

*Endoscopic Surgery in Children and Neonates:
to Be or Not to Be*

Public Lecture David C. van der Zee



Universitair Medisch Centrum
Utrecht

*“Endoscopic Surgery in
Children and Neonates:
to Be or Not to Be”*

Public lecture at the occasion of accepting the chair of Pediatric Surgery at the Faculty of Medicine of the University of Utrecht on Tuesday May 11th 2010 by David C. van der Zee, MD, PhD.

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Mister Rector Magnificus,
honorable members of the faculty,

I would also like to welcome some international guests that are with us today through videoconference:

From Hongkong we have Prof. CK Yeung, one of the forerunners in pediatric endoscopic surgery, former President of IPEG and dear friend. From Paris we have Abe Fingerhut, President of the European Association of Endoscopic Surgery. From Buenos Aires Argentina, we have Marcelo Martinez Ferro, President of the International Pediatric Endoscopy Group IPEG.

Ladies and gentlemen,

The title of this public lecture is:

“Endoscopic Surgery in Children and Neonates: to Be or Not to Be”

1. Introduction

August 28th 1963 Martin Luther King spoke the legendary words: “I have a dream”.

January 20th 2009, almost 46 years later, Barack Obama was inaugurated as the first colored president of the United States. Today another dream has come true. With the opening of the completely renewed OR complex in the Wilhelmina Children’s hospital we can truly set off as a “Center of Excellence” for endoscopic surgery in children and neonates, with top referent patient care, education and research in the field of endoscopic surgery, and not only for the Department of Pediatric Surgery, but for all pediatric surgical specialties.

2. Center of Excellence

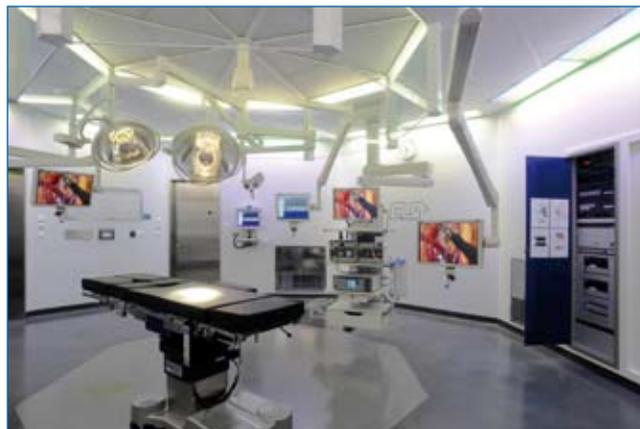


Figure 1: OR1 in operation.

This all started a mere 22 years ago, when, together with Klaas Bax, we recognized the importance of smaller scars, less pain, quicker recovery, fewer postoperative complications and a better quality of life. Since then more than 60 peer reviewed papers, directly related to endoscopic surgery in children and neonates were published, many of them nowadays still being referred to as first publication. After a first Symposium on “Sense and Non-sense” in endoscopic surgery in children in 1995, in the past two days we have organized a Symposium called “Endoscopic Surgery in Children and Neonates: to Be or Not to Be”, evaluating which endoscopic procedures have gained wide acceptance and which have not. It is beyond any doubt that endoscopy is here to stay. In spite of the fact that it is mere a technique, it is no longer imaginable that certain procedures will be performed other than endoscopically.

On the other hand some procedures have proven not to be suitable for endoscopic surgery, either because for some, to now unknown reason the outcome has adverse effects, such as in biliary atresia, or the endoscopic approach has proven to be too difficult, resulting in an unacceptable complication rate. An example of this may be the laparoscopic repair of duodenal atresia. After some initial reports by our group and Steve Rothenberg in the early nineties, normally this would be followed by series from others^{1,2}. However, not this time. Why would that be? Although an experienced group, we found an unacceptable increase in anastomotic leakage in our patient group, and we suspect other groups to have had likewise experiences⁴, so in 2005 we stopped the laparoscopic approach until only more recently we found to have gained sufficient experience in laparoscopic suturing to take up again the laparoscopic repair in 2008 and this time with success. Similarly the group from Rothenberg has a gap in their laparoscopic treatment of duodenal atresia, and in 2009 published their results from a more recent date with likewise good outcomes⁵. Another group from Kansas recently published their experience with U-staples as an alternative for suturing the anastomosis, because of unacceptable leakage earlier on⁴. The question is should everyone be doing such difficult procedures or should these procedures be restricted to a limited number of centers of expertise. An example of this is the long gap esophageal atresia where we have developed a thoracoscopic technique for elongation and delayed anastomosis of the two ends of the esophagus⁶. The open technique was first described by John Foker⁷⁻⁹, but proved to be a painstaking technique. By performing the procedure thoracoscopically many of the drawbacks could be overcome.

On the other hand if complications do occur you should have an armamentarium of alternative techniques available to bring the procedure to a good end, including gastric pull-up¹⁰, jejunal interposition¹¹ or colon interposition¹². It is our believe that such procedures should be reserved to a limited number of centers of expertise, and I will come back to this issue later on in my public lecture.



Figure 2: Clockwise- mobilization of distal esophagus; placing the first suture through distal esophagus; remaining distance between proximal and distal fistula; external view of traction sutures in neonate with esophageal atresia.

3. Education

Education is an important factor in endoscopic surgery. From the early start we have been involved in training programs in endoscopic surgery. We have participated in courses in Amsterdam, Dundee, Strasbourg, and Bologna. We have organized international courses for EUPSA, EAES and IPEG, and this week here in Utrecht we organized our first hands-on course. We have had fellowships for international colleagues from round the world.

In 2002, together with Ivo Broeders, we visited the SAGES congress in New York to compare the available virtual reality training devices, resulting in the sponsored acquisition of six virtual reality trainers for training purposes for surgical residents and pediatric surgical fellows in Utrecht and later on also for the surgical resident training in the regions of Utrecht and Nijmegen. One of the trainers is continuously in the Wilhelmina Children's Hospital for training purposes of the fellow and resident. As early as 2003 we published two papers on training and safety in endoscopic surgery.

Education is a complex of a variety of training modules over an extended time period.

It can be informative to attend a course in endoscopic surgery, but it is definitely not: "see one, do one, and teach one". We advocate at least a period of 6-12 months of continuous exposure to an endoscopic environment, where nursing staff, anesthesiologists and surgeons more or less "breathe" endoscopic surgery.

Such a development was nicely shown in our Department over the last decade: in the year 2000 we published a paper on the impact of endoscopic surgery on routine surgery, demonstrating that 60% of all

our abdominal procedures were carried out endoscopically, which was impressive at that time¹³.

In 2008 we described the increasing implementation in daily practice and resident's training: although the percentage of laparoscopy had increased to 80%, this did not have any negative impact on the training of residents and fellows¹⁴. This underlines that there should be no longer any discussion on whether a procedure should be performed laparoscopically or open.

Next to the classical way of learning by assisting in procedures and progressively taking over successive steps in procedures, the "Master-Apprentice" relation, the trainees should also go through preferably repetitive training courses with both training boxes and virtual reality trainers, increasing their dexterity and maintaining their abilities.

In the USA you have a formalized training program called FLS that teaches the basics of endoscopic surgery. In Toronto the group of pediatric surgeons with George Azzies in the lead is setting up a Pediatric FLS¹⁵. Apart from the training boxes commercially available for adult endoscopic training, two young ladies from Yale University have developed training boxes specifically for neonatal surgery. These unique small Tupperware-like boxes prove to be exquisitely suitable for neonatal exercises. We recognized the importance of these neonatal boxes and with our support they have been granted a sponsorship by Storz Company, who took on them the production of 50 of these neonatal devices to be dispersed throughout the world through the IPEG organization at the next IPEG congress in Hawaii in June for training purposes of pediatric surgical trainees worldwide.



Figure 3: Neonatal (Tupperware box) for practicing closure of diaphragmatic hernia in neonates.

They have just become available and we have had the privilege of being the first to use them in our hands-on course two days ago. In the Netherlands we will be organizing courses for pediatric surgical fellows in endoscopic surgery both internationally through societies like EAES and EUPSA, and through the Dutch Society of Pediatric Surgery. Also qualified pediatric surgeons are welcome to participate in these courses, because many of them have not been exposed to endoscopic surgery in their general surgical training and quite often they feel some hesitation to start on endoscopic surgery. In aviation pilots have to take an exam in the flight simulator every six months. In healthcare all we have to do is send in a form with

the congresses we've been to and which courses we have attended and for €350 you get a paper with a stamp for the next five years. Is this quality health care?

If we are so confident that we are proficient in our specialization why not take an exam every other time. We can discuss whether it should be five years or six months or something in between.

For endoscopic surgery we would like to propagate accreditation every second year. We, pediatric surgeons in the Netherlands are only a small group and this would be quite do-able for our Society. We could easily provide the means to do so. For larger Societies this might require some more organization, but for pediatric surgery these competences could easily be integrated into the training program.

Training and quality of health care are closely related. Without a proper training you cannot give good quality care^{16,17}.

4. Research

The third pillar on which our department rests is research.

Pediatric Surgery is a dynamic continuously changing specialty that cannot survive or exist without the continuous search for improvement of patient care.

The second most frequently carried out major surgical procedure in children in the US has always been the antireflux procedures for gastro-esophageal reflux disease. 50% of these patients are mentally handicapped. The most frequent performed procedure, the Nissen fundoplication, where the top side of the stomach is wrapped around the distal esophagus, however, was not without substantial morbidity. For our Department in 1988 that was reason to switch to a partial wrap according to Thal. We could demonstrate a reduction in hospitalization time from 16 to 7 days in mentally handicapped children in open surgery, and to 4.4 days in laparoscopic surgery. For normal children the mean hospitalization is 2.2 days. Interestingly, at the recent congress of the Dutch Society of Endoscopic Surgery in Amersfoort in March of this year there was a presentation from Ivo Broeders, stating that, in adult surgery, he had changed his technique from a total Nissen fundoplication to a partial Toupet wrap, and there was increasing consensus in the audience. We speak 2010.

When we set off on laparoscopic surgery we recognized the importance of good registration and in the field of pediatric surgery we were the first to publish our results prospectively with a success rate of 80.5% for antireflux surgery¹⁸. In literature most publications boast about the success rate of certain procedures. We turned the reasoning around and asked ourselves why 20% is still not satisfactory.

Led by our senior researcher and staff member Maud van Herwaarden we are currently looking for predictive factors for success or failure of antireflux surgery.

In collaboration with our colleagues from the adult surgery and department of gastroenterology, the department of pediatric gastroenterology in the Wilhelmina's Children's Hospital and the Academic Medical Center in Amsterdam we are prospectively collecting data from patient questionnaires, pH-studies, impedance measurements and esophageal manometry, as well as 13-C breath tests to evaluate gastric emptying. By collecting these data pre- and postoperatively we hope to be able to determine factors that may influence the outcome of antireflux surgery. We are pleased that we have just received a grant from the Wilhelmina Children's Hospital Fund to carry on this project.

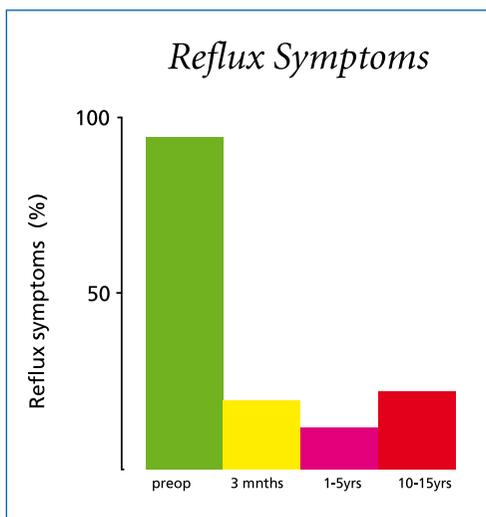


Figure 4: Symptoms over years

In a recent meeting of the Dutch Society of Pediatric Surgery we have reached agreement that other Pediatric Surgical Centers are going to collaborate and make this a National antireflux study.

Together with Philips Medical Industries and the Norwegian University of Bergen Maud van Herwaarden is furthermore developing a revolutionary new technique for non-invasive measurement of gastric volume, which could shed further light on the pathogenesis of gastroesophageal reflux.

We meanwhile have a 15-year follow-up of our primary group that was operated laparoscopically, and it is interesting to see that in the first years the complaints of reflux seem to diminish over the time¹⁹. However, in the later years complaints seem to increase again. It could well be that with growth in some patients the wrap becomes insufficient again. So far approximately 5% has undergone reiterative surgery. Gastroesophageal reflux is an important complication in patients with esophageal atresia²⁰. About half of all these patients will have signs of reflux and approximately 1/3 of them will undergo antireflux surgery at a later moment. We still know very little about the mechanisms that are in play and we intend to study this group shortly.

Another important aspect to follow-up in these patients is the occurrence of Barrett esophagus, a change in the mucosal lining that may later develop into cancer²¹. There are only very few studies in children and they are all retrospective. By developing a good prospective follow-up program for these patient groups future morbidity may be reduced or prevented.

A second line of research is the surgical management of morbid obesity in adolescents. Morbid obesity is an increasing health care problem reaching epidemic forms, also in the Netherlands.

The last decades, the prevalence of obesity in children has risen tenfold to approximately 3% of the population and it is expected that this tendency will continue. Without weight loss, these children are prone to develop complications of obesity in early adulthood, including Non-Alcoholic Fatty Liver Disease and Gastroesophageal reflux disease.



*Figure 5: Morbid obesity
(courtesy from news.softpedia.com)*

Furthermore, obesity causes diabetes, atherosclerosis and impaired pulmonary function. In addition to these somatic problems, obesity is linked to psychological distress and a lower quality of life. Apart from these individual consequences, the social impact is considerable. The estimated costs of the obesity boom in adolescents are huge. At

present, already 10% of the US annual budget is spent on obesity and related health problems. In the Netherlands 2.5 billion euro per year is paid for identical purposes and these expenses will only continue to rise unless better treatment options become available²². Putting that in perspective with the €29 billion national budget deficit, this is a major problem. Conventional treatments often have modest effects on weight reduction and health. In adults, bariatric surgery leads to far more weight loss and concomitant health improvements. Similar results from abroad achieved in adolescents seem promising but, due to a lack of high quality studies, at present surgery is not recommended in the Netherlands by the National Quality Institution of Healthcare (CBO). The CBO has stated that further research on health effects following bariatric surgery in young individuals is mandatory before clinical implementation can be considered²³.

In collaboration with Heideheugel Obesity Center, the Department of Pediatrics, the Department of Vascular Disease, the Department of Ethics, our staff member Sander Zwaveling is setting up a prospective randomised controlled study determining the beneficial factors for laparoscopic gastric banding in morbid obese children. In this setup we will collaborate with outstanding centers of expertise in morbid obesity surgery throughout the country. Hopefully we will be able to give sufficient answers to alleviate the ban on morbid obesity surgery in adolescents. However, prevention remains a major key player in improving health care for the new generation²⁴.

The third pillar of research is strongly related to endoscopic surgery in children and neonates and concerns the effects of CO₂ on wound healing. We know from experimental studies that CO₂ decreases the pH and down-regulates immune factors, reduces venous return and

decreases renal perfusion and urine production. Increase of CO₂ pressure also increases the negative effects²⁵. For that reason in pediatric endoscopic surgery we usually do not increase the CO₂ pressure above 5-8mm Hg. Equilibration in children and particular in neonates is vulnerable. We do not know what the effects are on cerebral perfusion or mucosal perfusion. What are the effects on microcirculation? For that reason our staff member Stefaan Tytgat is conducting experimental studies to determine the effects of CO₂ on microcirculation and wound healing. Comparing traction strenght of intestinal anastomosis in rats exposed to different levels of CO₂ pressure demonstrated that viability and traction strenght decreased with an increase of CO₂ pressure. Staining techniques on hypoxia are under way.

In a clinical trial using “Near-infrared Spectrometry” we could demonstrate a reduction in buccal microcirculation as a representative of intestinal microcirculation. Experimental studies will follow to confirm these findings. The future will have to learn us why procedures like hepatortoenterostomy in biliary atresia do not meet our expectatations when doing these procedures laparoscopically. Is it CO₂-related? Presently experimental studies are conducted elsewhere that hopefully will give some answers.

These three pillars of research are closely related to each other. Many patients with morbid obesity have gastroesophageal reflux. All the patients in the obesity study will undergo pre- and postoperative studies for reflux. In the experimental setting there exists an obese rat strain, that we can use for pre- and postoperative measurement of non-alcoholic fatty liver degeneration. In the clinical setting this is not possible due to ethical objections. Hopefully the

experimental study will give us more insight in the mechanisms that regulate non-alcoholic fatty liver degeneration and the effects on esophageal and gastric motility.

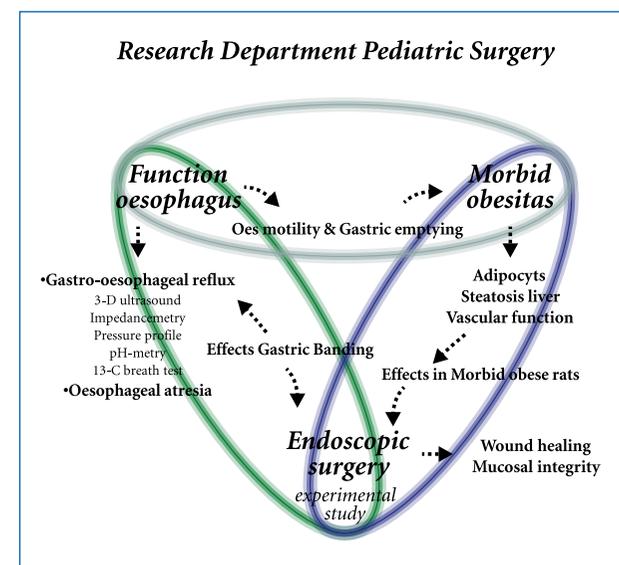


Figure 6: The three research pillars of the Department

The Department of Pediatric Surgery is part of the Traumacenter Utrecht. In collaboration with our colleagues of the adult trauma care we in particular are involved with multitraumatized children. The University Medical Center in Utrecht has all the departments available necessary for Trauma care, from neurosurgery to revalidation and psychology. Trauma has a major impact on the child and next to care of their injuries psychological support is of paramount importance. We are conducting follow-up studies on psychological development following trauma. Beside this, William Kramer, in

collaboration with VOLVO Cars , is involved in setting up programs for prevention of trauma. For example the wearing of helmets by children riding a bicycle is one of his projects.

Next to these research projects the Department is participating in a nation wide study by the Dutch Society of Pediatric Surgery on the outcome of six important neonatal anomalies. Determined outcome indicators will give us insight on our quality of care in comparison to the mean national standard. One of our staff members, Daisy Travassos is particular interested in Hirschsprung's disease, and will hopefully finish her thesis on this subject shortly.

5. International relations

International relations are important for exchange of knowledge, education and techniques, particularly in specialties such as pediatric surgery, where we often deal with less common occurring abnormalities.

There are many international societies, but let us focus on those involved in endoscopic surgery:

IPEG stands for International Pediatric Endoscopy Group. It is a worldwide organization of pediatric surgeons involved in endoscopic surgery. Its first meeting was held in 1991 and it nowadays is a firm group with over 600 members worldwide.

The mission statement of the society is:

“..... to support excellence in Pediatric Minimal Access Surgery and endoscopy through education and research; to provide a forum for the exchange of ideas; and to encourage and support development of standards of training and practice.”

For a number of years now we have been involved in the educational committee defining standards for training in pediatric endoscopic surgery, organizing hands-on courses for participants and serving as a facilitating moderator for the young generation. An example of this has been mentioned earlier in this lecture with the neonatal practicing box.

We have the aim to set up a training program for pediatric surgeons, residents and fellows that is the same worldwide. In this way we can provide a quality training irrespective of the place where the training is taking place. The Yale boxes can be of great help to come to such a universe program.



Figure 7: Training with the "Yale boxes".

In Europe there are many pediatric surgical endoscopic societies. Every self-respecting country has one. Even in the Netherlands we have a pediatric endoscopic working group within the Dutch Society of Endoscopic Surgery. Most of these Societies have between 30-50 members and all organize their annual meetings.

Next to that we have the European Association of Endoscopic Surgery, the E.A.E.S. It was founded in 1990 and now is the European counterpart of the American SAGES organization.

In the early days of the EAES there were quite a few of pediatric endoscopic surgeons that visited EAES. However, with increasing competition for the limited space within the congresses the pediatric surgeons at some point fell out of the boat.

In 2008 we set up a rally to join all these small societies within the

EAES and as of 2009 there is a pediatric surgical session again in the program and there is a representative in both the educational and program committee.

In the EAES web-based hand book, that is currently under construction, there will be a separate pediatric surgical section. It is our intention to establish a well sounded pediatric representation within EAES.

6. *Pediatric Surgery in the Netherlands*

Maybe some words about pediatric surgery in the Netherlands.

Pediatric surgery in the Netherlands is organized in six University Medical Centers. We are a small country and pediatric surgery is about rarities. Congenital anomalies like esophageal atresia or Hirschsprung's disease occur maybe 40-50 times in the whole of the country. With 35 pediatric surgeons that would mean that each would operate maybe 1-2 patients per year.

Up to now we have always said that because pediatric surgery covers the whole surgical spectrum, this guarantees quality of care. That may be true. The question is, could we do better.

During my chairmanship of the Dutch Society of Pediatric Surgery from 2003-2005 we developed a strategic plan to come to further concentration of treatment of seldom occurring malformations in a limited number of centers to improve our quality of care.

This is a slow process, careful not to tread on feelings and emotions, but today we have come to a point that we effectively are moving towards collaboration through alliances, that will facilitate further concentration.

This process runs parallel to ambitious plans of a group of pediatric oncologists, assembled in an organization called SKION, that wish to concentrate the treatment of pediatric oncology in one single center in the Netherlands. There is, however, major resistance from the Dutch Federation of University hospitals that wish to keep control of the process, and fear to lose a substantial part of their annual budget, if pediatric oncology departs from the University Medical Centers. They therefore strongly advocate distribution of several pediatric

subspecialties over the university hospitals, where pediatric oncology would be concentrated into two or three centers. Both groups are still on head-on collision course and NKOC is going to announce its choice in coming June.

Also within the Departments of Pediatrics in the University Medical Centers there are talks going on about concentration of certain procedures to a limited number of centers.

The University Medical Center in Utrecht has recently defined their strategic plan for the coming five years and nominated six strong points, one of them being Child Healthcare.

Let me say it this way: "There is no life on any planet without water; there is no Child Healthcare without pediatric surgery". It is our believe that pediatric surgery should have a solid basis within Child Healthcare, and not only as a serving one.

In all these discussions pediatric surgery has to keep ahead to define its own course in order not to be dictated how we are going to concentrate.

Coming back to endoscopic surgery, it is our strong believe that pediatric endoscopic is here to stay. So to answer the question "is endoscopic surgery in children and neonates there to be or not to be": yes it is here to be. In all pediatric surgical centers in the Netherlands there is an increasing amount of procedures that is performed endoscopically, and we have seen several presentations during the Symposium the last two days, from different centers in the Netherlands, which we think is a good development. We support the further incorporation of endoscopic surgery in our specialty and we are willing to offer training courses to do so and collaborate in performing different procedures where wanted.

In the light of concentration within the specialty we believe that for

certain complex procedures such as esophageal atresia, in particular when there is a long gap, or duodenal atresia, which we believe is the most difficult laparoscopic procedure, the endoscopic treatment should be concentrated in centers of excellence for pediatric endoscopic surgery.

What is the future going to bring us? Development of new techniques is a continuum, in spite of the budgetary restraints, as we have heard earlier today in the opening ceremony. Instruments will be miniaturized; we have developments in the field of surgery without scars, or single port surgery, further reducing the number of visible scars. Some of these techniques will have the future, while others will fade away. There are developments in tissue and stem cell engineering and gene therapy. In all these exciting developments it is paramount importance that we keep aware of the child as a patient, our patient, for whom we are responsible for their welfare and safety.

You may have noticed that this public lecture up to now has been in the “we” form.

You may think we think ourselves the queen or so. Although not unthinkable this is not the case: the “we” stands for “we” as a team, we are a team of pediatric surgeons, we are a team in the OR with the anesthesiologists and the OR nurses, we are a team with the nurses in the ward and the pediatricians with whom we collaborate there.

Without a team you can't function, and therefore all we have accomplished in the past has been an accomplishment of the team and I am grateful for that.



Staff Pediatric Surgery UMC Utrecht

7. Closing remarks

Coming to a close of this public lecture it is a custom to thank people that are dear to you. I have mentioned my staff members and other colleagues.

I would like to thank the College Board of the University of Utrecht. I would like to thank the faculty members of the Symposium which we have had the past two days. You are all dear friends to me and I am grateful that you were all willing to come over and share your expertise in the field of pediatric endoscopic surgery. I would like to thank my colleagues that have been with us through videoconference. I would also like to thank the benefactors for their support that has worked as a catalysis for the realization of the endoscopic OR's. I thank the Board of Directors of the UMC Utrecht for their guidance to reach our goal.

I would like to thank Kees Verkade who spontaneously offered to make an artwork for the occasion of the opening of the OR-complex.



Finally I'm grateful to have a loving wife and two beautiful daughters, who I have neglected repeatedly during the pursue of my career, for which I apologize. I'm proud to have these three beautiful ladies. At home we have a statue, made by Kees Verkade, called "Soutien feminin", which could be translated to "what's a man without his woman".



"Soutien Feminin"

Dear Ina, you are my conscience, you put me back on the right track where I tend to wander, you support me in times of peril. I tend to call it Ying-Yang, teamwork, and I seldom say thank you for it. Well, today before this audience let me say: thank you. You are my one and only.

I have spoken.

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Prof. Dr. David C. van der Zee was appointed as Professor in Pediatric Surgery in the UMC Utrecht on January 1st 2009.

He followed his medical studies at the University of Groningen, where he also did his general surgical training (Chief: Prof. Dr. P.J. Kuijjer). Since October 1988 he has been working in the Wilhelmina Children's Hospital Utrecht, as of 1991 as a pediatric surgeon. He defended his thesis on "Maternoembryonic transfusion and congenital malformations" on March 29th 1996. He has been acting as chief of the Department of Pediatric Surgery since April 2006.

The Department has developed three major research projects on: gastroesophageal reflux disease, morbid obesity in childhood and endoscopic surgery, which is in line with the Departments' main expertise: endoscopic surgery in children and neonates. The Department is internationally renowned for its expertise in endoscopic surgery, and he is involved in many international endoscopic organizations worldwide.

From May 9-11th 2010 the Department has organized an International Symposium and hands-on course on Endoscopic Surgery in Children and Neonates. On May 11th 2010 the new OR-complex was opened. The completely renewed OR Center has been rigged with endoscopic facilities in all OR's, ready to set of as a "Center of expertise for endoscopic surgery in children and neonates".



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