTH Aachen
Pauwelsstrasse 30
52074 Aachen
Germany
michale.stumpf@klinikum-pforzheim.de

van der Kolk, B. M.
Department of Surgery, Division of Abdominal Surgery
Radboud University Nijmegen
Medical Center Nijmegen
The Netherlands

Witkowski, P.
Department of Surgery
Division of Abdominal Organ Transplantation
Columbia University
177 Fort Washington Ave, 7HS, Room 200C
New York, NY 10032
USA
pw2004@columbia.edu
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# Risk for Migration and Erosion

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# Strategy to Improve Results

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What Can We Do To Decrease the Risk of Vas Deferens Injury due to Inguinal Hernioplasty?

P. Witkowski
Introduction

The implantation of polypropylene mesh in inguinal hernia repair surgery has been a tremendous breakthrough. It has significantly reduced the hernia recurrence rate from 15–20% to 0.5–5% and therefore has decreased the rate of spermatic cord, vas deferens, and testicular artery injury due to re-operation for recurrence [1]. We have only limited information, however, about the long-term effects of polypropylene mesh implantation on the vas deferens, especially with regard to fertility.

Despite new developments, polypropylene mesh remains the optimal and most commonly used material for inguinal hernioplasty. This mesh stimulates a pronounced chronic inflammatory reaction with connective tissue formation that incorporates the prosthesis into surrounding tissue. Although such scar formation fills out the hernia defect and effectively prevents hernia recurrence, it may ultimately cause damage to the adherent organs. This inflammatory process is clinically relevant because it remains active even years after mesh implantation [2].

Is There a Risk for a Vas Deferens Injury After Mesh Hernioplasty?

In my opinion, we have enough clinical as well as experimental data from animal studies to confirm this risk. Injury may occur in the postoperative period because of a chronic foreign body reaction involving tissue surrounding the implanted mesh, which may also include the spermatic cord and vas deferens.

Clinical experience indicates that a polypropylene mesh cannot be safely implanted in contact with any visceral or retroperitoneal organs, especially if placed under pressure or tension. Extensive fibrosis around the mesh can trap and damage inguinal nerves, the intestine, or the urinary bladder [3–5]. The mesh can even erode into the wall or lumen of those organs, leading to pain, infection, small bowel obstruction, or enterocutaneous fistula formation [3–7]. The same process may even lead to stenosis or obstruction of the urethra after polypropylene tape suspension for the treatment of stress urinary incontinence [4]. Erosion of the vagina has also been reported [8, 9]. As a remedy, a new polypropylene sling with an absorbable central suburethral part was developed to separate the polypropylene part of the sling from the urethra and vagina [10].

All of the complications described above are recognizable on obvious clinical presentation and result from placement of the mesh in close proximity to the organs.

Therefore, it is reasonable to expect that a structure as delicate as the vas deferens could also be damaged or occluded if a mesh were placed close enough to it, especially if left under tension or pressure.

Animal studies provide more arguments for an increased risk of vas injury when polypropylene mesh is used for the repair. In several studies, mesh was found to be adherent to the spermatic cord throughout its inguinal course, leading to significant foreign body reaction in all animals [2, 11–13]. Histology showed fibrosis, extensive skeletal muscle degeneration, and histiocytic inflammation along the outer part of the cord [11, 14]. Additionally, the thick muscular layer of the vas was more prominently attenuated after mesh hernia repair than after Shouldice repair in a canine experiment [11]. This attenuation is important because the vas is no longer considered a passive conduit through which the ejaculate travels. The rich adrenergic innervation, the complexity of the muscle layers of the vas, and the metabolically active vasal epithelium all suggest a very active role in sperm transport, which may be altered by the perivasal fibrosis attributable to the mesh [11]. When a mesh was placed in proximity, the lumen of the vas was narrowed compared with nonsurgical controls [12].

Other studies also suggest that even if fibrosis around the vas deferens and within its wall does not lead to reduction of the lumen of the vas, it may cause functional obstruction with dilatation of the proximal segment along with degenerative changes in mucosa and repression of spermatozoa [11, 14]. Foreign body reaction around the mesh may compromise blood flow within the cord and eventually compromise fertility [15]. Congestion of the pampiniform plexus was noted in 20%
Chapter 7 · What Can We Do To Decrease the Risk of Vas Deferens Injury

of animals after a Lichtenstein procedure, with spermatic cord vein thrombosis in up to 33% of cases after an open preperitoneal approach [2, 14]. Mesh repair led to decreases in arterial perfusion and testicular temperature and also reduced the proportion of seminiferous tubules with regular spermatogenesis [2]. Focal fibrinoid necrosis of the deferent duct wall was also reported [2].

The above results were observed in animals shortly after mesh implantation (weeks or months), whereas in humans, the mesh stays in the body for years and may cause much more extensive degenerative changes.

Finally, several clinical reports conclude that occlusive injury to the vas deferens resulted from mesh implantation [7, 16–20]. Because these reports represent only single cases, until recently they had only anecdotal value. But a recent multicenter study has drawn attention to the possibility that vas deferens injury may take place more commonly than we think [21]. The authors presented 14 cases of obstructive azoospermia leading to infertility because of bilateral or unilateral vas occlusion, with simultaneous, but different, pathology of the reproductive organs on the contralateral side. Mesh-related fibrosis as a cause of vas occlusion was verified during surgical revision of the inguinal region [21]. Mechanical injury of the vas by the edge of the mesh has also been blamed as a possible cause of spermatic granuloma [20]. Further reports suggest that vas obstruction may lead to increased serum levels of antisperm antibody even without sperm granulomas, which can additionally compromise fertility [15, 22].

How Great Is the Risk of Vas Injury After Mesh Hernioplasty?

Today we cannot estimate the risk because we do not know how many patients are affected. This is mainly because of poor clinical presentation of the injury. Isolated, unilateral occlusion of the vas is completely asymptomatic. Infertility is the only potential symptom, and it occurs only with bilateral occlusion or with unilateral injury in a patient with contralateral sex organ pathology. Diagnosis of mesh-related vas injury is further complicated by that fact that most patients do not test their fertility before or after surgery, and occlusion can develop not only shortly after surgery but also years later, when a patient has finished his procreative activity.

Furthermore, we do not have any noninvasive methods to detect vas injury or obstruction or to screen asymptomatic patients.

Because we have animal experimental data indicating that fibrosis around the implanted mesh compromises vas deferens function, and knowing that the vas can be occluded when mesh is placed in proximity, as seen with urethral or small bowel obstruction, we cannot exclude the possibility that symptomatic patients from case reports are only the tip of the iceberg and that there are asymptomatic patients with vas deferens injury and occlusion after inguinal hernioplasty. The majority of patients may have this complication and may be completely unaware of it because they either do not test their fertility or they remain fertile because of an uncompromised contralateral sex organ.

How Can We Assess the Risk?

Autopsies of patients who received inguinal mesh repair might give some estimates. Unfortunately, prospective studies with fertility monitoring before and after the procedure put a significant burden on patients and do not seem feasible at the moment [23].

What Can We Do Now?

Some surgeons may choose not to change anything and to continue using current surgical techniques until the actual risk rate is known. For the time being, I think that for patients whose procreative ability is of great concern, we should tailor our surgical approach to minimize the risk of vas injury without compromising repair results. These candidates would include young patients with bilateral hernia and those with compromised sex organs and contralateral hernia.

Careful handling of the spermatic cord, including the vas deferens, in order to avoid direct
intraoperative injury of this structure remains a constant principle of safe and efficient surgical technique [15]. To minimize the risk of vas occlusion, the general rule would be to avoid direct contact between the mesh and the vas deferens [24]:

- In the preperitoneal space the vas deferens is bare, so we may choose to avoid implanting mesh there, both in the posterior (laparoscopic, Nyhus, Stoppa, transabdominal preperitoneal, totally extraperitoneal repair) and anterior preperitoneal approaches (Rives, Kugel, Prolene Hernia System repair).

- Mesh plug insertion in the deep inguinal ring for indirect defects causes extensive fibrosis and may also involve the bare vas deferens; therefore, the plug is not advised in this location (Rutkow technique) [24].

- In the course of the inguinal canal, the vas runs in the spermatic cord and is better protected by the surrounding internal spermatic fascia and cremaster. Therefore, it seems reasonable not to excise the cremaster but instead to spare it and close it with absorbable suture after hernia sac dissection and reduction.

- Placement of the mesh on the posterior wall of the inguinal canal is better (Lichtenstein or Trabucco technique) because the transversalis fascia can separate the mesh from bare vas running in the preperitoneal space.

The disadvantage of the Lichtenstein operation, however, is that the spermatic cord is placed within the inguinal canal, where it is usually compressed between the mesh and the aponeurosis of the external oblique abdominal muscle. In such limited space, fibrosis around the mesh may still involve the spermatic cord and compromise the vas deferens.

Therefore, we may modify our technique; after placing the mesh on the posterior wall of the inguinal canal, we can reapproximate the aponeurosis of the external oblique muscle with the sutures below (instead of above) the spermatic cord, as described in the Trabucco repair [25] (Fig. 7.1–7.3).

This modification can be easily applied to the Lichtenstein operation, as has been previously suggested [26]. In this way, the spermatic cord is separated from the mesh with additional fascia and placed freely in subcutaneous tissue. Therefore, the risk of damage due to fibrosis surrounding the prosthesis is eliminated.

Additionally, polypropylene mesh is placed flat between two fascial layers, the transversalis fascia and the oblique aponeurosis, which limits fibrotic tissue ingrowth only to the intrafascial space. Fibrosis penetrating the mesh glues the fascial layers together, creating a uniform, triple-layer (fascia–mesh–fascia) solid scar, which effectively reinforces the abdominal wall around the deep inguinal ring and prevents recurrence. After such repair, oblique passage of the spermatic cord through the inguinal canal can thus be avoided; it is not essential for effectiveness of the repair, as in traditional suture operations. This approach was developed by Trabucco in his sutureless technique, in which a preshaped polypropylene mesh with flat-shape memory is placed without suture fixation on the posterior wall of the inguinal canal [25]. Long-term results of this approach indicate that it is as effective as any other tension-free technique [27–30]. This technique is especially popular in Italy, with thousands of patients and years of experience. A randomized study could be organized to
assess the effectiveness of such modification of the Lichtenstein technique, but in our opinion, a sufficient amount of indirect confirmatory evidence exists. Professor Smeds from Sweden started using this approach after our recent publication [26] a year ago and found only one (0.3%) recurrence after 300 repairs (personal communication).

In my opinion, a shutter-valve effect of mesh tails sutured together and wrapping the cord is dangerous because it unnecessarily enhances contact between the surface of the mesh with the cord, creating a cuff that contracts substantially around the spermatic cord in the postoperative period as the mesh contracts. It may compromise the vas as well as blood vessels within the cord. Moreover, the sharp edge of the mesh on which the spermatic cord directly kinks upon entering the inguinal canal from the deep inguinal ring is considered a common place for vas injury. A flat, preshaped onlay mesh with a hole for the spermatic cord decreases contact between the mesh and the cord without compromising the effectiveness of the Lichtenstein technique. The efficacy of this approach was clearly proven by the Trabucco technique and other repairs using a preshaped onlay mesh with a preformed hole for the spermatic cord. In the above proposed approach, direct kinking of the cord over the mesh is avoided, and the cord instead folds over the fascia of the external aponeurosis while entering the subcutaneous space. The proposed surgical techniques comply with the principles of the tension-free operation and can be easily implemented.

In summary, although the actual rate of vas deferens injury due to fibroblastic inflammation around polypropylene mesh is not yet known, there is strong experimental and clinical evidence that such processes can and do take place.

Therefore, until the risk is fully investigated, all patients with any known compromise to their reproductive health or with concerns about fertility can be offered a surgical technique that minimizes the potential risk without diminishing all the advantages of tension-free hernia repair. Isolating the spermatic cord from the mesh by placing it above (not below) the aponeurosis of the oblique abdominal muscle seems to be an easy, applicable, and effective solution.

References

Deysine: The previous study did not show much damage caused by the mesh. The differences were not statistically significant in most cases. So we don’t have any hard data to prove anything at this time. I would suggest that until we have more hard data, human hard data, we should restrain the kind of language that we use when we express our impressions.

Köckerling: I have to speak for the endoscopic procedure. At the moment, we really have no data,
even no clinical data, showing that there is really a higher problem for vas deferens injury or any other influence on that system due to endoscopic inguinal hernia repair. So I wouldn't go so far as to exclude this technique in younger patients who are fertile. Maybe we will have some problems. We should carefully look at those problems, learn how to avoid them, and choose the right mesh, but we shouldn't go so far as to exclude all mesh procedures.

Kehlet: I think we are at the state where we can say that we should not dissect the cremaster from the cord.

Amid: We have to understand that if we use a mesh and we don't remove the cremastic muscle, none of these potential problems will occur.