Appendix A. Conference discussion

**Dr I. Opitz (Zurich, Switzerland):** I have two questions: how long do you leave the epidural catheter in place and do you assess your pain management by visual analogue scale scores?

**DR. PILEGAARD:** The epidural catheter stays in for two days. We close it on the second day in the morning, and before that the patient is started on tablets for pain relief. Around 20% of patients are discharged on the second day after operation.

**DR. PILEGAARD:** given that you have the largest volume unit, every time you present I watch with interest and respect. Primarily this operation is performed for cosmesis. What sort of patient satisfaction did you look at in this study?

**DR. PILEGAARD:** I can say that the indications in all of these patients have been cosmetic. Some of the patients have complained about other symptoms, as you know: breathlessness, or they don’t feel they have the same physical capacity as other persons of the same age. But I think they are very non-specific symptoms. So our indications have in all cases been cosmetic.

**DR. NAIDU:** Did you make any objective assessment of the improvement in patient quality of life or satisfaction between your under-30 group and your over-30 group?

**DR. PILEGAARD:** You mean if there had been a change in quality of life? Could you repeat your question?

**DR. NAIDU:** Sorry. Was there any difference between the improvement in quality of life or patient satisfaction between the under-30 group and the over-30 group?

**DR. PILEGAARD:** We haven’t looked at that issue. We have only looked at quality of life in the group from 11 to 20 years, so I can’t tell you about that from our results. But we know from a paper from England that in young adults you have the same increase in quality of life as you see in the young ones, and when the patients come back to the outpatient clinic for postoperative control, they are very pleased with the operation. So I think they have the same change, but I can’t confirm this.

Some of the patients, especially the older ones, may have associated kyphoscoliosis of the spine. Would you work together with the orthopedic surgeon for correction of some of these patients? What is the management, and what is your experience in such patients?

**DR. PILEGAARD:** I have to say that we are not looking to see whether they have scoliosis or other things. We look at the anterior chest wall because that is the thing they complain about. I think if we go through our material, we will find the same result as you see in other groups, that is, around 15% having a scoliosis. We have not had any patient with severe scoliosis who has not been evaluated by the orthopedic surgeon before we see the patient, and I think the scoliosis should be treated before the pectus excavatum.

In older patients the pectus is very often not symmetric. So in asymmetric cases, is there a special trick to putting in the bars? Would it change from a symmetric case?

**DR. PILEGAARD:** Yes, it does. According to Park, you can bend the bar asymmetrically to elevate one side more than the other. Normally when you look at the X-ray after surgery you will see that the pectus bar is going just across the patient, but sometimes you need an oblique position. So it depends where you have to elevate, and sometimes you also can place the bar asymmetrically. So one end is going very long to one side of the patient because you need to elevate the whole area on the lateral side and then only a very short end of the bar is on the other side. It varies from patient to patient, so I can’t give you any exact advice. You have to look at the patient to see where you want to elevate the chest wall and then place the bar in the best way. Sometimes when you start the procedure, you put your introducer across the patient, but if you see that it is not giving an optimal result, you can try to reposition it in an oblique way and see if you get a better result.

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**Editorial comment**

**The Nuss procedure**

The issue of surgical repair of pectus deformities has always been a controversial one. The physiological consequences of the disease, except in the most severe cases, are poorly defined, the necessity of intervention constitutes an ongoing debate and the choice of the most appropriate surgical technique remains elusive. To this already-existing controversy, recently, an entirely new issue has been added: the Nuss procedure, which by its advocates is now presented as the non-invasive ‘procedure of choice’ and the ‘gold standard’ for the repair of most, if not all, pectus anomalies [1].

The introduction of this radically different technique changed the landscape of pectus excavatum surgery, which was previously dominated by the open approach. The number of interventions for pectus deformities tripled. Because it is highly unlikely that this dramatic increase was due to the rise in the number of children born with those deformities, one must look for other explanations, such as the extensive marketing efforts of the manufacturer, the fact that a large number of Nuss operations are now performed by specialties other than thoracic surgery, and, most of all, to the public’s...
attraction to the magic words 'minimally invasive'. Those individuals, who in the past would refuse to undergo the operation, now queue up to have their deformity corrected 'without surgery'.

But, is the Nuss operation really 'minimally invasive'? Is it appropriate to label a procedure, which includes passing of up to three, foot-long heavy steel rods through both pleural cavities and the narrow space between the heart and the sternum, leaving them in place for 3–5 years, then remove them surgically, really 'minimally invasive'? Albeit it saves the patient from a more visible anterior scar, the method necessitates up to six laterally located skin incisions that are re-opened years later to remove the steel rods. Further, the resulting scars of the intervention are compared with those inflicted by the 8–12-cm longitudinal or transverse incisions of the now-defunct ‘classic’ Ravitch operation. Today, open repairs of pectus deformities are done with a 4–5 cm long transverse or sub-mammary exposure, the total length of which compares favorably with the multiple incisions of the 'minimally invasive' Nuss procedure.

As far as the outcomes of the two approaches are concerned, in experienced hands, the short- and mid-term results appear comparable; however, the lack of long-term, randomized, prospective trials makes the final evaluation impossible. Unfortunately, just as it is the case in the issue of skin cosmesis, the relevant literature that evaluates the anatomical and physiological outcomes of the Nuss procedure versus the open approach does not refer to any minimally invasive contemporary methods of sterno-chondroplasty as a control group, but refers to a poorly defined mixture of open operations as the 'the Ravitch method'.

Our main objection to the 'minimally invasive' Nuss procedure, or more appropriately defined as the 'closed approach', is not those mentioned above, not even the higher cost, the often extended hospitalization, the necessity of long-term close follow-up, or the need of re-operation, but its potential of serious complications. In Nuss repairs, the possibility of serious injury to vital organs begins when the operator passes the rods in the narrow space between the heart and the sternum and persists as long as they are left in the patient’s body. The rate of complications with the Nuss procedure are not more numerous, but also are of great variety and often life threatening, a phenomenon, which is seldom, if ever, seen with the conventional open approach. The relevant literature lists every possible intra-operative and late mishap, such as perforation of the heart and hemopericardium and cardiac tamponade, injury to the lungs, the aorta, to the liver, to the brachial plexus, laceration of the diaphragm, obstruction of the thoracic inlet and the caval veins, dislocation of the sterno-clavicular joint, displacement, flipping, rotation of the bar, metal allergy, stubborn postoperative pain which far exceeds that of open operations, subcutaneous emphysema, recurrent pericardial and pleural effusions, increased rate of infections, erosion of the sternum and the skin, mammary artery pseudo-aneurysm, and entrapment of the bar by neo-calcification making its removal a major intervention. While such complications may be infrequent in the hands of an experienced surgeon, such as Dr Pilegaard, their potential lingers like the sword of Damocles over the head of every operator who uses the method.

We believe that before some of the recommendations forwarded by Dr Pilegaard and co-workers can be accepted, that is, that the indication of pectus repair should now be widely extended from children to adults, that the indication may be based solely on the patient’s wishes, and on the presence of >3-cm-deep sternal depressions, we need objective evidence-based trials, which examine in depth the clinical as well as the economical aspects of this innovative procedure.

Reference


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