Clinical results of revision meshes and the relation with the Noviomagus Revision Meshes: a literature review.

Introduction
The Noviomagus Revision Meshes are for use in combination with a bone impaction grafting procedure (BIG). This is a method for restoration of a bone defect by the incorporation of bone chips. This biologic solution for repairing the bone defect demands an experienced surgeon, costs extra time and is more expensive than other solutions, but results in a high quality solution and therefore is very suitable for demanding, younger patients.

Most hip prosthesis show good results on the short term. However, judgement of success can be made after 10 years or longer. A useful definition of a good result has been made by the NICO-2003 study group: 10 years after surgery over 90% of the hip implants have to be 'in situ' (NICE, 2003).

The Swedish and Norwegian hip registers are an important source of information for the evaluation of hip prosthesis. Of the large number registered, cemented hip prostheses in these databases, the survival rate of patients from 70 years and older after 10 years is 90% to 95% (Furnes, 2005), thus (a primary total hip replacement) normally meets with the NICE-2003 definition.
A special group are the patients with an age under 50. The Swedish and Norwegian registers show that the survival rate of 90% after 10 years is not achieved in this group.

The survival rate of a hip revision depends on different factors. The only conclusion that can be made, is that when this rate is high the entire revision has been performed well, including the used materials. A frequently made subdivision is loosening as result of an infection (septic) and other causes (aseptic); that an infection as cause for revision is distinguished from the failing of the implant or the surgical procedure.

When only a small part of the investigated hips in a study have been reconstructed by a mesh, the value of the information is limited because it's difficult to prove a direct link between the meshes and revision. Meshes are generally used in revision surgery when there is severe bone loss. These surgeries are more demanding than primary hip surgeries and it is harder to guarantee stability of the implant. Therefore, it is to be expected that the survival rate is lower compared to primary hip surgery and revision surgeries without the need for bone reconstruction .

Femoral Meshes
In 2000 Van Biezen published a study where at 17 of the 21 hips femoral meshes have been used. After a follow up of an average of 60 months, no surgery was necessary after the revision (Van Biezen, 2000). The results of this study are very good; a 100% survival rate on the middle long term (after 5 years) for femoral meshes. The type of mesh that is used, is not mentioned in the study.

In the study of Pekkarinen (2000) in 18 of the 68 hip prosthesis during revision surgery, a metal mesh is used. Pekkarinen claims no bone defects are visible direct proximal to the meshes and carefully concludes that the meshes (with wire and plates) seem to diminish complications.

In 2005 Schreurs and Arts (2005) published an article of a study of 33 femoral revision surgeries, performed between March 1991 and February 1996, where 12 metal meshes have been used. There was one non-recognisable intra-operative fracture. After a follow up of 10.4 years, there were 3 femoral fractures, all at the tip of the prosthesis, which are healed without removing the prosthesis.
The survival rate is 100% after more than 10 years. This means that the meshes do not cause any problems. The type of mesh that is used is not mentioned in the article. After consulting Dr. Schreurs, he explained that perforated stainless steel sheet has been used which could be cut and bend by the surgeon.

Acetabular meshes
In the study of Welten and Schreurs (Welten, 2000), 36 acetabular meshes are used. After 10 years the survival rate is 96% and after 12.3 years it's 87%. In more than half cases meshes have been placed in the hips, so the number of meshes is quite large and the follow up has been made after more than 10 years with a survival rate of more than 90%, which is good. Even, in a worst case and unrealistic scenario, if all revision surgeries have to been performed due to the meshes, the survival rate is still good (after 10 years 2 revisions: ~ 94%, and after 12.3 years 4 revisions ~ 89%). Unfortunately the meshes used in this study are made of a different material than the Noviomagus Revision Meshes.

In 2006, a study of Wadia has been published in the Journal of Bone and Joint Surgery, where there has been an acetabulum reconstruction by 43 patients with a rim mesh, comparable to the Noviomagus Revision Mesh. After an average follow up of 14.2 months the bone incorporation was good and there was no migration of the rim (Wadia, 2006). The number of meshes used is large. Though the results are promising, the follow up time is short.

Malik (2006) published a study where 73 hips are implanted, in which 47 steel meshes have been used for the reconstruction of the acetabulum. After an average of 4 years, no revision surgery has been performed. The results on the middle long term are very good with a survival rate of 100%. The number of hips where the meshes have been used is large.

After a follow up of Busch, the survival rate of a group of 24 patients under the age of 50 was 96% after 10 years and 88% after 20 years. After exclusion of the (1) infected revision, the survival rate was even higher (Busch, 2007). A cemented total hip combined with an acetebulum reconstruction in combination with metal geese and impacted bone grafts was implanted in the patients. The Noviomagus Revision Meshes, which are anatomically shaped, are derived from the metal geese in this study that has to be cut and bend during surgery. The number of hips which have been studies is average, the term is long and the results are very good, especially when the age of the patients has been taken into account: the patients were relatively young and therefore the hip had to endure more because of the high activity in comparison with elder people.

Jasty e.a. has studied a follow up of 54 hip revisions after 6.8 years where an acetabular mesh has been used. No revision surgery has been performed; the survival rate is 100%. By means of an X-ray scan, migration of the hip has been studied. There was a visible migration in 11% of the hips and they all had bone defects GRADE IV (medial wall defects with holes in the back < 1 cm diameter) and V (medial wall defects with holes in the back > 1 cm), with an incidence of 14 respectively 75% (Jasty, 1988). The survival rate is 100%, the period is middle long term and the number of hips in the study is large, however a CoCrMo mesh has been used. The interesting fact is, that the larger defects of the medical wall are more difficult to reconstruct with the acetabular mesh in 1981.

Conclusion
The meshes that have been used in the past have no significant negative influence on the clinical results of hip revisions. When taken into account that meshes are necessary when large bone reconstruction is necessary and therefore the surgery is more demanding, the results are very positive.

The Noviomagus Revision Meshes
The Noviomagus Revision Meshes (NRM) are made of medical quality stainless steel and 0.5 mm thick, the sizes are comparable to other meshes. The NRM are anatomically shaped and have holes of ø 3.5 mm.

The difference between the NRM and other meshes is that the NRM can easily be cut down, to improve usability and speed up surgery time, and minimize the number of sharp edges. Next to this, the Noviomagus Medial Wall Mesh has a larger sealed centre and therefore it's possible to use the Noviomagus mesh with large defects in the medial wall. The Noviomagus Proximal Femor and Universal Flat Meshes have flexible tabs for using cerclage wire for better fixation around the femur.

Conclusion
The meshes that are currently available have good clinical results. Because of the similarities and improvements made, it seems plausible that the Noviomagus Revision Meshes will have the same or better clinical results than the other meshes in the market.

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